Prepared for:
Nevada Environmental Response Trust

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1690011200-033

Prepared by
Ramboll US Corporation
Emeryville, California

Date
February 1, 2019

BASELINE ECOLOGICAL RISK ASSESSMENT WORK PLAN FOR OPERABLE UNIT 3
REVISION 1

NEVADA ENVIRONMENTAL RESPONSE TRUST SITE
HENDERSON, NEVADA

Baseline Ecological Risk Assessment Work Plan for Operable Unit 3, Revision 1

Nevada Environmental Response Trust
(Former Tronox LLC Site)
Henderson, Nevada

Nevada Environmental Response Trust (Trust) Representative Certification
I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of the Trust. Based on my own involvement and/or my inquiry of the person or persons who manage the system(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

not individually but solely as President

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Date: 1-31-19

Baseline Ecological Risk Assessment
Work Plan for Operable Unit 3, Revision 1

Nevada Environmental Response Trust
(Former Tronox LLC Site)
Henderson, Nevada

Responsible Certified Environmental Manager (CEM) for this project

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

______________________________ 2/1/2019 ________________________

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Date	**February 1, 2019**
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ACRONYMS AND ABBREVIATIONS

AFs	Assimilation Factors
AMPAC	American Pacific Corporation
AOC	Administrative Order of Consent
AP&CC	American Potash and Chemical Company
AUF	area use factor
AWF	Athens Road Well Field
BERA	baseline ecological risk assessment
BCL	basic comparison level
bgs	below ground surface
BHRA	baseline health risk assessment
BMI	Black Mountain Industrial
BOR	Bureau of Reclamation
BRC	Basic Remediation Company
BTAG	Biological Technical Assistance Group
CaCO3	calcium carbonate
CBR	critical body residue
CEM	certified environmental manager
COH	City of Henderson
COPEC	chemical of potential ecological concern
CSM	conceptual site model
DEQ	Department of Environmental Quality
DO	dissolved oxygen
DTS	distributed temperature survey
Eco-SSL	ecological soil screening level
ENVIRON	ENVIRON International Corporation
ERA	ecological risk assessment
ERED	Environmental Residue Effects Database
ESA	Endangered Species Act
ESV	ecological screening value
FBRs	fluidized bed reactors
FSP	field sampling plan
ft	feet
GPS	global positioning system
GWETS	Groundwater Extraction and Treatment System
GWTP	Groundwater Treatment Plant
HQ	hazard quotient
HHRA	Human health risk assessment
IWF	Interceptor Well Field
IX	ion exchange
kg/day	kilogram(s) per day
LANL	Los Alamos National Laboratory

LOAEL	lowest observed adverse effect level
LOC	level of concern
LOEC	lowest observable effect concentration
LOU	Letter of Understanding
LVW	Las Vegas Wash
LVWCC	Las Vegas Wash Coordination Committee
mg/kg	milligram(s) per kilogram
mg/L	milligrams per liter
mph	miles per hour
NDEP	Nevada Division of Environmental Protection
NERT	Nevada Environmental Response Trust
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NOEC	no observable effect concentration
NPDES	National Pollutant Discharge Elimination System
NRS	Nevada Revised Statutes
ORNL	Oak Ridge National Laboratory
OU	Operable Unit
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PEPCON	Pacific Engineering and Production Company of Nevada
PNWR	Pahranagat National Wildlife Refuge
Qal	quaternary alluvial deposits
RAIS	Risk Assessment Information System
Ramboll	Ramboll US Corporation
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RIBs	rapid infiltration basin
RTC	response to comments
SAP	Sampling and Analysis Plan
SBCM	San Bernardino County Museum
SC	specific conductance
Site	Nevada Environmental Response Trust (NERT) Site
SLERA	screening-level ecological risk assessment
SNWA	Southern Nevada Water Authority
SOP	standard operating procedure
SQuiRTs	NOAA Screening Quick Reference Tables
STORET	storage and retrieval
SVOCs	semi-volatile organic compounds
SWCA	SWCA Environmental Consultants
SWF	Seep Well Field
TDD	total daily dose
TDS	total dissolved solids

TECs	threshold effects concentrations
TEQs	toxic equivalency quotients
TIMET	Titanium Metals Corporation of America
TIN	total inorganic nitrogen
TIR	thermal infrared
Tronox	Tronox LLC
Trust	Nevada Environmental Response Trust
TRV	toxicity reference value
TSS	total suspended solids
µg/L	microgram per liter
UCL	upper confidence limit
UMCf	Upper Muddy Creek Formation
UMCf-fg1	UMCf-fine-grained facies
UMCf-cg1	UMCf-coarse-grained facies
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Valley	Las Vegas Valley
VOCs	volatile organic compounds
Wash	Las Vegas Wash
WBZs	water-bearing zones
WECCO	Western Electrochemical Company
WMP	wildlife management plan
WRF	Water Reclamation Facility
ww	wet weight
xMCf	Transitional Muddy Creek Formation

1.0 INTRODUCTION

This Baseline Ecological Risk Assessment (BERA) Work Plan (the "BERA Work Plan") was prepared by Ramboll US Corporation (Ramboll) on behalf of the Nevada Environmental Response Trust (the Trust or NERT) for Operable Unit 3 (OU-3) of the NERT Remedial Investigation Study Area (NERT RI Study Area), which is located approximately 2.5 miles north-northeast (downgradient) of the NERT Site (OU-1, the NERT Site, or the Site) in Henderson, Nevada (Figures 1-1 and 1-2). The OU-3 BERA will be conducted as part of the Remedial Investigation/Feasibility Study (RI/FS) for the NERT RI Study Area. Results of the BERA will inform the remedial investigation of potential ecological risks posed by hazardous substances within OU-3 that may have originated within OU-1 or OU-2.

Specific information about the ERA being performed for OU-1 is provided in the *Refined Screening Level Ecological Risk Assessment Work Plan, Revision 2* (Ramboll Environ 2015), which was approved by Nevada Division of Environmental Protection (NDEP) on July 2015. A screening-level ERA is also being conducted for OU-2, the details of which are provided in the *Screening Level Ecological Risk Assessment Work Plan for Operable Unit 2, Revision 1* (Ramboll 2018), which is under NDEP review. A BERA, like that being proposed for OU-3, is a comprehensive evaluation that considers conditions where a variety of ecological receptors and/or special status species are potentially at risk. A SLERA and refined SLERA can be used in place of a BERA if the conditions suggest that a comprehensive evaluation is not necessary due to a lack of sensitive ecological receptors or potentially incomplete exposure pathways. The approach proposed for the OU-3 BERA is discussed in detail in Section 1.2.

The three Operable Units (OUs) that make up the NERT RI Study Area are shown in Figure 1-2. The key features and properties within OU-3, including the Las Vegas Wash (Wash) and its weir systems, are shown in Figure 1-3. OU-3 encompasses an approximately 3.5-mile stretch of the Wash. The Wash is a natural channel that carries permitted treated municipal and industrial wastewater (including treated groundwater), storm water, urban runoff, and shallow groundwater from the Las Vegas Valley into Lake Mead. Nearly 700 species of amphibians, birds, mammals, reptiles, fish and invertebrates inhabit the variety of wetland, riparian and upland habitats of the Wash (Clark County 2000; 2003). In late 1997, perchlorate contamination was discovered in Las Vegas Wash and was determined to have originated from the Site and the former Pacific Engineering and Production Company of Nevada (PEPCON) facility located approximately 1.5 miles west of the Site (NDEP 2011). In 1999, Southern Nevada Water Authority (SNWA) hydrologists discovered a seep discharging to the Wash that contained high concentrations of perchlorate. In 1999 and 2002, temporary ion exchange (IX) groundwater treatment systems for removal of perchlorate were constructed at the Site and near the Wash, respectively. The temporary treatment systems were replaced by a biological fluidized bed reactor (FBR) treatment system located on the Site in 2004, which has continuously operated from 2004 to today.

Ramboll, on behalf of the Trust, is performing this BERA to evaluate potential risks to ecological receptors within OU-3 posed by chemicals that have migrated from the NERT Site to OU-3. The BERA will evaluate potential risks to ecological receptors that may be exposed to hazardous substances that are attributable and originating from the NERT Site in both the aquatic and terrestrial portions of OU-3. It is important to note that environmental conditions within OU-3 have been impacted by groundwater contamination (specifically perchlorate) originating from the former PEPCON site. Additionally, permitted industrial discharges from other companies within the Black Mountain Industrial Complex may have also impacted ecological receptors within OU-3. The BERA will generally follow the United States Environmental Protection Agency's (USEPA's) eight-step process for Superfund ecological risk assessments (ERAs) and will be consistent with USEPA's general framework for ERA (USEPA 1997, 1998).

1.1 OU-3 BERA Objectives

The BERA described in this work plan is proposed to be implemented as part of the RI/FS for OU-3. The objective of the BERA is to determine whether the chemical impacts in OU-3, if left unremediated, would pose unacceptable current or reasonably likely future risks to animals that inhabit the Wash. The purposes of this baseline assessment are to evaluate: (a) if significant ecological effects are occurring due to environmental impacts in OU-3 posed by chemicals that have migrated from the NERT Site to OU-3, (b) the probable causes of these effects, (c) the source of causal agents, and (d) the consequences of leaving the impacts in OU-3 unremediated. The BERA provides the basis for determining the need for remediation and provides information necessary for the development of protective remedial alternatives.

This BERA Work Plan provides the context and describes the approach for performing a BERA within OU-3. The BERA Work Plan has the following specific objectives:

- Review existing information on physical, chemical, and biological attributes of OU-3 to identify data useful for conducting the BERA and where there are data gaps that need to be filled.
- Develop the problem formulation and conceptual site models (CSMs) to identify and focus the risk assessment. This includes defining receptor groups and their exposure pathways.
- Define the lines of evidence that will be considered and evaluated to address potential risk to ecological receptors within OU-3.
- Describe the field investigation and types of data that will be generated to fill known data gaps, including decision points and statements about possible additional investigations, if necessary.
- Describe the tiered approach for evaluating the various lines of evidence and conducting the BERA.

1.2 BERA Approach Overview

A tiered (iterative) approach recommended by the USEPA will be used for the BERA (Figure 1-4; USEPA 1997, 1998). As shown in Figure 1-4, the ecological risk assessment process consists of eight steps. The first two steps are screening-level evaluations that are intentionally simplified and conservative, and usually tend to overestimate the amount of potential risk. This allows for the elimination of those chemicals that are not associated with risk, allowing subsequent efforts to focus on chemicals that are of potential concern. The steps that follow allow for a refinement of the risk assumptions to assess potential risk using more realistic exposure assumptions. Conducting assessments in a step-wise manner allows the risk assessor to maximize the use of available information and sampling data, while providing the opportunity to minimize the uncertainties inherent in the ERA process through the use of data more representative of the exposure setting and receptor characteristics.

The steps shown in Figure 1-4 are not intended to represent a linear sequence of compulsory tasks. Rather, some tasks may proceed in parallel, some tasks may be performed in a phased approach, and some tasks may be judged to be unnecessary. In the case of OU-3, data from previous studies is insufficient to conduct a screening-level evaluation prior to advancing to Steps 3-8 of the ERA process. While surface water data is available, sediment and soil data are outdated or insufficient. Specifically, sediment data were collected over 10 years ago and included only one sediment sample from within OU-3. Soil was only collected from limited locations in OU-3 and the areas sampled have since been covered with 2 to 5 feet of clean soil. Therefore, field sampling to support the BERA is proposed to be conducted in the initial phases of the ERA process.

1.3 Document Organization

In addition to this introduction, this work plan is organized into the following sections:

- **Section 2.0** – This section provides a summary of the Operable Units in the NERT RI Study Area, including historical industrial activities on the NERT Site that have the potential to impact OU-3.
- **Section 3.0** – This section provides a summary of previous and ongoing investigations within OU-3, as well as a description of data from these investigations that may be used in the BERA.
- **Section 4.0** – This section summarizes the proposed field sampling approach for the OU-3 BERA. The OU-3 BERA Field Sampling Plan (FSP), provided as Appendix A in this work plan includes the details involved with the field effort including sample media to be collected, field sampling procedures and equipment, proposed sampling locations and counts.
- **Section 5.0** – This section presents the ecological problem formulation, including a detailed description of the habitats and wildlife within the Wash, the site conceptual model, the assessment and measurement endpoints, field verification of sampling and design, site investigation, and measures of exposure and effect.
- **Section 6.0** – This section provides the approach used in the risk characterization phase of the BERA where exposure and effects data are compared and statements regarding potential risk are provided. This section also describes the overall degree of confidence in the risk estimates which includes the scientific uncertainties, the strengths and limitations of the analyses, and measures for risk management.
- **Section 7.0** – This section provides the schedule of deliverables for the OU-3 BERA Report.
- **Section 8.0** – This section provides the references cited in this OU-3 BERA Work Plan.

2.0 NERT RI STUDY AREA DESCRIPTION

This section provides a description of the NERT RI Study Area as it relates to the OU-3 BERA, specifically:

- A summary of historical industrial activities related to the NERT Site at OU-1 and OU-2 that could be the source of some chemical constituents in soil and groundwater in the NERT RI Study Area;
- A description of the Wash and its role in supporting both human and wildlife communities in the Las Vegas Valley; and
- Known or suspected transport pathways of chemical constituents from OU-1 and OU-2 to OU-3.

2.1 Summary of Operable Units within the NERT RI Study Area

This section summarizes historical industrial activities from OU-1 and OU-2 within the NERT RI Study Area as it relates to potential impacts to OU-3. This section also provides a description of OU-3 and the Wash.

2.1.1 OU-1 / NERT Site History

The NERT Site is comprised of approximately 347 acres located within Sections 12 and 13 of Township 22 S, Range 62 E within the Black Mountain Industrial (BMI)[1] Complex in unincorporated Clark County and is surrounded by the City of Henderson, Nevada. The NERT Site and surroundings, including the current BMI Complex, are shown in Figure 2-1.

The NERT Site history information summarized in this section was obtained from the *Technical Memorandum Remedial Investigation Data Evaluation* (Ramboll Environ 2016a) and the *Remedial Investigation and Feasibility Study Work Plan* (RI/FS Work Plan; ENVIRON 2014a). The BMI Complex, which includes the NERT Site/OU-1, was initially developed by the United States (U.S.) Government as a magnesium production facility during World War II. Some areas of the NERT Site and surrounding BMI Complex have been abandoned or are currently vacant, while other areas have been converted to retail or commercial use.

Following World War II, a portion of the NERT Site was leased by Western Electrochemical Company (WECCO). By August 1952, WECCO had purchased several portions of the area, what is now the BMI Complex, and produced manganese dioxide, sodium chlorate, potassium chlorate, and various perchlorates. In addition, in the early 1950s, pursuant to a contract with the U.S. Navy, WECCO constructed and operated a plant to produce ammonium perchlorate on land purchased by the Navy. In 1956, WECCO merged with American Potash and Chemical Company (AP&CC) and continued to operate the processes, with the Navy's continued involvement in the ammonium perchlorate process. Process wastewater generated by industrial operations within the NERT Site and surrounding BMI Complex during this time was initially accumulated in the Trade Effluent Ponds (partially located within OU-1) and later supplanted by disposal in off-site ponds via the Beta Ditch, which was an unlined ditch constructed circa 1941 or 1942.

[1] The acronym "BMI" has been applied to several entities over the years. From 1941 until 1951, it referred to Basic Magnesium Incorporated; in 1951, a syndicate of tenants formed under the name Basic Management, Inc. to provide utilities and other services at the complex; the group has also been known as Basic Metals, Inc., and at the present is called the Black Mountain Industrial Complex.

The Beta Ditch received a variety of wastes from process operations within the NERT Site in addition to receiving storm water and non-contact cooling water. Process wastes likely included byproducts of chlorate and perchlorate manufacturing and discharge from an acid drain system. By 1950, the Beta Ditch extended east of the NERT Site to a siphon inlet/pond location on what is now the adjacent Titanium Metals Corporation of America (TIMET) property. The siphon inlet then transmitted flows from the western section of the Beta Ditch under Boulder Highway to the eastern section of the Beta Ditch and subsequently to the Upper BMI Ponds (located within OU-2) and Lower BMI ponds (located within OU-3; Figure 2-2). The significance of the Beta Ditch is discussed further in Section 2.2.

In 1962, AP&CC purchased the ammonium perchlorate plant from the Navy but continued to supply the Navy and its contractors material from the operating process. AP&CC merged with Kerr-McGee in 1967. Production of certain perchlorates (sodium perchlorate and potassium perchlorate) and chlorates (sodium chlorate and potassium chlorate) was initiated in 1945 within Unit Buildings 3, 4, and 5, located in the southern portion of the Site (Figure 2-2). Production of ammonium perchlorate was initiated in 1951 within the central portion of the Site (Figure 2-2). Kerr-McGee began production of boron products (elemental boron, boron trichloride, and boron tribromide) at the Site in 1972. Kerr-McGee discontinued production of sodium chlorate and ammonium perchlorate in 1997 and 1998, respectively. High purity, battery active manganese dioxide was also produced at the Site starting in 1951 and continuing to the present. Manganese tailings associated with manganese dioxide production are also stockpiled on the Site.

The sodium chlorate and sodium perchlorate processes utilized sodium dichromate (hexavalent chromium) in the process solutions to aid the electrolytic process. Process liquors, spillage, and wash-water from the sodium chlorate and sodium perchlorate processes accumulated in the basements of Unit Buildings at the NERT Site and were subsequently pumped and removed from the basements. These materials were either returned to the process or managed as effluent. Deterioration and cracking of the concrete basement floors resulted in release of chromium-bearing chlorate process liquids to the underlying soils and groundwater. Consequently, the shallow groundwater beneath portions of the Site has been contaminated with perchlorate and chromium (Kleinfelder 1993).

During the 1970s, the USEPA, the State of Nevada, and Clark County investigated potential environmental impacts from operations conducted within the BMI Complex, including atmospheric emissions, groundwater and surface water discharges, and soil impacts (E&E 1982). From 1971 to 1976, Kerr-McGee modified their manufacturing process and constructed lined surface impoundments to recycle and evaporate industrial wastewater. Use of the Beta Ditch for process wastewater ceased in 1976 when each of the companies operating within the BMI Complex was required to implement zero discharge industrial wastewater management practices. Wastewater ponds within the NERT RI Study Area from 1976 to the present are shown in Figure 2-3.

In 1980, the USEPA requested specific information from the BMI Complex companies regarding their manufacturing processes and their waste management practices. Investigations of chromium-impacted groundwater began in late 1983. Identification and cleanup of chromium contaminated groundwater was initiated by Kerr-McGee based on a September 9, 1986 NDEP Consent Order. Treatment of hexavalent chromium in groundwater began in mid-1987 and is on-going today. In 1994, the NDEP issued a Letter of Understanding (LOU) that identified 69 specific areas or items of interest and indicated the level of environmental investigation they wanted Kerr-McGee to conduct (Figure 2-4a and 2-4b). A detailed discussion of the specific areas or items of interest identified in the LOU and a list of the products made, years of production, and approximate waste volumes for WECCO, AP&CC and Kerr-McGee are found in a CSM document prepared by ENSR (ENSR 2005). Ultimately, the RI/FS and final remedy implementation will resolve any issues associated with the LOUs.

In 1997, perchlorate, later shown to originate from the Site and the former PEPCON property, was detected in the Wash and the Colorado River (NDEP 2011). In 1999 and 2002, temporary groundwater treatment systems for removal of perchlorate were constructed at the Site and near the Wash, respectively. The temporary treatment systems were replaced by a biological fluidized bed reactor (FBR) treatment system located on the Site in 2004 which has continuously operated from 2004 to today.

In 2005, Tronox LLC (Tronox) took ownership of the facility formerly operated by Kerr-McGee and operated it to produce electrolytic manganese dioxide for use in the manufacture of alkaline batteries; elemental boron for use as a component of automotive airbag igniters; and boron trichloride for use in the pharmaceutical and semiconductor industries and in the manufacture of high-strength boron fibers for products that include sporting equipment and aircraft parts. In 2009, Tronox filed for Chapter 11 bankruptcy. The Trust took title to the NERT Site on February 14, 2011, as a result of the settlement of Tronox's bankruptcy proceeding. Tronox leased approximately 114 acres of the Site from February 2011 to September 2018, at which point the lease was assigned to EMD Acquisition LLC (EMD). EMD is continuing similar manufacturing operations at the Site.

2.1.2 OU-2 Study Area History

OU-2 lies between OU-1 (the NERT Site) and OU-3 (downgradient of the mid-plume containment boundary line and the Wash). OU-2 consists of the Eastside Sub-Area and the southern portion (upgradient of the mid-plume containment boundary line) of the NERT Off-Site Study Area, as shown in Figure 1-2. The evaluation of OU-2 from an ecological perspective follows numerous investigations conducted to evaluate the nature, extent, and movement of contaminants from OU-1 to downgradient and cross-gradient areas.

The information provided below provides context for OU-2 within the NERT RI Study Area and the relevance of industrial activities within OU-2 that may have impacted areas within OU-3. The western portion of OU-2 (generally west of Pabco Road) is comprised of the southern portion of the NERT Off-Site Study Area. The eastern portion of OU-2 (generally east of Pabco Road) is comprised of the Eastside Sub-Area. These sub-areas of OU-2 are described in the following sections.

2.1.2.1 NERT Off-Site Study Area

The portion of the NERT Off-Site Study Area located upgradient of the mid-plume containment boundary will be evaluated as part of the OU-2 SLERA. The NERT Off-Site Study Area boundary is shown in Figure 1-2. The southern portion of the NERT Off-Site Study Area (the portion located in OU-2) is bordered to the south by Warm Springs Road, to the east by Pabco Road, to the north by a line just north of Galleria Drive, and to the west by the western border of the NERT RI Study Area.

The southern portion of the NERT Off-Site Study Area was mostly vacant in the early 1950s with scattered structures located north and south of what is now North Boulder Highway. By the early 1980s, much of the NERT Off-Site Study Area had been developed with a combination of commercial and residential structures. The southern portion of the NERT Off-Site Study Area continues to be used primarily for residential housing, known as the Pittman Neighborhood, with commercial and light industrial operations adjacent to major roadways. The southern portion of the NERT Off-Site Study Area has been the subject of subsurface investigations related to the downgradient migration of contaminants originating from OU-1.

2.1.2.2 Eastside Sub-Area

This section summarizes information contained in the Phase 3 RI Work Plan (Ramboll Environ 2017b) for the Eastside Sub-Area. The Eastside Sub-Area is approximately 1,983 acres and located in the southeastern quadrant of the Las Vegas Valley within the boundaries of the City of Henderson. The Eastside Sub-Area is located east of Pabco Road, west of Lake Mead Parkway, northeast of North Boulder Highway, and south of Galleria Drive. Much of the Eastside Sub-Area is currently vacant, although residential construction is underway immediately west of Lake Mead Parkway. Over the next decade it is anticipated that additional residential housing, parks, schools, and retail stores will be developed within much of the remaining vacant area as part of a master-planned community. The southern-most portion of the Eastside Sub-Area is partially occupied by a number of commercial businesses along Lake Mead Parkway and residential structures are present or under construction in roughly the east-southeastern quarter of the Eastside Sub-Area.

The majority of the Eastside Sub-Area was historically operated by Basic Management for a variety of purposes. Areas used by Basic Management for general facility and utility operations were historically referred to as the BMI Common Areas and were used for wastewater disposal by chemical producers at the neighboring BMI Complex. The Upper BMI Ponds began receiving process water via the Beta Ditch in approximately 1942 or 1943 (under the ownership of the U.S. Government) and were operated by Basic Management from 1952 until 1976 (Figure 2-2). Wastewater in the unlined ponds was allowed to infiltrate into the subsurface and/or evaporate.

From 1976 to 1982, TIMET constructed 31 lined surface impoundments within the southwestern portion of the former Upper BMI Ponds area for the evaporation and storage of its process waste streams (Figure 2-3; Law Engineering 1993).

Between 1985 and 1990, TIMET discharged liquid process waste concentrates to a center post irrigation system (the TIMET Spray Wheel), which discharged high total dissolved solids (TDS) effluent to bare ground within the BMI Common Areas. Between 1992 and 2002, a series of unlined ponds were used for the discharge of treated municipal wastewater by the City of Henderson (BRC 2007). The ponds, referred to as the Southern Rapid Infiltration Basin (RIBs), were operated south of TIMET's lined surface impoundments.

Between 2007 and 2016, remediation activities were conducted by Basic Remediation Company (BRC) in the BMI Common Areas. An aerial overview of BRC's remediation area, which was defined in the Administrative Order of Consent issued by NDEP in 2006 (AOC3), is provided in Figure 2-5 (NDEP 2006). Basic Comparison Levels (BCLs) were used as screening levels that address human health exposure pathways to guide remedial excavations. Removal of impacted soils was followed by iterative confirmation sampling for a suite of contaminants and comprehensive human health risk assessments for each sub-area within the AOC3 boundary. Once the human health risk assessment for a sub-area was approved by NDEP, the agency issued a No Further Action (NFA) Determination for that sub-area (BRC 2014). Ultimately, NDEP issued NFA Determinations for the top 10 feet of soil for each sub-area based on its respective designated future land use type (e.g. industrial/commercial or residential). The NFA Determinations do not address impacts to groundwater or surface water. Figure 2-5 shows the areas that received NFA Determinations.

2.1.3 OU-3 and the Las Vegas Wash

The OU-3 boundary is shown on Figure 1-2. The west side of OU-3 contains a portion of the City of Henderson (COH) Bird Viewing Preserve (Birding Ponds) and the COH Water Reclamation Facility (WRF). The Northern RIBs, which were formerly used by the COH for infiltration of treated municipal wastewater, are located further east. The Tuscany residential community, the Weston Hills neighborhood, and the Chimera Golf Course are located in the eastern portion of OU-3, as well as mostly vacant areas with sparse vegetation north of the Tuscany community, a portion of which served as a former City of Henderson landfill (now closed) (Figure 1-3). The Wash is located downgradient (north) of each of these features.

The Wash is located in the southeast portion of the Las Vegas Valley (the Valley) (Figure 1-1). It is the primary drainage channel for the Valley (approximately 1,600 square miles) with perennial flows extending from Vegas Valley Drive for approximately 12 miles to Las Vegas Bay, at which point it empties into Lake Mead (Las Vegas Wash Coordination Committee [LVWCC] 2000), a reservoir on the lower Colorado River. The Wash is an essential component of the Valley's water resource infrastructure that is relied upon by the over three million residents of Southern Nevada. The Wash is the primary conveyance for treated wastewater and storm water flows from the Valley.

Up until the mid-twentieth century, the Wash was primarily an ephemeral channel incapable of supporting perennial emergent wetlands. From the 1950s to the 1970s, rapid urban development in the Valley resulted in increased storm water, urban runoff, and treated wastewater discharges that resulted in the establishment of extensive wetland and riparian areas along the Wash. By the 1980s, increasing base flows and periodic flood flows in the Wash contributed to extensive erosion, as well as loss of wetlands, loss of property, damage to infrastructure, excessive sediment transport to Lake Mead, and water quality degradation (LVWCC 2000). To address these issues, beginning in approximately 2000, a series of restoration measures have been implemented in the Wash. These measures include the construction of 21 weirs to control erosion, wetland restoration, and revegetation (LVWCC 2008.

The Wash is a highly sensitive and ecologically rich area. Two hundred and sixty-eight species of vertebrate wildlife have recently been documented along the Wash (LVWCC 2008). Surveys show that the Wash provides suitable habitat for many of Nevada's native wildlife species including critical habitat for threatened and endangered species.

2.2 Chemical Transport Pathways from OU-1 and OU-2 to OU-3

Characterization of sources of groundwater contamination and transport pathways from sources in OU-1/OU-2 to the Wash is being done as part of the NERT RI. Sources of groundwater contamination associated with the NERT Site are present in OU-1 (NERT Site) and the Eastside Sub-Area of OU-2 (where wastewater from OU-1 migrated to OU-2 and was ultimately placed into the BMI Ponds). These sources have resulted in a groundwater plume of perchlorate and other chemicals of concern that are discharging to the Wash. The former

PEPCON site is an additional source of perchlorate in groundwater. The perchlorate plume associated with the former PEPCON site is generally located to west of the plume originating from OU-1/OU-2, and also discharges perchlorate to the Wash.

Currently, groundwater contamination is discharging into the Wash largely through subsurface seepage. Subsurface seepage is currently being evaluated by NDEP through their contracts with AECOM and the USGS. Prior to the construction of the weirs, surface seeps had been identified along the banks of the Wash, and perchlorate contamination was detected in samples from these seeps along the southern bank. As a result of weir construction, the Wash channel is now at a higher elevation so that few above-ground seeps are still present along the Wash.

Historic releases within OU-1 included process chemicals leaking from soil to groundwater beneath OU-1 that then migrates in groundwater from OU-1 through OU-2, and into OU-3. Also, chemicals in the former BMI ponds in the Eastside Sub-Area of OU-2 impacted soil and leached into groundwater which then flows to OU-3 and discharges to surface water in the Wash. Vadose zone and deep soils within OU-1 and deep soils within OU-2 are an ongoing source of chemicals to groundwater and ultimately to the Wash.

2.2.1 Groundwater Remediation Systems

Groundwater investigation, remediation, and monitoring has been conducted at the NERT Site and downgradient of the NERT Site within the NERT Off-Site Study Area since the mid-1980s. The current Groundwater Extraction and Treatment System (GWETS) is designed to capture the highest concentrations of perchlorate and hexavalent chromium in groundwater originating from the NERT Site. Treatment of hexavalent chromium in groundwater began in 1987 and treatment of perchlorate in groundwater began in 1999. The GWETS has helped limit the migration of contamination in groundwater and has removed approximately 5,000 tons of perchlorate and over 23 tons of chromium from groundwater since treatment began.

The current GWETS utilizes three groundwater capture well fields, as shown on Figure 2-6, including the Interceptor Well Field (IWF), the Athens Road Well Field (AWF), the Seep Well Field (SWF), and the AP Area extraction wells. The IWF coupled with the on-site bentonite-slurry groundwater barrier wall (the “barrier wall”) provides capture of the highest concentrations of perchlorate and chromium and significantly reduces the amount of perchlorate and chromium in downgradient groundwater. Additional perchlorate mass is removed on-site via the AP Area extraction wells, which are located approximately 300 feet south of the IWF just west of the AP-5 pond. The off-site AWF, located approximately 8,200 feet downgradient of the IWF, captures moderate concentrations of both perchlorate and chromium (in comparison to groundwater captured by the IWF), but operates at higher extraction rates than the IWF, resulting in significant contributions to overall perchlorate mass removal from the environment and mitigation of perchlorate migration in groundwater. The SWF, located in close proximity to the Wash, operates at the highest extraction rate of the three well fields, but captures groundwater containing significantly lower perchlorate concentrations.

Treatment of chromium-contaminated groundwater extracted at the IWF and the AP Area occurs via the on-site Groundwater Treatment Plant (GWTP),[2] which chemically reduces hexavalent chromium and removes total chromium via chemical precipitation. Treatment of

[2] By convention, the “GWTP” consists of only the on-site hexavalent chromium treatment plant. The name pre-dates the installation of any of the perchlorate treatment systems and related components.

perchlorate-contaminated groundwater extracted at the IWF, AWF, SWF, or AP Area occurs via either 1) the on-site FBRs, which biologically remove perchlorate as well as chlorate, nitrate, and trace concentrations of residual chromium, or 2) an ion exchange (IX) treatment system. The IX treatment system was brought online in February 2017 to treat perchlorate in groundwater extracted from a portion of the SWF and assist NERT in managing the storage capacity of the GW-11 Pond which has been used to store extracted groundwater prior to treatment.

The FBR and IX systems discharge treated water to the Wash from a combined effluent pipe that discharges to a side channel of the Wash located immediately west of the Pabco Road erosion control structure under authority of National Pollutant Discharge Elimination System (NPDES) Permit NV0023060. Treated effluent discharged from the GWETS is generally non-detect for both perchlorate and hexavalent chromium.

3.0 EXISTING STUDIES AND DATA

This section describes the results of a literature review conducted for the Wash and surroundings as well as a summary of the studies currently being conducted within the Wash as part of the NERT RI and SNWA monitoring efforts. While a variety of data has been collected in the Wash, the OU-3 BERA will focus on risk associated with NERT's COPECs, as summarized in Section 5.4.

3.1 Summary of Existing Abiotic Data for the Wash

Several investigations and sampling programs have been implemented in and around the Wash. These programs have included sampling of groundwater, surface water, sediment, and soil, as described in the following section. Data related to NERT COPECs will be used in the BERA, as appropriate.

3.1.1 Groundwater Monitoring Programs in the NERT RI Study Area

There are several groundwater monitoring programs in place as part of the NERT RI, the primary purpose of which is to investigate perchlorate migration into the Wash. The primary groundwater monitoring programs are summarized below. Table 3-1 provides the results of groundwater sampling in 2017 from the wells closest to the Wash.

3.1.1.1 NERT Groundwater Monitoring Program

The current NERT groundwater monitoring program is described in the Remedial Performance Groundwater Sampling and Analysis Plan (SAP) (Ramboll Environ 2017a). Data collected as part of the NERT groundwater monitoring program are primarily used in the preparation of the NERT Annual Remedial Performance Reports for Chromium and Perchlorate (the Annual Performance Reports) and the Semi-Annual Remedial Performance Memoranda for Chromium and Perchlorate (the Semi-Annual Performance Memoranda), which are designed to meet reporting requirements described in the 2011 Interim Consent Agreement between the Trust and NDEP. The groundwater monitoring program includes eight monthly events, two quarterly events (generally performed in February and August), one semi-annual event (generally performed in November), and one annual event (generally performed in May). Groundwater monitoring wells included in the current monitoring program near the Wash include PC-155A, PC-155B, PC-156A, PC-156B, PC-157A, and PC-157B, as shown on Figure 3-1. These wells are screened in the shallow water-bearing zone and have been sampled semi-annually since the current monitoring program was implemented in November 2016. Samples from these six wells are analyzed for total chromium, perchlorate, TDS, chlorate, and nitrate. Samples from these wells are also collected and analyzed annually for volatile organic compounds (VOCs).

3.1.1.2 NERT Phase 1 and Phase 2 Remedial Investigation

The Trust has conducted groundwater sampling as part of the Phase 1 RI in 2015 and the Phase 2 RI in 2017. The goal of groundwater sampling conducted as part of the Phase 1 RI was to investigate groundwater data gaps within the NERT Site and NERT Off-Site Study Area. Six wells were installed and sampled near the Wash as part of the Phase 1 RI (PC-155A, PC-155B, PC-156A, PC-156B, PC-157A, PC-157B) to further investigate surface water and groundwater interactions in the downgradient plume adjacent to the Wash. Samples collected from these wells were analyzed for perchlorate, chlorate, metals, and general chemistry parameters in May 2015 as part of the Phase 1 RI. They were sampled again in February, June, and September 2016 as part of the Phase 1 RI supplementary sampling events, with samples analyzed for total chromium, boron, chlorate, perchlorate, TDS, and VOCs, before being added to the NERT groundwater monitoring program in November 2016, as described in Section 3.1.1.1. These wells were again sampled as part of the Phase 2 RI in October 2017, and samples were analyzed for perchlorate, chlorate, metals, general chemistry parameters, polychlorinated biphenyls (PCBs), and VOCs to address data gaps identified during the Phase 1 RI.

3.1.1.3 NDEP Downgradient Study Area Investigation

Additional groundwater sampling has been conducted in the Downgradient Study Area by AECOM under the direction of NDEP, the results of which will be incorporated by NERT into the comprehensive OU-3 RI report currently scheduled to be submitted to NDEP in late 2019. The objective of the Downgradient Study Area investigation is to identify subsurface pathways through which perchlorate-impacted groundwater is entering the Wash. Initial groundwater sample collection and gauging in the Downgradient Study Area was conducted by AECOM in April 2016, during which 61 monitoring wells were sampled. Samples were analyzed for perchlorate, chlorate, chromium (total and hexavalent), TDS, chloride, and bromide. This effort is described within the Groundwater Sampling Technical Memorandum, Revision 1 (AECOM 2017). Ramboll and AECOM installed (as a collaborative effort) nine additional monitoring wells in the Downgradient Study Area. The data from these wells will be evaluated as part of the OU-3 BERA. These monitoring wells are shown in Figure 3-1.

3.1.1.4 SNWA Groundwater Monitoring Program

SNWA conducts routine shallow groundwater sampling in the vicinity of the Wash to characterize groundwater quality and to evaluate the potential environmental impacts from shallow groundwater contributions to the Wash (SNWA 2015). SNWA began regularly monitoring shallow groundwater in approximately 20 monitoring wells near the Wash in the late 1990s. SNWA began sampling additional monitoring wells regularly in 2001 as part of a revegetation project. Currently, approximately 16 monitoring wells are sampled by SNWA quarterly for field water quality parameters, major ions, TDS, silica, boron, perchlorate, and metals.[3] The sampling wells closest to the Wash are shown in Figure 3-1.

3.1.2 Surface Water Sampling Programs

There are several surface water monitoring programs in place as part of the NERT RI and in support of the different programs in the Wash. The primary surface water programs include the LVWCC Surface Water Sampling Program, the NDEP Downgradient Study Area Investigation, the NERT SWF Quantification, and the NERT Las Vegas Wash Sampling. Sample locations from these various investigations are shown in Figure 3-2.

3.1.2.1 LVWCC Surface Water Monitoring Programs

The LVWCC was formed in 1998 and consists of 29 members from local, state, and federal agencies, environmental groups, the business community, the University of Nevada, and private citizens. The LVWCC published the most recent Las Vegas Wash Surface Water Quality Monitoring and Assessment Plan in October 2017, which describes surface water monitoring conducted within the Wash and other relevant tributaries and discharge sources by various agencies. The three primary agencies that currently conduct routine surface water sampling within the Wash include the SNWA, Bureau of Reclamation (BOR), and COH.

[3] Well locations include: COH-2B, LNDMW-1, LNDMW-2, WMW3.5N, WMW3.5S, WMW4.9N, WMW4.9S, WMW5.5S, WMW5.58SI, WMW5.7N, WMW6.15N, WMW6.15S, WMW6.55S, WMW6.9N, WMW6.9S, WMW7.8N

The Las Vegas Wash Surface Water Quality Monitoring and Assessment Plan (LVWCC 2017) provides a comprehensive review of SNWA's surface water sampling programs within the Wash, as well as surface water sampling programs performed by other agencies in the Wash.

SNWA acts as the lead agency for the LVWCC, and is one of several entities monitoring surface water in the Wash and tributaries to the Wash. SNWA has been regularly monitoring the Wash and its tributaries since approximately 2000 to evaluate the effect of channel improvements and assess overall water quality of the Wash. SNWA currently collects samples quarterly from approximately 10 locations along the Wash, ranging from the Flamingo Wash confluence (location Wash 11.5) to the Lake Mead confluence (location LVW 0.9). Samples are generally analyzed for alkalinity, ions, metals, minerals, and silica; samples from select locations are also analyzed for TDS and/or nutrients. Monthly samples are also collected from these 10 locations, which are analyzed for perchlorate, selenium, and TSS. Monthly samples collected from location Wash 3.4 are additionally analyzed for bacteria, ions, metals, minerals, nutrients, pharmaceutical and personal care products and steroids, and Legionella/Clostridium. Field parameters, including temperature, pH, DO, and specific conductance (SC), are also measured at each site during each monthly sampling event. Additional samples collected from location LVW 3.4 include weekly samples analyzed for TSS and turbidity, samples analyzed every other week for Giardia/Cryptosporidium, and samples analyzed twice per month for viruses. Additional analyses are also conducted twice per year on samples collected from location LVW 0.9 for various priority pollutants. Surface water sample locations recently sampled by SNWA and other LVWCC agencies are shown on Figure 3-2.

BOR has also been monitoring water in the Wash since 1989, primarily to track salinity changes along the Wash. BOR currently collects quarterly samples from approximately eight of the abovementioned surface water sampling locations within the Wash, which are analyzed for alkalinity, major ions, minerals, nutrients, perchlorate, selenium, silica, TDS, and TSS. Field parameters, including temperature, pH, and SC, are also measured at each location during each sampling event.

The COH also collects samples from approximately six of the abovementioned surface water sampling locations within the Wash every other week on behalf of various wastewater dischargers (COH, City of Las Vegas, City of North Las Vegas, and the Clark County Water Reclamation District) to comply with monitoring requirements of NPDES permits for each discharger. Samples are analyzed for bacteria, major ions, nutrients, TDS, TSS, and turbidity. Samples from location Wash 0.9 are additionally analyzed for selenium. Additional analyses are also conducted twice per year on samples collected from Wash 0.9 for additional ions, metals, and an extensive list of priority pollutants.

In addition to surface water samples collected from within the main Wash channel, SNWA and BOR monitor several additional surface water locations in tributaries to the Wash to characterize runoff that is entering the Wash (LVWCC 2017). SNWA currently monitors 14 locations across seven major tributaries, including Sloan Channel, Flamingo Wash, Monson Channel, Whitney Drain, Pittman Wash, Duck Creek, and Burns Street Channel. Sample locations are located upstream of the tributaries' confluence with either the Wash or another tributary of the Wash. Samples are collected from five of these locations on a quarterly basis and analyzed for alkalinity, bacteria, major ions, metals, minerals, nutrients, perchlorate, pharmaceutical and personal care products and steroids, priority pollutants, silica, surfactants, and TSS. Monthly samples are collected from all 14 locations and analyzed for selenium, TDS, and field parameters. BOR additionally samples six locations within treated effluent discharge channels to the wash. These locations are sampled quarterly and samples are analyzed for alkalinity, major ions, minerals, nutrients, perchlorate, selenium, silica, TDS, TSS, and field parameters

3.1.2.2 NDEP Downgradient Study Area Investigation

Additional surface water sampling has been conducted in the Downgradient Study Area by AECOM under the direction of NDEP, the results of which will be incorporated into the comprehensive OU-3 RI report currently anticipated to be submitted to NDEP in early 2020. The objective of the Downgradient Study Area investigation is to identify subsurface pathways through which perchlorate-impacted groundwater is entering the Wash. Initial surface water sample collection was conducted by AECOM in May 2016, during which samples were collected from 14 locations within the Wash, 7 locations within tributaries and/or side streams, and three surface seep locations, as shown on Figure 3-2. Samples were analyzed for perchlorate, chlorate, chromium (total and hexavalent), TDS, chloride, and bromide. These field investigation activities are fully described within the Surface Water and Seep Grab Sampling Technical Memorandum (AECOM 2016).

A second round of surface water sampling was performed by AECOM in conjunction with the United States Geological Survey designed to identify areas within the Wash where groundwater is discharging to the Wash (or vice versa). Surface water sampling was conducted by AECOM in December 2016, concurrent with a USGS seepage study scheduled for the same day. Surface water samples were collected from 14 locations within the Wash, one location in a tributary/side stream, and four locations within the wastewater discharge channel to which treated effluent from the GWETS is discharged. These same locations were sampled again in February 2017 daily for four consecutive days during daily minimum flow and daily high-end flow. A subset of five locations were also sampled during an estimated mid-flow period. Samples were analyzed for perchlorate, chlorate, TDS, chloride, and bromide. Samples were also collected from 45 locations across 11 transects in the Wash in January and February 2017, 8 of which were co-located with staff gages installed by AECOM designed to measure local flow rates and 3 of which were co-located with existing USGS gaging stations. Samples were analyzed for perchlorate, chlorate, TDS, chloride, and bromide. These field activities are fully described within the Surface Water Investigation Technical Memorandum (AECOM 2017b). An example dataset from AECOM's January-February 2017 Surface Water Investigation is provided in Table 3-2.

Additional surface water sampling was conducted by AECOM in May 2018 based on the findings of initial thermal infrared (TIR) imaging and fiber-optic distributed temperature survey (DTS) efforts conducted by AECOM in early 2018 (AECOM 2018). AECOM sampled approximately 13 transect locations and 14 grab sample locations. Samples were analyzed for perchlorate, chlorate, and TDS.

3.1.2.3 NERT Seep Well Field Quantification

In response to the 2014 Semi-Annual Remedial Performance Report and the 2014-2015 Annual Remedial Performance Report, NDEP requested that the Trust refine estimates of the sources of SWF flow by quantifying individual contributions of the Las Vegas Wash and the COH Bird Viewing Preserve to SWF extraction, as well as investigate the possibility of distinct groundwater sources from the shallow and deep zones (NDEP 2015). Surface water samples were collected by the Trust in February 2016 from the Wash immediately downgradient of the SWF in support of this effort, as shown on Figure 3-2. The results of this investigation were discussed in the Seep Well Field Flow Quantification Technical Memorandum, which was submitted to NDEP on September 9, 2016 (Ramboll Environ 2016b) and approved by NDEP on October 27, 2016. Samples were analyzed for the following:

- General chemistry parameters, including alkalinity, bicarbonate, carbon, carbonate, chlorate, chloride, hydroxide, nitrate, perchlorate, phosphorus, sulfate, TDS, and pH; and
- Metals, including aluminum, antimony, arsenic, barium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, vanadium, and zinc.

3.1.2.4 NERT Las Vegas Wash Sampling

The Trust routinely collects surface water samples from various locations along the Wash in support of its Remedial Investigation, permit compliance and remedial performance reporting efforts. Treated discharge from the Site's GWETS is discharged to the Wash from an effluent pipe that discharges to a side channel of Wash located immediately west of the Pabco Road erosion control structure under authority of NPDES Permit NV0023060. For compliance with the Site's NPDES permit, location Wash 5.5 in the Wash is sampled quarterly for iron, manganese, and TDS. The Site's NPDES permit also requires sampling of treated effluent discharged to the Wash from the Site as follows:

- Daily sampling for perchlorate;
- Weekly sampling for metals (chromium, hexavalent chromium, manganese, iron), pH, chemical biological oxygen demand (CBOD), dissolved oxygen (DO), total inorganic nitrogen (TIN), color, ammonia as N, phosphorus, and total suspended solids (TSS);
- Monthly sampling for sulfide and sulfate; and
- Quarterly sampling for TDS, oil and grease, chloride, additional metals, VOCs, semi-volatile organic compounds (SVOCs), pesticides, PCBs, dioxins, asbestos, and cyanide.

The Trust also collects surface water samples at several additional locations along the Wash in order to estimate perchlorate mass loading in the Wash (Figure 3-2), which is evaluated as part of the GWETS performance metrics reported in the Annual Remedial Performance Reports and the Semi-Annual Remedial Performance Memoranda. A sample dataset from the NERT June-December 2017 Surface Water Sampling Program is provided Table 3-3.

The Trust first presented perchlorate mass loading estimates at three locations (LVW 0.55, LVW 6.05, and LVW 8.85[4]) in the 2013 Semi-Annual Remedial Performance Report. These locations are co-located with United States Geological Survey (USGS) gaging stations that record streams flows that are used in the mass loading calculations. NDEP began sampling location Wash 0.55 in the late 1990s shortly after perchlorate contamination was first discovered the Wash in order to better understand perchlorate impacts on the Colorado River. Responsibility for this sampling was eventually transferred to Tronox, and subsequently the Trust when the Trust took title to the Site in 2011. The Trust also began sampling location Wash 6.05 in November 2016; previously, perchlorate data collected from this location by SNWA was used to estimate mass loading. Monthly surface water sampling at several additional locations in the Wash was proposed in the RI Phase 2 Modification No. 3 dated June 7, 2017, which was approved by NDEP on June 9, 2017, to allow monthly

[4] The numbers provided after LVW refer to the river mile.

perchlorate mass loading to be calculated at additional locations along the Wash. Following approval of the RI Phase 2 Modification No. 3, the Trust began sampling five additional locations in June 2017, one of which is a single point sample location (LVW 7.2) and four of which are multi-sample transects (LVW 6.6, LVW 5.3, LVW 4.2, LVW 3.5). Most of these locations are also co-located with USGS gaging stations, as shown on Figure 3-2. The abovementioned locations are currently sampled by the Trust monthly, except for location LVW 8.85 which is currently inaccessible due to property access limitations. Samples are analyzed for perchlorate, chlorate, and TDS.

The Trust also collects additional surface water samples from approximately eight locations in the Wash semi-annually in June and December in coordination with USGS supplemental instantaneous streamflow measurements at these locations, as shown on Figure 3-2. The Trust collects surface water samples from these locations contemporaneously with the USGS flow measurements, as practicable, to better estimate groundwater seepage at various locations within the Wash. These supplemental measurements began in December 2016 and are being conducted every six months for two years. Samples are analyzed for perchlorate, chlorate, and TDS.

3.1.3 Sediment Sampling Programs

SNWA conducted three rounds of sediment sampling in the Wash and its tributaries in support of their bioassessment studies between 2000 and 2008. Sample locations were selected by SNWA and the United States Fish and Wildlife Service (USFWS) although a rational for the selected locations was not provided. Chemicals of potential ecological concern (COPECs) were selected by SNWA and USFWS and compiled using general knowledge of COPECs routinely generated by industrial facilities (not necessarily the NERT Site) including metals, pesticides, polycyclic aromatic hydrocarbons (PAHs,), PCBs, dioxins, and other chemicals. Three reports were prepared by SNWA covering the following timeframes of investigation, as follows: 2000-2003 (SNWA 2006); 2005-2006 (SNWA 2008); and 2007-2008 (SNWA 2011).

This section provides a summary of information from the two most current sediment investigations that included locations in the Wash, the SNWA study from 2007-2008 (Section 3.1.3.1) and the DRI study from 2005-2006 (Section 3.1.3.2) (SNWA 2011 and DRI 2006). Both studies (The same sampling locations were used for both the 2005-2006 DRI sediment evaluation and the 2007-2008 SNWA sediment evaluation, which are shown in Figure 3-3. Table 3-4 provides a summary of concentrations of inorganic chemicals in sediment from the 2007-2008 sediment sampling. Although organic chemicals were analyzed during the 2007-2008 sediment sampling effort, the results were not tabulated as they were below laboratory detection limits. The SNWA study during 2007-2008 also included the collection of fish tissue and bird eggs, which is discussed in Section 3.2.3.

3.1.3.1 SNWA Sediment Evaluation[5]

SNWA conducted three rounds of sediment sampling in the Wash and its tributaries in support of their bioassessment studies between 2000 and 2008. This section provides a summary of data for the 2007-2008 timeframe because this information provides an overview of the available information and reflects the most current sampling event

[5] For the sediment data, there are some discrepancies between text and tables for the monitoring reports in regard to sample numbers. When such a discrepancy occurred, Ramboll used the tables to summarize the sample numbers described in the text.

conducted by SNWA (SNWA 2011). During the 2007-2008 sediment evaluation, a single composite sediment sample (representing five subsamples) was collected from each of the six locations. Specific details regarding the sediment sampling methods were not provided in the reports.

Of the 19 organic COPECs selected and analyzed by SNWA, none were detected; however, laboratory reporting limits may have been higher than the respective COPEC's LOCs. For the 22 inorganic COPECs analyzed, arsenic, copper, lead, and manganese exceeded their respective LOCs for sediment; however, no LOCs were identified for nine of the 22 inorganic COPECs (barium, beryllium, boron, magnesium, molybdenum, perchlorate, strontium, titanium, and vanadium). Each of these metals were detected in at least one sample with the exception of beryllium and boron (Table 3-4).

3.1.3.2 Desert Research Institute Sediment Evaluation

Sediment samples were collected from six locations in the Wash and surrounding areas (Duck Creek and the Clark County Wetlands Park) in 2006 to evaluate potential accumulation of contaminants in sediment (Papelis 2007). Samples were collected from bank soils and/or at the bank/stream interface in accordance with USEPA (1995) protocols. Samples were collected from the upper six inches of sediment at each location and composited. Samples were analyzed for selenium and physicochemical parameters including particle size distribution, specific surface area, mineralogy, and morphology. The concentrations of selenium in the supernatant (the liquid above the sediment) ranged from approximately 4 micrograms per liter (µg/L) to 8.1 µg/L in the Wash samples. Concentrations of selenium in sediment ranged from 1.7 milligram per kilogram (mg/kg) to 4.3 mg/kg in the Wash samples. All but one of the selenium sediment concentrations fell between levels of concern (LOCs)[6] and probable effect concentration[7], 1 and 4 mg/kg, respectively reported by Papelis (2006). LOCs represent threshold effects concentrations below which impact to ecological receptors is not expected. The LOCs were obtained from MacDonald et al (2000) and the Risk Assessment Information System (RAIS) Ecological Benchmark Values database (USDOE 2006). LOCs for selenium and perchlorate were obtained from USEPA (2004) and USEPA (2002), respectively.

3.2 Biological Data/Surveys

This section summarizes the results of species surveys and tissue residue analysis previously conducted in the Wash. Sections 3.2.1 and 3.2.2 provide information on species, populations and communities present within the Wash. The data provided is strictly observations and counts of various species in the Wash. These include benthic macroinvertebrate and fish community surveys and species counts for amphibians, reptiles, birds and mammals. These studies were used to inform the selection of receptors to use in the OU-3 BERA food web model (See Section 5.3). Tissue data is available from the literature for fish and bird eggs. These data are discussed in Section 3.2.3. While bird eggs were only collected in one location near OU-3 and fish tissue was collected in only one

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[6] It should be noted that the SNWA contractors used for their bioassessment studies reported that the selection of the LOCs was "not to be construed to represent a critical review of those data sources" and that "it [was] acknowledged that some sources containing potentially relevant information might have been overlooked and that some toxicity values that are not entirely applicable may have been used."

[7] The effect concentration is assumed to be a probable effects concentration as the LOC is based on a threshold effect concentration.

location within OU-3, these data will be considered in the OU-3 BERA risk assessment as appropriate.

3.2.1 Aquatic Community Studies

The Wash provides aquatic habitat for a variety of fish and macroinvertebrates which can be affected by changes in water flow and chemistry or placement of grade control structures or weirs. Previous studies on aquatic communities have been conducted for the aquatic organisms living in the Wash as summarized in the following sections.

3.2.1.1 Benthic Macroinvertebrates

Macroinvertebrates were surveyed annually in the spring from 2000 to 2003 and surveyed quarterly from 2004 to 2010 at 26 sites in the Wash and surrounding areas (tributaries and reference areas) using D-frame dip nets (Nelson 2011). Macroinvertebrate sampling locations from these surveys are shown in Figure 3-4. Results were used to evaluate how the benthic macroinvertebrate community responded to bank stabilization and enhancement activities in the Wash. Data collected suggests that hydrology and channel characteristics (current velocity, stream depth, and width), and water quality, are primary factors in determining macroinvertebrate community composition. The survey results indicated that there was no significant difference in taxa richness between seasons; however, there was a significant difference in the benthic macroinvertebrate community present at erosion control structures in the Wash when compared to the tributary and reference stations. Data shows taxa richness significantly increasing over time at areas with structures when compared to areas without structures, which may be attributed to the structures as well as to warm effluent, high baseflows, and altered water quality (Nelson 2011).

3.2.1.2 Fish Community

Shanahan (2005) conducted the most recent inventory of fishes in the Wash using direct capture techniques which included minnow traps, hoop nets, and seines. From this inventory, seven fish species were observed in the Wash. Two additional species were detected in a separate effort. In 2006, the shortfin molly (Poecilia mexicana) was first observed to be locally abundant in shallow ponded areas adjacent to the Pabco Road Weir, and in 2007, a small school of largemouth bass (Micropterus salmoides) was observed in the impoundment of the Bostick Weir (Ricks pers. comm). Pollard et al. (2002) also conducted fish sampling on the Wash and in the Clark County Wetlands Park Wetlands Park Nature Preserve. On the Wash, the researchers used a combination of electroshocking and minnow traps and detected six of the seven species found by Shanahan (2005) with the exception of the suckermouth catfish (Hypostomus plecostomus). Within the Clark County Wetlands Park Nature Preserve, Pollard et al. (2002) used a combination of minnow traps, gill nets, and seine hauls and found four species: red shiner (Cyprinella lutrensis), common carp (Cyprinus carpio), mosquitofish (Gambusia affinis), and green sunfish (Lepomis cyanellus).

Fishes that have been identified in the Wash are not native to Nevada nor are they native to the lower Colorado River and its tributaries. However, the species in the Wash are commonly found in the lower Colorado, Muddy, and Virgin Rivers. These fish likely migrated from Lake Mead to the Wash as flow conditions became favorable. Other sources of introductions may be attributed to direct human intervention (i.e. accidental release, stocking, etc.). Native fish were not historically found in the Wash (Bradley and Niles 1973), but if they did occur there, the non-natives likely replaced them by the 1970s.

3.2.2 Wildlife Population Surveys

The LVWCC has conducted a variety of population studies within the Wash and surroundings since early 2000. The LVWCC survey area includes the Clark County Wetlands Park (also referred to as the "Wetlands Park Nature Preserve") and the reach of the Wash contained within its boundaries ("LVWCC management area"). The boundaries of the LVWCC management area is consistent with the boundaries of OU-3. Approximately two hundred and seventy species of vertebrate wildlife have been documented along the Wash (LVWCC 2008). Surveys show that the Wash provides suitable habitat for many of Nevada's native wildlife species including critical habitat for threatened and endangered species. The individual reports can be found at: https://www.lvwash.org. A summary from these studies by organism group is provided below.

3.2.2.1 Amphibians

Systematic surveys to determine the presence of amphibians along the Wash were conducted in 2004 and 2005 by Rice (2007). Visual encounter surveys (see Crump and Scott 1994) were used to determine the presence of amphibian, particularly anuran, species in the Wash. Two species of amphibians were detected during these surveys, and an additional species, the Pacific tree frog (*Hyla regilla*), was detected while conducting surveys for other taxa (Van Dooremolen, pers. obs.). Several other amphibian species that were historically present in the Valley and surrounding areas (Stebbins 2003, Bradford et al. 2005) were not observed during these surveys.

Bradford et al. (2005) evaluated population status and distributional changes of amphibians over a 20,000-km^2 area in the eastern Mojave Desert, which included the Wash, from 1995 to 2004 by conducting visual and aural surveys and examining specimen records help at local museums. Their results indicate a decline in amphibian population as well as a significant change in the amphibian fauna present over the past century with the most striking change being the nearly complete replacement of the native leopard frog with the introduced bullfrog (*Rana catesbeiana*). Bradley and Niles (1973) detected six amphibians along the Wash, suggesting that species richness has declined over the years. This decline could be the result of habitat degradation, predation, or competition facilitated by changes in hydrology.

The most abundant amphibian in the Wash is the non-native bullfrog (*Rana catesbeiana*). The bullfrog is most often detected in slow moving backwater areas behind erosion control structures. They have also been documented, although to a lesser extent, in off channel areas of low to moderate salinity. As future weirs are constructed in the Wash, backwater habitats that are suitable for the bullfrog will expand and a concomitant increase in bullfrog populations is expected.

3.2.2.2 Reptiles

Many different reptiles occur along the Wash including snakes, lizards, and tortoises. Inventory work conducted by Shanahan (2005b) determined the presence of many lizards but only a few snakes. Species richness reported by Shanahan (2005a, pers. obs.) was substantially less than what was reported by Bradley and Niles (1973). Shanahan (2005a) conducted an intensive trapping effort for reptiles along the Wash from 2001 to 2003. Fourteen species (10 lizards and four snakes) were captured and the tracks of another snake were observed.

The most abundant reptile species trapped during the study was the Great Basin whiptail lizard (*Aspidosceles tigris tigris*) and the side-blotched lizard (*Uta stansburiana*), which is consistent with other studies of reptile abundance in the southwestern U.S. and in reference texts (Hirsch et al. 2002, Stebbins 2003, Szaro and Belfit 1986). Yearly variation in numbers and abundance of species is a characteristic of arid systems (Jones 1986), and spatial and temporal variability of primary productivity, particularly of annual vegetation, is a characteristic of the Mojave Desert (Smith et al. 1997). Primary productivity is likely a major factor in insect populations, which likely influences the abundance of the reptiles (mostly lizards) that prey upon these insects. Therefore, rainfall patterns may have an influence on spatiotemporal abundance of reptiles near the Wash.

3.2.2.3 Birds

Bird surveys are completed yearly in the Wash (LVWCC 2018). Data from 2005 to 2016 indicate that, as of 2016, there have been 209 species documented, comprising 43% of all bird species ever recorded for the State of Nevada with the species recorded being representative of lowland riparian areas in the region (GBBO 2018).

Prior to 2005, the most detailed assessment documenting the temporal variability of bird occurrence along the Wash was completed by Van Dooremolen (2005). The 2005 report includes a list of 128 species, of which 68 were presumed nesting. Van Dooremolen (2005) summarized survey data collected between 2000 and 2003 and analyzed the data by calculating species richness, attributing status and abundance measures for species detections. Of the 128-species detected in the three-year period, 49 were permanent residents, 24 were winter residents, 19 were summer residents, 31 were migrants, 2 were accidental, and 3 were introduced. Cumulatively, the study resulted in the identification of 140 species including birds detected outside of the study area on survey days.

Since 2005, San Bernardino County Museum (SBCM) has been contracted by SNWA to conduct point count surveys along the Wash (Braden et al. 2007). These surveys represent the most quantitative inventory of spatiotemporal bird occurrence and habitat usage ever conducted in the Wash area. Censuses are conducted biweekly at approximately 30 census points. In the first year of the study, 114 species were documented at census points and an additional 15 were reported as flyovers or off-point observations (Braden et al. 2007). Ninety species were present in the breeding season, and 66 were present in the non-breeding season. Species richness was fairly constant, with an average of 33 species detected per census event. Abundances varied more greatly and were highest from May through August and lowest from February through April. A total of 1,281 individuals were detected during the year. The six most abundant species represented more than 36% of the total abundance, while the top 23 species accounted for more than 73%. Five species were detected at all 29 points showing the widest distribution in Wash habitats, while a total of 21 species (including crissal thrasher and orange-crowned warbler) were detected at more than 75% of the points. Included in the most abundant and widely distributed species are 15 nesting species, some of which are thought to be in decline throughout the western U.S.

Attributing status to the 129-total species, there were 54 permanent residents, 25 winter residents, 25 summer residents, and 25 migrants. Twenty-one species were confirmed as breeding, while an additional 41 were identified as likely or possibly breeding (Braden et al. 2007). Including preliminary data gathered through the second year and a portion of the third year, 154 species have now been identified by the SBCM study. As a brief habitat note, vegetation data show that salt cedar accounts for the majority of habitat currently found at the census points.

3.2.2.4 Mammals

Bradley and Niles (1973) reported 39 mammal species found adjacent to the Wash. Since the Bradley and Niles (1973) inventory, mammal occurrence along the Wash has been well documented. There have been non-volant small mammal studies conducted along the Wash between 2002 and 2006. Larkin (2006) examined the status of small mammal populations in the dominant terrestrial habitat types found along the Wash by using a mark-recapture survey. Several rodent species made substantial use of salt cedar habitat. Desert wood rat (*Neotoma lepida*) and cactus mouse (*Peromyscus eremicus*) appeared dependent on salt cedar habitats, whereas desert pocket mouse (*Chaetodipus penicillatus*) and long-tailed pocket mouse (*Perognathus formosus*) were generalists that were found in all habitat types. The Merriam kangaroo rat (*Dipodomys merriami*) and little pocket mouse (*Perognathus longimembris*) were most abundant in saltbush and creosote bush habitats, respectively. However, these surveys have limited sites in woodland-marsh habitat. As a result, the Las Vegas Wildlife Management Plan (WMP) recommended additional monitoring in marsh habitats (Foster and Eckberg 2011). Eight sites located in marsh, riparian, and woodland habitats were surveyed between January 2010 to November 2010. Each site was monitored once during each season for two consecutive nights using baited traps situated along a transect. The yearlong survey resulted in 588 captures of ten species with the cactus mouse *(Peromyscus eremicus*) being the most abundant, followed by the house mouse (*Mus musculus*).

Herndon (2004), Larkin (2006), and Shanahan (2008, pers. obs.) observed 11 small non-volant mammals (Order Rodentia and Insectivora) along the Wash, and Foster and Eckberg (2011) observed 10 small nonvolant mammals in marsh/riparian habitats in the Wash. It appears that some species have declined in relative abundance since the 1970s; however, all species documented by Bradley and Niles in 1972 have been identified either by Larkin (2006) or Foster and Eckberg (2011).

3.2.2.5 Large Mammals

Large mammals were observed along the Wash while conducting surveys for other taxa and during other routine visits. These direct observations and observations of sign (i.e., scat, burrows, tracks, etc.) were used to establish occurrence along the Wash. The largest mammal that is found along the Wash is the bighorn sheep (*Ovis canadensis*). Between 1998 and 2006 only two bighorn sheep were observed which suggests that they are rarely found along the Wash. Coyote (*Canis latrans*) is another large mammal found along the Wash (LVWCC 2008).

Detailed demographic information is not known, but coyote pups are routinely observed in the spring. Two lagomorphs are common to the Wash and are regularly observed; they are the Audubon cottontail (*Sylvilagus audubonii*) and the black-tailed jack rabbit (*Lepus californicus*). The beaver (*Castor canadensis*), the largest member of Order Rodentia, is native to the Wash, but considered a nuisance species by cutting down willows and cottonwoods at revegetation sites (LVWCC 2008).

A medium to large-sized mammal inventory was conducted by Eckberg and Foster (2011b) between November 2009 to January 2011 in six upland and six riparian areas along the Wash using motion triggered camera traps. Animals captured were comprised of five families and eight different genera, including three species which have not been documented in the area since the early 1970s; striped skunk (*Mephitis mephitis*), Western spotted skunk (*Spilogale gracilis*), and ring-tailed cat (*Bassariscus astutus*).

Other large mammals that have been detected along the Wash include the kit fox (*Vulpes macrotis*), ringtail (*Bassariscus astutus*), bobcat (*Lynx rufus*), and raccoon (*Procyon lotor*). The bighorn sheep is the only protected large mammal found within the LVWCC management area which is consistent with the OU-3 study area around the Wash. In Nevada, it is unlawful to kill or possess a bighorn sheep unless a permit has been acquired from the Nevada Department of Wildlife (Nevada Revised Statutes [NRS] 501.376).

3.2.2.6 Bat Monitoring Studies

Bat studies were conducted in the Wash between 2004 to 2010 at sites within the Wash to document bat species diversity and activity utilizing acoustic monitoring systems (O'Farrell and Shanhan 2005, Eckberg and Foster 2011a). Data from these studies indicate the presence of 18 bat species in the Wash including California myotis (*Myotis californicus*), western yellow bat (*Lasiurus xanthinus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), pallid bat (*Antrozous pallidus*), Yuma myotis (*Myotis yumanensis*), hoary bat (*Lasiurus cinereus*), western pipistrelle bat (*Pipistrellus hesperus*), big brown bat (*Eptesicus fuscus*), Townsend's big-eared bat (*Corynorhinus townsendii*), western red bat (*Lasiurus blossevillii*), western small-footed bat (*Myotis ciliolabrum*), greater mastiff bat (*Eumops perotis*), Allen's big-eared bat (*Idionycteris phyllotis*), California leaf-nosed bat (*Macrotus californicus*), big free-tailed bat (*Nyctinomops macrotus*), fringed myotis (*Myotis thysanodes*), silver-haired bat (*Lasionycteris noctivagans*), and spotted bat (*Euderma maculatum*). Four of these are State-listed Sensitive species and four are State-listed Protected species. These studies indicate that bats are consistently using the Wash and not just migrating through.

3.2.2.7 Special Status Species

Several threatened and endangered species may occur along the Wash; however, only a few of these species are likely to occur for extended periods of time. Observations of special status birds is provided in Figure 3-5. Observations of desert tortoise are shown in Figure 3-6.

Southwestern Willow Flycatcher

There are no known historical detections of the federally endangered southwestern willow flycatcher, a subspecies of the willow flycatcher, in the LVWCC management area, which is consistent with the OU-3 study area in and around the Wash. However, Lawson (undated) observed the willow flycatcher to be an abundant migrant. Since 1998, SWCA Environmental Consultants (SWCA) has been contracted to conduct field surveys to determine the occurrence of the southwestern willow flycatcher in areas adjacent to the Wash and to assess existing potentially suitable nesting habitat (SWCA 1998; LVWCC 2018).

In general, one or two individuals were detected each year (although no individuals were detected in 1999, 2001, or 2005). However, in 2004, a survey conducted in May yielded 18 detections representing 16 individuals (SWCA 2005). These individuals were not detected during subsequent surveys, so it was concluded that they were migrants. This is typical of detections within the Wash. In 2007, an individual was detected during the third survey period, in late June. In 2017, two migrant willow flycatchers were detected (Van Dooremolen 2018). Federal protocol states that all migrants should have arrived on their breeding grounds by this time, so an individual detected during this survey period should be considered a potential breeder (Sogge et al. 1997) and thus of the endangered southwestern subspecies. Observations of both the willow flycatcher and the endangered southwestern willow flycatcher are shown in Figure 3-5.

Yuma Clapper Rail

Two records exist of clapper rail detections in the vicinity of the Wash prior to 1998. Alcorn (1988) states that, in early September 1959, eight clapper rails were detected in the Las Vegas Sewage disposal ditch (currently known as the City of Las Vegas Water Pollution Control Facility discharge channel), which discharges to the Wash at the northernmost boundary of the LVWCC management area, which has boundaries consistent with the OU-3 study area around the Wash. Another individual was recorded just one week later. These birds were undoubtedly of the now endangered subspecies, Yuma clapper rail, given the proximity to that population, which is restricted to the lower Colorado River system and the Salton Sea (Anderson and Ohmart 1985).

The next detections occurred nearly four decades later when SWCA documented two incidental observations of the Yuma clapper rail just upstream of Pabco Road during the 1998 southwestern willow flycatcher surveys (SWCA 1998). Despite systematic surveys conducted for the species in 2000 and 2001 by McKernan and Braden (2001, 2002) and those carried out by SWCA in 2002, 2003, 2005, 2006, and 2007 (SWCA 2002, 2003, 2005, 2006a, 2007), only two more clapper rails have been detected within the LVWCC management area since 1998. The third Yuma clapper rail was detected during the 2005 southwestern willow flycatcher surveys in the marsh upstream of the Demonstration Weir. The fourth Yuma clapper rail was detected in June 2006 in the C-1 channel (SWCA 2007), a tributary to the Wash that drains runoff from adjacent developments and that was dominated by cattails at the time of the detection. The most recent survey in 2017 did identify the presence of the clapper rail on Route 4 in the Clark County Mitigation Wetlands (Van Dooremolen 2017a).

Qualitative observations of habitat conditions indicate that the construction of erosion control structures has continued to increase the quantity of potential Yuma clapper rail habitat within the LVWCC management area which is consistent with the boundaries of OU-3.

Yellow-Billed Cuckoo

Information on the status of yellow-billed cuckoo along the Wash prior to 1998 is lacking. In 1998, a yellow-billed cuckoo was detected near the on the west end of the OU-3 boundary (SWCA 1998). The surveys conducted along the Wash in 2000 and 2001 (McKernan and Braden 2001, 2002) represent the first systematic surveys for this species within the boundaries of the management area, during which no migrant or resident yellow-billed cuckoos were detected. SWCA continued the systematic surveys in 2002, 2003, and 2004, still with no migrant or resident yellow-billed cuckoo detections (SWCA 2002, 2003, 2005), at which time surveys were ended due to lack of potentially suitable yellow-billed cuckoo habitat along the Wash. Surveys recommenced in 2013 for two sites in the Wash, including the Clark County Wetlands Park Nature Preserve and the Wash. One potential cuckoo territory was identified in the Wash resulting in five detections over three survey periods. In addition, a potential nest was identified based on alarm calls of the cuckoo. Habitat quality for the cuckoo was noted to have increased in the Wash from previous years (Van Dooremolen 2017b).

Desert Tortoise

Desert tortoises are protected by the Endangered Species Act (ESA) and are listed as threatened in the U.S. They are found throughout Clark County in valley bottoms and bajadas at low to moderate elevations. Desert tortoises are often found in areas vegetated with creosote bush. Along the Wash, the most suitable desert tortoise habitat is located in the areas towards the north and southeast. Desert tortoise surveys were first conducted along the Wash in 1994 (SWCA 1998). Survey methods followed the USFWS and U.S. Bureau of Land Management protocols (USFWS 1992, Eagen undated). During these surveys, two desert tortoises and three burrows were observed within the surveyed area.

Other tortoise survey activities that have been conducted along the Wash occurred between 2002 and 2003. Three tortoises were observed during surveys along a tortoise fence established for the survey[8] (Figure 3-6). Tortoise surveys were also conducted in 2005 (SWCA 2006a, SNWA 2006). Surveys were conducted by SWCA (2006) for Clark County and the BOR as part of an ESA section seven informal consultation with the USFWS. SWCA (2006b) found 12 burrows within the Wetlands Park, a carcass, a piece of scat, and 5 other burrows outside of the park.

Fish

No information or studies regarding the presence of listed species of fish in the Wash were found during the literature review. However, an email communication was initiated with Tim Ricks, a senior biologist with the LVWCC, who stated that razorback sucker and bonytail (the only two possible listed fish species) do not occur in the Wash. Critical habitat for these two species does exist in Lake Mead, however.

3.2.3 Tissue Residue Studies

SNWA and USFWS have conducted three sets of monitoring studies for whole body fish tissue and bird eggs in the Wash and its tributaries (SNWA 2006, SNWA 2008, SNWA 2011), as well as for a reference area (Pahranagat National Wildlife Refuge [PNWR]) located approximately 90 miles north of Las Vegas.

Sample locations selected by SNWA and USFWS are shown in Figure 3-3, although a rational for their selection was not provided. COPECs were selected by SNWA and USFWS and compiled using general knowledge of chemicals routinely generated by industrial operations. Data was compared to LOCs reportedly derived from selected compilations and databases[9]; however, the LOC source for each chemical was not provided.

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[8] A tortoise fence is designed to confine tortoises or exclude them from harmful situations, primarily roads and highways.

[9] It should be noted that SNWA reported that the selection of the LOCs was “not to be construed to represent a critical review of those data sources” and that “it [was] acknowledged that some sources containing potentially relevant information might have been overlooked and that some toxicity values that are not entirely applicable may have been used.” There are some discrepancies between text and tables for the monitoring reports in regard to sample numbers. When such a discrepancy occurred, Ramboll used the tables to summarize the sample numbers described in the text.

***Fish Tissue*[10]**

Monitoring efforts from 2007-2008 involved the collection and analysis of fish tissue from 34 fish from the Las Vegas Valley and PNWR. Four species of fish were collected including common carp, green sunfish, largemouth bass, and black bullhead (SNWA 2011; Table 3-5 and Table 3-6).

Whole body fish tissue was analyzed for 36 organic COPECs selected by SNWA and all but six (aldrin, endrin, heptachlor, o,p'-DDT, endosulfan II, and toxaphene) were detected. LOCs were available in the literature for only four of the detected organic COPECs. For those organic COPECs with a published LOC, only total PCBs exceeded its LOC of 0.1 mg/kg wet weight (ww) (Table 3-5) with a maximum concentration of 0.513 mg/kg ww. Levels of PCBs in fish from PNWR were generally an order of magnitude lower than levels in fish from the Wash.

Whole body fish tissue was analyzed for 19 inorganic COPECs; beryllium and molybdenum were not detected in whole fish. LOCs were available in the literature for only eight of the detected inorganic COPECs. For those inorganic COPECs with a published LOC, the maximum concentrations of seven chemicals exceeded their respective LOC as follows: arsenic (0.30 mg/kg ww), cadmium (0.13 mg/kg ww), chromium (11 mg/kg ww), copper (2.7 mg/kg ww), lead (0.57 mg/kg ww), selenium (7.7 mg/kg ww), and zinc (140 mg/kg ww; Table 3-6). When inorganic COPECs were detected in fish from the reference area, their concentrations were similar to or less than those observed in fish from the Las Vegas Valley. Whole fish samples from PNWR exceeded LOCs identified for chromium, copper, and zinc.

***Bird Eggs*[11]**

SNWA conducted a study involving the collection and analysis of bird eggs in the Las Vegas Valley in 2007-2008 (SNWA 2011). At total of 26 bird eggs (23 from five locations in the Las Vegas Valley and three from PNWR) were collected from the following species: American coot; killdeer; red-winged blackbird; and marsh wren. No information regarding the method of collection was provided in the report or in the referenced studies (LVWCC 2001; Intertox and Black & Veatch 2006; and Intertox 2008).

Bird eggs were analyzed for 36 organic COPECs (selected by SNWA) and all COPECs were detected at least once (Table 3-7). LOCs were available from the literature for only eleven of the detected organic COPECs. Maximum concentrations of four of the organic COPECs exceeded their respective LOC: dieldrin (1.17 mg/kg ww); heptachlor epoxide (0.313 mg/kg ww); p,p'-DDD (0.193 mg/kg ww); and p,p'-DDE (15.8 mg/kg ww).

Bird eggs were analyzed for 19 inorganic COPECs (Table 3-8). Of these, seven were not detected: aluminum; beryllium; cadmium; molybdenum; nickel; lead; and vanadium. Of the 12-remaining detected inorganic COPECs, seven did not have a corresponding LOC. Of the 12 COPECs with LOCs, only mercury exceeded its respective LOC with a maximum

[10] For the fish tissue data, there are some discrepancies between text and tables for the monitoring reports in regard to sample numbers. When such a discrepancy occurred, Ramboll used the tables to summarize the sample numbers described in the text.

[11] For the bird egg data, there are some discrepancies between text and tables for the monitoring reports in regard to sample numbers. When such a discrepancy occurred, Ramboll used the tables to summarize the sample numbers described in the text.

concentration of 0.22 mg/kg ww compared to the mercury LOC of 0.05 mg/kg ww. LOCs were available in the literature for only eight of the detected inorganic COPECs.

A comparison of the results from the reference area to the Las Vegas Valley study area showed that many of the organic COPECs that were detected in bird eggs collected from the Las Vegas Valley were also detected in at least a few of the eggs collected from PNWR. Levels of heptachlor epoxide, oxychlordane, trans-nonachlor, mirex, and total PCBs in eggs from PNWR were an order of magnitude lower than levels of these contaminants in eggs from the Wash. Only one bird egg from PNWR exceeded any LOC for an organic COPEC (the minimum LOC identified for 4,4'-DDE in bird eggs). When inorganic COPECs were detected in bird eggs from PNWR, their concentrations were similar to those observed in eggs from the Las Vegas Valley. Bird eggs from PNWR exceeded only one LOC for an inorganic COPEC, mercury.

4.0 PROPOSED FIELD SAMPLING OVERVIEW

The following section provides a summary of the proposed OU-3 field investigation. The proposed abiotic and biotic samples to be collected are described below. Proposed abiotic sampling includes collection of surface water, sediment, sediment pore water, and soil samples. The proposed biotic sampling program includes performing a macroinvertebrate community evaluation and the collection of macroinvertebrate and fish tissue samples. The complete FSP is provided in Appendix A. The FSP details the collection procedures, field instrumentation, sample handling, and laboratory analyses that will be used to measure chemical constituents in various media.

4.1 Study Area, Sample Locations, and Analytical Methods

The evaluation of existing data described in Section 3 was used to identify specific data gaps that need to be filled in order to conduct the OU-3 BERA. The proposed field sampling locations are shown in Figure 4-1 as transects with the intent of allowing the field team to make decisions about the specific location along or near the transect to sample at the time of sampling. Groundwater which originates at the NERT Site and is not captured by the GWETS generally discharges to the Las Vegas Wash east of Transect C. Therefore, sampling from Transects D through L represent areas of the Wash that may be influenced by NERT groundwater impacts, as well as those from sources other than NERT. Sampling Transects A, B and C are upstream of the NERT groundwater plume that enters the Wash and are therefore not influenced by NERT. Sampling at Transects A, B and C will provide information on contributions from other sources (i.e. AMPAC/Endeavor). Having sampling transects upstream and downstream of the area where groundwater from the NERT Site enters the Wash provides a basis of comparison regarding contributions from various sources.

The exact location of each sample collected will be documented using Global Positioning System (GPS) measurements. Where practicable, the samples collected for each type of analysis will be co-located to assist in the interpretation of the results and assess possible relationships between abiotic and biotic media.

Reference areas are areas that have similar ecological conditions as the target sampling zone. However, reference areas are not influenced by the Site. For this field sampling program, three reference areas have been selected upgradient from the Site within the Wash (Figure 4-1). Reference locations serve to form a basis of comparison for evaluation of site-related environmental conditions (e.g., contaminants, physical characteristics).

4.1.1 Proposed Abiotic Sample Types and Locations

The surface water, sediment, sediment pore water and soil sampling proposed in support of the OU-3 BERA is summarized below. Details regarding field instrumentation and methodology are provided in Appendix A.

4.1.1.1 Surface Water

As described in Section 3, there is a significant amount of surface water data for the Wash and surface water sampling is ongoing primarily by NERT and SNWA. The Ramboll/Tetra Tech sampling locations within the Wash coincide with USGS stream gages as the flow rates are necessary to calculate mass flux of perchlorate into the Wash. Most of the surface water sampling conducted in the Wash was focused on a small number of chemicals including perchlorate, chlorate, total and hexavalent chromium, total dissolved solids, chloroform and various ions. The surface water sampling being proposed for the OU-3 BERA includes sampling at the locations currently being sampled as part of the NERT monthly sampling program plus additional transects to ensure adequate spatial coverage of the Wash. Surface water samples will be analyzed for specific chemicals as described in Section 5.4 and Appendix A.

Surface water will be collected at two locations from each of the twelve transects as shown on the inset in Figure 4-1, with one sample collected closer to the southern bank and one collected closer to the northern bank. The southern bank represents the side of the Wash where groundwater discharges into the Wash. Results from previous studies indicate that chemical concentrations may be higher closer to the south bank. An additional surface water sample (co-located with sediment and macroinvertebrate sampling, if volume requirements can be met) will be collected from the COH Bird Viewing Preserve ponds as shown in Figure 4-1. Surface water samples will also be collected at each of the three reference locations, which are unimpacted by the Site (also identified on Figure 4-1).

The surface water in the Wash could be potentially impacted by the Site via discharge of contaminated groundwater. Human exposures to surface water could occur for the recreational users wading or fishing in the Wash. The surface water samples proposed above will be used in the OU-3 Baseline Health Risk Assessment (BHRA) which will be performed concurrently with this BERA to evaluate human health risks in OU-3.

4.1.1.2 Sediment

As described in Section 3, only two studies were found during the literature/data review for the Wash that included the collection of sediment. Both studies were conducted over 10 years ago in 2006 and 2007. Surface sediment samples (upper six inches) were collected from six locations in the Wash area[12] (only one of which was within OU-3) to evaluate potential accumulation of contaminants in sediment (SNWA 2011). A rational for the locations selected was not described. Given that the sediment evaluations were conducted over 10 years ago and were limited in both spatial extent and the number of constituents analyzed, the OU-3 BERA field sampling effort will include surface sediment sampling (0 to 6-inch depth) on or near each of the 12 transects closer to the south bank and at five transect locations closer to the north bank (Figure 4-1; Table A-2). The sediment sampling locations will coincide with the surface water sampling locations as closely as practicable. An additional sediment sample (co-located with surface water and macroinvertebrate sampling, if volume requirements can be met) will be collected from the COH Bird Viewing Preserve ponds. Sediment samples will also be collected at each of the three reference locations. Surface water samples will be analyzed for specific chemicals as described in Section 5.4 and Appendix A.

Human exposures to sediment could occur for the recreational users wading or fishing in the Wash. The sediment samples proposed above will be used in the OU-3 BHRA to evaluate human health risks in OU-3.

4.1.1.3 Sediment Pore Water

Sediment pore water has not been collected during any previous studies performed in the Wash, as discussed in Section 3. The purpose of pore water sampling is to evaluate

[12] Three of the sediment sampling locations were south of the wash, including one from a tributary and two from the City of Henderson Bird Viewing Preserve ponds. Another sampling location was on the east side of Lake Las Vegas which is well outside of OU-3.

dissolved constituents in water that occupies the spaces between sediment particles and to which benthic invertebrates are directly exposed. Evaluation of sediment pore water can provide insight into the fraction of chemicals in sediment that are bioavailable to aquatic organisms and are readily taken up into biological tissues and into the biological food web of the Wash. Since sediment pore water has not been sampled previously, it is proposed that pore water be collected as part of this investigation. Sediment pore water will be collected at nine of the twelve transects as illustrated on Figure 4-1 and at each of the three reference locations. The passive diffusion methodology that will be used to collect sediment pore water is described in Appendix A. Sediment pore water samples will be analyzed for specific chemicals as described in Section 5.4 and Appendix A.

4.1.1.4 Soil Data

As described in Section 3, only limited soil sampling has occurred in OU-3. Soil samples were collected in the seep area to the south of the Wash in a low-lying area near the former seep and seep sump installed by Kerr-McGee. During grading activities performed by SNWA in 2017, this area was covered with 2 to 5 feet of soil; therefore, these data are no longer relevant for use in the BERA. Therefore, the field sampling will include the collection of bank soil and soil from low-lying areas within the Wash at nine locations between 0 and 0.5 feet (ft) below ground surface (bgs) as well as surface soil at the seep area that was covered with clean soil to address potential risks to terrestrial receptors (Figure 4-1). In addition, deeper soil samples (between 0.5 and 3 feet bgs but targeting between 2 and 3 feet unless there is refusal) will be collected from a subset (i.e., six) of the bank soil sampling locations in the Wash. These samples will be used to determine if site-related chemicals have migrated deeper into the soil after deposition on the banks. Depending on the results of the deeper soil sampling, additional investigation, including consideration of fossorial mammals, may be warranted.

There were also former seeps that could have contributed to migration of Site-related chemicals to the Wash. However, most of those seeps are no longer present, as the installation of weirs increased the water level in some areas resulting in the inundation of former seeps. There has also been development in areas that resulted in the elimination of seeps. The nine-bank soil and soil sample locations proposed to address potential risks to terrestrial receptors are located near areas where human exposures could occur for recreational users, so these data will be used in the BHRA to evaluate human health risks in OU-3. Soil samples will be analyzed for specific chemicals as described in Section 5.4 and Appendix A. As discussed in the RI/FS Work Plan (ENVIRON 2014a), the human health impact from the Site on soils in other areas of the Off-Site RI Study Area (e.g. residential areas to the south of the Wash) is considered negligible and will be qualitatively discussed in the BHRA for OU-3.

4.1.2 Proposed Biological Sampling Types and Locations

This section provides a summary of the biological sampling proposed for OU-3. The review of existing biological studies summarized in Section 3 has informed the biological sampling approach described below.

4.1.2.1 Population and Community Studies within the Wash

A significant number of population and community studies have been conducted in the Wash. These include macroinvertebrate, fish, amphibian, reptile, bird and mammal surveys. These studies focused on basic counts of the different species within each of these organism groups. This information is provided in detail in Section 3. The studies were conducted over 10-15 years ago; however, they still provide valuable information regarding species assemblages in the Wash. This information was used to inform the problem formulation section of the OU-3 BERA (as presented in Section 5). It is proposed that a community evaluation only be conducted for the macroinvertebrate community in the Wash as described in the following section. No other species surveys are proposed as part of the OU-3 BERA field sampling effort at this time because the BERA will provide food web modeling to evaluate potential risks to wildlife species. If the BERA identifies potential risks for wildlife species, then focused studies on those species may be proposed in the future. The BERA will also use a quantitative approach, if available, to evaluate other species (fish and amphibians/reptiles) using chemical data and toxicity reference values. The results of this evaluation may also suggest the need for additional studies in the future.

4.1.2.2 Macroinvertebrate Community Evaluation

The macroinvertebrate community evaluations conducted in 2000-2010 (SNWA 2012) did not include an evaluation of the health of the benthic community in the Wash to assess the degree to which chemical inputs have impacted the benthic community. Therefore, a multi-metric assessment will be conducted in the Wash as part of the OU-3 BERA field sampling effort. Macroinvertebrates will be collected at each of the twelve transects, reference locations and the COH Bird Viewing Preserve ponds as shown on Figure 4-1. The actual placement of these reference locations for the macroinvertebrate sampling will be dependent upon the habitat and final selections will be made at the time of sampling.

Using multiple metrics to evaluate the benthic community allows for the synthesis of diverse biological information to understand relationships between human influence and biological attributes. The biological attributes or 'metrics' are sensitive to changes in biological integrity caused by human activities. The multi-metric approach compares what is found at a sampling location to what is expected using a regional baseline condition that reflects little or no human impact (Karr 1996). Multi-metric indices utilize a variety of measurements to assess the biological condition, or health, of a water body.

Multi-metric biological indices include the following benthic macroinvertebrate information:

- Pollution tolerance/intolerance taxa;
- Taxonomic composition (number and abundance of taxa); and
- Population attributes (e.g., number of predators)

These biological indices will be determined by a taxonomic laboratory on the collected macroinvertebrate samples, as further described in Appendix A.

4.1.2.3 Tissue Residues

Macroinvertebrate and fish tissue sampling is proposed for the OU-3 BERA field sampling effort as summarized below.

Macroinvertebrate Tissue

No macroinvertebrate tissue studies were identified during the OU-3 literature review. As macroinvertebrates support the base of the food chain, chemical concentrations in macroinvertebrate tissue can inform potential risk to fish and wildlife (i.e. wading birds) that forage on these organisms. Therefore, macroinvertebrates will be collected at each of the twelve transects, reference locations and from the COH Bird Viewing Preserve ponds[13]. These reference locations were selected because they are upgradient from Site-related influences and are identified on Figure 4-1. The tissue will be analyzed for organic and inorganic constituents in order to better estimate potential risk to the benthic invertebrate community and to the wildlife that forages on these organisms. Surface water samples will be analyzed for a more complete suite of chemicals, as described further in Section 5.4 and Appendix A.

Fish Tissue

As discussed in Section 3, a fish tissue study was conducted in the Wash in 2007-2008. Fish were collected from eight locations within the Wash, five of which were within OU-3. The tissue was analyzed for 36 organic and 19 inorganic chemicals (SNWA 2008, SNWA 2011). Since these data are over 10 years old, a re-evaluation of fish tissue is proposed for the OU-3 BERA. Fish will be collected at each of the twelve transects and reference locations. Fish samples will be analyzed for specific chemicals as described in Section 5.4 and Appendix A.

Bird Eggs

Bird eggs were also collected in 2007-2008; however, no collection of bird eggs is being proposed as part of the OU-3 BERA because the previous data will be considered in the BERA. Future sampling of eggs will only be proposed, if deemed necessary, based on the outcome of the OU-3 BERA.

[13] Collection of macroinvertebrates for tissue analysis is contingent upon the ability to obtain the required volume necessary for analysis.

5.0 BERA PROBLEM FORMULATION

Problem formulation is a planning step that identifies the major concerns and issues to be considered in an ERA, along with a description of the basic approaches that will be used to characterize the potential risks that may exist. The problem formulation step establishes the goals, scope, and focus of the assessment. Problem formulation synthesizes what is known about or predicted for a given site in order to develop a CSM that will guide the ERA process. A CSM is a written description and visual representation of predicted relationships between ecological entities and the stressors to which they may be exposed.

As stated in Section 1, the BERA will be conducted iteratively using a process that begins with an initial screening. The screening steps help refine the initial problem formulation by determining which, if any, exposure pathways may be excluded from further assessment, and to identify data gaps that limit confidence in the risk characterization.

The screening steps includes the following assumptions:

- The maximum concentrations in the abiotic media will be used to estimate exposure. Therefore, the receptors of concern are assumed to be exposed to only the maximum concentrations within OU-3, rather than the actual range of concentrations.
- The evaluation assumes that each species spends their entire lives only in the area of the highest chemical concentrations, which vastly overestimates exposure.
- The most conservative ecological screening value (ESV) for a particular chemical from all ESVs available are used thereby ensuring that all receptors are protected.

The refinement steps include the following assumptions:

- The COPEC concentrations are the 95% upper confidence limit (UCL) and the average concentrations as conservative, yet more realistic measurements of how receptors are actually exposed to COPECs.
- Migratory patterns and foraging ranges for the receptors of interest will be taken into consideration.
- The most appropriate ESVs for abiotic media (i.e., soil, surface water and sediment) and fish tissue critical body residues (CBRs) and toxicity reference values (TRVs) for wildlife will be used where available rather than simply using the most conservative value.

Although still conservative and protective, the refinements allow for a more realistic conservative assessment of potential ecological risks than the screening scenario; as such, it is more useful for the purpose of informing risk management decisions related to ecological risks within OU-3.

This problem formulation phase of the BERA Work Plan provides:

- A description of the environmental setting and the characterization of ecological habitats
- The identification of potentially exposed ecological receptors
- The identification of COPECs
- The identification of complete pathways by which ecological receptors could be exposed to COPECs
- The identification of assessment and measurement endpoints

- The development of a CSM

Information contained within this section was derived from literature sources and Site reconnaissance surveys by a senior-level Ramboll biologist (Linda Martello during multiple visits in 2016 and 2018). The Site reconnaissance survey was implemented to determine local land use, surrounding land uses, local ecology, the potential presence of threatened or endangered species and ecological receptors, and the presence or absence of ecologically susceptible areas.

5.1 Environmental Setting

This section describes the regional ecology, climate, geology, and local hydrogeology/ hydrology in and around OU-3.

5.1.1 Regional Ecology

Figures 5-1 and 5-2 illustrate the regional ecosystem distribution and the predominant ecosystem types, respectively, in OU-3. Figure 5-3 illustrates the distribution of vegetation in Clark County and the extent of urbanization in OU-3. The ecosystem type in this region of southern Nevada is Mojave Desert scrub (Clark County Department of Comprehensive Planning 2000). The Mojave Desert scrub ecosystem includes creosote-bursage and Mojave mixed scrub vegetation communities, invasive, transitional grasslands, as well as large tracts of urban development, small areas of barren land, and agricultural development.

Brown et al. (1998) described the Valley as part of the Mojave Desert Scrub of the broader Warm Temperate Desertlands classification. These areas are generally described by the following characteristics:

1. Arid climates
2. More than 50% of the ground may lack vegetation cover
3. Short freezing periods
4. Potentially greater than 200-day growing season
5. Characterized by the two most dominant plants observed, creosote bush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*)

Bradley and Deacon (1965) classified the Wash as part of the Stream and Stream Riparian communities (LVWCC 2008). These communities are also found along the Colorado River, Virgin River, Muddy River, and Meadow Valley Wash. Streamside vegetation typically found in these communities consists of trees such as Fremont cottonwoods (*Populus fremontii*), willows (*Salix* spp.), and salt cedar (*Tamarix ramosissima*), shrubs such as arrowweed (*Pluchea sericea*) and seep willow (*Baccharis salicifolia*), and grass-like plants such as cattails (*Typha* spp.) and tules (*Schoenoplectus acutus*). Two hundred species of birds, though fewer than in decades past, continue to use the remaining cover types as habitat (Appendix C; LVWCC 2008). Nearly 70 mammal, reptile, amphibian, and fish species also use habitats within the management area, which is consistent with the OU-3 study area along the Wash (LVWCC 2008). Only one other community, the Desert Springs and Marshes community, has greater vertebrate species richness. Historical disturbance along the Wash has resulted in an increase in invasive species (Bickmore 2003) and a substantial change in native wetland and riparian habitats (LVWCC 2000).

5.1.2 Climate and Meteorology

The climate of the Las Vegas Valley is arid with mild winters and dry hot summers. Average annual precipitation as measured in Las Vegas between 1980 and 2016 was 4.14 inches (NOAA 2018). Precipitation generally occurs during two periods, December through March and July through September. Winter storms generally produce low intensity rainfall over a large area. Summer storms generally produce high intensity rainfalls over a smaller area for a short duration. These violent summer thunderstorms account for most of the documented floods in the Las Vegas area. Winds frequently blow from the south or northwest at a mean velocity of approximately 9 miles per hour (mph); however, velocities in excess of 50 mph are not atypical when weather fronts move through the area. During these windy events, dust, sand, and soil at the ground surface can become airborne and may travel several miles. Temperatures can rise to 120°F in the summer, and the average relative humidity is approximately 20%. The mean annual evaporation from lake and reservoir surfaces ranges from 60 to 82 inches per year (Shevenell 1996).

5.1.3 Regional Geology

OU-3 lies within the Las Vegas Valley, which occupies a topographic and structural basin trending northwest-southeast and extending approximately 55 miles from near Indian Springs in the north to Railroad Pass to the south. The valley is bounded by the Las Vegas Range, Sheep Range, and Desert Range to the north; by Frenchman and Sunrise Mountains to the east; by the McCullough Range and River Mountains to the south and southeast; and the Spring Mountains to the west. The mountain ranges bounding the east, north, and west sides of the valley consist primarily of Paleozoic and Mesozoic sedimentary rocks (limestones, sandstones, siltstones, and fanglomerates), whereas the mountains on the south and southeast consist primarily of Tertiary volcanic rocks (basalt, rhyolite, andesite, and related rock types) that overlie Precambrian metamorphic and granitic basement (ENSR 2007).

Within the Las Vegas Valley, eroded Tertiary and Quaternary sedimentary and volcanic rocks comprise the unconsolidated basin deposits, which can be approximately 13,000 feet thick (ENSR 2007). The valley floor consists of fluvial, paludal (swamp), playa, and lacustrine deposits surrounded by more steeply sloping alluvial fan aprons derived from erosion of the surrounding mountains. Generally, the deposits grade finer with increasing distance from their source and with decreasing elevation. The structure within the Quaternary and Tertiary-aged basin fill is characterized by a series of generally north-south trending fault scarps. The major geologic units within the NERT RI Study Area are described below.

Alluvium. The surface of the NERT RI Study Area is primarily Quaternary alluvial deposits (Qal) that slope north toward Las Vegas Wash. The alluvium consists of a reddish-brown heterogeneous mixture of well-graded sand and gravel with lesser amounts of silt, clay, and caliche. Clasts within the alluvium are primarily composed of volcanic material. Boulders and cobbles are common. Due to the mode of deposition, no distinct beds or units are continuous over the area. The thickness of the alluvial deposits within the NERT RI Study Area ranges from less than 1 foot to more than 50 feet.

A major feature of the alluvial deposits is the stream-deposited sands and gravels that were laid down within paleochannels eroded into the surface of the underlying Muddy Creek Formation during infrequent flood runoff periods. These deposits vary in thickness and are narrow and generally linear. These generally uniform sand and gravel deposits exhibit higher hydraulic conductivity than the adjacent, well-graded deposits. In general, these paleochannels trend northeastward.

Transitional (or reworked) Muddy Creek Formation. Where present, the transitional Muddy Creek Formation (xMCf) is encountered at the base of the alluvium. The Transitional Muddy Creek Formation consists of reworked sediments derived from the Muddy Creek Formation, which is described below. Therefore, the xMCf appears similar to the Muddy Creek Formation, but it consists of reworked, less consolidated and indurated sediments.

Muddy Creek Formation. The Muddy Creek Formation of Pleistocene age occurs in the Las Vegas Valley as valley-fill deposits that are coarse-grained near mountain fronts and become progressively finer-grained toward the center of the valley. Locally, the Muddy Creek Formation reaches thicknesses greater than 1,000 feet in Las Vegas Valley. At the BMI complex facilities, the upper portion of this unit has been investigated to depths of approximately 300-400 feet, and the term "Upper Muddy Creek Formation" (or UMCf) has been used to describe the upper part of the formation. Where encountered beneath OU-1, the UMCf is composed of at least two thicker units of fine-grained sediments of clay and silt (the first and second fine-grained facies) interbedded with at least two thinner units of coarse-grained sediments of sand, silt, and gravel (the first and second coarse-grained facies). Except for the southernmost 1,000 feet adjacent to Lake Mead Parkway, the first fine-grained facies (UMCf-fg1) separates the first coarse-grained facies (UMCf-cg1) from the overlying Quaternary alluvium. Within the southern 1,000 feet of OU-1, the Muddy Creek Formation's UMCf-fg1 pinches out along a roughly west-northwesterly trending line.

Locally, the Muddy Creek Formation represents deposition in an alluvial apron environment from the Spring Mountains to the west, grading into fluvial, paludal (swamp), playa, and lacustrine environments further out into the valley center.

Additional Geologic Formations within the Northeast Sub-Area. Bedrock formations mapped as outcropping at the ground surface near the very northernmost part of the Northeast Sub-Area, within OU-3, include the Horse Springs Formation, which is dominated by carbonate rocks interbedded with white to yellow calcareous siltstone and shale, and the Thumb Formation, which is locally dominated by red to pink calcareous siltstone and sandstone, gypsiferous shale and claystone (Bell and Smith 1980).

5.1.4 Regional Hydrology and Hydrogeology

General descriptions of groundwater and surface water conditions within the NERT RI Study Area are described below.

5.1.4.1 Groundwater

Within OU-1, shallow groundwater is generally encountered between 20 and 80 feet bgs and is generally deepest in the southern portion of the Site (Ramboll Environ 2017a). Within the NERT Off-Site Study Area to the north, shallow groundwater is generally encountered between 2 and 36 feet bgs, becoming shallower as it approaches the Wash (Ramboll Environ 2017b). The buried alluvium-filled channel incised into the underlying muddy creek formation (known as the "Main Channel") is present near the northern boundary of OU-1 and below the NERT Off-Site Study Area. The Main Channel continues downgradient northeastward towards the Wash. The Main Channel ranges from 700 to 1000 feet wide with a maximum depth approaching 60 feet. Perchlorate and other contaminants found in groundwater in this area migrated from the NERT Site through subsurface transport in shallow groundwater (Ramboll Environ 2017a). The current perchlorate groundwater plume is illustrated in Figure 5-4. Beneath the Eastside Sub-Area, the first groundwater encountered occurs at depths of approximately 40 ft bgs or more and shallows northward. Groundwater is at, or near, the ground surface at Las Vegas Wash within OU-3 to the north (BRC 2016).

The groundwater flow direction within OU-1 is generally north to north-northwesterly, whereas within OU-2 and OU-3 the direction changes slightly towards the north-northeast. These generally uniform flow patterns may be influenced locally by lateral zones of coarser and more transmissive material (otherwise referred to as paleochannels) eroded into the underlying UMCf, artificial groundwater highs or “hydraulic mounds” created around the COH Bird Viewing Preserve, and hydraulic depressions created by the groundwater extraction well fields.

NDEP has defined three water-bearing zones (WBZs) that are of interest in the BMI Complex: the Shallow WBZ, which is defined by the first occurrence of groundwater in either the Qal, xMCf, or the UMCf where the xMCf is missing, is unconfined to partially confined, and is considered the “water table aquifer”; the Middle WBZ, which extends from approximately 90 to 300 ft bgs; and the Deep WBZ, which is defined as the contiguous WBZ that is generally encountered between 300 to 400 ft bgs (NDEP 2009). Environmental investigations within the NERT RI Study Area have historically focused on the Shallow WBZ, although recent investigations, including the RI, have included a number of Middle WBZ wells to improve vertical delineation of hydrogeology and chemical constituent distribution.

5.1.4.2 Surface Water

The NERT RI Study Area is located in a very arid region with few natural surface water bodies; however, surface water is present in some areas of the NERT Site and surrounding area, primarily in surface water impoundments receiving process wastewater, lined man-made lakes, and COH Bird Viewing Preserve, which are associated with a waste-water treatment plant. Only a small portion of the unlined Bird Viewing Preserve ponds are located within OU-3; most are located west of the OU-3 boundary. Other man-made water features within the NERT RI Study Area include the lined ponds at the Chimera Golf Club (within OU-3). Surface water is also present following storm events.

Surface topography generally slopes north towards the Wash, a 12-mile-long channel located approximately 2.6 miles north of the NERT Site that drains into Lake Mead. The water flowing through the Wash consists of urban runoff, shallow groundwater, storm water and treated wastewater from the Clark County Sanitation District, the COH, the City of Las Vegas, and treated discharge from NERT, TIMET, American Pacific Corporation (AMPAC), and weir dewatering activities.

However, storm water is captured and contained on the NERT Site via retention basins. Flow occurs as infrequent storm runoff that drains across the alluvial apron in shallow washes. All tributaries in the Valley discharge to the Wash. The Wash is a tributary to Lake Mead and it is the only channel through which the valley’s excess water flows to the lake. The water flowing through the Wash comprises less than two percent of the water that flows into Lake Mead and consists of urban runoff, shallow groundwater, storm water, and releases from the valley’s three water reclamation facilities (SNWA 2004). Urban runoff carries contaminants such as motor oil, pesticides, and pet waste, and shallow groundwater is highly saline as a result of salts that are leached from soil.

Prior to the development of Las Vegas Valley, the Wash was an ephemeral stream. Currently, the flow is perennial because of the effluent from wastewater treatment plants. This increase in flow caused significant erosion and downcutting of the Wash channel with the loss of wetland habitat and excessive sediment transport to Lake Mead (LVWCC 2000). Wildlife and their habitats have also been impacted as the function of the Wash has changed. A program of weir construction (15 weirs) has been conducted by the LVWCC to address erosion and downcutting. The Pabco Road Weir and part of the Historic Lateral Weir were constructed in early 2000. Twelve more weirs were constructed between 2000 and 2010. The Historic Lateral Weir was expanded in 2018. The Sunrise Mountain Weir is currently under construction.

5.2 Habitats in the Wash

The Wash is a dynamic ecological system that offers a variety of ecological habitats. Information obtained through the literature review, from multiple site reconnaissance efforts, and from the field investigations described in Sections 2 and 3 were used to develop this component of the problem formulation step. A site reconnaissance was conducted in OU-3 on two separate occasions in December 2014 and April 2018. The USEPA ecological checklist was completed during these reconnaissance visits and is provided in Appendix B. A photographic log of OU-3 and surroundings is provided in Appendix C. The checklist includes the following types of information:

- Land use / topography / impacted (i.e. urbanized or commercialized) versus unimpacted areas (i.e. native land)
- Habitats, vegetation types and biological communities
- Surface water features (if any) including lakes, ponds, streams, wetlands, etc. and the potential presence of benthic invertebrates
- The wildlife community (fish, birds, mammals) that may be present in the vicinity of OU-2
- The presence or absence of ecologically sensitive areas

Most vegetation types found along the Wash have changed tremendously with time, thus so have wildlife habitats. Plants that were dominant in the historical floodplain during the pre-settlement period are no longer dominant because of the drastic changes in hydrology that have occurred. Moreover, plants that became dominant during the post-hydric, pre-erosion period are not as extensive as they once were. This is because stream incision caused by erosion has lowered the surrounding water table, reducing the area suitable for hydrophytic vegetation. There are, however, areas of relict, deeply rooted facultative phreatophytic vegetation communities that are still able to survive. Most of the changes in habitat types within the Wash have occurred in or adjacent to the historical Wash floodplain. Xeric upland areas have not changed as much as the areas that were affected by increasing surface water discharge. Most of these upland areas are dominated by desert shrubs and subshrubs.

5.2.1 Marshes

Marshes on the Wash are saturated or inundated either permanently or for a substantial portion of the growing season. Dominant species currently found in marshes along the Wash include bulrush, cattails, and common reed. Large open water areas interspersed with dense stands of these species occur in the impoundments of the weirs along the channel, and the weir faces themselves are thick with wetland plants. The channel banks also support extensive marsh vegetation. Unvegetated sandbars and mudflats also occur in the marshes along the Wash, providing substrate for benthic macroinvertebrates, an important food source for wildlife. The development of marsh habitat has been assisted through active revegetation, primarily of tules, but also other bulrush and species such as yerba mansa and spike rush (*Eleocharis* spp.). Although periodic flooding can scour out and remove sections of emergent wetlands, the Wash stabilization program continues to increase the extent of the marsh habitat throughout the channel.

5.2.2 Riparian Areas

Riparian areas along the Wash are dominated by the non-native, invasive salt cedar, which forms dense, often monotypic stands along the banks. Quailbush (*A. lentiformis*) and bassia (*Bassia hyssopifolia*) thickets occur in isolated openings in the stands and on the edge separating the salt cedar from the adjacent uplands. Small patches of native woody species including Fremont cottonwood, Goodding willow, honey mesquite (*P. glandulosa* var. *torreyana*), and screwbean mesquite (*P. pubescens*) exist in restoration sites (see Kloeppel et al. 2006). Additionally, Goodding willow and to a lesser extent Fremont cottonwood and screwbean mesquite have begun to naturally establish along the channel banks, weirs, and sandbars. Native shrubs (in addition to quailbush) that provide understory cover include sandbar willow (*S. exigua*), arrowweed, and seepwillow.

Extensive removal of salt cedar (Bickmore 2003), which has been shown in some studies to provide lower quality habitat than native riparian species (Brown 1987), is ongoing along the channel in association with stabilization activities and grant-funded projects. These areas are revegetated with native plant species. Several of the sites that will be cleared of salt cedar do not have the hydrology to support functionally equivalent (woody riparian) species. Many riparian nesting birds have adapted to using salt cedar as their native habitats.

5.3 Ecological Receptors Selected for the OU-3 BERA

The summary of receptors observed in the Wash from previous studies is provided in Section 3. The information in these studies was used to identify receptors for evaluation in the OU-3 BERA. The identification of receptors initially relies on the identification of functional groups or feeding “guilds” that are representative of, or essential to, habitat function. These receptors are representative of entire classes of organisms (i.e., functional groups). Selection criteria for receptors include sensitivity, exposure potential, and expected presence in the area being studied, ecological relevance, trophic level, feeding habits, and the availability of life history information. The rationale for selecting each group of receptors is discussed below.

- **Invertebrates.** The benthic and terrestrial invertebrate community live in constant and direct contact with surface sediment and surface soil, respectively, that may be impacted. Invertebrates have vital functions within the ecosystem, including serving as a prey base for higher trophic level organisms and cycling of nutrients.
- **Fish.** The fish community lives in constant and direct contact with surface water that may be impacted. Exposures are also possible via sediment and the food chain (i.e., secondary consumers), particularly for bioaccumulative constituents. The fish community often dominates the aquatic ecosystem, in terms of biomass, and fish serve as a prey base for piscivorous wildlife.

- **Plants.** Plant roots are in constant and direct contact with soil or wetland sediment that may be impacted by constituents. Plant communities provide food for herbivores and essential habitat for many animal species.
- **Wildlife.** Birds and mammals are exposed to constituents in surface soil, sediment, and surface water primarily through prey ingestion. As higher trophic level species, birds and mammals are susceptible to compounds that bioaccumulate through the food chain. Individual foraging strategies and choices of prey may also promote incidental sediment and/or soil ingestion.

Ecological receptors that will be evaluated in the OU-3 BERA were selected to represent the different feeding guilds.

Representative Wildlife Species Selected for Evaluation in the OU-3 BERA	
Aquatic / Aquatic-Oriented Receptors	**Piscivores (fish-eating organisms)**
	Bald eagle (Haliaeetus leucocephalus)
	Omnivores
	Raccoon (Procyon lotor)
	Mallard duck (Anas platyrhynchos)
	Herbivores
	Canvasback duck (*Aythya valisineria*)
	Muskrat (*Ondatra zibethicus*)
	Insectivores
	Fringed Myotis (Myotis thysanodes)
	Fish Community
Terrestrial Receptors	**Carnivores**
	Red-tailed hawk (*Buteo jamaicensis*)
	Kit fox (*Vulpes macrotis*)
	Insectivores
	American robin (Turdus migratorius)
	Desert shrew (Notiosorex crawfordi)
	Herbivores
	Mourning dove (*Zenaida macroura*)
	Desert pocket mouse (*Chaetodipus penicillatus)*

5.4 Chemicals of Potential Ecological Concern

The objective of the BERA is to determine which chemicals that have migrated from the NERT Site (OU-1) to OU-3 are driving risks, if any, to ecological receptors. The selection of chemicals to include in the OU-3 BERA involved an evaluation of COPCs identified for OU-1 in soil and groundwater, review of effluent data that is discharged from the NERT outfall at Pabco Road, and a review of groundwater data from monitoring wells near the Wash. This evaluation resulted in the selection of the chemicals/parameters for the OU-3 BERA, as shown in Table 5-1 and as follows:

OU-3 BERA COPECs
Chlorate
Perchlorate
Chloroform (west of Pabco Road only)
Total Chromium
Hexavalent Chromium

5.5 Identification of Potentially Complete Exposure Pathways

A complete exposure pathway is one in which chemicals can be traced or expected to travel from the source to a receptor (USEPA 1997).

A complete exposure pathway has five parts:

1. A source of chemical constituents
2. An environmental medium and transport mechanism (such as historical runoff that impacted surrounding soils)
3. A point of exposure (such as surface soil)
4. A route of exposure (such as a receptor touching, drinking, or eating contaminated sediment)
5. A population of receptors (such as a community of benthic invertebrates).

The exposure pathway is considered complete and potentially capable of causing unacceptable risks only when all five parts are present. A CSM is intended to provide a clear description of how ecological receptors may come into contact with COPECs via release mechanisms and exposure to soil and/or associated food items. The CSM for OU-3 is provided in Figure 5-5 and identifies contaminant sources, release mechanisms, exposure media, exposure routes, and ecological receptors that will be evaluated in the BERA, based on a current understanding of environmental conditions in OU-3. This information will be used as necessary to understand potentially complete ecological exposure pathways from abiotic media for each receptor group in OU-3. These may include areas where releases from potential source areas were documented or inferred from field investigations such as releases of chemicals from groundwater to surface water.

The following are possible complete exposure pathways that will be evaluated in the BERA:

Aquatic

- Direct contact of invertebrates, plants, fish and wildlife to COPECs in surface water
- Bioaccumulation of surface water/sediment COPECs in invertebrates, plants and fish that can impact wildlife
- Direct contact of benthic invertebrates to COPECs in sediment and sediment pore water
- Exposure of aquatic oriented (riparian-obligate) birds and mammals to chemicals through the ingestion of food items (e.g., plants, invertebrates, and fish) and the incidental ingestion of sediment

Terrestrial

- Direct contact of terrestrial invertebrates to COPECs in surface soil
- Root uptake of surface soil COPECs by terrestrial plants
- Bioaccumulation of soil COPECs in invertebrates and plants that can impact wildlife
- Exposure of terrestrial birds and mammals to COPECs through the ingestion of food items (e.g., plants, invertebrates, and prey mammals) and drinking water and the incidental ingestion of soil

Of these pathways, the most important exposure routes for lower trophic level aquatic receptors and fish is direct contact with surface sediment and surface water, whereas ingestion of prey dominates the exposure pathway for wildlife.

Areas of OU-3 considered to be inaccessible or highly unlikely to attract wildlife will not be considered in the BERA as there would be no complete exposure pathway from source to receptor in these locations. The residential areas within the southeastern portion of OU-3 represent such cases. Based on the April 2-3 site reconnaissance, the residential areas do not contain significant attractive features for wildlife. The Chimera Golf Course contains artificial and maintained landscaping including the areas around the lined ponds. While the native wildlife may intermittently visit the ponds, these areas do not provide preferred habitat. The indigenous species will preferentially forage and nest near the Wash where the habitat is less disturbed and resources are abundant. Additionally, there is no pathway for chemicals from OU-1 into the lined ponds of the Chimera Golf Course. The current understanding of groundwater flow indicates that the groundwater pathway from OU-1 to OU-3 does not connect to these man-made ponds and therefore there is no complete chemical exposure pathway for receptors that might frequent the area.

5.6 Assessment and Measurement Endpoints

Ecological risk endpoints define ecological attributes that are to be protected (assessment endpoints) and measurable characteristics of those attributes (measurement endpoints). Assessment endpoints most often relate to attributes of biological populations or communities and focus the risk assessment on particular components of the ecosystem that are potentially at risk (USEPA 1997; 2003). Assessment endpoints describe an entity (e.g., fish-eating birds) and an attribute of that entity (e.g., survival rate). A measurement endpoint is a measurable ecological characteristic and/or response to a stressor and provides a method of quantifying potential effects on the receptors potentially at risk (USEPA 1998).

Because of the complexity of natural systems, it is generally not possible to directly assess the potential impacts to all ecological receptors present within an area. Therefore, receptor species (e.g., bald eagle) or species groups (e.g., fish) are often selected as surrogates to evaluate potential risks to larger components of the ecological community, or guilds (e.g., piscivorous birds), represented in the assessment endpoints (e.g., survival and reproduction of piscivorous birds).

Appropriate assessment endpoints for the BERA include those receptors that may be affected by COPECs that migrated from OU-1 to OU-3 and for which complete exposure pathways exist. Ecological receptors are selected for their potential exposure, ecological significance, economic importance, societal relevance, or cultural significance. The most conservative ESV for a particular chemical from all ESVs available are used during the screening thereby ensuring that all receptors are protected. As such, the measure of potential effect (or measurement endpoint) in the screening evaluation is the comparison of media concentrations against the most sensitive ESV among soil invertebrates, plants, birds and mammals.

The assessment and associated measurement endpoints being considered for the OU-3 BERA are listed in Table 5-2 and shown below as follows:

Aquatic and Aquatic-Oriented

- **Aquatic assessment endpoint 1:** Survival, growth and reproductive ability of benthic invertebrate communities within OU-3.

  Measure of potential effect—Comparison of sediment concentrations within OU-3 and reference areas against ESVs protective of benthic invertebrates.

  Measure of potential effect—analysis of the health of the benthic community in OU-3 and reference areas using multiple metrics including abundance and diversity.

- **Aquatic assessment endpoint 2:** Survival, growth and reproductive ability of water column invertebrate communities and plant communities within OU-3.

  Measure of potential effect—Comparison of surface water concentrations within OU-3 and reference areas against ESVs protective of aquatic plants and invertebrates

- **Aquatic assessment endpoint 3:** Survival, growth and reproductive ability of fish populations within OU-3.

  Measure of potential effect—Comparison of surface water concentrations within OU-3 and reference areas against ESVs protective of fish

  Measure of potential effect—comparison of modelled and measured fish tissue concentrations against tissue-based thresholds identified in the literature.[14]

- **Aquatic assessment endpoint 4:** Survival, growth and reproductive ability of aquatic-oriented (i.e. riparian-obligate) bird populations, including special status bird species, within OU-3.

[14] Concentrations of COPECs in surface water can be used to estimate tissue concentrations in fish through food web modelling. The estimated tissue concentrations can then be compared to tissue-based thresholds identified in the literature. Fish will also be collected from the Wash as described in the FSP. The concentrations of COPECs measured directly from fish tissue will also be compared to tissue-based thresholds.

Measure of potential effect—comparison of calculated total daily dose (TDD) for birds from ingestion of contaminated aquatic food items and abiotic media against constituent-specific TRVs in a food web model.

- **Aquatic assessment endpoint 5:** Survival, growth and reproductive ability of aquatic-oriented (i.e. riparian-obligate) mammal populations[15] within OU-3.

  Measure of potential effect—comparison of calculated TDD for mammals from ingestion of contaminated aquatic food items and abiotic media against constituent-specific TRVs in a food web model.

- **Aquatic assessment endpoint 5**: Survival, growth and reproductive ability of amphibian populations within OU-3.

  Measure of potential effect—comparison of surface water concentrations within OU-3 and reference areas against ESVs protective of amphibians and/or fish. Toxicological information for amphibians is limited. However, relevant amphibian toxicological data for selected chemicals will be reviewed. ESVs that are considered appropriate and protective of amphibians will be selected from amphibian and fish toxicological information for use in the risk assessment. The lack of amphibian TRVs will be addressed as an uncertainty.

Terrestrial

- **Terrestrial assessment endpoint 1:** Survival, growth and reproductive ability of indigenous terrestrial plant communities within OU-3.

  Measure of potential effect—comparison of soil concentrations within OU-3 against ESVs protective of terrestrial plants.

- **Terrestrial assessment endpoint 2:** Survival, growth and reproductive ability of terrestrial invertebrate communities within OU-3.

  Measure of potential effect—comparison of soil concentrations within OU-3 against ESVs protective of terrestrial invertebrates.

- **Terrestrial assessment endpoint 3:** Survival, growth and reproductive ability of terrestrial bird populations (including special status species) within OU-3.

  Measure of potential effect—comparison of calculated TDD for birds from ingestion of terrestrial food items and abiotic media against constituent-specific toxicity reference values (TRVs) in a food web model.

- **Terrestrial assessment endpoint 4:** Survival, growth and reproductive ability of terrestrial mammal populations within OU-3.

  Measure of potential effect—comparison of calculated TDD for mammals from ingestion of contaminated terrestrial food items and abiotic media against constituent-specific TRVs in a food web model.

- **Terrestrial assessment endpoint 5**: Survival, growth and reproductive ability of reptile populations within OU-3.

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[15] There are no listed species of mammals within OU-3 (SNWA 2008).

Measure of potential effect—Due to the very limited availability of toxicological information for reptiles, a comprehensive quantitative risk characterization for reptiles is not feasible without unacceptable levels of uncertainty (Sparling et al. 2000). Risk management decisions that are protective of other functional groups, however, are generally considered to be protective of reptiles. If relevant toxicological information is readily available for selected chemicals, that information will be considered for use in the risk assessment. The lack of reptile TRVs will be addressed as an uncertainty.

As described by Barnthouse et al. (2008), "regulations, policies, directives, and guidance documents frequently discuss the need for ERAs to consider risks to populations, not simply to individual organisms or organism-level attributes. The reason for this [need] is that, from a management perspective, the population-level attributes such as abundance, persistence, age composition, and genetic diversity are usually more relevant than are the health or persistence of individual organisms." The assessment endpoints listed above consider attributes that are tied to the population-level attributes of abundance and persistence, in that they consider survival, reproduction and growth. Decreased survival will result in smaller numbers of individuals, decreasing the population of that receptor. Similarly, decreased reproduction can result in smaller numbers of individuals over time, also decreasing the population of that receptor. Decreased growth of individuals, while not necessarily directly related to population-level effects, are also considered in the ERA. However, the analysis for special status species will be done on an individual level basis, as even a single individual comprises a larger percentage of those populations at risk. The assessment of risks to single individuals of special status species will be qualitatively considered as part of the narrative of the OU-3 BERA.

5.7 Ecological Conceptual Site Model

An ecological CSM is provided in Figure 5-5. The CSM is intended to provide a clear visual description of how ecological receptors may come into contact with deposition-related constituents via release mechanisms and exposure to soil, sediment, surface water, and/or associated food items. The CSM identifies the ecological receptor groups that will be evaluated in the ERA and the potentially complete exposure pathways.

5.8 Analysis: Exposure Assessment

The analysis phase examines two major parts of risk, exposure and effects, and their relationship to each other. The ecological exposure assessment involves the identification of potential exposure pathways and an evaluation of the magnitude of exposure to ecological receptors. Exposures will consider maximum, 95% UCLs and average concentrations as the 95% UCL and average concentrations reflect the larger areas of exposure that receptors are expected to encounter.

The exposure and effects assessment define the exposure parameters specific to each defined assessment endpoint and the toxicity data by which these endpoints are evaluated as follows:

- *Exposure assessment* identifies potential exposure pathways and an evaluation of the constituent concentrations to which ecological receptors are exposed.
- *Effects assessment* describes the potential adverse effects associated with the COPECs to each receptor.

5.8.1 Exposure Assessment for Aquatic and Terrestrial Communities

Exposure for water-column invertebrates and aquatic plants is based on consideration of COPEC concentrations in surface water. Exposure for sediment-dwelling invertebrates is based on consideration of COPEC concentrations in surface sediment. Surface sediments refer to the top 6 inches of sediment where the vast majority of benthic organisms reside.

Concentrations of COPECs will be measured in fish tissue as described in Section 4 and in the OU-3 BERA FSP (Appendix A). In the event that insufficient fish tissue is collected during the field sampling effort, concentrations of COPECs can be modelled into fish based on surface water concentrations and chemical-specific water to fish uptake factors.

Exposure of terrestrial invertebrates and plants to COPECs will be evaluated based on consideration of COPEC concentrations in soil.

5.8.2 Exposure Assessment for Wildlife

A food web model will be used to evaluate potential ecological risk via bioaccumulation pathways to representative mammalian and avian receptors that may feed within OU-3. A typical desert food web is illustrated in Figure 5-6a (desert aquatic food web) and Figure 5-6b (desert terrestrial food web). For aquatic- and terrestrial-oriented birds and mammals, possible exposure routes include incidental ingestion of sediment, surface water, and soil (as appropriate), as well as food items containing COPECs. The extent of exposure of COPECs via ingestion depends on a number of factors including concentrations of COPECs in food items, size of the receptor, and COPEC bioavailability. Site-specific tissue data in food items is not typically available so concentrations of COPECs in these tissues will be estimated using the concentrations obtained during the field sampling effort for each media. The media concentrations and literature-derived uptake factors in the food web model will be used to fill in gaps.

5.8.2.1 Wildlife Exposure Parameters

Exposure assumptions (e.g., body weights, food and water ingestion rates, food preferences, foraging range) for aquatic and terrestrial wildlife species will generally be obtained from the USEPA's Wildlife Exposure Factors Handbook (USEPA 1993) and Oak Ridge National Laboratory's (ORNL's) Estimating Exposure of Terrestrial Wildlife to Contaminants (ORNL 1994). Generally, the uptake factors used to model tissue concentrations are based on empirical values or regression algorithms obtained from a variety of sources such as Bechtel Jacobs (1998a), USEPA (2007; 1999b), and Los Alamos National Laboratory (LANL) Ecorisk Database (2017). Alternate sources may be used if the standard sources do not provide sufficient information. Food and water ingestion rates will be based on the receptor's average body weight identified in the literature. Exposure parameters also include species-specific behaviors such as migration and foraging range.

5.8.2.2 Calculation of Potential Doses

Food web ingestion-based modeling calculations will be performed to characterize potential exposures to contaminants via the food web and to identify potential impacts for mammals and birds. A TDD was calculated for each species in order to estimate dietary exposure using the formula, exposure parameters, and uptake factors. The exposure assessment yields estimates of total daily intake for the wildlife measurement endpoints via diet and incidental ingestion of soil/sediment while the animal is foraging or preening/grooming. The TDD calculation considers concentrations of COPECs in food items consumed by the animal, the amount of soil, sediment or surface water ingested, the proportion of different food items in the diet, body weight, area use factor (AUF) for each species, exposure duration, food ingestion rates, and assimilation factors (AFs) for each COPEC.

The TDD is not calculated for constituents that are not bioaccumulative. This would include chemicals such as aluminum, antimony, boron, hexavalent chromium, cyanide, fluoride, iron, manganese, molybdenum, strontium, and thallium. PAHs, if detected, will be addressed as high molecular weight PAHs and low molecular weight PAHs. PCBs, if detected, will be addressed as total PCBs. Dioxins/furans, if detected, will be addressed as mammal or bird toxic equivalency quotients (TEQs), as appropriate.

Ingestion modelling is based on species-specific exposure parameters and ingestion intake requirements. Maximum, 95% UCL and average media concentrations will be used to evaluate the range of potential intake exposures. The ingestion model that will be used is as follows:

$$\mathrm{TDD} = \frac{\left(\left[\mathrm{IR_{FOOD}}\ \mathrm{x}\ \mathrm{C_{FOOD}}\right] + \left[\mathrm{IR_{SOIL/SED}}\ \mathrm{x}\ \mathrm{C_{SOIL/SED}}\right] + \left[\mathrm{IR_{WATER}}\ \mathrm{x}\ \mathrm{C_{WATER}}\right]\right) \times \mathrm{AUF}\ \mathrm{x}\ \mathrm{ED}}{\mathrm{BW}}$$

Where:

TDD	=	Total daily dose (mg COPEC/kg wet weight per day [ww/day)
IR_{FOOD}	=	Ingestion rate of food (kg/day)
C_{FOOD}	=	Concentration of the COPEC in food (mg/kg)
$IR_{SOIL/SED}$	=	Ingestion rate of sediment or soil (kg/day)
$C_{SOIL/SED}$	=	Concentration of COPEC in soil or sediment (mg/kg)
IR_{WATER}	=	Ingestion rate of water (L/day)
C_{WATER}	=	Concentration of COPEC in water (milligrams per liter [mg/L])
AUF	=	Area use factor (unitless)
ED	=	Exposure duration (unitless)
BW	=	Body weight (kg ww)

and:

$$C_{FOOD} = \sum\left(\left(C_{FOOD1} + P_{FOOD1}\right) + \left(C_{FOOD2} + P_{FOOD2}\right) + \left(C_{FOOD\,i} + P_{FOOD\,i}\right)\right)$$

C_{FOOD}	=	Concentration of COPEC in food (mg/kg)
C_{FOOD1}	=	C_{MEDIUM} x BAF_{FOOD1} (mg/kg)
P_{FOOD1}	=	Proportion of diet composed of food item 1 (unitless)
C_{FOOD2}	=	C_{MEDIUM} x BAF_{FOOD2} (mg/kg)
P_{FOOD2}	=	Proportion of diet composed of food item 2 (unitless)
$C_{FOOD\,i}$	=	C_{MEDIUM} x $BAF_{FOOD\,i}$ (mg/kg)
$P_{FOOD\,i}$	=	Proportion of diet composed of the i^{th} food item (unitless)
BAF_{FOOD1}	=	Bioaccumulation factor for first food item (unitless)
BAF_{FOOD2}	=	Bioaccumulation factor for second food item (unitless)
$BAF_{FOOD\,i}$	=	Bioaccumulation factor for the i^{th} food item (unitless)

The food web modelling will start from an initial set of extremely conservative assumptions (maximum concentrations, 100% bioavailability for all receptors, and site AUF of 1 for most receptors). The food web models will then be refined to incorporate more realistic, site-specific 95% UCL and average exposure assumptions for constituent exposures to better understand refined and average exposure estimates.

5.9 Analysis: Effects Assessment

The effects assessment evaluates the potential for COPECs to impact representative receptors and estimates the relationship between the extent of exposure and severity of effects. For the “chemistry” measurement endpoint, comparing concentrations of COPECs in surface water and sediment to ESVs is part of the effects assessment. Comparing the TDD calculated during the exposure assessment to TRVs in the literature is also part of the effects assessment.

5.9.1 Effects Assessment for Invertebrates, Plants, and Fish

This section described the selection of ESVs that will be used to assess potential risks to invertebrates, plants, and fish. The bullets below present an overview of the documents that will be reviewed to determine the ESVs to be used in the BERA, Generally, these sources reflect low (i.e., conservative) screening values.

- Surface Water Screening Values
  - USEPA National Ambient Water Quality Criteria (USEPA 2015)
  - USEPA Region 4 (2018): Regional Ecological Risk Assessment (ERA) Supplemental Guidance
  - USEPA Draft Aquatic Life Ambient Water Quality Criterion for Selenium (Freshwater) (2016)
  - Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities: Appendix E, Toxicity Reference Values (USEPA 1999b)
  - Utah Department of Environmental Quality Division of Water Quality: (Utah DEQ 2015)
  - Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota – 1996 Revision (Suter and Tsao 1996)
  - USEPA. 2003a. U.S. EPA, Region V, RCRA Ecological Screening Levels. August 22, 2003
  - LANL. 2017. Los Alamos National Laboratory (LANL) Ecorisk Database (Release 3.1). Available at: https://www.lanl.gov/environment/protection/eco-risk-assessment.php
- Sediment Screening Values
  - USEPA Region 4 (2018): Regional ERA Supplemental Guidance
  - USEPA Region 6 Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA 1999b)
  - Threshold effects concentrations (TECs) from consensus-based sediment quality guidelines (MacDonald et al. 2000)
  - Freshwater screening values from USEPA Region 3 (USEPA 2006)
  - National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (Buchman 2008)

- Soil Screening Values
  - USEPA Ecological Soil Screening Levels (Eco-SSL) plant-based and soil invertebrate-based values (https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents)
  - LANL Ecological Risk Assessments. 2017. https://www.lanl.gov/environment/protection/eco-risk-assessment.php
  - USEPA Region 4 (2018): Regional ERA Supplemental Guidance
  - USEPA Region 6 Screening Level ERA Protocol for Hazardous Waste Combustion Facilities (USEPA 1999b)
  - ORNL terrestrial plant and invertebrate (earthworm) screening values (Efroymson et al. 1997a, 1997b). (Values for soil microorganisms and microbial processes (Efroymson et al. 1997b) will be used in cases when earthworm-based values are not available)

A preliminary list of available ESVs by chemical constituent and source is provided in Tables 5-3a (soil), Table 5-3b (sediment) and Table 5-3c (surface water). Surface water screening values are based on chronic criteria (i.e., the lowest and most conservative). Acute criteria will not be used for screening purposes. For applicable inorganic analytes, both dissolved phase and total recoverable screening values will be used. For hardness-dependent criteria (cadmium, chromium, copper, lead, nickel, and zinc), site-specific hardness values for the Wash (as calcium carbonate or $CaCO_3$) will be used.

The preferred sediment screening values reflect threshold effects concentrations when available, as these are the lowest (i.e., more conservative) of the sediment screening values. Probable effects concentrations and severe effects concentrations, for example, will not be used as screening values. For constituents lacking sediment screening thresholds background values may be used as a surrogate.

For soil, the USEPA Eco-SSLs represent the most comprehensive evaluation of soil screening levels for plants and invertebrates among available sources, so these values were preferentially used when available. If soil ESVs are not available for a certain chemical, then background values may be used as a reasonable basis of comparison.

5.9.2 Fish Critical Body Residue Values

The effects assessment for fish will rely on two types of effects metrics: surface water ESVs (as listed above) and CBRs expressed as concentrations of COPECs in fish tissue. A CBR is the concentration of chemical bioaccumulated in an aquatic organism that corresponds to a defined measure of toxicity (e.g., mortality). CBRs represent threshold tissue concentrations where concentrations in excess of the CBR could potentially result in adverse biological effects to the exposed fish (not consumers of fish). Fish tissue concentrations will be compared to CBRs available in the literature for potentially bioaccumulative constituents.

The Jarvinen and Ankley database (1999) and U.S. Army Corps of Engineers (USACE) Environmental Residue Effects Database (ERED) are the primary sources of CBRs that will be used in the evaluation of fish tissue residues for COPECs. CBRs will be reviewed for best relevance to the species of concern specifically as they pertain to the assessment endpoints for the OU-3 BERA. If early life stage fish CBRs are available, they will be considered.

Relevant no observable effect concentration (NOEC)- and lowest observable effect concentration (LOEC)-based CBRs will focus on impacts to survival and reproduction.

5.9.2.1 Effects Assessment for Bird and Mammal Populations

The effects assessment for wildlife is based on TRVs that relate ingested daily dose to ecotoxicological endpoints. TRVs are literature-derived concentrations or doses, below which adverse effects are unlikely (e.g., ORNL 1996). The No Observable Adverse Effect (NOAEL) TRV represents the highest concentration of exposure that is not statistically different than the control for a given toxicological endpoint. NOAEL TRVs are indicative of doses of constituents that have had no deleterious effects on a wildlife receptor. The Lowest Observable Adverse Effect (LOAEL) TRVs are the minimum doses of constituents where deleterious effects are apparent. This approach provides a basis for understanding potential effects to individual birds and mammals. Maximum concentrations are initially compared to NOAEL-based TRVs in the screening level steps, making this a highly conservative approach for evaluating potential risk. In the refinement steps, the 95% UCL and average media concentrations are compared to the NOAEL TRV, and where applicable, LOAEL-based TRVs to provide a range of potential risk outcomes.

TRVs will be compiled for each COPEC for both avian and mammalian receptors. For each COPEC identified, the ecotoxicological literature will be reviewed to identify a chronic exposure TRV representing a threshold body-weight-normalized dose for effects. Survival, reproduction and in some instances growth endpoints are considered when selecting TRVs.

The following literature sources will be reviewed for possible TRVs to be used in the OU-3 BERA. If TRVs are not available in these documents, additional literature will be reviewed for relevant data.

- USEPA. 2007. Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs. Attachment 4-5 Eco-SSL Standard Operating Procedure (SOP) #6: Derivation of Wildlife Toxicity Reference Value. OSWER Directive 9285.7-55. Revised June.
- USEPA. 2002. U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) Recommended Toxicity Reference Values for Mammals. Revision Date 11/21/02.
- USEPA. 2009. U.S.EPA Region 9 Biological Technical Assistance Group (BTAG) Recommended Toxicity Reference Values for Birds. Revision Date 02/24/09.
- Sample et al. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. June 1996. ES/ER/TM-86/R3.
- LANL. 2017. Los Alamos National Laboratory (LANL) Ecorisk Database (Release 3.1). Available at: https://www.lanl.gov/environment/protection/eco-risk-assessment.php

5.9.3 Background Soil and Sediment Data

Some chemicals (particularly naturally-occurring metals) may be present in environmental media but unrelated to Site releases. Background chemicals fall into two broad categories: those that are naturally occurring and those that are present due to anthropogenic sources (USEPA 2001). Metals often occur naturally in soil and geological formations. Weathering and dissolution of underlying soil may be a means of transporting metals into surrounding soils and water. Background chemicals may come from a variety of anthropogenic sources such as road runoff, atmospheric deposition, washout by rainfall (or precipitation scavenging), and surface flow of chemicals from upstream sources unrelated to activities at the Site.

USEPA (1989, 1992a, b) guidance allows for the elimination of chemicals from further quantitative evaluation if detected levels are not elevated above naturally-occurring levels. However, soil and sediment concentrations will also be considered relative to ESVs before chemicals are eliminated from further evaluation.

Typically, COPECs are defined as chemicals that are elevated above naturally-occurring levels based on statistical analyses. Generally, this approach is applicable to metals and radionuclides (USEPA 1989). The comparison of applicable soil concentrations within the OU-3 BERA dataset to background levels will be conducted using the existing background data sets presented in the BRC/TIMET regional background data set (BRC/TIMET 2007). This background data will only be relevant for chromium and hexavalent chromium as the other COPECs selected for the OU-3 BERA are organic. Specifically, as recommended by Neptune (2017), the 95 McCullough samples collected as part of the BRC/TIMET background study will be used in the background evaluation as OU-3 is located north of the NERT Site and north of the McCullough Range on alluvial soils generated from McCullough Range substrate. Since statistical analysis showed no significant difference in background data across different depth intervals up to 10 feet bgs and to ensure adequate sample size, the background data from 0-10 feet bgs will be compared to the OU-3 BERA soil/sediment data collected from within the top 0 to 0.5 feet. No additional data from literature will be used assuming the local soil conditions match those from the BRC/TIMET 2007 dataset.

6.0 RISK CHARACTERIZATION

Risk characterization is the estimation and description of risk based on the synthesis of the exposure and effects assessments conducted in the analysis phase (USEPA 1997, 1998, 1999b). Risk characterization for the measurement endpoints involves mathematical comparison of exposure and effects estimates for each measurement endpoint. Exposure estimates that are below the relevant effects metric (i.e., surface water quality benchmark, sediment quality benchmark, tissue-based benchmark, or TRV) indicate that adverse impacts to a given receptor are unlikely. Exposure estimates that exceed the relevant effects metric indicate that further investigation is warranted to define the potential for adverse impacts at the population level, as well as the spatial extent and severity of any such impacts (Barnthouse et al. 2008).

Specifically, the unitless ratio of exposure concentration and effects concentration (such as an ESV) is called a hazard quotient (HQ). The HQ is not a predictor of risk but rather is a value used to indicate whether there is potential risk. Where HQs are less than or equal to 1, it can be readily concluded that chemicals do not pose an unacceptable risk. When HQs exceed the threshold value of 1, it means that additional consideration may be needed to understand whether chemicals pose unacceptable risks. For example, the values used to calculate the HQ must be closely evaluated (e.g., if HQ is based on maximum concentrations and no effects benchmarks, then an HQ exceeding the threshold value of 1 does not likely indicate an unacceptable risk; an HQ based on a 95% UCL value and a low effect benchmark may indicate a potential unacceptable risk). Screening level, refined, and average HQs were calculated by comparing the maximum, 95% UCL or average concentrations for each constituent in each medium (i.e., an estimate of exposure) to the appropriate ESV (i.e., an estimate of effects) using the following formula:

$$HQ = \frac{\text{Maximum or 95\% UCL Concentration}}{\text{ESV}}$$

The estimation of risk to wildlife will be calculated by dividing the estimated exposures (TDD) by the TRV in order to calculate the HQ. Because individual-level effects are of concern for the federally listed species under consideration in the BERA, the results of the conservative screening level evaluation (HQs based on maximum concentrations and no effects benchmarks) may be interpreted to determine whether there are potential risks posed to federally-listed species.

6.1 Risk Characterization for Aquatic Organisms

Total potential risks to aquatic invertebrates, aquatic plants and fish in the screening evaluation will be assessed by comparing maximum surface water concentrations against the ESVs for aquatic receptors. Potential risks to benthic invertebrates in the screening evaluation will first be assessed by comparing maximum baseline sediment concentrations against sediment ESVs. The 95% UCL and average concentrations will then be used in the refinement steps.

The characterization of risk to fish involves two lines of evidence, surface water chemistry and the evaluation of chemicals in fish tissues relative to CBRs. Dissolved concentrations are most relevant for the evaluation of fish because fish are potentially exposed to COPECs dissolved in surface water via the gill membrane. Fish are also exposed to total concentrations through dietary uptake, but most water quality standards do not consider dietary uptake as an exposure pathway. The characterization of potential risk to fish based on concentrations of COPECs in fish tissue will also be evaluated using concentrations of COPECs modeled and measured in fish tissue.

6.2 Risk Characterization for Aquatic-Oriented Bird and Mammal Populations

In the screening level OU-3 BERA aquatic food web, wildlife receptors are assumed to be exposed to maximum COPEC concentrations. The TDD will then be compared to a NOAEL TRV versus a LOAEL TRV to ensure the highly conservative requirement of the screening step. Furthermore, it is assumed that receptors feed exclusively within OU-3, a conservative assumption for those receptors with larger home ranges or those receptors that are known to be only seasonally present within the Wash area. Consideration will also be given to the weirs in the Wash that are physical barriers that may affect movement of fish.

If the results of the screening evaluation suggest a potential risk to aquatic-oriented wildlife, then the HQs based on 95% UCL and average concentrations will be used. Also, specific life history information for each species will be considered including exposure duration (i.e. migration), food ingestion rates, AUFs (i.e. forging range) for each species, and AFs for each COPEC.

6.3 Risk Characterization for Terrestrial Organisms

Total potential risks to terrestrial plants and invertebrates will be assessed by comparing baseline soil concentrations against literature-based ESVs. Maximum detected baseline soil concentrations will be used to assess the potential for risks to terrestrial plants, terrestrial invertebrates, birds, and mammals in the screening level evaluation. The use of maximum concentrations in the screening level evaluation are not necessarily indicative of true exposures (e.g., receptors are unlikely to be exposed to the highest levels of all COPECs from the combination of existing concentrations at all times).

6.4 Risk Characterization for Terrestrial Bird and Mammal Populations

In the screening level terrestrial food web, wildlife receptors will be assumed to be continually exposed to the maximum baseline soil and surface water concentrations and feed and drink water exclusively within OU-3. This represents a conservative assumption for those receptors with larger home ranges or those receptors that are known to be only seasonally present within the Wash. Also, in the screening step, the TDD using maximum COPEC concentrations will be compared to a NOAEL TRV (versus a LOAEL TRV). Use of the NOAEL TRV ensures the highly conservative requirement of the screening step.

If the results of the screening evaluation suggest a potential risk to terrestrial wildlife, then the HQs based on 95% UCL and average concentrations will be calculated. Like aquatic-oriented wildlife, specific life history information for each species will be considered including exposure duration, food ingestion rates, AUFs for each species, and AFs for each COPEC.

6.5 Uncertainty Analysis

The characterization of uncertainty is a key component of the ERA process (USEPA 1997). This uncertainty analysis will provide a narrative discussion of the types of uncertainties that may influence the ERA results. Uncertainty in a risk evaluation represents “the imperfect knowledge concerning the present or future state of the system under consideration; a component of risk resulting from imperfect knowledge of the degree of hazard, or of its spatial and temporal distribution” (USEPA 1997).

Uncertainties can be introduced into an ERA at every step in the process, as information of varying quality is gathered from diverse sources in order to be integrated into a complex framework. Conservative assumptions are generally employed to compensate for that uncertainty, to ensure the protectiveness of the overall assessment. Varying levels of uncertainty exists with the available information utilized in the chemistry dataset, effects assessment benchmarks, population effects, bioavailability of constituents of potential ecological concerns, receptor organisms and in the risks estimated from surrogate receptors.

The uncertainties inherent in a risk assessment that will be addressed in the BERA are:

- Selection of ESVs, uptake factors, and TRVs
- The generic nature of ESVs, uptake factors, and use of values that are often the lowest available
- Calculation of the 95% UCL
- Additional components of the ERA approach

6.6 Risk Conclusions

The purpose of the BERA is to evaluate whether significant risks to aquatic and terrestrial wildlife, particularly special status species, are occurring due to exposure of COPECs within OU-3. Ecologically significant impacts to wildlife from a regulatory perspective are those that will occur on a scale that could impact populations, communities, and ecosystems of wildlife and the habitat that supports wildlife (USEPA 1994, 1997, 1998). Special regulatory consideration is given to individual organisms of threatened and endangered species populations since these individuals comprise a greater percentage of the small threatened and endangered populations (USEPA 1997, 1998).

In larger populations, communities, and ecosystems, *de minimis* impacts can be tolerated without ecologically significant impacts (Suter et al. 1995; USEPA 1994; TNRCC 2000). This means that some impacts can be tolerated without causing adverse (or perhaps even measurable) impacts to the valued ecological entities (i.e., the population, community, and ecosystem). A determination of the ecological significance of risk estimates for multiple receptors will be summarized in the Risk Conclusions section of the BERA Report. The findings of this risk assessment will be used in the FS to determine what areas require potential remediation to address unacceptable risk to ecological receptors.

7.0 SCHEDULE

The OU-3 BERA will be conducted following NDEP approval of this BERA Work Plan and completion of field activities described in Section 4 and Appendix A. The OU-3 BERA is anticipated to be submitted to NDEP for review in the third quarter of 2020, providing that the field effort for OU-3 occurs in the spring of 2019.

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TABLES

Table 3-1: Groundwater Analytical Data from Wells Near the Las Vegas Wash (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name	Unit	PC-155A	PC-155B	PC-156A	PC-156B	PC-157A	PC-157B	WMW3.5S
			10/19/2017	10/19/2017	10/19/2017	10/19/2017	10/20/2017	10/20/2017	08/21/2017
Field	Field Conductivity	us/cm	--	--	--	--	--	--	4,090
General Chemistry	Alkalinity (as CaCO3)	mg/l	180	180	280	270	280	200	185
	Alkalinity, Bicarbonate [As CaCO3]	mg/l	--	--	--	--	--	--	185
	Bicarbonate as HCO3	ug/l	220,000	220,000	340,000	320,000	340,000	250,000	--
	Bromide	mg/l	0.93 J	0.93 J	0.50 J	0.53 J	0.59 J	4.4	0.299
	Carbon	ug/l	1,700	1,600	2,900	2,900	2,700	1,800	--
	Carbonate (CO3)	ug/l	<2,400	<2,400	<2,400	<2,400	<2,400	<2,400	--
	Chlorate	ug/l	490	560	<100	<100	<50	330	--
	Chloride	mg/l	590	580	420	440	470	580	544
	Conductivity	umhos/cm	4,500	4,600	3,000	3,100	3,400	4,300	--
	Dissolved Solids (total)	mg/l	3,500	3,600	2,000	2,100	2,400	3,100	3,010
	Fluoride	mg/l	--	--	--	--	--	--	0.89
	Hydroxide	ug/l	<1,400	<1,400	<1,400	<1,400	<1,400	<1,400	--
	Nitrate (as N)	mg/l	--	--	--	--	--	--	8.69
	Nitrate (as NO3)	mg/l	18	19	<0.50	0.68 J	2.5	17	--
	Nitrate Nitrite as N	ug/l	4,000	4,200	<1.0	150	560	3,800	--
	Nitrite	mg/l	<0.14	<0.14	<0.14	<0.14	<0.14	<0.35	0.05
	Perchlorate	ug/l	2,400	2,400	320	480	800	2,400	1,360
	Phosphorus (total)	ug/l	160	<25	54	86	56	40 J	--
	Silica	mg/l	--	--	--	--	--	--	44.5
	Sulfate	mg/l	1,400	1,400	600	640	760	1,300	1,360
	Sulfide (total)	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0	4.8	--
	ortho-Phosphate (total) (as P)	mg/l	<0.16	<0.16	<0.16	<0.16	0.16 UJ	0.40 UJ	0.0749
	pH	s.u.	7.6 J	7.7 J	7.7 J	7.6 J	7.8 J	7.8 J	--
Metals	Aluminum	mg/l	0.058 J	0.050 UJ	0.050 UJ	0.050 UJ	<0.050	<0.050	0.0552
	Antimony	mg/l	--	--	--	--	--	--	0.001
	Arsenic	mg/l	0.064	0.063	0.11	0.11	0.12	0.083	0.027
	Barium	mg/l	--	--	--	--	--	--	0.0316
	Beryllium	mg/l	--	--	--	--	--	--	0.001
	Boron	mg/l	1.9 J	1.9 J	0.91 J	0.92 J	1.0	1.6	--
	Cadmium	mg/l	--	--	--	--	--	--	0.0015
	Calcium	mg/l	320	330	140	120	160	270	354
	Chromium (total)	mg/l	0.0025 UJ	0.0025 UJ	0.0025 UJ	0.0025 UJ	<0.0025	<0.0025	<0.011
	Chromium VI	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Copper	mg/l	--	--	--	--	--	--	0.0125

Table 3-1: Groundwater Analytical Data from Wells Near the Las Vegas Wash (Example 2017 Dataset)
Nevada Environmental Response Trust Site
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Chemical Group	Chemical Name	Unit	PC-155A	PC-155B	PC-156A	PC-156B	PC-157A	PC-157B	WMW3.5S
			10/19/2017	10/19/2017	10/19/2017	10/19/2017	10/20/2017	10/20/2017	08/21/2017
Metals	Iron	mg/l	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.125
	Lead	mg/l	0.0038 UJ	0.0038 UJ	0.0038 UJ	0.0038 UJ	<0.0038	<0.0038	0.00055
	Magnesium	mg/l	140	150	60	55	67	120	135
	Manganese	mg/l	1.4 J	1.4 J	0.56 J	0.61 J	<0.015	1.3	0.177
	Mercury	mg/l	--	--	--	--	--	--	--
	Molybdenum	mg/l	--	--	--	--	--	--	0.0301
	Nickel	mg/l	--	--	--	--	--	--	0.0125
	Potassium	mg/l	27	28	23	24	22	26	50
	Selenium	mg/l	--	--	--	--	--	--	0.0093
	Silver	mg/l	--	--	--	--	--	--	0.0125
	Sodium	mg/l	460	480	400	430	380	420	402
	Strontium	mg/l	6.8	7.1	4.1	2.3	4.3	5.9	--
	Thallium	mg/l	--	--	--	--	--	--	0.0005
	Uranium-238	ug/l	25	25	14	19	16	24	--
	Vanadium	mg/l	0.022 J	0.022 J	0.087 J	0.036 J	0.056	0.019	0.0125
	Zinc	mg/l	--	--	--	--	--	--	0.0125
	Zirconium	mg/l	0.050 UJ	0.050 UJ	0.050 UJ	0.050 UJ	<0.050	<0.050	--
PCBs	Aroclor-1260	ug/l	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	--
VOCs	1,1,1,2-Tetrachloroethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,1,1-Trichloroethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,1,2,2-Tetrachloroethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,1,2-Trichloroethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,1-Dichloroethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,1-Dichloroethene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,1-Dichloropropene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,2,3-Trichlorobenzene	ug/l	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	--
	1,2,3-Trichloropropane	ug/l	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	--
	1,2,4-Trichlorobenzene	ug/l	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	--
	1,2,4-Trimethylbenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,2-Dibromo-3-chloropropane	ug/l	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--
	1,2-Dibromoethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,2-Dichlorobenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,2-Dichloroethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,2-Dichloropropane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,3,5-Trimethylbenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--

Table 3-1: Groundwater Analytical Data from Wells Near the Las Vegas Wash (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name	Unit	PC-155A 10/19/2017	PC-155B 10/19/2017	PC-156A 10/19/2017	PC-156B 10/19/2017	PC-157A 10/20/2017	PC-157B 10/20/2017	WMW3.5S 08/21/2017
VOCs	1,3-Dichlorobenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,3-Dichloropropane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,4-Dichlorobenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	1,4-Dioxane	ug/l	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--
	2,2-Dichloropropane	ug/l	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	--
	2-Butanone	ug/l	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	--
	2-Chlorotoluene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	4-Chlorotoluene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Benzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Bromobenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Bromochloromethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Bromodichloromethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Bromoform	ug/l	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	--
	Bromomethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Carbon tetrachloride	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Chlorobenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Chloroethane	ug/l	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	--
	Chloroform	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Chloromethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Cumene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Dibromochloromethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Dibromomethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Dichlorodifluoromethane	ug/l	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	--
	Ethyl benzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Ethyl tert-butyl ether	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Hexachlorobutadiene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Methylene Chloride	ug/l	<0.88	<0.88	<0.88	<0.88	<0.88	<0.88	--
	Naphthalene	ug/l	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	--
	Styrene	ug/l	1.1 J	0.40 J	0.35 J	<0.25	<0.25	<0.25	--
	Tetrachloroethene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Toluene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Trichloroethene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Trichlorofluoromethane	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	Vinyl chloride	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	cis-1,2-Dichloroethene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--

Table 3-1: Groundwater Analytical Data from Wells Near the Las Vegas Wash (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name	Unit	PC-155A	PC-155B	PC-156A	PC-156B	PC-157A	PC-157B	WMW3.5S
			10/19/2017	10/19/2017	10/19/2017	10/19/2017	10/20/2017	10/20/2017	08/21/2017
VOCs	cis-1,3-Dichloropropene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	m,p-Xylene	ug/l	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--
	n-Butylbenzene	ug/l	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	--
	n-Propylbenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	o-Xylene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	p-Cymene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	sec-Butylbenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	tert-Butylbenzene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	trans-1,2-Dichloroethene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--
	trans-1,3-Dichloropropene	ug/l	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--

Notes:

--	Not Analyzed
<	Not Detected
µg/L	Microgram per Liter
J	Reported result is an estimate.
mg/L	Milligram per Liter
PCBs	Polychlorinated Biphenyls
UJ	The analyte was analyzed for and was not present above the level of the associated value.
umhos/cm	Micromhos per Centimeter
us/cm	MicroSiemens per Centimeter
VOCs	Volatile Organic Compounds

Table 3-1: Groundwater Analytical Data from Wells Near the Las Vegas Wash (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name	Unit	WMW4.9S	WMW5.58S	WMW5.5S	WMW6.15S	WMW6.55S	WMW6.9S
			08/21/2017	08/21/2017	08/21/2017	08/21/2017	08/21/2017	08/21/2017
Field	Field Conductivity	us/cm	2,460	2,380	2,950	3,420	4,910	6,580
General Chemistry	Alkalinity (as CaCO3)	mg/l	192	163	216	284	174	211
	Alkalinity, Bicarbonate [As CaCO3]	mg/l	192	163	216	284	174	211
	Bicarbonate as HCO3	ug/l	--	--	--	--	--	--
	Bromide	mg/l	0.222	0.291	0.22	0.448	0.899	1.04
	Carbon	ug/l	--	--	--	--	--	--
	Carbonate (CO3)	ug/l	--	--	--	--	--	--
	Chlorate	ug/l	--	--	--	--	--	--
	Chloride	mg/l	336	318	425	510	615	783
	Conductivity	umhos/cm	--	--	--	--	--	--
	Dissolved Solids (total)	mg/l	1,630	1,520	1,960	2,260	3,820	5,420
	Fluoride	mg/l	0.89	1.1	0.851	1.75	1.3	1.68
	Hydroxide	ug/l	--	--	--	--	--	--
	Nitrate (as N)	mg/l	9.64	8.04	9.38	0.19	5.74	3.29
	Nitrate (as NO3)	mg/l	--	--	--	--	--	--
	Nitrate Nitrite as N	ug/l	--	--	--	--	--	--
	Nitrite	mg/l	0.05	0.444	0.05	0.05	0.05	0.05
	Perchlorate	ug/l	341	283	1,340	652	1,620	22
	Phosphorus (total)	ug/l	--	--	--	--	--	--
	Silica	mg/l	31.8	40.2	34.3	83.8	81.1	77.4
	Sulfate	mg/l	610	569	718	796	1,870	2,820
	Sulfide (total)	mg/l	--	--	--	--	--	--
	ortho-Phosphate (total) (as P)	mg/l	0.0488	0.0551	0.0077	0.0667	0.0131	0.028
	pH	s.u.	--	--	--	--	--	--
Metals	Aluminum	mg/l	0.0125	0.0443	0.0062	0.0125	0.0125	0.0125
	Antimony	mg/l	0.001	0.001	0.0002	0.001	0.001	0.001
	Arsenic	mg/l	0.021	0.03	0.022	0.12	0.047	0.072
	Barium	mg/l	0.0125	0.0125	0.0176	0.0335	0.0125	0.0125
	Beryllium	mg/l	0.001	0.001	0.0002	0.001	0.001	0.001
	Boron	mg/l	--	--	--	--	--	--
	Cadmium	mg/l	0.0015	0.0015	0.00025	0.0015	0.0015	0.0015
	Calcium	mg/l	172	132	193	164	406	510
	Chromium (total)	mg/l	<0.011	<0.011	0.0015	<0.011	<0.011	<0.011
	Chromium VI	ug/l	--	--	--	--	--	--
	Copper	mg/l	0.0125	0.0125	0.0025	0.0125	0.0125	0.0125

Table 3-1: Groundwater Analytical Data from Wells Near the Las Vegas Wash (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name	Unit	WMW4.9S	WMW5.58S	WMW5.5S	WMW6.15S	WMW6.55S	WMW6.9S
			08/21/2017	08/21/2017	08/21/2017	08/21/2017	08/21/2017	08/21/2017
Metals	Iron	mg/l	0.125	0.125	0.025	0.125	0.125	0.125
	Lead	mg/l	0.00055	0.00055	0.00015	0.00055	0.00055	0.00055
	Magnesium	mg/l	69.6	58.1	76.4	69.1	187	307
	Manganese	mg/l	0.0125	0.84	0.0025	0.474	0.486	0.123
	Mercury	mg/l	0.0001	--	0.0001	0.0001	0.0001	0.0001
	Molybdenum	mg/l	0.0125	0.0279	0.0229	0.0256	0.0125	0.0715
	Nickel	mg/l	0.0125	0.0125	0.0073	0.0125	0.0125	0.0125
	Potassium	mg/l	35.5	23.4	40.4	25.3	36.3	79.7
	Selenium	mg/l	0.0025	0.0025	0.0077	0.0025	0.0128	0.0122
	Silver	mg/l	0.0125	0.0125	0.0025	0.0125	0.0125	0.0125
	Sodium	mg/l	237	265	319	488	501	616
	Strontium	mg/l	--	--	--	--	--	--
	Thallium	mg/l	0.0005	0.0005	0.0001	0.0005	0.0005	0.0005
	Uranium-238	ug/l	--	--	--	--	--	--
	Vanadium	mg/l	0.0125	0.0125	0.0101	0.0738	0.0304	0.0125
	Zinc	mg/l	0.0125	0.0125	0.0025	0.0125	0.0125	0.0125
	Zirconium	mg/l	--	--	--	--	--	--
PCBs	Aroclor-1260	ug/l	--	--	--	--	--	--
VOCs	1,1,1,2-Tetrachloroethane	ug/l	--	--	--	--	--	--
	1,1,1-Trichloroethane	ug/l	--	--	--	--	--	--
	1,1,2,2-Tetrachloroethane	ug/l	--	--	--	--	--	--
	1,1,2-Trichloroethane	ug/l	--	--	--	--	--	--
	1,1-Dichloroethane	ug/l	--	--	--	--	--	--
	1,1-Dichloroethene	ug/l	--	--	--	--	--	--
	1,1-Dichloropropene	ug/l	--	--	--	--	--	--
	1,2,3-Trichlorobenzene	ug/l	--	--	--	--	--	--
	1,2,3-Trichloropropane	ug/l	--	--	--	--	--	--
	1,2,4-Trichlorobenzene	ug/l	--	--	--	--	--	--
	1,2,4-Trimethylbenzene	ug/l	--	--	--	--	--	--
	1,2-Dibromo-3-chloropropane	ug/l	--	--	--	--	--	--
	1,2-Dibromoethane	ug/l	--	--	--	--	--	--
	1,2-Dichlorobenzene	ug/l	--	--	--	--	--	--
	1,2-Dichloroethane	ug/l	--	--	--	--	--	--
	1,2-Dichloropropane	ug/l	--	--	--	--	--	--
	1,3,5-Trimethylbenzene	ug/l	--	--	--	--	--	--

Table 3-1: Groundwater Analytical Data from Wells Near the Las Vegas Wash (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name	Unit	WMW4.9S	WMW5.58S	WMW5.5S	WMW6.15S	WMW6.55S	WMW6.9S
			08/21/2017	08/21/2017	08/21/2017	08/21/2017	08/21/2017	08/21/2017
VOCs	1,3-Dichlorobenzene	ug/l	--	--	--	--	--	--
	1,3-Dichloropropane	ug/l	--	--	--	--	--	--
	1,4-Dichlorobenzene	ug/l	--	--	--	--	--	--
	1,4-Dioxane	ug/l	--	--	--	--	--	--
	2,2-Dichloropropane	ug/l	--	--	--	--	--	--
	2-Butanone	ug/l	--	--	--	--	--	--
	2-Chlorotoluene	ug/l	--	--	--	--	--	--
	4-Chlorotoluene	ug/l	--	--	--	--	--	--
	Benzene	ug/l	--	--	--	--	--	--
	Bromobenzene	ug/l	--	--	--	--	--	--
	Bromochloromethane	ug/l	--	--	--	--	--	--
	Bromodichloromethane	ug/l	--	--	--	--	--	--
	Bromoform	ug/l	--	--	--	--	--	--
	Bromomethane	ug/l	--	--	--	--	--	--
	Carbon tetrachloride	ug/l	--	--	--	--	--	--
	Chlorobenzene	ug/l	--	--	--	--	--	--
	Chloroethane	ug/l	--	--	--	--	--	--
	Chloroform	ug/l	--	--	--	--	--	--
	Chloromethane	ug/l	--	--	--	--	--	--
	Cumene	ug/l	--	--	--	--	--	--
	Dibromochloromethane	ug/l	--	--	--	--	--	--
	Dibromomethane	ug/l	--	--	--	--	--	--
	Dichlorodifluoromethane	ug/l	--	--	--	--	--	--
	Ethyl benzene	ug/l	--	--	--	--	--	--
	Ethyl tert-butyl ether	ug/l	--	--	--	--	--	--
	Hexachlorobutadiene	ug/l	--	--	--	--	--	--
	Methylene Chloride	ug/l	--	--	--	--	--	--
	Naphthalene	ug/l	--	--	--	--	--	--
	Styrene	ug/l	--	--	--	--	--	--
	Tetrachloroethene	ug/l	--	--	--	--	--	--
	Toluene	ug/l	--	--	--	--	--	--
	Trichloroethene	ug/l	--	--	--	--	--	--
	Trichlorofluoromethane	ug/l	--	--	--	--	--	--
	Vinyl chloride	ug/l	--	--	--	--	--	--
	cis-1,2-Dichloroethene	ug/l	--	--	--	--	--	--

Table 3-1: Groundwater Analytical Data from Wells Near the Las Vegas Wash (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Chemical Group	Chemical Name	Unit	WMW4.9S	WMW5.58S	WMW5.5S	WMW6.15S	WMW6.55S	WMW6.9S
			08/21/2017	08/21/2017	08/21/2017	08/21/2017	08/21/2017	08/21/2017
VOCs	cis-1,3-Dichloropropene	ug/l	--	--	--	--	--	--
	m,p-Xylene	ug/l	--	--	--	--	--	--
	n-Butylbenzene	ug/l	--	--	--	--	--	--
	n-Propylbenzene	ug/l	--	--	--	--	--	--
	o-Xylene	ug/l	--	--	--	--	--	--
	p-Cymene	ug/l	--	--	--	--	--	--
	sec-Butylbenzene	ug/l	--	--	--	--	--	--
	tert-Butylbenzene	ug/l	--	--	--	--	--	--
	trans-1,2-Dichloroethene	ug/l	--	--	--	--	--	--
	trans-1,3-Dichloropropene	ug/l	--	--	--	--	--	--

Notes:

--	Not Analyzed
<	Not Detected
µg/L	Microgram per Liter
J	Reported result is an estimate.
mg/L	Milligram per Liter
PCBs	Polychlorinated Biphenyls
UJ	The analyte was analyzed for and was not present above t
umhos/cm	Micromhos per Centimeter
us/cm	MicroSiemens per Centimeter
VOCs	Volatile Organic Compounds

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
GLW3.78	0.30 ft	02/09/2017 11:28	<0.25	230	260	1,400	47
	0.42 ft	02/06/2017 10:45	1.5	220	270	1,500	54
	0.50 ft	02/08/2017 10:10	0.62 J	210	260	1,400	52
	0.70 ft	02/07/2017 09:35	0.48 J	200	260	1,400	40
	0.96 ft	02/06/2017 16:40	0.5	210	270	1,500	40
	1.20 ft	02/07/2017 16:35	<0.25	200	260	1,500	48
	1.40 ft	02/08/2017 16:42	1.5	190	260	1,500	46
		02/09/2017 16:30	<0.25	200	370	1,500	43
GLW4.4	1.10 ft	02/06/2017 11:04	0.61	99	250	1,400	28
		02/07/2017 10:18	1.4	100	270	1,400	25 J+
		02/08/2017 10:07	<0.25	120	270	1,400	27
		02/09/2017 10:22	0.52	120	250	1,400	26
	1.20 ft	02/06/2017 14:15	0.51	93	260	1,500	33
		02/07/2017 16:06	0.32 J	80	260	1,400	20 J+
		02/08/2017 13:47	<0.25	110	260	1,400	27
		02/09/2017 13:11	0.62 J	140	270	1,400	31 J+
	1.30 ft	02/06/2017 16:19	0.58	79	250	1,400	15
		02/07/2017 14:11	1.6	97	270	1,500	25
		02/08/2017 16:21	0.56	110	230	1,400	17
		02/09/2017 15:44	<0.25	110	260	1,500	23
GLW4.85	0.60 ft	02/06/2017 10:22	0.91 J	4,300	390	2,200	1,100
		02/06/2017 15:58	0.75 J	3,000	350	1,900	750
		02/08/2017 09:45	<0.25	1,100	310	1,600	290
	0.70 ft	02/07/2017 09:42	1	3,000	380	2,100	860 J+
		02/09/2017 09:58	<0.25	1,600	340	1,600	320
	0.80 ft	02/07/2017 15:42	0.29 J	1,200	300	1,600	290
		02/08/2017 16:00	1	940	270	1,600	270
		02/09/2017 15:18	<0.25	900	300	1,600	180

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
GLW4.9	1.20 ft	02/07/2017 10:55	1.4	94	270	1,400	28 J+
		02/08/2017 10:50	1.6	100	250	1,400	22
		02/09/2017 10:50	0.33 J	100	240	1,400	27
	1.40 ft	02/07/2017 16:45	0.32 J	77	280	1,400	17
		02/08/2017 16:35	1.4 J	84	240	1,400	15
GLW4.9	1.40 ft	02/09/2017 15:53	0.54	91	230	1,400	14
	1.45 ft	02/06/2017 11:15	1.7	87	260	1,500	23
	1.50 ft	02/06/2017 15:00	<0.25	71	260	1,500	21
GLWC6.1_3	0.90 ft	02/06/2017 15:00	0.42 J	110	250	1,100	1.1 J
		02/07/2017 15:06	<0.25	100	260	1,100	<0.95
	1.00 ft	02/06/2017 10:07	<0.25	100	230	1,000	<0.95
		02/07/2017 09:30	<0.25	100	220	1,100	1.5 J
		02/08/2017 15:00	0.45 J	110	240	1,100	<0.95
	1.10 ft	02/09/2017 14:57	<0.25	76	270	1,100	<0.95
	1.20 ft	02/08/2017 10:05	0.26 J	93	210	1,100	<0.95
		02/09/2017 09:32	0.39 J	87	230	1,100	<0.95
GLWC6.1_4	1.00 ft	02/08/2017 16:07	0.54	81	250	1,100	<0.95
	1.10 ft	02/06/2017 10:35	0.25 UJ	96	340	1,400	<0.95
	1.30 ft	02/06/2017 15:45	0.68 J	93	330	1,400 J	1.3 J
		02/07/2017 10:35	<0.25	100	280	1,300	<0.95
		02/07/2017 16:10	0.31 J	92	350	1,300	<0.95
		02/08/2017 10:35	0.46 J	88	220	1,200	<0.95
		02/09/2017 10:33	0.45 J	71	250	1,100	<0.95
	1.60 ft	02/09/2017 15:51	0.35 J	72	290	1,200	<0.95

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
LW3.4	0.42 ft	02/06/2017 11:10	1.5	180	270	1,400	53
	0.50 ft	02/07/2017 11:11	0.51	180	270	1,400	52 J+
		02/08/2017 10:30	0.60 J	170	260	1,500	50
		02/09/2017 12:00	<0.25	190	260	1,400	42
		02/09/2017 13:33	<0.25	200	290	1,500	52
	0.60 ft	02/07/2017 14:35	0.62	170	270	1,500	42
		02/08/2017 14:18	1.7	180	260	1,400	46
		02/08/2017 17:05	1.4	150	260	1,500	32
		02/09/2017 16:55	0.27 J	160	290	1,500	38
	0.63 ft	02/06/2017 14:46	0.54	160	260	1,500	53
	0.70 ft	02/06/2017 17:01	0.5	130	260	1,500	38 J+
		02/07/2017 17:00	<0.25	140	250	1,500	39
LW3.75	0.50 ft	02/09/2017 10:58	0.59	140	260	1,400	27
	0.67 ft	02/06/2017 16:30	0.59	100	260	1,400	26 J+
LW3.75	0.80 ft	02/08/2017 09:57	0.56 J	120	260	1,400	26
		02/09/2017 16:11	<0.25	130	320	1,500	31
	0.83 ft	02/06/2017 10:25	1.4	110	270	1,400	30
	0.90 ft	02/07/2017 10:45	0.61 J	120	270	1,400	35 J+
	1.00 ft	02/07/2017 16:25	0.55 J	110	250	1,400	27
		02/08/2017 16:30	1.5	110	260	1,500	23
LW3.85	0.50 ft	02/07/2017 10:12	0.57 J	120 J+	270	1,400	32
		02/08/2017 09:27	0.58 J	130	260	1,400	34
		02/08/2017 16:05	1.4	130	260	1,500	24
		02/09/2017 10:30	<0.25	140	260	1,400	28
	0.58 ft	02/06/2017 16:03	0.6	100	260	1,500	28 J+
	0.60 ft	02/06/2017 09:53	1.7	130	260	1,400	36
		02/07/2017 15:50	0.70 J	110	250	1,500	31
		02/09/2017 15:45	<0.25	130	290	1,500	32

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
LW4.1	0.30 ft	02/06/2017 11:20	0.5	220	260	1,500	51
		02/06/2017 16:42	0.59	180	260	1,500	38
		02/07/2017 10:39	1.4	230	270	1,500	47 J+
		02/09/2017 10:38	0.28 J	230	290	1,400	40
	0.40 ft	02/07/2017 16:20	<0.25	160	280	1,500	38 J+
		02/08/2017 10:22	<0.25	210	270	1,400	53
		02/08/2017 16:33	0.54	170	250	1,500	<0.95
		02/09/2017 16:02	<0.25	160	270	1,500	36
LW4.95	1.00 ft	02/07/2017 10:45	1.5	79	260	1,500	24 J+
		02/09/2017 10:35	0.65	82	240	1,400	24
	1.08 ft	02/06/2017 13:20	0.73	70	240	1,400	20
	1.10 ft	02/06/2017 11:30	1.6	79	270	1,500	20
		02/06/2017 15:15	<0.25	57	250	1,500	13
		02/08/2017 10:30	1.4	83	260	1,400	19
		02/09/2017 12:30	0.27 J	91	290	1,500	22 J+
	1.20 ft	02/07/2017 13:25	<0.25	74	240	1,500	12
		02/07/2017 16:30	0.26 J	63	270	1,400	13
		02/08/2017 13:05	1.7	81	250	1,400	14
		02/09/2017 15:40	0.54	78	240	1,400	10
LW4.95	1.30 ft	02/08/2017 16:20	1.3	2,000	240	1,300	11

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
LW5.3	1.00 ft	02/07/2017 09:45	0.98 J	57	260	1,500	19 J+
		02/08/2017 10:00	1.5	73	260	1,400	15
		02/09/2017 10:00	0.56	67	240	1,500	22
	1.10 ft	02/09/2017 15:15	0.54	66	230	1,300	9.1
	1.20 ft	02/06/2017 10:00	2.3	56	260	1,500	17
		02/06/2017 16:00	<0.25	55	250	1,400	11
		02/07/2017 15:45	0.25 J	54	280	1,400	11
		02/08/2017 15:45	1.3	60	240	1,400	8.9
	2.00 ft	02/07/2017 09:50	1.7	59	260	1,500	20 J+
		02/08/2017 10:03	1.5	81	250	1,400	17
		02/09/2017 10:03	<0.25	120	280	1,400	30
	2.20 ft	02/09/2017 15:18	0.51	69	240	1,400	8.8
	2.30 ft	02/06/2017 16:10	<0.25	61	250	1,400	12
	2.35 ft	02/06/2017 10:35	1.9	56	260	1,500	16
	2.40 ft	02/07/2017 15:50	0.25 J	52	280	1,400	9.6
		02/08/2017 15:50	1.4	64	240	1,400	9
LW5.9	0.40 ft	02/07/2017 10:00	0.26 J	56	300	1,500	17 J+
		02/08/2017 10:35	0.55	70	240	1,500	15
		02/09/2017 10:01	0.60 J	74	260	1,400	15
	0.50 ft	02/06/2017 11:08	<0.25	71	260	1,400	21
	0.60 ft	02/06/2017 15:18	0.5	54	240	1,300	6.7
		02/07/2017 15:27	0.30 J	55	280	1,400	10
		02/08/2017 15:41	0.55	61	240	1,300	9.6
	0.70 ft	02/09/2017 15:27	0.26 J	61	260	1,300	6.9

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
LW6.05	0.50 ft	02/08/2017 09:35	<0.25	65	270	1,500	18
		02/09/2017 09:31	0.77	69	240	1,500	19
	0.60 ft	02/06/2017 11:20	0.26 J	57	270	1,400	18
		02/07/2017 09:30	0.50 J	51	250	1,500	18 J+
		02/07/2017 11:20	1.5	63	250	1,600	17
		02/09/2017 12:00	0.30 J	74	290	1,600	14
	0.70 ft	02/06/2017 12:36	0.46 J	60	240	1,400	13
		02/06/2017 15:26	0.65	48	210	1,400	8.9
LW6.05	0.70 ft	02/07/2017 14:48	1.2	50	250	1,400	6
		02/08/2017 15:36	0.32 J	55	240	1,400	7.7
		02/09/2017 15:23	0.31 J	60	220	1,400	6.8
	0.80 ft	02/08/2017 12:35	0.56	72	240	1,500	11 J
LW6.7	0.30 ft	02/08/2017 09:03	<0.25	62	280	1,700	<0.95
		02/09/2017 09:11	1.7	76	270	1,700	<0.95
	0.40 ft	02/06/2017 10:15	0.30 J	53	250	1,400	<0.95
		02/07/2017 09:13	0.56 J	69	270	1,700	<0.95
	0.60 ft	02/06/2017 15:00	0.36 J	44	200	1,200	<0.95
		02/07/2017 14:25	1.4	55	240	1,400	<0.95
		02/08/2017 15:02	0.33 J	55	250	1,400	<0.95
		02/09/2017 15:04	0.71	66	220	1,400	<0.95

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
LW7.2	0.70 ft	02/07/2017 08:55	0.40 J	58	210	1,200	<0.95
		02/08/2017 08:45	<0.25	59	230	1,200	<0.95
		02/09/2017 08:56	1.1	71	230	1,300	<0.95
	0.80 ft	02/06/2017 09:45	<0.25	51	240	1,300	<0.95
		02/06/2017 12:10	0.52	53	220	1,200	<0.95
		02/07/2017 10:55	1.3	60	220	1,300	<0.95
		02/08/2017 11:07	0.54	86	220	1,300	<0.95
		02/09/2017 10:52	0.27 J	69	250	1,300	0.95 UJ
	0.90 ft	02/07/2017 14:02	1.1	44	210	1,200	<0.95
		02/08/2017 14:40	<0.25	49	220	1,100	<0.95
		02/09/2017 14:41	0.35 J	67	200	1,200	<0.95
	1.00 ft	02/06/2017 14:30	0.44 J	43	200	1,200	<0.95
LWC3.7	0.33 ft	02/06/2017 10:16	1.5	1,500	330	1,900	550
	0.40 ft	02/07/2017 10:32	0.72 J	1,800	360	2,100	670 J+
		02/09/2017 10:48	<0.25	1,800	360	2,100	670
	0.50 ft	02/08/2017 09:48	0.81 J	2,000	340	2,000	570
		02/08/2017 16:20	1.6 J	80	360	2,200	770
	0.58 ft	02/06/2017 16:20	<0.25	2,500	410	2,300	880
	0.60 ft	02/07/2017 16:10	<0.25	2,600	370	2,200	830
		02/09/2017 16:00	<0.25	3,100	460	2,500	1,100
LWC6.1_1	0.58 ft	02/06/2017 09:45	<0.25	98	250	1,100	<0.95
LWC6.1_1	0.70 ft	02/08/2017 14:43	0.49 J	90	240	1,100	<0.95
	0.80 ft	02/06/2017 14:43	0.45 J	110	250	1,100	<0.95
		02/07/2017 14:45	<0.25	100	280	1,100	<0.95
	0.90 ft	02/07/2017 09:03	<0.25	98	270	660	1.3 J
		02/08/2017 09:45	0.39 J	100	220	1,100	<0.95
	1.00 ft	02/09/2017 09:10	0.41 J	88	240	1,100	<0.95
	1.10 ft	02/09/2017 14:39	<0.25	79	280	1,200	<0.95

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
LWC6.1_2	0.60 ft	02/06/2017 14:55	0.36 J	91	140	710	<0.95
		02/08/2017 10:00	<0.25	64	96	630	<0.95
		02/09/2017 09:25	0.30 J	50	100	610	<0.95
	0.70 ft	02/07/2017 09:20	<0.25	67	140	1,100	<0.95
		02/07/2017 14:58	<0.25	47	110	610	<0.95
		02/08/2017 14:53	0.32 J	64	110	590	<0.95
	0.80 ft	02/06/2017 10:00	<0.25	78	120	690	<0.95
		02/09/2017 14:52	<0.25	51	100	590	<0.95
T3.5A	0.20 ft	02/02/2017 11:08	1.1	310	420	2,700	73
T3.5B	0.50 ft	02/02/2017 11:13	0.64 J	430	280	1,500	140
T3.5C	0.60 ft	02/02/2017 11:22	<0.25	420	270	1,600	98
T3.5D	1.40 ft	02/02/2017 12:00	<0.25	270	260	1,500	66
T3.5E	1.50 ft	02/02/2017 12:07	<0.25	190	260	1,500	47
T3.5F	1.50 ft	02/02/2017 12:34	0.84 J	140	260	1,500	38
	4.00 ft	02/02/2017 12:25	0.7	130	250	1,500	37
T3.75A	0.90 ft	01/30/2017 11:48	0.34 J	270	280	1,400	63 J+
T3.75B	0.70 ft	01/30/2017 11:53	0.33 J	210	280	1,400	51 J+
T3.75C	0.60 ft	01/30/2017 12:00	0.34 J	110	280	1,400	31
T3.75D	0.40 ft	01/30/2017 12:09	<0.25	260	280	1,500	85
T3.8A	0.40 ft	01/30/2017 11:30	0.60 J	270	260	1,400	57 J+
T3.8B	0.40 ft	01/30/2017 11:37	0.59 J	210	260	1,400	45 J+
T3.8C	0.40 ft	01/30/2017 11:46	0.53 J	110	250	1,400	32 J+
T3.8D	0.40 ft	01/30/2017 11:55	<0.25	130	250	1,500	46 J+
T4.2A	0.40 ft	02/01/2017 09:55	0.6	260	260	1,400	66
T4.2B	1.00 ft	02/01/2017 10:19	0.67 J	170	260	1,400	40
T4.2C	0.80 ft	02/01/2017 10:35	0.58	88	260	1,400	27
T4.2D	1.00 ft	02/01/2017 10:47	0.58	78	270	1,400	25
T4.65A	0.70 ft	01/31/2017 10:40	1.4	250	280	1,500	57 J+

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
T4.65B	0.90 ft	01/31/2017 10:50	1.8	210	260	1,500	51
T4.65C	1.30 ft	01/31/2017 10:58	0.74 J	100	260	1,500	31
T4.65D	0.60 ft	01/31/2017 11:06	1.7	78	260	1,500	30
T4.6A	0.30 ft	01/31/2017 10:40	1.7	260	280	1,600	64 J+
T4.6B	0.60 ft	01/31/2017 10:47	1.6	210	280	1,600	57 J+
T4.6C	0.80 ft	01/31/2017 10:56	<0.25	100	280	1,500	30 J+
T4.6D	0.80 ft	01/31/2017 11:13	1.6	83	280	1,500	32 J+
T4.75A	1.30 ft	02/01/2017 10:04	0.69 J	3,100	360	2,200	820 J+
T4.75B	0.90 ft	02/01/2017 10:13	0.59	94	260	1,600	23 J+
T4.75C	2.20 ft	02/01/2017 10:23	0.57	83	270	1,600	22 J+
T4.75D	1.50 ft	02/01/2017 10:35	<0.25	35 J	350	2,100	420 J+
T5.3A	1.40 ft	02/02/2017 09:32	0.30 J	140	300	1,500	32
	2.80 ft	02/02/2017 09:37	<0.25	130	290	1,500	33
T5.3B	2.00 ft	02/02/2017 10:13	<0.25	54	290	1,500	18
T5.3C	1.20 ft	02/02/2017 09:59	<0.25	51	290	1,500	17
T6.35A	1.50 ft	02/03/2017 09:32	0.31 J	55	260	1,500	18
T6.35B	1.00 ft	02/03/2017 09:55	0.57	53	270	1,600	17
	3.00 ft	02/03/2017 09:44	0.32 J	56	270	1,500	18
T6.35C	1.00 ft	02/03/2017 09:19	<0.25	57	270	1,600	18
T6.8A	1.00 ft	02/03/2017 09:13	1.3	51	250	1,500	<0.95
T6.8B	1.30 ft	02/03/2017 09:25	1.6	59	270	1,700	<0.95
T6.8C	0.40 ft	02/03/2017 09:32	1.8	73	290	1,900	1.6 J
T6.8D	0.90 ft	02/03/2017 09:41	0.64	52	230	1,300	<0.95
T6.8E	0.70 ft	02/03/2017 09:50	0.77	48	240	1,200	<0.95
T6A	0.90 ft	02/02/2017 09:00	<0.25	49	290	1,500	16
T6B	1.70 ft	02/02/2017 09:05	<0.25	49	290	1,500	16

Table 3-2: AECOM Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Depth	Sample Time	General Chemistry				
			Bromide	Chlorate	Chloride	Dissolved Solids (total)	Perchlorate
			mg/L	µg/L	mg/L	mg/L	µg/L
T6C	**1.70 ft**	**02/02/2017 09:13**	<0.25	50	280	1,500	16
T6D	**0.40 ft**	**02/02/2017 09:18**	<0.25	50	280	1,500	15

Notes:

µg/L	Microgram per Liter
ft	Feet/Foot
mg/L	Milligram per Liter
J	Reported result is an estimate
J+	Reported result is an estimate, potential positive bias

Table 3-3: Ramboll/Tetra Tech Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample Date	General Chemistry		
		Chlorate	Dissolved Solids (total)	Perchlorate
		µg/L	mg/L	µg/L
LVW 0.55	06/27/2017	200	1,300	39
	07/24/2017	260	1,300	41
	08/30/2017	300	1,400	36
	09/26/2017	260	1,300	46
	10/16/2017	200	1,400	63
	11/13/2017	230	1,400	57
	12/04/2017	280	1,400	64
LVW 3.5-1	06/27/2017	290	1,400	77
	07/24/2017	350	1,300	59
	08/30/2017	360	1,400	55
	09/26/2017	310	1,400	57
	10/16/2017	210	1,400	74
	11/13/2017	300	1,400	89
	12/04/2017	320	1,300	78
LVW 3.5-2	06/27/2017	280	1,400	79
	07/24/2017	340	1,300	57
	08/30/2017	390	1,400	54
	09/26/2017	290	1,300	53
	10/16/2017	240	1,400	74
	11/13/2017	260	1,400	78
	12/04/2017	330	1,300	80
LVW 3.5-3	06/27/2017	250	1,400	67
	07/24/2017	310	1,300	51
	08/30/2017	370	1,400	51
	09/26/2017	270	1,300	51
	10/16/2017	230	1,400	69
	11/13/2017	230	1,400	81
	12/04/2017	320	1,300	78
LVW 3.5-4	06/27/2017	250	1,300	63
	07/24/2017	310	1,300	52
	08/30/2017	370	1,300	49
	09/26/2017	280	1,400	48
	10/16/2017	210	1,400	67
LVW 3.5-4	11/13/2017	230	1,400	52 J+
	12/04/2017	310	1,400	74
LVW 3.5-5	06/27/2017	260	1,400	67
	07/24/2017	310	1,300	44
	08/30/2017	320	1,300	42
	09/26/2017	280	1,400	47
	10/16/2017	190	1,400	58
	11/13/2017	210	1,400	46
	12/04/2017	280	1,300	66

Table 3-3: Ramboll/Tetra Tech Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample Date	General Chemistry		
		Chlorate	Dissolved Solids (total)	Perchlorate
		µg/L	mg/L	µg/L
LVW 3.5-6	06/27/2017	240	1,400	57
	07/24/2017	280	1,300	44
	08/30/2017	320	1,300	44
	09/26/2017	280	1,300	40
	10/16/2017	180	1,300	55
	11/13/2017	210	1,300	47
	12/04/2017	250	1,300	55
LVW 4.2-1	06/28/2017	250	1,400	57
	07/25/2017	260	900	45
	08/23/2017	420	1,300	41
	09/25/2017	430	1,400	66
	10/17/2017	260	1,400	64
	11/14/2017	290	1,400	79
	12/05/2017	300	1,300	73
LVW 4.2-2	06/28/2017	210	1,500	55
	07/25/2017	200	800	35
	08/23/2017	390	1,300	37
	09/25/2017	400	1,400	50
	10/17/2017	240	1,400	54
	11/14/2017	240	1,400	64
	12/05/2017	260	1,400	27
LVW 4.2-3	06/28/2017	180	1,400	40
	07/25/2017	150	970	18
	08/23/2017	370	1,300	29
LVW 4.2-3	09/25/2017	360	1,400	43
	10/17/2017	150	1,400	26
	11/14/2017	170	1,400	38
	12/05/2017	250	1,300	57
LVW 4.2-4	06/28/2017	160	1,400	36
	07/25/2017	170	1,100	21
	08/23/2017	370	1,300	22
	09/25/2017	290	1,400	27
	10/17/2017	130	1,400	22
	11/14/2017	100	1,400	25
	12/05/2017	140	1,300	70
LVW 5.3-1	06/29/2017	190	1,400	21
	07/25/2017	130	980	13
	08/23/2017	360	1,300	15
	09/25/2017	330	1,400	22
	10/17/2017	130	1,400	25
	11/14/2017	120	1,400	28
	12/05/2017	140	1,300	19

Table 3-3: Ramboll/Tetra Tech Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample Date	General Chemistry		
		Chlorate	Dissolved Solids (total)	Perchlorate
		µg/L	mg/L	µg/L
LVW 5.3-2	06/29/2017	170	1,400	17
	07/25/2017	170	1,200	12
	08/23/2017	360	1,300	8
	09/25/2017	310	1,400	13
	10/17/2017	110	1,400	15
	11/14/2017	100	1,400	21
	12/05/2017	150	1,400	24
LVW 5.3-3	06/29/2017	150	1,400	12
	07/25/2017	170	1,300	12
	08/23/2017	360	1,100	7.6
	09/25/2017	270	1,400	14
	10/17/2017	110	1,400	14
	11/14/2017	96	1,400	18
	12/05/2017	130	1,300	18
LVW 6.05	06/26/2017	110	1,300	14
	07/24/2017	38	1,400	14
	08/30/2017	180	1,400	12
	09/26/2017	150	1,300	15
	10/16/2017	86	1,300	22
	11/13/2017	340	1,500	1.6 J
	12/04/2017	130	1,400	22
LVW 6.6-1	06/28/2017	120	1,500	13 J
	07/25/2017	160	1,400	3.3 J
	08/23/2017	350	1,200	<0.95
	09/25/2017	160 J	1,500	<0.95
	10/17/2017	86	1,600	2.6 J
	11/14/2017	80	1,600	13
	12/05/2017	72	1,500	7.5
LVW 6.6-2	06/28/2017	130	1,200	18
	07/25/2017	160	1,200	3.0 J
	08/23/2017	340	1,100	<0.95
	09/25/2017	160	1,100	<0.95
	10/17/2017	64	1,200	<0.95
	11/14/2017	84	1,100	<0.95
	12/05/2017	72	1,300	<0.95
LVW 6.6-3	06/28/2017	140	1,200	2.4
	07/25/2017	160	1,100	1.5 J
	08/23/2017	350	1,100	<0.95
	09/25/2017	170 J	1,100	<0.95
	10/17/2017	70	1,100	<0.95
	11/14/2017	83	1,100	<0.95
	12/05/2017	270	1,500	52

Table 3-3: Ramboll/Tetra Tech Las Vegas Wash Surface Water Analytical Data (Example 2017 Dataset)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample Date	General Chemistry		
		Chlorate	Dissolved Solids (total)	Perchlorate
		µg/L	mg/L	µg/L
LVW 7.2	06/28/2017	140	1,200	1.3
	07/25/2017	150	1,500	6.1 J
	08/23/2017	330	1,500	<0.95
	09/25/2017	<100	1,100	<0.95
	10/17/2017	85	1,600	1.8 J
	11/14/2017	80	1,500	2.1 J
	12/05/2017	90	1,500	1.6 J

Notes:

µg/L Microgram per Liter
mg/L Milligram per Liter

Table 3-4: Concentrations of Inorganic Chemicals in Composite[*] Sediment Samples Collected From the Las Vegas Wash and Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

	Location†																**LOC ‡**
	LW10.75		**NP**		**DC_1**		**BSC**		**PB**		**LW0.8**		**LVB**		**LVB**		
Chemical	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	
Aluminum	3500	5200	4700	6700	3900	5000	5800	11000	6300	9100	8000	11000	7400	10000	8600	11000	58,000
Antimony	ND		ND		ND		ND		ND		ND		ND		ND		25
Arsenic	ND		ND		ND		ND		ND		8.7	**12**	8.4	**11**	9.7	**13**	5.9
Barium	47	70	53	76	35	45	96	180	62	90	130	178	110	147	120	160	NA
Beryllium	ND		ND		ND		ND		ND		ND		ND		ND		NA
Boron	ND		ND		ND		ND		ND		ND		ND		ND		NA
Cadmium	ND		ND		ND		ND		ND		ND		ND		ND		0.58
Chromium	5.9	8.7	5.7	8.1	6	7.7	11	21	9.5	14	12	16	11	15	12	16	26
Copper	9.4	14	5.1	7.2	5.9	7.5	8.7	**17**	9.1	13	10	14	8.1	11	9.3	12	16
Iron	3100	4600	4100	5800	4400	5600	6400	12000	5500	7900	8600	12000	7900	11000	8900	12000	20000
Lead	ND		ND		ND		5.2	9.9	ND		18	25	26	**35**	32	**43**	31
Magnesium	14000	21000	13000	18000	10000	13000	65000	120000	15000	22000	17000	23000	11000	15000	12000	16000	NA
Manganese	74	110	81	120	84	110	100	190	170	240	300	410	330	440	380	**510**	460
Mercury	ND		ND		ND		ND		ND		ND		ND		ND		0.15
Molybdenum	ND		ND		ND		ND		ND		ND		ND		ND		NA
Nickel	ND		ND		ND		5.7	11	5.2	7.5	8.3	11	7.6	10	8.8	12	16
Selenium	ND		ND		ND		ND		ND		ND		ND		ND		1
Strontium	350	520	170	240	140	180	310	590	140	200	790	1100	310	410	360	480	NA
Titanium	120	180	160	230	240	310	380	720	240	350	380	520	440	590	470	630	NA
Vanadium	7.7	11	8.2	12	11	14	21	40	12	17	20	27	18	24	20	27	NA
Zinc	37	54	30	43	19	24	34	65	59	85	55	75	35	47	39	52	90

Notes:
(1) Chemical concentrations in bold and shaded exceed the minimum level of concern (LOC) for that chemical.

[*] Each data point represents a concentration in a single composite sample.
[†] Sampling locations are described in Table 2.
[‡] Minimum LOC from the previous bioassessment report (Intertox 2008) or from the U.S. DOE RAIS database (U.S. DOE 2007), whichever is lower. LOCs are listed in units of mg/kg dw.
dw Dry Weight Criterion
LOC Level of concern
NA Not Available
ND Not Detected
ww Wet Weight Residue

Source: SNWA. 2008. Las Vegas Wash Monitoring and Characterization Study: Ecotoxicological Screening Assessment of Selected Contaminants of Potential Concerning Sediment, Whole Fish, Bird Eggs, and Water, 2007-2008. Prepared for Southern Nevada Water Authority, Bureau of Reclamation, and U.S. Fish and Wildlife Service. February.

Table 3-5: Concentrations of Organic Chemicals in Individual* Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Aldrin			Dieldrin			Endrin			Heptachlor			Heptachlor epoxide		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	NPGS01	Green sunfish		ND		0.00714	0.00135	0.189		ND			ND		0.00064	0.00012	0.0169
NP	NPGS02	Green sunfish		ND		0.0288	0.00727	0.164		ND			ND		0.00242	0.00061	0.0138
NP	NPGS03	Green sunfish		ND		0.0208	0.00492	0.189		ND			ND		0.00233	0.00055	0.0211
NP	NPGS04	Green sunfish		ND		0.0253	0.00653	0.196		ND			ND		0.00306	0.00079	0.0237
NP	NPGS05	Green sunfish		ND		0.0224	0.00543	0.165		ND			ND		0.00303	0.00073	0.0223
NP	NPGS06	Green sunfish		ND		0.0223	0.00538	0.182		ND			ND		0.00304	0.00073	0.0248
NP	NPBB01	Black bullhead		ND		0.0262	0.00548	0.694		ND			ND		0.00075	0.00016	0.0198
NP	NPBB02	Black bullhead		ND		0.0256	0.00492	0.834		ND			ND		0.00101	0.00019	0.0330
NP	NPBB03	Black bullhead		ND		0.0222	0.00477	0.641		ND			ND		0.00206	0.00044	0.0593
DC	DCGS01	Green sunfish		ND		0.0197	0.00500	0.115		ND			ND		0.00594	0.00151	0.0349
DC	DCGS02	Green sunfish		ND		0.00897	0.00213	0.111		ND			ND		0.00281	0.00067	0.0346
DC	DCGS04	Green sunfish		ND		0.00993	0.00243	0.110		ND			ND		0.00395	0.00097	0.0436
DC	DCGS05	Green sunfish		ND		0.00660	0.00161	0.0517		ND			ND		0.00568	0.00139	0.0445
DC	DCGS06	Green sunfish		ND		0.0206	0.00522	0.125		ND			ND		0.00473	0.00120	0.0288
DC	DCGS03	Green sunfish		ND		0.0115	0.00271	0.0696		ND			ND		0.00430	0.00102	0.0261
PB	LVWCC01	Common carp		ND		0.0435	0.0111	0.316		ND			ND		0.0364	0.00930	0.264
PB	LVWCC02	Common carp		ND		0.0369	0.00940	0.195		ND			ND		0.0613	0.0156	0.324
PB	LVWCC03	Common carp		ND		0.0595	0.0168	0.251		ND			ND		0.0848	0.0240	0.357
PB	LVWGS01	Green sunfish		ND		0.0158	0.00395	0.116		ND			ND		0.00340	0.00085	0.0249
PB	LVWGS02	Green sunfish		ND		0.0410	0.0122	0.144		ND			ND		0.0100	0.00299	0.0353
PB	LVWGS03	Green sunfish		ND		0.0370	0.00907	0.136		ND			ND		0.00825	0.00202	0.0303
PB	LVWGS04	Green sunfish		ND		0.0119	0.00292	0.101		ND			ND		0.00475	0.00117	0.0403
LVB	LVBCC01	Common carp		ND		0.00164	0.00053	0.00413		ND			ND		0.00719	0.00233	0.0181
LVB	LVBCC02	Common carp		ND		0.00082	0.00016	0.00828		ND			ND		0.00199	0.00039	0.0200
LVB	LVBCC03	Common carp		ND		0.00061	0.00020	0.00645		ND			ND		0.00169	0.00055	0.0179
LVB	LVBCC04	Common carp		ND		0.00453	0.00113	0.00968		ND			ND		0.0227	0.00568	0.0485
LVB	LVBCC05	Common carp		ND		0.0390	0.00908	0.216		ND			ND		0.0452	0.0105	0.250
LVB	LVBCC06	Common carp		ND		0.02023	0.00473	0.0785		ND			ND		0.0355	0.00830	0.138
PNWR	PNWRCC01	Common carp		ND			ND			ND			ND			ND	
PNWR	PNWRCC02	Common carp		ND		0.00005	0.00001	0.00058		ND			ND			ND	
PNWR	PNWRCC03	Common carp		ND			ND			ND			ND			ND	
PNWR	PNWRCC04	Common carp		ND			ND			ND			ND			ND	
PNWR	PNWRCC05	Common carp		ND		0.00009	0.00002	0.00095		ND			ND			ND	
PNWR	PNWRLM01	Largemouth bass		ND			ND			ND			ND			ND	
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**NA**	

Table 3-5: Concentrations of Organic Chemicals in Individual* Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Oxychlordane			Alpha-Chlordane			Gamma-Chlordane			Trans-Nonachlor			Cis-Nonachlor		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	NPGS01	Green sunfish	0.00157	0.00030	0.0415	0.00145	0.00027	0.0384	0.00118	0.00022	0.0314	0.0186	0.00352	0.494	0.00321	0.00061	0.0851
NP	NPGS02	Green sunfish	0.00782	0.00197	0.0444	0.00647	0.00163	0.0367	0.00373	0.00094	0.0212	0.0378	0.00952	0.214	0.00556	0.00140	0.0316
NP	NPGS03	Green sunfish	0.00535	0.00126	0.0485	0.00569	0.00134	0.0516	0.00300	0.00071	0.0272	0.0344	0.00812	0.312	0.00631	0.00149	0.0573
NP	NPGS04	Green sunfish	0.00742	0.00192	0.0574	0.0141	0.00364	0.109	0.00608	0.00157	0.0471	0.0505	0.0131	0.391	0.00955	0.00247	0.0740
NP	NPGS05	Green sunfish	0.00542	0.00131	0.0399	0.00465	0.00112	0.0342	0.00335	0.00081	0.0247	0.0381	0.00923	0.281	0.00496	0.00120	0.0365
NP	NPGS06	Green sunfish	0.00457	0.00110	0.0372	0.00810	0.00195	0.0660	0.00509	0.00123	0.0414	0.0409	0.00985	0.333	0.00576	0.00139	0.0469
NP	NPBB01	Black bullhead	0.00077	0.00016	0.0204	0.00153	0.00032	0.0406	0.00122	0.00026	0.0324	0.00418	0.00087	0.111	0.00082	0.00017	0.0216
NP	NPBB02	Black bullhead	0.00071	0.00014	0.0233	0.00340	0.00065	0.111	0.00317	0.00061	0.104	0.00663	0.00128	0.216	0.00131	0.00025	0.0426
NP	NPBB03	Black bullhead	0.00131	0.00028	0.0377	0.00451	0.00097	0.130	0.00397	0.00085	0.114	0.0170	0.00365	0.490	0.00356	0.00076	0.1026
DC	DCGS01	Green sunfish	0.00832	0.00212	0.0489	0.0127	0.00324	0.0749	0.00297	0.00076	0.0174	0.0341	0.00869	0.201	0.00813	0.00207	0.0478
DC	DCGS02	Green sunfish	0.00275	0.00066	0.0340	0.00332	0.00079	0.0409		ND		0.0194	0.00461	0.239	0.00606	0.00144	0.0747
DC	DCGS04	Green sunfish	0.00383	0.00094	0.0423	0.00357	0.00088	0.0394		ND		0.0249	0.00610	0.275	0.0135	0.00331	0.149
DC	DCGS05	Green sunfish	0.00314	0.00077	0.0246	0.00301	0.00074	0.0236	0.00183	0.00045	0.0144	0.0365	0.00892	0.286	0.0136	0.00331	0.106
DC	DCGS06	Green sunfish	0.00381	0.00097	0.0232	0.00784	0.00199	0.0478	0.00203	0.00052	0.0124	0.0365	0.00925	0.222	0.0184	0.00466	0.112
DC	DCGS03	Green sunfish	0.00296	0.00070	0.0180	0.00614	0.00145	0.0373	0.00165	0.00039	0.0100	0.0195	0.00461	0.118	0.00725	0.00172	0.0440
PB	LVWCC01	Common carp	0.00236	0.00060	0.0171	0.0171	0.00438	0.124	0.0169	0.00433	0.123	0.0233	0.00595	0.169	0.00927	0.00237	0.0674
PB	LVWCC02	Common carp	0.00431	0.00110	0.0228	0.0239	0.00609	0.126	0.0259	0.00661	0.137	0.0392	0.00998	0.207	0.0125	0.00319	0.0660
PB	LVWCC03	Common carp	0.00440	0.00124	0.0185	0.0277	0.00785	0.117	0.0274	0.00775	0.115	0.0398	0.0113	0.167	0.0155	0.00438	0.0652
PB	LVWGS01	Green sunfish	0.00270	0.00067	0.0198	0.00760	0.00190	0.0556	0.00318	0.00079	0.0233	0.0169	0.00422	0.124	0.00453	0.00113	0.0332
PB	LVWGS02	Green sunfish	0.0114	0.00341	0.0403	0.0227	0.00678	0.0801	0.00852	0.00254	0.0300	0.0577	0.0172	0.203	0.0153	0.00455	0.0537
PB	LVWGS03	Green sunfish	0.0121	0.00296	0.0445	0.0163	0.00398	0.0598	0.00651	0.00159	0.0239	0.0643	0.0158	0.237	0.0162	0.00396	0.0595
PB	LVWGS04	Green sunfish	0.00497	0.00122	0.0422	0.00401	0.00098	0.0340	0.00153	0.00037	0.0130	0.0271	0.00663	0.230	0.00773	0.00189	0.0656
LVB	LVBCC01	Common carp	0.00026	0.00009	0.00067	0.00378	0.00123	0.00954	0.00267	0.00087	0.00674	0.00490	0.00159	0.0124	0.00499	0.00162	0.0126
LVB	LVBCC02	Common carp		ND		0.00102	0.00020	0.0103	0.00068	0.00013	0.00681	0.00126	0.00025	0.0127	0.00219	0.00043	0.0220
LVB	LVBCC03	Common carp	0.00010	0.00003	0.00106	0.00114	0.00037	0.0121		ND		0.00151	0.00049	0.0161	0.00110	0.00036	0.0117
LVB	LVBCC04	Common carp	0.00112	0.00028	0.00239	0.00919	0.00230	0.0196	0.00803	0.00201	0.0172	0.0144	0.00360	0.0308		ND	
LVB	LVBCC05	Common carp	0.00149	0.00035	0.00827	0.00882	0.00205	0.0489	0.0107	0.00249	0.0592	0.00872	0.00203	0.0483		ND	
LVB	LVBCC06	Common carp		ND		0.00689	0.00161	0.0267	0.00691	0.00162	0.0268	0.0121	0.00282	0.0468		ND	
PNWR	PNWRCC01	Common carp		ND		0.00028	0.00006	0.00174	0.00019	0.00004	0.00121	0.00038	0.00008	0.0023	0.00009	0.00002	0.00053
PNWR	PNWRCC02	Common carp		ND		0.00010	0.00003	0.00117		ND		0.00011	0.00003	0.00131		ND	
PNWR	PNWRCC03	Common carp		ND		0.00023	0.00005	0.00261	0.00016	0.00004	0.00178	0.00022	0.00005	0.00247		ND	
PNWR	PNWRCC04	Common carp		ND		0.00036	0.00007	0.00517	0.00029	0.00006	0.00414	0.00028	0.00006	0.00397	0.00008	0.00002	0.00121
PNWR	PNWRCC05	Common carp	0.00019	0.00005	0.00203	0.00014	0.00003	0.00149	0.00011	0.00003	0.00122	0.00013	0.00003	0.00136	0.00004	0.00001	0.00041
PNWR	PNWRLM01	Largemouth bass	0.00004	0.00001	0.00045	0.00006	0.00001	0.00075		ND		0.00021	0.00005	0.00270		ND	
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**NA**	

Table 3-5: Concentrations of Organic Chemicals in Individual* Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Alpha-HCH			Beta-HCH			Delta-HCH			Gamma-HCH			DDMU		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	NPGS01	Green sunfish		ND			ND			ND		0.00005	0.00001	0.00145		N/A	
NP	NPGS02	Green sunfish		ND		0.00071	0.00018	0.00404		ND		0.00033	0.00008	0.00187	0.00163	0.00041	0.00925
NP	NPGS03	Green sunfish		ND		0.00037	0.00009	0.00333		ND		0.00030	0.00007	0.00273	0.00145	0.00034	0.0131
NP	NPGS04	Green sunfish		ND		0.00061	0.00016	0.00474		ND		0.00031	0.00008	0.00241	0.00241	0.00062	0.0186
NP	NPGS05	Green sunfish		ND		0.00031	0.00007	0.00226		ND		0.00034	0.00008	0.00250		N/A	
NP	NPGS06	Green sunfish		ND		0.00050	0.00012	0.00405	0.00069	0.00017	0.00560	0.00024	0.00006	0.00198	0.00130	0.00031	0.0106
NP	NPBB01	Black bullhead		ND		0.00021	0.00004	0.00555		ND		0.00015	0.00003	0.00409	0.00078	0.00016	0.0207
NP	NPBB02	Black bullhead		ND		0.00020	0.00004	0.00659		ND			ND		0.00124	0.00024	0.0403
NP	NPBB03	Black bullhead		ND			ND		0.00018	0.00004	0.00524	0.00010	0.00002	0.00295	0.00143	0.00031	0.0413
DC	DCGS01	Green sunfish		ND		0.00038	0.00010	0.00223		ND		0.00014	0.00004	0.00082		N/A	
DC	DCGS02	Green sunfish		ND		0.00031	0.00007	0.00377		ND		0.00014	0.00003	0.00173		N/A	
DC	DCGS04	Green sunfish		ND		0.00044	0.00011	0.00491		ND		0.00010	0.00003	0.00116		N/A	
DC	DCGS05	Green sunfish		ND		0.00036	0.00009	0.00283		ND		0.00013	0.00003	0.00098		N/A	
DC	DCGS06	Green sunfish		ND		0.00162	0.00041	0.00990	0.00038	0.00010	0.00234	0.00024	0.00006	0.00148	0.00370	0.00094	0.0226
DC	DCGS03	Green sunfish		ND		0.0104	0.00247	0.0634	0.00107	0.00025	0.00651	0.00048	0.00011	0.00292	0.00349	0.00083	0.0212
PB	LVWCC01	Common carp	0.00129	0.00033	0.00941	0.0151	0.00385	0.1094	0.00213	0.00055	0.0155	0.00036	0.00009	0.00263	0.00000	0.00000	0.00000
PB	LVWCC02	Common carp		ND		0.0206	0.00526	0.1089	0.00304	0.00077	0.0161	0.00040	0.00010	0.00211	0.00809	0.00206	0.0427
PB	LVWCC03	Common carp	0.00112	0.00032	0.00473	0.0332	0.00939	0.140	0.00478	0.00135	0.0201	0.00049	0.00014	0.00208	0.0109	0.00309	0.0460
PB	LVWGS01	Green sunfish		ND		0.0103	0.00256	0.0751	0.00058	0.00014	0.00425	0.00028	0.00007	0.00204	0.00000	0.00000	0.00000
PB	LVWGS02	Green sunfish	0.00213	0.00063	0.00750	0.0414	0.0123	0.146	0.00487	0.00145	0.0171	0.00086	0.00026	0.00303	0.00374	0.00111	0.0132
PB	LVWGS03	Green sunfish	0.00221	0.00054	0.00813	0.0460	0.0113	0.169	0.00554	0.00136	0.0204	0.00121	0.00030	0.00444	0.00311	0.00076	0.0115
PB	LVWGS04	Green sunfish	0.00141	0.00035	0.0119	0.0117	0.00287	0.0993	0.00112	0.00027	0.00950	0.00019	0.00005	0.00163	0.00231	0.00057	0.0196
LVB	LVBCC01	Common carp	0.0547	0.0177	0.138	0.00231	0.00075	0.00583	0.00026	0.00009	0.00067	ND			0.0118	0.00384	0.0299
LVB	LVBCC02	Common carp		ND		0.00089	0.00017	0.00895	0.00015	0.00003	0.00147	0.00049	0.00010	0.00494	0.00249	0.00049	0.0251
LVB	LVBCC03	Common carp		ND		0.00050	0.00016	0.00528		ND		ND			0.00261	0.00085	0.0278
LVB	LVBCC04	Common carp		ND		0.00404	0.00101	0.00864	0.00036	0.00009	0.00076	0.00100	0.00025	0.00214	0.0358	0.00895	0.0764
LVB	LVBCC05	Common carp		ND		0.0259	0.00603	0.143	0.00249	0.00058	0.0138	0.00081	0.00019	0.00450	0.0680	0.0158	0.377
LVB	LVBCC06	Common carp	0.00210	0.00049	0.00814	0.0954	0.0223	0.3703	0.00572	0.00134	0.0222	0.00350	0.00082	0.0136	0.0297	0.00695	0.115
PNWR	PNWRCC01	Common carp		ND		0.00029	0.00007	0.00182		ND		0.00041	0.00009	0.00257	0.00047	0.00011	0.00295
PNWR	PNWRCC02	Common carp		ND		0.00029	0.00008	0.00336		ND		0.00015	0.00004	0.00175	0.00022	0.00006	0.00263
PNWR	PNWRCC03	Common carp		ND			ND			ND		0.00031	0.00007	0.00357	0.00050	0.00012	0.00576
PNWR	PNWRCC04	Common carp		ND			ND			ND		0.00011	0.00002	0.00155	0.00017	0.00003	0.00241
PNWR	PNWRCC05	Common carp		ND		0.00019	0.00005	0.00203		ND		0.00071	0.00017	0.00759	0.00024	0.00006	0.00257
PNWR	PNWRLM01	Largemouth bass		ND		0.00019	0.00005	0.00240		ND		0.00011	0.00003	0.00135	0.00029	0.00007	0.00375
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**NA**	

Table 3-5: Concentrations of Organic Chemicals in Individual* Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	o,p'-DDD			p,p'-DDD			o,p'-DDE			p,p'-DDE			o,p'-DDT		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	NPGS01	Green sunfish		ND		0.00073	0.00014	0.01950	0.00007	0.00001	0.00174	0.04440	0.00841	1.18000		ND	
NP	NPGS02	Green sunfish		ND		0.00322	0.00081	0.01830	0.00103	0.00026	0.00585	0.03780	0.00954	0.21500		ND	
NP	NPGS03	Green sunfish		ND		0.00350	0.00083	0.03170	0.00070	0.00017	0.00637	0.04900	0.01160	0.44500		ND	
NP	NPGS04	Green sunfish		ND		0.00402	0.00104	0.03110	0.00200	0.00052	0.01550	0.05100	0.01320	0.39500		ND	
NP	NPGS05	Green sunfish		ND		0.00222	0.00054	0.01640	0.00112	0.00027	0.00823	0.04200	0.01020	0.30900		ND	
NP	NPGS06	Green sunfish		ND		0.00230	0.00056	0.01880	0.00119	0.00029	0.00973	0.03000	0.00722	0.24400		ND	
NP	NPBB01	Black bullhead		ND		0.00052	0.00011	0.01370	0.00011	0.00002	0.00292	0.00784	0.00164	0.20800		ND	
NP	NPBB02	Black bullhead		ND		0.00038	0.00007	0.01240	0.00006	0.00001	0.00194	0.01130	0.00217	0.36800		ND	
NP	NPBB03	Black bullhead		ND		0.00167	0.00036	0.04820	0.00018	0.00004	0.00524	0.03630	0.00779	1.05000		ND	
DC	DCGS01	Green sunfish		ND		0.00231	0.00059	0.01360	0.00100	0.00025	0.00586	0.05290	0.01350	0.31100		ND	
DC	DCGS02	Green sunfish		ND		0.00218	0.00052	0.02690	0.00071	0.00017	0.00880	0.04580	0.01090	0.56500		ND	
DC	DCGS04	Green sunfish		ND		0.00137	0.00034	0.01520	0.00101	0.00025	0.01110	0.10200	0.02510	1.13000		ND	
DC	DCGS05	Green sunfish		ND		0.00131	0.00032	0.01020	0.00069	0.00017	0.00544	0.13000	0.03170	1.02000		ND	
DC	DCGS06	Green sunfish		ND		0.00240	0.00061	0.01460	0.00289	0.00073	0.01760	0.15700	0.03970	0.95500		ND	
DC	DCGS03	Green sunfish	0.00060	0.00060	0.01550	0.00549	0.00130	0.03330	0.00529	0.00125	0.03210	0.05340	0.01260	0.32400		ND	
PB	LVWCC01	Common carp	0.00887	0.00227	0.06450	0.01370	0.00349	0.09920	0.01200	0.00306	0.08700	0.16500	0.04210	1.20000		ND	
PB	LVWCC02	Common carp	0.01330	0.00340	0.07040	0.01290	0.00329	0.06820	0.01690	0.00432	0.08950	0.13800	0.03520	0.72900		ND	
PB	LVWCC03	Common carp	0.01410	0.00398	0.05930	0.02060	0.00584	0.08690	0.01920	0.00543	0.08080	0.42000	0.11900	1.77000		ND	
PB	LVWGS01	Green sunfish		ND		0.00121	0.00030	0.00882	0.00090	0.00023	0.00662	0.03280	0.00819	0.24000		ND	
PB	LVWGS02	Green sunfish		ND		0.01570	0.00469	0.05540	0.00854	0.00254	0.03010	0.13300	0.03960	0.46800		ND	
PB	LVWGS03	Green sunfish		ND		0.01760	0.00430	0.06460	0.00928	0.00227	0.03410	0.17600	0.04310	0.64700		ND	
PB	LVWGS04	Green sunfish		ND		0.00646	0.00158	0.05480	0.00199	0.00049	0.01680	0.06200	0.01520	0.52600		ND	
LVB	LVBCC01	Common carp	0.00665	0.00215	0.01680	0.02720	0.00882	0.06870	0.01610	0.00520	0.04050	0.20700	0.06700	0.52100		ND	
LVB	LVBCC02	Common carp	0.00227	0.00044	0.02280	0.00879	0.00172	0.08860	0.00476	0.00093	0.04800	0.11200	0.02190	1.13000		ND	
LVB	LVBCC03	Common carp	0.00193	0.00063	0.02050	0.00889	0.00288	0.09460	0.00358	0.00116	0.03810	0.11100	0.03600	1.18000		ND	
LVB	LVBCC04	Common carp	0.02770	0.00693	0.05920	0.10600	0.02640	0.22600	0.08550	0.02140	0.18300	0.60500	0.15100	1.29000		ND	
LVB	LVBCC05	Common carp	0.04180	0.00973	0.23100	0.13500	0.03140	0.74800	0.19300	0.04490	1.07000	0.92400	0.21500	5.12000		ND	
LVB	LVBCC06	Common carp	0.02550	0.00595	0.09880	0.08940	0.02089	0.34700	0.11300	0.02650	0.43900	1.06000	0.24800	4.12000		ND	
PNWR	PNWRCC01	Common carp		ND		0.00061	0.00014	0.00378		ND		0.00940	0.00209	0.05850		ND	
PNWR	PNWRCC02	Common carp	0.00014	0.00004	0.00161	0.00021	0.00006	0.00248		ND		0.00444	0.00117	0.05210		ND	
PNWR	PNWRCC03	Common carp	0.00011	0.00003	0.00123	0.00023	0.00005	0.00261	0.00006	0.00001	0.00069	0.00355	0.00085	0.04060		ND	
PNWR	PNWRCC04	Common carp		ND			ND			ND		0.00413	0.00084	0.05880		ND	
PNWR	PNWRCC05	Common carp	0.00013	0.00003	0.00136	0.00016	0.00004	0.00176	0.00010	0.00002	0.00108	0.00295	0.00070	0.03160		ND	
PNWR	PNWRLM01	Largemouth bass		ND		0.00016	0.00004	0.00210	0.00005	0.00001	0.00060	0.00367	0.00088	0.04700		ND	
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**NA**	

Table 3-5: Concentrations of Organic Chemicals in Individual* Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	p,p'-DDT			1,2,3,4-Tetrachlorobenzene			1,2,4,5-Tetrachlorobenzene			Hexachlorobenzene			Pentachloroanisole		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	NPGS01	Green sunfish	0.00056	0.00011	0.01480		ND		0.00076	0.00014	0.02000	0.04260	0.00806	1.13000	0.00049	0.00009	0.01310
NP	NPGS02	Green sunfish	0.00250	0.00063	0.01420		ND		0.00382	0.00096	0.02170	0.05300	0.01340	0.30100	0.00063	0.00016	0.00357
NP	NPGS03	Green sunfish	0.00174	0.00041	0.01580		ND		0.00415	0.00098	0.03770	0.08180	0.01930	0.74200	0.00089	0.00021	0.00808
NP	NPGS04	Green sunfish	0.00287	0.00074	0.02220		ND		0.00694	0.00179	0.05370	0.05040	0.01300	0.39000	0.00117	0.00030	0.00905
NP	NPGS05	Green sunfish	0.00194	0.00047	0.01430		ND		0.00710	0.00172	0.05230	0.05390	0.01300	0.39700	0.00087	0.00021	0.00637
NP	NPGS06	Green sunfish	0.00151	0.00036	0.01230		ND		0.00398	0.00096	0.03240	0.04470	0.01080	0.36400	0.00073	0.00018	0.00594
NP	NPBB01	Black bullhead	0.00020	0.00004	0.00525		ND		0.00253	0.00053	0.06680	0.06260	0.01310	1.65560	0.00030	0.00006	0.00788
NP	NPBB02	Black bullhead		ND			ND		0.00144	0.00028	0.04690	0.03000	0.00577	0.97900	0.00025	0.00005	0.00814
NP	NPBB03	Black bullhead	0.00040	0.00009	0.01150		ND		0.00224	0.00048	0.06460	0.03370	0.00724	0.97200	0.00030	0.00006	0.00852
DC	DCGS01	Green sunfish	0.00195	0.00050	0.01140		ND		0.00344	0.00087	0.02020	0.05500	0.01400	0.32300	0.00210	0.00053	0.01230
DC	DCGS02	Green sunfish	0.00099	0.00024	0.01230		ND			ND		0.07540	0.01790	0.92900	0.00130	0.00031	0.01600
DC	DCGS04	Green sunfish	0.00156	0.00038	0.01720		ND			ND		0.05940	0.01460	0.65600	0.00111	0.00027	0.01230
DC	DCGS05	Green sunfish		ND			ND		0.00192	0.00047	0.01500	0.05010	0.01220	0.39200	0.00110	0.00027	0.00860
DC	DCGS06	Green sunfish	0.00230	0.00058	0.01400		ND			ND		0.00411	0.00104	0.02510	0.00083	0.00021	0.00506
DC	DCGS03	Green sunfish	0.00193	0.00046	0.01170	0.00116	0.00027	0.00702		ND		0.00269	0.00064	0.01630	0.00051	0.00012	0.00307
PB	LVWCC01	Common carp		ND		0.00917	0.00234	0.06660	0.01550	0.00396	0.11300	0.05730	0.01460	0.41600	0.00344	0.00088	0.02500
PB	LVWCC02	Common carp	0.00289	0.00074	0.01530		ND		0.00555	0.00141	0.02930	0.16970	0.04320	0.89600	0.00421	0.00107	0.02220
PB	LVWCC03	Common carp		ND			ND		0.01000	0.00283	0.04220	0.20640	0.05840	0.86900	0.00756	0.00214	0.03180
PB	LVWGS01	Green sunfish	0.00097	0.00024	0.00711		ND		0.00702	0.00175	0.05140	0.06910	0.01730	0.50600	0.00135	0.00034	0.00989
PB	LVWGS02	Green sunfish	0.00447	0.00133	0.01570		ND		0.01510	0.00451	0.05320	0.10690	0.03180	0.37600	0.00237	0.00071	0.00834
PB	LVWGS03	Green sunfish	0.00508	0.00124	0.01870		ND		0.01820	0.00445	0.06690	0.10850	0.02660	0.39900	0.00248	0.00061	0.00912
PB	LVWGS04	Green sunfish	0.00201	0.00049	0.01710		ND		0.00785	0.00192	0.06660	0.08130	0.01990	0.69000	0.00091	0.00022	0.00776
LVB	LVBCC01	Common carp		ND			ND			ND		0.01500	0.00487	0.03790		ND	
LVB	LVBCC02	Common carp		ND			ND			ND		0.13500	0.02640	1.36000	0.00113	0.00022	0.01140
LVB	LVBCC03	Common carp		ND			ND			ND		0.02250	0.00728	0.23900	0.00022	0.00007	0.00234
LVB	LVBCC04	Common carp		ND			ND			ND		0.19500	0.04880	0.41700	0.00190	0.00047	0.00405
LVB	LVBCC05	Common carp		ND			ND			ND		0.19400	0.04520	1.07000	0.00236	0.00055	0.01310
LVB	LVBCC06	Common carp		ND			ND			ND		0.24100	0.05640	0.93600	0.00433	0.00101	0.01680
PNWR	PNWRCC01	Common carp		ND			ND			ND		0.01970	0.00439	0.12200	0.00438	0.00098	0.02720
PNWR	PNWRCC02	Common carp		ND			ND			ND		0.06480	0.01710	0.76000	0.00233	0.00061	0.02730
PNWR	PNWRCC03	Common carp		ND		0.00148	0.00035	0.01690		ND		0.07490	0.01790	0.85500	0.00279	0.00067	0.03180
PNWR	PNWRCC04	Common carp		ND			ND			ND		0.05700	0.01160	0.81200	0.00154	0.00031	0.02190
PNWR	PNWRCC05	Common carp		ND		0.00097	0.00023	0.01040		ND		0.09050	0.02160	0.96900	0.00253	0.00060	0.02710
PNWR	PNWRLM01	Largemouth bass		ND			ND			ND		0.04580	0.01100	0.58700	0.00067	0.00016	0.00856
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**NA**	

Table 3-5: Concentrations of Organic Chemicals in Individual* Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Pentachlorobenzene			Endosulfan II			Endosulfan I			Endosulfan Sulfate			Mirex		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	NPGS01	Green sunfish	0.0105	0.00199	0.279		ND			ND			ND		0.00097	0.00018	0.02590
NP	NPGS02	Green sunfish	0.0417	0.0105	0.237		ND		0.00949	0.00239	0.05390		ND		0.00125	0.00031	0.00708
NP	NPGS03	Green sunfish	0.0384	0.00906	0.348		ND		0.00476	0.00112	0.04320		ND		0.00174	0.00041	0.01580
NP	NPGS04	Green sunfish	0.0341	0.00882	0.264		ND		0.00952	0.00246	0.07370		ND		0.00131	0.00034	0.01020
NP	NPGS05	Green sunfish	0.0356	0.00862	0.262		ND		0.00392	0.00095	0.02880		ND		0.00126	0.00031	0.00928
NP	NPGS06	Green sunfish	0.0299	0.00721	0.244		ND		0.00364	0.00088	0.02970		ND		0.00184	0.00044	0.01500
NP	NPBB01	Black bullhead	0.0303	0.00632	0.801		ND			ND			ND		0.00034	0.00007	0.00905
NP	NPBB02	Black bullhead	0.0193	0.00371	0.629		ND			ND			ND		0.00029	0.00005	0.00930
NP	NPBB03	Black bullhead	0.0191	0.00410	0.551		ND			ND			ND		0.00049	0.00010	0.01410
DC	DCGS01	Green sunfish	0.0355	0.00904	0.209		ND		0.00840	0.00214	0.04940		ND		0.00256	0.00065	0.01510
DC	DCGS02	Green sunfish	0.0467	0.0111	0.576		ND		0.00575	0.00137	0.07090		ND		0.00087	0.00021	0.01070
DC	DCGS04	Green sunfish	0.0443	0.0108	0.489		ND		0.00821	0.00201	0.09060	0.00832	0.00204	0.09190	0.00069	0.00017	0.00766
DC	DCGS05	Green sunfish	0.0397	0.00970	0.311		ND		0.00502	0.00123	0.03930	0.01891	0.00462	0.14800	0.00100	0.00024	0.00783
DC	DCGS06	Green sunfish		ND			ND		0.02230	0.00567	0.13600		ND		0.00087	0.00022	0.00530
DC	DCGS03	Green sunfish	0.00118	0.00028	0.00716		ND		0.00226	0.00053	0.01370		ND		0.00193	0.00046	0.01170
PB	LVWCC01	Common carp	0.0239	0.00610	0.173		ND		0.00096	0.00025	0.00700		ND		0.00097	0.00025	0.00703
PB	LVWCC02	Common carp	0.0465	0.0118	0.245		ND			ND			ND		0.00074	0.00019	0.00388
PB	LVWCC03	Common carp	0.0568	0.0161	0.239		ND			ND			ND		0.00116	0.00033	0.00489
PB	LVWGS01	Green sunfish	0.0430	0.0107	0.315		ND		0.00224	0.00056	0.01640		ND		0.00110	0.00028	0.00809
PB	LVWGS02	Green sunfish	0.0473	0.0141	0.166		ND		0.01330	0.00396	0.04680		ND		0.00394	0.00117	0.01390
PB	LVWGS03	Green sunfish	0.0471	0.0115	0.173		ND		0.01640	0.00402	0.06040		ND		0.00474	0.00116	0.01740
PB	LVWGS04	Green sunfish	0.0480	0.0118	0.407		ND		0.00572	0.00140	0.04850		ND		0.00205	0.00050	0.01740
LVB	LVBCC01	Common carp	0.0193	0.00627	0.049		ND		0.00405	0.00131	0.01020	0.00518	0.00168	0.01310	0.00069	0.00022	0.00173
LVB	LVBCC02	Common carp	0.0249	0.00487	0.251		ND			ND			ND		0.00049	0.00010	0.00494
LVB	LVBCC03	Common carp	0.0131	0.00425	0.139		ND		0.00049	0.00016	0.00524		ND		0.00076	0.00025	0.00809
LVB	LVBCC04	Common carp	0.0672	0.0168	0.144		ND		0.00523	0.00131	0.01120		ND		0.00174	0.00043	0.00371
LVB	LVBCC05	Common carp	0.0476	0.0111	0.264		ND		0.00626	0.00146	0.03470		ND		0.00061	0.00014	0.00340
LVB	LVBCC06	Common carp	0.0735	0.0172	0.285		ND		0.00333	0.00078	0.01290		ND		0.00360	0.00084	0.01400
PNWR	PNWRCC01	Common carp	0.0168	0.00374	0.105		ND		0.00001	0.00000	0.00007	0.00016	0.00004	0.00098		ND	
PNWR	PNWRCC02	Common carp	0.0364	0.00958	0.427		ND			ND			ND			ND	
PNWR	PNWRCC03	Common carp	0.0155	0.00372	0.177		ND			ND			ND			ND	
PNWR	PNWRCC04	Common carp	0.0244	0.00496	0.348		ND			ND			ND			ND	
PNWR	PNWRCC05	Common carp	0.0172	0.00409	0.184		ND		0.00002	0.00001	0.00023		ND			ND	
PNWR	PNWRLM01	Largemouth bass	0.0340	0.00819	0.435		ND			ND			ND			ND	
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**6.30000**	

Table 3-5: Concentrations of Organic Chemicals in Individual* Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Chloropyrifos			Total HCH			Total Chlordane			Total DDT			Total PCB		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	NPGS01	Green sunfish	0.00015	0.00003	0.00407	0.00005	0.00001	0.00145	0.02670	0.00505	0.70700	0.04580	0.00867	1.21000	0.59995	0.114	15.9
NP	NPGS02	Green sunfish	0.00062	0.00016	0.00351	0.00104	0.00026	0.00591	0.06380	0.01610	0.36200	0.04620	0.01160	0.26200	0.29533	0.0745	1.68
NP	NPGS03	Green sunfish	0.00032	0.00008	0.00293	0.00067	0.00016	0.00606	0.05710	0.01350	0.51800	0.05640	0.01330	0.51200	0.41636	0.0983	3.78
NP	NPGS04	Green sunfish	0.00131	0.00034	0.0102	0.00092	0.00024	0.00716	0.09070	0.02340	0.70200	0.06230	0.01610	0.48300	0.34859	0.0901	2.70
NP	NPGS05	Green sunfish	0.00047	0.00011	0.00347	0.00065	0.00016	0.00476	0.05950	0.01440	0.43800	0.04720	0.01140	0.34800	0.33755	0.0817	2.49
NP	NPGS06	Green sunfish	0.00051	0.00012	0.00413	0.00143	0.00034	0.01160	0.06740	0.01630	0.54900	0.03630	0.00874	0.29600	0.42468	**0.102**	3.46
NP	NPBB01	Black bullhead	0.00012	0.00003	0.00321	0.00036	0.00008	0.00963	0.00928	0.00194	0.24500	0.00945	0.00197	0.25000	0.10666	0.0223	2.82
NP	NPBB02	Black bullhead		ND		0.00020	0.00004	0.00659	0.01620	0.00313	0.53000	0.01300	0.00249	0.42300	0.14844	0.0286	4.84
NP	NPBB03	Black bullhead	0.00015	0.00003	0.00426	0.00028	0.00006	0.00820	0.03240	0.00696	0.93500	0.04000	0.00858	1.15000	0.20770	0.0446	5.99
DC	DCGS01	Green sunfish	0.00111	0.00028	0.00653	0.00052	0.00013	0.00304	0.07220	0.01840	0.42400	0.05810	0.01480	0.34100	0.54080	**0.138**	3.18
DC	DCGS02	Green sunfish	0.00032	0.00008	0.00393	0.00045	0.00011	0.00550	0.03430	0.00817	0.42300	0.04970	0.01180	0.61300	0.39647	0.0944	4.89
DC	DCGS04	Green sunfish		ND		0.00055	0.00013	0.00607	0.04970	0.01220	0.54900	0.10600	0.02610	1.17000	0.39909	0.0978	4.41
DC	DCGS05	Green sunfish		ND		0.00049	0.00012	0.00381	0.06380	0.01560	0.49900	0.13200	0.03220	1.03000	0.78010	**0.190**	6.11
DC	DCGS06	Green sunfish	0.00103	0.00026	0.00631	0.00225	0.00057	0.01370	0.07320	0.01860	0.44700	0.16800	0.04260	1.02000	0.54170	**0.137**	3.30
DC	DCGS03	Green sunfish	0.00047	0.00011	0.00285	0.01199	0.00284	0.07280	0.04180	0.00988	0.25300	0.07220	0.01710	0.43800	0.34053	0.0806	2.07
PB	LVWCC01	Common carp		ND		0.01880	0.00482	0.13700	0.10500	0.02690	0.76600	0.19900	0.05090	1.45000	1.13299	**0.290**	8.23
PB	LVWCC02	Common carp		ND		0.02410	0.00613	0.12700	0.16700	0.04260	0.88200	0.19200	0.04900	1.02000	1.37628	**0.351**	7.26
PB	LVWCC03	Common carp		ND		0.03960	0.01120	0.16700	0.20000	0.05650	0.84000	0.48500	0.13700	2.04000	1.81169	**0.513**	7.63
PB	LVWGS01	Green sunfish		ND		0.01110	0.00278	0.08140	0.03830	0.00958	0.28100	0.03580	0.00896	0.26200	0.40137	**0.100**	2.94
PB	LVWGS02	Green sunfish		ND		0.04930	0.01470	0.17300	0.12600	0.03750	0.44300	0.16500	0.04930	0.58200	0.85416	**0.255**	3.01
PB	LVWGS03	Green sunfish		ND		0.05490	0.01340	0.20200	0.12400	0.03030	0.45500	0.21100	0.05160	0.77600	1.17925	**0.289**	4.34
PB	LVWGS04	Green sunfish		ND		0.01440	0.00353	0.12200	0.05000	0.01230	0.42500	0.07470	0.01830	0.63400	0.49019	**0.120**	4.16
LVB	LVBCC01	Common carp		ND		0.05730	0.01860	0.14400	0.02380	0.00771	0.06000	0.26800	0.08700	0.67700	0.33651	**0.109**	0.849
LVB	LVBCC02	Common carp		ND		0.00152	0.00030	0.01540	0.00713	0.00139	0.07190	0.13000	0.02550	1.31000	0.27269	0.0533	2.75
LVB	LVBCC03	Common carp		ND		0.00050	0.00016	0.00528	0.00553	0.00179	0.05890	0.12800	0.04150	1.36000	0.20506	0.0665	2.18
LVB	LVBCC04	Common carp	0.00025	0.00006	0.00053	0.00540	0.00135	0.01150	0.05540	0.01390	0.11800	0.85900	0.21500	1.84000	0.85532	**0.214**	1.83
LVB	LVBCC05	Common carp		ND		0.02920	0.00680	0.16200	0.07490	0.01740	0.41500	1.36000	0.31700	7.55000	0.87996	**0.205**	4.88
LVB	LVBCC06	Common carp		ND		0.10700	0.02490	0.41400	0.06140	0.01430	0.23800	1.32000	0.30900	5.12000	1.76768	**0.413**	6.86
PNWR	PNWRCC01	Common carp		ND		0.00071	0.00016	0.00439	0.00094	0.00021	0.00583	0.01050	0.00234	0.06520	0.01906	0.00425	0.119
PNWR	PNWRCC02	Common carp		ND		0.00044	0.00011	0.00511	0.00021	0.00006	0.00248	0.00501	0.00132	0.05880	0.01915	0.00504	0.225
PNWR	PNWRCC03	Common carp		ND		0.00031	0.00007	0.00357	0.00060	0.00014	0.00686	0.00446	0.00107	0.05090	0.06086	0.0146	0.695
PNWR	PNWRCC04	Common carp		ND		0.00011	0.00002	0.00155	0.00102	0.00021	0.01450	0.00430	0.00087	0.06120	0.01595	0.00324	0.227
PNWR	PNWRCC05	Common carp	0.00023	0.00005	0.00244	0.00090	0.00021	0.00962	0.00061	0.00014	0.00651	0.00358	0.00085	0.03840	0.06792	0.0162	0.727
PNWR	PNWRLM01	Largemouth bass		ND		0.00029	0.00007	0.00375	0.00030	0.00007	0.00390	0.00417	0.00101	0.05350	0.01547	0.00373	0.198
	Minimum LOC			**0.00040**			**NA**			**0.10000**			**NA**			**0.10000**	

Table 3-5: Concentrations of Organic Chemicals in Individual* Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Toxaphene		
			dw	ww	ln
NP	NPGS01	Green sunfish	ND		
NP	NPGS02	Green sunfish	ND		
NP	NPGS03	Green sunfish	ND		
NP	NPGS04	Green sunfish	ND		
NP	NPGS05	Green sunfish	ND		
NP	NPGS06	Green sunfish	ND		
NP	NPBB01	Black bullhead	ND		
NP	NPBB02	Black bullhead	ND		
NP	NPBB03	Black bullhead	ND		
DC	DCGS01	Green sunfish	ND		
DC	DCGS02	Green sunfish	ND		
DC	DCGS04	Green sunfish	ND		
DC	DCGS05	Green sunfish	ND		
DC	DCGS06	Green sunfish	ND		
DC	DCGS03	Green sunfish	ND		
PB	LVWCC01	Common carp	ND		
PB	LVWCC02	Common carp	ND		
PB	LVWCC03	Common carp	ND		
PB	LVWGS01	Green sunfish	ND		
PB	LVWGS02	Green sunfish	ND		
PB	LVWGS03	Green sunfish	ND		
PB	LVWGS04	Green sunfish	ND		
LVB	LVBCC01	Common carp	ND		
LVB	LVBCC02	Common carp	ND		
LVB	LVBCC03	Common carp	ND		
LVB	LVBCC04	Common carp	ND		
LVB	LVBCC05	Common carp	ND		
LVB	LVBCC06	Common carp	ND		
PNWR	PNWRCC01	Common carp	ND		
PNWR	PNWRCC02	Common carp	ND		
PNWR	PNWRCC03	Common carp	ND		
PNWR	PNWRCC04	Common carp	ND		
PNWR	PNWRCC05	Common carp	ND		
PNWR	PNWRLM01	Largemouth bass	ND		
Minimum LOC				**0.40000**	

Notes:
[*] Each data point represents a concentration in an individual fish.

Non-detect values for the concentrations of individual constituents were ignored.
Detection limits were not determined for chlordane.

Chemical concentrations in bold and shaded exceed the minimum level of concern (LOC) for that chemical.

LOCs were taken from Table 18 in ACT I (2011).

dw	Dry Weight Residue
DC	Duck Creek
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
HCH	Hexachlorocyclohexane
ln	Lipid-Normalized Residue
LOC	Level of concern
LVB	Las Vegas Bay
NA	Not Available
ND	Not Detected
NP	Nature Preserve
PB	Mainstrem Wash Location LW6.05
PCBs	Polychlorinated Biphenyls
PNWR	Pahranagat National Wildlife Refuge
ww	Wet Weight Residue

Source: SNWA. 2008. Las Vegas Wash Monitoring and Characterization Study: Ecotoxicological Screening Assessment of Selected Contaminants of Potential Concerning Sediment, Whole Fish, Bird Eggs, and Water, 2007-2008. Prepared for Southern Nevada Water Authority, Bureau of Reclamation, and U.S. Fish and Wildlife Service. February.

Table 3-6: Concentrations of Inorganic Chemicals in Individual [*] Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Al		As		Ba		Be		B		Cd		Cr		Cu		Fe		Hg		Mg		Mn	
			dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww
NP	NPGS01	Green sunfish	22	4.3	0.30	0.07	1.5	0.3	ND		ND		ND		0.7	0.1	1.3	0.26	66	13	ND		2900	570	9	1.8
NP	NPGS02	Green sunfish	220	57	0.66	0.17	4.5	1.2	ND		4	0.9	ND		1.0	0.33	2.9	0.73	180	46	ND		2500	650	9	2.3
NP	NPGS03	Green sunfish	67	17	0.30	0.09	3.3	0.85	ND		3	0.7	ND		1.0	0.3	1.8	0.48	89	23	ND		2500	640	11	2.8
NP	NPGS04	Green sunfish	32	8.3	0.30	0.08	4.1	1.1	ND		ND		ND		42	**11**	10	**2.7**	260	68	ND		2100	540	16	4.2
NP	NPGS05	Green sunfish	ND		0.30	0.07	2.4	0.61	ND		ND		ND		ND		1.3	0.32	34	8.5	0.2	0.04	2100	540	6.9	1.8
NP	NPGS06	Green sunfish	ND		ND		2.5	0.63	ND		4	0.9	ND		2.4	0.6	1.1	0.27	53	13	ND		2000	510	7.4	1.8
NP	NPBB01	Black bullhead	380	78.2	0.30	0.07	16	3.2	ND		6	1	ND		1.9	0.39	5.3	**1.1**	370	76	ND		2900	600	40	8.3
NP	NPBB02	Black bullhead	44	9.1	ND		6.4	1.3	ND		3	0.5	ND		3.2	0.67	4.3	**0.91**	200	41	ND		2600	540	37	7.8
NP	NPBB03	Black bullhead	19	4.3	ND		9.7	2.2	ND		ND		ND		24	**5.4**	3.4	0.78	250	57	ND		2700	620	50	11
DC	DCGS01	Green sunfish	18	4.9	0.30	0.07	1.6	0.45	ND		3	0.7	ND		6	1.6	1.7	0.45	85	23	ND		1700	460	21	5.6
DC	DCGS02	Green sunfish	89	22	0.40	0.09	2.0	0.48	ND		3	0.9	ND		2.1	0.52	1.7	0.43	110	26	ND		2000	500	21	5.1
DC	DCGS03	Green sunfish	69	17	0.40	0.10	1.8	0.45	ND		3	0.8	ND		ND		1.6	0.41	83	21	ND		2100	530	17	4.4
DC	DCGS04	Green sunfish	25	6.0	0.30	0.07	0.97	0.24	ND		3	0.7	ND		0.6	0.1	1.3	0.31	56	14	ND		1700	420	22	5.3
DC	DCGS05	Green sunfish	58	15	0.30	0.09	1.3	0.34	ND		5	1	ND		1.0	0.34	1.3	0.34	84	22	ND		2000	510	19	4.9
DC	DCGS06	Green sunfish	40	11	0.40	0.10	0.86	0.24	ND		ND		ND		0.7	0.2	1.4	0.38	69	19	ND		1700	460	20	5.4
PB	LVWCC01	Common carp	ND		ND		5.6	1.5	ND		ND		ND		1.0	0.34	5.1	**1.4**	120	34	ND		1900	530	9.1	2.5
PB	LVWCC02	Common carp	15	3.9	0.50	0.1	2.8	0.75	ND		ND		ND		ND		3.4	**0.90**	150	39	ND		1700	450	10	2.7
PB	LVWCC03	Common carp	5.0	1.0	0.88	**0.25**	2.2	0.64	ND		ND		ND		ND		8.4	**2.4**	230	65	ND		1400	400	9.8	2.8
PB	LVWGS01	Green sunfish	12	3.1	ND		1.1	0.28	ND		ND		ND		0.8	0.2	2	0.50	50	13	ND		1700	430	12	3.1
PB	LVWGS02	Green sunfish	ND		0.5	0.1	0.6	0.2	ND		ND		ND		1.0	0.3	1.1	0.36	34	11	ND		1700	530	13	4.1
PB	LVWGS03	Green sunfish	7.6	2.2	0.50	0.20	1.3	0.38	ND		ND		ND		0.9	0.3	1.2	0.34	40	12	ND		1400	420	7.4	2.2
PB	LVWGS04	Green sunfish	68	18	0.30	0.08	2.9	0.74	ND		ND		ND		0.6	0.2	2	0.51	96	25	ND		1700	430	11	2.8
LVB	LVBCC01	Common carp	300	100	0.60	0.20	11	3.8	ND		ND		ND		1.0	0.5	2.4	0.80	590	200	ND		1500	520	20	6.6
LVB	LVBCC02	Common carp	480	114	**1.1**	**0.27**	30	7.1	ND		ND		0.3	**0.07**	6.6	1.6	4.2	**1.0**	880	210	0.2	0.05	2500	600	32	7.6
LVB	LVBCC03	Common carp	680	143	**1.4**	**0.30**	26	5.5	ND		ND		0.61	**0.13**	2.9	0.61	5	**1.1**	1100	230	0.2	0.04	2700	580	30	6.4
LVB	LVBCC04	Common carp	150	49	0.60	0.19	9.5	3.1	ND		ND		ND		3.4	1.1	2.6	0.84	394	130	ND		1400	470	14	4.4
LVB	LVBCC05	Common carp	9.6	2.5	0.30	0.09	3.7	0.95	ND		ND		ND		0.7	0.2	6.1	**1.6**	120	31	ND		1600	400	6.9	1.8
LVB	LVBCC06	Common carp	5.0	1.0	0.40	0.10	6.5	1.6	ND		ND		0.2	0.04	4.5	1.1	3.8	**0.94**	205	51	0.42	0.1	1400	350	6.4	1.6
PNWR	PNWRCC01	Common carp	ND		ND		3.6	0.99	ND		ND		ND		ND		4.8	**1.3**	100	28	ND		1300	370	6.7	1.8
PNWR	PNWRCC02	Common carp	ND		ND		6.2	1.3	ND		ND		ND		ND		4.9	**1.0**	160	34	ND		1600	340	6.4	1.4
PNWR	PNWRCC03	Common carp	ND		ND		4.7	1.2	ND		ND		ND		ND		1.8	0.45	120	30	ND		1600	400	5.4	1.3
PNWR	PNWRCC04	Common carp	20	4.5	ND		14	3.1	ND		ND		ND		ND		3.3	0.73	150	33	ND		1800	410	7.4	1.6
PNWR	PNWRCC05	Common carp	4.0	0.9	0.40	0.09	5	1.2	ND		ND		ND		6	1.4	3.1	0.71	140	33	ND		1500	340	6	1.4
PNWR	PNWRLM01	Largemouth bass	11	2.4	0.30	0.06	2.9	0.67	ND		ND		ND		11	2.5	1.8	0.40	100	23	0.2	0.04	1700	380	5	1.1
Minimum LOC				**NA**	**1.00**	**0.22**		**NA**		**NA**		**NA**		**0.05**		**4**		**0.9**		**NA**	**0.62**	**0.17**		**NA**		**NA**

Source: SNWA. 2008. Las Vegas Wash Monitoring and Characterization Study: Ecotoxicological Screening Assessment of Selected Contaminants of Potential Concerning Sediment, Whole Fish, Bird Eggs, and Water, 2007-2008. Prepared for Southern Nevada Water Authority, Bureau of Reclamation, and U.S. Fish and Wildlife Service. February.

Table 3-6: Concentrations of Inorganic Chemicals in Individual [*] Whole Fish Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Mo		Ni		Pb		Se		Sr		V		Zn	
			dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww
NP	NPGS01	Green sunfish	ND		ND		ND		**5.3**	1.1	550	110	ND		120	**24**
NP	NPGS02	Green sunfish	ND		ND		0.3	0.07	**5.5**	1.4	290	74	0.6	0.1	94	**24**
NP	NPGS03	Green sunfish	ND		ND		ND		**4.3**	1.1	400	100	ND		100	**27**
NP	NPGS04	Green sunfish	ND		18.0	4.8	ND		**5.2**	1.3	340	88	ND		100	**27**
NP	NPGS05	Green sunfish	ND		ND		0.3	0.06	**4.7**	1.2	400	100	ND		97	**25**
NP	NPGS06	Green sunfish	ND		ND		ND		**4.6**	1.2	420	110	ND		79	**20**
NP	NPBB01	Black bullhead	ND		ND		0.72	0.15	2.7	0.55	360	74	1	0.2	170	**35**
NP	NPBB02	Black bullhead	ND		ND		0.85	0.18	1.4	0.3	450	93	0.9	0.2	150	**30**
NP	NPBB03	Black bullhead	ND		7.9	1.8	0.93	0.21	1.7	0.38	500	110	1	0.2	130	**30**
DC	DCGS01	Green sunfish	ND		2.7	0.72	ND		**6.5**	1.8	320	88	ND		82	**22**
DC	DCGS02	Green sunfish	ND		0.8	0.2	ND		**7.7**	1.9	420	100	ND		98	**24**
DC	DCGS03	Green sunfish	ND		ND		ND		**6.7**	1.7	270	69	ND		100	**26**
DC	DCGS04	Green sunfish	ND		ND		ND		**11**	2.7	340	83	ND		90	**22**
DC	DCGS05	Green sunfish	ND		ND		ND		**7.4**	1.9	370	94	ND		83	**21**
DC	DCGS06	Green sunfish	ND		ND		ND		**10**	2.9	320	87	ND		86	**24**
PB	LVWCC01	Common carp	ND		1.0	0.3	ND		**4.1**	1.1	420	120	ND		320	**89**
PB	LVWCC02	Common carp	ND		1.0	0.32	0.6	0.1	**7.2**	1.9	300	80	ND		290	**77**
PB	LVWCC03	Common carp	ND		0.9	0.2	ND		**5.3**	1.5	240	67	ND		510	**140**
PB	LVWGS01	Green sunfish	ND		ND		ND		**6.1**	1.5	240	60	ND		88	**22**
PB	LVWGS02	Green sunfish	ND		ND		ND		**3.5**	1.1	250	77	ND		78.6	**25**
PB	LVWGS03	Green sunfish	ND		ND		ND		**3.5**	1	190	57	ND		65	19
PB	LVWGS04	Green sunfish	ND		ND		ND		**4.8**	1.3	210	54	ND		72	19
LVB	LVBCC01	Common carp	ND		1.0	0.3	1.7	**0.6**	**4.3**	1.4	170	58	1.6	0.5	210	**71**
LVB	LVBCC02	Common carp	ND		3.9	0.9	3.3	**0.8**	**5.6**	1.4	310	75	2.9	0.69	230	**54**
LVB	LVBCC03	Common carp	ND		1.8	0.4	2.4	**0.5**	**6.4**	1.3	190	40	3.1	0.65	220	**46**
LVB	LVBCC04	Common carp	ND		2.7	0.9	1.1	**0.4**	**4.6**	1.5	190	62	1	0.40	150	**49**
LVB	LVBCC05	Common carp	ND		0.6	0.1	1.9	**0.5**	**4.1**	1	310	80	ND		330	**85**
LVB	LVBCC06	Common carp	ND		2.5	0.6	0.86	0.21	**5.3**	1.3	210	51	1	0	270	**65**
PNWR	PNWRCC01	Common carp	ND		ND		ND		0.9	0.25	230	62	ND		250	**68**
PNWR	PNWRCC02	Common carp	ND		ND		ND		0.9	0.18	390	81	ND		270	**57**
PNWR	PNWRCC03	Common carp	ND		1.0	0.3	ND		1.0	0.24	310	77	ND		250	**61**
PNWR	PNWRCC04	Common carp	ND		ND		ND		1.0	0.23	380	85	ND		190	**42**
PNWR	PNWRCC05	Common carp	ND		4.1	0.9	ND		1.1	0.25	270	61	ND		190	**44**
PNWR	PNWRLM01	Largemouth bass	ND		5.6	1.3	ND		1.5	0.34	190	42	ND		57	13
Minimum LOC				**NA**		**NA**		**0.22**	**3**			**NA**		**NA**		**20**

Source: SNWA. 2008. Las Vegas Wash Monit
2007-2008. Prepared for Southern Nev

Notes:
[*] Each data point represents a concentration in an individual fish.

Element symbols are presented in Table 1 (ACT I 2011).

Wet weight based concentrations were calculated using moisture content of individual samples.
Chemical concentrations highlighted and in bold text exceed the minimum level of concern (LOC) for that chemical.

LOCs were taken from Table 19 (ACT I 2011).
Some values are rounded.

Al	Aluminum	PB	Mainstrem Wash Location LW6.05
As	Arsenic	Pb	Lead
B	Boron	PCBs	Polychlorinated Biphenyls
Ba	Barium	PNWR	Pahranagat National Wildlife Refuge
Be	Beryllium	Se	Selenium
Cd	Cadmium	Sr	Strontium
Cr	Chromium	V	Vanadium
Cu	Copper	WW	Wet Weight Residue
DC	Duck Creek	Zn	Zinc
dw	Dry Weight Residue		
Fe	Iron		
Hg	Mercury		
ln	Lipid-Normalized Residue		
LOC	Level of concern		
LVB	Las Vegas Bay		
Mg	Magnesium		
Mn	Manganese		
Mo	Molybdenum		
NA	Not Available		
ND	Not Detected		
Ni	Nickel		
NP	Nature Preserve		

Source: SNWA. 2008. Las Vegas Wash Monitoring and Characterization Study: Ecotoxicological Screening Assessment of Selected Contaminants of Potential Concerning Sediment, Whole Fish, Bird Eggs, and Water, 2007-2008. Prepared for Southern Nevada Water Authority, Bureau of Reclamation, and U.S. Fish and Wildlife Service. February.

Table 3-7: Concentrations of Organic Chemicals in Individual[*] Bird Eggs Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust
Henderson, Nevada

Location	Sample ID	Common Name	Aldrin			Dieldrin			Endrin			Heptachlor			Heptachlor			Oxychlordane		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	07AC-6	American coot	ND			0.0256	0.00665	0.0458	ND			0.00177	0.00046	0.00317	0.0211	0.00548	0.0378	0.0135	0.00352	0.0243
NP	07AC-7	American coot	ND			0.0174	0.00444	0.0305	ND			0.00045	0.00012	0.00080	0.00887	0.00226	0.0156	0.0137	0.00349	0.0240
NP	07AC-8	American coot	ND			0.0287	0.00810	0.0519	ND			ND			0.0303	0.00853	0.0547	0.0217	0.00611	0.0392
DC	07KD-3	Killdeer	0.00010	0.00003	0.00015	3.95	**1.17**	5.78	ND			0.00112	0.00033	0.00164	0.124	0.0368	0.182	0.0977	0.0289	0.143
DC	07KD-7	Killdeer	ND			0.0244	0.00750	0.0409	0.00064	0.00020	0.00108	ND			0.0395	0.0121	0.0662	0.00895	0.00275	0.0150
DC	07KD-8	Killdeer	ND			0.0307	0.00894	0.0632	0.00048	0.00014	0.00099	ND			0.0461	0.0134	0.0949	0.0153	0.00447	0.0316
DC	07KD-9	Killdeer	ND			0.499	**0.169**	0.707	ND			0.00157	0.00053	0.00222	0.0316	0.0107	0.0448	0.0542	0.0183	0.0768
BSC	07KD-1	Killdeer	ND			0.0235	0.00673	0.0410	ND			0.00085	0.00024	0.00148	0.0288	0.00824	0.0502	0.0103	0.00294	0.0179
BSC	07KD-2	Killdeer	ND			0.0174	0.00464	0.0258	ND			0.00165	0.00044	0.00245	0.021	0.00561	0.0312	0.0112	0.00298	0.0166
BSC	07KD-5	Killdeer	ND			0.0220	0.00615	0.0414	0.0415	0.0116	0.0782	0.00062	0.00017	0.00117	0.0137	0.00384	0.0259	0.00969	0.00271	0.0183
BSC	07KD-6	Killdeer	0.00185	0.00055	0.00320	0.0228	0.00680	0.0393	0.00362	0.00108	0.00625	ND			0.299	**0.089**	0.52	0.0134	0.00400	0.0231
BVP	07AC-1	American coot	ND			0.0238	0.00605	0.0482	ND			0.00181	0.00046	0.00365	0.0231	0.00588	0.0468	0.00750	0.00191	0.0152
BVP	07AC-2	American coot	ND			0.0123	0.00311	0.0251	ND			0.00134	0.00034	0.00275	0.0211	0.00537	0.0433	0.00543	0.00138	0.0111
BVP	07AC-9	American coot				0.0197	0.00517	0.0406	0.00053	0.00014	0.00109	ND			0.0574	0.0151	0.118	0.00352	0.00093	0.00727
BVP	07KD-4	Killdeer	0.00009	0.00002	0.00016	0.0352	0.00940	0.0615	ND			0.00267	0.00071	0.00467	0.0486	0.0130	0.0849	0.0183	0.00490	0.0321
BVP	07KD-10	Killdeer	ND			0.0217	0.00609	0.0348	ND			ND			0.817	**0.229**	1.31	ND		
BVP	07KD-12	Killdeer	0.00547	0.00167	0.0124	0.135	0.0413	0.307	0.0106	0.00324	0.0240	ND			1.02	**0.313**	2.32	0.0380	0.0116	0.0863
PB	07KD-11	Killdeer	ND			0.0900	0.0264	0.132	0.00035	0.00010	0.0005	ND			0.0466	0.0136	0.0685	0.0133	0.00391	0.0196
PB	07RWB-	Red-winged blackbird	ND			0.147	0.0383	0.468	ND			ND			0.0952	0.0249	0.304	0.0705	0.0184	0.225
PB	07RWB-	Red-winged blackbird	ND			0.0422	0.0103	0.107	ND			ND			0.0443	0.0109	0.112	0.00656	0.00161	0.0166
PB	07RWB-	Red-winged blackbird	ND			0.0371	0.00738	0.0804	ND			ND			0.1260	0.0251	0.273	0.0104	0.00208	0.0226
PB	07-MW-1	Marsh wren	ND			0.0156	0.00372	0.0524	0.00021	0.00005	0.00070	ND			0.0725	0.0173	0.244	0.00735	0.00176	0.0247
PB	07-MW-2	Marsh wren	ND			0.0493	0.0105	0.125	0.00071	0.00015	0.00181	ND			0.0600	0.0128	0.152	0.00562	0.00120	0.0142
PNWR	07AC-3	American coot	ND			0.0154	0.00422	0.0263	0.00128	0.00035	0.00220	0.00090	0.00025	0.00154	0.0141	0.00387	0.0241	0.00276	0.00076	0.00473
PNWR	07AC-4	American coot	ND			0.00293	0.00068	0.00786	ND			0.00041	0.00010	0.00111	0.00285	0.00066	0.00765	0.00384	0.00089	0.0103
PNWR	07AC-5	American coot	ND			0.0201	0.00511	0.0328	ND			0.00126	0.00032	0.00205	0.0174	0.00441	0.0283	0.00412	0.00105	0.00672
Minimum LOC			NA			**0.15**			**0.27**			**NA**			**0.04**			**NA**		

Table 3-7: Concentrations of Organic Chemicals in Individual[*] Bird Eggs Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust
Henderson, Nevada

Location	Sample ID	Common Name	Alpha-Chlordane			Gamma-Chlordane			Trans-Nonachlor			Cis-Nonachlor			Alpha-HCH			Beta-HCH		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	07AC-6	American coot	0.00070	0.00018	0.00125	0.00048	0.00012	0.00086	0.00297	0.00077	0.00532	0.00098	0.00026	0.00176		ND		0.0125	0.00324	0.0223
NP	07AC-7	American coot	0.00023	0.00006	0.00040	0.00031	0.00008	0.00055	0.00174	0.00044	0.00305		ND			ND		0.00725	0.00185	0.0127
NP	07AC-8	American coot	0.00056	0.00016	0.00101		ND		0.00351	0.00099	0.00634	0.00439	0.00124	0.00793		ND		0.0108	0.00305	0.0195
DC	07KD-3	Killdeer	0.00278	0.00082	0.00407		ND		0.385	0.114	0.563	0.0352	0.0104	0.0515		ND		0.0159	0.00470	0.0232
DC	07KD-7	Killdeer	0.00030	0.00009	0.00051		ND		0.0101	0.00311	0.0170		ND			ND		0.0187	0.00574	0.0313
DC	07KD-8	Killdeer	0.00040	0.00012	0.00081		ND		0.0197	0.00572	0.0405	0.00340	0.00099	0.00699		ND		0.0194	0.00566	0.0400
DC	07KD-9	Killdeer	0.00177	0.00060	0.00251		ND		0.102	0.0345	0.145	0.00033	0.00011	0.00046		ND		0.0233	0.00789	0.0331
BSC	07KD-1	Killdeer	0.00070	0.00020	0.00122	0.00091	0.00026	0.00159	0.0134	0.00384	0.0234		ND			ND		0.482	0.138	0.840
BSC	07KD-2	Killdeer	0.00052	0.00014	0.00077	0.00030	0.00008	0.00045	0.0136	0.00363	0.0202		ND		0.00175	0.00047	0.00260	1.88	0.503	2.80
BSC	07KD-5	Killdeer	0.00099	0.00028	0.00187	0.00074	0.00021	0.00139	0.0160	0.00447	0.0301		ND			ND		0.656	0.184	1.24
BSC	07KD-6	Killdeer	0.00134	0.00040	0.00232		ND		0.0122	0.00366	0.0212	0.405	0.121	0.701		ND		0.751	0.225	1.30
BVP	07AC-1	American coot	0.00043	0.00011	0.00087		ND		0.00214	0.00054	0.00432		ND			ND		0.0711	0.0181	0.144
BVP	07AC-2	American coot	0.00030	0.00008	0.00061		ND		0.00133	0.00034	0.00272		ND			ND		0.0496	0.0126	0.102
BVP	07AC-9	American coot	0.00025	0.00006	0.00051		ND		0.00250	0.00066	0.00517		ND			ND		0.0371	0.00977	0.0766
BVP	07KD-4	Killdeer		ND		0.00061	0.00016	0.00107	0.0321	0.00858	0.0561	0.00032	0.00009	0.00056		ND		0.0747	0.0199	0.131
BVP	07KD-10	Killdeer	0.00044	0.00012	0.0007	0.00144	0.00040	0.00230	0.0109	0.00306	0.0175		ND			ND		0.176	0.0493	0.282
BVP	07KD-12	Killdeer		ND			ND		0.164	0.05032	0.374	1.55	0.475	3.53		ND		0.350	0.107	0.796
PB	07KD-11	Killdeer	0.00058	0.00017	0.00086		ND		0.0264	0.00774	0.0389	0.00311	0.00091	0.00457		ND		0.275	0.0805	0.404
PB	07RWB-	Red-winged blackbird	0.00028	0.00007	0.00090		ND		0.153	0.03990	0.488	0.0571	0.0149	0.182		ND		0.121	0.0316	0.386
PB	07RWB-	Red-winged blackbird	0.00068	0.00017	0.00173		ND		0.0143	0.00351	0.0363	0.00749	0.00184	0.0190		ND		0.136	0.0334	0.345
PB	07RWB-	Red-winged blackbird	0.00084	0.00017	0.00182		ND		0.0450	0.00895	0.0975	0.0264	0.00525	0.0571		ND		0.255	0.0507	0.552
PB	07-MW-1	Marsh wren	0.00064	0.00015	0.00215	0.00136	0.00033	0.00459	0.00369	0.00088	0.0124	0.00294	0.00070	0.00991		ND		0.228	0.0545	0.768
PB	07-MW-2	Marsh wren	0.00054	0.00012	0.00138		ND		0.0122	0.00262	0.0310		ND			ND		0.205	0.0438	0.518
PNWR	07AC-3	American coot	0.00027	0.00007	0.00046	0.00041	0.00011	0.00070	0.00208	0.00057	0.00355		ND			ND		0.00716	0.00197	0.0123
PNWR	07AC-4	American coot	0.00008	0.00002	0.00022	0.00006	0.00001	0.00016	0.00052	0.00012	0.00141		ND			ND		0.00126	0.00029	0.00339
PNWR	07AC-5	American coot	0.00038	0.00010	0.00063	0.00052	0.00013	0.00084	0.00303	0.00077	0.00495		ND			ND		0.0121	0.00308	0.0198
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**NA**			**NA**	

Table 3-7: Concentrations of Organic Chemicals in Individual[*] Bird Eggs Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust
Henderson, Nevada

Location	Sample ID	Common Name	Delta-HCH			Gamma-HCH			DDMU			o,p'-DDD			p,p'-DDD			o,p'-DDE		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	07AC-6	American coot		ND			ND		0.0265	0.00688	0.0474		ND			ND		0.0125	0.00324	0.0223
NP	07AC-7	American coot		ND			ND		0.00894	0.00228	0.0157		ND			ND		0.00351	0.00089	0.00615
NP	07AC-8	American coot		ND		0.00043	0.00012	0.00078	0.00831	0.00234	0.0150		ND		0.00033	0.00009	0.00060	0.00641	0.00181	0.0116
DC	07KD-3	Killdeer		ND			ND		0.0148	0.00437	0.0216		ND			ND		0.0128	0.00378	0.0187
DC	07KD-7	Killdeer		ND			ND		0.0208	0.00638	0.0348		ND			ND		0.0109	0.00336	0.0183
DC	07KD-8	Killdeer		ND			ND		0.0189	0.00550	0.0389		ND			ND		0.0108	0.00315	0.0223
DC	07KD-9	Killdeer		ND			ND		0.0143	0.00483	0.0202		ND			ND		0.00720	0.00243	0.0102
BSC	07KD-1	Killdeer	0.482	0.138	0.840		ND			N/A		0.103	0.029	0.179	0.00604	0.00173	0.0105	0.00184	0.00053	0.00321
BSC	07KD-2	Killdeer	0.00042	0.00011	0.00063		ND		0.0666	0.0178	0.0989	0.00166	0.00044	0.00246		ND		0.0191	0.00509	0.0283
BSC	07KD-5	Killdeer		ND			ND		0.244	0.0684	0.460	0.00488	0.00137	0.00919		ND		0.0666	0.0187	0.126
BSC	07KD-6	Killdeer		ND			ND		0.759	0.227	1.31	0.0232	0.00694	0.0401	0.647	**0.193**	1.12	0.381	0.114	0.659
BVP	07AC-1	American coot	0.00046	0.00012	0.00093		ND		0.0405	0.0103	0.0819		ND		0.0263	0.00668	0.0532	0.00724	0.00184	0.0146
BVP	07AC-2	American coot	0.00010	0.00003	0.00020		ND		0.0307	0.00779	0.0629		ND			ND		0.00520	0.00132	0.0107
BVP	07AC-9	American coot	0.00084	0.00022	0.00173	0.00042	0.00011	0.00086	0.0156	0.00411	0.0323		ND		0.00456	0.0012	0.0094	0.00607	0.00160	0.0125
BVP	07KD-4	Killdeer		ND			ND		0.0197	0.00525	0.0344		ND			ND		0.00938	0.00251	0.0164
BVP	07KD-10	Killdeer	0.00073	0.00020	0.00116		ND		0.0597	0.0167	0.0955	0.00639	0.00179	0.0102	0.0105	0.0029	0.0167	0.0187	0.00523	0.0299
BVP	07KD-12	Killdeer		ND			ND		1.45	0.442	3.28		ND			ND		2.00	0.613	4.55
PB	07KD-11	Killdeer		ND		0.00101	0.00030	0.00149	0.00826	0.00242	0.0121		ND		0.00079	0.00023	0.00116	0.00479	0.00140	0.00704
PB	07RWB-	Red-winged blackbird		ND			ND		0.0560	0.0146	0.179		ND		0.00769	0.00201	0.0245	0.0436	0.0114	0.139
PB	07RWB-	Red-winged blackbird		ND			ND		0.0191	0.00469	0.0485		ND		0.00143	0.00035	0.00362	0.00798	0.00195	0.0202
PB	07RWB-	Red-winged blackbird		ND			ND		0.0239	0.00476	0.0518		ND			ND		0.0105	0.00209	0.0227
PB	07-MW-1	Marsh wren		ND			ND		0.0142	0.00341	0.0480		ND		0.00364	0.00087	0.0122	0.00448	0.00107	0.0151
PB	07-MW-2	Marsh wren		ND			ND		0.0471	0.0101	0.119		ND		0.00814	0.00174	0.0206	0.0177	0.00378	0.0448
PNWR	07AC-3	American coot		ND			ND		0.0166	0.00456	0.0284		ND			ND		0.00620	0.00171	0.0106
PNWR	07AC-4	American coot		ND			ND		0.00242	0.00056	0.00651		ND			ND		0.00098	0.00023	0.00263
PNWR	07AC-5	American coot		ND			ND		0.0166	0.00422	0.0271		ND			ND		0.00668	0.0017	0.0109
Minimum LOC				**NA**			**10.00**			**NA**			**NA**			**0.10**			**NA**	

Table 3-7: Concentrations of Organic Chemicals in Individual[*] Bird Eggs Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust
Henderson, Nevada

Location	Sample ID	Common Name	p,p'-DDE			o,p'-DDT			p,p'-DDT			1,2,3,4-Tetrachlorobenzene			1,2,4,5-Tetrachlorobenzene			Hexachlorobenzene		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	07AC-6	American coot	0.522	**0.136**	0.935	0.00228	0.00059	0.00409		ND		0.0382	0.00993	0.0685	0.0242	0.00629	0.0433	0.0553	0.0144	0.0991
NP	07AC-7	American coot	0.271	0.0692	0.476	0.00097	0.00025	0.00170	0.00098	0.00025	0.00172	0.0358	0.00914	0.0629	0.0159	0.00406	0.0279	0.0383	0.00977	0.0672
NP	07AC-8	American coot	0.290	0.0818	0.524		ND		0.00135	0.00038	0.00244	ND			ND			0.0454	0.0128	0.0820
DC	07KD-3	Killdeer	0.670	**0.198**	0.980	0.00529	0.00157	0.00774	0.00383	0.00113	0.00560	0.0406	0.0120	0.0594	ND			0.0562	0.0166	0.0823
DC	07KD-7	Killdeer	0.649	**0.199**	1.09		ND		0.00066	0.00020	0.00110	ND			ND			0.0522	0.0160	0.0875
DC	07KD-8	Killdeer	0.495	**0.144**	1.02		ND		0.00047	0.00014	0.00096	ND			ND			0.0610	0.0177	0.125
DC	07KD-9	Killdeer	0.749	**0.253**	1.06	0.00348	0.00118	0.00493		ND		0.0554	0.0187	0.0785	0.0156	0.00529	0.0222	0.0602	0.0203	0.0853
BSC	07KD-1	Killdeer	0.0916	0.0262	0.160	11.9	3.41	20.8	0.0188	0.00537	0.0327	0.0197	0.00562	0.0343	0.0303	0.00868	0.0529	0.00889	0.00254	0.0155
BSC	07KD-2	Killdeer	3.47	**0.926**	5.15	0.00510	0.00136	0.00758	0.0208	0.00556	0.0309	0.0346	0.00923	0.0514	0.0142	0.00379	0.0211	0.0625	0.0167	0.0928
BSC	07KD-5	Killdeer	12.6	**3.54**	23.8	0.016	0.00444	0.0299	0.0312	0.00872	0.0587	0.0334	0.00934	0.0628	0.0118	0.00329	0.0222	0.0448	0.0125	0.0844
BSC	07KD-6	Killdeer	17.6	**5.27**	30.5		ND			ND		0.0113	0.00338	0.0195	0.0134	0.00400	0.0231	0.212	0.0633	0.366
BVP	07AC-1	American coot	1.84	**0.466**	3.71	0.00242	0.00062	0.00490	0.00820	0.00208	0.0166	0.0631	0.0160	0.128	0.0269	0.00684	0.0544	0.0636	0.0162	0.129
BVP	07AC-2	American coot	1.46	**0.370**	2.99	0.00140	0.00036	0.00287		ND		0.0366	0.00929	0.0750	0.0134	0.00340	0.0275	0.0583	0.0148	0.120
BVP	07AC-9	American coot	1.20	**0.317**	2.48		ND			ND		ND			ND			0.0302	0.00794	0.0623
BVP	07KD-4	Killdeer	0.861	**0.230**	1.51	0.00528	0.00141	0.00922		ND		0.0489	0.0131	0.0855	0.0210	0.00560	0.0367	0.0546	0.0146	0.0954
BVP	07KD-10	Killdeer	3.00	**0.840**	4.80		ND			ND		0.00071	0.00020	0.00114	ND			0.137	0.0383	0.219
BVP	07KD-12	Killdeer	51.7	**15.8**	118		ND		0.112	0.0343	0.254	0.0295	0.00902	0.0670	0.0285	0.00872	0.0647	0.434	0.133	0.987
PB	07KD-11	Killdeer	3.29	**0.965**	4.84		ND			ND		0.00462	0.00135	0.00680	0.00503	0.00147	0.00739	0.0637	0.0187	0.0936
PB	07RWB-	Red-winged blackbird	4.55	**1.19**	14.5		ND			ND		0.00155	0.00041	0.00495	ND			0.0600	0.0156	0.191
PB	07RWB-	Red-winged blackbird	0.574	**0.141**	1.45		ND			ND		0.00146	0.00036	0.00371	ND			0.0252	0.00617	0.0639
PB	07RWB-	Red-winged blackbird	0.828	**0.165**	1.79		ND			ND		0.00231	0.00046	0.00500	0.00527	0.00105	0.0114	0.0428	0.00852	0.0928
PB	07-MW-1	Marsh wren	0.547	**0.131**	1.84		ND			ND		0.00202	0.00048	0.00681	0.00431	0.00103	0.0145	0.0217	0.00519	0.0731
PB	07-MW-2	Marsh wren	0.915	**0.196**	2.32		ND			ND		0.00178	0.00038	0.00450	0.00458	0.00098	0.0116	0.0341	0.00731	0.0865
PNWR	07AC-3	American coot	0.308	0.0847	0.528		ND			ND		0.0439	0.0121	0.0751	0.0155	0.00426	0.0265	0.0486	0.0134	0.0832
PNWR	07AC-4	American coot	0.319	0.0743	0.857		ND			ND		0.0220	0.00513	0.0592	0.00949	0.00221	0.0255	0.0127	0.00296	0.0342
PNWR	07AC-5	American coot	0.663	**0.169**	1.08	0.00045	0.00011	0.00073		ND		0.0439	0.0111	0.0716	0.0177	0.00449	0.0288	0.0451	0.0114	0.0735
Minimum LOC				**0.10**			**NA**			**0.20**			**NA**			**NA**			**6.20**	

Table 3-7: Concentrations of Organic Chemicals in Individual[*] Bird Eggs Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust
Henderson, Nevada

Location	Sample ID	Common Name	Pentachloroanisole			Pentachlorobenzene			Endosulfan II			Endosulfan I			Endosulfan Sulfate			Mirex		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	07AC-6	American coot	0.00027	0.00007	0.00049	0.00097	0.00025	0.00174		ND			ND			ND			ND	
NP	07AC-7	American coot	0.00036	0.00009	0.00062	0.00091	0.00023	0.00159		ND			ND			ND		0.00022	0.00006	0.00038
NP	07AC-8	American coot	0.00027	0.00008	0.00050		ND			ND			ND			ND		0.00111	0.00031	0.00200
DC	07KD-3	Killdeer	0.00035	0.00010	0.00052	0.00103	0.00030	0.00150		ND			ND			ND		0.00386	0.00114	0.00565
DC	07KD-7	Killdeer	0.00029	0.00009	0.00049		ND			ND		0.00272	0.00084	0.00456		ND		0.00050	0.00016	0.00085
DC	07KD-8	Killdeer	0.00034	0.00010	0.00069		ND			ND		0.00715	0.00208	0.0147		ND		0.00116	0.00034	0.00238
DC	07KD-9	Killdeer	0.00034	0.00011	0.00048	0.00174	0.00059	0.00246		ND		0.139	0.0470	0.197		ND		0.00627	0.00212	0.00888
BSC	07KD-1	Killdeer	0.0463	0.0133	0.0808	0.00044	0.00013	0.00076	0.00214	0.00061	0.00373		ND		0.00605	0.00173	0.0105		ND	
BSC	07KD-2	Killdeer	0.00022	0.00006	0.00032	0.00231	0.00062	0.00343		ND		0.00698	0.00186	0.0104		ND			ND	
BSC	07KD-5	Killdeer	0.00048	0.00013	0.00090	0.00121	0.00034	0.00229		ND		0.00775	0.00217	0.0146		ND		0.00012	0.00003	0.00022
BSC	07KD-6	Killdeer	0.00016	0.00005	0.00028	0.0875	0.0262	0.151		ND			ND			ND		0.0105	0.00313	0.0181
BVP	07AC-1	American coot	0.00032	0.00008	0.00064	0.00396	0.00101	0.00801		ND			ND			ND			ND	
BVP	07AC-2	American coot	0.00021	0.00005	0.00043	0.00316	0.00080	0.00647		ND			ND			ND			ND	
BVP	07AC-9	American coot	0.00075	0.00020	0.00154		ND			ND			ND			ND		0.00517	0.00136	0.0107
BVP	07KD-4	Killdeer	0.00031	0.00008	0.00054	0.00106	0.00028	0.00185		ND		0.0149	0.00397	0.02596		ND		0.00195	0.00052	0.00340
BVP	07KD-10	Killdeer	0.00019	0.00005	0.00031	0.0167	0.00466	0.0266		ND			ND			ND			ND	
BVP	07KD-12	Killdeer	0.00039	0.00012	0.00089	0.176	0.0538	0.400		ND		0.0310	0.00950	0.0706		ND			ND	
PB	07KD-11	Killdeer	0.00032	0.00009	0.00047	0.0133	0.00389	0.0195		ND		0.0212	0.00620	0.0311		ND		0.00452	0.00132	0.00664
PB	07RWB-	Red-winged blackbird	0.00044	0.00012	0.00141		ND			ND		0.108	0.02820	0.345		ND		0.0106	0.00278	0.03396
PB	07RWB-	Red-winged blackbird	0.00039	0.00010	0.00099	0.00869	0.00213	0.0220		ND		0.00515	0.00126	0.0131		ND		0.00214	0.00052	0.00541
PB	07RWB-	Red-winged blackbird	0.00025	0.00005	0.00053	0.0148	0.00295	0.0322		ND		0.0219	0.00435	0.0474		ND		0.00564	0.00112	0.0122
PB	07-MW-1	Marsh wren	0.00016	0.00004	0.00055	0.0176	0.00420	0.0591		ND		0.00627	0.00150	0.0211		ND		0.00615	0.00147	0.0207
PB	07-MW-2	Marsh wren	0.00018	0.00004	0.00046	0.0105	0.00225	0.0266		ND		0.00796	0.00170	0.0202		ND		0.00637	0.00136	0.0161
PNWR	07AC-3	American coot	0.00039	0.00011	0.00066	0.00143	0.00039	0.00245		ND			ND			ND			ND	
PNWR	07AC-4	American coot	0.00012	0.00003	0.00033	0.00065	0.00015	0.00174		ND			ND			ND		0.00012	0.00003	0.00033
PNWR	07AC-5	American coot	0.00045	0.00011	0.00073	0.00169	0.00043	0.00276		ND			ND			ND			ND	
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**NA**			**20.00**	

Table 3-7: Concentrations of Organic Chemicals in Individual[*] Bird Eggs Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust
Henderson, Nevada

Location	Sample ID	Common Name	Chloropyrifos			Total HCH			Total Chlordane			Total DDT			Total PCB			Toxaphene		
			dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln	dw	ww	ln
NP	07AC-6	American coot		ND		0.0125	0.00324	0.0223	0.0415	0.0108	0.0744	0.563	0.146	1.01	0.488	0.127	0.875		ND	
NP	07AC-7	American coot		ND		0.00725	0.00185	0.0127	0.0253	0.00644	0.0443	0.286	0.0729	0.501	0.308	0.0785	0.540		ND	
NP	07AC-8	American coot	0.00410	0.00116	0.00741	0.0112	0.00317	0.0203	0.0604	0.0170	0.109	0.307	0.0865	0.554	0.531	0.150	0.959		ND	
DC	07KD-3	Killdeer		ND		0.0159	0.00470	0.0232	0.646	0.191	0.945	0.707	0.209	1.03	1.96	0.580	2.87		ND	
DC	07KD-7	Killdeer	0.00168	0.00052	0.00281	0.0187	0.00574	0.0313	0.0589	0.0181	0.0987	0.681	0.209	1.14	1.31	0.402	2.19		ND	
DC	07KD-8	Killdeer	0.00250	0.00073	0.00515	0.0194	0.00566	0.0400	0.0849	0.0247	0.175	0.525	0.153	1.08	0.638	0.186	1.31		ND	
DC	07KD-9	Killdeer		ND		0.0233	0.00789	0.0331	0.192	0.0647	0.271	0.774	0.262	1.10	1.77	0.599	2.51		ND	
BSC	07KD-1	Killdeer		ND			ND		0.482	0.138	0.840	0.0550	0.0157	0.0958	12.2	3.48	21.2	1.5	0.43	2.6
BSC	07KD-2	Killdeer		ND		1.88	0.503	2.80	0.0483	0.0129	0.0717	3.58	0.956	5.32	1.08	0.287	1.60		ND	
BSC	07KD-5	Killdeer		ND		0.656	0.184	1.24	0.0417	0.0117	0.0786	13.0	3.64	24.5	1.40	0.392	2.64		ND	
BSC	07KD-6	Killdeer	0.00080	0.00024	0.00137	0.751	0.225	1.30	0.731	0.219	1.26	19.4	5.81	33.6	4.98	1.49	8.60		ND	
BVP	07AC-1	American coot		ND		0.0715	0.0182	0.145	0.0350	0.00889	0.0708	1.92	0.488	3.88	0.620	0.157	1.25		ND	
BVP	07AC-2	American coot		ND		0.0497	0.0126	0.102	0.0295	0.00750	0.0605	1.49	0.379	3.06	0.514	0.131	1.05		ND	
BVP	07AC-9	American coot	0.00066	0.00017	0.00137	0.0384	0.0101	0.0792	0.0637	0.0167	0.131	1.23	0.324	2.54	0.435	0.114	0.898		ND	
BVP	07KD-4	Killdeer		ND		0.0747	0.0199	0.131	0.103	0.0274	0.179	0.896	0.239	1.57	1.69	0.450	2.95		ND	
BVP	07KD-10	Killdeer	0.00108	0.00030	0.00172	0.177	0.0495	0.283	0.830	0.232	1.33	3.10	0.867	4.95	1.80	0.504	2.88		ND	
BVP	07KD-12	Killdeer		ND		0.350	0.107	0.796	2.78	0.849	6.31	55.3	16.9	126	16.2	4.95	36.8		ND	
PB	07KD-11	Killdeer	0.00155	0.00045	0.00228	0.276	0.0808	0.405	0.0900	0.0264	0.132	3.31	0.969	4.86	1.01	0.296	1.49		ND	
PB	07RWB-	Red-winged blackbird	0.00223	0.00058	0.00711	0.121	0.0316	0.386	0.376	0.0981	1.20	4.66	1.22	14.9	6.20	1.62	19.8		ND	
PB	07RWB-	Red-winged blackbird	0.00160	0.00039	0.00405	0.136	0.0334	0.345	0.0734	0.0180	0.186	0.603	0.148	1.53	1.10	0.27	2.79		ND	
PB	07RWB-	Red-winged blackbird	0.00108	0.00022	0.00235	0.255	0.0507	0.552	0.209	0.0415	0.452	0.862	0.172	1.87	3.01	0.599	6.52		ND	
PB	07-MW-1	Marsh wren	0.00093	0.00022	0.00314	0.228	0.0545	0.768	0.0885	0.0211	0.298	0.570	0.136	1.92	3.20	0.764	10.77		ND	
PB	07-MW-2	Marsh wren	0.00174	0.00037	0.00441	0.205	0.0438	0.518	0.0784	0.0168	0.199	0.988	0.211	2.50	2.84	0.607	7.19		ND	
PNWR	07AC-3	American coot		ND		0.00716	0.00197	0.0123	0.0205	0.00563	0.0351	0.331	0.0910	0.567	0.105	0.0289	0.180		ND	
PNWR	07AC-4	American coot		ND		0.00126	0.00029	0.00339	0.00776	0.00181	0.0209	0.322	0.0751	0.866	0.129	0.0301	0.347		ND	
PNWR	07AC-5	American coot		ND		0.0121	0.00308	0.0198	0.0267	0.00677	0.0435	0.687	0.175	1.12	0.298	0.0757	0.486		ND	
Minimum LOC				**NA**			**NA**			**NA**			**NA**			**16.00**			**50.00**	

Notes:
[*] Each data point represents a concentration in a single bird egg.
Chemical concentrations highlighted and in bold text exceed the minimum level of concern (LOC) for that chemical.

LOCs were taken from Table 20 in ACT I (2011).

BSC	Burns Street Channel
BVP	Bird Viewing Preserve
dw	Dry Weight Residue
DC	Duck Creek
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
HCH	Hexachlorocyclohexane
ln	Lipid-Normalized Residue
LOC	Level of concern
NA	Not Available or Not Analyzed
ND	Not Detected
NP	Nature Preserve
PB	Mainstrem Wash Location LW6.05
PCBs	Polychlorinated Biphenyls
PNWR	Pahranagat National Wildlife Refuge
WW	Wet Weight Residue

Source: SNWA. 2008. Las Vegas Wash Monitoring and Characterization Study: Ecotoxicological Screening Assessment of Selected Contaminants of Potential Concerning Sediment, Whole Fish, Bird Eggs, and Water, 2007-2008. Prepared for Southern Nevada Water Authority, Bureau of Reclamation, and U.S. Fish and Wildlife Service.

Table 3-8: Concentrations of Inorganic Chemicals in Individual[*] Bird Eggs Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Al		As		Ba		Be		B		Cd		Cr		Cu		Fe		Hg	
			dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww
NP	07AC-6	American coot	ND		0.74	0.19	5	1.3	ND		ND		ND		ND		2.8	0.74	100	26	ND	
NP	07AC-7	American coot	ND		0.64	0.16	4.1	1	ND		ND		ND		ND		2.4	0.61	130	32	ND	
NP	07AC-8	American coot	ND		ND		2.9	0.81	ND		3	1	ND		ND		2.2	0.61	98	28	ND	
DC	07KD-3	Killdeer	ND		ND		1.1	0.33	ND		ND		ND		ND		3	0.88	92	27	0.20	**0.06**
DC	07KD-7	Killdeer	ND		ND		1.8	0.56	ND		ND		ND		ND		3	0.94	100	31	0.20	**0.05**
DC	07KD-8	Killdeer	ND		ND		0.84	0.24	ND		ND		ND		ND		3.7	1.1	100	30	0.36	**0.11**
DC	07KD-9	Killdeer	ND		ND		0.3	0.1	ND		ND		ND		ND		3.1	1.0	98	33	0.20	**0.06**
BSC	07KD-1	Killdeer	ND		ND		1.2	0.34	ND		ND		ND		ND		3.2	0.9	74	21	0.30	**0.07**
BSC	07KD-2	Killdeer	ND		ND		1.5	0.4	ND		ND		ND		ND		3.3	0.89	110	29	0.46	**0.12**
BSC	07KD-5	Killdeer	ND		ND		0.82	0.23	ND		ND		ND		ND		3.5	0.97	91	25	ND	
BSC	07KD-6	Killdeer	ND		ND		2.1	0.64	ND		ND		ND		ND		2.6	0.78	130	38	ND	
BVP	07AC-1	American coot	ND		ND		5.2	1.3	ND		ND		ND		ND		3.8	0.97	110	27	ND	
BVP	07AC-2	American coot	ND		ND		2.8	0.72	ND		ND		ND		ND		5.4	1.4	110	28	ND	
BVP	07AC-9	American coot	ND		ND		6.1	1.6	ND		ND		ND		ND		3.7	0.98	100	26	ND	
BVP	07KD-4	Killdeer	ND		ND		2.3	0.6	ND		3	0.7	ND		ND		3.1	0.83	120	32	0.82	**0.22**
BVP	07KD-10	Killdeer	ND		ND		0.83	0.23	ND		ND		ND		ND		2.8	0.79	93	26	ND	
BVP	07KD-12	Killdeer	ND		ND		2	0.62	ND		3	0.8	ND		ND		3.5	1.1	120	36	ND	
PB	07KD-11	Killdeer	ND		ND		0.4	0.1	ND		ND		ND		ND		3.3	0.96	110	32	ND	
PB	07RWB-1	Red-winged blackbird	ND		0.6	0.2	3.1	0.82	ND		3	0.9	ND		ND		3.2	0.83	170	44	ND	
PB	07RWB-2	Red-winged blackbird	ND		0.4	0.1	2.7	0.66	ND		ND		ND		ND		2.3	0.56	170	43	ND	
PB	07RWB-3	Red-winged blackbird	ND		0.4	0.08	3	0.59	ND		ND		ND		ND		2.1	0.43	140	28	ND	
PB	07MW-1	Marsh wren	ND		0.5	0.1	2.1	0.5	ND		ND		ND		ND		4	0.96	140	34	ND	
PB	07MW-2	Marsh wren	ND		0.3	0.06	3	0.65	ND		ND		ND		ND		2.9	0.61	120	27	ND	
PNWR	07AC-3	American coot	ND		0.4	0.1	4.8	1.3	ND		ND		ND		1	0.3	3	0.82	98	27	ND	
PNWR	07AC-4	American coot	ND		0.4	0.1	8.1	1.9	ND		3	0.6	ND		ND		3.9	0.91	130	31	0.32	**0.08**
PNWR	07AC-5	American coot	ND		0.3	0.09	3.2	0.81	ND		ND		ND		ND		2.5	0.64	110	29	0.44	**0.11**
Minimum LOC			**na**		**--**	**1.3**	**na**		**na**		**--**	**3.2**	**na**		**na**		**na**		**na**		**1**	**0.05**

Table 3-8: Concentrations of Inorganic Chemicals in Individual[*] Bird Eggs Collected From the Las Vegas Wash and Its Tributaries (Data from 2007-2008; Units: mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

Location	Sample ID	Common Name	Mg		Mn		Mo		Ni		Pb		Se		Sr		V		Zn	
			dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww	dw	ww
NP	07AC-6	American coot	490	130	1	0.3	ND		ND		ND		3.4	0.9	17	4.4	ND		71	19
NP	07AC-7	American coot	560	140	2.2	0.57	ND		ND		ND		3.4	0.87	26	6.6	ND		80	20
NP	07AC-8	American coot	460	130	1.5	0.43	ND		ND		ND		2.4	0.67	23	6.4	ND		71	20
DC	07KD-3	Killdeer	380	110	0.6	0.2	ND		ND		ND		2.8	0.83	15	4.5	ND		47	14
DC	07KD-7	Killdeer	430	130	2.7	0.82	ND		ND		ND		4.5	1.4	24	7.3	ND		55	17
DC	07KD-8	Killdeer	400	120	1	0.44	ND		ND		ND		3.3	0.96	21	6	ND		56	16
DC	07KD-9	Killdeer	370	130	1	0.3	ND		ND		ND		5	1.7	14	4.8	ND		48	16
BSC	07KD-1	Killdeer	420	120	1.9	0.53	ND		ND		ND		2.2	0.64	22	6.3	ND		47	14
BSC	07KD-2	Killdeer	340	92	1	0.35	ND		ND		ND		2.6	0.69	13	3.5	ND		50	13
BSC	07KD-5	Killdeer	490	140	1.5	0.43	ND		ND		ND		3	0.83	35	9.7	ND		55	15
BSC	07KD-6	Killdeer	370	110	1	0.32	ND		ND		ND		3.3	0.99	23	6.8	ND		55	16
BVP	07AC-1	American coot	630	160	2.4	0.62	ND		ND		ND		4.4	1.1	29	7.5	ND		56	14
BVP	07AC-2	American coot	680	170	2.5	0.63	ND		ND		ND		4.1	1	21	5.2	ND		59	15
BVP	07AC-9	American coot	560	150	1.7	0.44	ND		ND		ND		2.7	0.71	49	13	ND		57	15
BVP	07KD-4	Killdeer	410	110	0.9	0.2	ND		ND		ND		3.3	0.88	16	4.3	ND		62	17
BVP	07KD-10	Killdeer	390	110	1.6	0.44	ND		ND		ND		6.2	1.7	14	3.8	ND		49	14
BVP	07KD-12	Killdeer	460	140	ND		ND		ND		ND		5.4	1.6	18	5.4	ND		44	14
PB	07KD-11	Killdeer	360	110	1	0.44	ND		ND		ND		4	1.2	11	3.3	ND		45	13
PB	07RWB-1	Red-winged blackbird	540	140	6	1.6	ND		ND		ND		8.9	2.3	96	25	ND		63	16
PB	07RWB-2	Red-winged blackbird	310	77	4.1	1	ND		ND		ND		9	2.2	26	6.4	ND		51	13
PB	07RWB-3	Red-winged blackbird	410	82	3.3	0.66	ND		ND		ND		6.9	1.4	22	4.4	ND		61	12
PB	07MW-1	Marsh wren	680	160	4.7	1.1	ND		ND		ND		8.8	2.1	130	30	ND		63	15
PB	07MW-2	Marsh wren	380	80	2.9	0.63	ND		ND		ND		8.9	1.9	23	5.0	ND		58	12
PNWR	07AC-3	American coot	520	140	3.9	1.1	ND		ND		ND		2.4	0.66	12	3.3	ND		64	18
PNWR	07AC-4	American coot	780	180	4	0.94	ND		ND		ND		2.7	0.63	36	8.4	ND		71	17
PNWR	07AC-5	American coot	460	120	2.8	0.72	ND		ND		ND		3.2	0.81	7.6	1.9	ND		52	13
Minimum LOC			**na**		**na**		--	**16**	**na**		**na**		--	**3**	**na**		**na**		--	**50**

Notes:
Chemical concentrations highlighted and in bold text exceed the minimum level of concern (LOC) for that chemical. LOCs were taken from LOCs in ACT I (2011).
[*] Each data point represents a concentration in a single egg sample.

Al	Aluminum	Mg	Magnesium
As	Arsenic	Mn	Manganese
B	Boron	Mo	Molybdenum
Ba	Barium	NA	Not Available
Be	Beryllium	ND	Not Detected
BSC	Burns Street Channel	Ni	Nickel
BVP	Bird Viewing Preserve	NP	Nature Preserve
Cd	Cadmium	PB	Mainstrem Wash Location LW6.05
Cr	Chromium	Pb	Lead
Cu	Copper	PCBs	Polychlorinated Biphenyls
DC	Duck Creek	PNWR	Pahranagat National Wildlife Refuge
dw	Dry Weight Residue	Se	Selenium
Fe	Iron	Sr	Strontium
Hg	Mercury	V	Vanadium
In	Lipid-Normalized Residue	WW	Wet Weight Residue
LOC	Level of concern	Zn	Zinc

Source: SNWA. 2008. Las Vegas Wash Monitoring and Characterization Study: Ecotoxicological Screening Assessment of Selected Contaminants of Potential Concerning Sediment, Whole Fish, Bird Eggs, and Water, 2007-2008. Prepared for Southern Nevada Water Authority, Bureau of Reclamation, and U.S. Fish and Wildlife Service.

Table 5-1: Chemicals of Potential Ecological Concern to be Evaluated in the OU-3 BERA

Nevada Environmental Response Trust Site
Henderson, Nevada

OU-3 BERA COPECs and Water Quality Parameters
Perchlorate
Chlorate
Chloroform
Total Chromium
Hexavalent Chromium
Total Dissolved Solids
Total Organic Carbon
Hardness (as Calcium Carbonate)

Table 5-2: Assessment and Measurement Endpoints for the OU-3 BERA
Nevada Environmental Response Trust Site
Henderson, Nevada

Assessment Endpoint	Measurement Endpoint	Receptors
Aquatic		
Survival, growth and reproductive ability of benthic invertebrate communities within OU-3	(1) Comparison of sediment concentrations within OU-3 and reference areas against ecological screening values protective of benthic invertebrates (2) Benthic community analysis in OU-3 and reference areas using multiple metrics to assess benthic community health.[1]	Benthic invertebrate community
Survival, growth and reproductive ability of aquatic invertebrate and aquatic plant communities within OU-3	Comparison of surface water concentrations within OU-3 and reference areas against ecological screening values protective of aquatic plants and invertebrates.	Aquatic invertebrate and aquatic plant communities
Survival, growth and reproduction of fish populations within OU-3	(1) Comparison of surface water concentrations within OU-3 and reference areas against ecological screening values protective of fish (2) Comparison of modelled fish tissue concentrations against tissue-based thresholds identified in the literature[2] (3) Comparison of measured fish tissue concentrations against tissue-based thresholds identified in literature.	Fish community
Survival, growth and reproduction of aquatic-orientied bird populations within OU-3	Comparison of calculated TDD for birds from ingestion of contaminated aquatic food items and abiotic media against constituent-specific TRVs.	Bald eagle, mallard duck, canvasback duck
Survival, growth and reproduction of aquatic-oriented mammal populations within OU-3	Comparison of calculated TDD for birds from ingestion of contaminated aquatic food items and abiotic media against constituent-specific TRVs.	Raccoon, muskrat
Survival, growth and reproduction of amphibian populations within OU-3	Comparison of surface water concentrations within OU-3 and reference areas against ESVs protective of fish. Due to the very limited availability of toxicological information for amphibians, it is common practice to assume that the risk estimation for fish will also be protective of amphibians.	Amphibian community
Terrestrial		
Survival, growth and reproductive ability of indigenous terrestrial plant communities within OU-3	Comparison of soil concentrations within OU-3 against ecological screening values protective of terrestrial plants.	Terrestrial plant community
Survival, growth and reproductive ability of terrestrial invertebrate communities within OU-3	Comparison of soil concentrations within OU-3 against ecological screening values protective of terrestrial invertebrates.	Terrestrial invertebrate community
Survival, growth and reproduction of terrestrial-orientied avian populations within OU-3	Comparison of calculated TDD for birds from ingestion of contaminated terrestrial food items and abiotic media against constituent-specific TRVs in a food web model.	Red-tailed hawk, American robin, mourning dove
Survival, growth and reproduction of terrestrial-oriented mammalian populations within OU-3	Comparison of calculated TDD for birds from ingestion of contaminated terrestrial food items and abiotic media against constituent-specific TRVs in a food web model.	Kit fox, fringed myotis (bat), desert shrew, desert pocket mouse
Survival, growth and reproduction of reptile populations within OU-3	Comparison of calculated TDD for mammals from ingestion of contaminated terrestrial food items and abiotic media against constituent-specific TRVs in a food web model. Due to the very limited availability of toxicological information for reptiles, it is common practice to assume that the risk estimation for terrestrial mammals will also be protective of reptiles.	Reptile community

Notes:

TDD Total daily dose
TRV Toxicity reference value

1 Benthic macroinvertebrates will also be collected for tissue analysis. The results of which will be used in the baseline ecological risk assessment food web model as part of the dose estimate for invertivorous fish, birds and mammals.

2 Concentrations of COPECs in surface water can be used to estimate tissue concentrations in fish through food web modelling. The estimated tissue concentrations can then be compared to tissue-based thresholds identified in the literature. Fish will also be collected from the LVW as described in the FSP. The concentrations of COPECs measured directly from fish tissue will also be compared to tissue-based thresholds.

TABLE 5-3a: Surface Soil Ecological Screening Values (All Data mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

CASRN	Chemical Name	Preferred ESV (mg/kg)	Source	Eco-SSL Avian	Eco-SSL Inverts	Eco-SSL Mammal	Eco-SSL Plants	Min EcoSSL	Source	USEPA R4	R6 Earth-worms	R6 Plants	Min R6	Source	LANL	Source [7]	ORNL Inverts	ORNL Microbes	ORNL Plants	Min ORNL	Source	Dutch Target	Dutch Intervention	Dutch HC50
14866-68-3	Chlorate	NC	--	NC	NC	NC	NC	NC	--	NC	NC	NC	NC	--	NC		NC	NC	NC	NC	--	NC	NC	NC
14797-73-0	Perchlorate	3.5	LANL	NC	NC	NC	NC	NC	--	NC	NC	NC	NC	--	3.5	Soil - Receptor Earthworm	NC	NC	NC	NC	--	NC	NC	NC
TOC	Total Organic Carbon	NC	--	NC	NC	NC	NC	NC	--	NC	NC	NC	NC	--	NC		NC	NC	NC	NC	--	NC	NC	NC
7440-47-3	Chromium (total)	26	Eco-SSL Avian	26	NC	34	NC	26	Eco-SSL Avian	23	NC	NC	NC	--	23	Soil - Receptor American Robin	0.4	10	1	0.4	ORNL Inverts	100	380	230
18540-29-9	Chromium VI	130	Eco-SSL Mammal	NC	NC	130	NC	130	Eco-SSL Mammal	0.34	0.2	0.018	0.018	R6 Plants	0.34	Soil - Receptor Earthworm	NC	NC	NC	NC	--	NC	78	NC
67-66-3	Chloroform	0.05	R4	NC	NC	NC	NC	NC	--	0.05	NC	NC	NC	--	8	Soil- Receptor Deer Mouse	NC	NC	NC	NC	--	0.02	5.6	60

Note

(1) All Ecological Screening Values (ESVs) are in milligrams per kilogram (mg/kg).
(2) Hierarchy of surface soil ecological screening values are as follows (in order of preference): Eco-SSL; USEPA R4; USEPA R6; LANL; ORNL; and Dutch ESVs (Target, Intervention, HC50). The USEPA 2002 guidance has an ESV of 1 mg/kg in soil for perchlorate.
(3) The ESV for "DDT/DDE/DDD (total)" was used as a surrogate criterion for DDE, DDT, and DDD for ESVs obtained from USEPA Region 4.
(4) The ESV for total PCBs was used as a surrogate criterion for individual PCBs for ESVs obtained from USEPA Region 4 and ORNL.
(5) The ESV for endosulfan was used as a surrogate criterion for endosulfan I and endosulfan II for ESVs obtained from USEPA Region 4 and Dutch values (Target, Intervention, and HC50).
(6) USEPA Region 4 states "narrative" as the ESV and refers the reader to the Eco-SSL document (USEPA 2007).
(7) The No Effect ESV for invertebrates was used when it was available. When it wasn't, the lowest and most conservative No Effect ESV was used. For perchlorate, perchlorate ion was used as a surrogate.

µg/kg	Microgram per kilogram.	mg/kg	Milligram per kilogram
bgs	Below Ground Surface	NC	No Criterion
BHC	Hexachlorocyclohexane	ND	Not detected
DL	Detection limit	ng/kg	Nanograms per kilogram
DDD	Dichlorodiphenyldichloroethylene	OCPs	Organochlorine pesticides
DDE	Dichlorodiphenyldichloroethylene	OPPs	Organophosphate pesticides
DDT	Dichlorodiphenyltrichloroethane	PeCDD	Pentachlorodibenzo-p-furan
Eco SSL	Ecological Soil Screening Value	PeCDF	Pentachlorodibenzofuran
ESV	Ecological Screening Value	PAHs	Polycyclic Aromatic Hydrocarbons
EPN	Ethylp-nitrophenyl thionobenzenephosphonate	PCBs	Polychlorinated biphenyls
ft	Foot	pci/g	PicoCuries per gram
HMW	High Molecular Weight	RAD	Radium Compounds
HPCDD	Heptachlorodibenzo-p-dioxin	TCDD	Tetrachlorodibenzodioxin
HPCDF	Heptachlorodibenzofuran	TCDF	Tetrachlorodibenzofuran
HXCDD	Hexachlorodibenzo-p-dioxin mixture	TEQ	Toxic equivalency
HxCDF	Heptachlorodibenzofuran mixture	TPH	Total Petroleum Hydrocarbons
LANL	Los Alamos National Laboratory		
LMW	Low Molecular Weight		

References

Dutch ESVs: Swartjes, F.A. 1999. Risk-based Assessment of Soil and Groundwater Quality in the Netherlands: Standards and Remediation Urgency. Risk Analysis 19(6): 1235-1249

The Netherlands Ministry of Housing, Spatial Planning and Environment's Circular on target values and intervention values for soil remediation http://www.minvrom.nl/minvrom/docs/bodem/S&I2000.PDF and Annex A: Target Values, Soil Remediation Intervention Values and Indicative Levels for Serious Contamination http://www.minvrom.nl/minvrom/docs/bodem/annexS&I2000.PDF were also consulted, but they combine the ecological and human health values.

Eco-SSL ESVs: USEPA. 2007. Ecological Soil Screening Level (Eco-SSL) Guidance and Documents. https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents.

LANL: LANL. 2019. "ECORISK Database (Release 4.1)." LANL and National Nuclear Security Adminstration. https://www.lanl.gov/environment/protection/eco-risk-assessment.php (Accessed: January 10, 2019).

ORNL ESVs: Efroymson, R.A. , M.E. Will, and G.W. Suter II. 1997b. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-126/R2. (Available at http://www.esd.ornl.gov/programs/ecorisk/documents/tm126r21.pdf)

USEPA R4 ESVs: USEPA Region 4. Regional Ecological Risk Assessment (ERA) Supplemental Guidance. https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance (Accessed April 16, 2018).

USEPA 2002 ESV for perchlorate: USEPA. 2002. Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization. NCEA-1-0503. External Review Draft. http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=36247.

TABLE 5-3b: Sediment Ecological Screening Values (All Data mg/kg)
Nevada Environmental Response Trust Site
Henderson, Nevada

CASRN	Chemical Name	Preferred ESV [1, 2] (mg/kg)	Source	USEPA R4 FW ESV [3]	R6 FW ESV	LANL [5]	Source	MacDonald (2000)	USEPA R3 FW ESV
14866-68-3	Chlorate	NC	--	NC	NC	NC		NC	NC
14797-73-0	Perchlorate	NC	--	NC	NC	NC		NC	NC
TOC	Total Organic Carbon	NC	--	NC	NC	NC		NC	NC
7440-47-3	Chromium (total)	4.34E+01	USEPA R4	4.34E+01	2.60E+01	4.30E+01	Sediment - Aquatic Community Organisms	4.34E+01	4.34E+01
18540-29-9	Hexavalent Chromium	6.60E+02	LANL	NC	NC	6.60E+02	Sediment - Violet-green Swallow	NC	NC
67-66-3	Chloroform	8.70E-02	USEPA R4	8.70E-02	5.94E-02	9.20E+00	Sediment - Occult Little Brown Myotis Bat	NC	NC

Note

(1) All Ecological Screening Values (ESVs) are in milligrams per kilogram (mg/kg).

(2) Hierarchy of surface soil ecological screening values are as follows (in order of preference): USEPA R4; USEPA R6; LANL; MacDonald (2000); and USEPA R3.

(3) Assumed 1% organic carbon for those chemicals where applicable.

(4) The ESV for most conservative PCB was used as a surrogate criterion for individual PCBs where applicable.

(5) The No Effect ESV for invertebrates or aquatic community organisms was used when it was available. When it wasn't, the lowest and most conservative No Effect ESV was used.

BHC	Hexachlorocyclohexane	LMW	Low Molecular Weight
CaCO3	Calcium carbonate	mg/kg	Milligram per kilogram
DDD	Dichlorodiphenyldichloroethylene	NC	No Criterion
DDE	Dichlorodiphenyldichloroethylene	PeCDD	Pentachlorodibenzo-p-furan
DDT	Dichlorodiphenyltrichloroethane	PeCDF	Pentachlorodibenzofuran
ESV	Ecological Screening Value	PAHs	Polycyclic Aromatic Hydrocarbons
EPN	Ethylp-nitrophenyl thionobenzenephosphonate	PCBs	Polychlorinated biphenyls
FW	Freshwater	TCDD	Tetrachlorodibenzodioxin
HMW	High Molecular Weight	TCDF	Tetrachlorodibenzofuran
HPCDD	Heptachlorodibenzo-p-dioxin	TEQ	Toxic equivalency
HPCDF	Heptachlorodibenzofuran	TPH	Total Petroleum Hydrocarbons
HXCDD	Hexachlorodibenzo-p-dioxin mixture		
HxCDF	Heptachlorodibenzofuran mixture		
LANL	Los Alamos National Laboratory		

References

LANL. 2019. "ECORISK Database (Release 4.1)." LANL and National Nuclear Security Adminstration. https://www.lanl.gov/environment/protection/eco-risk-assessment.php (Accessed: January 10, 2019).

MacDonald 2000: MacDonald D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology 39: 20-31.

USEPA R3 ESVs: USEPA Region 3. Freshwater Sediment Screening Benchmarks. https://www.epa.gov/risk/freshwater-sediment-screening-benchmarks (Accessed June 20, 2018).

USEPA R4 ESVs: USEPA Region 4. Regional Ecological Risk Assessment (ERA) Supplemental Guidance. https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance (Accessed April 16, 2018).

USEPA R6 ESVs: USEPA Region 6. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (EPA530-D-99-001A). August.

TABLE 5-3c: Surface Water Ecological Screening Values (All Data mg/L)
Nevada Environmental Response Trust Site
Henderson, Nevada

CASRN	Chemical Name	Preferred ESV [1, 2] (mg/L)	Source		NRWQC		USEPA R4 [3]		USEPA R6		LANL	Source		Suter and Tsao (1996)		USEPA R3
14866-68-3	**Chlorate**	NC	--		NC		NC		NC		NC			NC		NC
14797-73-0	**Perchlorate**	6.00E-01	USEPA 2002		NC		NC		NC		3.50E+01	Water - Montane Shrew		NC		NC
TOC	**Total Organic Carbon**	NC	--		NC		NC		NC		NC			NC		NC
7440-47-3	**Chromium (total)**	1.10E-02	LANL		NC		NC		NC		1.10E-02	Water - Aquatic Community Organisms		NC		8.50E-02
18540-29-9	**Hexavalent Chromium**	1.10E-02	NRWQC		1.10E-02		1.10E-02		1.10E-02		1.10E-02	Water - Aquatic Community Organisms		NC		1.10E-02
67-66-3	**Chloroform**	1.40E-01	USEPA R4		NC		1.40E-01		2.80E-02		1.80E-03	Water - Aquatic Community Organisms		2.80E-02		1.80E-03

Note

(1) All Ecological Screening Values (ESVs) are in milligrams per kilogram (mg/L).

(2) Hierarchy of surface soil ecological screening values are as follows (in order of preference): NRWQC; USEPA R4; USEPA R6; LANL; Suter and Tsao (1996); and USEPA R3. The LANL value ESL is for a shrew which is not a purely aquatic organisms; therefore, as a conservative measure USEPA 2002 was used for an ESV.

(3) USEPA R4 FW ESVs may have one or more types of ESVs (hardness-dependent, narcotic mode of action, PAH-specific). The ESVs listed in this table is from Table 1A in the USEPA R4 guidance; however, the most appropriate ESV will be selected from the guidance upon review of the data.

(4) The ESV for most conservative PCB was used as a surrogate criterion for individual PCBs where applicable.

(5) The No Effect ESV for invertebrates or aquatic community organisms was used when it was available. When it wasn't, the lowest and most conservative No Effect ESV was used. For perchlorate, perchlorate ion was used as a surrogate. Assumed "Water" in database was freshwater.

BHC	Hexachlorocyclohexane	LMW	Low Molecular Weight
CaCO3	Calcium carbonate	mg/L	Milligram per liter
DDD	Dichlorodiphenyldichloroethylene	NC	No Criterion
DDE	Dichlorodiphenyldichloroethylene	PeCDD	Pentachlorodibenzo-p-furan
DDT	Dichlorodiphenyltrichloroethane	PeCDF	Pentachlorodibenzofuran
ESV	Ecological Screening Value	PAHs	Polycyclic Aromatic Hydrocarbons
EPN	Ethylp-nitrophenyl thionobenzenephosphonate	PCBs	Polychlorinated biphenyls
FW	Freshwater	TCDD	Tetrachlorodibenzodioxin
HMW	High Molecular Weight	TCDF	Tetrachlorodibenzofuran
HPCDD	Heptachlorodibenzo-p-dioxin	TEQ	Toxic equivalency
HPCDF	Heptachlorodibenzofuran	TPH	Total Petroleum Hydrocarbons
HXCDD	Hexachlorodibenzo-p-dioxin mixture		
HxCDF	Heptachlorodibenzofuran mixture		
LANL	Los Alamos National Laboratory		

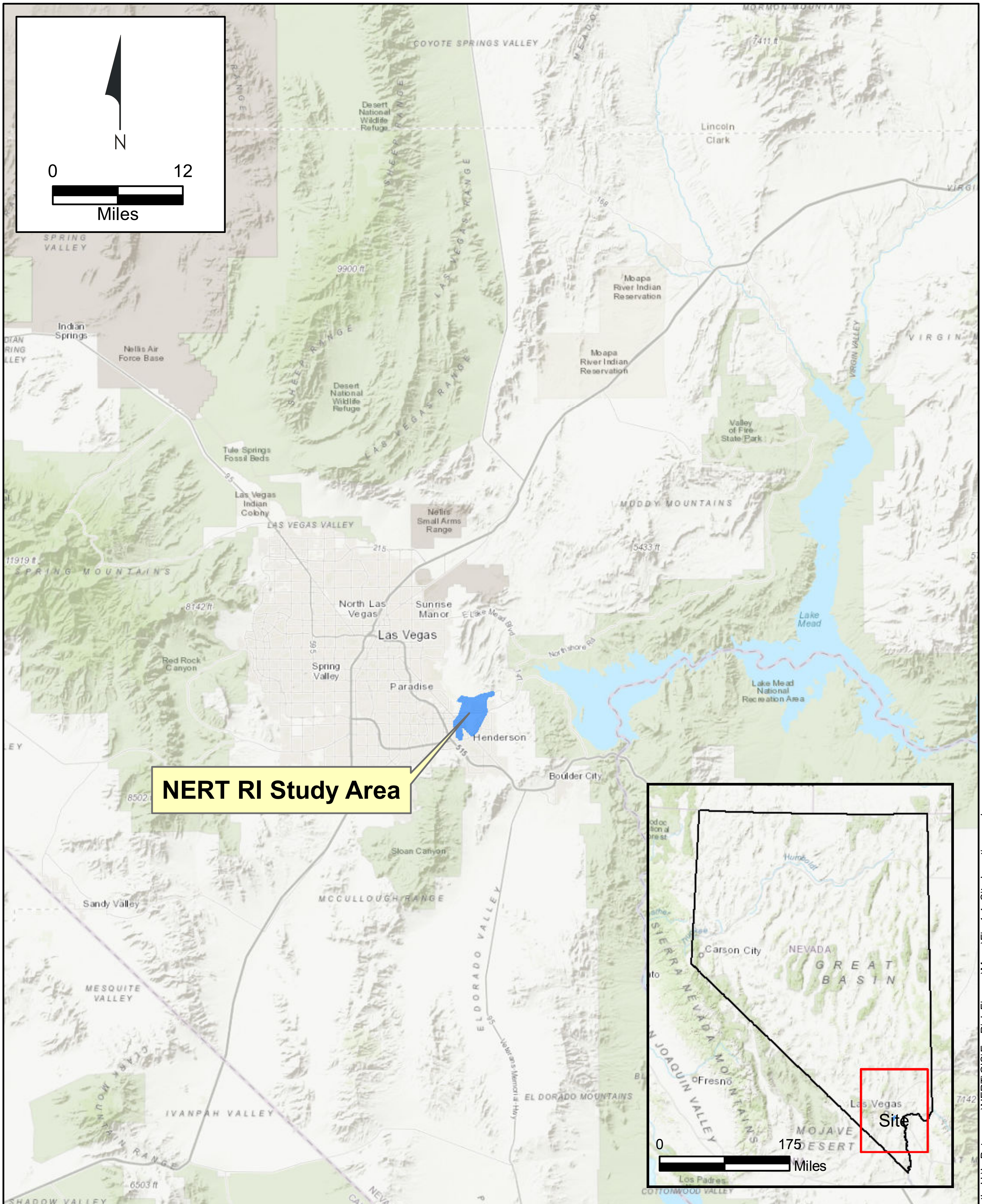
LANL. 2019. "ECORISK Database (Release 4.1)." LANL and National Nuclear Security Adminstration. https://www.lanl.gov/environment/protection/eco-risk-assessment.php (Accessed: January 10, 2019).

USEPA R4 ESVs: USEPA Region 4. Regional Ecological Risk Assessment (ERA) Supplemental Guidance. https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance (Accessed April 16, 2018).

USEPA R6 ESVs: USEPA Region 6. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (EPA530-D-99-001A). August.

USEPA National Recommended Water Quality Criteria -- Aquatic Life Criteria. https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

FIGURES



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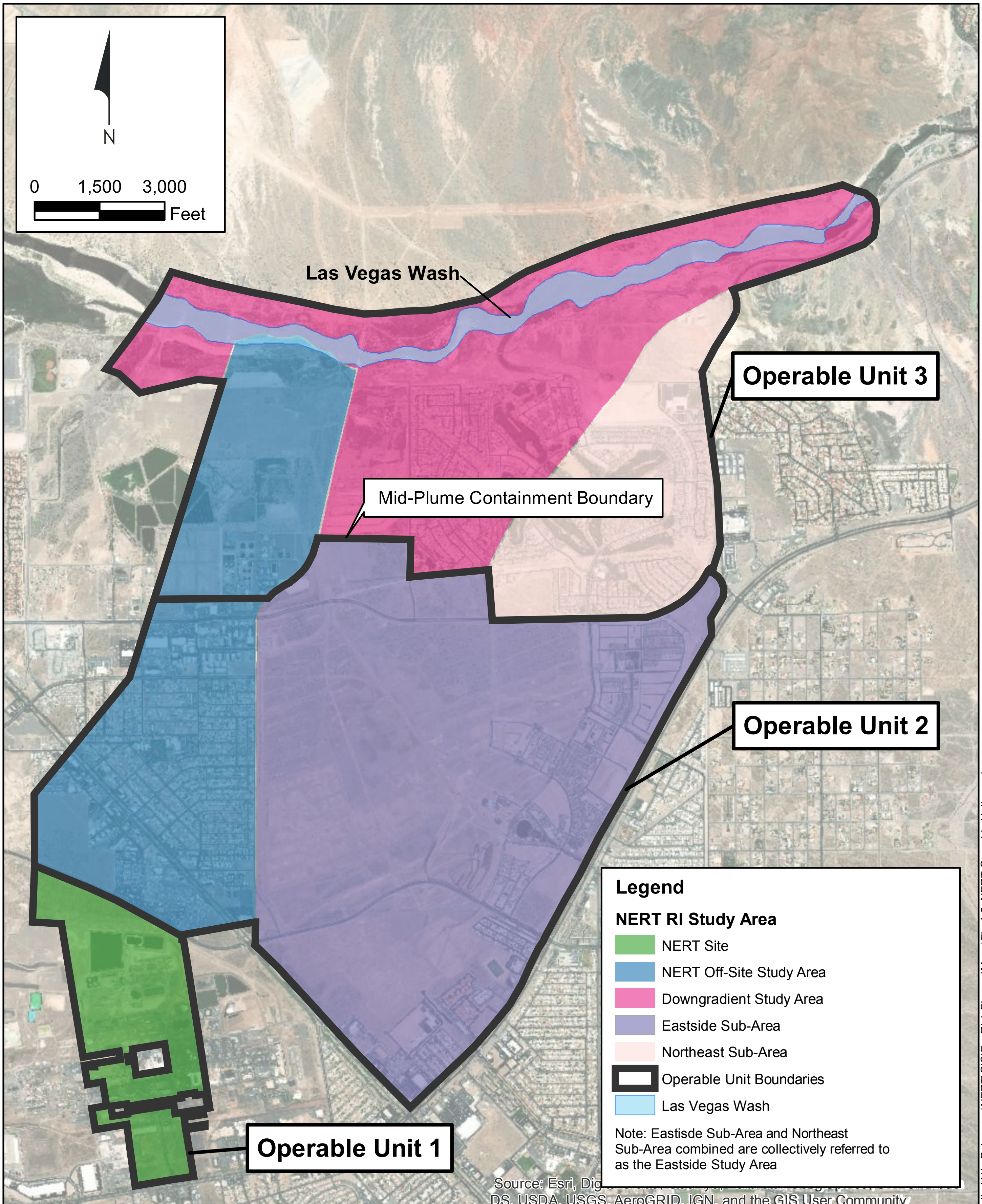
RAMBOLL

NERT RI Study Area Location Map

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **1-1**

Drafter: RS	Date: 10/2/2018	Contract Number: 169000 6943	Approved by:	Revised:



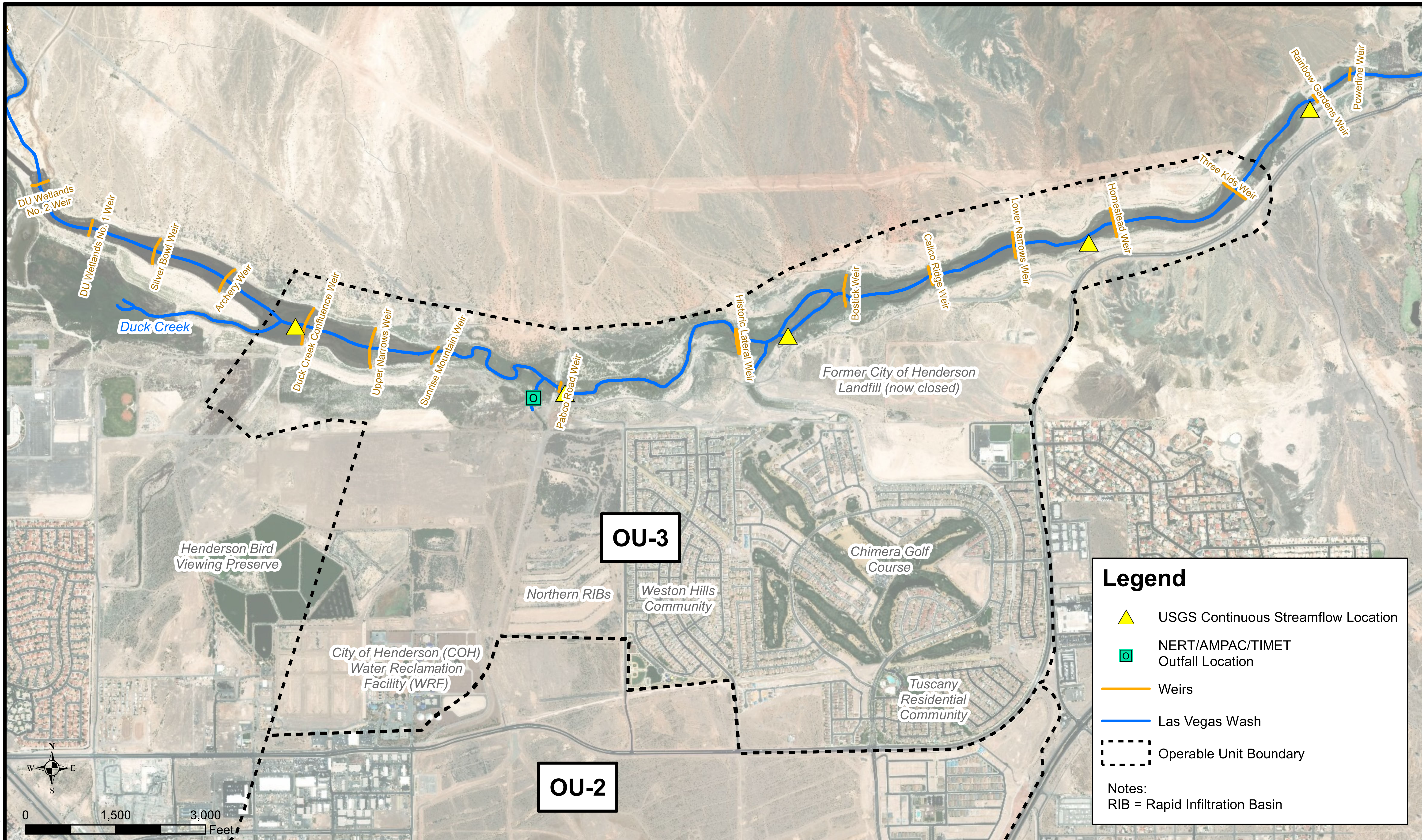
RAMBOLL

NERT Operable Units and RI Study Areas

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure 1-2

Drafter: RS Date: 10/2/2018 Contract Number: 169000 6943 Approved by: Revised:



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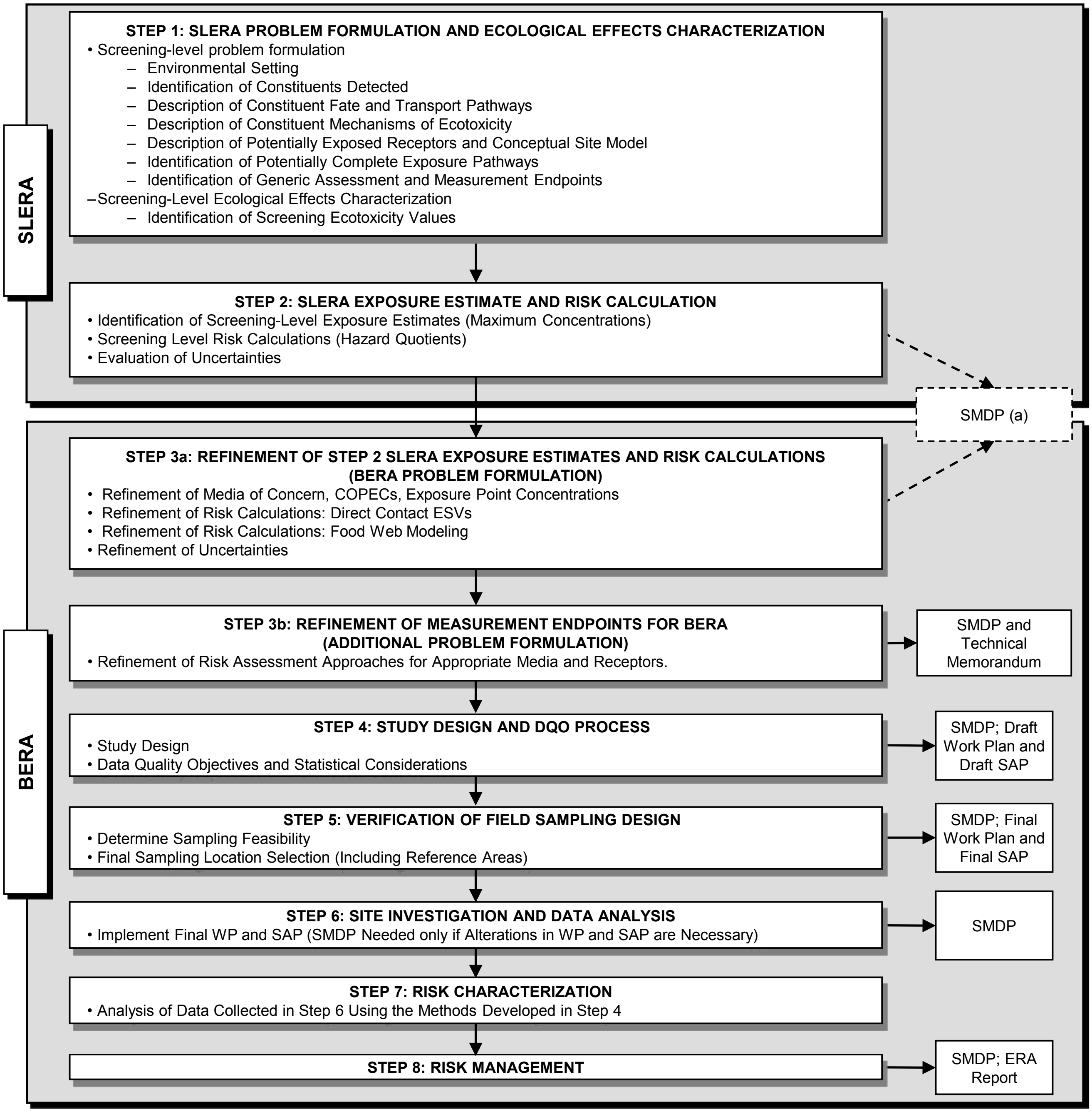
RAMBOLL

DRAFTED BY: EF | DATE: 7/24/2018

OU-3 and Las Vegas Wash Weirs
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
1-3

PROJECT: 1690006933-018



Notes:

COPEC	Chemical of Potential Ecological Concern.
DQO	Data Quality Objectives.
ERA	Ecological Risk Assessment.
ESV	Ecological Screening Value.
SAP	Sampling and Analysis Plan.
SMDP	Scientific Management Decision Point.
WP	Work Plan.
BERA	Baseline ERA.
SLERA	Screening-level ERA.
USEPA	United State Environmental Protection Agency.

(a) SMDP occurs EITHER after Step 2 or after Step 3a.

Source: Adapted from Figure 1-2 of USEPA 1997 (modification to reflect the Step 1-3a elements specific to the Chemtronics ERA).

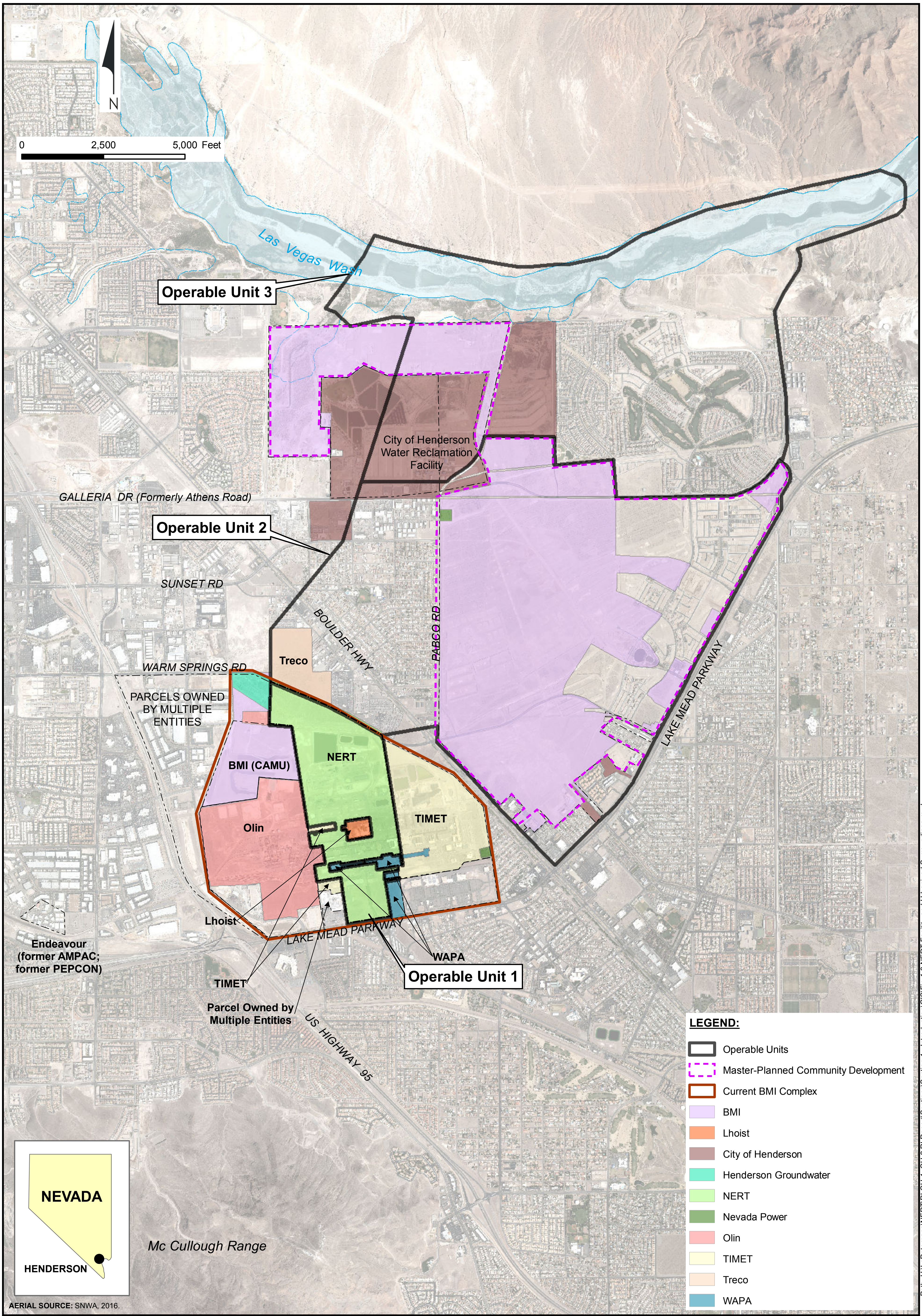
RAMBOLL

USEPA Expanded Eight-Step Ecological Risk Assessment Process

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **1-4**

Drafter: RS Date: 5/8/2018 Contract Number: 169000 6943 Approved by: Revised:

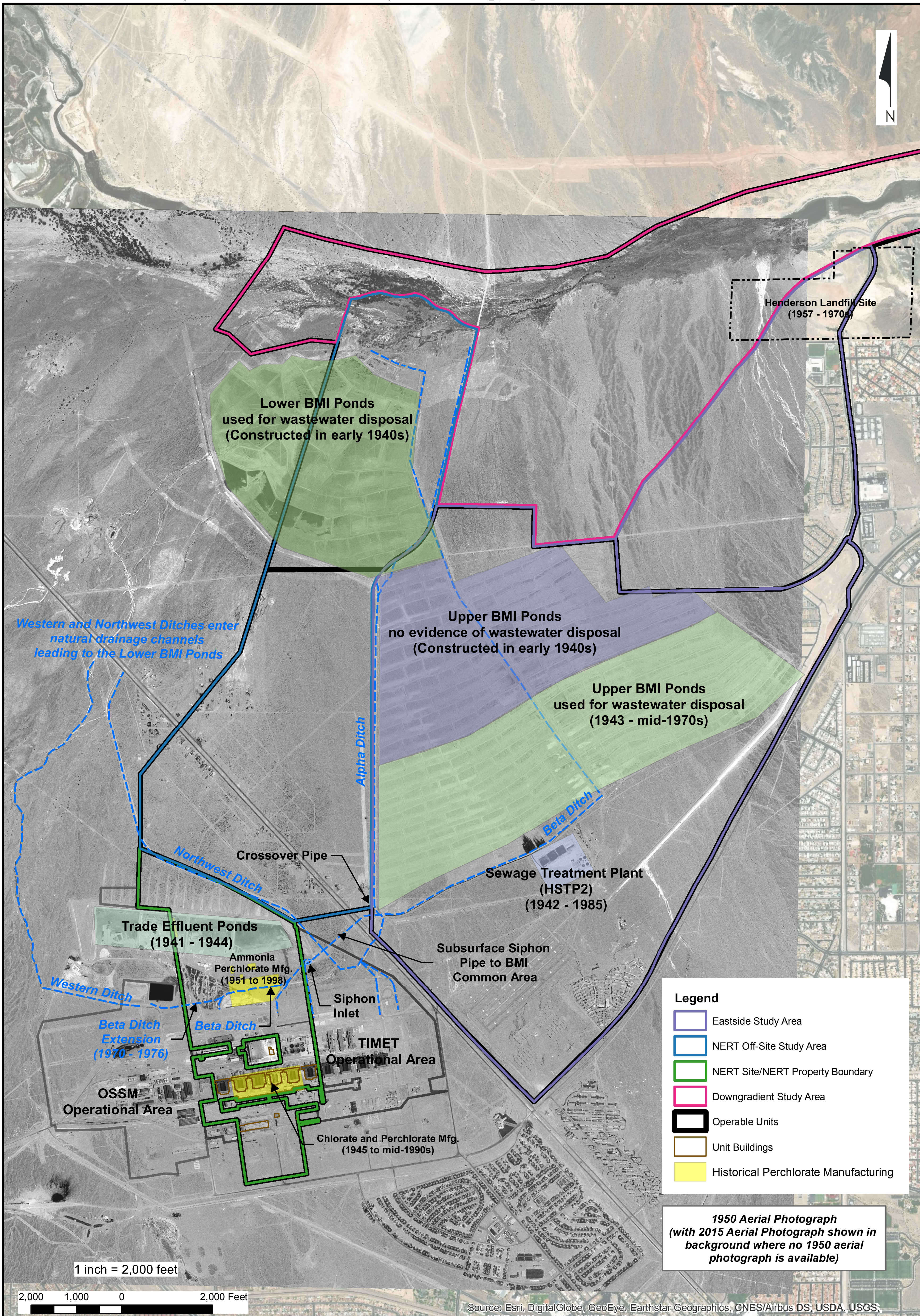


Surrounding BMI Complex Facilities
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
2-1

Drafter: RS | Date: 10/16/2018 | Contract Number: 169000 6943 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment - Ecological\OU-3 BERA Work Plan\2018 07 22 Files\OU-3 BERA Figures 2018 07 22\Archive\BMI_Operations_1940-1976.mxd



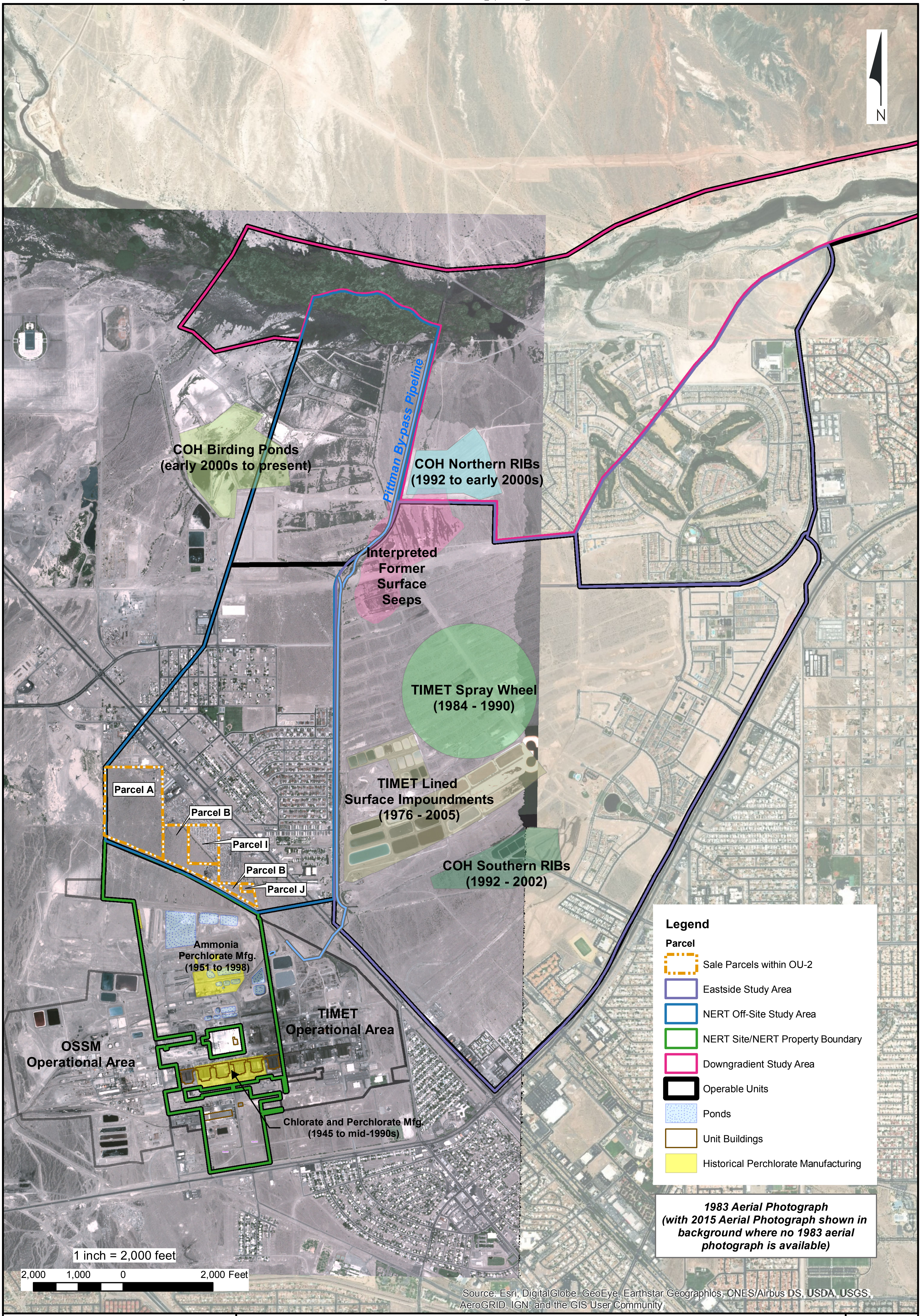
RAMBOLL

Historical Wastewater Ponds (established before 1975)
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
2-2

Drafter: RS | Date: 7/24/2018 | Contract Number: 169000 6943 | Approved by: | Revised:

Path: H:\LePetomane\NERT\Risk Assessment - Ecological\OU-3 BERA Work Plan\2018 07 22 Files\OU-3 BERA Figures 2018 07 22\Archive\BMI_Operations_1976-2005.mxd

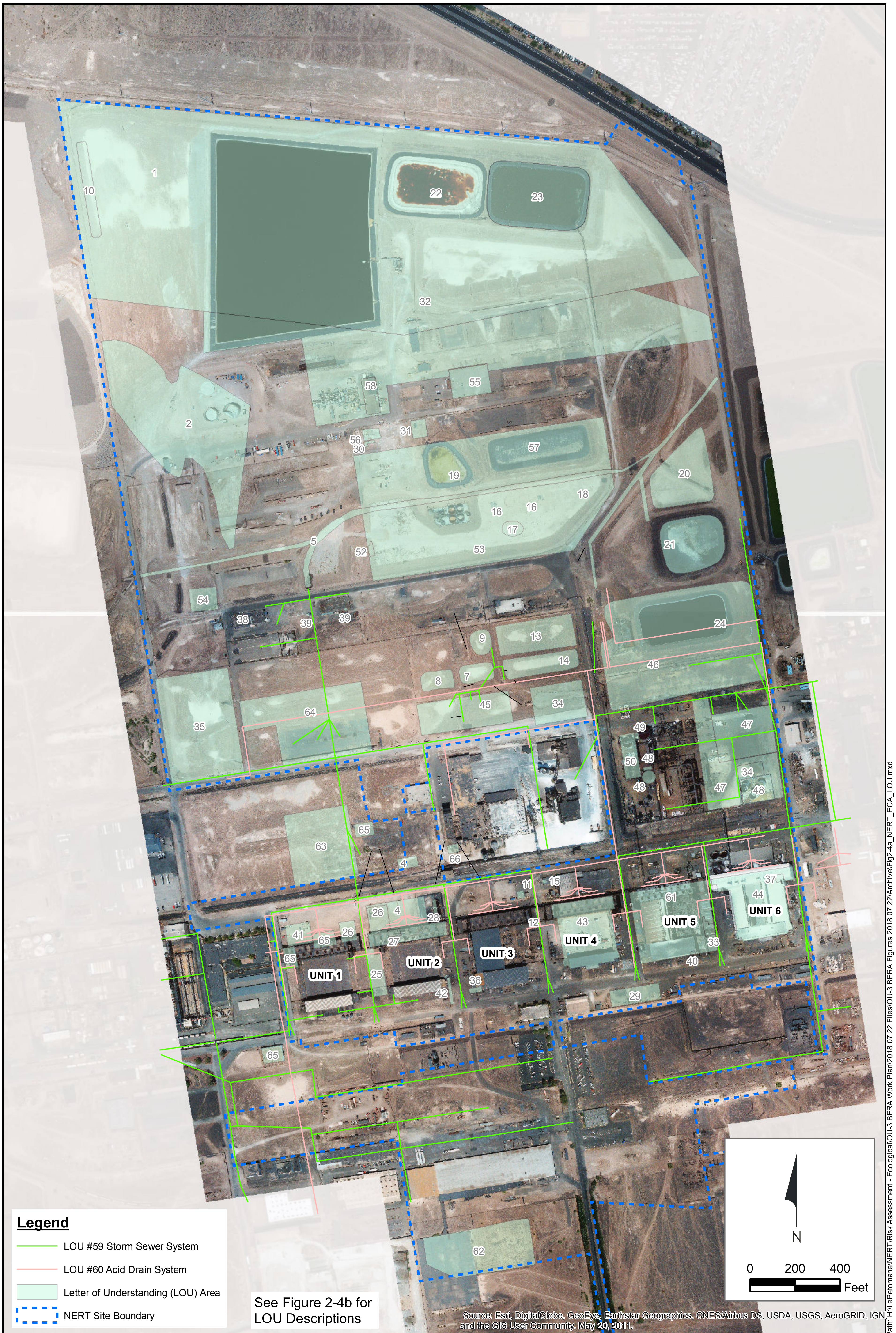


RAMBOLL

Historical Wastewater Ponds (1976 - Present)
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
2-3

Drafter: RS | Date: 7/24/2018 | Contract Number: 169000 6943 | Approved by: | Revised:



RAMBOLL

LOU Locations

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **2-4a**

Drafter: RS | Date: 10/5/2018 | Contract Number: 1690006606 | Approved by: | Revised:

LOU #	LOU Description
1	Trade Effluent Settling Ponds
2	Open Area Due South of Trade Effluent Settling Ponds
3	Air Pollution Emissions Associated with Industrial Processes
4	Former Hardesty Chemical Company Site
5	On-Site Portion of Beta Ditch Including the Small Diversion Ditch
6	Unnamed Drainage Ditch Segment
7	Old P-2 Surface Impoundment
8	Old P-3 Surface Impoundment
9	New P-2 Pond and Associated Piping
10	On-Site Hazardous Landfill
11	Sodium Chlorate Filter Cake Area North of Unit 3
12	Hazardous Waste Storage Area Between Units 3 and 4
13	Closed Surface Impoundment S-1
14	Closed Surface Impoundment P-1
15	Platinum Drying Unit North of Unit 4
16	Ponds AP-1, AP-2 and AP-3 and Associated Transfer Lines
17	Ponds AP-1, AP-2 and AP-3 and Associated Transfer Lines
18	Pond AP-4
19	Pond AP-5
20	Pond C-1 and Associated Piping
21	Pond MN-1 and Associated Piping
22	Ponds WC-West and Associated Piping
23	Ponds WC-East and Associated Piping
24	Leach Beds, Associated Conveyance Facilities and Former Manganese Tailings Area
25	Process Hardware Storage Area Between Units 1 and 2
26	Trash Storage Area North of Units 1 and 2
27	PCB Storage Area - Unit 2
28	Hazardous Waste Storage Area North of Unit 2
29	Solid Waste Dumpsters
30	Ammonium Perchlorate Area- Pad 35
31	Drum Crushing and Recycling Area
32	Groundwater Remediation Unit
33	Sodium Perchlorate Platinum By-Product Filter
34	Manganese Tailings Area
35	Truck Unloading Area
36	Former Satellite Accumulation Point - Unit 3, Maintenance Shop
37	Former Satellite Accumulation Point - Unit 6, Maintenance Shop
38	Former Satellite Accumulation Point - AP Laboratory
39	Former Satellite Accumulation Point - AP Maintenance Shop
40	PCB Transformer Spill
41	Unit 1 Tenants - Stains
42	Unit 2 Salt Redler
43	Unit 4 and 5 Basements
44	Unit 6 Basements
45	Diesel Storage Tank Area - Stains
46	Former Old Main Cooling Tower and Recirculation Lines
47	Leach Plant Area Manganese Ore Piles
48	Leach Plant Area Anolyte Tanks
49	Leach Plant Area Sulfuric Acid Storage Tank
50	Leach Plant Area Leach Tanks
51	Leach Plant Area Transfer Lines To/From Unit 6
52	AP Plant Area Screening Building, Dryer Building, and Associated Sump
53	AP Plant Area Tank Farm
54	AP Plant Area Change House/Laboratory and Septic Tank
55	AP Plant Area Storage Pads - Fire
56	AP Plant Area Old Building D-1 Washdown
57	AP Plant Area New Building D-1 Washdown
58	AP Plant SI and Transfer Lines To/From AP SI
59	Storm Sewer System
60	Acid Drain System
61	Old Sodium Chlorate Plant Decommissioning
62	State Industries Inc. Site, Including Impoundments and Catch Basin
63	J.B. Kellet, Inc. Trucking Site
64	Koch Materials Company
65	Assorted KMCC Tenants
66	Flintkote Company
67	Delbert Madsen and Estate of Delbery Madsen

Path: H:\LePetomane\NERT\Risk Assessment - Ecological\OU-3 BERA Work Plan\2018 07 22 Files\OU-3 BERA Figures 2018 07 22\Archive\Fig2-4b_NERT_LOU_Descriptions.mxd

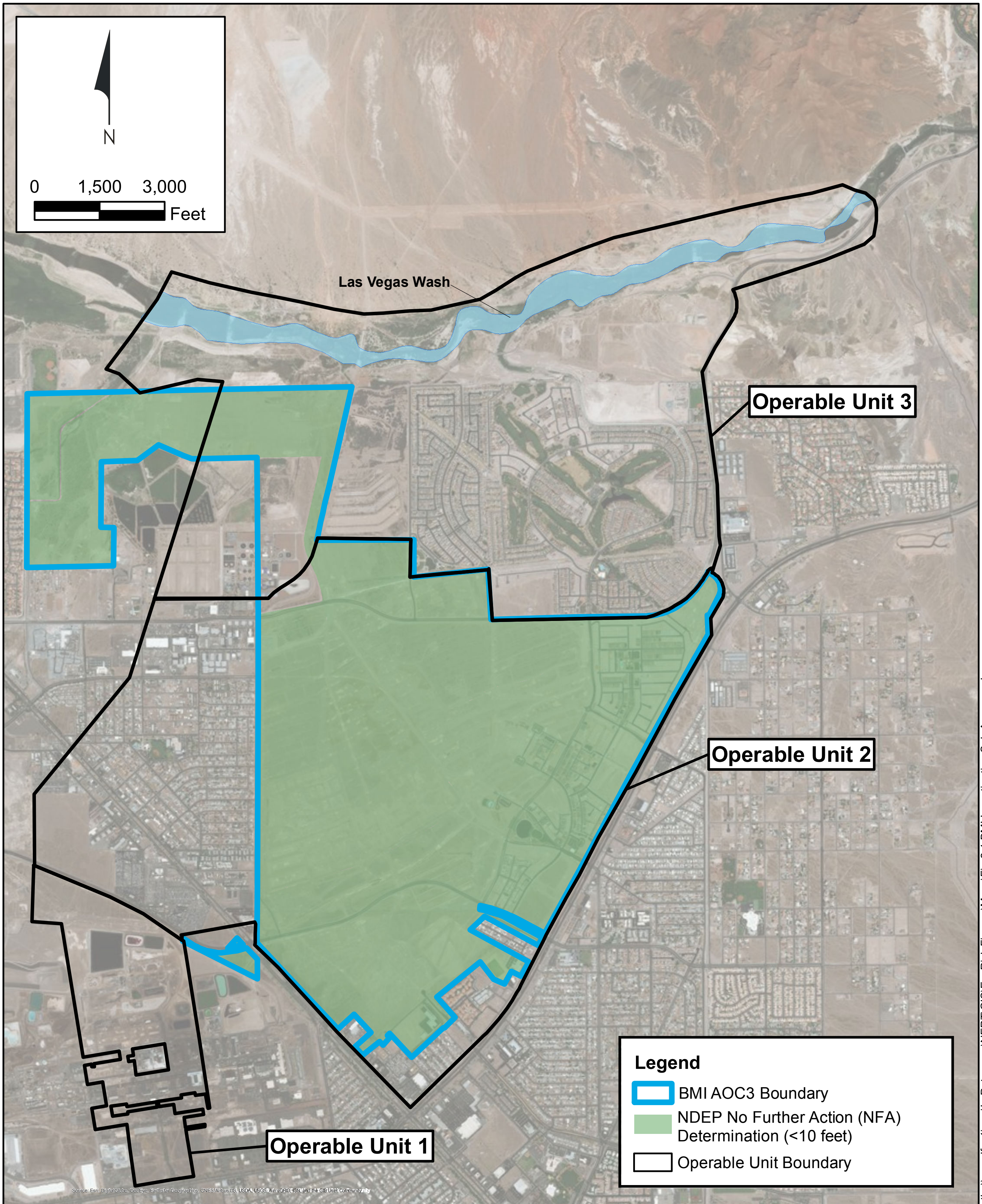
RAMBOLL

LOU Descriptions

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure
2-4b

Drafter: EA Date: 7/24/2018 Contract Number: 1690006941 Approved by: Revised:



Path: \\wcevlfps1\eng\LePetomane\NERT\GIS\EcoRisk Figures\Maps\Fig 2-1 BMI Investigation Sub Areas.mxd

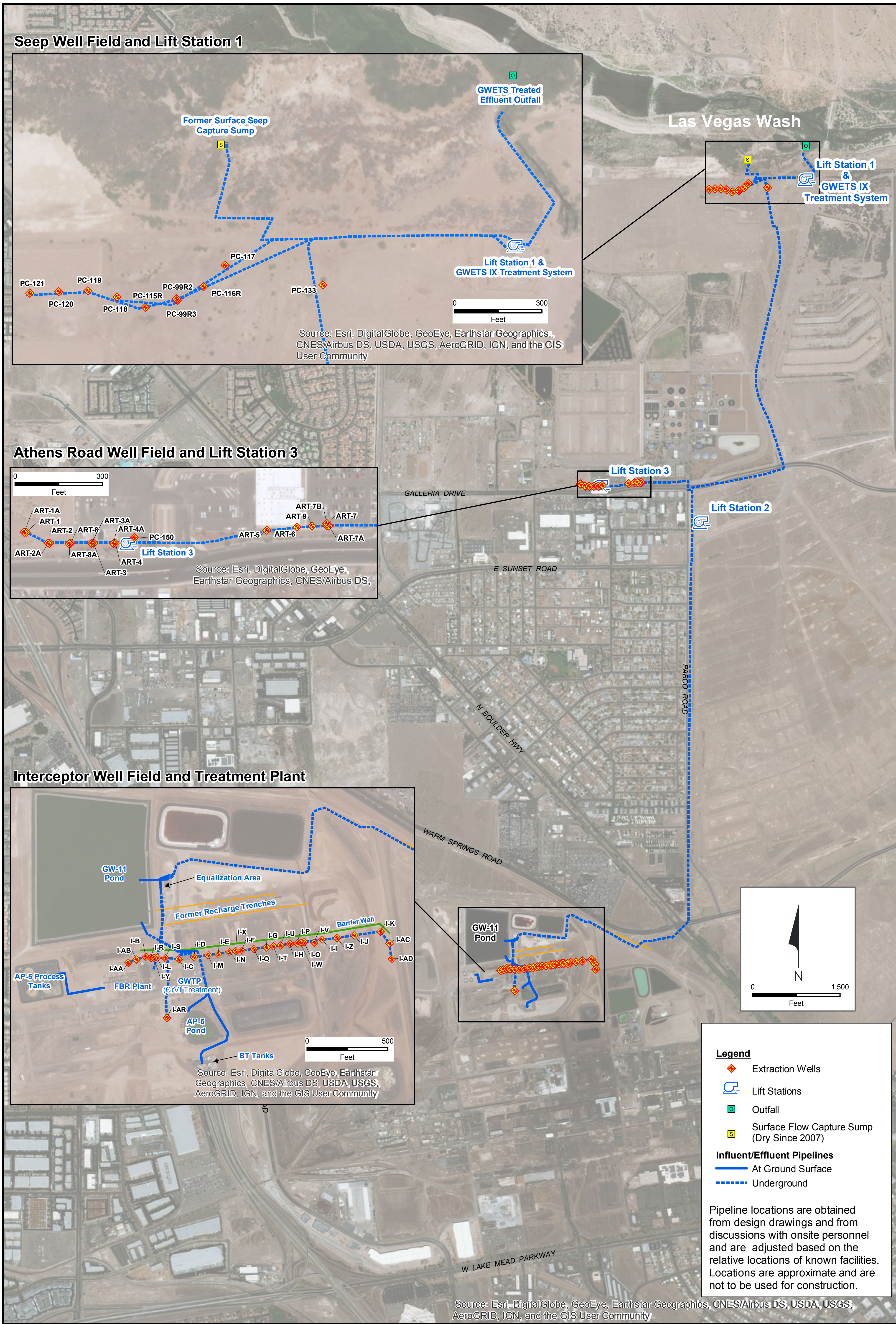
RAMBOLL

BMI Investigation No Further Action Determination Areas

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **2-5**

Drafter: RS | Date: 5/11/2018 | Contract Number: 169000 6943 | Approved by: | Revised:



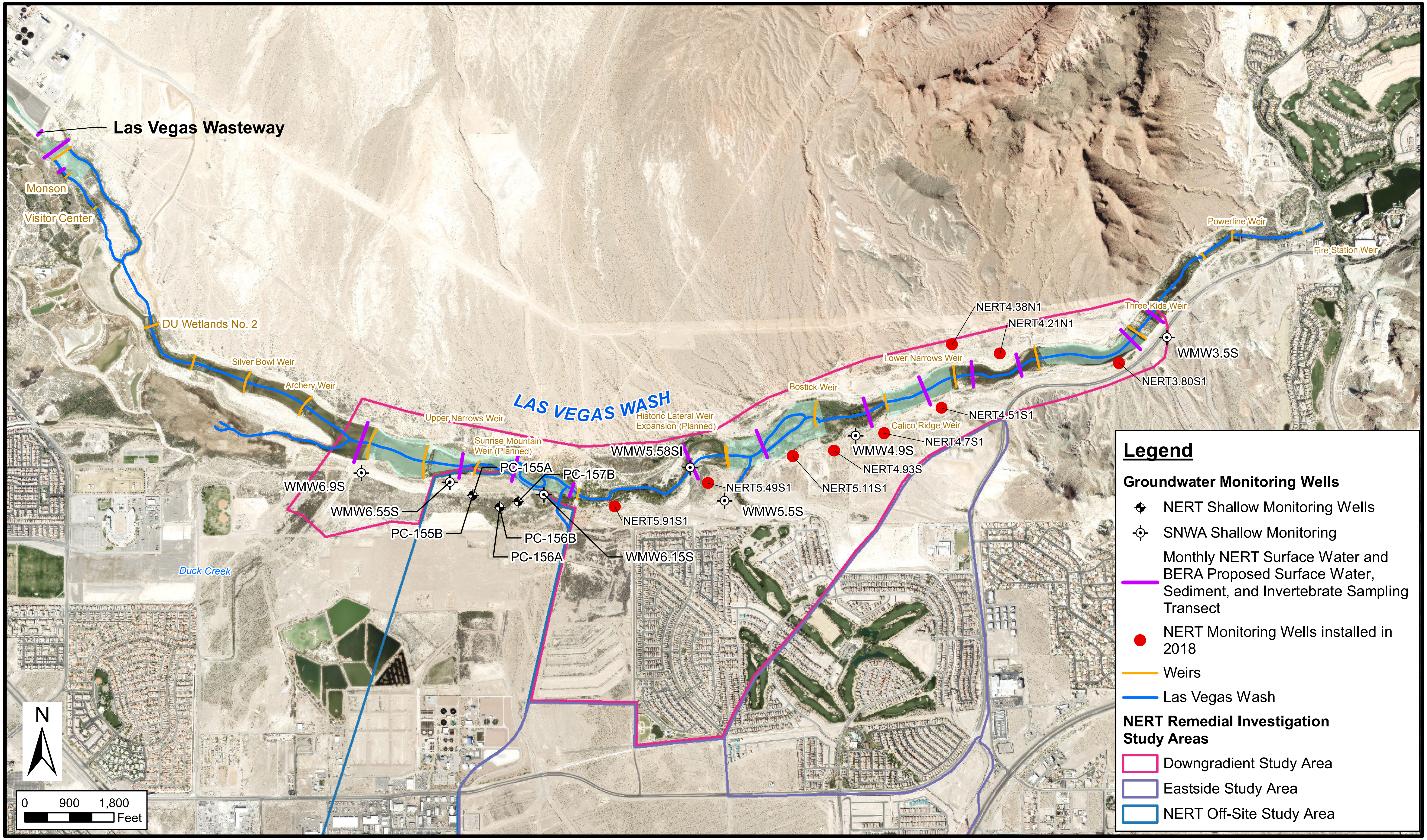
RAMBOLL

GWETS Overview Map

Nevada Environmental Response Trust Site
Henderson, Nevada

FIGURE **2-6**

DRAFTED BY: | DATE: 5/14/2018 | PROJECT: 1690006943



RAMBOLL

DRAFTED BY: EF | DATE: 10/26/2018

Location of Groundwater Monitoring Wells Nearest to the Las Vegas Wash

Nevada Environmental Response Trust Site

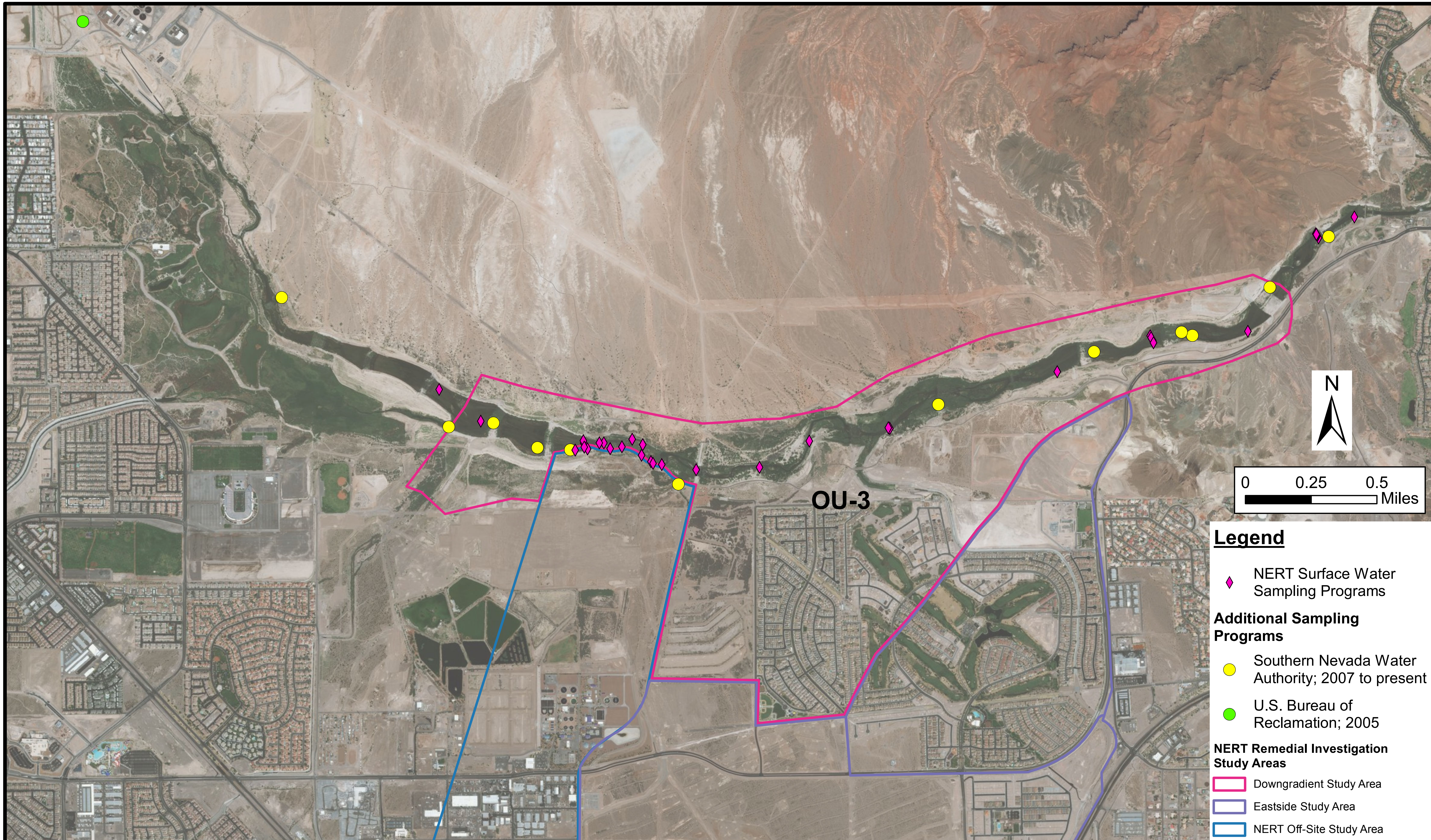
Henderson, Nevada

Figure

3-1

PROJECT: 1690006943-018

H:\LePetomane\NERT\GIS\EcoRisk Figures\2018\Figure 3-1 Monitoring Well Locations-2.mxd



RAMBOLL

NERT and SNWA Surface Water Sampling Locations in the Las Vegas Wash

Nevada Environmental Response Trust Site

Henderson, Nevada

Figure

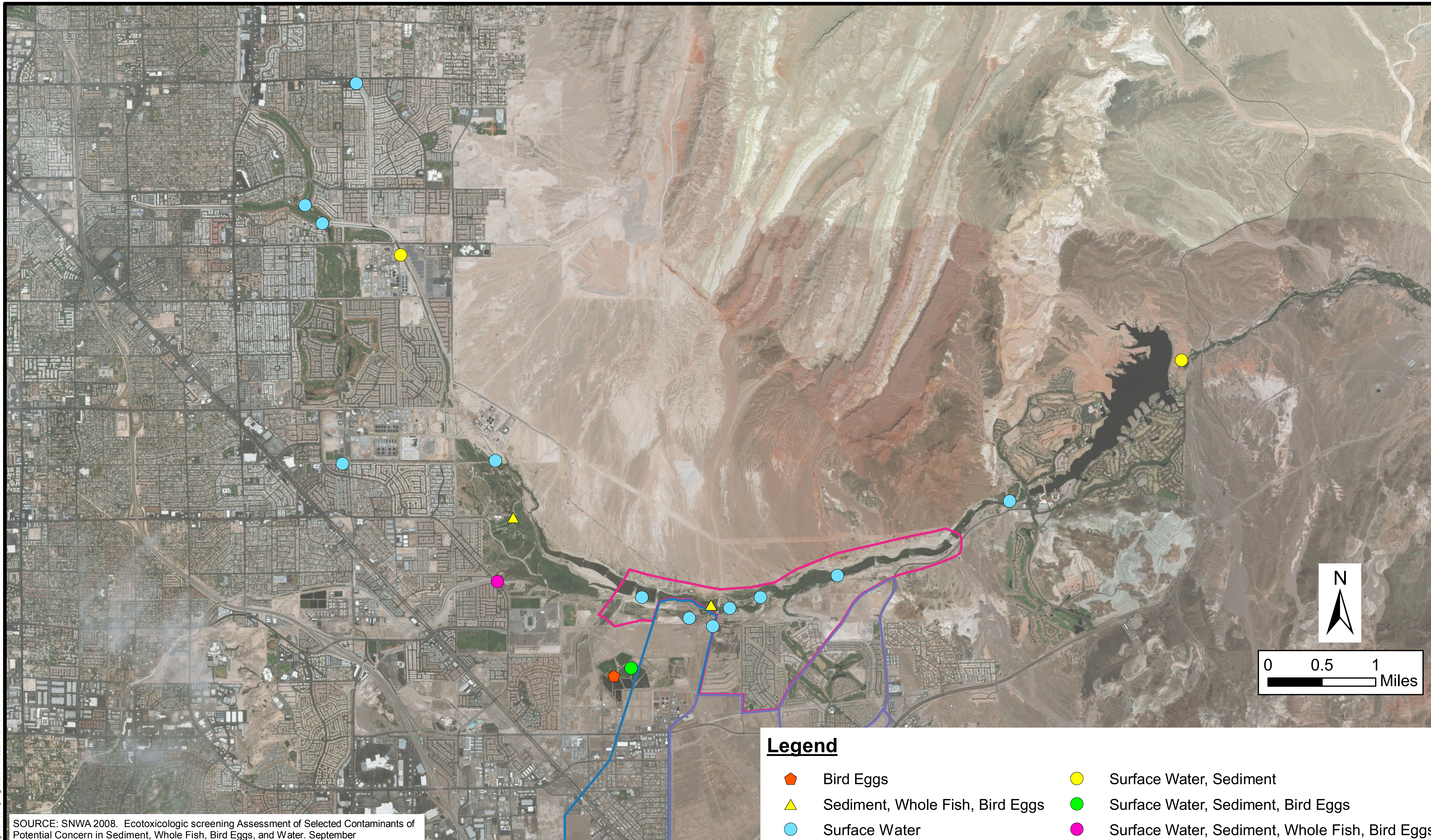
3-2

DRAFTED BY: EF

DATE: 6/19/2018

PROJECT: 16900069433-018

K:\GIS\EcoRisk Figures\2018\All Wash Locations\Figure x All Wash Sampling Location_year.mxd



RAMBOLL

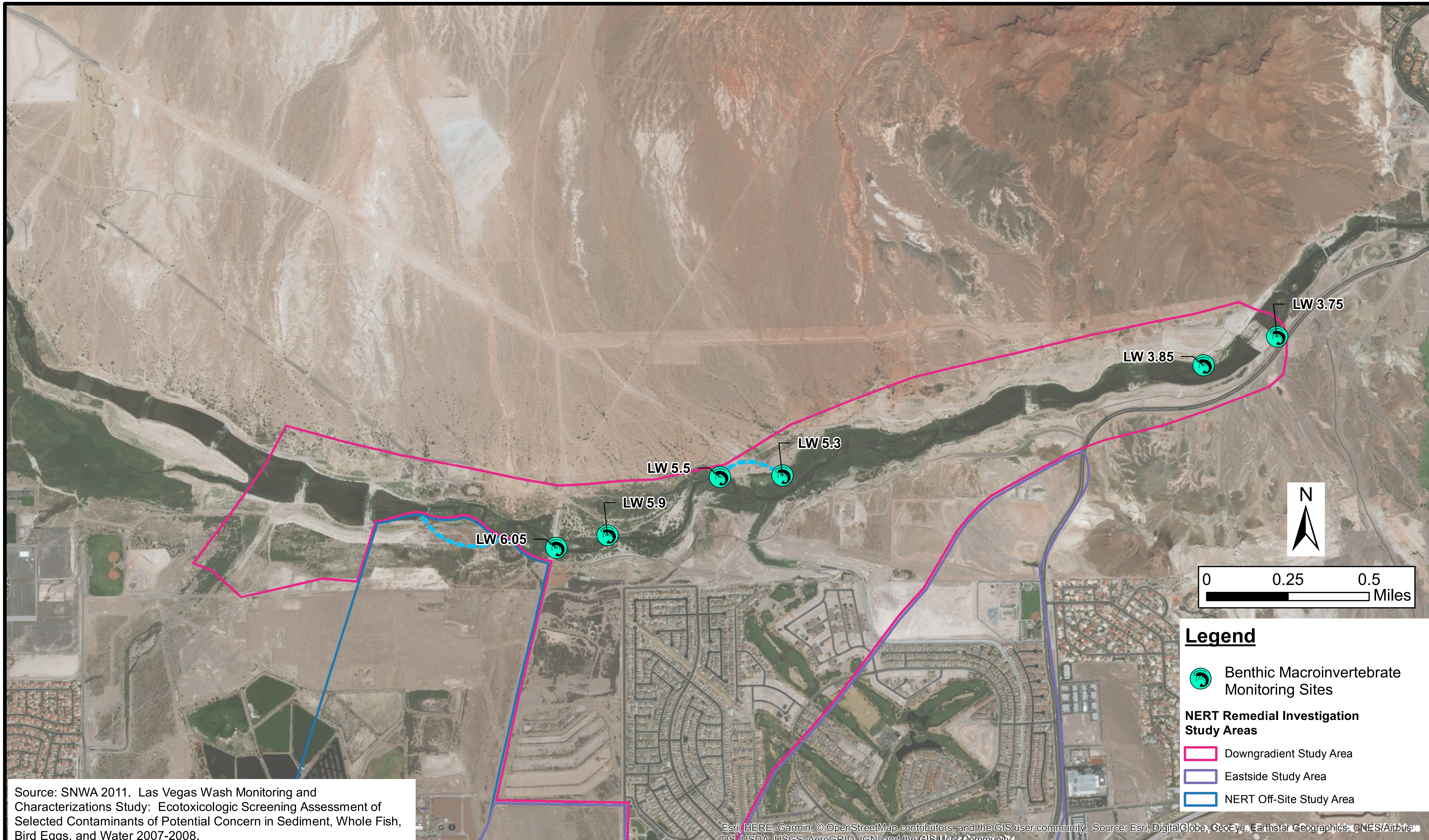
DRAFTED BY: EF | DATE: 6/19/2018

Southern Nevada Water Authority Ecotoxicological Assessment of the Las Vegas Wash and Tributaries

Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
3-3

PROJECT: 16900069433-018



RAMBOLL

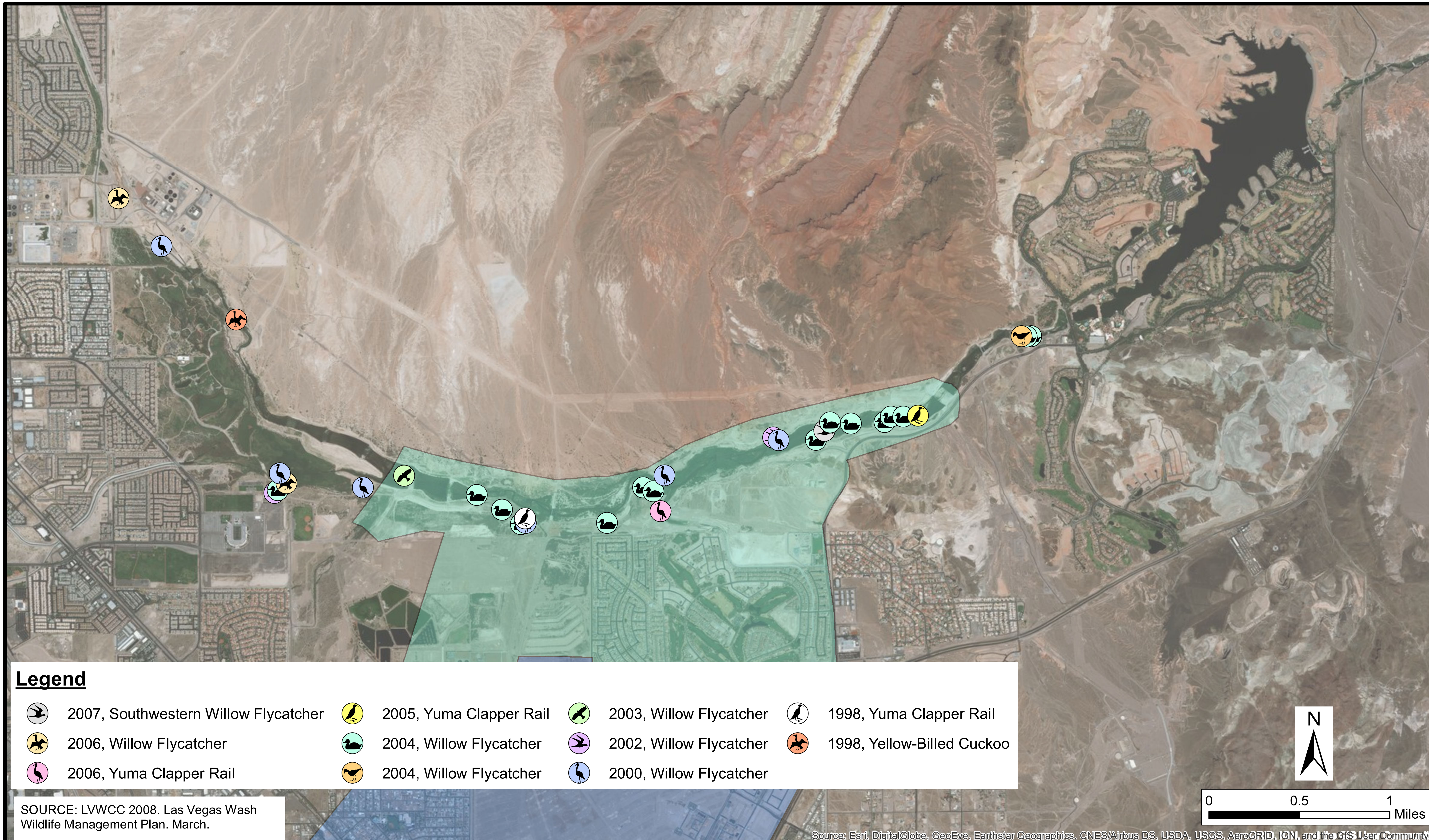
DRAFTED BY: EF | DATE: 6/19/2018

Southern Nevada Water Authority Macroinvertebrate Survey of the Las Vegas Wash

Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
3-4

PROJECT: 1690006943-018



RAMBOLL

DRAFTED BY: EF | DATE: 6/19/2018

Location of Willow Flycatcher, Yuma Clapper Rail and Yellow-Billed Cuckoo in and adjacent to OU-3

Nevada Environmental Response Trust Site

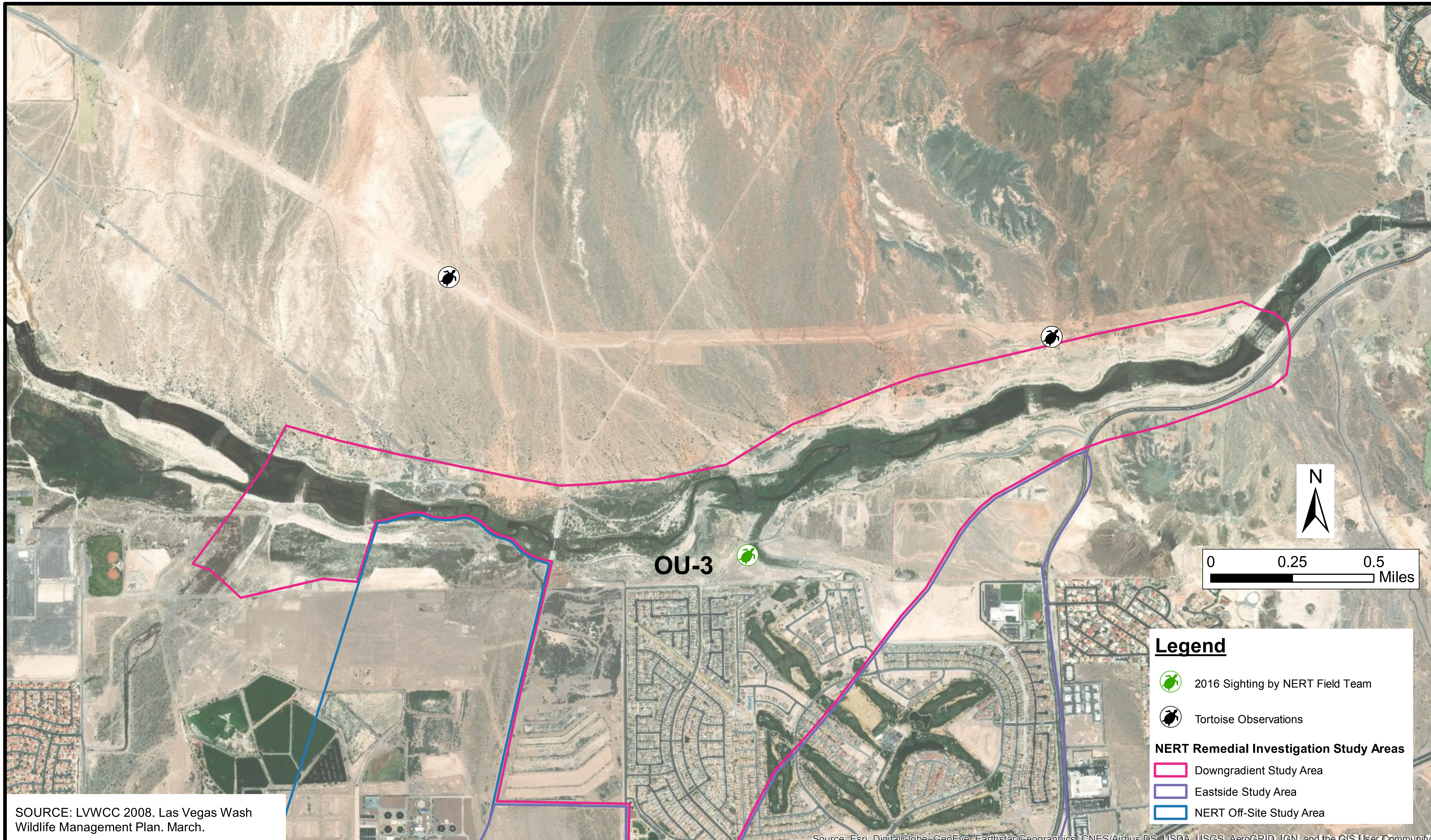
Henderson, Nevada

Figure

3-5

PROJECT: 16900069433-018

K:\GIS\EcoRisk Figures\2018\Figure X Flycatcher.mxd



H:\LePetomane\NERT\GIS\EcoRisk Figures\2018\Figure X Tortoise Locations.mxd

RAMBOLL

DRAFTED BY: EF | DATE: 10/4/2018

Location of Desert Tortoises Documented in and adjacent to OU-3

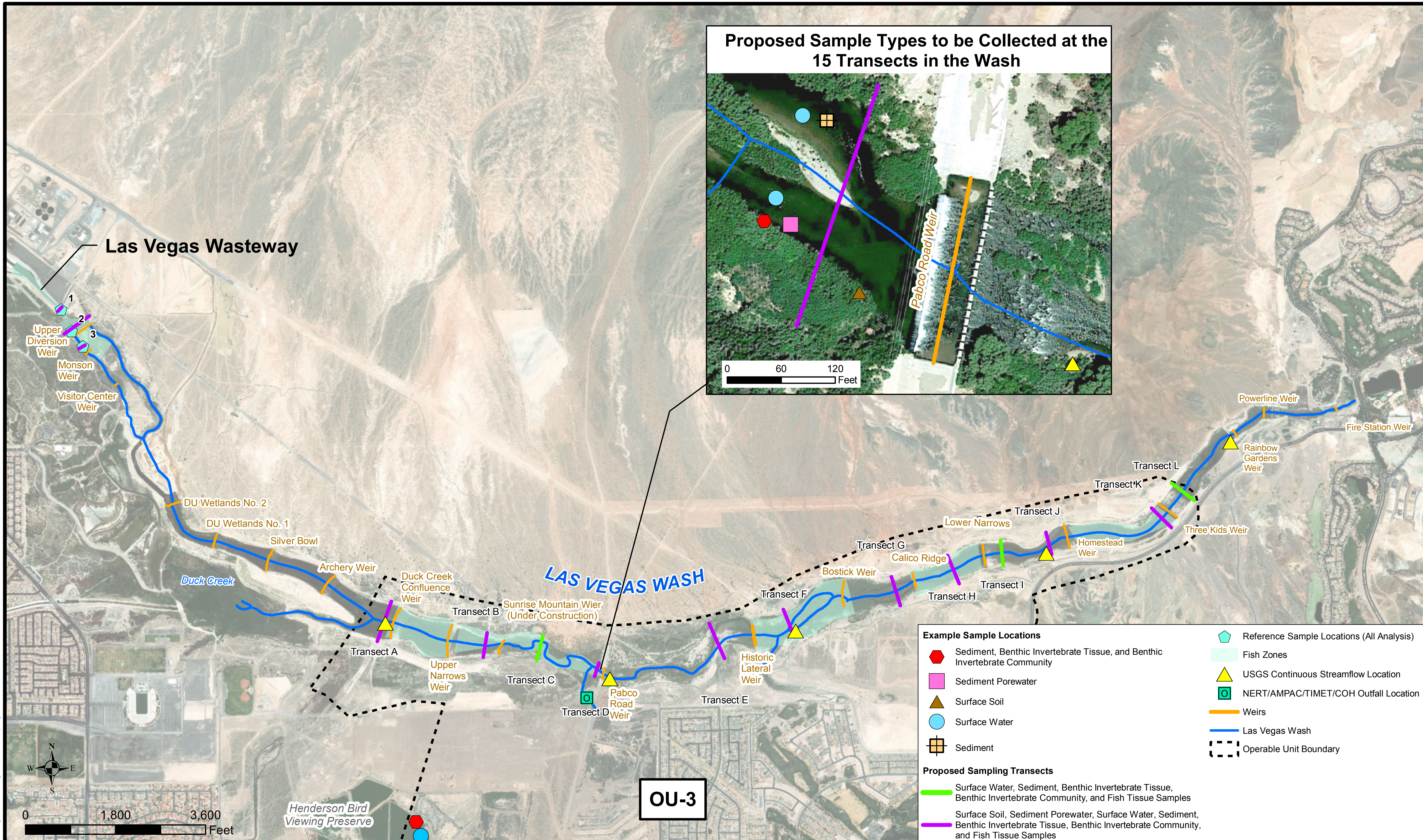
Nevada Environmental Response Trust Site

Henderson, Nevada

Figure

3-6

PROJECT: 1690006943-018



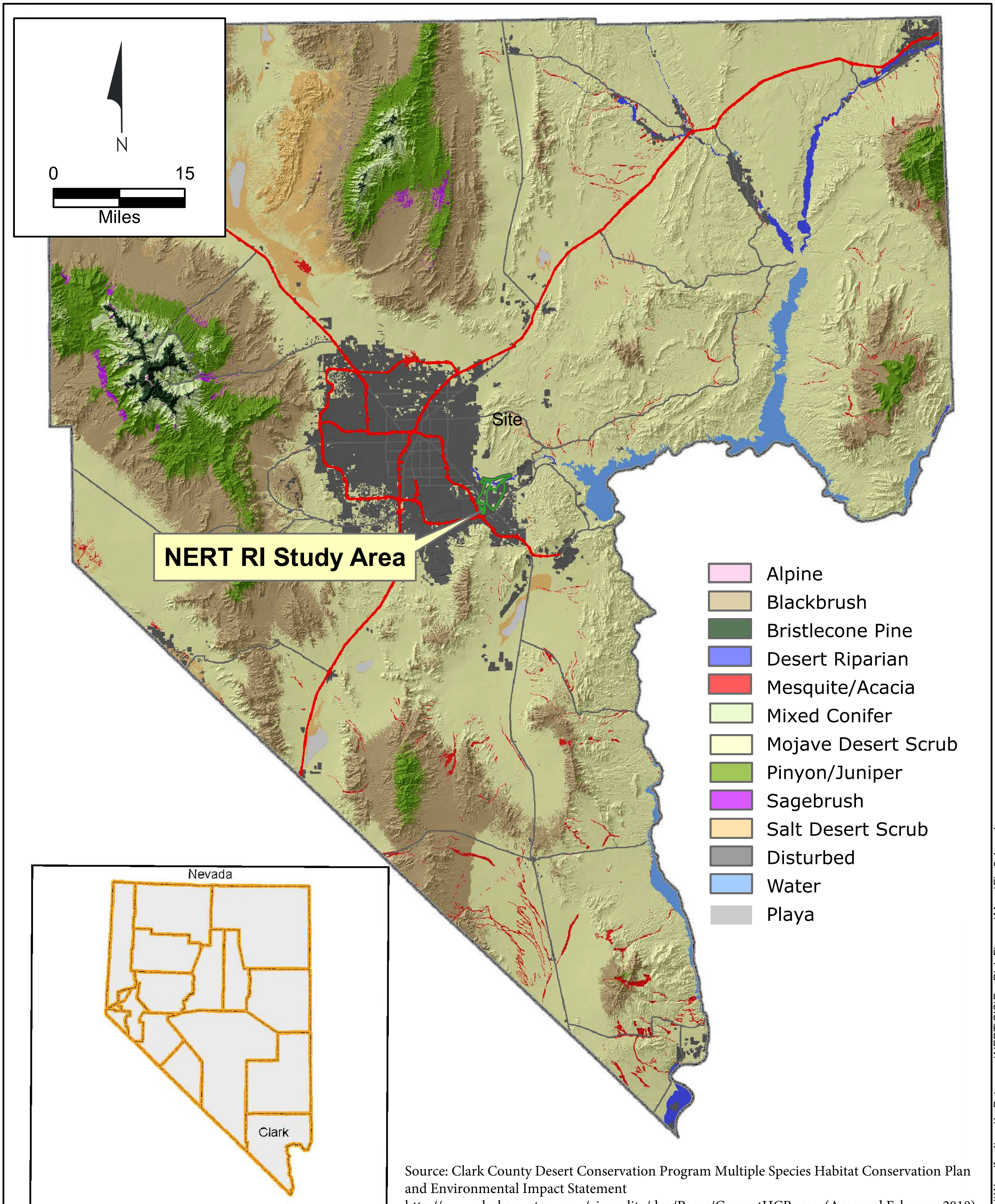
RAMBOLL

DRAFTED BY: EF | DATE: 10/23/2018

Ramboll OU-3 BERA Proposed Sampling Locations
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
4-1

PROJECT: 16900069433-018



Source: Clark County Desert Conservation Program Multiple Species Habitat Conservation Plan and Environmental Impact Statement
http://www.clarkcountynv.gov/airquality/dcp/Pages/CurrentHCP.aspx (Accessed February 2018)

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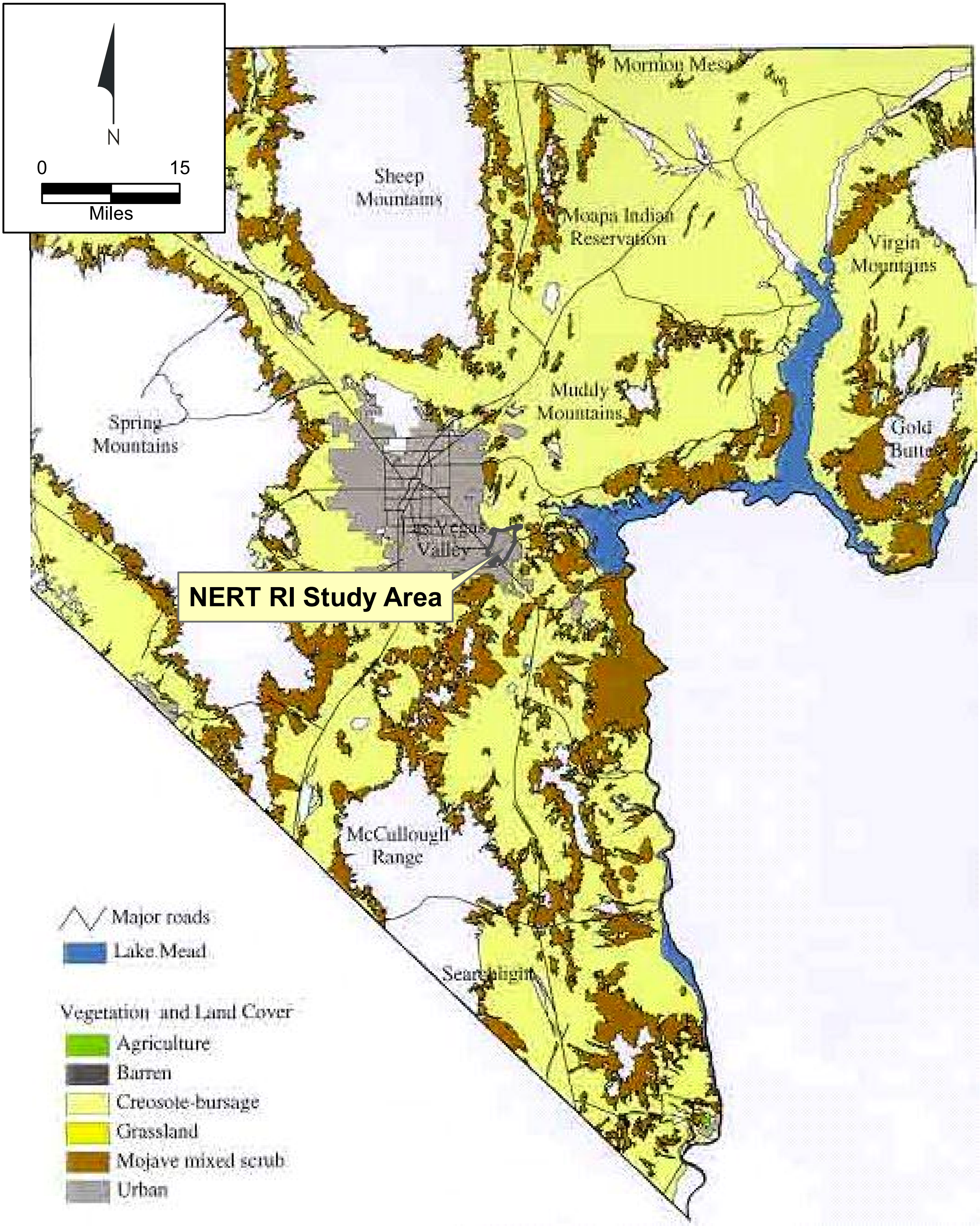
RAMBOLL

Clark County Ecosystem Distribution Map

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-1**

Drafter: RS | Date: 5/8/2018 | Contract Number: 169000 6943 | Approved by: | Revised:



Source: Clark County Desert Conservation Program Multiple Species Habitat Conservation Plan and Environmental Impact Statement http://www.clarkcountynv.gov/airquality/dcp/Pages/CurrentHCP.aspx (Accessed February 2018)

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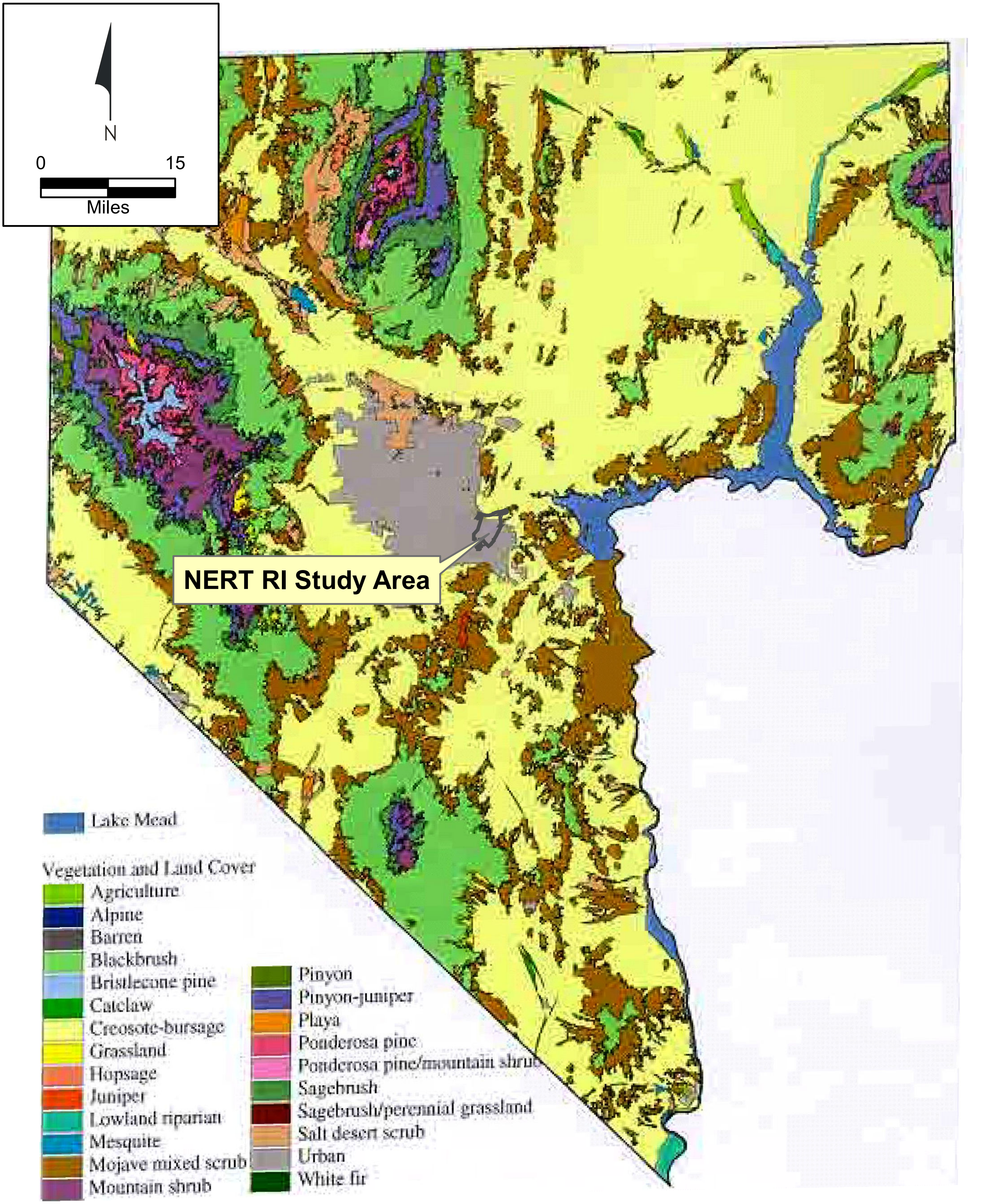
RAMBOLL

Clark County Mojave Desert Scrub Ecosystem

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-2**

Drafter: RS | Date: 5/29/2018 | Contract Number: 169000 6943 | Approved by: | Revised:



Source: Clark County Desert Conservation Program Multiple Species Habitat Conservation Plan and Environmental Impact Statement
http://www.clarkcountynv.gov/airquality/dcp/Pages/CurrentHCP.aspx (Accessed February 2018)

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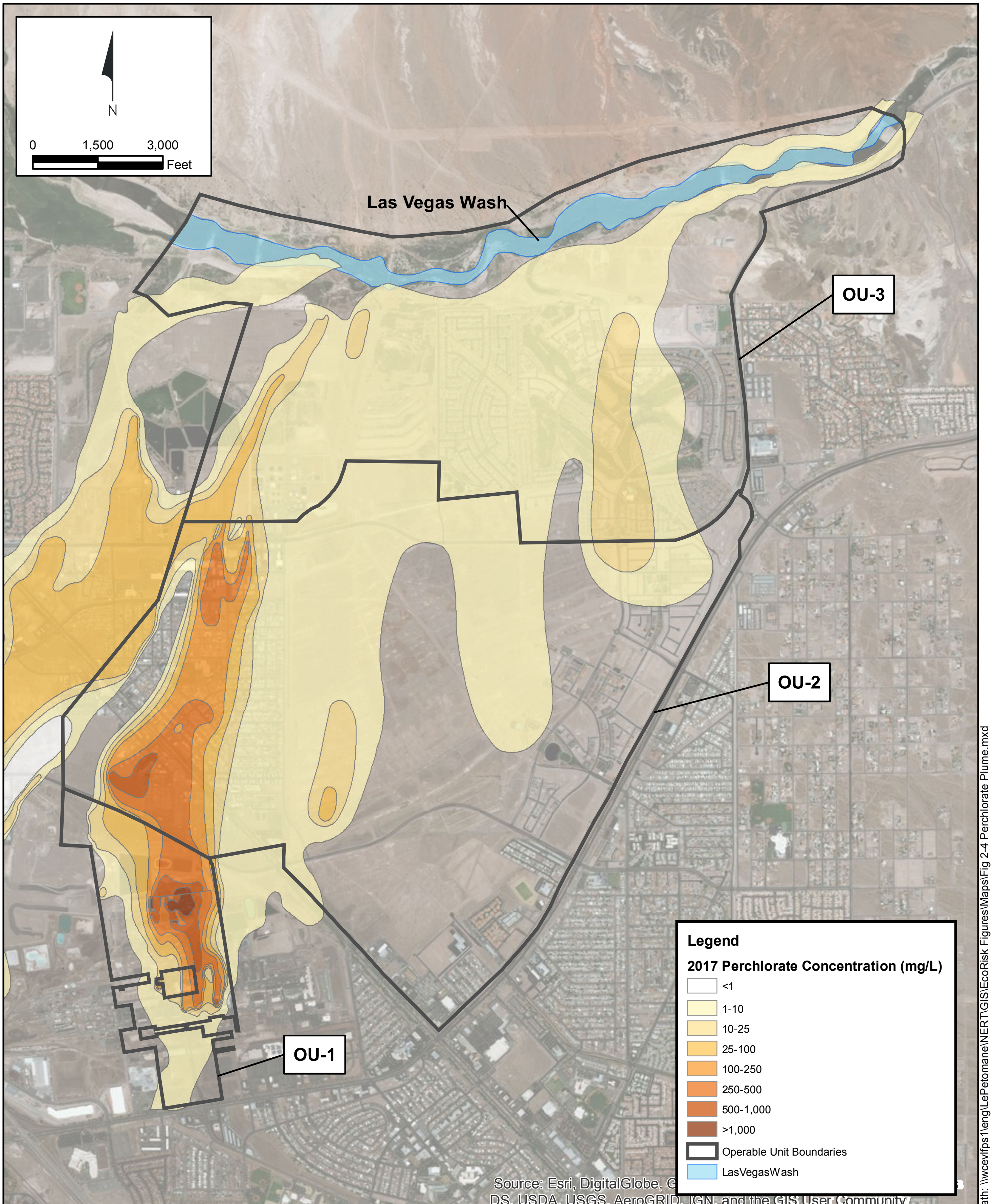
Clark County Distribution of Vegetation and Extent of Urbanization in and around Henderson, NV

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure 5-3

Drafter: RS | Date: 5/29/2018 | Contract Number: 169000 6943 | Approved by: | Revised:



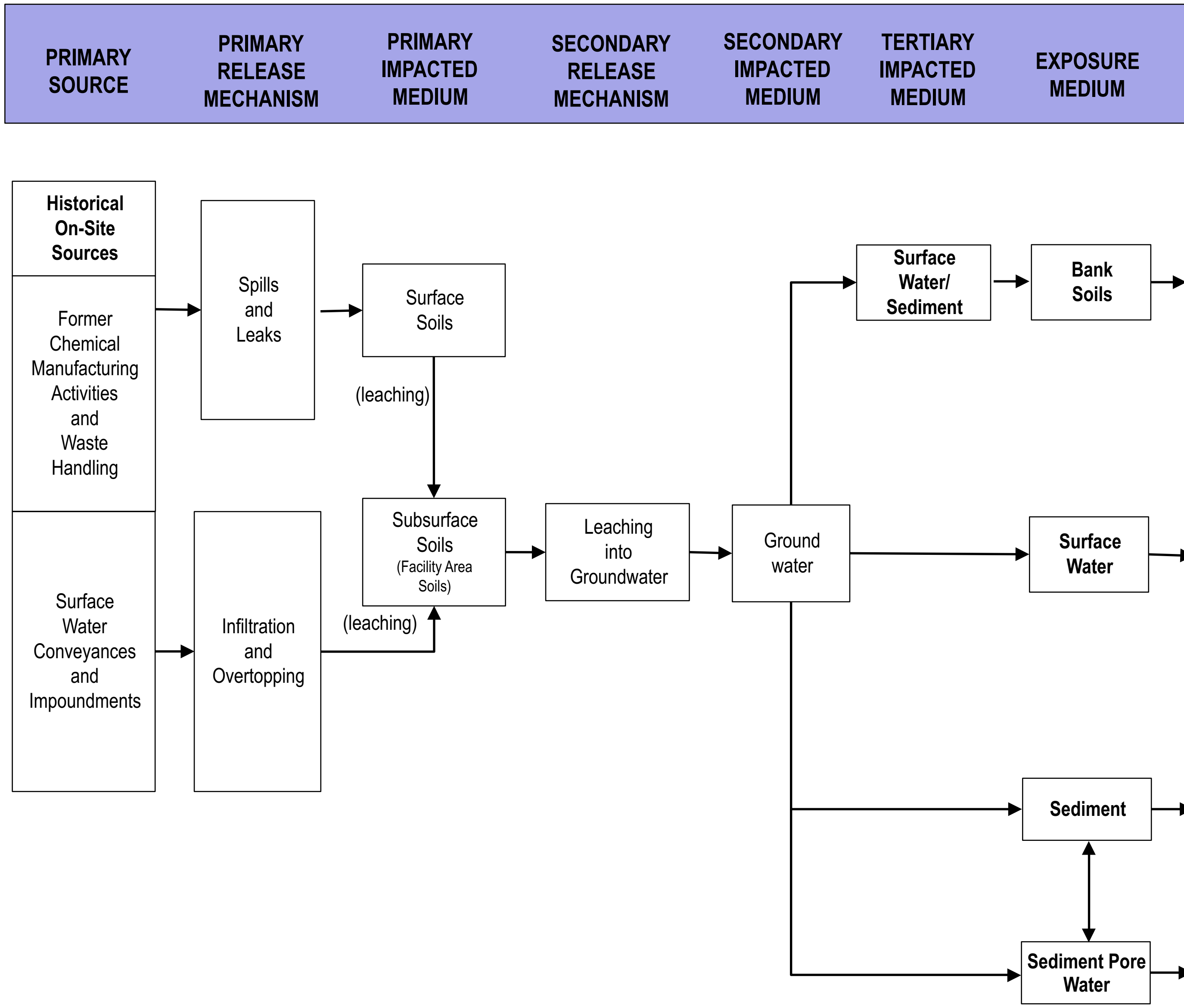
RAMBOLL

Perchlorate Groundwater Plume

Nevada Environmental Response Trust Site, Henderson, Nevada

Figure **5-4**

Drafter: RS | Date: 5/29/2018 | Contract Number: 169000 6943 | Approved by: | Revised:



Exposure Medium	Potential Exposure Route	Aquatic Receptors: Benthic Invertebrates	Aquatic Receptors: Aquatic Plants/ Inverts	Aquatic Receptors: Fish	Aquatic Receptors: Birds and Mammals	Terrestrial Receptors: Terrestrial Invertebrates	Terrestrial Receptors: Terrestrial Plants	Terrestrial Receptors: Birds and Mammals
Bank Soils	Bioaccumulation	--	--	--	--	●	●	●
	Ingestion	--	--	--	--	--	--	●
	Direct Contact	--	--	--	--	●	○	○
	Root Uptake	--	--	--	--	--	●	--
Surface Water	Bioaccumulation	○	●	●	●	--	--	--
	Ingestion	○	--	●	●	--	--	●
	Direct Contact	○	●	●	●	--	--	○
Sediment	Bioaccumulation	●	○	●	●	--	--	--
	Ingestion	--	○	○	●	--	--	--
	Direct Contact	●	○	●	○	--	--	--
Sediment Pore Water	Bioaccumulation	●	○	●	●	--	--	--
	Direct Contact	●	○	○	--	--	--	--

● Potentially complete and will be quantitatively evaluated in the risk assessment.

○ Potentially complete and will be considered qualitatively in the risk assessment

-- Pathway considered and found incomplete or insignificant.

RAMBOLL

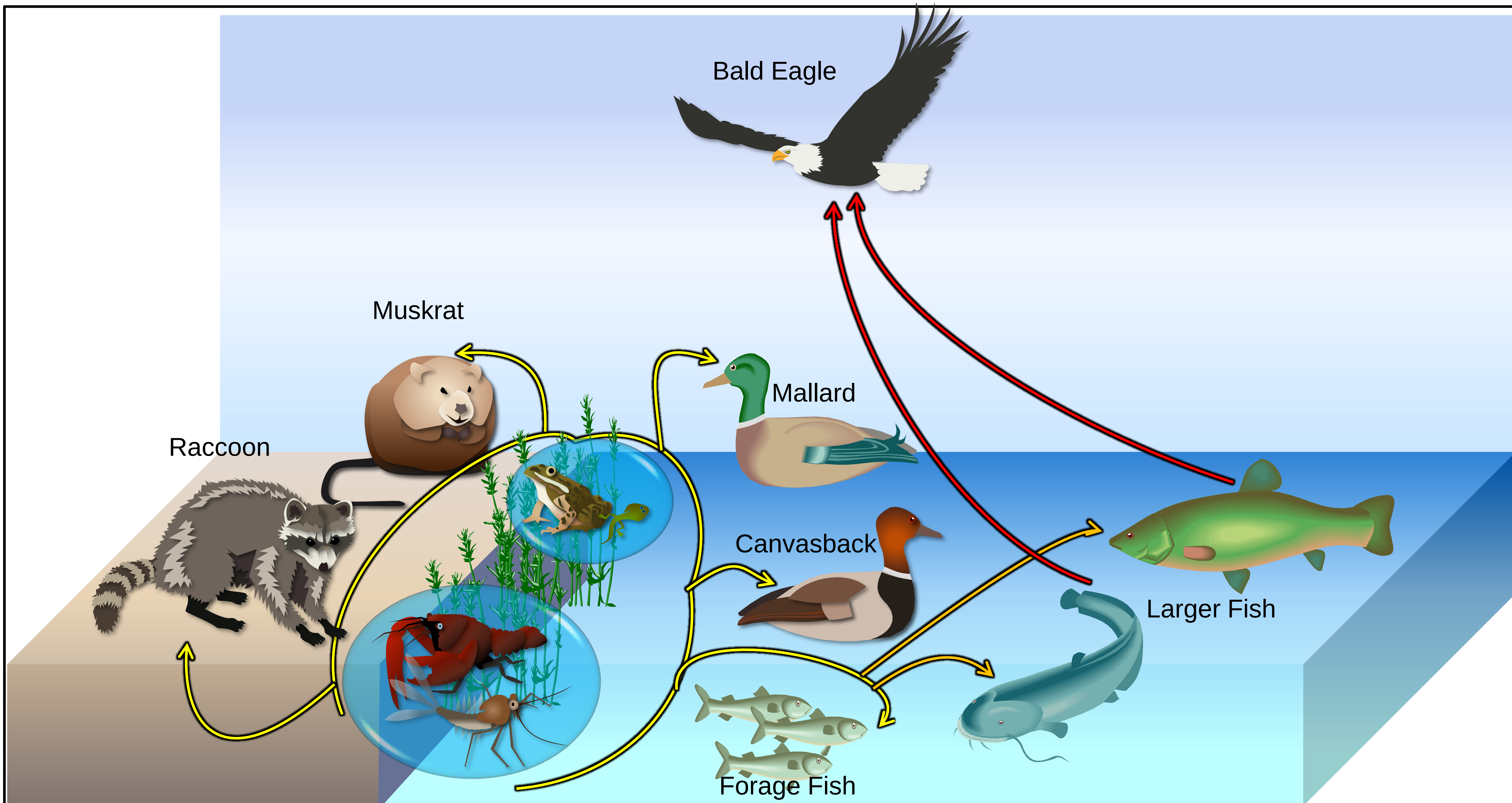
DRAFTED BY: RS | DATE: 7-23-18

Ecological Conceptual Site Model for the OU-3

Nevada Environmental Response Trust Site, Henderson, Nevada

FIGURE **5-5**

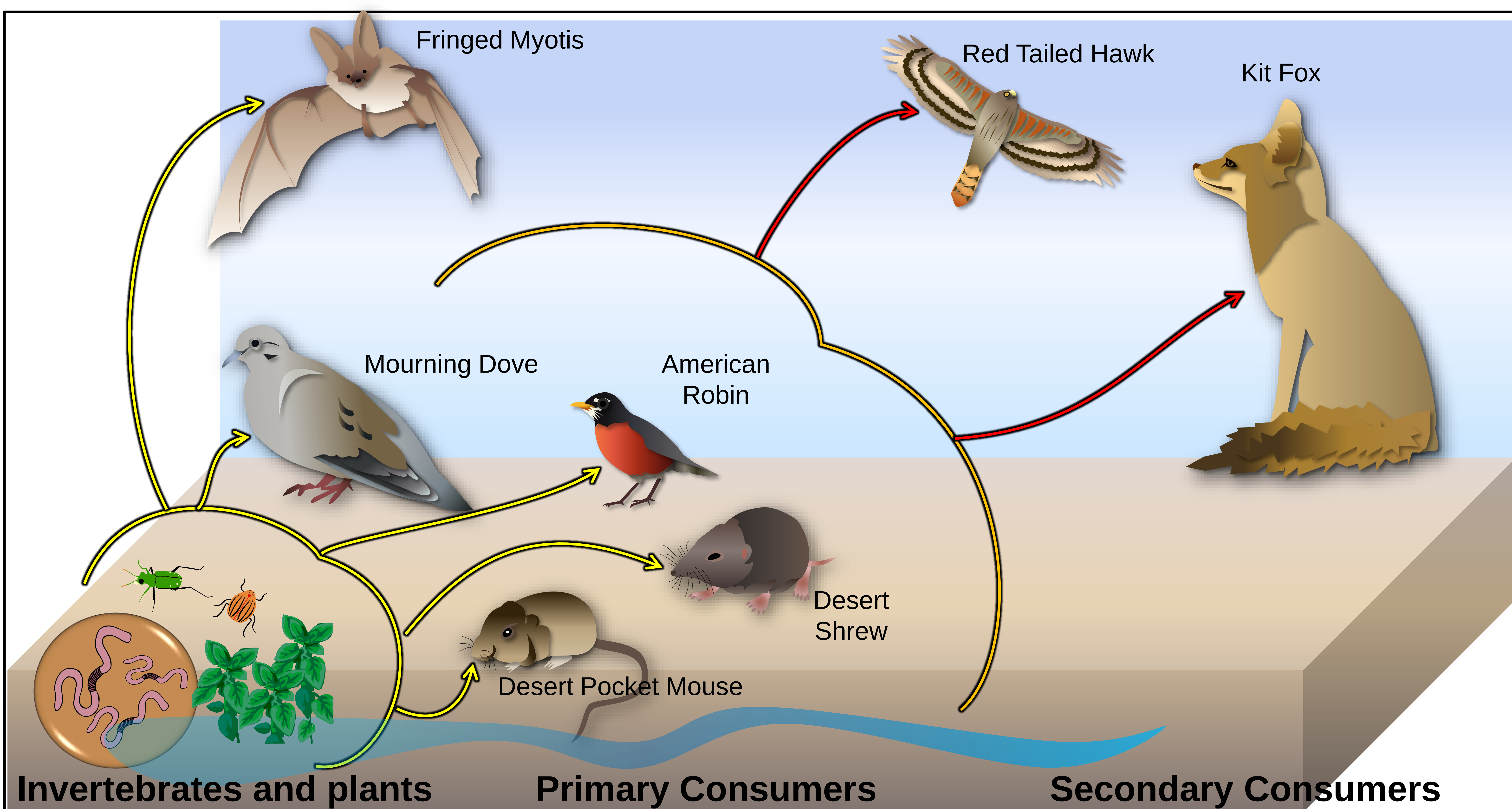
PROJECT: 1690006943



RAMBOLL

Desert Aquatic Food Web
NERT Environmental Response Trust Site
Henderson Nevada

FIGURE
5-6a



RAMBOLL

Desert Terrestrial Food Web
NERT Environmental Response Trust Site
Henderson Nevada

FIGURE
5-6b

APPENDIX A
OU-3 BERA FIELD SAMPLING PLAN

APPENDIX A

FIELD SAMPLING PLAN FOR OPERABLE UNIT 3 REVISION 1

NEVADA ENVIRONMENTAL RESPONSE TRUST SITE; HENDERSON, NEVADA

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

°C	Celsius
BERA	baseline ecological risk assessment
BMIC	Benthic macroinvertebrate community
BMICHD	Benthic macroinvertebrate community Hester-Dendy sample
BMICSG	Benthic macroinvertebrate community sediment grab sample
BMIT	Benthic macroinvertebrate tissue
bgs	below ground surface
cm	centimeter
COH	City of Henderson
COPEC	chemical of potential ecological concern
DQO	Data Quality Objectives
FSP	Field Sampling Plan
FT	Fish tissue
GPS	global positioning system
HASP	Health and Safety Plan
LVWCC	Las Vegas Wash Coordination Committee
MS/MSD	matrix spike/matrix spike duplicates
N	North
NERT	Nevada Environmental Response Trust
OU	operable unit
PCB	polychlorinated biphenyls
PW	(sediment) pore water
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
Ramboll	Ramboll US Corporation
RIBs	Rapid Infiltration Basins
RI/FS	remedial investigation/feasibility study
RPD	relative percent difference
S	South
SED	sediment
Site	NERT Site
SO	soil
SVOC	semi-volatile organic compounds
SW	surface water
Trust	Nevada Environmental Response Trust
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	volatile organic compounds
Wash	Las Vegas Wash
WRF	Water Reclamation Facility

1.0 INTRODUCTION

This Field Sampling Plan (FSP) was prepared by Ramboll US Corporation (Ramboll) on behalf of the Nevada Environmental Response Trust (the Trust or NERT) for Operable Unit 3 (OU-3) adjacent to and downgradient of OU-1 and OU-2 and the NERT Site (the Site) located in Henderson, Nevada (Figure 1-1 of the OU-3 BERA Work Plan). The OU-3 FSP describes methods for obtaining environmental samples, as well as the analytical methods that will be used to quantify concentrations of chemicals of potential ecological concern (COPECs) in the samples collected. The information obtained under this OU-3 FSP will form the basis of the Baseline Ecological Risk Assessment (BERA) for OU-3, conducted as part of the Trust's Remedial Investigation/Feasibility Study (RI/FS). The OU-3 BERA is necessary to evaluate whether constituents from OU-1 pose a potential risk to ecological receptors in OU-3 present in abundance in the Las Vegas Wash (Wash). Specific information regarding OU-3 and the OU-3 BERA is provided in the BERA Work Plan for OU-3 (Ramboll 2018a).

The NERT RI Study Area is divided into three Operable Units (OUs) as follows and shown in Figure 1-2 of the OU-3 BERA Work Plan:

- OU-1: Includes the NERT Site.
- OU-2: Includes the Eastside Sub-Area and a portion of the NERT Off-Site Study Area south (i.e., upgradient) of the mid-plume containment boundary line1.
- OU-3: Includes the Northeast Sub-Area, the Downgradient Study Area, and the portion of the NERT Off-Site Study Area north (i.e., downgradient) of the mid-plume containment boundary line.

A complete description of each of the OUs and site history is provided in Section 2 of the OU-3 BERA Work Plan.

1.1 Field Sampling Plan Organization

The remainder of this FSP is organized as follows:

- Section 2.0 – Data Quality Objectives, including a description of the Study Area and sample locations
- Section 3.0 – Proposed Sample Locations, Sample Types and Analytical Approach
- Section 4.0 – Sampling Procedures and Equipment
- Section 5.0 – Sample Quality Control, Designation, Handling, and Analysis
- Section 6.0 – Data Validation, Reporting, and Schedule
- Section 7.0 – References

[1] The mid-plume containment boundary line is the boundary between OU-2 and OU-3 and represents the Remedial Action Objective (RAO) for OU-2 of mid-plume containment and mass removal.

2.0 DATA QUALITY OBJECTIVES

In this section, the United States Environmental Protection Agency (USEPA) Data Quality Objectives (DQO) process is followed to assist with systematic planning for the proposed environmental sampling program described in this FSP. The DQO process is USEPA's recommended planning process when environmental data are used to derive an estimate of contamination (USEPA 2002). The DQO process is used to develop performance and acceptance criteria that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. Performance criteria apply to new data collected for the project, while acceptance criteria apply to existing data proposed for inclusion in the project. As this FSP describes only the collection of new data, acceptance criteria are not applicable to the DQO process used in this FSP.

Performance criteria are met through the inclusion of field quality assurance/quality control (QA/QC) samples collected during the investigation including field duplicate samples and equipment blanks. These QA/QC samples are described in detail in Section 5 and in the NERT Quality Assurance Project Plan (QAPP). The QAPP describes the necessary QA, QC and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria (USEPA 2001). The QAPP and Health and Safety Plan (HASP) for the NERT Site will be used where appropriate. A QAPP Addendum and HASP Addendum specific for the OU-3 Wash sampling will be developed during preparation for field program implementation.

The DQO process, as described in USEPA guidance, involves the following seven steps (USEPA 2006):

1. Define the problem
2. Identify the goal of the study
3. Identify information needed for the study
4. Define the boundaries of the study and selection of sampling locations
5. Define the analytic approach
6. Specify the performance of acceptance criteria
7. Develop the plan for obtaining data

DQOs 1-5 are summarized in the remainder of Section 2.0. DQO 5 is summarized in Section 3.0. DQO 6 will be provided in a forthcoming QAPP Addendum (Ramboll 2018b).[2] DQO 7 is summarized in Sections 4.0 through 6.0.

2.1 Problem Definition, Study Goals, and Data Gaps

A summary of Steps 1-3 of the DQO process as applied to OU-3 is provided in this section. The Site has been the location of industrial operations since 1942, when it was developed by the US government as a magnesium plant to support World War II operations. Following the war, the Site continued to be used for industrial activities, including production of perchlorates, boron, and manganese compounds. Former industrial and waste management

[2] Note that existing data will not be used in the OU-3 BERA; therefore, acceptance criteria will not need to be specified.

activities conducted at the Site, as well as those conducted at adjacent properties, resulted in contamination of environmental media, including soil, groundwater, and surface water. The Site has been the subject of numerous investigations and removal actions beginning in 1979. The OU-3 BERA Work Plan (See Section 2) provides a summary of the industrial activities and removal actions for the NERT RI Study Area.

The overall purpose of the OU-3 BERA is to describe the likelihood, nature, and extent of adverse effects to ecological receptors (plants and animals) that may occur from exposure to contaminants present in OU-3. The objectives of this FSP are to (1) guide data collection activities in support of the OU-3 BERA; and (2) ensure a consistent and appropriate methodology for the collection and analysis of environmental samples collected in OU-3. As such, this OU-3 FSP describes the methods that will be used to collect and analyze representative surface water, sediment, sediment pore water, soil, and biota from OU-3, as well as suitable off-Site reference areas, as appropriate. The references areas provide data from areas not expected to be impacted from Site activities but that are ecologically similar to the other sampling locations within OU-3 and the Wash. This data will provide a basis of comparison for the data collected from within OU-3.

The data collected from the field effort will be used in the risk assessment calculations to quantify potential impacts of chemicals within OU-3 to ecological receptors present in the area, as described in the OU-3 BERA Work Plan. This information is intended to help risk managers decide what, if any, mitigation measures can be implemented to protect ecological receptors. A key goal of the BERA is to identify those chemicals that may be driving risk to ecological receptors within OU-3. The chemical classes being considered in the OU-3 BERA are shown in Table A-1.

This FSP was developed after a review of existing data for the Wash and OU-3 to identify investigations necessary to determine potential impact of chemicals in OU-3 to ecological receptors. To fully characterize potential impact to ecological receptors from exposure to contaminants present in OU-3, as well as identify the specific chemicals that are driving risk, a broad range of analyses are proposed for the BERA as follows:

- Chemical Analysis: Surface water, sediment, sediment pore water, and soil
- Tissue Residue Chemistry: Benthic (sediment-associated) macroinvertebrates and fish
- Community Analysis: Benthic macroinvertebrates

2.2 OU-3 Boundaries

Step 4 of the DQO process is to define the boundaries of the Study Area. The OU-3 boundary is shown on Figure A-1. The west side of OU-3 contains a portion of the City of Henderson (COH) Bird Viewing Preserve (Birding Ponds) and the COH Water Reclamation Facility (WRF). The Northern Rapid Infiltration Basins (RIBs), which were formerly used by the COH for infiltration of treated municipal wastewater, are located further east. The Tuscany residential community, the Weston Hills neighborhood, and the Chimera Golf Course are located in the eastern portion of OU-3, as well as mostly vacant areas with sparse vegetation north of the Tuscany community, a portion of which served as a former City of Henderson landfill (now closed; Figure A-1). The Wash is located downgradient (north) of each of these features.

The Wash is of particular importance for the OU-3 BERA as it the primary drainage channel for the Las Vegas Valley with perennial flows extending from Vegas Valley Drive for approximately 12 miles to Las Vegas Bay, at which point it empties into Lake Mead (Las

Vegas Wash Coordination Committee [LVWCC] 2000). The Wash is a highly sensitive and ecologically rich area. Two hundred and sixty-eight species of vertebrate wildlife have been documented along the Wash (LVWCC 2008). Surveys show that the Wash provides suitable habitat for many of Nevada's native wildlife species including critical habitat for threatened and endangered species.

2.3 Selection of Sampling Locations in the Wash

A judgmental sampling design is proposed, in which sample locations are selected based on professional judgment during the implementation of the field program, as the field sampling team will be able to assess conditions in real time. Figure A-2 provides proposed sampling transects where samples will be collected. Figures A-2a through A-2e provide a general indication of possible sample locations for each of the media being sampled at each of the 15 sampling transects. However, the actual sample locations will be selected and global positioning system (GPS) coordinates will be documented at the time of collection.

The sampling transects were selected to be consistent with the Trust's current monthly surface water sampling program locations, some of which coincide with United States Geological Survey (USGS) stream gages (Ramboll Environ 2017b). The co-location of the Trust's sampling locations with the USGS sampling locations are necessary to calculate mass flux of perchlorate into the Wash. Therefore, the sampling proposed for the OU-3 BERA includes sampling at the locations currently sampled as part of the Trust's monthly sampling program plus additional transects to obtain more complete coverage of the Wash. However, as described above, these proposed sampling locations serve as a guide. The actual sampling locations will be selected during the implementation of the field program at the discretion of the Field Team Leader. The proposed analyses will include a full suite of chemicals as shown in Table A-1. Table A-2 provides a summary of the sampling types that will be collected at each of the Transects shown in Figure A-2. Section 3 provides the proposed sampling locations, while Section 4 describes the sampling methodology.

3.0 PROPOSED SAMPLE LOCATIONS, SAMPLE TYPES AND ANALYTIC APPROACH

A summary of previous studies conducted in OU-3 is provided in the BERA Work Plan for OU-3 (Ramboll 2018a). These previous studies form the rationale for the selection of sample media to be evaluated with the proposed sampling included in this FSP. The following describes the proposed sample types and locations, and the analytical methods to be used to identify COPECs. As shown in Figure A-2, sampling is proposed along 12 transects across the Wash, as well as from three reference locations to the west and outside of OU-3. The reference locations were selected upstream of the Las Vegas Wasteway and therefore provide a representation of "background" conditions in the Wash. The 12 transects include:

- Nine transects, represented by purple transect lines on Figure A-2, will include sampling of the following environmental media: Bank soil, surface water, sediment, sediment pore water, benthic invertebrate community composition, benthic invertebrate tissue and fish tissue.
- Three transects, represented by green transect lines on Figure A-2, will include sampling for a subset of the environmental media planned for the purple transects: surface water, sediment, benthic invertebrate community composition, benthic invertebrate tissue and fish tissue.

3.1 Proposed Sample Types and Locations

Representative surface water, sediment, sediment pore water, soil, and biota tissue will be collected from within OU-3, as described below. Sample locations are proposed in the following subsections. The selection of sample locations was based on consideration of:

- Representativeness of OU-3 conditions
- Range of concentrations to understand potential risks to a variety of organisms, including humans
- Potential presence of special status species
- Accessibility to target media and locations
- Depositional areas in sediment, if available
- Identification of appropriate reference area(s)

3.1.1 Surface Water

Surface water will be collected from two locations in each of 12 transects within the Wash—one location closer to the northern bank and one closer to the southern bank[3], as shown on Figure A-2 and Table A-2, for a total of 24 samples. In addition, surface water will be collected from each of 3 upgradient reference areas and the COH Bird Viewing Preserve (Figure A-2; Table A-2), for a total of four samples. The COH Bird Viewing Preserve receives treated wastewater, which infiltrates to groundwater; therefore, there is no pathway for perchlorate-contaminated groundwater to enter the Bird Viewing Preserve ponds. Data from the COH Bird Viewing Preserve will assist the ecological risk assessment team in

[3] The southern bank of the Wash represents the side of the wash where perchlorate-impacted groundwater primarily discharges. Previous studies have shown that perchlorate concentrations in surface water tend to be higher closer to the southern bank.

understanding potential exposure from treated wastewater versus potential exposure surface water, comprised of the combination of treated wastewater and groundwater, in the Wash.

Actual surface water sampling locations will be determined in the field, at the discretion of the Field Team Leader. To the extent practical, surface water samples will be co-located with sediment, sediment pore water, and biota tissue samples.

The following parameters will be measured in surface water in the field: pH, dissolved oxygen, specific conductivity, oxidation reduction potential, temperature, hardness (as calcium carbonate) total dissolved solids, and turbidity. Surface water samples will be analyzed for perchlorate, chlorate, chloroform, total chromium and hexavalent chromium.

3.1.2 Sediment

Surface sediment (0-6 inches below ground surface [bgs]) will be collected from one location at the southern bank of the Wash in each of 12 transects and one location at the northern bank of the Wash in six of the 12 transects, as shown on Figure A-2 and Table A-2, for a total of 18 samples. In addition, sediment will be collected from each of 3 upgradient reference areas and the COH Bird Viewing Preserve (Figure A-2; Table A-2), for a total of four samples. Actual sediment sampling locations will be determined in the field, at the discretion of the Field Team Leader; depositional areas, if available, will be targeted for sampling. If appropriate fine-grained sediment is not available at the time of sampling, less than the target number of sediment samples may be collected, in consultation with the Trust and NDEP. To the extent practical, sediment samples will be co-located with surface water, sediment pore water, and biota tissue samples. Sediment samples will be analyzed for perchlorate, chlorate, chloroform, total chromium, hexavalent chromium and total organic carbon and acid volatile sulfides.

3.1.3 Sediment Pore Water

Sediment pore water will be collected from one location at the southern bank of the Wash in each of nine transects, as shown on Figure A-2 and Table A-2, for a total of nine samples. In addition, sediment pore water will be collected from each of three upgradient reference areas (Figure A-2; Table A-2), for a total of three samples. Actual pore water sampling locations will be determined in the field, at the discretion of the Field Team Leader. Measuring porewater provides a means of assessing bioavailability of contaminants in sediment. Porewater sampling provides critical information for assessing exposure and uptake of chemicals to benthic invertebrates and subsequently the fish and wildlife that forage on these organisms. The sediment porewater concentrations measured in the Wash will be compared to surface water ecological screening values to determine potential toxicity to benthic invertebrates.

If appropriate fine-grained sediment is not available at the time of sampling, fewer pore water samples may be collected, in consultation with the Trust and NDEP. To the extent practical, sediment pore water samples will be co-located with surface water, sediment, and biota tissue samples. The pore water samplers will be placed in surface sediments to a depth of approximately 6 inches consistent with the sediment sampling depths described in Section 3.1.2. Sediment pore water samples will be analyzed for perchlorate, chlorate, chloroform, total chromium and hexavalent chromium.

3.1.4 Soil

Surface soil (0-6 inches bgs) will be collected from one location at the southern bank (floodplain) of the Wash in each of nine transects, as shown on Figure A-2 and Table A-2, for a total of nine samples, as well as from the southern banks of each of three upgradient reference areas (Figure A-2; Table A-2), for a total of three samples. In addition, surface soil will be collected from three locations within the seep area that was covered with clean soil, for a total of three samples. Deeper soil samples (between 0.5 and 3 feet bgs but targeting between 2 and 3 feet unless there is refusal) will be collected from a subset (i.e., six) of the bank soil sampling locations in the Wash. The deeper soil sample from the hand auger will be homogenized. These samples will be used to determine if site-related chemicals have migrated deeper into the soil after deposition on the banks. Depending on the results of the deeper soil sampling, additional investigation, including consideration of fossorial mammals, may be warranted. Actual soil sampling locations will be determined in the field, at the discretion of the Field Team Leader. Soil samples will be analyzed for perchlorate, chlorate, chloroform, total chromium and hexavalent chromium.

3.1.5 Benthic Macroinvertebrates

Benthic macroinvertebrates will be collected from one location at the southern bank of the Wash in each of 12 transects and from three reference areas upstream of the Las Vegas Wasteway, as shown on Figure A-2 and Table A-2. At each location, benthic macroinvertebrates will be collected for both tissue analyses and community assessment. Tissue analyses will include a total of 12 samples. The benthic macroinvertebrate community will be evaluated via both sediment grab samples and multi-plate artificial substrate samplers. Invertebrate samples collected for community assessment will be collected in replicate, with three replicates per sample per collection type (three grab samples and 3 multi-plate samples per location). Actual invertebrate sampling locations will be determined in the field, at the discretion of the Field Team Leader. To the extent practical, benthic macroinvertebrate samples will be co-located with surface water, sediment, and sediment pore water samples. Benthic invertebrate tissue will be analyzed for perchlorate, chlorate, chloroform, total chromium and hexavalent chromium.

3.1.6 Fish

Fish are mobile, but some mobility is constrained by the presence of weirs within the Wash. Fish will be collected within zones, rather than target specific locations to account for their mobility in general. Fish will be collected from each of 5 sampling zones, as shown on Figure A-2 and Table A-2. A target of 3 fish samples (bluegill and bass [family *Centrarchidae*], and catfish [family *Ictaluridae*]) will be collected from each sampling zone, for a total of 15 whole body fish tissue samples, if available. Fish tissue will be analyzed for perchlorate, chlorate, chloroform, total chromium and hexavalent chromium.

3.2 Laboratory Analytical Methods

A complete list of laboratory analytical methods is provided in Table A-3, detailed in the QAPP (Ramboll Environ 2017a) and revised if necessary in the forthcoming QAPP Addendum (Ramboll 2018b).

4.0 SAMPLING PROCEDURES AND EQUIPMENT

Sampling and data collection equipment and associated procedures are described in the following sections.

4.1 Documentation Procedures

Records that may be generated during field work include field notes, field data sheets, photographic logs, sample chain-of-custody records, equipment inspection/calibration records, and others as necessary. Units of measure for any field measurements and/or analyses will be clearly identified on the field forms and in notes and logs as necessary. The Field Team Leader will review the field data to evaluate the completeness of the field records.

4.1.1 Field Notes

Field logbooks will provide the means of recording data collection activities at the time they take place. The logbooks will be bound field survey notebooks assigned to field personnel. The logbooks will be stored with the project files in a centralized document repository at a field project team office location when not in use. Activities will be described in as much detail as possible such that the activity being described can be reconstructed without reliance on memory. Entries will be made in language that is objective, factual, and free of personal opinions or terminology that might later prove unclear or ambiguous.

The cover of each logbook will be identified by the project name, project-specific document number, and the time period which the logbook describes (beginning and end dates). The title page of each logbook will have contact information for the sampling program Project Manager. Entries into the logbook will contain a variety of project-specific information. At the beginning of each entry, the date, start time, weather, names of all team members present, health and safety meeting topics discussed for that day, level of personal protection being used, printed name, contact information, and the signature of the person making the entry will be entered. Names and affiliations of visitors to the field investigation area and the purpose of their visit will be recorded.

All entries will be made in ink signed and dated and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, initialed, and dated by the user. Whenever a sample is collected, or a measurement is made, it will be recorded in the field logbook or on field data sheets. Any photographs taken will be identified by number and a description of the photograph will be provided. All equipment used to conduct measurements will be identified. Additionally, any calibration conducted will be recorded.

4.1.2 Field Data Sheets

Field data sheets will be completed by field personnel during sample collection activities. The types of field data sheets may include surface water sampling logs, sediment and pore water sampling logs, soil sampling logs, and biota tissue data sheets. If deemed necessary, electronic copies of the data sheets may be produced after sampling has been completed, describing sampling conducted. Example field data sheets are provided in Attachment A.

4.1.3 Photographs

Digital photographs will be taken, as necessary, to supplement and verify information entered into field logbooks. For each photograph taken, the following will be recorded in the field logbook:

- Date, time, and location
- Number and brief description of the photograph
- Direction in which the photograph was taken, if relevant

If a number of photographs are taken during a task, general notes will be sufficient on the group of photographs taken, so long as the information outlined above can be inferred from the information provided for each photograph.

4.2 Instrument Calibration Procedures

One instrument anticipated to be used during the field program which will require calibration includes a water quality meter (e.g., pH, dissolved oxygen, specific conductivity, oxidation reduction potential, temperature, and turbidity: Attachment A). Equipment that can be field calibrated will be calibrated at least once per day prior to beginning sampling activities, with calibration results documented on the NERT OU-3 Surface Water Collection Field Data Sheet and in the field logbook. Equipment that must be calibrated in a laboratory setting will only be used if a current calibration certificate is available (for example, a calibration certificate is provided with a piece of rental monitoring equipment). Calibration procedures will be consistent with manufacturer instruction manuals for each instrument.

4.3 Sampling Methodology

Methodology is described in the following subsections for sampling of surface water, sediment, sediment pore water, soil, benthic invertebrates, and fish tissue. The collection of biological organisms will be done under an appropriate Nevada Scientific Collection Permit.

4.3.1 Surface Water Collection

Surface water collection will be co-located with sediment, sediment pore water, and benthic macroinvertebrate sampling locations, to the extent practical. Surface water will be collected from the approximate middle of the water column at each location using grab sampling methodology (e.g., direct filling or Kemmerer sampler). Surface water samples will be collected prior to any other media in order to minimize the disturbance of sediment that might alter the analytical results. In deeper water, the Kemmerer sampler will be lowered to the desired depth and a messenger will then close the sampling container. The sampler will be lowered several times until all laboratory containers are filled.

Water quality parameters (i.e. pH, dissolved oxygen, specific conductivity, oxidation reduction potential, temperature, and turbidity) will be recorded at each surface water sampling location using a multi meter. Surface water samples will be collected sequentially from downstream to upstream locations, if practicable. If not practicable, an explanation of why will be provided in the field notes.

Following collection of a surface water sample, the position of the sample will be recorded using GPS. Samples will be placed in the specified laboratory containers (Table A-3), capped, labeled, placed in plastic bags, and stored in coolers on ice for shipment to the analytical laboratory, following procedures described in Section 5.

4.3.2 Sediment Collection

Sediment collection will be co-located with surface water, sediment pore water, and benthic macroinvertebrate sampling locations, to the extent practical. Sediment sample collection will target depositional areas, if available. The upper 6 inches of sediment will be collected. Depending on the consistency of the sediment and water depth, a trowel or scoop (shallow areas), push corer (intermediate areas), or a petite ponar (deeper areas) will be used to collect sediment. Several grab samples will be collected from the same location to acquire the appropriate volume of sediment for the laboratory containers. Individual grab samples will be gently mixed until visually observed to be homogeneous. Sampling containers will be filled using the homogeneous sample. Certain analyses are sensitive to disturbance (e.g., hexavalent chromium); sediment collected for these analyses will be quickly placed directly into sampling containers, handling the sediment as little as possible.

The general characteristics (e.g., texture, color) of the sediment will be recorded. Water quality parameters (i.e. pH, dissolved oxygen, specific conductivity, oxidation reduction potential, temperature, and turbidity) will be recorded as close as possible to the sediment/surface water interface using a multi meter. Sediment samples will be collected after surface water collection and sequentially from downstream to upstream locations, if practicable. If not practicable, an explanation of why will be provided in the field notes.

Following collection of a sediment sample, the position of the sample will be recorded using GPS. Samples will be placed in the specified laboratory containers (Table A-3), capped, labeled, placed in plastic bags, and stored in coolers on ice for shipment to the analytical laboratory, following procedures described in Section 5.

4.3.3 Sediment Pore Water Collection

Sediment pore water collection will be co-located with surface water, sediment, and benthic macroinvertebrate sampling locations, to the extent practical. Sediment pore water sample collection will target depositional areas, if available, and the upper 6 inches of sediment. Pore water will be collected via passive diffusion sampling devices (hereafter referred to as "peepers"). Peepers consist of a passive diffusion bag or passive diffusion chambers placed within a perforated push point casing. The diffusion bag (or chambers) consists of a semipermeable membrane (0.45 micrometers [µm]) filled with deionized water that allows dissolved chemicals to diffuse into the sampler providing an estimate of the time-averaged concentration of a given chemical in sediment pore water. The diffusion bags and chambers are effectively the same except that the diffusion chambers house the semipermeable membrane within a rigid structure to protect the membrane material. When possible, the diffusion bags are preferred over the rigid structures because they offer greater flexibility for device placement and securing the devices. Exhibits 1 and 2 illustrate example passive diffusion sampler devices.

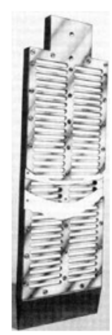


Exhibit 1. Rigid passive diffusion device, the Modified Hesslein In-Situ Pore Water Sampler (small volume peeper)

Exhibit 2. Passive diffusion bags, with and without mesh protector

A: Diffusion Bag with Polyethylene Mesh
B: Diffusion Bag Without Mesh
C: Diffusion Bag and Mesh Attached to Bailer Bottom

Before deployment, the peepers will be prepared according to the peeper-specific laboratory protocol. Sediment peepers will be deployed after sediment collection at a given location. The peepers will be buried within the sediment as deep as possible to allow the surrounding interstitial water to infiltrate the sampler, but targeting the upper 6 inches of sediment, if practicable. If the sediment is soft and, the peepers will be pressed into the sediment by hand (wadeable water) or with a weighted frame (deeper water). The peepers will be connected with leader lines attached to the shoreline, if possible, to facilitate retrieval. If attachment to the shoreline is not possible, the leader lines will be attached to floating buoys to identify their locations. GPS coordinates will also be recorded. Concentration equilibrium between the pore water and the peeper generally requires approximately 28 days. Duplicate devices will be deployed in areas where recovery of the device may be challenging (i.e., in areas of swift flow or in areas where recreational activity may result in disturbance.

Following retrieval of each sediment peeper, pore water will be extracted in the manner most appropriate for the sampling device. Some analytes may be oxygen dependent, and if so, those will be handled anaerobically through the use of argon glove bags at the time of pore water extraction according to the peeper-specific laboratory protocol. The peeper-specific laboratory protocol will be included in the forthcoming QAPP Addendum once the type of peeper has been selected for the field sampling. Pore water samples will be placed in the specified laboratory containers (Table A-3), capped, labeled, placed in plastic bags, and stored in coolers on ice for shipment to the analytical laboratory, following procedures described in Section 5.

4.3.4 Soil Collection

Surface soil samples will be collected using hand tools, such as a scoop, trowel, shovel, or auger. The sampling method will depend on the soil conditions. Surface soil samples will target the upper 6 inches of soil. Subsurface soil samples, targeting 6 inches to 3 feet bgs, will be collected using a hand auger. Similar to sediment sample collection, several grab samples will be collected from the same location to acquire the appropriate volume of soil for the laboratory containers. Individual grab samples will be gently mixed until visually observed to be homogeneous. Sampling containers will be filled using the homogeneous sample. Certain analyses are sensitive to disturbance (e.g., hexavalent chromium); soil collected for these analyses will be quickly placed directly into sampling containers, handling the sediment as little as possible.

The general characteristics (e.g., texture, color, staining, vegetation) of the soil at each sampling location will be recorded. Following collection of a soil sample, the position of the sample will be recorded using GPS. Samples will be placed in the specified laboratory containers (Table A-3), capped, labeled, placed in plastic bags, and stored in coolers on ice for shipment to the analytical laboratory, following procedures described in Section 5.

4.3.5 Benthic Macroinvertebrate Collection

Benthic macroinvertebrate collection will be co-located with surface water, sediment, and sediment pore water sampling locations, to the extent practical. Benthic macroinvertebrates will be collected for both tissue analyses and community assessment, using similar gross collection techniques. The macroinvertebrate sampling will generally follow the USEPA Rapid

Bioassessment Protocols III (USEPA 1989, 1999) for wadeable streams using sediment grab sampling, kicknets and/or multi-plate sampling techniques, as described in the following subsections.

Prior to sampling, a description of each benthic macroinvertebrate sampling location and a quantitative evaluation of habitat quality will be recorded on a Water Quality and Vegetation Field Data Sheet for high or low gradient streams, as appropriate for the local sampling area (Attachment A; USEPA 1999). Also prior to sampling, water quality measurements, including pH dissolved oxygen, specific conductance, temperature, and turbidity, will be recorded.

4.3.5.1 Sediment Grab Samples for Macroinvertebrates

Sediment grab samples will be collected for invertebrate tissue analyses and community assessment. Grab samples will be collected using a trowel or shovel (wadeable water) or a petite Ponar sampler (deeper water). Grab samples provide a direct measure of the organisms living in the bulk sediment of the Wash. Actual sampling locations will be areas of fine-grained sediment, if available.

For benthic macroinvertebrate tissue analyses, several sediment grab samples will be placed into a seine and gently rotated in the Wash surface water to remove sediment particles and isolate benthic macroinvertebrates. All remaining invertebrates will be hand-collected, rinsed to remove attached sediment particles, blotted dry with a paper towel, and weighed. All macroinvertebrates collected from a sampling location will be pooled together to obtain a sufficient sample tissue volume for analyses. Macroinvertebrates will be identified to the lowest taxonomic level that is practical. If insufficient sample volume is obtained, a hierarchy of preferred analyses may be implemented. Prior to sample packaging and shipment, macroinvertebrates will be depurated (removal of gut contents) by holding the organisms at 4 degrees Celsius (°C) for 24 hours. The composite sample then will be wrapped in aluminum foil (dull side against the sample) and placed into a small, plastic zip-top bag, and labelled, following procedures described in Section 5. Samples will be frozen in a freezer or on dry ice prior to shipment to the analytical laboratory.

For benthic macroinvertebrate community assessment, sediment grab samples will be collected in replicate from each sampling location. Three replicate samples per location will be collected and individually packaged for taxonomic identification to document the variability of the benthic community as part of the data evaluation. Following sample collection, benthic macroinvertebrate samples will be preserved immediately with a 70 percent ethanol solution and placed into plastic sampling containers. The samples will be labelled immediately after preservation, following procedures described in Section 5. Samples will be shipped to the taxonomic laboratory; no additional preservation (e.g., ice) is necessary.

4.3.5.2 Hester-Dendy Samplers for Macroinvertebrates

Multi-plate samplers will be also used for benthic invertebrate community assessment. Because sediment physical characteristics can interfere with the ability to interpret benthic invertebrate data in the context of water quality, multi-plate samplers, such as Hester-Dendy arrays, minimize these influences and will be implemented for the OU-3 sampling. The Hester-Dendy multi-plate samplers consist of a series of 14 round hardboard plates, separated by spacers and fastened together through their centers to a threaded eyebolt. The hardboard sampler is approximately 14 centimeters (cm) long and has a surface area of roughly 0.116 square meters.

Benthic macroinvertebrate samples collected using Hester-Dendy artificial substrate samplers will be placed 1 to 2 feet above the sediment surface (i.e., elevated enough to avoid getting the sampler filled with mud, but close enough to the sediment surface to attract sediment-dwelling organisms). This approach allows consideration of organisms that exist in the river that have habitat preferences not readily sampled using sediment grab sampling. This sampling approach can provide insight into the difference in the abundance of the benthic community within the Wash (if any) that could be due to variables in the characteristics of the sediment, because this approach standardizes the habitat structure at each location. Both approaches provide insight into the diversity and abundance of benthic organisms that inhabit the Wash.

Three Hester-Dendy samplers will be placed at each sampling location by securing to rebar or a cinderblock anchor and attaching to a leader line connected to shore or a buoy to facilitate retrieval. The actual placement of the Hester-Dendy samplers will be based on field conditions so that the samplers can be secured above the sediment surface for a period of 28 days, at which time, they will be collected, preserved with a 70 percent ethanol solution, and placed in sample containers and labelled (see Section 5) for shipment to the taxonomic laboratory for processing. All Hester-Dendy samplers will be deployed over the same 28-day timeframe.

4.3.5.3 Kicknet Sampling for Macroinvertebrates

Kicknet sampling is an alternative method for benthic macroinvertebrate collection that may be employed if necessary. Kicknet sampling can be implemented in a variety of habitats within the Wash and is ideal for flowing water systems. The method consists of standing upgradient while positioning a net or a D-frame dipnet approximately 1 to 2 feet downgradient and “kicking” or disturbing the sediment substrate. Organisms within the surface sediment are loosened and are carried by the current into the downgradient net. Organisms collected in the net are processed according to the tissue analysis or community assessment methods, as appropriate, described in Section 4.3.5.1 for sediment grab samples. Kick nets will be used if substrates are rocky, water is shallow, and if grab samples and multi-plate sample devices do not provide sufficient quantity of macroinvertebrate community samples.

4.3.5.4 Macroinvertebrate Taxonomic Identification

Taxonomic identification for the benthic community samples (grab samples and multi-plate samplers) will be performed by a certified taxonomic laboratory (to be determined). The following standard metrics will be used to quantify the health of the benthic community:

- Species richness
- Abundance
- Ephemeroptera, Plecoptera, and Trichoptera richness
- Hilsenhoff Biotic Index
- Percent model affinity
- Species diversity
- Dominance
- Non-chironomid/oligochaete richness
- Chironomid mouthpart deformities

The benthic community assessment metrics will be calculated in accordance with USEPA (1989, 1999).

4.3.6 Fish Tissue Collection

As described in Section 3.1.6, three types of fish will be collected, if available, from each fish sampling zone in the Wash. Fish will be collected using a variety of methods (e.g., hoop nets, minnow traps, seines, and electrofishing), determined in the field based on conditions at the time of sampling. During collection, fish will be placed into temporary holding containers (live well) filled with surface water and held at ambient temperature until sampling for the zone is completed. Efforts will be made to minimize disturbance to the aquatic habitat while sampling. Each fish sample will be a composite fish sample comprised of 2 to 3 fish. Within each fish sample, the smallest fish will be at least 75 percent the length of the largest fish.

When sampling is completed, individual fish will be identified to the lowest taxonomic level practical. Sediment will be removed from each specimen by rinsing with DI water. Individual fish will be composited to satisfy sample volume requirements. At least two fish will be composited in each sample; composited fish will be of the same species, if possible. The weight of the composite fish sample will be determined in the field. Any individuals not used for this sampling effort will be released into the environment at the sampling location from which the individual was collected. The composite sample will be wrapped in aluminum foil (dull side against the sample) and placed into a small, plastic zip-top bag, and labelled, following procedures described in Section 5. Samples will be frozen in a freezer or on dry ice prior to shipment to the analytical laboratory.

4.4 Decontamination Procedures

Non-dedicated sampling and monitoring equipment that is exposed to environmental contaminants will be thoroughly decontaminated prior to first use and between uses. At a minimum, decontamination procedures will include scrubbing the equipment with a brush or sponge in a solution of Alconox® detergent (or equivalent) in potable water, followed by a first rinse in potable water and a second rinse in deionized water. Equipment that is new from the factory must be wrapped in plastic as it is being transported to the Site, otherwise it must be decontaminated prior to use.

4.5 Investigation-Derived Waste

The remainder of surface water, sediment, and soil that is not placed in sample containers will be returned to the environment at the location where sample collection occurred immediately following the collection of necessary samples. Sample collection equipment will be decontaminated with a phosphate free soap, as described in Section 4.4. Rinse water will be disposed of on the NERT Site in the GW-11 pond. Solid investigation-derived waste, such as disposable gloves, disposable spoons and bowls, will be placed in a sanitary trash dumpster on the NERT site.

5.0 SAMPLE QUALITY CONTROL, DESIGNATION, HANDLING, AND ANALYSIS

Field sampling personnel and subcontracted analytical laboratories will handle samples in a manner to maximize data quality. Samples will be collected, handled, and stored in such a manner that they are representative of their original condition and chemical composition. Identification of samples and maintenance of custody are important elements that will be used to ensure samples characterize site conditions. All samples will be properly identified and maintained under standard chain-of-custody protocol to protect sample integrity. The following sections discuss the sample handling and custody requirements in detail. Additional information, as appropriate, will be provided in a forthcoming QAPP Addendum.

5.1 Field QA/QC

Field QA/QC samples collected during the proposed investigation include field duplicate samples, equipment blanks, and trip blanks. The description and purpose of these samples is discussed in this section. In addition, matrix spike/matrix spike duplicate (MS/MSD) procedures are used as a laboratory control measure, and while not defined as field QA/QC samples, they do require additional sample volume as described in Section 5.1.3.

Appropriate sample IDs for field QA/QC samples are discussed in Section 5.2. The frequency of analysis of field and laboratory QA/QC samples will be summarized in the forthcoming QAPP Addendum that will supplement the QAPP currently in place for the NERT Site (Ramboll Environ 2017a).

5.1.1 Field Duplicates

Field duplicate samples are replicate samples collected as close as possible to the same time that primary samples are collected and from the same location, depth, or source, and is used to document analytical precision. Field duplicate samples will be labeled and packaged in the same manner as primary samples. Sample identification nomenclature is provided in Section 5.2. Field duplicates will be collected at a frequency of 1 in every 10 primary samples and will be analyzed for the same suite of parameters as the primary sample. The relative percent difference (RPD) between the field duplicate sample and the primary sample is evaluated to assess the homogeneity of the sample matrix and to assess the reproducibility of laboratory and field sample collection techniques.

5.1.2 Equipment Blanks

Equipment blank samples are used to assess the effectiveness of decontamination procedures. Equipment blank samples are obtained by filling decontaminated sampling equipment with reagent-grade deionized water, sampling this water, and submitting the sample for analysis. Alternatively, deionized water can be poured over or through the decontaminated sampling equipment and then collected and submitted for analysis. Equipment blanks will be collected for 1 in every 20 samples prior to use and will be analyzed for the same suite of parameters as the primary sample to assess the effectiveness of decontamination procedures, unless the equipment is dedicated to a single use.

5.1.3 Matrix Spike/Matrix Spike Duplicates

The MS/MSD is a laboratory control sample on which additional QA/QC analyses are performed to assess the effect of matrix interference on the analytical results. MS/MSD procedures are performed on field samples at a frequency of 1 per 20 samples. Field samples to be used for MS/MSD analyses will be collected with a double sample volume.

Due to hold time and available sample quantity issues, the laboratory may not always be able to use project specified MS/MSD samples for a batch.

5.2 Sample Identification

Sample nomenclature will be based on the sample transect, the abiotic or biotic sample type, the sample depth, any quality assurance samples, and sample date. Figure A-2 shows the sample transects planned for the OU-3 BERA field effort. There are 12 sampling transects proposed for the OU-3 BERA from west to east and labelled as A through L. The transects are then subdivided according to the north (N) or south (S) bank of the Wash. Abiotic media samples will be identified as follows:

- Surface water: SW
- Sediment: SED
- Sediment pore water: PW
- Surface soil: SO
- Subsurface soil: SUBSO

Each discrete sample will use the following general identification convention:

> [Transect]-[north or south bank]-[sample matrix code][discrete sampling number]-[sample date]

An example discrete sediment sample identification number is as follows:

> *A-N-SED001-181014*: Transect A, north bank, sediment sample number 1 collected on October 14, 2018

Biotic media samples will be identified as follows:

- Benthic macroinvertebrate tissue: BMIT
- Fish tissue: FT
- Benthic macroinvertebrate community: BMIC
- Benthic macroinvertebrate community sediment grab sample: BMICSG
- Benthic macroinvertebrate community Hester-Dendy sample: BMICHD

The same general identification convention identified for abiotic media will be used for biotic media. An example benthic macroinvertebrate community sample, collected with Hester-Dendy sampler, identification number is as follows:

> *A-N-BMICHD001-181014*: Transect A, north bank, benthic macroinvertebrate community sample number 1 collected on October 14, 2018

The nomenclature for field duplicate samples will include the matrix (e.g., SED), followed by a consecutive number for field duplicates and the date, but not the exact sample location within that transect (i.e., a blind duplicate), as follows:

> *SED-001-181014*

The nomenclature for equipment blanks will include “EB,” followed by a consecutive number for equipment blanks and the date, as follows:

> *EB-001-181014*

The nomenclature for trip blanks will include “TB,” followed by a consecutive number for trip blanks and the date, as follows:

TB-001-181014

The nomenclature for MS/MSD samples will include the primary sample ID, followed by a MS or MSD, as follows:

A-N-SED001-181014-MS/MSD

A detailed record of all QC samples specific to each sampling type will be contained in the field logbook.

5.3 Sample Labels

A sample label will be affixed to all sample containers sent to the analytical laboratory. Field personnel will complete an identification label for each sample with the following information written in waterproof, permanent ink:

- Client or Site name and project number
- Sample location and depth, if relevant
- Unique sample identifier (see Section 5.2)
- Date and time sample collected
- Filtering performed, if any
- Preservative used, if any
- Name or initials of sampler
- Analyses or analysis code requested

The use of pre-printed sample labels is preferred to reduce sample misidentification problems due to transcription errors. Sample labels must be completed and affixed to the sample container in the field at the time of sample collection. Once labeled, sample containers will also be taped with clear tape to ensure the label remains affixed to the container, if necessary.

If errors are made on a sample label, corrections will be made by drawing a single line through the error and recording the correct information. All corrections will be dated and initialed.

5.4 Containers, Preservation, and Hold Times

The analytical methods, type of sample containers to be used for each sample type and analysis, preservation requirements, and holding times are provided in Table A-3.

Each lot of preservative and sampling containers will be certified as contaminant-free by the provider and/or the laboratory. The laboratories will maintain certification documentation in their files. All preserved samples will be clearly identified on the sample label and chain-of-custody form. If samples requiring preservation are not preserved, field records will clearly specify the reason for the discrepancy.

Surface water, sediment, pore water, soil, and biota tissue sample containers will be placed in Ziplock® (or equivalent) air tight plastic bags, if possible, and immediately refrigerated or placed in a cooler with ice to chill and maintain a sample temperature of 4 (± 2) °C. Subsequently, biota tissue samples may be frozen in a freezer or on dry ice prior to shipping.

5.5 Sample Handling, Custody, and Shipping

Proper sample handling techniques are used to ensure the integrity and security of the samples. Samples for field measured parameters will be analyzed immediately in the field by the sampling crew and recorded in the field logbook and field data sheets. Samples for laboratory analysis will be transferred immediately to appropriate laboratory-supplied containers in accordance with the following sample handling protocols:

- Clean gloves will be donned before touching any sample containers, and care will be taken to avoid direct contact with the sample, as much as possible.
- Samples will be quickly observed for color, appearance, and composition and recorded, as necessary.
- The sample container will be labeled before or immediately after sampling in accordance with Section 5.3 of this FSP.
- Surface water, sediment, pore water, soil, and biota tissue sample containers will be placed in Ziplock® (or equivalent) air tight plastic bags, if possible, and immediately refrigerated or placed in a cooler with ice to chill and maintain a sample temperature of 4 (± 2) °C. Subsequently, biota tissue samples may be frozen in a freezer or on dry ice prior to shipping.
- Sample bottles or canisters will be wrapped in bubble wrap as necessary to minimize the potential for breakage or damage during shipment.
- Samples will be placed in an ice chest and cooled to 4 (± 2) °C or lower for transport to the laboratory. Biota tissue samples may be shipped frozen under dry or wet ice.
- The chain-of-custody form will be placed in a separate plastic bag and taped to the cooler lid or placed inside the cooler. A custody seal will be affixed to the cooler. Chain-of-custody procedures are described further below.

The samplers are responsible for proper handling practices until receipt at the laboratory, or by the courier, at which time the Laboratory Project Manager assumes responsibility of the samples through analysis and ultimately to the appropriate disposal of samples.

Standard sample chain-of-custody procedures will be used to maintain and document sample integrity during collection, transportation, storage, and analysis. Custody documents must be written in waterproof, permanent ink. Documents will be corrected by drawing one line through the incorrect entry, entering the correct information, and initialing and dating the correction. The Field Team Leader is responsible for proper custody practices so that possession and handling of individual samples can be traced from the time of collection until receipt at the laboratory, or by the courier. The Laboratory Project Manager is responsible for establishing and implementing a control system for the samples in their possession that allows tracing from receipt of samples to disposal.

The chain-of-custody form provides an accurate written record that traces the possession of individual samples from the time of collection in the field until they are accepted at the analytical laboratory. The chain-of-custody form also documents the samples collected and the analyses requested. The sampler will record the following information on the chain-of-custody forms:

- Client and project number
- Name, initials, and/or signature of sampler

- Name of destination analytical laboratory
- Name and phone number of Project Manager in case of questions
- Unique sample identifier for each sample
- Data and time of collection for each sample
- Number and type of containers included for each sample
- Analysis or analyses requested for each sample
- Preservatives used, if any, for each sample
- Sample matrix for each sample
- Any filtering performed, if applicable, for each sample
- Signatures of all persons having custody of the samples
- Dates and times of transfers of custody
- Shipping company identification number, if applicable
- Any other pertinent notes, comments, or remarks
- Unused lines on the form will be crossed out and initialed.

A sample is considered to be under the control of, and in the custody of, the responsible person if the samples are in their physical possession, locked or sealed in a tamper-proof container or stored in a secure area.

The person who collects the sample is the initial custodian of the sample. Any transfers are documented on the chain-of-custody by the individuals relinquishing and receiving the sample, along with their signature, and the date and time of transfer. This transfer must continue until the custody is released to a commercial carrier (e.g. FedEx), or the laboratory (either at the laboratory or to a laboratory employed courier). Once the sample has arrived at the stationary laboratory, it must be entered into the sample custody control system of the laboratory. If the sample is further transported to a subcontracted laboratory, the laboratory will produce an internal chain-of-custody form that will be available upon request. Chain-of-custody forms will be maintained in the field investigation project file and at the analytical laboratory.

To discourage tampering during transport, a custody seal will be placed on each cooler after the samples are packed. These consist of a security tape or label with the date and initial of the sampler or person currently in possession of the sample. Receiving personnel at the laboratory will note on the cooler receipt form whether or not the custody seals are intact.

If shipping samples using a commercial courier is necessary, each cooler sent will have a separate chain-of-custody form. Samples collected during the investigation will be identified as environmental samples. Samples will be packed in the same manner as when being transported from the sampler to the laboratory, with the following changes:

- Extra packing material will be used to fill the coolers to limit movement within the container. Absorbent material, if available, will also be placed under the samples in the event of minor fluid leakage during shipping.
- Wet ice should be contained in Ziplock® bags, and the cooler should be lined with plastic as described below.

- Coolers containing ice and/or liquid samples should be lined with a plastic bag (such as a contractor garbage bag) to limit the potential for leaks in the event of ice bags leaking or sample container breakage. All necessary precautions must be taken to prevent any liquids leaking from sample coolers while in transit.
- Coolers will be closed and taped shut. If the cooler has a drain, it too will be closed and taped shut to prevent leaks.
- A minimum of two custody seals will be affixed to the front and side openings of the cooler so that the cooler cannot be opened without breaking a seal. The seals will be covered with wide clear tape so that the seals do not accidentally break in transit.

6.0 DATA VALIDATION, REPORTING, AND SCHEDULE

Data generated during performance of the field work will undergo two levels of review and validation: one at the laboratory and a second review after the data are received by Ramboll. Ramboll and a designated independent data validation contractor (to be determined) will perform the second data validation review. Details regarding data validation procedures are described in the NERT QAPP and will be modified in the forthcoming QAPP Addendum, if necessary (Ramboll Environ 2017a).

The field program implementation will be performed following NDEP approval of the BERA Work Plan and this FSP. It is anticipated that the field program will be implemented over approximately 2 months. Laboratory analyses will be conducted under standard turn-around time (i.e., 3–5 weeks). Data validation will be performed over 3-4 weeks following receipt of all final analytical data packages. The field investigation data and results will be evaluated in the OU-3 BERA in 2019-2020.

7.0 REFERENCES

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TABLES

TABLE A-1: Chemical Classes that will be Evaluated in the OU-3 BERA
Nevada Environmental Response Trust Site
Henderson, Nevada

Groups
Perchlorate
Chlorate
Chloroform
Total Chromium
Hexavalent Chromium
Total Dissolved Solids
Total Organic Carbon
Hardness (as Calcium Carbonate)

TABLE A-2: Proposed Number of Surface Water, Sediment, Sediment Pore Water, Soil, and Biota Tissue Samples by Transect to be Collected for the OU-3 BERA Field Sampling

Nevada Environmental Response Trust Site
Henderson, Nevada

Transect and Transect Color Depicted on Sampling Location Figure A-2 (a)	Surface Water		Sediment		Sediment Pore Water	Soil	Benthic Macro Invertebrate Community (Grab Sampling)		Benthic Invertebrate Community (Hester Dendy)		Benthic Macro invertebrate Tissue (Grab or Hester Dendy)	Fish Tissue (Multiple Trophic Levels) collected from 5 Fish Zones in the LVW
	South Bank	North Bank	South Bank	North Bank			Number of locations	Number of replicates	Number of locations	Number of replicates		(Minimum) Number of Fish Collected in Each Fish Zone
A	1	1	1	1	1	1	1	3	1	3	1	3
B	1	1	1	1	1	1	1	3	1	3	1	
C	1	1	1				1	3	1	3	1	3
D	1	1	1	1	1	1	1	3	1	3	1	
E	1	1	1		1	1	1	3	1	3	1	3
F	1	1	1	1	1	1	1	3	1	3	1	
G	1	1	1		1	1	1	3	1	3	1	
H	1	1	1		1	1	1	3	1	3	1	3
I	1	1	1				1	3	1	3	1	
J	1	1	1	1	1	1	1	3	1	3	1	
K	1	1	1	1	1	1	1	3	1	3	1	3
L	1	1	1				1	3	1	3	1	
Reference Location 1	1		1		1	1	1	3	1	3	1	1
Reference Location 2	1		1		1	1	1	3	1	3	1	1
Reference Location 3	1		1		1	1	1	3	1	3	1	1
OU-3 Totals	12	12	12	6	9	9	12	36	12	36	12	15
Reference Location Totals	3		3		3	3	3		3		3	3

(a) The sample location figures are Figure 4-1 in the OU-3 BERA Work Plan and Figure A-2 in the OU-3 FSP

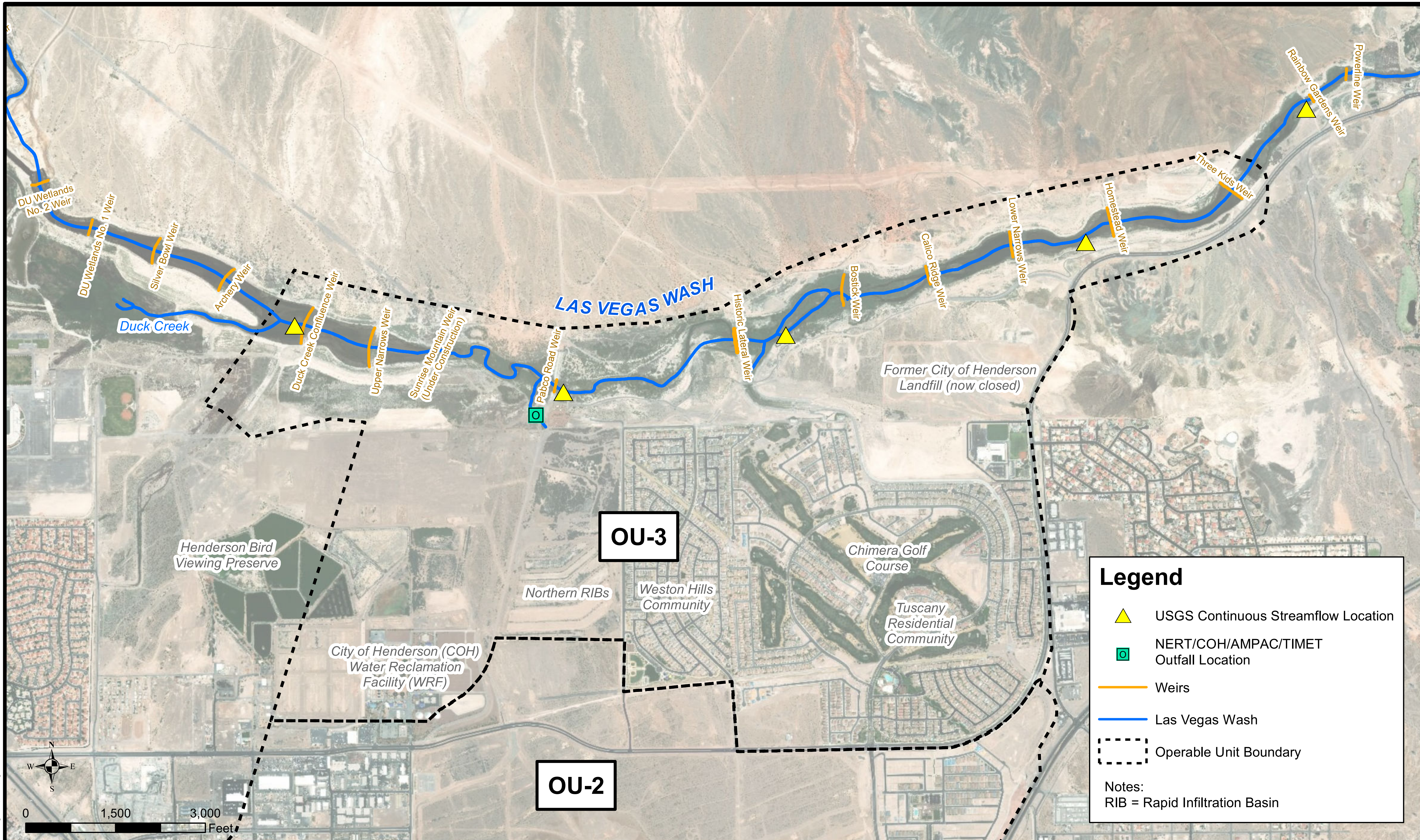
Purple	Samples to be collected include surface soil, sediment, sediment pore water, surface water, benthic invertebrate tissue, benthic invertebrate community and fish tissue, as indicated in Figure A-2.
Green	Samples to be collected include sediment, surface water, benthic invertebrate tissue, benthic invertebrate community and fish tissue, as indicated in Figure A-2.

TABLE A-3: Analytical Methods, Volumes, Containers, Hold Times and Preservatives for Each Sampling Matrix
Nevada Environmental Response Trust Site
Henderson, Nevada

ANALYTES	MATRIX	ANALYTICAL METHOD	VOLUME/CONTAINER	HOLD TIMES	PRESERVATIVES
Perchlorate	Surface Water - Total	EPA 314.0	250 ml P	28 Days	4 Degrees C
	Surface Water - Dissolved	EPA 314.0	250 ml P	28 Days	4 Degrees C
	Sediment	EPA 314.0	4 oz Amber Jar	28 Days	4 Degrees C
	Sediment Porewater	EPA 314.0	250 ml P	28 Days	4 Degrees C
	Soil	EPA 314.0	4 oz Amber Jar	28 Days	4 Degrees C
	Benthic Invertebrate Tissue	EPA 314.1	2g/Aluminum foil	28 Days	Dry or Wet Ice
	Fish Tissue	EPA 314.2	2g/Aluminum foil	28 Days	Dry or Wet Ice
Chlorate	Surface Water - Total	EPA 300.1	125 ml P	28 Days	Ethylene Diamine
	Surface Water - Dissolved	EPA 300.1	125 ml P	28 Days	Ethylene Diamine
	Sediment	EPA 300.1	4 oz Jar	28 Days	4 Degrees C
	Sediment Porewater	EPA 300.1	125 ml P	28 Days	Ethylene Diamine
	Soil	EPA 300.1	4 oz Jar	28 Days	4 Degrees C
	Benthic Invertebrate Tissue	4 Degrees C	2g/Aluminum foil	28 Days	Dry or Wet Ice
	Fish Tissue	4 Degrees C	2g/Aluminum foil	28 Days	Dry or Wet Ice
Chloroform	Surface Water - Total	SW-846 8260	3x40ml G	14 Days	HCl to pH<2
	Surface Water - Dissolved	SW-846 8260	3x40ml G	14 Days	HCl to pH<2
	Sediment	SW-846 8260	Terracore/Encore	48 Hrs	MeOH/Water
	Sediment Porewater	SW-846 8260	3x40ml G	14 Days	HCl to pH<2
	Soil	SW-846 8260	Terracore/Encore	48 Hrs	MeOH/Water
Total Chromium	Surface Water - Total	SW-846 6020	250ml Pl	180 Days	HNO3 to pH<2
	Surface Water - Dissolved	SW-846 6020	250ml Pl	180 Days	HNO3 to pH<2
	Sediment	SW-846 6020	4 oz Glass	180 Days	4 Degrees C
	Sediment Porewater	SW-846 6020	250ml Pl	180 Days	HNO3 to pH<2
	Soil	SW-846 6020	4 oz Glass	180 Days	4 Degrees C
	Benthic Invertebrate Tissue	SW-846 6020	2g/Aluminum foil	180 Days	Dry or Wet Ice
	Fish Tissue	SW-846 6020	2g/Aluminum foil	180 Days	Dry or Wet Ice
Hexavalent Chromium	Surface Water - Total	SW-846 7196	125ml Pl	24 Hours	4 Degrees C
	Surface Water - Dissolved	SW-846 7196	125ml Pl	24 Hours	4 Degrees C
	Sediment	SW-846 7196	4 oz Glass	28 Days	4 Degrees C
	Sediment Porewater	SW-846 7196	125ml Pl	24 Hours	4 Degrees C
	Soil	SW-846 7196	4 oz Glass	28 Days	4 Degrees C
Total Dissolved Solids	Water	SM2540C	500ml Pl	7 Days	4 Degrees C
Total and/or Dissolved Organic Carbon	Surface Water - Total	SW-846 9060	250 ml Amber Glass	28 Days	HCl to pH<2
	Surface Water - Dissolved	SW-846 9060	250 ml Amber Glass	28 Days	HCl to pH<2
	Sediment	Lloyd Kahn	4 oz Jar	14 Days	4 Degrees C
	Sediment Porewater	SW-846 9060	250 ml Amber Glass	28 Days	HCl to pH<2
	Soil	Lloyd Kahn	4 oz Jar	14 Days	4 Degrees C
Hardness	Surface Water - Total	SM2340	250ml Pl	180 Days	HNO3 to pH<2
	Surface Water - Dissolved	SM2340	250ml Pl	180 Days	HNO3 to pH<2
Percent Lipids (a)	Fish Tissue	Lab SOP	5g/Aluminum foil	6 Months	Dry or Wet Ice
Percent Moisture (a)	Benthic Invertebrate Tissue	Lab SOP	5g/Aluminum foil	6 Months	Dry or Wet Ice
	Fish Tissue	Lab SOP	5g/Aluminum foil	6 Months	Dry or Wet Ice

Notes:
(a) Biological tissues only
SOP Standard operating procedure
EPA Environmental Protection Agency
SW Solid Waste

FIGURES



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RAMBOLL

DRAFTED BY: EF

DATE: 10/5/2018

OU-3 and Weirs in the Las Vegas Wash

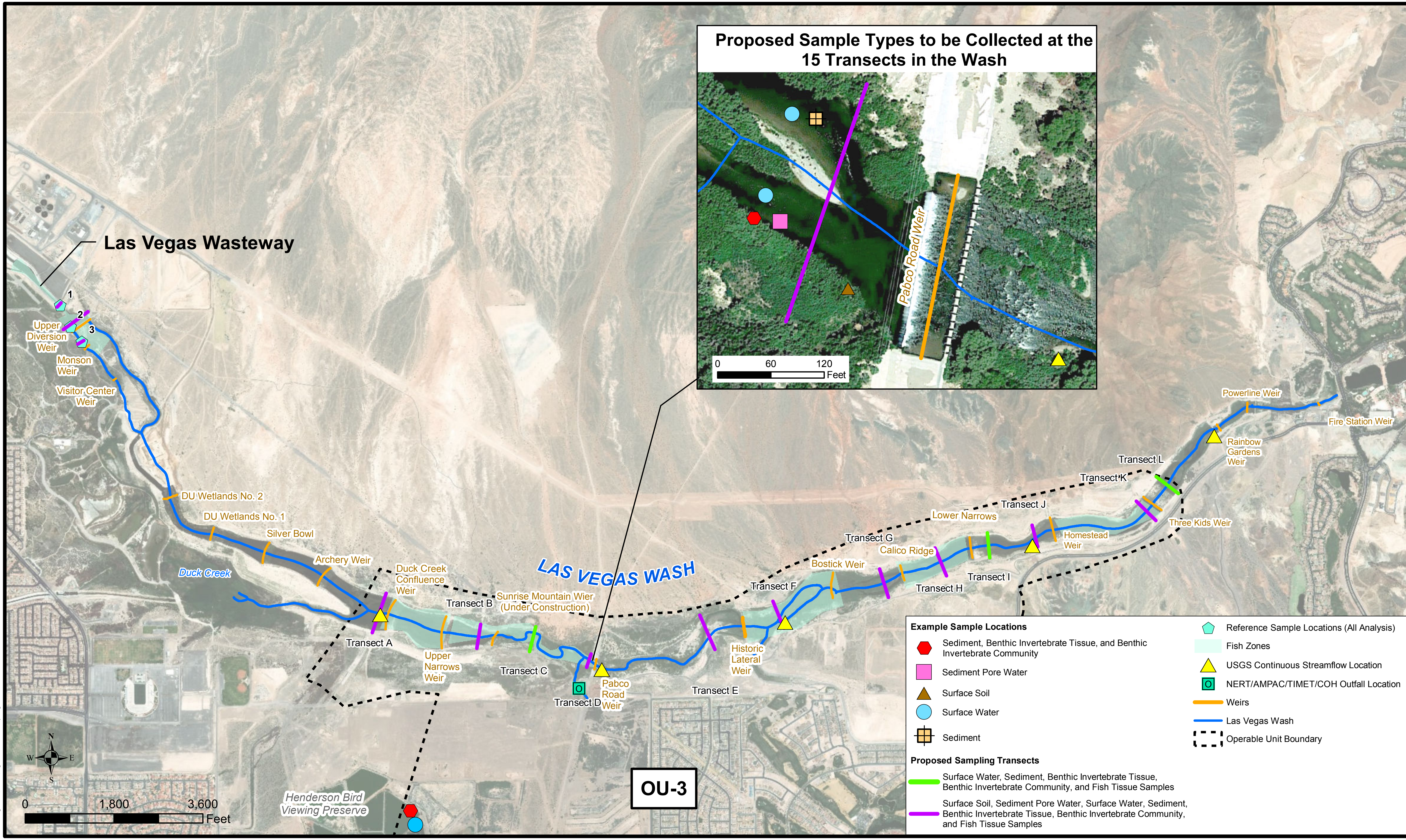
Nevada Environmental Response Trust Site

Henderson, Nevada

Figure

A-1

PROJECT: 1690006943-018



RAMBOLL

DRAFTED BY: EF | DATE: 10/23/2018

Ramboll OU-3 BERA Proposed Sampling Locations
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
A-2

PROJECT: 16900069433-018

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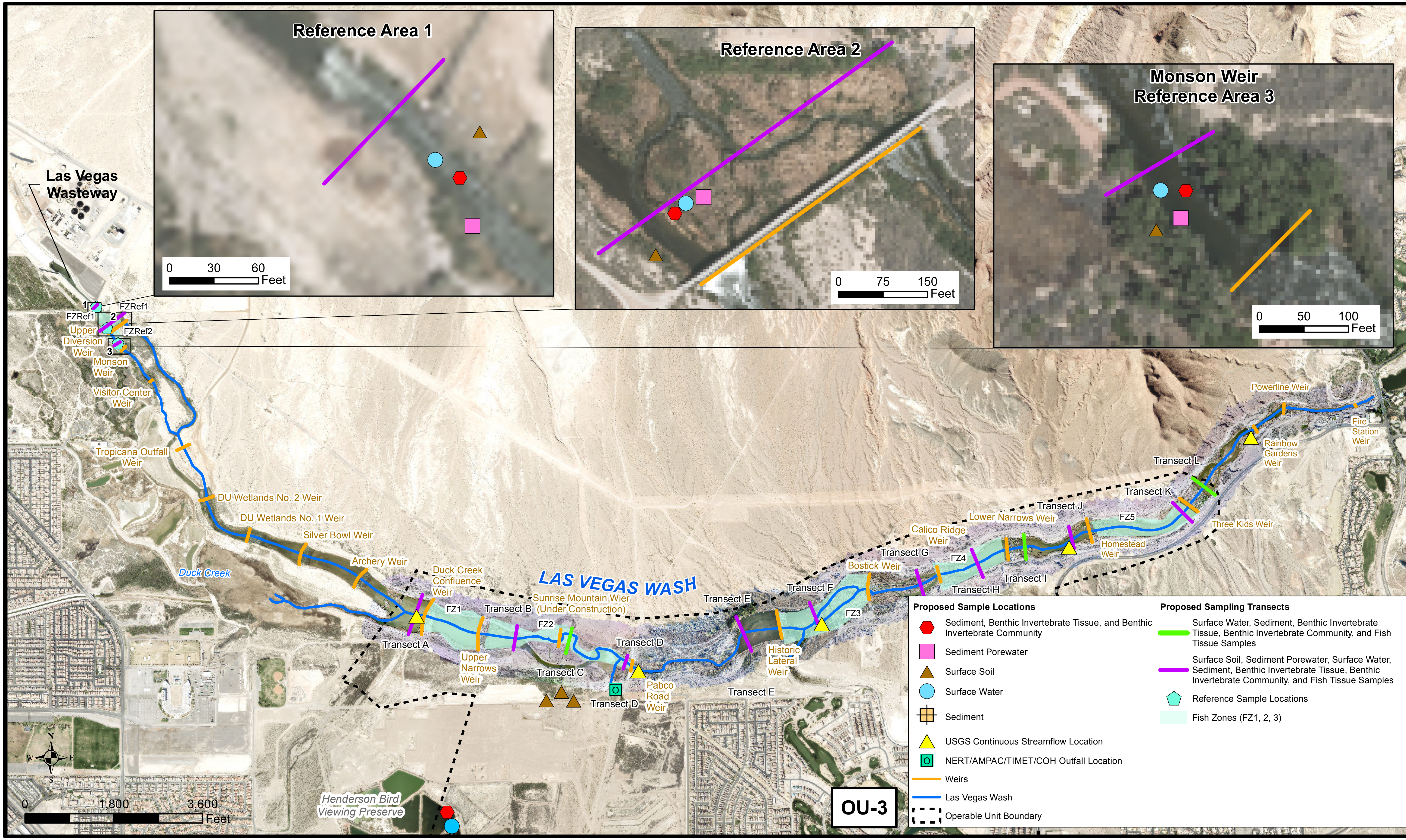

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RAMBOLL

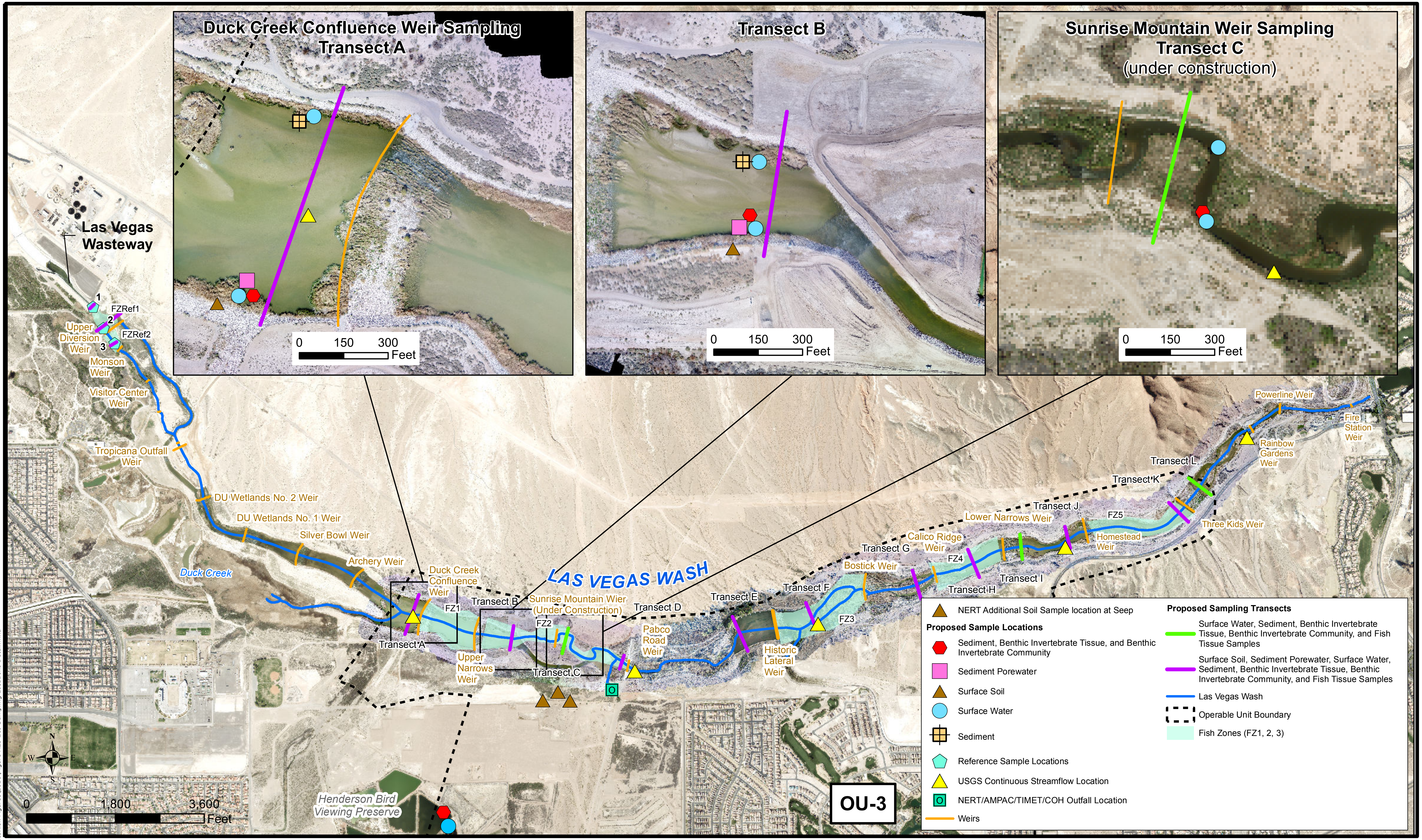
DRAFTED BY: EF | DATE: 1/24/2019

OU-3 BERA Proposed Sampling Locations
Reference Location Transects 1, 2 and 3

Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
A-2a

PROJECT: 1690069433-018



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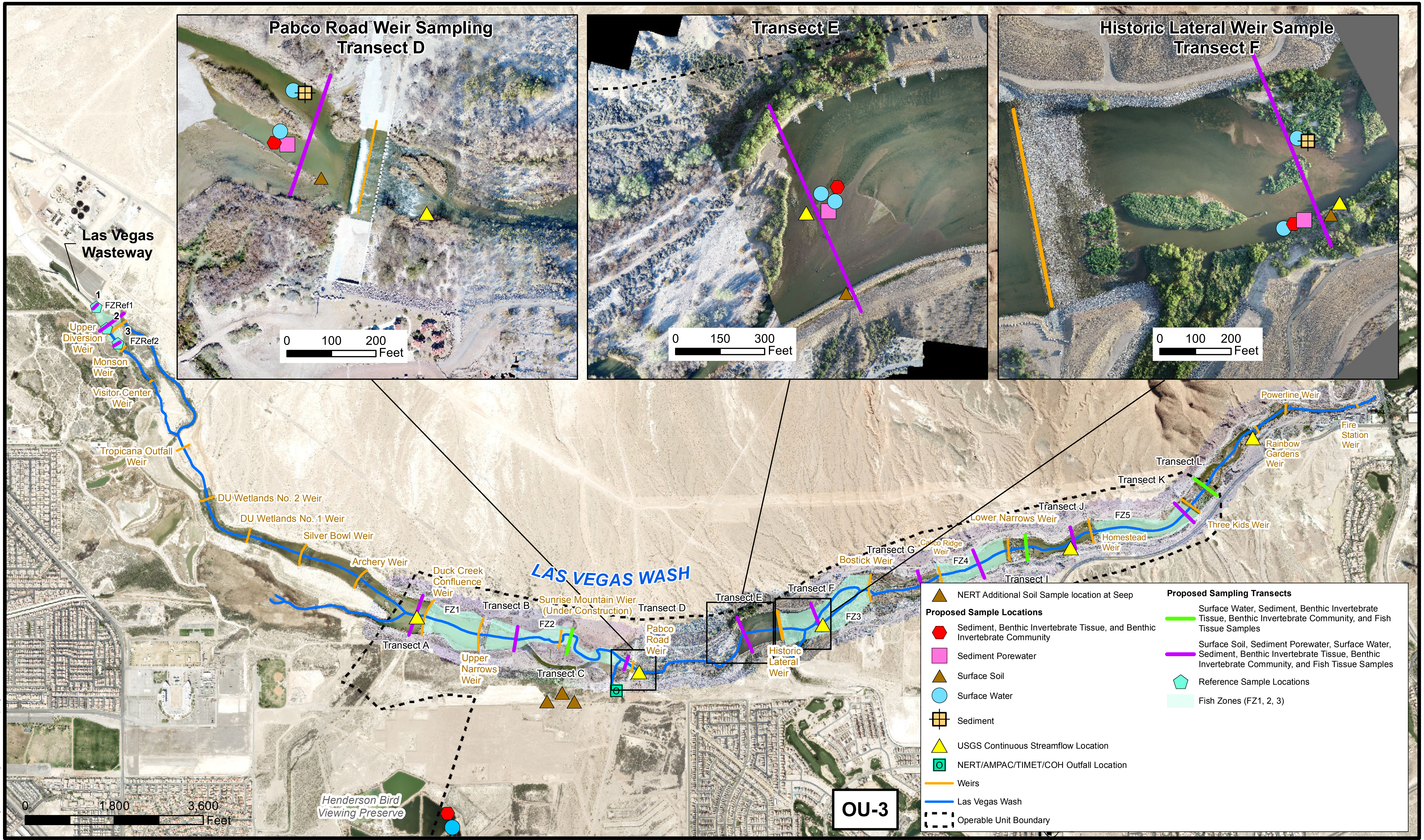
DRAFTED BY: EF/RS | DATE: 1/24/2019

OU-3 BERA Proposed Sampling Locations
Transects A, B and C
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
A-2b

PROJECT: 1690006943-018



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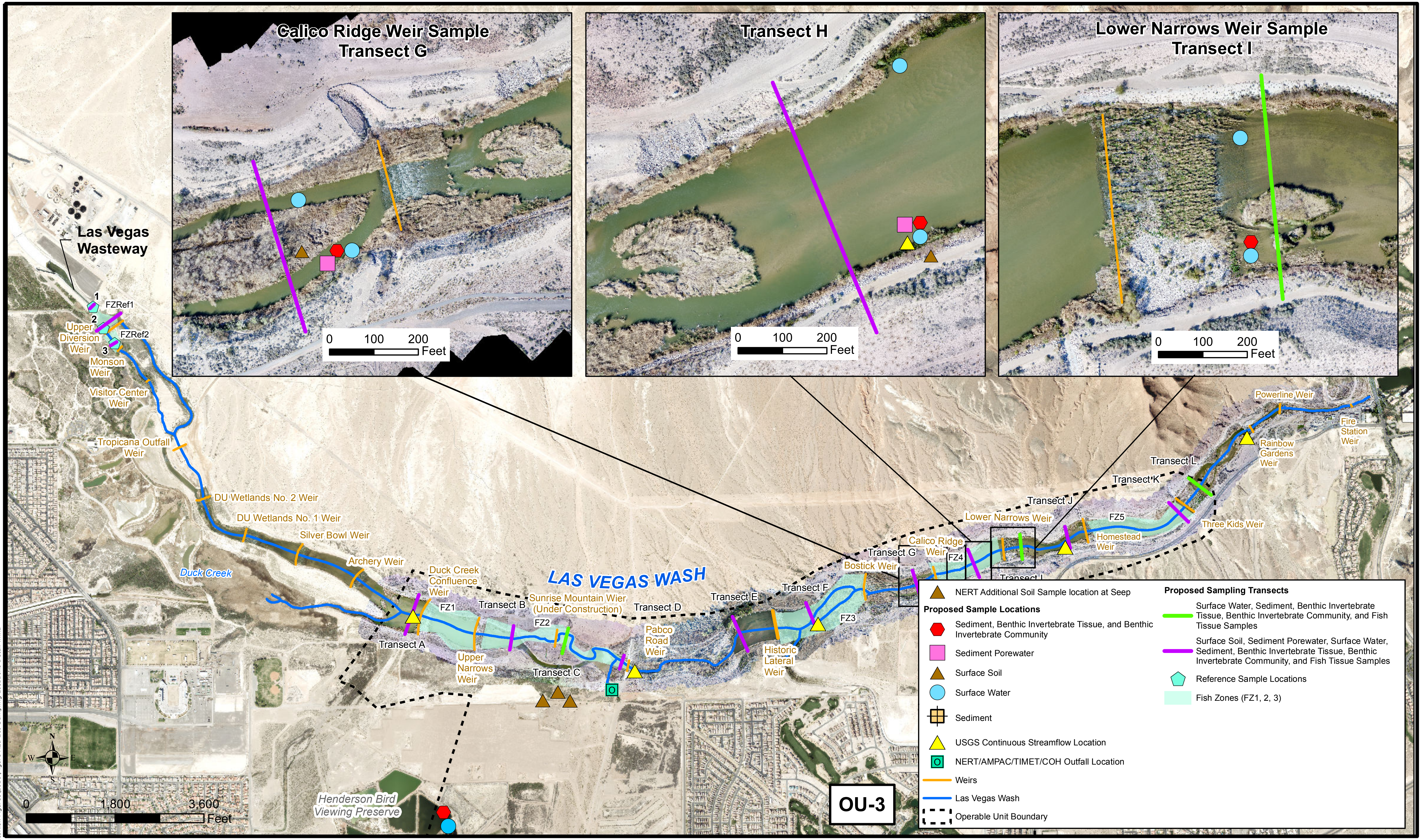
DRAFTED BY: EF/RS | DATE: 1/24/2019

OU-3 BERA Proposed Sampling Locations
Transects D, E and F
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
A-2c

PROJECT: 16900069433-018



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DRAFTED BY: EF/RS

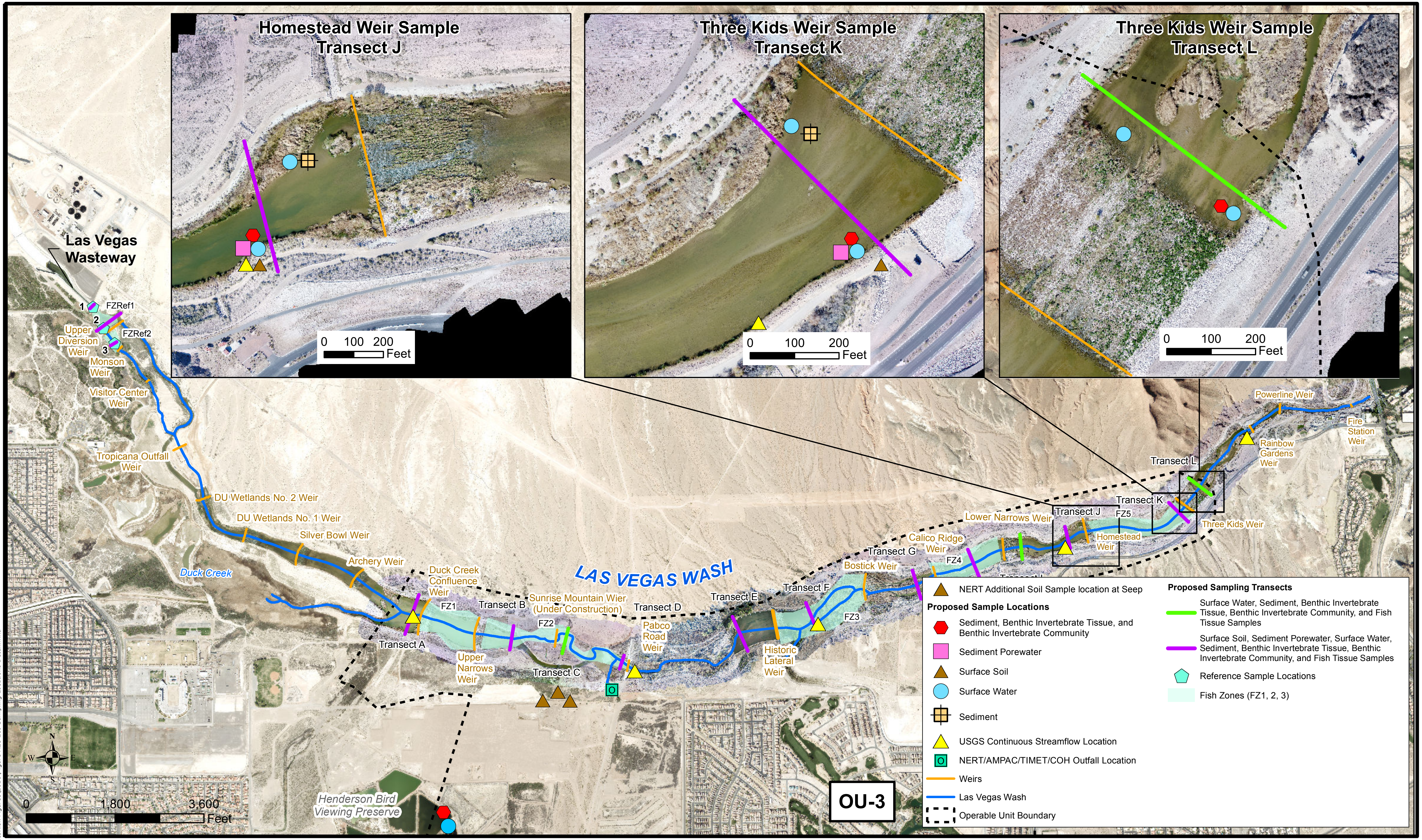
DATE: 1/24/2019

OU-3 BERA Proposed Sampling Locations
Transects G, H and I

Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
A-2d

PROJECT: 1690069433-018



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RAMBOLL

DRAFTED BY: EF/RS | DATE: 1/24/2019

OU-3 BERA Proposed Sampling Locations
Transects J, K and L
Nevada Environmental Response Trust Site
Henderson, Nevada

Figure
A-2e

PROJECT: 1690069433-018

Attachment A
OU-3 Field Data Sheets

NERT OU-3 Surface Water Collection Field Data Sheet

Investigators:	**Date:**
Water Quality Probe (e.g. YSI 650 MDS):	**Start Time:**
GPS Unit Type:	
Probe Calibration Date:	**Weather at start:**
Secchi Disk Depth (in feet):	**Water Depth (surface to bottom):**

Notes or Observations:

Instruments Calibrated/Date:

Logbook Page:

Sample Location / Transect	Sample Depth (feet bws)	Conduct-ivity (mS/cm)	Water Temp (°C or °F)	pH	Dissolved Oxygen (DO in mg/L)	Oxygen Reduction Potential (mV)	Turbidity (NTUs)	Surface Water Sample? (Y/N)	Field Dup or MS/MSD?	Notes, if any

Notes:

°C	Degrees Celsius
°F	Degrees Fahrenheit
bws	below water surface
Dup	Duplicate
mg/L	milligrams per liter
mS/cm	milliSiemens per centimeter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
mV	Millivolts
NTU	Nephelometric Turbidity Unit
pH	Potential of Hydrogen
Y/N	Yes or No

RAMBOLL

NERT OU-3 Sediment Collection Field Data Sheet

Sampling Region:	**Sampling Date:**
GPS Unit Type:	**Start Time:**
REH Investigator(s):	**Weather at Start:**
Notes or Observations:	

Sample Location / Transect	Sample Time	Water Depth (in feet)	Local Bottom Substrate (Rocky, Silty, etc.,)	Field Dup or MS / MSD?	Jar #s and size collected	PW Peeper Deployed? (Y or N)	Sediment Sample ID	Location Notes (sediment texture / color)

Sediment Collection / Pore Water DeploymentConfiguration Sketch and/or Rellocation Notes:

Notes:

Y/N	Yes or No	MSD	Matrix Spike
Dup	Duplicate	MSD	Matrix Spike Duplicate

Water quality parameters for the sediment/water interface at this location are recorded on a water quality form.

Page __ of __

RAMBOLL

NERT OU-3 Sediment Pore Water Collection Field Data Sheet

Sampling Region:	Sampling Date:
REH Investigator(s):	
GPS Unit Type:	
Pore Water Sampler Type:	
Deployment Date:	
Retrieval Date:	
Equilibration Time:	
Notes or Observations:	

Sample Location / Transect	Pore Water Device Deployment Date	Pore Water Device Retrieval Date	Pore Water Sample Collection Date	Volume Available	Field Dup or MS / MSD?	Notes

Sediment Collection / Pore Water Deployment Configuration Sketch and/or Rellocation Notes:

Notes:

Dup	Duplicate	MSD	Matrix Spike Duplicate
MSD	Matrix Spike	Y/N	Yes or No

RAMBOLL

NERT OU-3 Soil Collection Field Data Form

Sampling Region:	**Sampling Date:**
GPS Unit Type:	**Start Time:**
REH Investigator(s):	**Weather at Start:**
Notes or Observations:	

Sample Location / Transect	Sample Time	Soil Type	Field Dup or MS / MSD?	Jar #s and size collected	Biota?	Soil Sample ID	Location Notes

Configuration Sketch and/or Rellocation Notes:

Notes:

Dup	Duplicate	MSD	Matrix Spike Duplicate
MSD	Matrix Spike	Y/N	Yes or No

NERT OU-3 Macroinvertebrate Tissue Sample Field Data Sheet

TRANSECT ID		
DATE	TIME	Type of Sample (Circle): Grab / Hester Dendy / Other:________
OTHER:		Depuration Time

Weather (circle all that apply): heavy rain / overcast / steady rain / partly cloudy / intermittent rain / clear-sunny / Other__________
Inches of rain in the last 24 hours:
Other notes:

Check all that apply:

FLOW	WATER CLARITY	WATER COLOR
O Dry	O Clear/Transparent	O None
O Stagnant/Still	O Cloudy/Slightly Turbid	O Brown/Muddy
O Low	O Opaque/Very Turbid	O Green
O Normal	O Other	O Tannic/Black
O High		O Other:
O Flood over banks		

WATER SURFACE

O Clear

O Oily sheen that breaks when disturbed

O Oily sheen that does not break when disturbed

O Some foam Color: __________________________

O More than 3" foam Color: __________________________

Odor (circle): natural or none / fishy / sewage / gasoline / chlorine / sulfur / other ____________

MACROINVERTEBRATES

MARK THESE TAXA AS X, R, C, or D

X = not found, R (rare)=1-9, C (common)=10-99, and D (dominant) = 100 individuals or greater

These are freshwater organisms common to many waterbodies in North America.

	Stonefly Nymphs		Net Spinning Caddisflies		Black Fly Larvae
	Mayfly Nymphs		Dobsonfly/Helgrammite		Lunged Snails
	Water Penny Larvae		Dragonfly & Damselfly		Aquatic Worms
	Riffle Beetles		Crayfish		Leeches
	Aquatic Snipe Flies		Crane Flies		Chironomids
	Caddisflies		Aquatic Sow Bugs		Other:
	Gilled Snails		Scud Clams		Other:
	Midge Fly Larvae		Black Fly Larvae		Other:

Notes:

Page __ of __

NERT OU-3 Fish Tissue Collection Field Data Sheet

Transect:	
Wildlife Collection Permit# (if applicable):	
Date:	**Notes / Observations:**
Start Time:	
GPS Coordinates (or where they can be found if collected electronically):	
Investigators	
Time spent at trasect in efforts to collect fish	
Fish collection method	

Flow status (circle one): runoff event high flow low flow normal other

Sample #	Fish #	Genus	Species	Length (mm)	Weight (grams)	Comments
	001					
	002					
	003					
	004					
	005					
	006					
	007					
	008					
	009					
	010					
	011					
	012					
	013					
	014					
	015					

Length (mm) of 75%tile of Longest Fish:	**Total # Fish Collected in Sample:**	
Collected by:	**Date:**	**Time:**
Relinquished by:	**Date:**	**Time:**
Received by:	**Date:**	**Time:**

NERT OU-3 Habitat Assessment Field Data Sheet (High Gradient Stream Location)

Adapted from USEPA Rapid Bioassessment Protocols (USEPA, 1999: EPA 81-B-99-002)

Las Vegas Wash	Transect
GPS Unit	
Investigators	
Form Completed By	Date Time

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (I.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity or niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <3.3 m/s, deeps is >0.5 m)	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than if missing other regimes).	Only 2 of the 4 regimes present (if fast-shallow or slow-shallow are missing score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affectedby sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30%of thebottom affected; slightdeposition in pools.	Moderate deposition of new gravel, sand or fine sediment onold and new bars; 30-50%of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; morethan 50% ofthe bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET - HIGH GRADIENT STREAMS

Adapted from USEPA Rapid Bioassessment Protocols (USEPA, 1999: EPA 81-B-99-002)

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization , i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankment or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7), variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally still flat water or shallow riffles; poor habitat distance between riffles divided by the width of the stream is greater than 25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note. Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 cm or less in average stubble height.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank)	Width of riparian zone >18m; human activities (I.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 m; human activities have impacted zone only minimally.	Width of riparian zone 6-12 m; human activities have impacted zone a great deal.	Width of riparian zone <6m: little or no riparian vegetation due to human activities.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ____________

RAMBOLL

Page ______ of ______

NERT OU-3 Habitat Assessment Field Data Sheet (Low Gradient Stream Location)

Adapted from USEPA Rapid Bioassessment Protocols (USEPA, 1999: EPA 81-B-99-002)

Las Vegas Wash	Transect
GPS Unit	
Investigators	
Form Completed By	Date Time

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (I.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud of clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation , mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET - LOW GRADIENT STREAMS

Adapted from USEPA Rapid Bioassessment Protocols (USEPA, 1999: EPA 81-B-99-002)

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization , i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankment or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 cm or less in average stubble height.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank)	Width of riparian zone >18m; human activities (I.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 m; human activities have impacted zone only minimally.	Width of riparian zone 6-12 m; human activities have impacted zone a great deal.	Width of riparian zone <6m: little or no riparian vegetation due to human activities.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____________

APPENDIX B
USEPA ECOLOGICAL CHECKLIST FOR OU-3

CHECKLIST FOR ECOLOGICAL ASSESSMENT/SAMPLING

Introduction

The checklist that follows provides guidance in making observations for an ecological assessment. It is not intended for limited or emergency response actions (e.g., removal of a few drums) or for purely industrial settings with no discharges. The checklist is a screening tool for preliminary site evaluation and may also be useful in planning more extensive site investigations. It must be completed as thoroughly as time allows. The results of the checklist will serve as a staring point for the collection of appropriate biological data to be used in developing a response action. It is recognized that certain questions in this checklist are not universally applicable and that site-specific conditions will influence interpretation. Therefore, a site synopsis is requested to facilitate final review of the checklist by a trained ecologist.

Checklist

The checklist has been divided into sections that correspond to data collection methods and ecosystem types. These sections are:

- I Site Description
  - IA. Summary of Observations and Site Setting
- II Terrestrial Habitat Checklist
  - IIA. Wooded
  - IIB. Shrub/Scrub
  - IIC. Open Field
  - IID. Miscellaneous
- III Aquatic Habitat Checklist – Non-Flowing Systems
- IV Aquatic Habitat Checklist – Flowing Systems
- V Wetlands Habitat Checklist

(1)

Checklist for Ecological Assessment/Sampling

I. SITE DESCRIPTION

1. Site Name: NERT Operable Unit 3 Henderson, Nevada

   Location: Las Vegas Wash, Henderson, Nevada (LVW)

   County: Clark City: Henderson State: CA.

2. Latitude: ______________ Longitude: ______________

3. What is the approximate area of the site: ______________

4. Is this the first site visit? 9 Yes 9 No. If no, attach trip report of previous site visit(s), if available.

   Date(s) of previous site visit(s): ______________

5. Please attach to the checklist USGS topographic map(s) of the site, if available.

6. Are aerial or other site photographs available? 9 Yes 9 No. If yes, please attach any available photo(s) to the site map at the conclusion of this section.

A photo log is provided as Appendix C
Additional OU-3 site figures are also in the Baseline Ecological Risk Assessment (BERA) workplan.

The area to the north is 100% rural

OU-3

7. The land use of the site is:

The area surrounding the ~~site is~~: South up to one mile ~~radius~~ to the South

The land use of the site is:	The area surrounding the site
0 % Urban	10 % Urban
___ % Rural	20 % Rural
15 % Residential	20 % Residential
5 % Industrial (✓ light ___ heavy)	20 % Industrial (✓ light ___ heavy) OU-2
— % Agricultural	— % Agricultural
(Crops: —)	(Crops: —)
65 % Recreational	3 % Recreational
(Describe: note if it is a park etc.) Chimera Golf Course and Las Vegas Wash (LVW)	(Describe: note if it is a park, etc.)
0 % Undisturbed	0 % Undisturbed
15 % Other vacant dirt	27 % Other Graded dirt for residential Housing Cadence Community

8. Has any movement of soil taken place at the site? 9___ Yes 9___ No. If yes, please identify the most likely cause of this disturbance:

9 ~~Agricultural Use~~ 9 Heavy Equipment 9 ~~Mining~~

9 ~~Natural Events~~ 9 Erosion 9 Other

Please describe:

Weir construction - heavy equipment
monitoring wells - drilling
Las Vegas Wash - bank erosion, bank stabilization projects, weir construction revegetation efforts.

9. Do any potential sensitive environmental areas exist adjacent to or in proximity to the site, e.g., Federal and State parks, National and State monuments, wetlands, prairie potholes? *Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information.*

Yes - Las Vegas Wash

Please provide the source(s) of the information used to identify these sensitive areas, and indicate their general location on the site map.

Site Reconnaissance by an experienced senior biologist plus a comprehensive literature review of documents produced by the Las Vegas Wash Coordination Commission; Southern Nevada Water Authority and NDEP.

10 What type of facility is located at the site? None in OU-3

9 Chemical OU-1 9 Manufacturing OU-1 9 Mixing 9 Waste disposal

9 Other (specify) No "facity" is located within OU-3 however groundwater is discharging from the NERT site to the LVW.

11. What are the suspected contaminants of concern at the site? If know, what are the maximum concentration levels? In groundwater from the NERT site: perchlorate, chromium, hexavalent chromium, chloroform

12. Check any potential routes of off-site migration of contaminants observed at the site

9 Swales 9 Depressions 9 Drainage ditches

9 Runoff 9 Windblown particulates 9 Vehicular traffic

9 Other (specify) groundwater

13. If known, what is the approximate depth to the water table?__________

14. Is the direction of surface runoff apparent from site observations? 9 yes 9 no. If yes, to which of the following does the surface runoff discharge? Indicate all that apply.

9 Surface water 9 Groundwater 9 Sewer 9 Collection impoundment

15. Is there a navigable waterbody or tributary to a navigable waterbody? 9 yes 9 no

Yes - Las Vegas Wash drains to Lake Mead which is a navigable waterbody.

The facility area (OU-1) was graded so that stormwater would be captured on-site. There are also two main designated retention basins and a drainage channel to collect stormwater.

16. Is there a waterbody anywhere on or in the vicinity of the site? If yes, also complete Section III: Aquatic Habitat Checklist – Non-Flowing Systems and/or Section IV: Aquatic Habitat Checklist – Flowing Systems.

9 yes (approx. distance Within OU-3) 9 no
approximately 2.5 miles from OU-1 (The NERT Facility)

17. Is there evidence of flooding? 9 yes 9 no *Wetlands and flood plains are not always obvious; do not answer "no" without confirming information.* If yes, complete Section V: Wetland Habitat Checklist. The Las Vegas Wash can flood but bank stabilization and revegetation efforts have reduced the probability of flooding

18. If a field guide was used to aid any of the identifications, please provide a reference. Also, estimate the time spent identifying fauna. [Use a blank sheet if additional space is needed for text.]

The site reconnaissance was conducted by a senior certified biologist
The Peterson Field Guides as well as maps + reports from the LVWCC.org site

19. Are any threatened and/or endangered species (plant or animal) known to inhabit the area of the site? 9 yes 9 no *If yes, you are required to verify this information with the U.S. Fish and Wildlife Service.* If species' identities are known, please list them next.
There are four listed species in the vicinity of the LVW in OU-3 including desert tortoise, Yuma clapper rail, Southwestern willow Flycatcher, Yellow-billed cuckoo. These species can be found at Clark County Wetlands Park, the LVW, and potentially at the City of Henderson Bird Viewing Pond.

20. Record weather conditions at the time this checklist was prepared:

Date: April 2-3, 2018

~80 Temperature (EC/EF)

71 °F Normal daily high temperature

7 mph NW Wind (direction/speed)

0 Precipitation (rain,snow)

10% Cloud cover

IA. SUMMARY OF OBSERVATIONS AND SITE SETTING

Operable unit 3 includes the Las Vegas Wash, a highly sensitive and ecologically rich area. Nearly 300 vertebrate species. Surveys conducted by the Las Vegas Wash Coordination Committee / SN Southern Nevada Water Authority. The LVW provides high quality habitat for many of Nevada's native wildlife species including critical habitat for threatened and endangered species.

South of the Las Vegas Wash are the City of Henderson Bird Viewing Ponds, the City of Henderson Water Reclamation Facility, The Tuscany residential community and the Chimera Golf Course.

Completed by Linda Martello PhD Affiliation Ramboll

Additional Preparers

Site Manager John Pekala

Date April 7, 2018

II TERRESTRIAL HABITAT CHECKLIST — The information in this Section is specific to the Las Vegas Wash. There is very little native vegetation elsewhere aside from the Bird Ponds.

IIA. WOODED

1. Are there any wooded areas at the site? 9 yes 9 no If no, go to Section IIB: Shrub/Scrub.

2. What percentage or area of the site is wooded? (~30 % _________ acres). Indicate the wooded area on the site map which is attached to a copy of this checklist. Please identify what information was used to determine the wooded area of the site.
The site recon and the LVWCC (2008) were used to assess the terrestrial habitats.

3. What is the dominant type of vegetation in the wooded area? (Circle one: Evergreen/Deciduous/Mixed) Provide a photograph, if available. Photo log is provided in App. C.
Dominant wooded plant, if known: Cottonwood, Mesquite, Catclaw, salt cedar

4. What is the predominant size of the trees at the site? Use diameter at breast height.

9 0 - 6 in. 9 6 - 12 in. 9 >12 in. >10 feet (LVWCC 2008)

5. Specify type of understory present, if known. Provide a photograph, if available.
Consists of native, naturalized or weedy species from the Asteraceae, Poaceae, and Chenopodiaceae.

IIB. SCHRUB/SCRUB

1. Is shrub/scrub vegetation present at the site? 9 yes 9 no If no, go to Section IIC: Open Field.

2. What percentage of the site is covered by scrub/shrub vegetation? (27 % _____ acres). Indicate the areas of shrub/scrub on the site map. Please identify what information was used to determine this area.
Quailbush, fourwing saltbush, desert saltbush, shadscale
Site Recon + LVWCC (2008)

3. What is the dominant type of scrub/shrub vegetation, if known? Provide a photograph, if available. A photo log is provided as Appendix C.

4. What is the approximate average height of the scrub/shrub vegetation?

9 0 - 2 ft. ● 2 - 5 ft. 9 > 5 ft.

↳ however plant heights often exceed 6 feet. (LVWCC 2008)

LVWCC 2008. Land Cover Types of the Las Vegas Wash, NV.

5. Based on site observations, how dense is the scrub/shrub vegetation?

9 Dense 9 Patchy 9 Sparse

IIC. OPEN FIELD

1. Are there open (bare, barren) field areas present at the site? 9 yes 9 no If yes, please indicate the type below:

9 Prairie/plains 9 Savannah 9 Old field 9 Other (specify) fallow disturbed

2. What percentage of the site is open field? (30 % _______ acres). Indicate the open fields on the site map.

3. What is/are the dominant plant(s)? Provide a photograph, if available.

Saltbrush, Creosote or unvegetated
Photos provided in Appendix C.

4. What is the approximate average height of the dominant plant? 2 feet

5. Describe the vegetation cover: 9 Dense 9 Sparse 9 Patchy

Dense in patches but then sparse between

IID. MISCELLANEOUS

1. Are other types of terrestrial habitats present at the site, other than woods, scrub/shrub, and open field? 9 yes 9 no If yes, identify and describe them below.

2. Describe the terrestrial miscellaneous habitat(s) and identify these area(s) on the site map.

Not Applicable

3. What observations, if any, were made at the site regarding the presence and/or absence of insects, fish, birds, mammals, etc.?

There is an abundance of insects, fish, birds and mammals. A complete library of wildlife in the LVW can be found at LVWash.org

4. Review the questions in Section I to determine if any additional habitat checklists should be completed for this site.

Noted

III AQUATIC HABITAT CHECKLIST

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist.

1. What type of open-water, non-flowing system is present at the site?

   9 Natural (pond, lake)
   9 Artificially created (lagoon, reservoir, canal, impoundment)

2. If known, what is the name(s) of the waterbody(ies) on or adjacent to the site?

   City of Henderson Bird Viewing Ponds

3. If a waterbody is present, what are its known uses (e.g., recreation, navigation, etc.)?

   wildlife viewing

4. What is the approximate size of the waterbody(ies)? ~250 acre(s).

   only approximately 50 acres is within the OU-3 boundary

5. Is any aquatic vegetation present? 9 yes 9 no If yes, please identify the type of vegetation present if known.

   9 Emergent 9 Submergent 9 Floating

6. If known, what is the depth of the water? widely variable

7. What is the general composition of the substrate? Check all that apply.

9 Bedrock	9 Sand (coarse)	9 Muck (find/black)
9 Boulder (>10 in.)	9 Silt (fine)	9 Debris
9 Cobble (2.5 - 10 in.)	9 Marl (shells)	9 Detritus
9 Gravel (0.1 - 2.5 in.)	9 Clay (slick)	9 Concrete

   9 Other (specify) ______

8. What is the source of water in the waterbody?

9 River/Stream/Creek	9 Groundwater to LVW	9 Industrial discharge
9 Surface runoff	9 Other (specify) treated wastewater to LVW + Bird Ponds	

9. Is there a discharge from the site to the waterbody? 9 yes 9 no If yes, please describe this discharge and its path.

Groundwater discharges from OU-1 to OU-3 (LVW)

10. Is there a discharge from the waterbody? 9 yes 9 no. If yes, and the information is available, identify from the list below the environment into which the waterbody discharges.

9 River/Stream/Creek	9 onsite	9 offsite	Distance ~5 miles to Lake Mead
9 Groundwater	9 onsite	9 offsite	
9 Wetland	9 onsite	9 offsite	Distance ________
9 Impoundment	9 onsite	9 offsite	

11. Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected provide the measurement and the units of measure below: This information was obtained from LVWCC

1,000 acres Area (area of LVW within OU-3 assuming a 1/4 mile buffer around the wash.

NA Depth (average)

20-22 Temperature (depth of the water at which the reading was taken) ________

7.6-8.2 pH

7.5-9.8 Dissolved oxygen

NA Salinity

NA Turbidity (clear, slightly turbid, turbid, opaque) (Seecchi disk depth ________)

\- Other (specify)

12. Describe observed color and area of coloration.

NA

13. Mark the open-water, non-flowing system on the site map attached to this checklist.

NA

14. What observations, if any, were made at the waterbody regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc.?

As described previously, there is an abundance of insects, fish, birds + mammals. A complete library of wildlife in the LVW can be found at LVWash.org.

IV AQUATIC HABITAT CHECKLIST – FLOWING SYSTEMS

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist.

1. What type(s) of flowing water system(s) is (are) present at the site?

9 River / Wash - perenniel	9 Stream	9 Creek
9 Dry wash	9 Arroyo	9 Brook
9 Artificially created (ditch, etc.)	9 Intermittent Stream	9 Channeling
9 Other (specify) ______		

2. If known, what is the name of the waterbody? Las Vegas Wash and tributaries

3. For natural systems, are there any indicators of physical alteration (e.g. channeling, debris, etc.)? 9 yes 9 no If yes, please describe indicators that were observed.

LVW was once ephemeral but is now perenniel due to treated wastewater entering the wash year round. Bank stabilization, weir construction & revegetation efforts have improved water quality and reduced bank erosion & sedimentation.

4. What is the general composition of the substrate? Check all that apply.

9 Bedrock	9 Sand (coarse)	9 Muck (find/black)
9 Boulder (>10 in.)	9 Silt (fine)	9 Debris
9 Cobble (2.5 - 10 in.)	9 Marl (shells)	9 Detritus
9 Gravel (0.1 - 2.5 in.)	9 Clay (slick)	9 Concrete
9 Other (specify) ______		

5. What is the condition of the bank (e.g., height, slope, extent of vegetative cover)?

Since the advent of bank stabilization efforts the banks are mostly vegetated, height and slope vary with location along the wash.

6. Is the system influenced by tides? 9 yes 9 no What information was used to make this determination?

This waterbody is in southern Nevada and not large enough to be influenced by tides.

7. Is the flow intermittent? 9 yes 9 no If yes, please note the information that was used in making this determination.

Perennial due to treated wastewater.

8. Is there a discharge from the site to the waterbody? 9 yes 9 no If yes, please describe the discharge and its path.

Groundwater enters the Wash + treated wastewater.

9. Is there a discharge from the waterbody? 9 yes 9 no If yes, and the information is available, please identify what the waterbody discharges to and whether the discharge is on site or off site.

The LVW empties into Lake Mead.

10. Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected, provide the measurement and the units of measure in the appropriate space below: See page 10

_________ Area

_________ Depth (average)

_________ Temperature (depth of the water at which the reading was taken) __________

_________ pH

_________ Dissolved oxygen

_________ Salinity

_________ Turbidity (clear, slightly turbid, turbid, opaque) (Seecchi disk depth _________)

_________ Other (specify)

11. Describe observed color and area of coloration.

No unusual coloration was observed during the Site Reconnaissance.

12. Is any aquatic vegetation present? 9 yes 9 no If yes, please identify the type of vegetation present, if know.

9 Emergent 9 Submergent 9 Floating

13. Mark the flowing water system on the attached site map. maps are attached

14. What observations were made at the waterbody regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc.?

There is an abundance of insects, birds and mammals in and around the LVW. Benthic macroinvertebrate and fish community studies have been conducted and quantified. These studies are available at LVwash.org.

V. WETLAND HABITAT CHECKLIST

1. Based on observation and/or available information, are designated or known wetland definitely present at the site? 9 yes 9 no

Please note the sources of observations and information used (e.g., USGS Topographic Maps, National Wetland Inventory, Federal or State Agency, etc.) To make this determination.

USFWS has mapped wetlands in the LVW.

2. Based on the location of the site (e.g., along a waterbody, in a floodplain) and site conditions (e.g. standing water, dark, wet soils; mud cracks; debris line; water marks), are wetland habitats suspected? 9 yes 9 no If yes, proceed with the remainder of the wetland habitat identification checklist.

3. What type(s) of vegetation are present in the wetland?

9 Submergent 9 Emergent 9 Scrub/Shrub 9 Wooded
9 Other (specify) ____________________________

4. Provide a general description of the vegetation present in and around the wetland (height, color, etc.). Provide a photograph of the known or suspected wetlands, if available.

The wetland classes in the LVW consist of two types: Palustrine scrub-shrub and Palustrine emergent.

5. Is standing water present? 9 yes 9 no If yes, is water: 9 Fresh 9 Brackish
What is the approximate area of the water (sq. ft.) ____________________
Please complete questions 4, 11, 12 in Checklist III - Aquatic Habitat – Non-Flowing Systems.

6. Is there evidence of flooding at the site? What observations were noted?

9 Buttressing 9 Water marks 9 Mud cracks

9 Debris line 9 Other (describe below)

Periodic flooding can occur as visible by washed out areas and destroyed vegetation. Flooding has been mitigated with improved bank and thick vegetation.

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7. If known, what is the source of the water in the wetland?

9 Stream/River/Creek/Lake/Pond | 9 Groundwater

9 Flooding | 9 Surface Runoff

Treated Wastewater, groundwater and surface run-off.

8. Is there a discharge from the site to a known or suspected wetland? waterbody 9 yes 9 no If yes, please describe.

Discharge is to Lake Mead.

9. Is there a discharge from the wetland? 9 yes 9 no If yes, to what waterbody is discharge released?

9 Surface Stream/River | 9 Groundwater | 9 Lake/Pond | 9 Marine

Lake Mead

10. If a soil sample was collected, describe the appearance of the soil in the wetland area. Circle or write in the best response. No soil has been collected to date

Color (blue/grey, brown, black, mottled) —

Water content (dry, wet, saturated/unsaturated) —

11. Mark the observed area(s) on the attached site map.

Maps are attached

APPENDIX C
OU-3 PHOTO LOG

Photo 1: Duck Creek Confluence and Upper Narrows Weir.
Source: https://www.lvwash.org/html/being_done_goals_updates.html

Photo 2: The Bostick Weir, named after a local conservationist Vern Bostick, completed in 2003.
Source: https://www.lvwash.org/cfml/photo/index.cfml?gid=130

RAMBOLL	**Site Photographs** Las Vegas Wash Nevada Environmental Response Trust Site Henderson, Nevada

Photo 3: View of the Pabco Weir.
Source: https://www.lvwash.org/cfml/photo/index.cfml?gid=140

Photo 4: View of the Historic Lateral Weir.
Source: https://www.lvwash.org/cfml/photo/index.cfml?gid=136

Photo 5: View of the Homestead Weir.
Source: https://www.lvwash.org/cfml/photo/index.cfml?gid=137

Photo 6: View of the Lower Narrows Weir.
Source: https://www.lvwash.org/cfml/photo/index.cfml?gid=138

Photo 7: View of the Three Kids Weir.

Source: https://www.lvwash.org/html/being_done_stabilization_threekids.html

Photo 8: City of Henderson Bird Viewing Preserve.

Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 9: City of Henderson Bird Viewing Preserve.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 10: City of Henderson Bird Viewing Preserve.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 11: Las Vegas Wash showing high diversity bank vegetation.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 12: View across the Las Vegas Wash looking north near Pabco Weir
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 13: View of the Las Vegas Wash.

Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 14: Pedestrian bridge crossing Las Vegas Wash.

Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 15: Pedestrian bridge crossing Las Vegas Wash.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 16: Las Vegas Wash showing various bird species including coots and mallards.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 17: View of Las Vegas Wash riffle area near Pabco Weir.

Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 18: View of riparian vegetation bordering the Las Vegas Wash near Pabco Weir.

Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 19: Illustration of bank stabilization at the temporary diversion channels used during weir condition. Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 20: Illustration of bank stabilization at the temporary diversion channels used during weir condition. Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 21: View of the Las Vegas Wash – abundant grasses.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 22: Willow and mesquite upstream of the Bostick Weir.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 23: Emergent vegetation near the Duck Creek Weir.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 24: Desert saltbush near the Duck Creek Weir.
Photo taken during the April 2-3, 2018 Site Reconnaissance

Photo 25: Typical emergent vegetation in the Las Vegas Wash.
Photo taken during the April 2-3, 2018 Site Reconnaissance