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DIVISION OF ENVIRONMENTAL
RESPONSE AND REMEDIATION

Brent H. Everett
Director

SCANNED

DERR-2017-012401

ERRC-160-17

December 14, 2017

Ryan Dunham
Site Assessment Manager
EPA Region 8 (8EPR-B)
1595 Wynkoop Street
Denver, Colorado 80202-1129

Dear Mr. Dunham:

Enclosed for your review is the *Expanded Site Investigation (ESI) Analytical Results Report* (ARR) for the **Redwood Road Dump** (Site) (CERCLIS ID# UTD980961502) located in Salt Lake City, Utah.

The ARR focuses on the surface water exposure pathway and provides inorganic metal concentrations from surface water, and sediment samples collected upgradient and downgradient of the Site from the City Drain Canal. Other exposure pathways have been extensively examined by prior investigations and are summarized in the report. ARR appendices include key data tables and figures from these previous studies.

Above-background concentrations of barium, calcium, chromium, copper, iron, lead, mercury, nickel, sodium, zinc, benzo(a)pyrene, dibenz(a, h)anthracene, and arochlor 1260 were detected in surface soils. However, there is no on-site population or residences at the Site. There are no schools or day cares located within 200 feet of the Site. No exposure to contaminants is anticipated at the Site when the Site is appropriately maintained and controlled under current operating practices. Arsenic, antimony, selenium, and pentachlorophenol were found in Site groundwater above SCDM benchmarks. However, there are no downgradient wells used for drinking water within four miles from the Site.

Although a 2000 Targeted Brownfield Assessment attributed a release of lead and arsenic from the Site to the City Drain Canal, data from this most current sampling show a higher background concentration of both metals than in most downgradient surface water samples. The City Drain Canal joins the Northwest Oil Drain and flows to the Great Salt Lake. The Northwest Oil Drain has an extensive history of petroleum and industrial contamination. Elevated concentrations of lead have been documented in sediments at the mouth of the Northwest Oil

Drain. However, it does not appear that the Site is a contributor to the lead contaminant load as upgradient lead contamination in the City Drain Canal is higher in the background sample than in any downgradient sample. Thus, we recommend a finding of No Further Remedial Action for the Site.

After reviewing the ESI ARR, please inform us of any comments or changes that need to be incorporated into the final version of the document. If you have any questions, please contact Neil Taylor at (801) 536-4102.

Sincerely,

Dale T. Urban, P.G.
Site Assessment Section Manager
Division of Environmental Response and Remediation

DTU/NBT/jn

Enclosure: Expanded Site Investigation Analytical Results Report

cc: Royal DeLegge MPA, EHS, Director, Salt Lake County Health Department (w/out enclosure)

UTAH DEPARTMENT of
ENVIRONMENTAL QUALITY
ENVIRONMENTAL RESPONSE & REMEDIATION

EXPANDED SITE INVESTIGATION

ANALYTICAL RESULTS REPORT

REDWOOD ROAD DUMP

Salt Lake County, Utah
UTD980961502

Prepared by Neil B. Taylor
Utah Division of Environmental Response and Remediation

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EXPANDED SITE INVESTIGATION

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REDWOOD ROAD DUMP

Salt Lake County, Utah
UTD980961502

Prepared by Neil B. Taylor
Project Manager

Utah Department of Environmental Quality
Division of Environmental Response and Remediation
195 North 1950 West
Salt Lake City, UT 84116

December 2017

Approved: _____ Date: 12/7/17
Neil B. Taylor, UDEQ Project Manager

Approved: Dale T Urban Date: 12/5/17
Dale T. Urban, UDEQ Site Assessment Section Manager

Approved: _____ Date: _____
Ryan Dunham, Site Assessment Manager, EPA Region 8

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1.0 INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and in accordance with applicable provisions of the National Contingency Plan, the Utah Department of Environmental Quality, Division of Environmental Response and Remediation (DERR) has prepared this Expanded Site Investigation (ESI) Analytical Results Report (ARR) for the **Redwood Road Dump,** UTD980961502**,** (referred to as the "Site") in Salt Lake City, Salt Lake County, Utah. This ESI was prepared under a cooperative agreement between DERR and the U.S. Environmental Protection Agency, Region 8 (EPA). Surface water and sediment samples were collected as part of this ESI. Field notes and photographs were produced throughout the sampling event to document sample locations, sampling methods and field observations. The field notes and photographs were later transcribed to the Field Activities Report (Appendix A).

2.0 SITE OBJECTIVES

The objectives of this ESI were to:

- Determine the presence of contamination in selected media.
- Assess the potential contamination characteristics.
- Assess the potential routes for contaminant migration.
- Assess the suspected exposure pathways.
- Address data gaps from previous assessments.
- Identify potential targets that may be affected by on-site or off-site contamination as well as other targets that may be impacted by the contamination migration via the suspected exposure pathways.
- Determine if additional assessment under CERCLA is warranted.

3.0 SITE DESCRIPTION

3.1 Site Location and Description

The Site includes two historical landfills, bisected by Interstate 215 (I-215). The eastern landfill extends west from 1900 West Street to I-215 at about 2000 West. The northern border is 500 South Street. The western half of the landfill begins at I-215 at about 2000 West and continues to 2200 West. The southern border is Indiana Avenue and the northern border is 500 South (Figure 2). The Site is approximately 70 acres in size and is owned by Salt Lake City Corporation. The Site is located in the Southeast ¼ of the Southeast ¼ of the Northeast ¼ of Section 9, Township 1 South, Range 1 West, Salt Lake Base Meridian (U.S. Geological Survey, 1975). The Salt Lake City Road Maintenance and Automobile Impound Lot is located directly north (across 500 South Street) of the eastern landfill (Yeomans, 1995). In 2014, Salt Lake City constructed a four-acre, one-megawatt solar farm on the northern flank of the eastern landfill. The solar panels are held down by surface-placed concrete ballast blocks. These concrete blocks sit on a layer of rock that was placed over the existing grade to not disturb the cap (Sokol, 2015). The city operates a large wood chipping and composting operation on the south end of the western landfill (Figure 2). The City Drain canal flows south to north on the eastern edge of the western landfill. The City Drain flows approximately 11 miles to the Northwest Oil Drain (NWOD) Delta (the Delta) of the Great Salt Lake. The Delta sediments are contaminated with oil, grease, lead, and mercury (TechLaw, 2012). The NWOD also flows to the Delta (Figure 1).

3.2 Site History and Previous Work

3.2.1 Site History

The Site was the primary landfill for Salt Lake City from 1923 until 1962, when it was closed to public dumping. The Site is estimated to contain approximately 1,340,000 cubic yards of refuse and fill (Eckoff, 1997). A manifest system was not in place at the landfill during its operation, and no records remain of waste content or quantities dumped at the Site (Utah Bureau of Solid and Hazardous Waste, 1987). The eastern portion of the Site was used from 1962 to 1995 by Salt Lake City Corporation's Parks and Recreation Department and Public Services Department for the disposal of leaves, grass clippings, tree trimmings and storm sewer sludge. I-215 was constructed through the center of the Site in 1988 creating an eastern and western refuse pile. It is believed that waste characteristics at the Site include municipal wastes such as household, commercial, industrial and organic materials (Yeomans, 1995).

The northern portion of the east landfill, and the sliver of land directly north of the eastern landfill across 500 South Street, are used for Salt Lake City's automobile impound lot. Salt and gravel are stored in the southern portion of the western landfill. Both landfills are perimeter fenced (Taylor, 2010). The landfills are closed to the public with no dumping allowed. A City vehicle washing and refueling facility has been constructed on City property northwest of the eastern landfill.

Chromium and lead-contaminated soils were illegally placed in the central part of the eastern landfill sometime during December of 1991 by Tool Design Engineering and Manufacturing facility personnel (Utah Division of Solid and Hazardous Waste, 2010). Chromium concentrations in samples collected from the soil ranged from 1,240 milligrams per kilogram (mg/kg) to 3,300 mg/kg. Lead concentrations ranged from 1,000 mg/kg to 1,800 mg/kg. The contaminated soils were discovered in 1992. Approximately 310 cubic yards of soil was removed from the landfill under the supervision of the Utah Division of Solid and Hazardous Waste and Terracon Consultants in November 1997. Historical records do not clearly identify the location of the contaminated soil. All eight cleanup verification samples were non-detect for chromium and lead.

3.2.2 Preliminary Investigation

A report entitled "Preliminary Investigations Disposition of Garbage Materials in Abandoned Landfill" (PI) was prepared for the Utah Department of Transportation (UDOT), Salt Lake City, Utah, by Dr. David W. Eckhoff in July of 1977. Twenty auger holes were drilled into the landfill. The investigation found that mixed garbage and refuse had been dumped and burned on the Site. The garbage is covered to various depths by soil, but not with an engineered landfill cap (Eckoff, 1997). A Preliminary Assessment (PA) of the Site was prepared by the Utah Department of Health's Bureau of Solid and Hazardous Waste in 1987.

3.2.3 Site Inspection

A 1991 Site Inspection (SI) sampling event included seven groundwater samples, three surface water samples, ten soil samples and three sediment samples (Hawkins, 1992). All samples were analyzed for volatiles, base-neutral/acid extractables, pesticides, PCBs, and metals. Selected data and figures from the 1991 SI are provided as Appendix B. A sample location map is provided as Appendix B, Figure 1.

Soil sample analyses indicated the presence of 21 base neutral/acid compounds, five volatile organic compounds, 12 pesticide compounds, and arochlor 1260 (a polychlorinated biphenyl (PCB) compound). Concentrations of the polycyclic aromatic hydrocarbons (PAHs) benzo(a)anthracene and benzo(a)pyrene exceeded the Superfund Chemical Data Matrix (SCDM) Cancer Risk Screening Concentration (CRSC) benchmarks in several on-site locations. These PAHs likely formed during the incomplete combustion of garbage and wood. The PCB Aroclor-1260 was also detected at 150 mg/kg in one soil sample collected from the center of the eastern landfill. This exceeds the 0.3 mg/kg CRSC soil benchmark. No other soil contaminant exceeded SCDM benchmarks (U.S. Environmental Protection Agency, 2017). Figure 4 provides the location and concentration of benzo(a)pyrene detected in both landfills in either the Site Investigation or a Targeted Brownfield Assessment (TBA) conducted in 2000.

The upgradient City Drain surface water sample contained aluminum at a concentration of 104 microgram per liter (µg/L). However, the downgradient, surface water sample from the City Drain contained aluminum at a concentration of 728 microgram per liter (µg/L). All surface water samples exceeded the 87 µg/L Criteria Chronic Concentration CCC, SCDM environmental benchmark for aluminum. The downgradient surface water sample also contained lead at a concentration of 8 µg/L. This result exceeds the 2.5 µg/L CCC benchmark.

Arsenic was detected at 314, 248 and 179 µg/L in three of four downgradient wells as compared to 19 µg/L in the background well. The Maximum Contaminant Level (MCL) for arsenic is 10 µg/L. The closest downgradient groundwater sample also contained 34.2 µg/L antimony, which is also above the 6 µg/L MCL. The location of elevated concentrations of arsenic in groundwater detected during the SI or TBA investigations are provided in Figure 5. The nearest downgradient well used for drinking water is located 4.9 miles north of the Site.

Lead was detected in Site soils at concentrations ranging from 15.5 to 2,610 mg/kg. The highest concentration was found in the northern corner of the western landfill. There is no SCDM benchmark for lead in soil. The Regional Screening Level for lead is 400 mg/kg. The highest concentration of iron in the City Drain (1,060 µg/kg) and in groundwater under the eastern landfill (2,570 µg/kg) exceeded the 1,000 µg/kg CCC.

The Site received a higher priority for further investigation under CERCLA on January 27, 1992. DERR conducted a Site Inspection Prioritization (SIP) for the Site in September 1995 (U.S. Environmental Protection Agency, 2013). The report concluded that the Site may present hazards to those working and living near it, as well as to transients and bottle collectors (Yeomans, 1995). Although the Site is vegetated and surface runoff is slow, the SIP concluded that the accumulated refuse, soil, and shallow groundwater contain hazardous substances and these present a threat to human health and the environment.

3.2.4 Targeted Brownfield Assessment

In 2000, the Salt Lake City Corporation considered relocating the City's existing fleet maintenance and office facilities to the Site. The City requested DERR assistance in screening the site for potential contamination. The objective of the June 2000 targeted Brownfields Assessment (TBA) was to collect screening information from selected locations across the site to evaluate environmental conditions in preparation for a potential change in land use. The DERR conducted a TBA for the western portion of the Site and the Salt Lake City Road Maintenance and Automobile Impound Lot in June 2000. Selected data and figures from the TBA are provided as Appendix C. Appendix C, Figure 3 identifies the approximate location of trenches cut and sample locations. Soil samples were collected from preselected locations, and 15 direct push borings were installed across the western landfill. Soil, soil gas, groundwater and surface water samples were collected and submitted for laboratory analysis of volatile organics, semivolatile organics, metals, and pesticides. Field observations from June 15, 2000, trenching and investigation activities suggest that refuse in the western landfill is limited to the landfill's eastern bench.

Soil and groundwater samples were collected during installation of direct push wells and from selected trench locations across the Site. Soil samples were collected directly at the soil/water interface. No organic or inorganic compounds were found in concentrations exceeding SCDM benchmarks with the exception of arsenic, dibenz(a,h)anthracene, and benzo(a)pyrene (Rees, 2001).

Lead was reported in soil samples at concentrations from 14.2 to 1,930 mg/kg. Soil samples collected from the base of a 10-foot trench cut (SB-2) in the center of the western landfill revealed benzo(a)pyrene at 5,000 µg/kg and dibenz(a,h)anthracene at 1,000 µg/kg (Rees, 2001). The SCDM CRSC for both compounds is 20 µg/kg (U.S. Environmental Protection Agency, 2017). The CRSC for benzo(a)pyrene was also exceeded in five samples collected from the western portion of the landfill. Arsenic, antimony, selenium, and pentachlorophenol were detected in Site groundwater above SCDM benchmarks. The location of elevated concentrations of benzo(a)pyrene in soil detected during the SI, TBA, and ESI investigations is provided in Figure 4. No VOCs, semivolatile organic compounds (SVOCs), PCBs, or pesticides were detected in any other samples above SCDM benchmarks (Rees, 2001).

Lead was detected at 56.1 µg/L in the downgradient City Drain Canal surface water sample, collected during the TBA, but was not detected in the upgradient sample. The CMC for lead in surface water is 65 µg/L and the CCC for lead is 2.5 µg/L. Arsenic was also detected in the upgradient City Drain sample at 61 µg/L and in the

downgradient sample at 82.8 µg/L (Rees, 2001). No other metal was reported in surface water above SCDM benchmarks. The arsenic CMC is 340 µg/L and the lead CCC is 150 µg/L.

Arsenic was detected in multiple soil samples above the 30 mg/kg SCDM Reference Dose Screening Concentration (RDSC) benchmark for soil and the 0.77 mg/kg CRSC. The highest concentration of arsenic in any soil sample (43.9 mg/kg) was collected from a trench cut in the center of the western landfill (SB-2). No background soil sample was collected during the TBA. The 1991 SI reported a background arsenic concentration of 10.8 µg/kg. Only one TBA soil sample exceeded three times the SI arsenic background.

Arsenic was detected in many groundwater samples significantly above the MCL of 10 µg/L and the SCDM freshwater acute exposure benchmark CCC of 150 µg/L. Arsenic was detected at two locations north of the western landfill at 1,290 µg/L and 1,000 µg/L. Dissolved arsenic was reported in groundwater collected from the middle of the western landfill at an estimated concentration of 1,170 µg/L. Other groundwater samples ranged from 2.4 µg/L to 236 µg/L. Figure 5 provides the location of elevated arsenic concentrations in groundwater detected during either the SI or the TBA. No other dissolved metals were detected in groundwater above SCDM benchmarks (Rees, 2001; U.S. Environmental Protection Agency, 2017).

3.2.5 Portland Cement Site Investigations

The Portland Cement Superfund site is located directly south of the eastern landfill and Indiana Avenue on approximately 71 acres. The risks posed by the Portland cement site were derived from cement kiln dust and chromium bearing bricks that were landfilled within the Site boundaries. The dust contained several heavy metals including arsenic, cadmium, chromium, lead, manganese and molybdenum. The contaminated soil, kiln dust and chromium bricks were removed from the Portland Cement site from 1992 through 1997 (Howes, 2007). A groundwater plume beneath the Portland Cement site contains elevated concentrations of arsenic, chromium, lead, manganese and molybdenum.

Groundwater contamination is contained in the shallowest aquifer within the Portland Cement site boundaries by a canal on the eastern boundary of the Portland Cement site known as the "City Drain," a City sewer line on the east and north of the site, and a storm-water ditch west of I-215. Analytical results of semiannual groundwater monitoring beneath the Portland Cement site indicate that the contaminant plume is contained within the Portland Cement site boundaries (Utah Department of Environmental Quality, 2012).

3.2.6 Northwest Oil Drain Delta Sediment Investigation

The NWOD canal system begins at about 1000 North and Warm Springs Road, about 1.5 miles east of the City Drain. The NWOD canal also flows from south to north (Figure 1). The City Drain and the NWOD join about six miles north of the site and flow northwest toward the Farmington Bay Wildlife Management Area (FBWMA) and the Great Salt Lake (GSL) in a shallow sediment deposition area known as the "Northwest Oil Drain Delta" (the Delta) (Waddell et al., 2009). The NWOD is a set of canals constructed in the 1920s for the transport and disposal of waste refinery oils, other industrial wastewater effluents, sewage, and storm water. The canals were used extensively throughout the 1950s. There are two primary canals and several small tributary canals entering from the industrialized area to the east. The two primary canals were used for industrial waste and a lesser canal was used for sewage. The length of the canal is approximately 15 linear miles. A large portion of the southern end of the canal system is no longer in use, although the remainder of the canal system still receives treated municipal and industrial wastes (TechLaw, 2012). Both the NWOD and the City Drain flow to the Delta.

Removal actions were conducted by the Northwest Oil Drain Working Group under an Administrative Order on Consent for approximately 8.6 miles of the oil drain in 2004 and 2005 extending from Boy Scout Drive (1300 North) downstream to the City Drain and south for 5.75 miles from the NWOD Great Salt Lake outlet. These actions consisted of removal and disposal of sediments and sidewalls to reduce the concentration of oil, grease, diesel-range organics, and metals such as lead and mercury (TechLaw, 2012).

An assessment of inorganic contaminant concentrations in the sediments of the Delta and on the impact of the contaminants on the health of fish and birds was published in 2009 by the U.S. Fish and Wildlife Service. Selected data and figures from the 2009 Delta study are provided as Appendix D. Section 7.0 of the U.S. Fish

and Wildlife Service report addresses contaminant assessment of sediments in the Delta and is included in Appendix D. A map of the Delta in relation to the Site is provided as Figure 1 and as Appendix D, Figure 7-1.

The assessment identified the average level of mercury in avian eggs to be 5.99 mg/kg dry weight, double the Level of Concern (3 mg/kg) identified by the Department of Interior (Waddell et al., 2009). Mercury has not been identified as a contaminant of concern from the Redwood Road Dump. The U.S. Fish and Wildlife Service collected twenty sediment samples in a grid pattern across the NWOD Delta. A map of the sediment sample locations is provided on Figure 7-1, page 75 of the report, in Appendix D. The geometric mean concentration of 14 metals exceeded their respective Threshold Effects Concentration (TEC), out of the 15 metals for which TECs could be identified (MacDonald et al., 2000; Waddell et al., 2009). The TEC is a consensus-based sediment quality guideline for freshwater ecosystems developed by academia to identify a level below which harmful environmental effects are unlikely. The 14 metals include aluminum, arsenic, barium, beryllium, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium and zinc.

The geometric mean concentration of lead in the sediment samples (193 mg/kg) also exceeded the higher Probable Effects Concentration (PEC) of 128 mg/kg. The Probable Effect Concentration (PEC) is a screening level above which harmful effects are more likely than not to be observed (MacDonald et al., 2000). Another assessment of the nature and extent of lead, mercury, total petroleum hydrocarbons-diesel range organics, polycyclic aromatic hydrocarbons, and oil and grease in the FBWMA was published in 2012 by EPA. The NWOD Delta includes part of the FBWMA. A copy of this report is provided in Appendix E. Twenty-five sediments samples were collected within the FBWMA. A map of the sample locations is provided as Figure 1 in Appendix E.

Results from the 2011 FBWMA site investigation showed that lead concentrations ranged from 28 mg/kg to 325 mg/kg within the 0-6" depth interval (Appendix E, Table 1). A map of the sample locations and their corresponding lead and mercury concentrations is provided as Figure 2 in Appendix E. The highest lead concentrations were noted near the mouth of the canal at sampling locations FBWMA-018-11, FBWMA-019-11, and FBWMA-020-11. Lead concentrations at these sites were 234 mg/kg, 325 mg/kg, and 291 mg/kg, respectively. These concentrations significantly exceed the 35.8 mg/kg TEC and the 128 mg/kg PEC (MacDonald et al., 2000). Lead concentrations decrease as distance increases from the mouth of the canal outward past the three sampling locations mentioned above (Waddell et al., 2009).

Mercury concentrations in the 0-6" sediment depth interval ranged from 0.077 mg/kg to 5.3 mg/kg (Appendix E, Table 1). As seen in the lead results for sediment, the highest concentrations of mercury were noted at sampling locations FBWMA-018-11, FBWMA-019-11, and FBWMA-020-11, near the mouth of the NWOD, with mercury concentrations of 2.7 mg/kg, 5.3 mg/kg, and 4 mg/kg, respectively. Statistically, significant relationships were found between the concentrations of Pb and Hg ($r^2 = 0.91$) (Waddell et al., 2009). The source of the contamination was not identified as a part of the study. Potential sources include the NWOD and the City Drain.

3.2.7 Site Reassessment

A Site Reassessment Report (SRA) was written in 2011 to update Site data and identify data gaps. The SRA resulted in a recommendation to conduct an ESI to sample downgradient shallow wells and wetlands and resample groundwater and surface water. When no downgradient wells used for drinking water were identified between the Site and the Great Salt Lake, the ESI sample plan was modified to only sample surface water and sediment from the City Drain Canal.

4.0 FIELD ACTIVITIES

ESI sampling was conducted on June 9, 2015 by DERR sampling personnel Neil Taylor and David Bird. The weather was clear with temperatures in the high 80s. Field activities included the collection of seven surface water samples and four sediment samples. This total includes a field duplicate surface water sample (RD-SW-07). All personnel conducted sampling in Level D personal protective gear. The northing and easting of surface water and sediment sample locations were identified using a GeoExplorer 3® and documented in the field notes. Downstream samples were collected before upstream samples. A map of sample locations is provided as Figure 3. A one-liter polyethylene bottle was lowered into the City Drain at various locations to collect surface water

samples. Clean stainless-steel spoons were used to collect sediment samples at the same location as surface water samples when sediment was found. Water samples were preserved with nitric acid.

All samples were labeled, bagged and placed on ice in coolers and transported to DERR. Chain-of-custody forms and sampling documentation were prepared using EPA's Scribe software. All samples were hand delivered to ALS Laboratories for inorganic metals analysis on June 9, 2015. Completed chain-of-custody forms are included in Appendix F.

Field notes and photographs were taken throughout the sampling event to document sample locations, sampling methods, and field observations. The field notes will remain in the DERR project file. Field notes and photographs were transcribed to the Field Activities Report and provided additional details about the Site. The Field Activities Report is included in Appendix A. The laboratory analytical data validation reports are presented in Appendix G.

5.0 DEVIATIONS FROM THE WORK PLAN

The following are deviations from the *Expanded Site Investigation Work Plan* implemented for the Site (Taylor, 2015):

- The decontamination sample (RD-SW-08) was not collected because an adequate quantity of clean stainless-steel spoons was available for sediment samples and a dipper was not used to collect surface water samples. Field decontamination was unnecessary.
- The sample for water hardness (RD-SW-09) was not collected because water hardness (as calcium carbonate) can be calculated from calcium and magnesium concentrations. A separate sample for hardness measurement purposes was not necessary.
- Salt Lake City e-mailed authorization to sample the City Drain canal (Stewart, 2014). A signed *Consent For Access to Property Form* was not necessary.
- Sediment sample RD-SE-05 was to be collected at the same location as RD-SW-05. Sample RD-SE-06 was to be collected at the same location as RD-SW-06. Both samples were not collected because the sides of the City Drain canal were lined with rock at the planned sample locations and there was no sediment to collect.

6.0 WASTE/SOURCE CHARACTERISTICS

Both west and east landfills contain municipal trash and unknown quantities of hazardous materials. Petroleum wastes were found in four of twenty landfill soil borings that were part of a 1977 UDOT landfill waste investigation. The investigation concluded that the majority of the organic matter in the landfill had decomposed or had been burned, leaving mainly inorganic matter, ash, and cover material. An undefined chemical waste was found in one of the twenty borings. The volume of the landfills is calculated at approximately 1,340,000 cubic yards (Eckoff, 1997). The landfills are not properly contained to minimize leaching of materials into the shallow groundwater.

Chromium and lead-contaminated soils were illegally placed in the central part of the eastern landfill sometime during December of 1991 by Tool Design Engineering and Manufacturing facility personnel (Utah Division of Solid and Hazardous Waste, 2010). Chromium concentrations in samples collected from the soil ranged from 1,240 mg/kg to 3,300 mg/kg. Lead concentrations ranged from 1,000 mg/kg to 1,800 mg/kg. The contaminated soils were removed in 1997 and the cleanup was verified by confirmation sampling (Terracon, 1997).

7.0 GROUNDWATER PATHWAY

7.1 Hydrogeology

Precipitation that falls as rain or snow in the mountain ranges flows down the range fronts and recharges the deep aquifer within the Salt Lake Valley. The shallow water table aquifer is generally recharged by downward infiltration from precipitation, canals, irrigated lands and streams as well as by upward leakage from the underlying confined aquifer. Surficial basin fill deposits within the Salt Lake Valley generally consist of a series of Quaternary lacustrine, alluvial fan, sand dune, mud-rock flow, ash falls, glacial and floodplain sediments. Groundwater occurs within these valley fill deposits as a complex series of aquifers. The deeper aquifer lies in Quaternary deposits of clay, silt, sand, and gravels that are hydraulically interconnected with individual beds of sand and gravel ranging in thickness from less than one foot to tens of feet. The maximum thickness of the principal aquifer is greater than 1,000 feet in the northern portion of the valley. Most deep drinking water wells in the Salt Lake Valley are completed in sediments at depths of less than 1,200 feet (Waddell et al., 1987)

There are no wells currently in use on-site. Drilling logs from the four monitoring wells installed at the Site in 1991, in addition to the well logs from the neighboring Portland Cement site reveal a lithology of clay, silt and sand beneath the landfill (Hawkins, 1991). A soil survey of the Salt Lake area identified the soils at the Site as dumps, Salt Air Silty Clay Loam, Loamy Borrow Pits, Sandy Terrace Escarpments, and Decker Fine Sandy Loam (Hawkins, 1992).

Groundwater flow in the shallow aquifer although complex, due to the interaction with local surface water and underground utility pathways, is generally to the northwest. A 42-inch sanitary sewer is buried at an average depth of 17 feet below grade on the eastern border of the Site. The bedding material of the sewer line appears to be removing groundwater from the shallow aquifer and routing it to the City Drain. Groundwater flow under the eastern landfill also appears to be toward the City Drain (Hawkins, 1992).

7.2 Targets

Seventeen municipal wells from three cities are located within the four-mile target distance range from the Site. All wells are located east or south of the Site and hydraulically upgradient (Utah Division of Drinking Water, 2017). All three city water systems are blended with multiple groundwater and surface water sources. Approximately 4,102 underground points of diversion are located within four miles of the Site. The uses for the large majority are for "domestic" or irrigation purposes, and most are upgradient of the Site. All downgradient wells within three miles of the Site are 200 to 400 feet deep artesian wells drawing from the deeper, confined aquifer. The few existing downgradient wells are privately owned, and none are presently used for residential drinking water (Utah Division of Water Rights, 2017).

Several residential wells located 4.1 miles north and downgradient of the Site were used for drinking water until recent private testing revealed arsenic levels above the MCL. One well was sampled by DERR personnel in 2015 as part of the investigation of a separate site. Arsenic was found at 5 µg/L. This is below the 10 µg/L MCL and above the 4 µg/L RDSC and 0.057 µg/L CRSC SCDM benchmarks (Mitkem Laboratories, 2015).

7.3 Sample Locations

No groundwater samples were collected as a part of this investigation.

7.4 Analytical Results

There were no additional groundwater analytical results generated as a part of this ESI.

7.5 Conclusions

The Site may be the source of elevated arsenic detected as high as 1,290 µg/L in downgradient, shallow groundwater. However, a United States Geological Survey study has determined that elevated arsenic in groundwater under landfills may not be the results of arsenic disposed of as landfill waste. Rather, dissolved

organic carbon in a landfill leachate plume may dissolve arsenic from arsenic-containing iron oxides in the aquifer and bedrock. Degradation of the dissolved organic carbon in the plume removes oxygen from the water and creates reducing conditions that favor the dissolution of iron oxides and the release of arsenic from the sediments (Delemos et al., 2006).

Seventeen municipal wells from three cities are located within the four-mile, target-distance limit from the Site. All are located east or south of the Site and hydraulically upgradient. All downgradient wells located within four miles of the Site are privately owned, and none are used for drinking water.

8.0 SURFACE WATER PATHWAY

8.1 Hydrology

The Salt Lake Valley is located in the Great Basin drainage system, which is a closed system with no outlets. The Jordan River and its tributaries form the main drainage for the valley. The Jordan River is a Class 3B stream and discharges into the Great Salt Lake (State of Utah, 2014). The Surplus Canal and the City Drain are located in close proximity to the Site. The City Drain is located west of I-215 and just east of the western landfill. The Surplus Canal is a losing stream, about 1,000 feet to the west of the Site and likely receives no contribution from contaminated groundwater (U.S. Environmental Protection Agency, 1998). The City Drain is the primary discharge point for Site groundwater. The NWOD and the City Drain join about six miles downgradient of the Site and discharge into the FBWMA 10 miles north and downgradient of the Site (Hawkins, 1992).

8.2 Targets

There are no surface drinking water sources within the 15-mile target distance limit from the Site. The discharge points for the Jordan River, the Surplus Canal, and the NWOD Delta in the Great Salt Lake are characterized by freshwater marshes. The discharge points are within the confines of the FBWMA (Hawkins, 1992). Approximately 50 miles of wetland frontage occur within the 15-mile target distance limit (U.S. Fish and Wildlife Service).

8.3 Sample Locations

Sample locations were selected to characterize sections of the City Drain canal before its merger with the NWOD. Surface water and sediment samples were co-located whenever possible. A description of sample locations and the sampling rationale is provided as Table 1.

- Samples RD-SW-01 and RD-SE-01 were collected from the City Drain after the drain flows under Indiana Avenue. This location is on the southern and upgradient boundary of the Site and serves as a background sample for both surface water and sediments.
- Samples RD-SW-02 and RD-SE-02 were collected from the City Drain after it flows under 500 South. This sample is approximately 100 yards north and downgradient of the Site.
- Samples RD-SW-03 and RD-SE-03 were collected from the City Drain as it flows parallel to Dauntless Avenue (1000 North) and before the City Drain combines with a storm water drainage canal that runs on the north side of I-215.
- Samples RD-SW-04 and RD-SE-04 were collected from the City Drain at 1700 North before the City Drain Canal merges with a branch of the Jordan River.
- Samples RD-SW-05 and RD-SE-05 were planned to be collected from the City Drain at Rose Park Lane before the canal merges with the NWOD. All sediment had been removed from the canal banks, and no sediment sample was collected.
- Samples RD-SW-06, RD-SW-07, and RD-SE-06 were planned to be collected from the combined flows of the City Drain and the NWOD at approximately 3300 North. All sediment had been removed from the canal banks, and no sediment sample was collected.

8.4 Analytical Results

8.4.1 Surface Water

As specified by the Hazard Ranking System (HRS), analytical results from field samples are typically compared to analytical results from background sample(s) and to Sample Quantitation Limits (SQL) for determining an observed release. The criteria for establishing an "observed release" is as follows:

- If the background concentration is not detected, an observed release is established when the sample concentration equals or exceeds the sample quantitation limit; or
- If the background concentration equals or exceeds the detection limit, an observed release is established when the sample concentration "significantly exceeds" the background concentration. Generally, "significantly exceeds" is defined to be situations where the sample concentration exceeds the background concentration by at least three times (U.S. Environmental Protection Agency, 1990).

A summary of the inorganic metal concentrations detected in surface water samples is provided in Table 2. The concentration of aluminum (1,290 µg/L) in the upgradient sample (RD-SW-01) significantly exceeds the 750 µg/L CMC and the 87 µg/L CCC. However, the concentration of aluminum (258 µg/L) in the first downgradient sample after the Site (RD-SW-02), although still exceeding the CCC, is significantly less than the upgradient sample. The concentration of aluminum at Dauntless Avenue (363 µg/L), 1700 North (124 µg/L), and Rose Park Lane (96.4 µg/L) exceed the CCC.

The concentration of iron (2,130 µg/L) in the upgradient surface water sample also significantly exceeds the CMC of 1,000 µg/L. However, downgradient iron concentrations are below SCDM benchmarks. Lead was detected in the upgradient surface water sample at a concentration of 12.8 µg/L. This is above the 2.5 µg/L CCC benchmark. However, lead concentrations in all downgradient samples are below the CMC and CCC. No other inorganic metal concentrations exceed an SCDM benchmark (U.S. Environmental Protection Agency, 2017).

8.4.2 Sediment

A summary of inorganic metal concentrations detected in canal sediment samples is provided in Table 3. Potassium was detected at 4,590 mg/kg in sediment collected from the City Drain at Dauntless Avenue and I-215. This exceeds by over three times the 1,480 mg/kg concentration of potassium detected in the background sediment sample. Silver was found at 1.5 mg/kg in sediment collected at 500 South and I-215 and was found at 1.3 mg/kg at Dauntless Avenue and I-215. These exceed by over three times the background concentration of silver detected in the background sample (0.2 mg/kg). A TEC or PEC has not been determined for either potassium or silver. Both upgradient and downgradient concentrations of arsenic, copper, and lead exceed the sediment TEC. The concentration of copper and lead remain elevated above the TEC at the last sample point (1700 North and I-215).

8.5 Conclusions

Although the concentration of aluminum, cadmium, copper, and lead are above environmental benchmarks in both surface water or sediment, none significantly exceeds the background sample concentration and thus, none of the releases can be attributed to the Site. Only aluminum was found in downgradient surface water samples above an SCDM benchmark. Only potassium and silver concentrations in downgradient City Drain sediment significantly exceed the upgradient sediment metal concentrations. No metal was both present in a concentration exceeding a SCDM benchmark or sediment toxicity benchmark and present at a concentration at least three times background. Thus, no releases of concern can be tied to the Site from this study. Previous studies have shown a release of lead to the City Drain both above a SCDM benchmark and significantly above background concentrations (Rees, 2001).

9.0 SOIL EXPOSURE PATHWAY

9.1 Geology

The Wasatch Front is underlain by the active Wasatch Fault system. This system is a major geologic structure that extends generally north and south for a distance of some 210 miles. Vertical movement along this fault system exceeds three miles. The Wasatch Front is subdivided into several valleys (Waddell et al., 1987).

The Site is located in the Jordan River Valley of the Great Basin Section of the Basin and Range Physiographic Province. The Jordan River Valley is bounded by the Wasatch Mountains to the east, the Oquirrh Mountains to the west, the Traverse Mountain Range to the south, and the Great Salt Lake to the north. Basin-fill deposits were eroded from the Wasatch and Oquirrh Mountains and deposited in the Salt Lake Valley. The general stratigraphy of the area is characterized by several hundred to several thousand feet of unconsolidated and semi-consolidated basin-fill deposits. Mountain streams and historical lakes carried most of the sediment into the basin and ancient Lake Bonneville. The fine-grained sediments were deposited in deeper portions of Lake Bonneville. The coarser-grained sediments were deposited along the margins of ancient Lake Bonneville near the mountains as its level eventually receded to its present level as the Great Salt Lake (Waddell, et al., 1987).

9.2 Targets

The Redwood Road Dump is enclosed by chain link and barbed wire fences. This barrier prevents unauthorized vehicle access (Taylor, 2010). There is no on-site population or residences. There are no schools or day cares located within 200 feet of the site. There is a population of 130,095 within the four-mile Target Distance Limit (U.S. Census Bureau, 2010). Table 4 lists the target population within various distances. Both western and eastern landfills are fenced. Two means of access are available to the eastern landfill; one is from the north through a gate that is locked at night, and one from the south through a road barrier. Approximately 50 miles of wetland frontage occur within the 15-mile target distance limit (U.S. Fish and Wildlife Service).

9.3 Sample Locations

No soil samples were collected during the ESI. Only limited subsurface soil hazardous constituent analysis has been conducted for the eastern landfill.

9.4 Analytical Results

There are no new analytical results for the soil exposure pathway. Previous investigations summarized in Section 3.2 have identified a variety of organic and inorganic contaminants present in Site soils because of historical use as a municipal landfill including concentrations of barium, calcium, chromium, copper, iron, mercury, nickel, sodium, and zinc over three times that of the background sample. Lead was found in the subsurface soils as high as 2,610 mg/kg. Benzo(a)pyrene was detected in the soil as high as 5,000 µg/kg and dibenz(a, h)anthracene detected as high as 1,000 µg/kg. The benchmark for benzo(a)pyrene and dibenz(a, h)anthracene is 20 µg/kg.

9.5 Conclusions

Although a variety of both organic and inorganic contaminants is present in surface soils, the Site is fenced and well maintained. No exposure to Site contaminants is anticipated when the Site is controlled under current operating practices.

10.0 AIR EXPOSURE PATHWAY

10.1 Meteorology

The Salt Lake Valley is characterized as being semiarid. The normal maximum temperature ranges from 37.0° F in January to 93.7° F in July. The normal minimum temperature ranges from 19.7° F in January to 61.8° F in July. The average annual rainfall is 15.31 inches per year with a normal monthly high of 2.21 inches in April and a

normal monthly low of 0.72 inches in July. The average annual snowfall is 58.0 inches. The estimated pan evaporation is a 3.91 inches per year (Western Regional Climate Center). The winds are predominantly from the south and southeast and have a mean speed of four to five miles per hour (Ashcroft et al., 1992).

10.2 Targets

Table 4 lists the target population within various distances. Both western and eastern landfills are fenced. Two means of access are available to the eastern landfill; one is from the north through a gate that is locked at night, and one from the south through a road barrier. The landfills are covered to various depths by soil. There is not an engineered landfill cap (Eckoff, 1997).

10.3 Sample Locations

There were no additional samples collected beyond the soil gas samples collected during prior investigations described in Section 3.2.

10.4 Analytical Results

No additional analytical results were generated by this ESI.

10.5 Conclusions

Methane, as the result of the decomposition of municipal waste, is the only airborne contaminant identified by prior investigations as a potential exposure hazard. Methane was not identified in concentrations that should be an explosion or health hazard under current operating conditions at the Site.

11.0 DATA QUALITY

Sampling was conducted according to methods outlined in the DERR Quality Assurance Program Plan for Environmental Data Operations (QAPP) of November 2014 and other relevant EPA guidance documents. Samples were kept in the possession of the DERR project manager and strict chain of custody was maintained during the sampling event. All collected samples were kept on ice and cooled to 4° C. Water samples were preserved by nitric acid to a pH below 2. All sample information was logged into a field notebook, and collected samples were photo documented on-site. EPA chain-of-custody forms were completed using the Scribe software and accompanied the sample shipments to the laboratory. Copies of the chain-of-custody forms are included in Appendix F. All samples were hand carried to the laboratory the day of collection and analyzed within 21 days of collection.

Samples RD-SW-03 and RD-SE-02 were collected as double volume laboratory duplicates for QA/QC purposes. Surface water sample RD-SW-07 was collected as a field duplicate of sample RD-SW-06. Both samples identified the same metals in similar concentrations. The relative percent difference of analyte concentrations was below the 30 percent rejection limit.

A validation package was prepared by Weston Solutions for the water and sediment samples (Appendix G). Data were determined to be acceptable according to EPA Data quality concerns, adjustments, and qualifications noted in the review are summarized in Table 5. The data validation package was reviewed by the project manager and the data was transcribed into Tables 2 to 3. The Data Quality Objectives for the Site, as presented in Table 6 of this report, were met.

12.0 SUMMARY

The Site was the primary landfill for Salt Lake City from 1923 until 1962, when it was closed to public dumping. I-215 was constructed through the center of the Site in 1988 creating an eastern and western refuse pile. It is believed that waste characteristics at the Site include municipal wastes such as household, commercial, industrial

and organic materials. The City Drain Canal bisects the site. Water from the canal eventually enters the FBWRA approximately 10 miles downstream of the site. Approximately 50 miles of wetland frontage occur within the 15-mile target distance limit.

The Site has undergone a series of studies to identify potential Site contaminants and off-site effects. Above background concentrations of barium, calcium, chromium, copper, iron, lead, mercury, nickel, sodium, zinc, benzo(a)pyrene, dibenz(a, h)anthracene, and arochlor 1260 were detected in surface soil. However, there is no on-site population or residences at the Redwood Road Dump. There are no schools or day cares located within 200 feet of the site. No exposure to contaminants is anticipated at the Site when the Site is appropriately maintained and controlled under current operating practices.

Arsenic, antimony, selenium, and pentachlorophenol were found in Site groundwater above SCDM benchmarks. However, there are no downgradient wells used for drinking water within four miles from the Site. Arsenic levels in surface water increase from a background concentration of 54.8 µg/L to a concentration of 89.5 µg/L immediately downstream of the Site. Arsenic concentrations decrease after that point to a concentration of 15.4 µg/L at the Sewer Canal.

Elevated concentrations of lead have been found in sediments of the FBWRA. The focus of this ESI was to determine if surface water and groundwater flowing to the canal from the Site may be a source of contaminants flowing to the FBWRA. Most inorganic metal concentrations in water collected from the City Drain Canal as a part of this ESI were higher in the upgradient sample than the downgradient sample. Both upgradient and downgradient inorganic metal concentrations of aluminum exceed an SCDM benchmark.

Both upgradient and downgradient surface water contains lead at a concentration exceeding an SCDM benchmark. Both upgradient and downgradient sediments contain arsenic, copper, lead, and cadmium in concentrations that exceed an environmental benchmark. Thus, no significant releases of metals to surface water or sediment can be attributed to the Site at this time.

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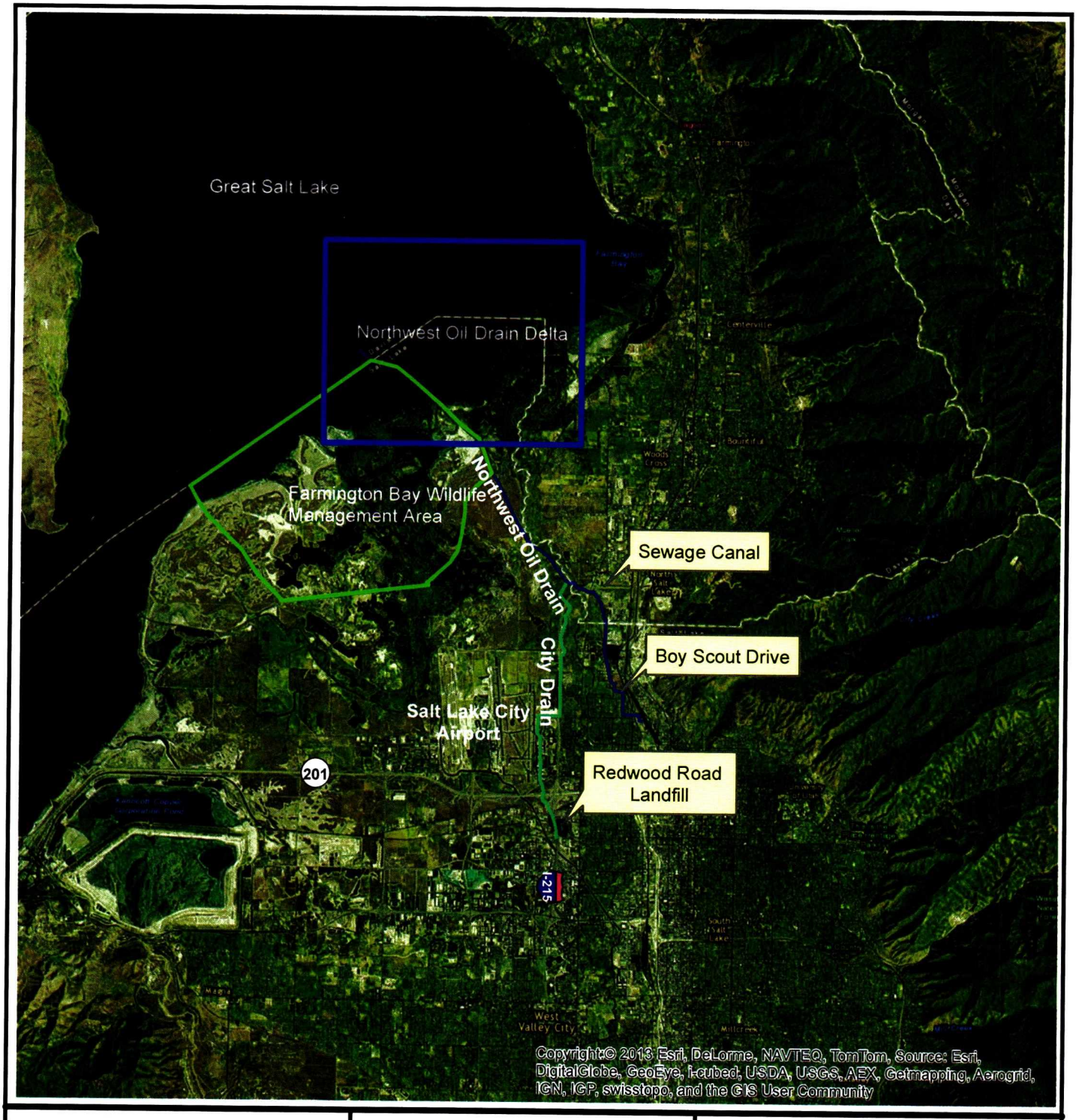
FIGURES



FBWMA

Northwest Oil Drain

City Drain

Redwood Road Landfill

2.5 1.25 0 2.5 Miles

N W E S

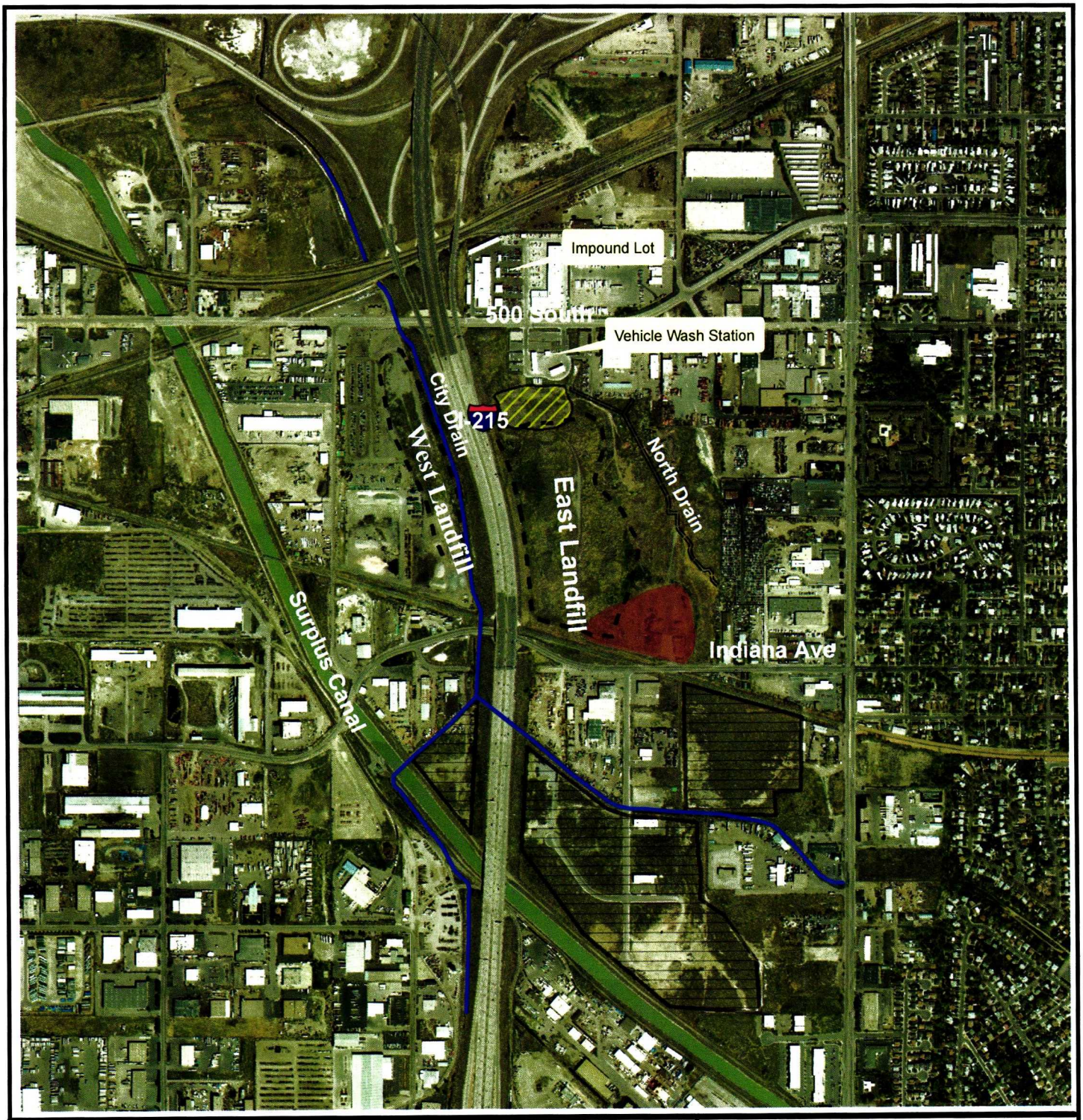
Utah Department of Environmental Quality
Division of Environmental Response and Remediation

Figure 1
Redwood Road Dump Site Location Map

Salt Lake County, Utah

by: Neil B. Taylor

Date: 03/04/2017



North Drain

City Drain

Portland Cement

Composting

Solar Farm

Landfills

200 100 0 200 400 Yards

N

W E

S

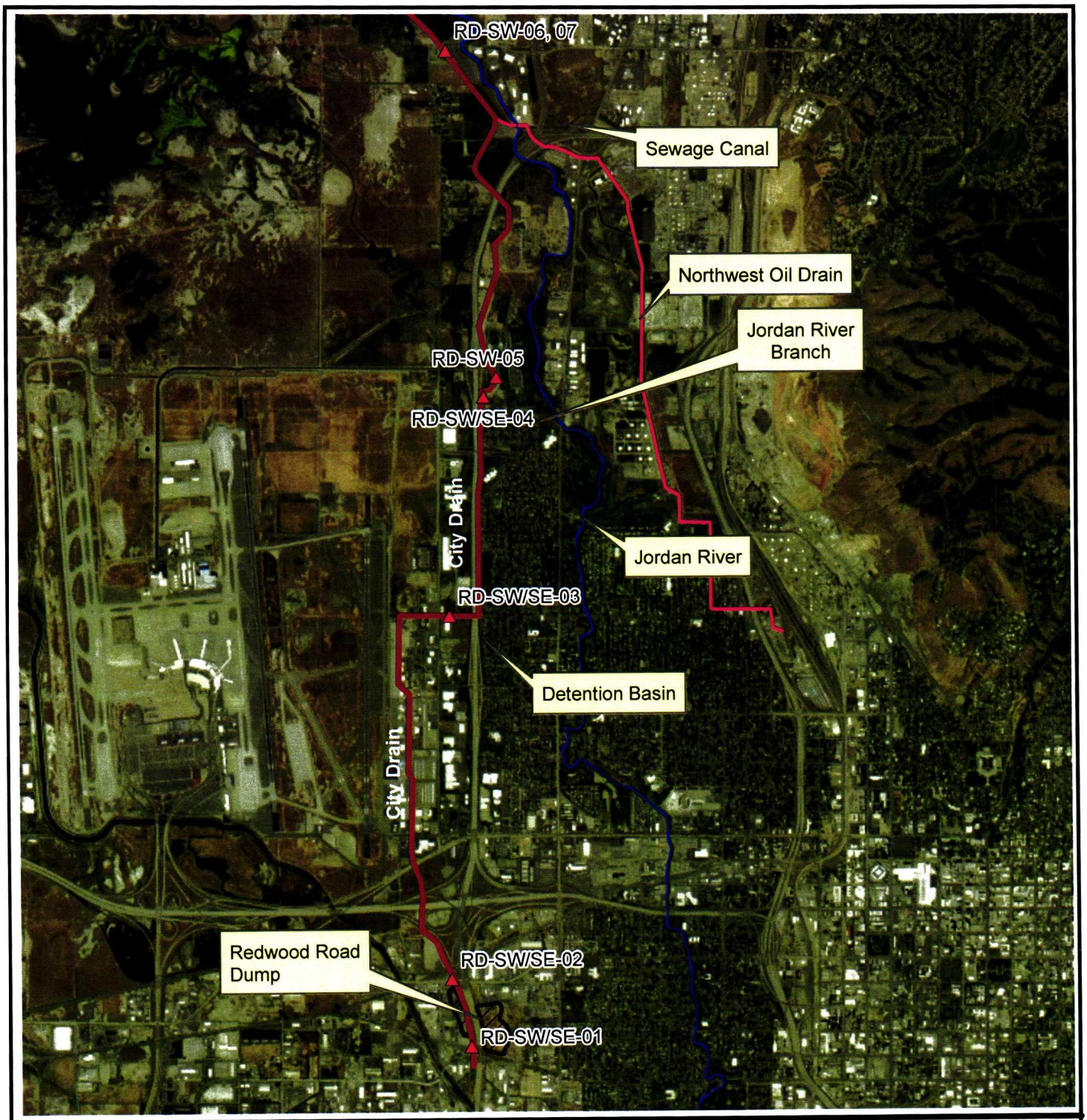
Utah Department of Environmental Quality
Division of Environmental Response and Remediation

Figure 2
Redwood Road Dump
Detailed Site Map

Salt Lake County, Utah

by: Neil B. Taylor

Date: 07/10/2015



Sample Locations

City Drain

NWOD

Jordan River

Redwood Landfill

0.75 0.375 0 0.75 Miles

N

W E

S

Utah Department of Environmental Quality
Division of Environmental Response and Remediation

Figure 3
Redwood Road Dump
Sample Locations

Salt Lake County, Utah

by: Neil B. Taylor Date: 09/04/2015

- 1991 SI Soil BaP
- 2000 TBA Trench BaP
- 2000 TBA Soil BaP
- Landfills

BaP Concentrations in mg/kg

100 50 0 100 Yards

N
W E
S

Utah Department of Environmental Quality
Division of Environmental Response and Remediation

Figure 4
Redwood Road Dump
Benzo(a)Pyrene in Soil

Salt Lake County, Utah

by: Neil B. Taylor Date: 06/22/2016

- 1991 SI Monitoring Well
- 2000 TBA Groundwater
- Landfills

Arsenic Concentrations in mg/kg

150 75 0 150 Yards

N
W E
S

Utah Department of Environmental Quality
Division of Environmental Response and Remediation

Figure 5
Redwood Road Dump
Arsenic in Groundwater

Salt Lake County, Utah

by: Neil B. Taylor Date: 10/20/2015

TABLES

Table 1: Sample Collection Summary

Field Sample No.	Matrix	Location	Rationale	QA/QC
RD-SW-01	Surface water	Indiana Ave at I-215	Identify background contaminant levels	Background
RD-SW-02	Surface water	500 South and I-215	Identify immediate downgradient contaminant levels	
RD-SW-03	Surface water	Dauntless Ave (1000 North) and I-215	Identify contaminant levels before entrance of drainage detention basin	Lab Duplicate
RD-SW-04	Surface water	1700 North and I-215	Identify contaminant levels after entrance of drainage detention basin and before entrance of a branch of the Jordan River	
RD-SW-05	Surface water	2200 West and Rose Park Lane	Identify contaminant levels after merging with a branch of the Jordan River	
RD-SW-06	Surface water	North Salt Lake Center Street at the Sewer Canal	Identify contaminant levels after merging with the Sewage Canal	
RD-SW-07	Surface water	North Salt Lake Center Street at the Sewer Canal	Identify contaminant levels after merging with Sewage Canal	Field Duplicate
RD-SE-01	Sediment	Indiana Ave at I-215	Identify background contaminant levels	Background
RD-SE-02	Sediment	500 South and I-215	Identify immediate downgradient contaminant levels	Lab Duplicate
RD-SE-03	Sediment	Dauntless Ave (1000 North) and I-215	Identify contaminant levels before entrance of drainage detention basin	
RD-SE-04	Sediment	1700 North and I-215	Identify contaminant levels after entrance of drainage detention basin and before entrance of a branch of the Jordan River	

Redwood Road Dump UTD980961502
ESI ARR
Sampled June 9, 2015

Table 2: Surface Water - Summary of Inorganic Metals Concentrations

	Sample Number >>>			RD-SW-01		RD-SW-02		RD-SW-03		RD-SW-04		RD-SW-05		RD-SW-06		RD-SW-07	
	Traffic Number >>>			MH0AA0		MH0AA1		MH0AA2		MH0AA3		MH0AA4		MH0AA5		MH0AA6	
	Sample Location >>>	SCDM* Bench-Mark Values		Indiana Avenue at I-215		500 South at I-215		Dauntless Ave at I-215		1700 North at I-215		2200 West and Rose Park Lane		Center Street at Sewer Canal		Duplicate of RD-SW-06	
		CMC	CCC	Background		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Cas No.	Analyte	µg/L	µg/L	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
7429-90-5	Aluminum	750	87	**1,290**		**258**		**363**		**124**		**96.4**		73.3		71.4	
7440-36-0	Antimony	---	---	3.4		2.6		2.8		2.2		2.2		1		0.9	U
7440-38-2	Arsenic	340	150	54.8	J	61.1	J	89.5	J	49.8	J	42.8	J	15.4	J	15.3	J
7440-39-3	Barium	---	---	104		71.7		80.5		68.1		61		62.2		62	
7440-41-7	Beryllium	---	---	0.21	U	0.048	U	0.03	U	0.02	U	1	U	0.02	U	0.01	U
7440-43-9	Cadmium	2	0.25	0.22	U	1	U	1	U	1	U	1	U	0.1	U	0.05	U
7440-70-2	Calcium	---	---	96,600		85,400		69,700		76,500		74,000		118,000		117,000	
7440-47-3	Chromium	---	---	3.9		1.3	U	1.5	U	0.86	U	0.8	U	2	U	1.9	U
7440-48-4	Cobalt	---	---	1.5		0.96	U	0.85	U	0.7	U	0.6	U	0.6	U	0.6	U
7440-50-8	Copper	2.3	1.4	17.6		6.7		8.9		4.9		4.1		7.6		7.7	
7439-89-6	Iron	---	1,000	**2,130**		902		925		776		724		719		734	
7439-92-1	Lead	65	2.5	**12.8**		3.5		3.7		1.6		1.4	U	0.8		0.8	U
7439-95-4	Magnesium	---	---	59,400		55,300				49,900		46,500		41,500		41,300	
7439-96-5	Manganese	---	---	191		183		117		123		114		60.2		59.2	
7440-02-0	Nickel	470	52	5.6		4.5		4.1		3.7		3.5		4.7		4.7	
7440-09-7	Potassium	---	---	28,100		27,500		29,100		22,300		19,800		29,200		29,000	
7782-49-2	Selenium	290	5	1.8	J	1.8	J	1.9	J	1.5	J	0.1	J	1.5	J	1.6	J
7440-22-4	Silver	3.2	---	0.12	U	0.06	U	0.1	U	0.02	U	0.2	U	0.04	U	0.04	U
7440-23-5	Sodium	---	---	341,000		356,000		451,000		406,000		343,000		446,000		436,000	
7440-28-0	Thallium	---	---	0.095	U	1	U	1	U	1	U	1	U	0.1	U	0.06	U
7440-62-2	Vanadium	---	---	7.1		5.1		10.2		5.1	J	4.6	J	1.9	J	1.8	J
7440-66-6	Zinc	120	120	45.8		14.7		18.5		6.2		15.6		19		18.4	

*SCDM - Superfund Chemical Data Matrix, 06/2016
CMC = Criteria Maximum Concentration. The SCDM freshwater acute exposure benchmark adjusted to a water hardness of 355 mg/L as $CaCO_3$
CCC = Criteria Chronic Concentration. The SCDM freshwater chronic exposure benchmark adjusted to a water hardness of 355 mg/L as $CaCO_3$
U - Undetected. Sample Quantification Limit is provided.
J - The analyte was positively identified; the associated numberical value is the approximate concentration of the analyte in the sample.
A **bold** value indicates the concentration is equal to or greater than the threshold value listed in the SCDM Benchmark Value columns .

Redwood Road Dump UTD980961502
ESI ARR
Sampled June 9, 2015

Table 3: Sediment - Summary of Inorganic Metals Concentrations

	Sample Number >>>			RD-SE-01		RD-SE-02		RD-SE-03		RD-SE-04	
	Traffic Number >>>			MH0AA9		MH0AB0		MH0AB1		MH0AB2	
	Sample Location >>>			Indiana Avenue at I-215		500 South at I-215		Dauntless Ave at I-215		1700 North at I-215	
		TEC	PEC	Background		Sediment		Sediment		Sediment	
Cas No.	Analyte	mg/kg	mg/kg	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
7429-90-5	Aluminum	---	---	4,730		6,210		12,800		8,160	
7440-36-0	Antimony	---	---	4.1	J-	1.8	J-	2.3	J-	6.4	UJ
7440-38-2	Arsenic	9.79	33	**20.2**	J+	**22.8**	J+	**15.7**	J+	8.6	J+
7440-39-3	Barium	---	---	153		231		250		106	
7440-41-7	Beryllium	---	---	0.3	J	0.3	J	0.7		0.6	
7440-43-9	Cadmium	8.3	0.7	0.9		**1.4**		**1.7**		0.6	
7440-70-2	Calcium	---	---	64,700		55,000		97,200		52,600	
7440-47-3	Chromium (total)	43.4	111	16.8		21.1		24.3		13.8	
7440-48-4	Cobalt	---	---	4.2	J	4.7	J	8.7	J	5.1	J
7440-50-8	Copper	53	31	**84.2**		**126**		**92.6**		**41.4**	
7439-89-6	Iron	---	---	10,400		11,700		19,800		12,600	
7439-92-1	Lead	319	12	**73.6**	J	**123**	J	**72.5**	J	**36.9**	J
7439-95-4	Magnesium	---	---	15,100	J	11,700	J	15,300	J	20,400	J
7439-96-5	Manganese	---	---	293	J+	286	J+	412	J+	205	J+
7440-02-0	Nickel	1599	178	8.4		11.1		18.9		10.8	
7440-09-7	Potassium	---	---	1,480		2,170		**4,590**		2,580	
7782-49-2	Selenium	---	---	3.7	U	**1.5**	J	1.9	U	3.7	U
7440-22-4	Silver	39	---	0.2	J	**1.5**		**1.3**	J	1.1	U
7440-23-5	Sodium	---	---	1,790		939		1,130		554	
7440-28-0	Thallium	---	---	2.6	U	2.6	U	3.3	U	2.7	U
7440-62-2	Vanadium	---	---	14.4		16		30.6		20.5	
7440-66-6	Zinc	383	404	**247**	J+	298	J+	211	J+	80.4	J+

U - Undetected. Sample Quantification Limit is provided. UJ - The reported quantitation limit is estimated because quality control criteria were not met.

TEC = Threshold Effect Concentration - Level below which harmful effects are unlikely to occur.
CMC = Criteria Maximum Concentration. The SCDM freshwater acute exposure benchmark adjusted to a water hardness of 355 mg/L as $CaCO_3$
CCC = Criteria Chronic Concentration. The SCDM freshwater chronic exposure benchmark adjusted to a water hardness of 355 mg/L as $CaCO_3$
J - The analyte was positively identified; the associated numberical value is the approximate concentration of the analyte in the sample.
J- The associated numerical value is an estimated quantity but the results may be biased low.
J+ The associated numerical value is an estimated quantity but the results may be biased high.
A shaded value represents a concentration at least three times background or greater or when the background measurement is undetected (U) and the sample equals or exceeds the sample quantitation limit. These concentrations qualify as "Observed Releases".
A green value represents a concentration greater than the PEC.
A **bold** value indicates the concentration is equal to or greater than the TEC.

Redwood Road Dump UTD980961502
ESI ARR
Sampled June 9, 2015

Table 4 Target Population Distances		
Distance	**Population**	**Cumulative Population**
0.25 Miles	50	50
0-0.5 Miles	2,202	2,252
0.5-1 Miles	8,644	10,896
1-2 Miles	23,053	33,950
2-3 Miles	33,186	67,136
3-4 Miles	62,959	130,095

Source: U.S. Census Bureau, 2010

Table 5: Data Quality Concerns, Adjustments, and Qualifications

Groundwater Surface Water	Data Concern	Analytes	Data Adjustment/Qualifier
Surface Water	A serial dilution analysis was performed on sample MH0AA2. Results were not assessed unless the native concentration was nominally 50× the MDL. The %D for arsenic exceeded the control limit at 11%; therefore, arsenic in the samples, all detects, was qualified as estimated, "J." The remaining percent differences (%Ds) were within the control limit of ≤10%.	Arsenic	J qualifier
Surface Water	Results were qualified as nondetected, "U," at the detection limit as the metal was present in the method blank	Antimony, beryllium, chromium, cobalt, silver, thallium, cadmium, and lead	U qualifier
Sediment	A laboratory duplicate analysis was performed on sample MH0AB0. The antimony results exceeded the control limit of ± the reporting limit (RL) and the lead (78%) and magnesium (46%) RPDs exceeded the control limit; therefore, results for these analytes were qualified as estimated, "J," for detects and, "UJ," for nondetects in the samples.	Antimony, lead, and magnesium	J qualifier for detections UJ qualifier for nondetects
Sediment	A matrix spike analysis was performed on sample MH0AB0. Results were not assessed when the native concentration exceeded the spike amount by 4× or more. Recoveries were above the control limit; therefore, detects for these analytes in the samples were qualified as estimated with a potential high bias, "J+." The antimony recovery was below the control limit at 25%; therefore, antimony detected in the samples was qualified as estimated with a potential low bias, "J-." As the post digestion spike recovery for antimony was acceptable, nondetected antimony in sample MH0AB2 was qualified as estimated, "UJ," instead of being rejected.	Arsenic, manganese, and zinc	J+ qualifier for detections in sample MH0AB0 J- qualifier for antimony detections in sample MH0AB2 UJ qualifier for nondects in sample MH0AB2

Table 6: Data Quality Objectives

Step 1 Problem Statement	Step 2 Identifying the Decisions	Step 3 Decision Inputs	Step 4 Study Boundaries	Step 5 Decisions Rules	Step 6 Tolerance Limits on Errors	Step 7 Optimization of Sample Design
Lead in surface water, has been detected at a level significantly exceeding SCDM screening levels. Arsenic has also been detected in surface water at about half the SCDM benchmark. No surface water or sediment samples have been collected from downgradient surface waters to determine potential threats to downgradient sensitive environments. Total water hardness has not been determined to permit accurate determination of SCDM hardness based on environmental benchmarks.	Are Site contaminants present in surface water or sediments at levels that could pose a threat to downgradient sensitive environments?	Field and laboratory analytical results from surface water and sediment upgradient and downgradient samples will form the basis for making subsequent decisions. Surface water total hardness analytical results will be used to calculate SCDM hardness based environmental benchmarks. Analytical results from surface water will be compared to SCDM environmental benchmarks. Analytical results from sediment samples will be compared to background concentrations to determine if an "observed release" of contaminants is present.	Surface water and sediment samples will be collected upgradient of the Site and downgradient of the Site at locations before and after the City Drain merges with several downgradient canals before entering sensitive environments at the Great Salt Lake. Co-located sediment samples will also be collected.	In general, sample results will be compared to background samples and to SCDM benchmarks to determine if potential environmental threats exist. Contaminant concentrations in upgradient and downgradient samples will be used to further identify the extent of contamination.	Judgmental sampling will be used to bias samples toward more potentially contaminated areas. Statistical sampling will not be used and the tolerance limits on decision errors will not be calculated. All analytical data will be reviewed, verified and validated to ensure data are acceptable for the intended use.	Sample locations may be adjusted based on utility clearances or other field factors. Site maps, updated with the results from previous sample studies, will be used to determine the number and location of potential source sample locations. The surface water sample used for determining total water hardness will be collected at a location that accurately represents the quality of water flowing from the Site into sensitive environments.

APPENDIX A

FIELD ACTIVITIES REPORT

FIELD ACTIVITIES REPORT
SURFACE WATER AND SEDIMENT SAMPLING
For the Redwood Road Dump
CERCLIS ID UTD980961502
June 9, 2015

On June 9, 2015 Utah Department of Environmental Quality Division of Environmental Response and Remediation (DERR) personnel coordinated groundwater, sediment and surface water sampling in connection with the investigation of the Redwood Road Dump (Site). This report describes the sampling effort.

Sampling Conditions

DERR sampling personnel included Neil Taylor and David Bird. The weather was clear with temperatures in the high 80s. Photographs document the sample locations. All personnel conducted sampling in Level D personal protective gear. The northing and easting of surface water and sediment sample locations were identified using a GeoExplorer 3® and documented in the field notes. All samples were labeled, bagged and placed on ice in coolers and transported to DERR. All samples were hand delivered to ALS Laboratories for metals analysis on June 9, 2015.

RD-SW-06/07

This sample was collected on West Center Street in North Salt Lake from the City Drain. The canal banks were very steep with rock placed on the canal banks. No sediment was available to sample. This location is northeast and downstream of the City Drain Canal merger with the Sewage Canal and Northwest Oil Drain.

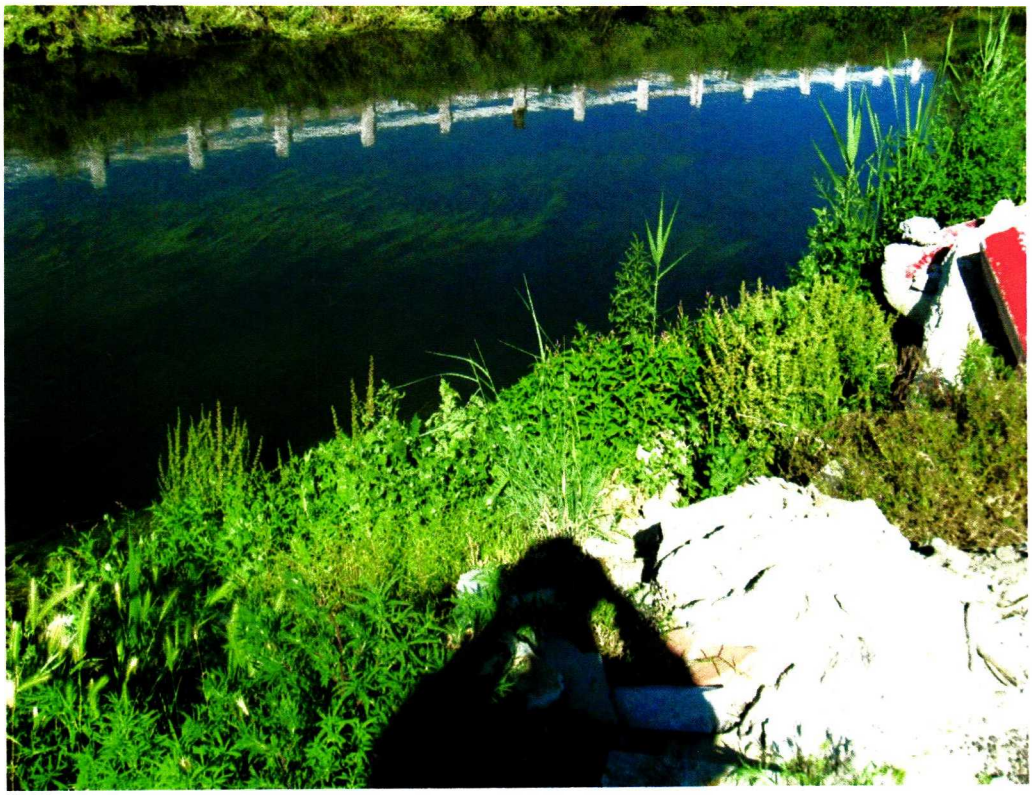


Figure 1 - Looking West

RD-SW-04

The sample was collected by taking the 2100 South exit off I-215 and then proceeding east along Rose Park Lane to 2200 West. There was very little, if any, flow in the canal at this location and banks were steep. This location is before the merge with the branch of the Jordan River. Water looked stagnant and the canal banks were lined with rock with no sediment available to sample.

Figure 2 - Looking West

RD-SW-04/SE-04

This is after the merge with the Jordan River branch, but appeared to have little difference from after the merge. There was very little flow and the water was stagnant. Canal banks were very steep and the sampler had to be lowered and retrieved by rope. A small amount of sediment was sampled.

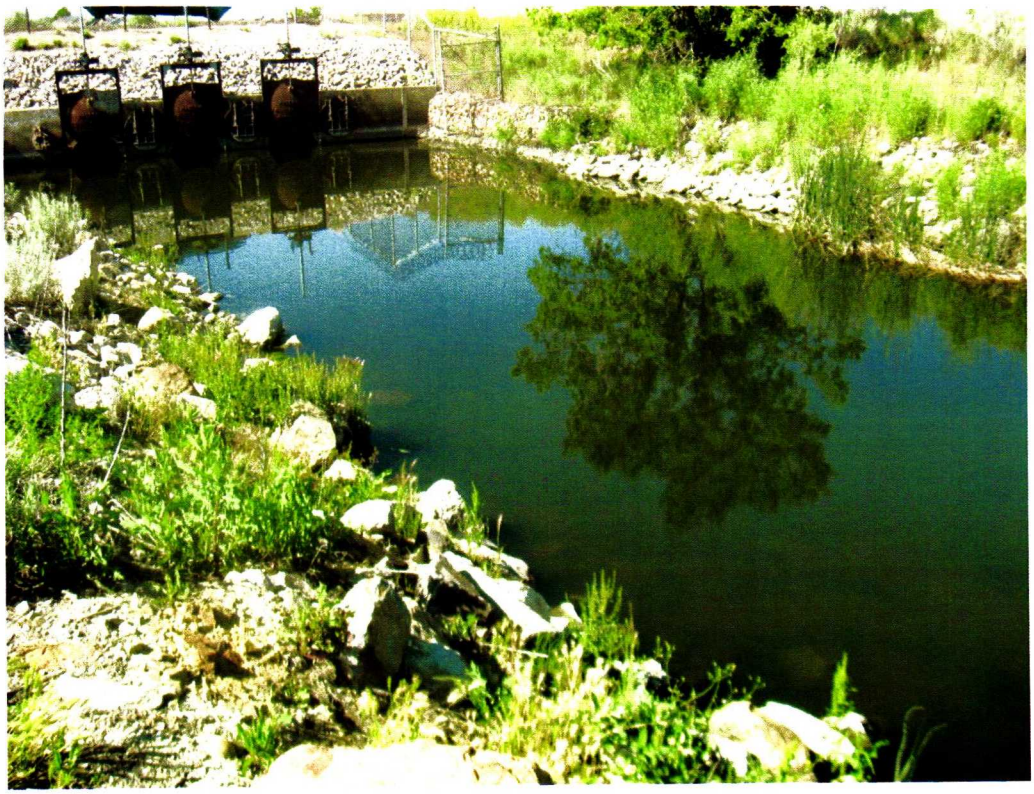


Figure 3 - Looking Southwest

RD-SW/SE-03

This City Drain sample location is at the east end of Dauntless Avenue on the south side of the avenue on the north bank of the City Drain. Water was flowing a bit more here and the water appeared more clear. A surface water laboratory duplicate was also collected here.

Figure 4 - Looking southwest

SW/SE-02

This location is on the west side of I-215 along 500 South and is just east of a city impound lot. The mud here was very dark in color and smelled of petroleum. Sediment was dark and sticky.

Figure 5 - Looking east

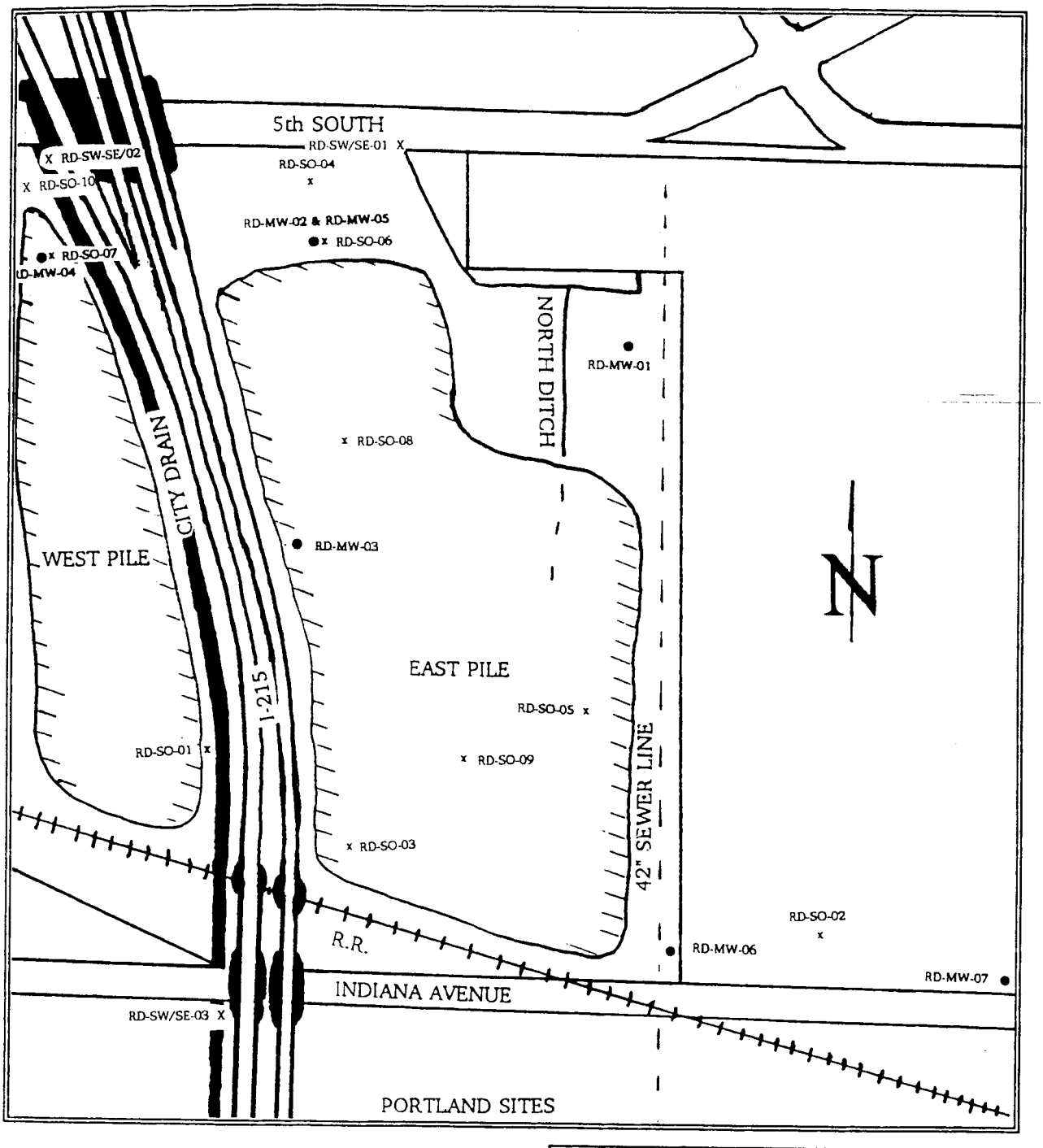
RD-SW/SE-01

This is the upgradient sample location just after the City Drain Canal has past under Indiana Avenue. The sample was collected on the south bank of the canal on property used by the city to store equipment and salt.

Figure 6 - Looking east

APPENDIX B

SELECTED TABLES AND FIGURES FROM THE 1991 SITE INVESTIGATION



- Monitor Well Location
- x Sample Location

UTAH DEPARTMENT OF HEALTH

BUREAU OF ENVIRONMENTAL RESPONSE AND REMEDIATION

Sample Location Map

Redwood Road Dump Site

Figure 3

By	Date	Scale
TH	6/11/91	Not to Scale

TABLE 2

ORGANIC DATA RESULTS FOR GROUNDWATER AND SURFACE WATER SAMPLES

Redwood Road Dump, Salt Lake County, Utah

Sample Number	RD-GW-01	RD-GW-02	RD-GW-03	RD-MW-04	RD-GW-05	RD-GW-06	RD-MW-07	RD-SW-01	RD-SW-02	RD-SW-03	RD-SW-04
Traffic Number	HN922	HN923	HN924	HN925	HN926	HN927	HN928	HN918	HN919	HN920	HN921
Sample Location	Downgradient	Downgradient	Downgradient	Downgradient	Oplicate	Background	Background	North Ditch	City Drain D	City Drain U	Blank
Sample Type	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Surface Water	Surface Water	Surface Water	
VOLATILES											
Tetrachloroethane										7J	
SEMIVOLATILES											
bis (2-Ethylhexyl) Phthalate								2J			
Phenathrene		1J									
Fluoranthene					3J						
Pyrene					3J						

J - The associated numerical value is an estimated because:

1. the Quality Control criteria were not met, or
2. the amount detected in the sample is below the contract required detection limit - Organic analysis only

Measured in parts per Billion (ppb)

TABLE 3

INORGANIC ANALYSES FOR GROUNDWATER AND SURFACE WATER SAMPLES

Redwood Road Dump Site, Salt Lake City, Utah

Sample Number	RD-SW-01	RD-SW-02	RD-SW-03	RD-MW-01	RD-MW-02	RD-MW-03	RD-MW-04	RD-MW-05	RD-MW-06	RD-MW-07
Traffic Number	MHN632	MHN633	MHN634	MHN636	MHN637	MHN638	MHN639	MHN640	MHN641	MHN642
Sample Location	North Ditch	City Drain D	City Drain U	Downgradient	Downgradient	Downgradient	Downgradient	Duplicate	Upgradient	Upgradient
TYPE	Surface Water	Surface Water	Surface Water	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Aluminum	1380	728	666	234	385	260	560	251	104	108
Antimony	<24.0	25	<24.0	<24.0	<24.0	<24.0	<24.0	34.2	<24.0	<24.0
Arsenic	16.7	53.4	59.2	248	40.8	314	179	41.1	11.6	19
Barium	69.4J	72.7J	76.6J	29.9J	429J	472J	81.7J	395J	37.7J	57.4J
Beryllium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.3	<1.0	<1.0
Cadmium	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Calcium	46500	56300	70800	30600	59600	13400	38800	55800	54600	92300
Chromium	<6.0	<6.0	<6.0	10	<6.0	27.2	<6.0	<6.0	<6.0	8
Cobalt	<5.0	<5.0	<5.0	8.2	<5.0	17.3	8.2	<5.0	<5.0	<5.0
Copper	19	14.7	24.3	96.1	<5.0	15.2	5.4	6.7	21.9	26.2
Iron	1460	1060	710	148	1260	2570	659	1210	44.9	53.7
Lead	23.6	8	4.8	<1.0	9.7	4.8	1.1	3.3	<1.0	<1.0
Magnesium	16000	36500	48200	92900	63200	110000	162000	59900	101000	87300
Manganese	33	92.4	98.5	97.9	538	350	775	500	36.9	222
Mercury	<.20J	<.20J	<.20J	<.20J	<.20J	<.20J	<.20J	<20J	<.20J	<.20J
Nickel	<12.0	<12.0	<12.0	40	15.9	30.4	26.2	<12.0	<12.0	<12.0
Potassium	14400	37000	53900	157000	70300	141000	196000	67100	39600	57400
Selenium	2.5J	3J	2.5J	14.8J	<1.0J	<1.0J	<10.0J	<1.0J	<1.0J	7.1J
Silver	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Sodium	112000	460000	598000	5420000	2020000	495000	6250000	197000	352000	362000
Thallium	<10.0J	<10.0J	<10.0	<10.0R	<1.0J	<10.0J	<10.0R	<1.0J	<1.0J	<1.0J
Vanadium	6.8	8.4	6.1	78.3	4.6	17.2	37.4	7.2	8.1	10.4
Zinc	62.7	53.9	62.3	29.8	16.4	51	19.7	19	33	23.6

J - The associated numerical value is an estimate because:

1. the Quality Control criteria were not met, or
2. the amount detected in the sample is below the contract required detection limit - Organic analysis only

Measured in Parts Per Billion (ppb)

TABLE 4

ORGANIC DATA RESULTS FOR SOIL AND SEDIMENT SAMPLES

Redwood Road Dump, Salt Lake City, Utah

Sample Number	RD-SO-01	RD-SO-02	RD-SO-03	RD-SO-04	RD-SO-05	RD-SO-06	RD-SO-07	RD-SO-08	RD-SO-09	RD-SO-10	RD-SE-01	RD-SE-02	RD-SE-03
Traffic Number	HN907	HN908	HN909	HN910	HN911	HL951	HL952	HN912	HN913	HN914	HN915	HN916	HN917
Sample Location	Downgradient	Background	Downgradient	Downgradient	Downgradient	RD-MW-02	RD-MW-04	Downgradient	Downgradient	Downgradient	North Ditch	City Drain, D	City Drain, U
SEMIVOLIBLE													
bis (2-Ethylhexyl) phtalate	86J		74J	63J	68J		620J	34J	82J			140J	100J
2-Methylnaptholene							86J						
Napthalene							120J						
Acenapthlene							80J						
Dibenzofuran							54J						
Fluorene							110J						
Phenanthrene	1200		38J	84J			1000J		500		240J		
Anthracene	270						140J		140J		50J		
Flouranthene	2700		56J	110J			1000J		800		240J		
Pyrene	2700		58J	130J			410J		650		280J		59J
Benzo(a)anthracene	1700			67J			410J		430		140J		
Chrysene	1500		35J				760J		350J		150J		
Benzo(b)fluoranthene	1100		25J	72J			410J		280J		110J		
Benzo(k)fluoranthene	1100		30J	79J			410J		280J		110J		
Carbazole	63J						63J						
Di-n-Butylphtalate	47J			37J					47J				
Benzo(a)Pyrene	1200		34J						290J		96J		
Ideno(1.2.3-cd)Pyrene	660			77J					200J				
Benzo(g.h.i)Perylene			140J										
N-Nitrosodiphenyamine (1)											110J		
PESTICIDES/PCB													
Methoxychlor	6J	4.3	1.9J	5.9J				1.6J	67	2.5J	7.3J		
Heptachlor	1J			1.5J	.23J				.80J		.74J	.22J	
Endrin	.70J			.56J					1.7J				
gamma-Chlordane	.54J		.64J	.97J					6.5J		1.3J		
4,4'-DDE		14		1J					11		.56J		
4,4'-DDD		5.2		1.2J					4.7J				
4,4'-DDT		16	1.1J	2.3J					30J				
Endosulfan II				1.1J									
Endrin aldehyde				.99J									
Dieldrin									6.5J				
Endrin ketone									12				
alpha-Chlordane									1.6J				
Aroclor-1260									150				
VOLATILES													
Acetone			6J			53J	270				16J	5J	
Benzene							6J						
Ethylbenzene							8J						
Xylenes (total)							61						

J - The associated numerical value is an estimated because.

1. the Quality Control criteria were not met, or
2. the amount detected in the sample is below the contract required detection limit - Organic analysis only

Measured in Parts Per Billion (PPB)

TABLE 5

INORGAINC ANALYSES FOR SOIL AND SEDIMENT SAMPLES

Redwood Road Dump Site, Salt Lake City, Utah

Sample Number	RD-SO-01	RD-SO-02	RD-SO-03	RD-SO-04	RD-SO-05	RD-SO-08	RD-SO-09	RD-SO-10	RD-SE-01	RD-SE-02	RD-SE-03
Traffic Number	MHN621	MHN622	MHN623	MHN624	MHN625	MHN626	MHN627	MHN628	MHN629	MHN630	MHN631
Sample Location	Downgradient	Downgradient	Downgradient	Background	Downgradient	Downgradient	Downgradient	Downgradient	North Ditch	City Drain D	City Drain U
Alluminum	10400	8250	5650	9920	8980	5590	6770	23600	8070	1210	13800
Antimony	28.8J	<6.6J	12.8J	<5.9J	8.4J	30J	14.9J	15.9J	11.9J	12.4J	45.8J
Arsenic	21.2J	10.8J	3.3J	9.4J	8.8J	4.7J	11.5J	28J	4.9J	7J	22J
Barium	534	198	87.5	126	145	61.6	263	1760	230	38.2	117
Beryllium	<1.2	<.49	<.39	<.58	<.82	<.54	<.81	<1.5	<.86	<.28	<1.0
Cadmium	6.2	<3.3J	<.68	<.85	<.69	<.84	<1.3	<3.3	<1.1	<.69	<.85
Calcium	33700	36700	61300	50700	40300	292000	57500	80200	79100	107000	51400
Chromium	56.7	14.2	14.6	16.5	12.4	21.8	17.2	125	12.6	2.5	18.4
Cobalt	14.5	4.1	4.3	6	5.7	1.5	4.4	16.3	5.8	1.7	8.5
Copper	375	59.9	17.9	47.5	22	11.4	58	235	40.5	5.6	55.8
Iron	104000	9710	8590	14800	13800	9900	12800	165000	21500	4520	19000
Lead	553	219	15.5	214	24.5	15.5	268	2610	68.2	5.2	23.8
Magnesium	8360	21100	5270	12400	9030	9770	8430	17200	33000	36800	16400
Manganese	529	250	171	293	328	117	246	645	261	129	345
Mercury	.41J	<.14J	<.11J	0.22J	<.12J	<.11J	0.22J	0.77J	0.15J	<.11J	<.14J
Nickel	72.7	9.1	7.4	13.8	14.4	11.7	13	52.5	10.9	7.2	17.5
Potassium	3200	3550	1580	3290	2860	1740	2270	1560	2910	345J	5110
Selenium	<.25J	<.28J	<.22J	<.25j	<.23J	<.23J	<.26J	<.86J	<.26J	<.23J	<.28J
Silver	2	<1.1	<.89	0.98	<.92	<.91	<.97	1.4	<1.0	<.92	<1.1
Sodium	1040	836	121	566	85.6	255	181	2910	625	272	3770
Thallium	0.36	0.32	<.22	0.32	0.26	<.23	<.24	<.27	<.26	<.23	0.31
Vanadium	26.3	21.8	15.6	24.1	17.6	44.8	18	39.3	18.8	7	29.1
Zinc	2580	112	49.7	103	55.2	28.9	207	1570	222	18.3	80.2

J - The associated numerical value is an estimate because:

1. the Quality Control criteria were not met, or
2. the amount detected in the sample is below the contract required detection limit - Organic analysis only

Measured in Parts Per Million (ppm)

APPENDIX C

SELECTED TABLES AND FIGURES FROM THE 2000 TARGETED BROWNFIELD ASSESSMENT

DRAFT

TARGETED BROWNFIELDS ASSESSMENT
ANALYTICAL RESULTS REPORT

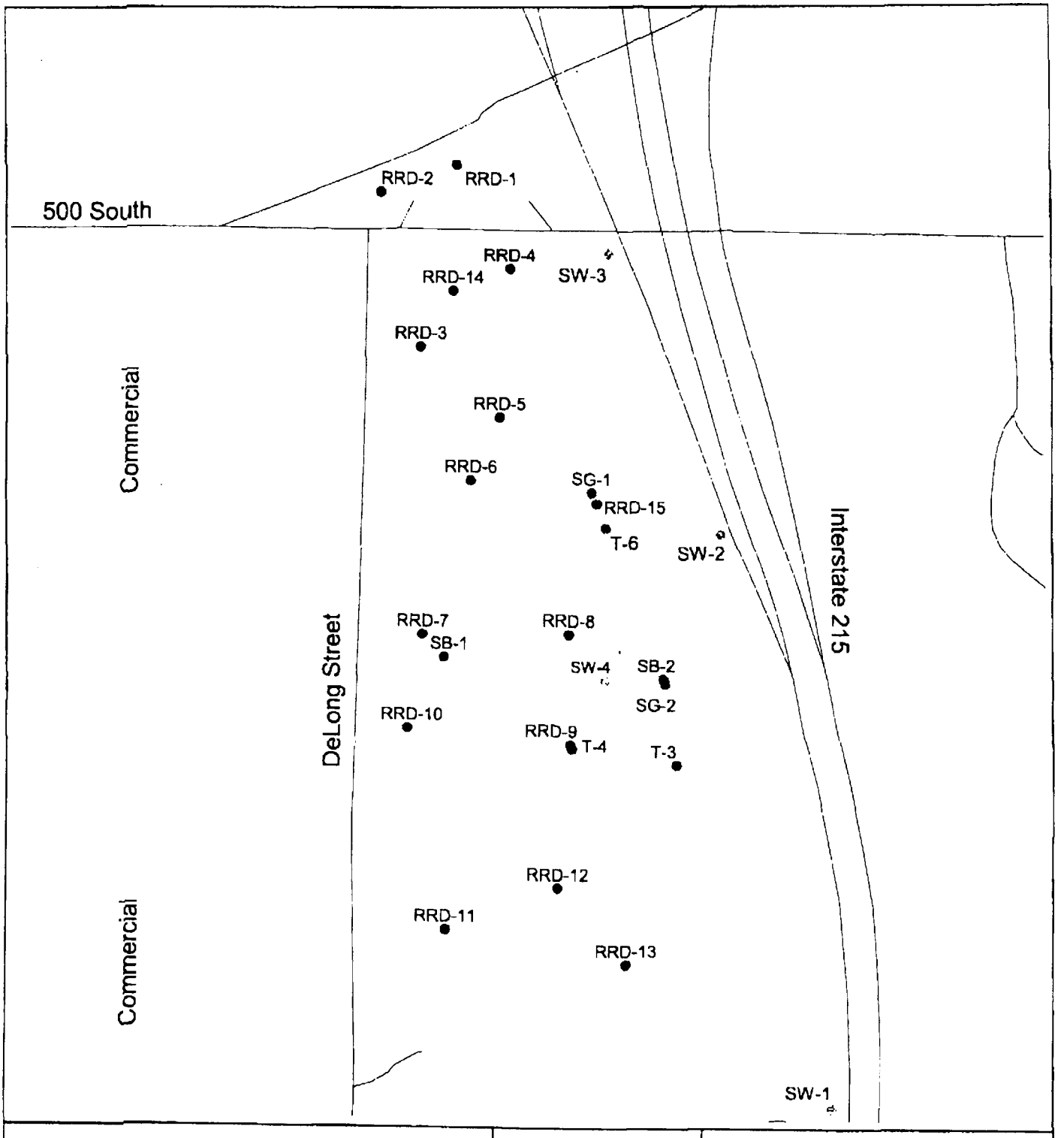
Western Portion of the Redwood Road Dump and the Salt Lake City Road Maintenance and Automobile Impound Lot
Salt Lake County, Utah

SCANNED

DERR 2001-001542

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
Division of Environmental Response and Remediation
Prepared by : William L. Rees

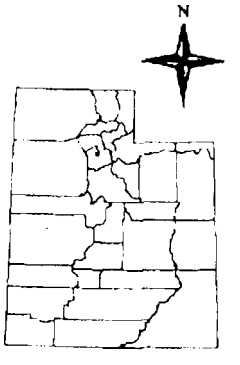
FIGURES



0 200 400 600 800 Feet

LEGEND

- Roads
- Sample Location
- RRD-4 - Soil and Groundwater Sample
- SG-1 - Soil Gas Sample Location
- SB-2 - Soil Sample Location
- T-3 - Phase I Trench Location
- SW-1 - Surface Water Sample

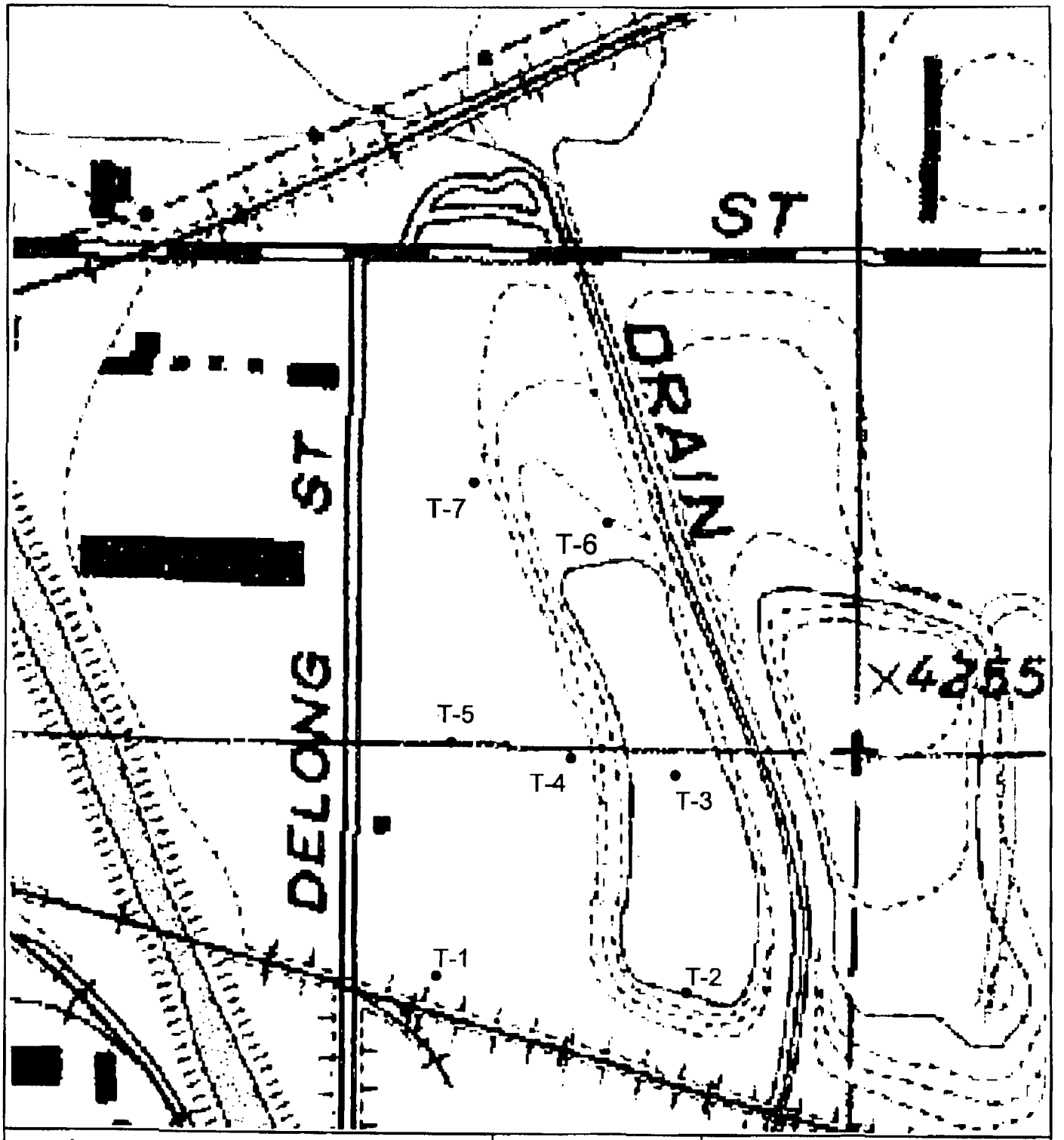


Site Location

Utah Department
of Environmental Quality
Division of Environmental
Response and Remediation

Figure 3
Sample Locations
Redwood Road Dump TBA

By: B.Rees Date: April 30, 2001



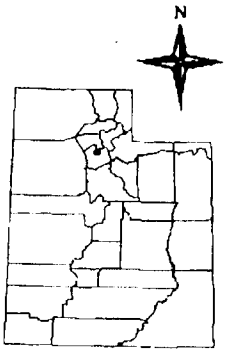
0 200 400 600 800 Feet

LEGEND

- Phase I Investigation Trenches

T-4 - Trench Identification

Based on the Phase I investigation, the refuse appears to be limited to the eastern portion of the RRD West.

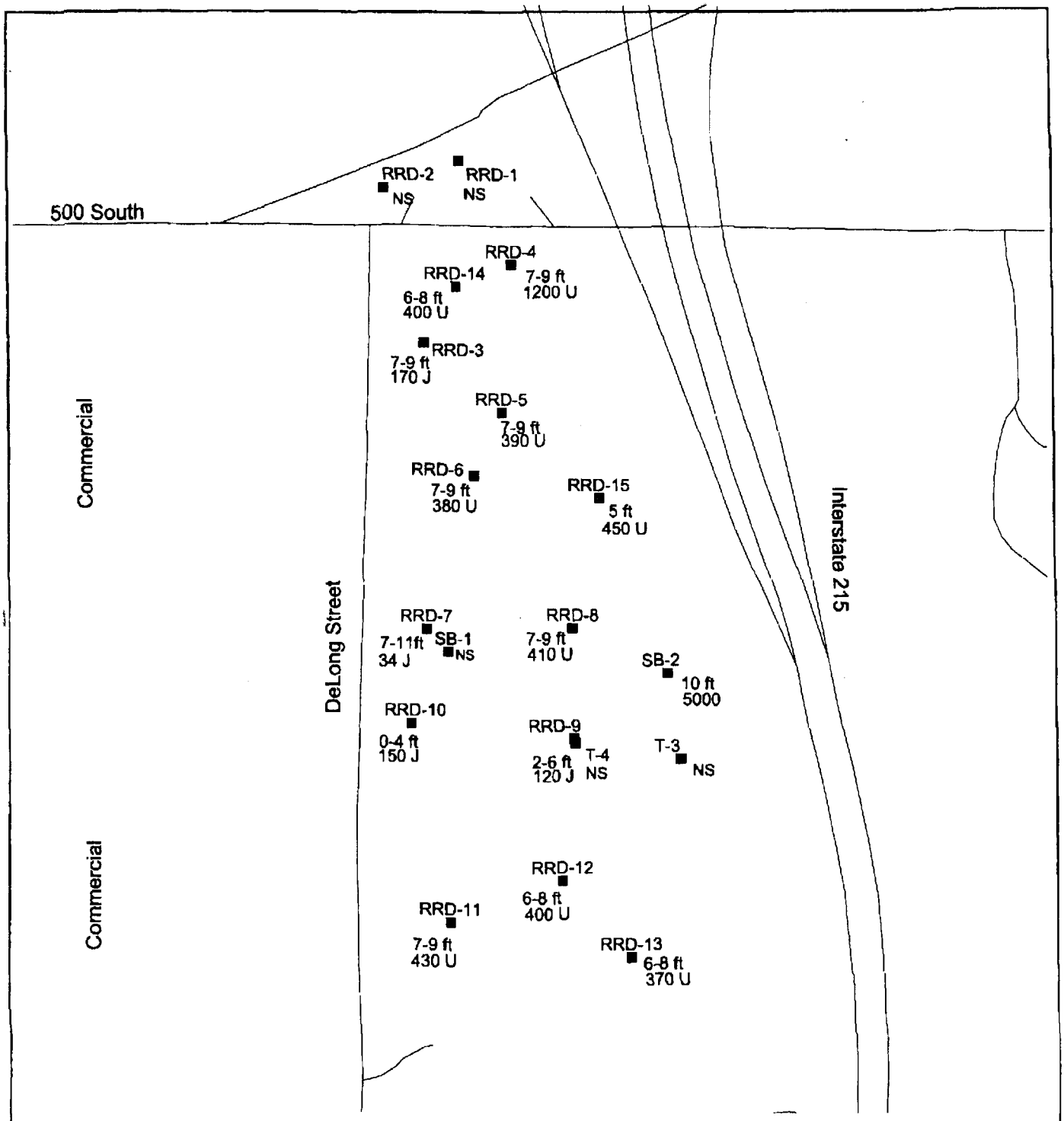


Site Location

Utah Department
of Environmental Quality
Division of Environmental
Response and Remediation

Figure 3a
Phase I Trench Locations
Redwood Road Dump TBA

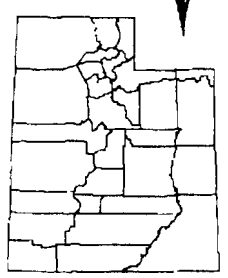
By: B. Rees Date: May 1, 2001



0 200 400 600 800 Feet

LEGEND

- Roads
- ■ Soil Sample Location
- 5000 - Benzo (a) pyrene concentration (ug/kg)
- 7 - 9 ft - Depth of Soil Sample
- NS - Sample not collected from this location
- U - Laboratory Quantitation Limit
- J - Estimated Value

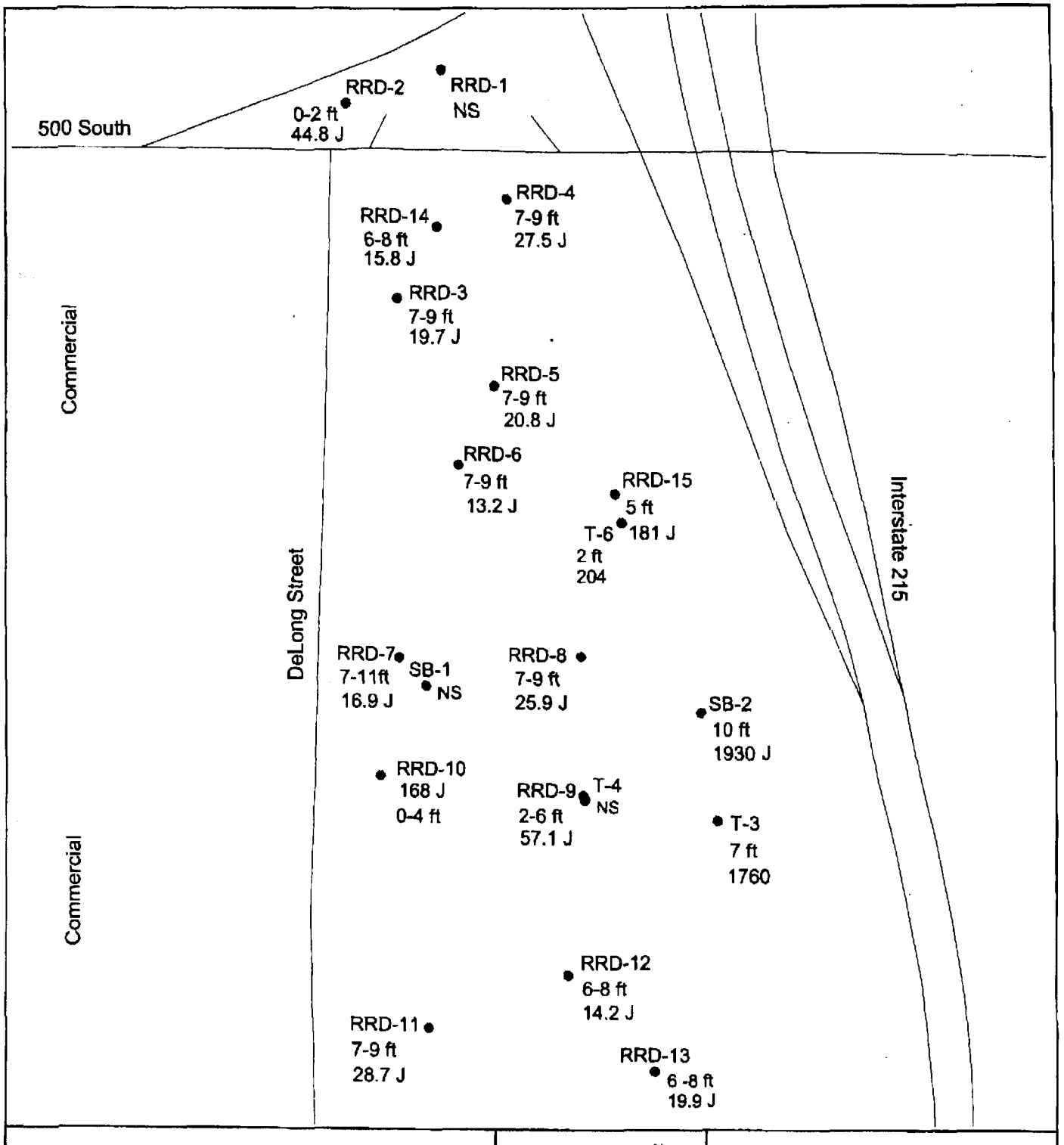


Site Location

Utah Department
of Environmental Quality
Division of Environmental
Response and Remediation

Figure 4
Benzo (a) Pyrene Concentrations in Soil
Redwood Road Dump TBA

By: B. Rees Date: April 30, 2001



LEGEND

Roads

Soil Sample Location

28.7 J - Estimated Lead Concentration (mg/kg)

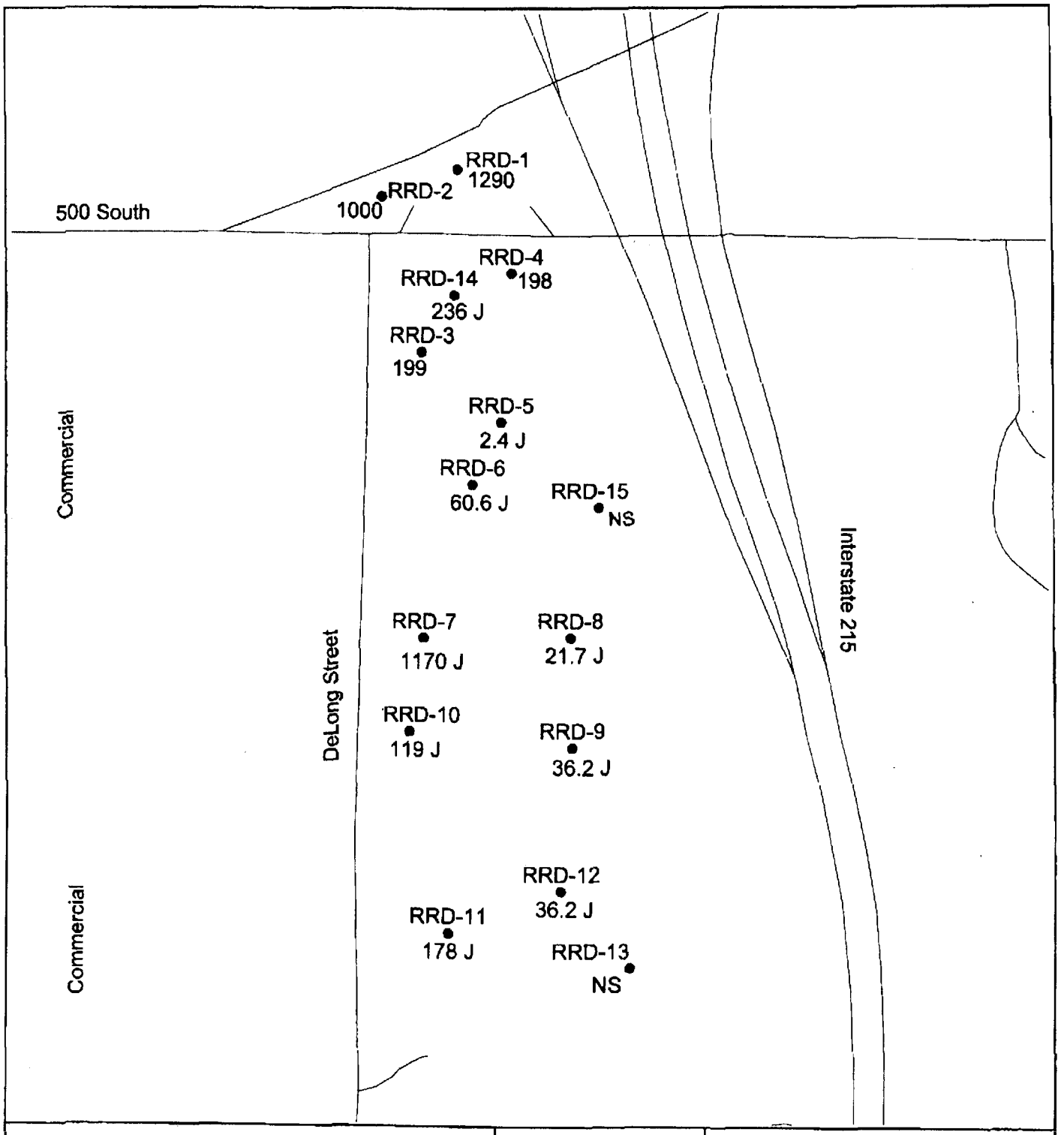
7 -9 ft - Depth of Soil Sample

NS - Sample not collected

Utah Department
of Environmental Quality
Division of Environmental
Response and Remediation

Figure 4a
Lead Concentrations in Soil
Redwood Road Dump TBA

By: B. Rees Date: May 1, 2001



0 200 400 600 800 Feet

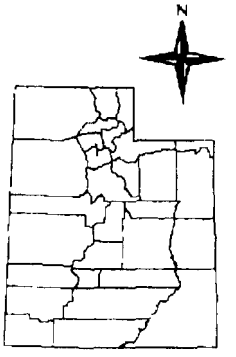
LEGEND

Roads

• Groundwater Sample Location

178 J - Dissolved Arsenic (ug/L)

NS - Sample not collected



Site Location

Utah Department
of Environmental Quality
Division of Environmental
Response and Remediation

Figure 5
Dissolved Arsenic in Groundwater
Redwood Road Dump TBA

By: B. Rees Date: April 27, 2001

TABLES

Table

Total Metals in Soil
SLC Redwood Road Dump Targeted Brownfields Assessment

	Sample Number	N/A	RRD-2		RRD-3		RRD-4		RRD-5		RRD-6		RRD-7		RRD-8		RRD-9	
	Traffic Number	N/A	MHEX44		MHEX46		MHEX49		MHEX51		MHEX53		MHEX55		MHEX57		MHEX59	
	Sample Location	N/A	SLC Automobile Impound Lot		Northwestern portion of RRD Landfill		Northeast portion of RRD, north of east bench		Northern portion of RRD, west of east bench		Northern portion of RRD, off SE corner of impound lot fence		Central portion of RRD, north of switch yard		Central portion of RRD, east of switch yard		Central portion of RRD, west of east bench	
	Site Address	N/A	500 South, West of I-215		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Depth	N/A	0 - 2 feet bgs		7 - 9 feet bgs		7 - 9 feet bgs		7 - 9 feet bgs		7 - 9 feet bgs		7 - 11 feet bgs		7 - 9 feet bgs		2 - 6 feet bgs	
	Sample Date	N/A	6/19/2000		6/19/2000		6/20/2000		6/20/2000		6/20/2000		6/20/2000		6/21/2000		6/21/2000	
	Sample Type	EPA Region III - Industrial Screening Criteria	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Cas No.	Analyte	mg/kg	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
7429-90-5	Aluminum		5,710	J	10,900	J	13,400	J	12,800		6,840		9,140		11,400		8,850	
7440-36-0	Antimony	820	1.3	J	0.78	J	0.92	J	1.6	J	0.83	J	0.98	J	1.2	J	3.3	J
7440-38-2	Arsenic	3.8	**9.6**		**8.8**		**15.2**		**6.0**	J	7.1	J	**11.4**	J	**9.8**	J	**8.7**	J
7440-39-3	Barium	140,000	115		102		169		115		98.1		105		131		170	
7440-41-7	Beryllium	4,100	0.49		0.6		0.87		0.87	J	0.57	J	0.52	J	0.84	J	0.63	J
7440-43-9	Cadmium	2,000	0.81	J	0.24		0.25		0.24	U	0.25	U	0.34	J	0.27	U	0.46	J
7440-70-2	Calcium		148,000	J	53,700	J	71,100	J	57,400		52,600		48,600		49,800		80,200	
7440-47-3	Chromium	6,100	16.2		15.4		17.7		17.2	J	11.2	J	12.7	J	17.1	J	12.7	J
7440-48-4	Cobalt	120,000	3.3	J	5.7		9.0		7.1	J	5.0	J	5.4	J	8.9	J	4.4	J
7440-50-8	Copper	82,000	31.7		31.8		46.8		32.7	J	25.2	J	25.1	J	46.4	J	33.9	J
7439-89-6	Iron		8,490	J	15,000	J	18,800	J	19,500		12,900		14,600		20,300		14,100	
7439-92-1	Lead		44.8	J	19.7	J	27.5	J	20.8	J	13.2	J	16.9	J	25.9	J	57.1	J
7439-95-4	Magnesium		14,200		15,200		29,000		12,200	J	11,900	J	12,300	J	19,400	J	12,400	J
7439-96-5	Manganese		249	J	283	J	752	J	469	J	286	J	316	J	516	J	372	J
7439-97-6	Mercury	610	0.10		0.08		0.08		0.11	UJ	0.11	UJ	0.30	J	0.11	UJ	0.11	J
7440-02-0	Nickel	41,000	8.5	J	13.3		21.4		16.7	J	11.2	J	12.2	J	20.6	J	10.2	J
7440-09-7	Potassium		2,340	J	3,600	J	4,620	J	6,940		3,080		4,360		4,360		4,220	
7782-49-2	Selenium	10,000	0.69	UJ	0.68	U	0.76	U	0.72	UJ	0.74	UJ	0.73	UJ	0.81	UJ	0.74	UJ
7440-22-4	Silver	10,000	0.37		0.23	U	0.25	U	0.24	U	0.25	U	0.24	U	0.27	U	0.38	
7440-23-5	Sodium		785		3,200		3,060		3,520	J	1,950	J	1,560	J	3,770	J	1,920	J
7440-28-0	Thallium	140	0.57	J	0.7		0.83		1.2	J	0.97	J	0.92	J	0.88	J	1.1	J
7440-62-2	Vanadium	14,000	16.3		25.3		32		28.2	J	19.1	J	23.4	J	26	J	22.7	J
7440-66-6	Zinc	610,000	63.7	J	63.2	J	74	J	85.9		49.6		61.9		84.1		96.2	

Results equal to or greater than the EPA Region III Industrial Screening criteria are shown in bold.

bgs - below ground surface

NA - Not Applicable

Q - Qualifier

mg/kg - parts per million

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.

UJ - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

R - Reported value is "rejected."

U - The analyte was not detected above the laboratory quantitation limit.

Total Metals in Soil
SLC Redwood Road Dump Targeted Brownfields Assessment

	Sample Number	RRD-10		RRD-11		RRD-12		RRD-13		RRD-14		RRD-15		SB-2	
	Traffic Number	MHEX61		MHEX65		MHEX67		MHEX69		MHEX71		MHEX75		MHEX77	
	Sample Location	Central portion of RRD, adjacent to DeLong Street		Southwestern portion of RRD		Southern portion of RRD		Southeastern portion of RRD		Northern portion of RRD, Impound Lot		Northern portion of RRD, east bench		Central portion of RRD, east bench	
	Site Address	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Depth	0 - 4 feet bgs		7 - 9 feet bgs		6 - 8 feet bgs		6 - 8 feet bgs		6 - 8 feet bgs		5 feet bgs		10 feet bgs	
	Sample Date	6/21/2000		6/21/2000		6/22/2000		6/22/2000		6/22/2000		6/22/2000		6/22/2000	
	Sample Type	Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Cas No	Analyte	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
7429-90-5	Aluminum	7,680		13,000		7,150		7,160		7,280		19,200		11,100	
7440-36-0	Antimony	3.4	J	0.82	J	0.73	UJ	0.75	UJ	1.0	J	4.1	J	21.4	J
7440-38-2	Arsenic	10.6	J	7.7	J	7.9	J	7.0	J	18.8	J	24.7	J	43.9	J
7440-39-3	Barium	386		125		107		125		118		1470		1,290	
7440-41-7	Beryllium	0.58	J	0.94	J	0.55	J	0.56	J	0.56	J	1.4	J	0.96	J
7440-43-9	Cadmium	0.68	J	0.35	J	0.24	U	0.25	U	0.25	U	0.36	J	6.8	J
7440-70-2	Calcium	58,300		67,100		43,000		34,800		50,200		73,200		65,800	
7440-47-3	Chromium	19.4	J	19.4	J	12.2	J	12.3	J	15.7	J	34.1	J	54.2	J
7440-48-4	Cobalt	4.6	J	6.6	J	4.5	J	5.1	J	4.8	J	6.6	J	7.4	J
7440-50-8	Copper	48.2	J	39.7	J	24.7	J	26.2	J	28	J	168	J	429	J
7439-89-6	Iron	13,300		20,200		14,500		14,100		14,800		88,000		49,000	
7439-92-1	Lead	168	J	28.7	J	14.2	J	19.8	J	15.8	J	181	J	1,930	J
7439-95-4	Magnesium	15,000	J	18,100	J	16,500	J	15,000	J	12,400	J	5,610	J	7,780	J
7439-96-5	Manganese	263	J	391	J	237	J	251	J	342	J	414	J	470	J
7439-97-6	Mercury	0.11	UJ	0.12	UJ	0.12	UJ	0.19	J	0.13	UJ	5.8	J	0.75	J
7440-02-0	Nickel	12.5	J	18	J	11.3	J	11.4	J	11.9	J	20.5	J	53.6	J
7440-09-7	Potassium	2,870		4,230		2,930		2,990		2,600		1,160		1,490	
7782-49-2	Selenium	0.81	J	0.80	J	0.73	UJ	0.75	UJ	0.78	UJ	4.3	J	2.7	J
7440-22-4	Silver	0.49		0.27	U	0.24	U	0.25	U	0.25	U	3.3		5.5	
7440-23-5	Sodium	707	J	7,530	J	6,660	J	12,100	J	2,890	J	3,550	J	2,240	J
7440-28-0	Thallium	0.51	J	1.1	J	1.4	J	1.2	J	0.84	J	7.6	J	3.6	J
7440-62-2	Vanadium	21.3	J	28.8	J	22.9	J	18.7	J	26.8	J	40.1	J	25.9	J
7440-66-6	Zinc	186		89.8		57.2		63.9		58.9		499		2,190	

Results equal to or greater than the EPA Region III Industrial Screening criteria are shown in bold

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UJ - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

R - Reported value is "rejected."

U - The analyte was not detected above the laboratory quantitation limit.

Table 2

Dissolved Metals in Groundwater
SLC Redwood Road Dump Targeted Brownfields Assessment

	Sample Number	N/A	RRD-1		RRD-2		RRD-3		RRD-30		RRD-4		RRD-5		RRD-6	
	Traffic Number	N/A	MH01K1		MHEX45		MH01K2		MH01K3		MH01K4		MHEX52		MHEX54	
	Sample Location	N/A	SLC Automobile Impound Lot		SLC Automobile Impound Lot		Northwestern portion of RRD Landfill		Duplicate of RRD-3		Northeast portion of RRD, north of east bench		Northern portion of RRD, west of east bench		Northern portion of RRD, off SE corner of impound lot fence	
	Site Address	N/A	500 South, West of I-215		500 South, West of I-215		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Date	N/A	6/19/2000		6/19/2000		6/19/2000		6/19/2000		6/20/2000		6/20/2000		6/20/2000	
	Sample Type	MCL or EPA Region III Tap Water Screening Criteria	Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater	
Cas No.	Analyte	µg/L	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
7429-90-5	Aluminum		9.0	U	589		9.0	U	9.0	U	9.0	U	15	UJ	15	UJ
7440-36-0	Antimony	15	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	2.0	U	2.0	U
7440-38-2	Arsenic	50	1,290		1,000		199		201		198		2.4	J	60.5	J
7440-39-3	Barium	2,000	29.9		74.2		115		123		95.7		31.4	J	69	J
7440-41-7	Beryllium	73	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
7440-43-9	Cadmium	5	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ	1.0	UJ
7440-70-2	Calcium		1,870	J	5,230	J	57,100	J	55,000	J	15,700	J	21,600	J	25,100	J
7440-47-3	Chromium	100	1.0	U	1.8		1.0	U	1.3		1.0	U	1.2	J	1.0	UJ
7440-48-4	Cobalt	2,200	6.0	U	6.0	U	6.0	U	6.0	U	6.0	U	3.0	UJ	3.0	UJ
7440-50-8	Copper	1,300	31.1		20.5		1.8		2.1		5.3		1.0	U	5.2	U
7439-89-6	Iron		20.2		667		114		177		61.3		151	J	134	J
7439-92-1	Lead	15	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ	1.0	UJ
7439-95-4	Magnesium		3,540	J	5,580	J	101,000	J	97,000	J	29,500	J	81,900	J	26,000	J
7439-96-5	Manganese	730	13.4		28.8		382		405		220		40.4	J	431	J
7439-97-6	Mercury	2	0.20	J	0.25	J	0.20	UJ	0.20	UJ	0.20	UJ	0.56		0.12	J
7440-02-0	Nickel	730	3.5		5.7		34.6		34.8		9.6		1.0	UJ	11.4	J
7440-09-7	Potassium		19,200		24,800		71,200		68,900		39,200		108,000	J	51,900	J
7782-49-2	Selenium	50	11.2		11		3.0	U	3.4		3.0		2.0	UJ	2.0	UJ
7440-22-4	Silver	100	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
7440-23-5	Sodium		1,980,000	J	1,510,000	J	3,750,000	J	4,170,000	J	3,335,000	J	5,610,000		2,200,000	
7440-28-0	Thallium	2.6	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	3.0	UJ	3.3	UJ
7440-62-2	Vanadium	262	148		136		11.3		11.2		48.6		3.7	J	8.3	J
7440-66-6	Zinc	5,000	4.1		4.0		3.0	U	4.2		3.0	U	1.0	U	6.5	U

Results equal to or greater than MCLs or EPA Region III Tap Water Screening criteria are shown in bold.

bgs - below ground surface

NA - Not Applicable

Q - Qualifier

ug/L - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.

UJ - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

R - Reported value is "rejected."

U - The analyte was not detected above the laboratory quantitation limit.

Table 2

Dissolved Metals in Groundwater
SLC Redwood Road Dump Targeted Brownfields Assessment

	Sample Number	RRD-7		RRD-8		RRD-9		RRD-10		RRD-20		RRD-11		RRD-12		RRD-14	
	Traffic Number	MHEX58		MH01K5		MHEX60		MHEX62		MHEX64		MHEX66		MHEX68		MHEX70	
	Sample Location	Central portion of RRD, north of switch yard		Central portion of RRD, east of switch yard		Central portion of RRD, west of east bench		Central portion of RRD, adjacent to DeLong Street		Duplicate sample of RRD-10		Southwestern portion of RRD		Southern portion of RRD		Northern portion of RRD, Impound Lot	
	Site Address	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Date	6/20/2000		6/21/2000		6/21/2000		6/21/2000		6/21/2000		6/21/2000		6/22/2000		6/22/2000	
	Sample Type	Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater	
Cas No.	Analyte	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
7429-90-5	Aluminum	15	UJ	15	UJ	15	UJ	15	UJ	15	UJ	5.0	UJ	15	UJ	15	UJ
7440-36-0	Antimony	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
7440-38-2	Arsenic	**1,170**	J	21.7	J	36.2	J	**119**	J	**123**	J	**178**	J	36.2	J	**235**	J
7440-39-3	Barium	32.1	J	27.5	J	242	J	122	J	125	J	65.9	J	124	J	133	J
7440-41-7	Beryllium	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	2.7		1.0	U	1.0	U
7440-43-9	Cadmium	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ
7440-70-2	Calcium	6,620	J	7,410	J	63,300	J	105,000	J	110,000	J	56,300	J	101,000	J	17,300	J
7440-47-3	Chromium	1.6	J	1.3	J	1.0	UJ	1.5	J	1.5	J	1.3	J	1.0	UJ	1.3	J
7440-48-4	Cobalt	3.0	UJ	3.0	UJ	3.0	UJ	3.0	UJ	3.0	UJ	4.6	J	3.0	UJ	3.0	UJ
7440-50-8	Copper	49.1		1.0	U	1.0	U	1.0	U	1.0	U	16.4		1.0	U	2.5	U
7439-89-6	Iron	39.5	UJ	143	J	718	J	3,400	J	3,670	J	95.8	J	97.4	J	61.5	J
7439-92-1	Lead	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ	1.0	UJ
7439-95-4	Magnesium	22,500	J	33,200	J	76,500	J	155,000	J	160,000	J	130,000	J	125,000	J	32,000	J
7439-96-5	Manganese	62.3	J	22.4	J	212	J	731	J	663	J	421	J	743	J	36	J
7439-97-6	Mercury	0.10	UJ	0.10	UJ	0.10	UJ	0.10	UJ	0.10	UJ	0.10	UJ	0.10	UJ	0.10	UJ
7440-02-0	Nickel	35.2	J	1.1	J	3.7	UJ	9.8	J	9.6	J	20.1	J	5.0	J	1.8	J
7440-09-7	Potassium	94,400	J	75,500	J	61,500	J	63,200	J	67,300	J	230,000	J	355,000	J	82,200	J
7782-49-2	Selenium	4.7	J	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	7.8	UJ	2.6	J	2.0	UJ
7440-22-4	Silver	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
7440-23-5	Sodium	3,190,000		3,220,000		707,000		951,000		988,000		1,990,000		23,400,000		3,720,000	
7440-28-0	Thallium	3.0	UJ	3.0	UJ	3.0	UJ	3.0	UJ	3.0	UJ	3.0	UJ	5.8	UJ	3.0	UJ
7440-62-2	Vanadium	119	J	2.7	J	1.0	UJ	3.3	J	2.9	J	30.7	J	1.0	UJ	23.7	J
7440-66-6	Zinc	2.6	U	1.0	U	1.0	U	2.9	U	1.0	U	1.0	U	1.9	U	2.7	U

Results equal to or greater than MCLs or EPA, Region III Tap Water Screening criteria are shown in bold.

bgs - below ground surface

NA - Not Applicable

Q - Qualifier

ug/L - parts per billion

J - The associated numerical value is an estimated quantity because the *Quality Control* criteria were not met

UJ - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

R - Reported value is "rejected."

U - The analyte was not detected above the laboratory quantitation limit

Table 3
Total Metals in Surface Water
SLC Redwood Road Dump Targeted Brownfields Assessment

	Sample Number	N/A	RRD-SW-1		RRD-SW-2		RRD-SW-3		RRD-SW-4		RRD-SW-5	
	Traffic Number	N/A	MHET62		MHEX79		MHEX78		MHET63		MHET64	
	Sample Location	N/A	Southern portion of canal		Central portion of canal		Northern portion of canal		Northern portion of wetlands		Duplicate of SW-4	
	Sample Date	N/A	6/23/2000		6/23/2000		6/23/2000		6/23/2000		6/23/2000	
	Sample Type	MCL or EPA Region III Tap Water Screening Criteria	Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Cas No.	Analyte	µg/L	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
7429-90-5	Aluminum		61.7	J	5,440		4,690		9.0	UJ	17.9	J
7440-36-0	Antimony	15	4.6		7.0		6.9		3.0	U	3.0	U
7440-38-2	Arsenic	50	**61**		**79.7**		**82.8**		4.0		6.1	
7440-39-3	Barium	2,000	67.9		243		239		133		131	
7440-41-7	Beryllium	73	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
7440-43-9	Cadmium	5	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
7440-70-2	Calcium		93,300		125,000		123,000		25,500		25,800	
7440-47-3	Chromium (total)	100	1.0	U	14.8		13.1		1.0	U	1.0	U
7440-48-4	Cobalt	2,200	6.0	U	6.0	U	6.0	U	6.0	U	6.0	U
7440-50-8	Copper	1,300	2.1	U	89.7		86		1.0	U	1.0	U
7439-89-6	Iron		379		7,550		6,510		124		144	
7439-92-1	Lead	15	1.0	U	**56.1**		**50.3**		1.0	U	1.0	U
7439-95-4	Magnesium		63,800		69,300		67,300		17,200		17,100	
7439-96-5	Manganese	730	162		310		308		152		120	
7439-97-6	Mercury	2	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
7440-02-0	Nickel	730	4.1		12.2		13.1		1.0	U	1.0	U
7440-09-7	Potassium		27,100		31,600		27,600		7,980		7,890	
7782-49-2	Selenium	50	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
7440-22-4	Silver	100	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
7440-23-5	Sodium		454,000	J	483,000	J	411,000	J	131,000	J	132,000	J
7440-28-0	Thallium	2.6	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
7440-62-2	Vanadium	262	5.3		17		14.6		1.0	U	1.0	U
7440-66-6	Zinc	5,000	13.1	U	221		214		3.0	U	3.0	U

Results equal to or greater than MCLs or EPA Region III Tap Water Screening criteria are shown in bold

bgs - below ground surface

NA Not Applicable

Q - Qualifier

ug/L - parts per billion

J - *The associated numerical value is an estimated quantity because the* Quality Control criteria were not met

UJ - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its app

R - Reported value is "rejected."

U - The analyte was not detected above the laboratory quantitation limit.

Table 4
VOCs in Soil
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	N/A	RRD-2		RRD-3		RRD-4		RRD-5		RRD-6	
	Traffic Number	N/A	HW894		HW896		HW900		HW924		HW926	
	Sample Location	N/A	SLC Automobile Impound Lot		Northwestern portion of RRD Landfill		Northeast portion of RRD, north of east bench		Northern portion of RRD, west of east bench		Northern portion of RRD, off SE corner of impound lot fence	
	Site Address	N/A	500 South, West of I-215		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Depth	N/A	0 - 2 feet bgs		7 - 9 feet bgs		7 - 9 feet bgs		7 - 9 feet bgs		7 - 9 feet bgs	
	Sample Date	N/A	6/19/2000		6/19/2000		6/20/2000		6/20/2000		6/20/2000	
	Sample Type	EPA Region III Industrial screening Criteria	Soil		Soil		Soil		Soil		Soil	
Cas No.	Analyte	µg/kg	µg/kg	Q	µg/kg	Q	µg/kg	Q	µg/kg	Q	µg/kg	Q
75-71-8	Dichlorodifluoromethane	410,000,000	12	U	11	U	12	U	12	U	11	U
74-87-3	Chloromethane	440,000	12	U	11	U	12	U	12	U	11	U
75-01-4	Vinyl Chloride	9,800	12	U	11	U	12	U	12	U	11	U
74-83-9	Bromomethane	2,900,000	12	U	11	U	12	U	12	U	11	U
75-00-3	Chloroethane	2,000,000	12	U	11	U	12	U	12	U	11	U
75-69-4	Trichlorofluoromethane	610,000,000	12	U	11	U	12	U	12	U	11	U
75-35-4	1,1-Dichloroethene	9,500	12	U	11	U	12	U	12	U	11	U
76-13-1	Trichlorotrifluoroethane	61,000,000,000	12	U	11	U	12	U	12	U	11	U
67-64-1	Acetone	200,000,000	12	U	47		12	U	25		19	
75-15-0	Carbon Disulfide	200,000,000	12	U	1	J	12	U	0.4	J	0.3	J
79-20-9	Methyl Acetate	2,000,000,000	12	U	11	U	12	U	12	U	11	U
75-09-2	Methylene Chloride	760,000	0.4	J	11	U	12	U	12	U	11	U
156-60-5	trans-1,2-Dichloroethene	41,000,000	12	U	11	U	12	U	12	U	11	U
1634-04-4	Methyl Tert-Butyl Ether		12	UJ	11	UJ	12	UJ	12	UJ	11	UJ
75-34-3	1,1-Dichloroethane	200,000,000	12	U	11	U	12	U	12	U	11	U
156-59-2	cis-1,2-Dichloroethene	20,000,000	12	U	11	U	12	U	12	U	11	U
78-93-3	2-Butanone (MEK)	1,200,000,000	12	U	11	U	12	U	12	U	11	U
67-66-3	Chloroform	940,000	12	U	11	U	12	U	12	U	11	U
71-55-6	1,1,1-Trichloroethane	570,000,000	12	U	11	U	12	U	12	U	11	U
110-82-7	Cyclohexane	10,000,000,000	12	U	11	U	12	U	12	U	11	U
56-23-5	Carbon Tetrachloride	44,000	12	U	11	U	12	U	12	U	11	U
71-43-2	Benzene	100,000	12	U	11	U	12	U	12	U	11	U
107-06-2	1,2-Dichloroethane	63,000	12	U	11	U	12	U	12	U	11	U
79-01-6	Trichloroethene (TCE)	520,000	12	U	11	U	12	U	12	U	11	U
108-87-2	Methylcyclohexane		12	U	11	U	12	U	12	U	11	U
78-87-5	1,2-Dichloropropane	84,000	12	U	11	U	12	U	12	U	11	U
75-27-4	Bromodichloromethane	92,000	12	U	11	U	12	U	12	U	11	U
10061-01-5	cis-1, 3-Dichloropropene		12	U	11	U	12	U	12	U	11	U
108-10-1	4-Methyl-2-Pentanone (MIK)	160,000,000	12	U	11	U	12	U	12	U	11	U
108-88-3	Toluene	410,000,000	0.8	J	0.7	J	1	J	0.7	J	2	J
10061-02-6	trans-1,3-Dichloropropene		12	U	11	U	12	U	12	U	11	U
79-00-5	1,1,2-Trichloroethane	100,000	12	U	11	U	12	U	12	U	11	U
127-18-4	Tetrachloroethene (PCE)	110,000	12	U	11	U	12	U	12	U	11	U
591-78-6	2-Hexanone	82,000,000	12	U	11	U	12	U	12	U	11	U
124-48-1	Dibromochloromethane	68,000	12	U	11	U	12	U	12	U	11	U
106-93-4	1,2-Dibromoethane	67	12	U	11	U	12	U	12	U	11	U
108-90-7	Chlorobenzene	41,000	12	U	11	U	12	U	12	U	11	U
100-41-4	Ethylbenzene	200,000,000	12	U	11	U	12	U	12	U	11	U
1330-20-7	Xylene (Total)	4,000,000,000	12	U	11	U	12	U	12	U	11	U
100-42-5	Styrene	410,000,000	0.6	J	11	U	12	U	12	U	11	U
75-25-2	Bromoform (tribromomethane)	720,000	12	U	11	U	12	U	12	U	11	U
98-82-8	Isopropylbenzene	3,100,000	12	U	11	U	12	U	12	U	11	U
79-34-5	1,1,2,2-Tetrachloroethane	220,000	12	U	11	U	12	U	12	U	11	U
541-73-1	1,3-Dichlorobenzene	1,800,000	12	U	11	U	12	U	12	U	11	U
106-46-7	1,4-Dichlorobenzene	240,000	12	U	11	U	12	U	12	U	11	U
95-50-1	1,2-Dichlorobenzene	180,000,000	12	U	11	U	12	U	12	U	11	U
96-12-8	1,2-Dibromo-3-chloropropane	4,100	12	U	11	U	12	U	12	U	11	U
120-82-1	1,2,4-Trichlorobenzene	20,000,000	12	U	11	U	12	U	12	U	11	U

Results equal to or greater than EPA, Region III Industrial Screening criteria are shown in bold.
bgs - below ground surface
NA - Not Applicable
Q - Qualifier
ug/kg - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
UJ - The reported amount is estimated because Quality Control criteria were not met.
Element or compound was not detected.
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
R - Reported value is "rejected."
U - The analyte was not detected above the laboratory quantitation limit.

Table 5
VOCs in Groundwater
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	RRD-10S		RRD-20		RRD-11		RRD-12		RRD-12S		RRD-14		RRD-14S	
	Traffic Number	HX379		HX380		HX145		HX424		HX425		HX427		HX429	
	Sample Location	Duplicate of RRD-10		Duplicate of RRD-10		Southwestern portion of RRD		Southern portion of RRD		Duplicate of RRD-12		Northern portion of RRD, Impound Lot		Northern portion of RRD, Impound Lot	
	Site Address	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Date	6/21/2000		6/21/2000		6/21/2000		6/22/2000		6/22/2000		6/22/2000		6/22/2000	
	Sample Type	Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater	
Cas No.	Analyte	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
75-71-8	Dichlorodifluoromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
74-87-3	Chloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
75-01-4	Vinyl Chloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U
74-83-9	Bromomethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
75-00-3	Chloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
75-69-4	Trichlorofluoromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
75-35-4	1,1-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
76-13-1	Trichlorotrifluoroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
67-64-1	Acetone	10	U	10	U	8	J	28		10	U	10	U	10	U
75-15-0	Carbon Disulfide	10	U	10	U	10	U	10	U	10	U	0.3	J	10	U
79-20-9	Methyl Acetate	10	U	10	U	10	U	10	U	10	U	10	U	10	U
75-09-2	Methylene Chloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U
156-60-5	trans-1,2-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1634-04-4	Methyl Tert-Butyl Ether	10	U	10	U	10	U	10	U	10	U	10	U	10	U
75-34-3	1,1-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
156-59-2	cis-1,2-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
78-93-3	2-Butanone (MEK)	10	U	10	U	10	U	7	J	10	U	10	U	10	U
67-66-3	Chloroform	10	U	10	U	10	U	10	U	10	U	10	U	10	U
71-55-6	1,1,1-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
110-82-7	Cyclohexane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
56-23-5	Carbon Tetrachloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U
71-43-2	Benzene	10	U	2	J	1	J	2	J	10	U	2	J	10	U
107-06-2	1,2-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
79-01-6	Trichloroethene (TCE)	10	U	10	U	10	U	10	U	10	U	10	U	10	U
108-87-2	Methylcyclohexane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
78-87-5	1,2-Dichloropropane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
75-27-4	Bromodichloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
10061-01-5	cis-1, 3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
108-10-1	4-Methyl-2-Pentanone (MIK)	10	U	10	U	10	U	10	U	10	U	10	U	10	U
108-88-3	Toluene	0.4	J	21		13		15		0.2	J	22		0.5	J
10061-02-6	trans-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
79-00-5	1,1,2-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
127-18-4	Tetrachloroethene (PCE)	10	U	10	U	10	U	10	U	10	U	10	U	10	U
591-78-6	2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
124-48-1	Dibromochloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
106-93-4	1,2-Dibromoethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
108-90-7	Chlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
100-41-4	Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1330-20-7	Xylene (Total)	10	U	1	J	0.4	J	10	U	10	U	0.8	J	10	U
100-42-5	Styrene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
75-25-2	Bromoform (tribromomethane)	10	U	10	U	10	U	10	U	10	U	10	U	10	U
98-82-8	Isopropylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
541-73-1	1,3-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
106-46-7	1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
95-50-1	1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
96-12-8	1,2-Dibromo-3-chloropropane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U

Results equal to or greater than MCLs or EPA, Region III Tap Water Screening criteria are shown in bold
bgs - below ground surface
NA - Not Applicable
Q - Qualifier
ug/L - parts per billion

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Element or compound was not detected.
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
R - Reported value is "rejected."
U - The analyte was not detected above the laboratory quantitation limit

Table 6
VOCs in Surface Water
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	N/A	RRD-SW-1		RRD-SW-2		RRD-SW-3		RRD-SW-4		RRD-SW-5	
	Traffic Number	N/A	HX437		HX435		HX434		HX436		HX439	
	Sample Location	N/A	Southern portion of canal		Central portion of canal		Northern portion of canal		Northern portion of wetlands		Duplicate of SW-4	
	Sample Date	N/A	6/23/2000		6/23/2000		6/23/2000		6/23/2000		6/23/2000	
	Sample Type	MCL or EPA Region III Tap Water Screening Criteria	Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Cas No.	Analyte	µg/L	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
75-71-8	Dichlorodifluoromethane	350	10	U	10	U	10	U	10	U	10	U
74-87-3	Chloromethane	2.1	10	U	10	U	10	U	10	U	10	U
75-01-4	Vinyl Chloride	2	10	U	10	U	10	U	10	U	10	U
74-83-9	Bromomethane	8.5	10	U	10	U	10	U	10	U	10	U
75-00-3	Chloroethane	3.6	10	U	10	U	10	U	10	U	10	U
75-69-4	Trichlorofluoromethane	1,300	10	U	10	U	10	U	10	U	10	U
75-35-4	1,1-Dichloroethene	7	10	U	10	U	10	U	10	U	10	U
76-13-1	Trichlorotrifluoroethane	59,000	10	U	10	U	10	U	10	U	10	U
67-64-1	Acetone	610	10		12		10	U	10	U	10	U
75-15-0	Carbon Disulfide	1,000	10	U	10	U	10	U	10	U	10	U
79-20-9	Methyl Acetate	6,100	10	U	10	U	10	U	10	U	10	U
75-09-2	Methylene Chloride	4.1	10	U	10	U	10	U	10	U	10	U
156-60-5	trans-1,2-Dichloroethene	100	10	U	10	U	10	U	10	U	10	U
1634-04-4	Methyl Tert-Butyl Ether	8,300	10	U	10	U	10	U	10	U	10	U
75-34-3	1,1-Dichloroethane	800	10	U	10	U	10	U	10	U	10	U
156-59-2	cis-1,2-Dichloroethene	70	10	U	10	U	10	U	10	U	10	U
78-93-3	2-Butanone (MEK)	1,900	10	U	10	U	10	U	10	U	10	U
67-66-3	Chloroform	0.15	0.6	J	0.4	J	10	U	10	U	10	U
71-55-6	1,1,1-Trichloroethane	200	10	U	10	U	10	U	10	U	10	U
110-82-7	Cyclohexane	180,000	10	U	10	U	10	U	10	U	10	U
56-23-5	Carbon Tetrachloride	5	10	U	10	U	10	U	10	U	10	U
71-43-2	Benzene	5	10	U	10	U	10	U	10	U	10	U
107-06-2	1,2-Dichloroethane	5	10	U	10	U	10	U	10	U	10	U
79-01-6	Trichloroethene (TCE)	5	10	U	10	U	10	U	10	U	10	U
108-87-2	Methylcyclohexane	6,300	10	U	10	U	10	U	10	U	10	U
78-87-5	1,2-Dichloropropane	5	10	U	10	U	10	U	10	U	10	U
75-27-4	Bromodichloromethane	0.17	10	U	10	U	10	U	10	U	10	U
10061-01-5	cis-1, 3-Dichloropropene		10	U	10	U	10	U	10	U	10	U
108-10-1	4-Methyl-2-Pentanone (MIK)	140	10	U	10	U	10	U	10	U	10	U
108-88-3	Toluene	1,000	10	U	10	U	10	U	10	U	10	U
10061-02-6	trans-1,3-Dichloropropene		10	U	10	U	10	U	10	U	10	U
79-00-5	1,1,2-Trichloroethane	5	10	U	10	U	10	U	10	U	10	U
127-18-4	Tetrachloroethene (PCE)	5	10	U	10	U	10	U	10	U	10	U
591-78-6	2-Hexanone	1,500	10	U	10	U	10	U	10	U	10	U
124-48-1	Dibromochloromethane	0.13	10	U	10	U	10	U	10	U	10	U
106-93-4	1,2-Dibromoethane	0.00075	10	U	10	U	10	U	10	U	10	U
108-90-7	Chlorobenzene	110	10	U	10	U	10	U	10	U	10	U
100-41-4	Ethylbenzene	700	10	U	10	U	10	U	10	U	10	U
1330-20-7	Xylene (Total)	10,000	10	U	10	U	10	U	10	U	10	U
100-42-5	Styrene	100	10	U	10	U	10	U	10	U	10	U
75-25-2	Bromoform (tribromomethane)	8.5	10	U	10	U	10	U	10	U	10	U
98-82-8	Isopropylbenzene		10	U	10	U	10	U	10	U	10	U
79-34-5	1,1,2,2-Tetrachloroethane	0.41	10	U	10	U	10	U	10	U	10	U
541-73-1	1,3-Dichlorobenzene	5.5	10	U	10	U	10	U	10	U	10	U
106-46-7	1,4-Dichlorobenzene	0.47	10	U	10	U	10	U	10	U	10	U
95-50-1	1,2-Dichlorobenzene	550	10	U	10	U	10	U	10	U	10	U
96-12-8	1,2-Dibromo-3-chloropropane	0.047	10	U	10	U	10	U	10	U	10	U
120-82-1	1,2,4-Trichlorobenzene	70	10	U	10	U	10	U	10	U	10	U

Results equal to or greater than MCLs or EPA, Region III Tap Water Screening criteria are shown in bold.
bgs - below ground surface
NA - Not Applicable
Q - Qualifier
ug/L - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
UJ - The reported amount is estimated because Quality Control criteria were not met.
Element or compound was not detected.
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
R - Reported value is "rejected."
U - The analyte was not detected above the laboratory quantitation limit.

Table 7
SVOCs in Soil
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	N/A	RRD-3		RRD-4		RRD-5		RRD-6		RRD-7		RRD-8	
	Traffic Number	N/A	HW896		HW900		HW 924		HW 926		HW 928		HW 931	
	Sample Location	N/A	Northwestern portion of RRD Landfill		Northeast portion of RRD, north of east bench		Northern portion of RRD, west of east bench		Northern portion of RRD, off SE corner of impound lot fence		Central portion of RRD, north of switch yard		Central portion of RRD, east of switch yard	
	Site Address	N/A	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Depth	N/A	7 - 9 feet bgs		7 - 9 feet bgs		7 - 9 feet bgs		7 - 9 feet bgs		7 - 11 feet bgs		7 - 9 feet bgs	
	Sample Date	N/A	6/19/2000		6/20/2000		6/20/2000		6/20/2000		6/20/2000		6/21/2000	
	Sample Type	EPA Region III Industrial screening criteria	Soil		Soil		Soil		Soil		Soil		Soil	
Cas No.	Analyte	ug/kg	µg/kg	Q	µg/kg	Q	µg/kg	Q	µg/kg	Q	µg/kg	Q	µg/kg	Q
100-52-7	Benzaldehyde	200,000,000	1500	UJ	1200	UJ	390	UJ	380	UJ	380	UJ	410	UJ
108-95-2	Phenol	1,200,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
111-44-4	bis(2-Chloroethyl) ether	5200	1500	UJ	1200	U	390	U	380	U	380	UJ	410	U
95-57-8	2-Chlorophenol	10,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
95-48-7	2-Methylphenol	100,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
108-60-1	2,2'-oxybis(1-Chloropropane)		1500	U	1200	UJ	390	U	380	U	380	U	410	U
98-86-2	Acetophenone	200,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
106-44-5	4-Methylphenol	10,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
621-64-7	N-Nitroso-di-n-propylamine		1500	U	1200	U	390	U	380	U	380	U	410	U
67-72-1	Hexachloroethane	410,000	1500	U	1200	U	390	U	380	U	380	U	410	U
98-95-3	Nitrobenzene	1,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
78-59-1	Isophorone	6,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
88-75-5	2-Nitrophenol		1500	U	1200	U	390	U	380	U	380	U	410	U
105-67-9	2,4-Dimethylphenol	41,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
111-91-1	bis(2-Chloroethoxy) methane		1500	U	1200	U	390	U	380	U	380	U	410	U
120-83-2	2,4-Dichlorophenol	61,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
91-20-3	Naphthalene	41,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
106-47-8	4-Chloroaniline	82,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
87-68-3	Hexachlorobutadiene	73,000	1500	U	1200	UJ	390	U	380	U	380	U	410	U
105-60-2	Caprolactam	1,000,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
59-50-7	4-Chloro-3-methylphenol		1500	U	1200	U	390	U	380	U	380	U	410	U
91-57-6	2-Methylnaphthalene	41,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
77-47-4	Hexachlorocyclopentadiene	14,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
88-06-2	2,4,6-Trichlorophenol	520,000	1500	U	1200	U	390	U	380	U	380	U	410	U
95-95-4	2,4,5-Trichlorophenol	200,000,000	3900	U	3100	U	990	U	950	U	970	U	1000	U
92-52-4	1,1-Biphenyl		1500	U	1200	U	390	U	380	U	380	U	410	U
91-58-7	2-Chloronaphthalene		1500	U	1200	U	390	U	380	U	380	U	410	U
88-74-4	2-Nitroaniline		3900	U	3100	U	990	U	950	U	970	U	1000	U
131-11-3	Dimethylphthalate	20,000,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
606-20-2	2,6-Dinitrotoluene	2,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
208-96-8	Acenaphthylene		1500	U	1200	U	390	U	380	U	380	U	410	U
99-09-2	3-Nitroaniline		3900	U	3100	U	990	U	950	U	970	U	1000	U
83-32-9	Acenaphthene	120,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
51-28-5	2,4-Dinitrophenol	4,100,000	3900	UJ	3100	U	990	U	950	UJ	970	UJ	1000	U
100-02-7	4-Nitrophenol	16,000,000	3900	U	3100	U	990	U	950	U	970	U	1000	U
132-64-9	Dibenzofuran	8,200,000	1500	U	1200	U	390	U	380	U	380	U	410	U
121-14-2	2,4-Dinitrotoluene	4,100,000	1500	U	1200	U	390	U	380	U	380	U	410	U
84-66-2	Diethylphthalate	1,600,000,000	1500	U	1200	U	390	U	380	U	380	U	410	U
86-73-7	Fluorene	82,000,000	1500	U	1200	U	390	UJ	380	U	380	U	410	UJ
7005-72-3	4-Chlorophenyl-phenylether		1500	U	1200	UJ	390	UJ	380	U	380	U	410	UJ
100-01-6	4-Nitroaniline		3900	U	3100	U	990	U	950	U	970	U	1000	U
534-52-1	4,6-Dinitro-2-methylphenol	200,000	3900	U	3100	U	990	UJ	950	U	970	U	1000	U
86-30-6	N-nitrosodiphenylamine (1)		1500	U	1200	U	390	UJ	380	U	380	U	410	U
101-55-3	4-Bromophenyl-phenylether		1500	U	1200	U	390	UJ	380	U	380	U	410	U
118-74-1	Hexachlorobenzene	3,600	1500	U	1200	UJ	390	UJ	380	U	380	U	410	U
1912-24-9	Atrazine	26,000	1500	UJ	1200	U	390	UJ	380	UJ	380	UJ	410	UJ
87-86-5	Pentachlorophenol	48,000	3900	U	3100	U	990	UJ	950	UJ	970	U	1000	U
85-01-8	Phenanthrene		1500	U	1200	U	390	UJ	380	U	48	J	410	U
120-12-7	Anthracene	610,000,000	1500	U	1200	U	390	UJ	380	U	8	J	410	U
86-74-8	Carbazole	290,000	1500	U	1200	U	390	UJ	380	U	380	U	410	U
84-74-2	Di-n-butylphthalate		1500	U	1200	U	390	UJ	380	U	380	U	410	U
206-44-0	Fluoranthene	82,000,000	34	J	1200	U	390	UJ	380	U	11	J	410	U
129-00-0	Pyrene	61,000,000	350	J	1200	U	390	UJ	380	U	100	J	410	U
85-68-7	Butylbenzylphthalate	41,000,000	1500	U	1200	U	390	UJ	380	U	380	U	410	U
91-94-1	3,3' -Dichlorobenzidine	13,000	1500	UJ	1200	U	390	UJ	380	U	380	UJ	410	UJ
56-55-3	Benzo (a) anthracene	7,800	150	J	1200	U	390	UJ	380	U	38	J	410	U
218-01-9	Chrysene	780,000	430	J	1200	U	390	UJ	380	U	44	J	410	U
117-81-7	bis (2-Ethylhexyl) phthalate	410,000	1500	U	1200	U	390	U	380	U	380	U	410	U
117-84-0	Di-n-octylphthalate		1500	U	1200	U	390	U	380	U	380	U	410	U
205-99-2	Benzo (b) fluoranthene	7,800	130	J	1200	U	390	U	380	U	380	U	410	U
207-08-9	Benzo (k) fluoranthene	78,000	1500	U	1200	U	390	U	380	U	380	U	410	U
50-32-8	Benzo (a) pyrene	780	170	J	1200	U	390	U	380	U	34	J	410	U
193-39-5	Indeno (1,2,3 - cd) pyrene	7,800	1500	U	1200	U	390	U	380	U	380	U	410	U
53-70-3	Dibenz (a, h) anthracene	780	1500	U	1200	U	390	U	380	U	380	U	410	U
191-24-2	Benzo (g,h,i) perylene		130	J	1200	U	390	U	380	U	43	J	410	U

Results equal to or greater than EPA, Region III Industrial Screening criteria are shown in bold.
bgs - below ground surface
NA - Not Applicable
Q - Qualifier
ug/kg - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
UJ - The reported amount is estimated because Quality Control criteria were not met.
Element or compound was not detected.
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
R - Reported value is "rejected."
U - The analyte was not detected above the laboratory quantitation limit.

Table 7
SVOCs in Soil
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	RRD-9		RRD-10		RRD-11		RRD-12	
	Traffic Number	HX 375		HX 377		HX 144		HX 423	
	Sample Location	Central portion of RRD, west of east bench		Central portion of RRD, adjacent to DeLong Street		Southwestern portion of RRD		Southern portion of RRD	
	Site Address	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Depth	2 - 6 feet bgs		0 - 4 feet bgs		7 - 9 feet bgs		6 - 8 feet bgs	
	Sample Date	6/21/2000		6/21/2000		6/21/2000		6/22/2000	
	Sample Type	Soil		Soil		Soil		Soil	
Cas No.	Analyte	µg/kg	Q	µg/kg	Q	µg/kg	Q	µg/kg	Q
100-52-7	Benzaldehyde	31	J	3500	UJ	430	UJ	400	UJ
108-95-2	Phenol	380	U	3500	U	430	U	400	U
111-44-4	bis(2-Chloroethyl) ether	380	U	3500	U	430	U	400	U
95-57-8	2-Chlorophenol	380	U	3500	U	430	U	400	U
95-48-7	2-Methylphenol	380	U	3500	U	430	U	400	U
108-60-1	2,2'-oxybis(1-Chloropropane)	380	U	3500	UJ	430	U	400	U
98-86-2	Acetophenone	380	U	3500	U	430	U	400	U
106-44-5	4-Methylphenol	380	U	3500	U	430	U	400	U
621-64-7	N-Nitroso-di-n-propylamine	380	U	3500	UJ	430	U	400	U
67-72-1	Hexachloroethane	380	U	3500	U	430	U	400	U
98-95-3	Nitrobenzene	380	U	3500	U	430	U	400	U
78-59-1	Isophorone	380	U	3500	U	430	U	400	U
88-75-5	2-Nitrophenol	380	U	3500	U	430	U	400	U
105-67-9	2,4-Dimethylphenol	380	U	3500	U	430	U	400	U
111-91-1	bis(2-Chloroethoxy) methane	380	U	3500	U	430	U	400	U
120-83-2	2,4-Dichlorophenol	380	U	3500	U	430	U	400	U
91-20-3	Naphthalene	18	J	3500	U	430	U	400	U
106-47-8	4-Chloroaniline	380	UJ	3500	U	430	U	400	U
87-68-3	Hexachlorobutadiene	380	U	3500	UJ	430	U	400	U
105-60-2	Caprolactam	380	U	3500	U	430	U	400	U
59-50-7	4-Chloro-3-methylphenol	380	U	3500	U	430	U	400	U
91-57-6	2-Methylnaphthalene	41	J	66	J	430	U	400	U
77-47-4	Hexachlorocyclopentadiene	380	U	3500	UJ	430	U	400	U
88-06-2	2,4,6-Trichlorophenol	380	U	3500	U	430	U	400	U
95-95-4	2,4,5-Trichlorophenol	950	U	8800	U	1100	U	1000	U
92-52-4	1,1-Biphenyl	15	J	3500	U	430	U	400	U
91-58-7	2-Chloronaphthalene	380	U	3500	U	430	U	400	U
88-74-4	2-Nitroaniline	950	U	8800	U	1100	U	1000	U
131-11-3	Dimethylphthalate	380	U	3500	U	430	U	400	U
606-20-2	2,6-Dinitrotoluene	380	U	3500	U	430	U	400	U
208-96-8	Acenaphthylene	380	U	3500	U	430	U	400	U
99-09-2	3-Nitroanitine	950	U	8800	U	1100	U	1000	U
83-32-9	Acenaphthene	380	U	3500	U	430	U	400	U
51-28-5	2,4-Dinitrophenol	950	U	8800	U	1100	U	1000	U
100-02-7	4-Nitrophenol	950	U	8800	U	1100	U	1000	U
132-64-9	Dibenzofuran	380	U	3500	U	430	U	400	U
121-14-2	2,4-Dinitrotoluene	380	U	3500	U	430	U	400	U
84-66-2	Diethylphthalate	380	U	3500	U	430	U	400	U
86-73-7	Fluorene	17	J	3500	U	430	UJ	400	UJ
7005-72-3	4-Chlorophenyl-phenylether	380	U	3500	UJ	430	UJ	400	UJ
100-01-6	4-Nitroaniline	950	U	8800	U	1100	U	1000	U
534-52-1	4,6-Dinitro-2-methylphenol	950	U	8800	UJ	1100	U	1000	U
86-30-6	N-nitrosodiphenylamine (1)	380	U	3500	UJ	430	U	400	U
101-55-3	4-Bromophenyl-phenylether	380	U	3500	UJ	430	U	400	U
118-74-1	Hexachlorobenzene	380	U	3500	UJ	430	U	400	U
1912-24-9	Atrazine	380	UJ	3500	UJ	430	UJ	400	UJ
87-86-5	Pentachlorophenol	950	UJ	8800	UJ	1100	U	1000	U
85-01-8	Phenanthrene	78	J	200	J	430	U	400	U
120-12-7	Anthracene	15	J	3500	UJ	430	U	400	U
86-74-8	Carbazole	380	U	3500	UJ	430	U	400	U
84-74-2	Di-n-butylphthalate	380	U	3500	UJ	430	U	400	U
206-44-0	Fluoranthene	86	J	110	J	430	U	400	U
129-00-0	Pyrene	120	J	320	J	430	U	400	U
85-68-7	Butylbenzylphthalate	380	U	3500	UJ	430	U	400	U
91-94-1	3,3' -Dichlorobenzidine	380	U	3500	UJ	430	UJ	400	UJ
56-55-3	Benzo (a) anthracene	86	J	190	J	430	U	400	U
218-01-9	Chrysene	120	J	350	J	430	U	400	U
117-81-7	bis (2-Ethylhexyl) phthalate	380	U	3500	UJ	430	U	400	U
117-84-0	Di-n-octylphthalate	380	U	3500	U	430	U	400	U
205-99-2	Benzo (b) fluoranthene	120	J	130	J	430	U	400	U
207-08-9	Benzo (k) fluoranthene	75	J	3500	U	430	U	400	U
50-32-8	Benzo (a) pyrene	120	J	150	J	430	U	400	U
193-39-5	Indeno (1,2,3 - cd) pyrene	83	J	3500	U	430	U	400	U
53-70-3	Dibenz (a, h) anthracene	380	U	3500	U	430	U	400	U
191-24-2	Benzo (g,h,i) perylene	250	J	290	J	430	U	400	U

Results equal to or greater than EPA, Region III Industrial Screening criteria are shown in bold.
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NA - Not Applicable
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ug/kg - parts per billion

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Element or compound was not detected.
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
R - Reported value is "rejected."
U - The analyte was not detected above the laboratory quantitation limit.

Table 7
SVOCs in Soil
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	RRD-13		RRD-14		RRD-15		SB-2	
	Traffic Number	HX 426		HX 428		HX 430		HX 432	
	Sample Location	Southeastern portion of RRD		Northern portion of RRD, Impound Lot		Northern portion of RRD, east bench		Central portion of RRD, east bench	
	Site Address	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Depth	6 - 8 feet bgs		6 - 8 feet bgs		5 feet bgs		10 feet bgs	
	Sample Date	6/22/2000		6/22/2000		6/22/2000		6/22/2000	
	Sample Type	Soil		Soil		Soil		Soil	
Cas No.	Analyte	µg/kg	Q	µg/kg	Q	µg/kg	Q	µg/kg	Q
100-52-7	Benzaldehyde	370	UJ	400	UJ	230	J	100	J
108-95-2	Phenol	370	U	400	U	450	R	1400	U
111-44-4	bis(2-Chloroethyl) ether	370	U	400	U	450	U	1400	UJ
95-57-8	2-Chlorophenol	370	U	400	U	450	R	1400	U
95-48-7	2-Methylphenol	370	U	400	U	450	R	1400	U
108-60-1	2,2'-oxybis(1-Chloropropane)	370	U	400	U	450	U	1400	U
98-86-2	Acetophenone	370	U	400	U	450	U	1400	U
106-44-5	4-Methylphenol	370	U	400	U	450	R	1400	U
621-64-7	N-Nitroso-di-n-propylamine	370	U	400	U	450	U	1400	U
67-72-1	Hexachloroethane	370	U	400	U	450	U	1400	U
98-95-3	Nitrobenzene	370	U	400	U	450	U	1400	U
78-59-1	Isophorone	370	U	400	U	450	U	1400	U
88-75-5	2-Nitrophenol	370	U	400	U	450	R	1400	U
105-67-9	2,4-Dimethylphenol	370	U	400	U	450	R	1400	U
111-91-1	bis(2-Chloroethoxy) methane	370	U	400	U	450	U	1400	U
120-83-2	2,4-Dichlorophenol	370	U	400	U	450	R	1400	U
91-20-3	Naphthalene	370	U	400	U	220	J	1400	J
106-47-8	4-Chloroaniline	370	U	400	U	450	U	1400	U
87-68-3	Hexachlorobutadiene	370	U	400	U	450	U	1400	U
105-60-2	Caprolactam	370	U	400	UJ	450	U	1400	U
59-50-7	4-Chloro-3-methylphenol	370	U	400	U	450	R	1400	U
91-57-6	2-Methylnaphthalene	370	U	400	U	300	J	1200	J
77-47-4	Hexachlorocyclopentadiene	370	U	400	UJ	450	U	1400	U
88-06-2	2,4,6-Trichlorophenol	370	U	400	U	450	R	1400	U
95-95-4	2,4,5-Trichlorophenol	940	U	1000	U	1100	R	3600	U
92-52-4	1,1-Biphenyl	370	U	400	U	19	J	220	J
91-58-7	2-Chloronaphthalene	370	U	400	U	450	U	1400	U
88-74-4	2-Nitroanilne	940	U	1000	U	1100	U	3600	U
131-11-3	Dimethylphthalate	370	U	400	U	450	U	1400	U
606-20-2	2,6-Dinitrotoluene	370	U	400	U	450	U	1400	U
208-96-8	Acenaphthylene	370	U	400	U	450	U	270	J
99-09-2	3-Nitroaniline	940	U	1000	U	1100	U	3600	U
83-32-9	Acenaphthene	370	U	400	U	450	U	590	J
51-28-5	2,4-Dinitrophenol	940	U	1000	UJ	1100	R	3600	UJ
100-02-7	4-Nitrophenol	940	U	1000	UJ	1100	R	3600	U
132-64-9	Dibenzofuran	370	U	400	U	65	J	780	J
121-14-2	2,4-Dinitrotoluene	370	U	400	U	450	U	1400	U
84-66-2	Diethylphthalate	370	U	400	U	450	U	36	J
86-73-7	Fluorene	370	UJ	400	U	450	U	840	J
7005-72-3	4-Chlorophenyl-phenylether	370	UJ	400	U	450	U	1400	U
100-01-6	4-Nitroaniline	940	U	1000	UJ	1100	U	3600	U
534-52-1	4,6-Dinitro-2-methylphenol	940	U	1000	U	1100	R	3600	U
86-30-6	N-nitrosodiphenylamine (1)	370	U	400	U	450	U	1400	U
101-55-3	4-Bromophenyl-phenylether	370	U	400	U	450	U	1400	U
118-74-1	Hexachlorobenzene	370	U	400	U	450	U	1400	U
1912-24-9	Atrazine	370	UJ	400	UJ	450	UJ	1400	UJ
87-86-5	Pentachlorophenol	940	U	1000	U	1100	R	3600	U
85-01-8	Phenanthrene	370	U	400	U	120	J	8600	
120-12-7	Anthracene	370	U	400	U	26	J	1900	
86-74-8	Carbazole	370	U	400	U	450	U	570	J
84-74-2	Di-n-butylphthalate	370	U	400	U	170	J	1400	U
206-44-0	Fluoranthene	370	U	400	U	36	J	9700	
129-00-0	Pyrene	370	U	400	U	55	J	10,000	
85-68-7	Butylbenzylphthalate	370	U	400	U	450	U	1400	U
91-94-1	3,3' -Dichlorobenzidine	370	UJ	400	U	450	U	1400	UJ
56-55-3	Benzo (a) anthracene	370	U	400	U	26	J	5600	
218-01-9	Chrysene	370	U	400	U	40	J	6400	
117-81-7	bis (2-Ethylhexyl) phthalate	370	U	400	U	450	U	1400	U
117-84-0	Di-n-octylphthalate	370	U	400	U	450	U	1400	U
205-99-2	Benzo (b) fluoranthene	370	U	400	U	450	U	5800	
207-08-9	Benzo (k) fluoranthene	370	U	400	U	450	U	1800	
50-32-8	Benzo (a) pyrene	370	U	400	U	450	U	5000	
193-39-5	Indeno (1,2,3 - cd) pyrene	370	U	400	U	450	U	3300	
53-70-3	Dibenz (a, h) anthracene	370	U	400	U	450	U	1000	J
191-24-2	Benzo (g,h,i) perylene	370	U	400	U	450	U	4000	

Results equal to or greater than EPA, Region III Industrial Screening criteria are shown in bold.
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UJ - The reported amount is estimated because Quality Control criteria were not met.
Element or compound was not detected.
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R - Reported value is "rejected."
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Table 8
SVOCs in Groundwater
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	N/A	RRD-1		RRD-2		RRD-3		RRD-30		RRD-4		RRD-5	
	Traffic Number	N/A	HW 893		HW895		HW 897		HW898		HW 922		HW925	
	Sample Location	N/A	SLC Automobile Impound Lot		SLC Automobile Impound Lot		Northwestern portion of RRD Landfill		Duplicate of RRD-3		Northeast portion of RRD, north of east bench		Northern portion of RRD, west of east bench	
	Site Address	N/A	500 South, West of I-215		500 South, West of I-215		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Date	N/A	6/19/2000		6/19/2000		6/19/2000		6/19/2000		6/20/2000		6/20/2000	
	Sample Type	MCL or EPA Region III Tap Water Screening Criteria	Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater	
Cas No.	Analyte	µg/L	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
100-52-7	Benzaldehyde	3,700	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
108-95-2	Phenol	22,000	10	U	10	U	10	U	10	U	10	U	10	U
111-44-4	bis(2-Chloroethyl) ether	0.0096	10	U	10	U	10	U	10	U	10	U	10	U
95-57-8	2-Chlorophenol	30	10	U	10	U	10	U	10	U	10	U	10	U
95-48-7	2-Methylphenol	1,800	10	U	10	U	10	U	10	U	10	U	10	U
108-60-1	2,2'-oxybis(1-Chloropropane)		10	U	10	U	10	U	10	U	10	U	10	U
98-86-2	Acetophenone	0.042	10	U	10	U	10	U	10	U	10	U	10	U
106-44-5	4-Methylphenol	180	10	U	10	U	10	U	10	U	10	U	10	U
621-64-7	*N-Nitroso-di-n-propylamine*		10	U	10	U	10	U	10	U	10	U	10	U
67-72-1	Hexachloroethane		10	U	10	U	10	U	10	U	10	U	10	U
98-95-3	Nitrobenzene	3.5	10	U	10	U	10	U	10	U	10	U	10	U
78-59-1	Isophorone	70	10	U	10	U	10	U	10	U	10	U	10	U
88-75-5	2-Nitrophenol		10	U	10	U	10	U	10	U	10	U	10	U
105-67-9	2,4-Dimethylphenol	730	10	U	10	U	10	U	10	U	10	U	10	U
111-91-1	bis(2-Chloroethoxy) methane		10	U	10	U	10	U	10	U	10	U	10	U
120-83-2	2,4-Dichlorophenol	110	10	U	10	U	10	U	10	U	10	U	10	U
91-20-3	Naphthalene	6.5	10	U	10	U	10	U	10	U	10	U	10	U
106-47-8	4-Chloroaniline	150	10	U	10	U	10	U	10	U	10	U	10	U
87-68-3	Hexachlorobutadiene	0.86	10	U	10	U	10	U	10	U	10	U	10	U
105-60-2	*Caprolactam*	18,000	10	U	10	U	10	U	10	U	10	U	10	U
59-50-7	4-Chloro-3-methylphenol		10	U	10	U	10	U	10	U	10	U	10	U
91-57-6	2-Methylnaphthalene	120	10	U	10	U	10	U	10	U	10	U	10	U
77-47-4	Hexachlorocyclopentadiene	260	10	U	10	U	10	UJ	10	U	10	U	10	U
88-06-2	2,4,6-Trichlorophenol	6.1	10	U	10	U	10	U	10	U	10	U	10	U
95-95-4	2,4,5-Trichlorophenol	3,700	25	U	25	U	25	U	25	U	25	U	25	U
92-52-4	1,1-Biphenyl		10	U	10	U	10	U	10	U	10	U	10	U
91-58-7	2-Chloronaphthalene		10	U	10	U	10	U	10	U	10	U	10	U
88-74-4	2-Nitroaniline		25	U	25	U	25	U	25	U	25	U	25	U
131-11-3	Dimethylphthalate	370,000	10	U	10	U	10	U	10	U	10	U	10	U
606-20-2	*2,6-Dinitrotoluene*	37	10	U	10	U	10	U	10	U	10	U	10	U
208-96-8	Acenaphthylene		10	U	10	U	10	U	10	U	10	U	10	U
99-09-2	3-Nitroaniline		25	U	25	U	25	U	25	U	25	U	25	U
83-32-9	Acenaphthene	370	10	U	10	U	10	U	10	U	10	U	10	U
51-28-5	2,4-Dinitrophenol	73	25	U	25	U	25	U	25	U	25	U	25	U
100-02-7	4-Nitrophenol	290	25	U	25	U	25	U	25	U	25	U	25	U
132-64-9	Dibenzofuran	24	10	U	10	U	10	U	10	U	10	U	10	U
121-14-2	2,4-Dinitrotoluene	73	10	U	10	U	10	U	10	U	10	U	10	U
84-66-2	Diethylphthalate	29,000	10	U	10	U	10	U	10	U	10	U	10	U
86-73-7	Fluorene	240	10	U	10	U	10	U	10	U	10	U	10	U
7005-72-3	4-Chlorophenyl-phenylether		10	U	10	U	10	U	10	U	10	U	10	U
100-01-6	4-Nitroaniline		25	U	25	U	25	UJ	25	U	25	U	25	U
534-52-1	4,6-Dinitro-2-methylphenol		25	U	25	U	25	U	25	U	25	U	25	U
86-30-6	*N-nitrosodiphenylamine (1)*		10	U	10	U	10	U	10	U	10	U	10	U
101-55-3	4-Bromophenyl-phenylether		10	U	10	U	10	U	10	U	10	U	10	U
118-74-1	Hexachlorobenzene	0.042	10	U	10	U	10	U	10	U	10	U	10	U
1912-24-9	Atrazine	0.3	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
87-86-5	Pentachlorophenol	0.56	25	U	25	U	25	U	25	U	25	U	25	U
85-01-8	Phenanthrene		10	U	10	U	10	U	10	U	10	U	10	U
120-12-7	Anthracene	1,800	10	U	10	U	10	U	10	U	10	U	10	U
86-74-8	Carbazole	3.3	10	U	10	U	10	U	10	U	10	U	10	U
84-74-2	Di-n-butylphthalate		10	U	10	U	10	U	10	U	10	U	10	U
206-44-0	Fluoranthene	1,500	10	U	10	U	10	U	10	U	10	U	10	U
129-00-0	*Pyrene*	180	10	U	10	U	10	UJ	10	U	10	U	10	U
85-68-7	Butylbenzylphthalate	7,300	10	U	10	U	10	UJ	10	U	10	U	10	U
91-94-1	3,3' -Dichlorobenzidine	0.15	10	U	10	U	10	UJ	10	U	10	U	10	U
56-55-3	Benzo (a) anthracene	0.092	10	U	10	U	10	UJ	10	U	10	U	10	U
218-01-9	Chrysene	9.2	10	U	10	U	10	UJ	10	U	10	U	10	U
117-81-7	bis (2-Ethylhexyl) phthalate	4.8	10	U	10	U	10	UJ	10	U	10	U	10	U
117-84-0	Di-n-octylphthalate		10	U	10	U	10	U	10	U	10	U	10	U
205-99-2	*Benzo (b) fluoranthene*	0.092	10	U	10	U	10	U	10	U	10	U	10	U
207-08-9	Benzo (k) fluoranthene	0.92	10	U	10	U	10	U	10	U	10	U	10	U
50-32-8	Benzo (a) pyrene	0.0092	10	U	10	U	10	U	10	U	10	U	10	U
193-39-5	Indeno (1,2,3 - cd) pyrene		10	U	10	U	10	U	10	U	10	U	10	U
53-70-3	Dibenz (a, h) anthracene	0.0092	10	U	10	U	10	U	10	U	10	U	10	U
191-24-2	Benzo (g,h,i) perylene		10	U	10	U	10	U	10	U	10	U	10	U

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Table 8
SVOCs in Groundwater
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	RRD-6		RRD-7		RRD-8		RRD-9		RRD-10	
	Traffic Number	HW927		HW929		HW933		HX 376		HX 378	
	Sample Location	Northern portion of RRD, off SE corner of impound lot fence		Central portion of RRD, north of switch yard		Central portion of RRD, east of switch yard		Central portion of RRD, west of east bench		Central portion of RRD, adjacent to DeLong Street	
	Site Address	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Date	6/21/2000		6/21/2000		6/21/2000		6/21/2000		6/21/2000	
	Sample Type	Groundwater		Groundwater		Groundwater		Groundwater		Groundwater	
Cas No.	Analyte	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
100-52-7	Benzaldehyde	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
108-95-2	Phenol	10	U	10	U	10	U	10	U	10	U
111-44-4	bis(2-Chloroethyl) ether	10	U	10	U	10	U	10	U	10	U
95-57-8	2-Chlorophenol	10	U	10	U	10	U	10	U	10	U
95-48-7	2-Methylphenol	10	U	10	U	10	U	10	U	10	U
108-60-1	2,2'-oxybis(1-Chloropropane)	10	U	10	U	10	U	10	U	10	U
98-86-2	Acetophenone	10	U	10	U	10	U	10	U	10	U
106-44-5	4-Methylphenol	10	U	10	U	10	U	10	U	10	U
621-64-7	N-Nitroso-di-n-propylamine	10	U	10	U	10	U	10	U	10	U
67-72-1	Hexachloroethane	10	U	10	U	10	U	10	U	10	U
98-95-3	Nitrobenzene	10	U	10	U	10	U	10	U	10	U
78-59-1	Isophorone	10	U	10	U	10	U	10	U	10	U
88-75-5	2-Nitrophenol	10	U	10	U	10	U	10	U	10	U
105-67-9	2,4-Dimethylphenol	10	U	10	U	10	U	10	U	10	U
111-91-1	bis(2-Chloroethoxy) methane	10	U	10	U	10	U	10	U	10	U
120-83-2	2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U
91-20-3	Naphthalene	10	U	10	U	10	U	10	U	10	U
106-47-8	4-Chloroaniline	10	U	10	U	10	U	10	U	10	U
87-68-3	Hexachlorobutadiene	10	U	10	U	10	U	10	U	10	U
105-60-2	Caprolactam	10	U	10	U	10	U	10	U	10	U
59-50-7	4-Chloro-3-methylphenol	10	U	10	U	10	U	10	U	10	U
91-57-6	2-Methylnaphthalene	10	U	10	U	10	U	10	U	10	U
77-47-4	Hexachlorocyclopentadiene	10	U	10	U	10	U	10	U	10	U
88-06-2	2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U
95-95-4	2,4,5-Trichlorophenol	25	U	25	U	25	U	25	U	25	U
92-52-4	1,1-Biphenyl	10	U	10	U	10	U	10	U	10	U
91-58-7	2-Chloronaphthalene	10	U	10	U	10	U	10	U	10	U
88-74-4	2-Nitroaniline	25	U	25	U	25	U	25	U	25	U
131-11-3	Dimethylphthalate	10	U	10	U	10	U	10	U	10	U
606-20-2	2,6-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U
208-96-8	Acenaphthylene	10	U	10	U	10	U	10	U	10	U
99-09-2	3-Nitroaniline	25	U	25	U	25	U	25	U	25	U
83-32-9	Acenaphthene	10	U	10	U	10	U	10	U	10	U
51-28-5	2,4-Dinitrophenol	25	U	25	U	25	U	25	U	25	U
100-02-7	4-Nitrophenol	25	U	25	U	25	U	25	U	25	U
132-64-9	Dibenzofuran	10	U	10	U	10	U	10	U	10	U
121-14-2	2,4-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U
84-66-2	Diethylphthalate	10	U	10	U	10	U	10	U	10	U
86-73-7	Fluorene	10	U	10	U	10	U	10	U	10	U
7005-72-3	4-Chlorophenyl-phenylether	10	U	10	U	10	U	10	U	10	U
100-01-6	4-Nitroaniline	25	U	25	UJ	25	UJ	25	UJ	25	UJ
534-52-1	4,6-Dinitro-2-methylphenol	25	U	25	U	25	U	25	U	25	U
86-30-6	N-nitrosodiphenylamine (1)	10	U	10	U	10	U	10	U	10	U
101-55-3	4-Bromophenyl-phenylether	10	U	10	U	10	U	10	U	10	U
118-74-1	Hexachlorobenzene	10	U	10	U	10	U	10	U	10	U
1912-24-9	Atrazine	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
87-86-5	Pentachlorophenol	25	U	25	U	25	U	25	U	25	U
85-01-8	Phenanthrene	10	U	10	U	10	U	10	U	10	U
120-12-7	Anthracene	10	U	10	U	10	U	10	U	10	U
86-74-8	Carbazole	10	U	10	U	10	U	10	U	10	U
84-74-2	Di-n-butylphthalate	10	U	10	U	10	U	10	U	10	U
206-44-0	*Fluoranthene*	10	U	10	U	10	U	10	U	10	U
129-00-0	Pyrene	10	U	10	U	10	U	10	U	10	U
85-68-7	Butylbenzylphthalate	10	U	10	U	10	U	10	U	10	U
91-94-1	3,3' -Dichlorobenzidine	10	U	10	UJ	10	UJ	10	UJ	10	UJ
56-55-3	Benzo (a) anthracene	10	U	10	U	10	U	10	U	10	U
218-01-9	Chrysene	10	U	10	U	10	U	10	U	10	U
117-81-7	bis (2-Ethylhexyl) phthalate	10	U	10	U	10	U	10	U	10	U
117-84-0	Di-n-octylphthalate	10	U	10	UJ	10	U	10	U	10	U
205-99-2	Benzo (b) fluoranthene	10	U	10	UJ	10	U	10	U	10	U
207-08-9	Benzo (k) fluoranthene	10	U	10	UJ	10	U	10	U	10	U
50-32-8	Benzo (a) pyrene	10	U	10	UJ	10	U	10	U	10	U
193-39-5	Indeno (1,2,3 - cd) pyrene	10	U	10	UJ	10	U	10	U	10	U
53-70-3	Dibenz (a, h) anthracene	10	U	10	UJ	10	U	10	U	10	U
191-24-2	Benzo (g,h,i) perylene	10	U	10	UJ	10	U	10	U	10	U

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SVOCs in Groundwater
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	RRD-20		RRD-11		RRD-12		RRD-14	
	Traffic Number	HX380		HX145		HX 424		HX 427	
	Sample Location	Duplicate of RRD-10		Southwestern portion of RRD		Southern portion of RRD		Northern portion of RRD, Impound Lot	
	Site Address	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Date	6/21/2000		6/21/2000		6/22/2000		6/22/2000	
	Sample Type	Groundwater		Groundwater		Groundwater		Groundwater	
Cas No.	Analyte	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
100-52-7	Benzaldehyde	10	UJ	10	UJ	10	UJ	10	UJ
108-95-2	Phenol	10	U	1	J	10	U	10	U
111-44-4	bis(2-Chloroethyl) ether	10	U	10	U	10	U	10	U
95-57-8	2-Chlorophenol	10	U	1	J	10	U	10	U
95-48-7	2-Methylphenol	10	U	10	U	10	U	10	U
108-60-1	2,2'-oxybis(1-Chloropropane)	10	U	10	U	10	U	10	U
98-86-2	Acetophenone	10	U	10	U	10	U	10	U
106-44-5	4-Methylphenol	10	U	10	U	10	U	10	U
621-64-7	N-Nitroso-dl-n-propylamine	10	U	0.9	J	10	U	10	U
67-72-1	Hexachloroethane	10	U	10	U	10	U	10	U
98-95-3	Nitrobenzene	10	U	10	U	10	U	10	U
78-59-1	Isophorone	10	U	10	U	10	U	10	U
88-75-5	2-Nitrophenol	10	U	10	U	10	U	10	U
105-67-9	2,4-Dimethylphenol	10	U	10	U	10	U	10	U
111-91-1	bis(2-Chloroethoxy) methane	10	U	10	U	10	U	10	U
120-83-2	2,4-Dichlorophenol	10	U	10	U	10	U	10	U
91-20-3	Naphthalene	10	U	10	U	10	U	10	U
106-47-8	4-Chloroaniline	10	U	10	U	10	U	10	U
87-68-3	Hexachlorobutadiene	10	U	10	U	10	U	10	U
105-60-2	Caprolactam	10	U	10	U	10	U	10	U
59-50-7	4-Chloro-3-methylphenol	10	U	1	J	10	U	10	U
91-57-6	2-Methylnaphthalene	10	U	10	U	10	U	10	U
77-47-4	Hexachlorocyclopentadiene	10	U	10	U	10	U	10	U
88-06-2	2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U
95-95-4	2,4,5-Trichlorophenol	25	U	25	U	25	U	25	U
92-52-4	1,1-Biphenyl	10	U	10	U	10	U	10	U
91-58-7	2-Chloronaphthalene	10	U	10	U	10	U	10	U
88-74-4	2-Nitroaniline	25	U	25	U	25	U	25	U
131-11-3	Dimethylphthalate	10	U	10	U	10	U	10	U
606-20-2	2,6-Dinitrotoluene	10	U	10	U	10	U	10	U
208-96-8	Acenaphthylene	10	U	10	U	10	U	10	U
99-09-2	3-Nitroaniline	25	U	25	U	25	U	25	U
83-32-9	Acenaphthene	10	U	1	J	10	U	10	U
51-28-5	2,4-Dinitrophenol	25	U	25	U	25	U	25	U
100-02-7	4-Nitrophenol	25	U	25	U	25	U	25	U
132-64-9	Dibenzofuran	10	U	10	U	10	U	10	U
121-14-2	2,4-Dinitrotoluene	10	U	1	J	10	U	10	U
84-66-2	Diethylphthalate	10	U	10	U	10	U	10	U
86-73-7	Fluorene	10	U	10	U	10	U	10	U
7005-72-3	4-Chlorophenyl-phenylether	10	U	10	U	10	U	10	U
100-01-6	4-Nitroaniline	25	UJ	25	UJ	25	U	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U	25	U	25	U	25	U
86-30-6	N-nitrosodiphenylamine (1)	10	U	10	U	10	U	10	U
101-55-3	4-Bromophenyl-phenylether	10	U	10	U	10	U	10	U
118-74-1	Hexachlorobenzene	10	U	10	U	10	U	10	U
1912-24-9	Atrazine	10	UJ	10	UJ	10	UJ	10	UJ
87-86-5	Pentachlorophenol	25	U	3	J	25	U	25	U
85-01-8	Phenanthrene	10	U	10	U	10	U	10	U
120-12-7	Anthracene	10	U	10	U	10	U	10	U
86-74-8	Carbazole	10	U	10	U	10	U	10	U
84-74-2	Di-n-butylphthalate	10	U	10	U	10	U	10	U
206-44-0	Fluoranthene	10	U	10	U	10	U	10	U
129-00-0	Pyrene	10	U	2	J	10	U	10	U
85-68-7	Butylbenzylphthalate	10	U	10	U	10	U	10	U
91-94-1	3,3' -Dichlorobenzidine	10	UJ	10	UJ	10	U	10	U
56-55-3	Benzo (a) anthracene	10	U	10	U	10	U	10	U
218-01-9	Chrysene	10	U	10	U	10	U	10	U
117-81-7	bis (2-Ethylhexyl) phthalate	10	U	10	U	10	U	10	U
117-84-0	Di-n-octylphthalate	10	U	10	U	10	U	10	U
205-99-2	Benzo (b) fluoranthene	10	U	10	U	10	U	10	U
207-08-9	Benzo (k) fluoranthene	10	U	10	U	10	U	10	U
50-32-8	Benzo (a) pyrene	10	U	10	U	10	U	10	U
193-39-5	Indeno (1,2,3 –cd) pyrene	10	U	10	U	10	U	10	U
53-70-3	Dibenz (a, h) anthracene	10	U	10	U	10	U	10	U
191-24-2	Benzo (g,h,i) perylene	10	U	10	U	10	U	10	U

Results equal to or greater than MCLs or EPA, Region III Tap Water Screening criteria are shown in bold.
bgs - below ground surface
NA - Not Applicable
Q - Qualifier
ug/L - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
UJ - The reported amount is estimated because Quality Control criteria were not met.
Element or compound was not detected.
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
R - Reported value is "rejected."
U - The analyte was not detected above the laboratory quantitation limit.

Table 9
SVOCs in Surface Water
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	N/A	RRD-SW-1		RRD-SW-2		RRD-SW-3		RRD-SW-4		RRD-SW-5	
	Traffic Number	N/A	HX437		HX435		HX434		HX438		HX439	
	Sample Location	N/A	Southern portion of canal		Central portion of canal		Northern portion of canal		Northern portion of wetlands		Duplicate of SW-4	
	Sample Date	N/A	6/23/2000		6/23/2000		6/23/2000		6/23/2000		6/23/2000	
	Sample Type	MCL or EPA Region III Tap Water Screening Criteria	Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Cas No.	Analyte	µg/L	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
100-52-7	Benzaldehyde	3,700	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
108-95-2	Phenol	22,000	10	U	10	U	10	U	10	U	10	U
111-44-4	bis(2-Chloroethyl) ether	0.0096	10	U	10	U	10	U	10	U	10	U
95-57-8	2-Chlorophenol	30	10	U	10	U	10	U	10	U	10	U
95-48-7	2-Methylphenol	1,800	10	U	10	U	10	U	10	U	10	U
108-60-1	2,2'-oxybis(1-Chloropropane)		10	U	10	U	10	U	10	U	10	U
98-86-2	Acetophenone	0.042	10	U	10	U	10	U	10	U	10	U
106-44-5	4-Methylphenol	180	10	U	10	U	10	U	10	U	10	U
621-64-7	N-Nitroso-di-n-propylamine		10	U	10	U	10	U	10	U	10	U
67-72-1	Hexachloroethane		10	U	10	U	10	U	10	U	10	U
98-95-3	Nitrobenzene	3.5	10	U	10	U	10	U	10	U	10	U
78-59-1	Isophorone	70	10	U	10	U	10	U	10	U	10	U
88-75-5	2-Nitrophenol		10	U	10	U	10	U	10	U	10	U
105-67-9	2,4-Dimethylphenol	730	10	U	10	U	10	U	10	U	10	U
111-91-1	bis(2-Chloroethoxy) methane		10	U	10	U	10	U	10	U	10	U
120-83-2	2,4-Dichlorophenol	110	10	U	10	U	10	U	10	U	10	U
91-20-3	Naphthalene	6.5	10	U	10	U	10	U	10	U	10	U
106-47-8	4-Chloroaniline	150	10	U	10	U	10	U	10	U	10	U
87-68-3	Hexachlorobutadiene	0.86	10	U	10	U	10	U	10	U	10	U
105-60-2	Caprolactam	18,000	10	U	10	U	10	U	10	U	10	U
59-50-7	4-Chloro-3-methylphenol		10	U	10	U	10	U	10	U	10	U
91-57-6	2-Methylnaphthalene	120	10	U	10	U	10	U	10	U	10	U
77-47-4	Hexachlorocyclopentadiene	260	10	U	10	U	10	U	10	U	10	U
88-06-2	2,4,6-Trichlorophenol	6.1	10	U	10	U	10	U	10	U	10	U
95-95-4	2,4,5-Trichlorophenol	3,700	25	U	25	U	25	U	25	U	25	U
92-52-4	1,1-Biphenyl		10	U	10	U	10	U	10	U	10	U
91-58-7	2-Chloronaphthalene		10	U	10	U	10	U	10	U	10	U
88-74-4	2-Nitroaniline		25	U	25	U	25	U	25	U	25	U
131-11-3	Dimethylphthalate	370,000	10	U	10	U	10	U	10	U	10	U
606-20-2	2,6-Dinitrotoluene	37	10	U	10	U	10	U	10	U	10	U
208-96-8	Acenaphthylene		10	U	10	U	10	U	10	U	10	U
99-09-2	3-Nitroaniline		25	U	25	U	25	U	25	U	25	U
83-32-9	Acenaphthene	370	10	U	10	U	10	U	10	U	10	U
51-28-5	2,4-Dinitrophenol	73	25	U	25	U	25	U	25	U	25	U
100-02-7	4-Nitrophenol	290	25	U	25	U	25	U	25	U	25	U
132-64-9	Dibenzofuran	24	10	U	10	U	10	U	10	U	10	U
121-14-2	2,4-Dinitrotoluene	73	10	U	10	U	10	U	10	U	10	U
84-66-2	Diethylphthalate	29,000	10	U	0.4	J	10	U	10	U	10	U
86-73-7	Fluorene	240	10	U	10	U	10	U	10	U	10	U
7005-72-3	4-Chlorophenyl-phenylether		10	U	10	U	10	U	10	U	10	U
100-01-6	4-Nitroaniline		25	U	25	U	25	U	25	U	25	U
534-52-1	4,6-Dinitro-2-methylphenol		25	U	25	U	25	U	25	U	25	U
86-30-6	N-nitrosodiphenylamine (1)		10	U	10	U	10	U	10	U	10	U
101-55-3	4-Bromophenyl-phenylether		10	U	10	U	10	U	10	U	10	U
118-74-1	Hexachlorobenzene	0.042	10	U	10	U	10	U	10	U	10	U
1912-24-9	Atrazine	0.3	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
87-86-5	Pentachlorophenol	0.56	25	U	25	U	25	U	25	U	25	U
85-01-8	Phenanthrene		10	U	10	U	10	U	10	U	10	U
120-12-7	Anthracene	1,800	10	U	10	U	10	U	10	U	10	U
86-74-8	Carbazole	3.3	10	U	10	U	10	U	10	U	10	U
84-74-2	Di-n-butylphthalate		10	U	10	U	10	U	10	U	10	U
206-44-0	Fluoranthene	1,500	10	U	10	U	10	U	10	U	10	U
129-00-0	Pyrene	180	10	U	10	U	10	U	10	U	10	U
85-68-7	Butylbenzylphthalate	7,300	10	U	10	U	10	U	10	U	10	U
91-94-1	3,3' -Dichlorobenzidine	0.15	10	U	10	U	10	U	10	U	10	U
56-55-3	Benzo (a) anthracene	0.092	10	U	10	U	10	U	10	U	10	U
218-01-9	Chrysene	9.2	10	U	10	U	10	U	10	U	10	U
117-81-7	bis (2-Ethylhexyl) phthalate	4.8	10	U	10	U	10	U	10	U	10	U
117-84-0	Di-n-octylphthalate		10	U	10	U	10	U	10	U	10	U
205-99-2	Benzo (b) fluoranthene	0.092	10	U	10	U	10	U	10	U	10	U
207-08-9	Benzo (k) fluoranthene	0.92	10	U	10	U	10	U	10	U	10	U
50-32-8	Benzo (a) pyrene	0.0092	10	U	10	U	10	U	10	U	10	U
193-39-5	Indeno (1,2,3 - cd) pyrene		10	U	10	U	10	U	10	U	10	U
53-70-3	Dibenz (a, h) anthracene	0.0092	10	U	10	U	10	U	10	U	10	U
191-24-2	Benzo (g,h,i) perylene		10	U	10	U	10	U	10	U	10	U

Results equal to or greater than MCLs or EPA, Region III Tap Water Screening criteria are shown in bold.

bgs - below ground surface

NA - Not Applicable

Q - Qualifier

ug/L - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.

UJ - The reported amount is estimated because Quality Control criteria were not met.
Element or compound was not detected.

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

R - Reported value is "rejected."

U - The analyte was not detected above the laboratory quantitation limit.

Table 10
PCBs/Pesticides in Soil
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	N/A	SB-1	
	Traffic Number	N/A	HW932	
	Sample Location	N/A	Former SwitchYard RRD Landfill	
	Site Address	N/A	500 South and Delong Street	
	Sample Depth	N/A	0-1 feet bgs	
	Sample Date	N/A	6/21/2000	
	Sample Type	EPA Region III Industrial Screening Criteria	Soil	
Cas No.	Analyte	µg/kg	µg/kg	Q
319-84-6	alpha-BHC (Hexachlorocyclohexane)	910	0.37	J
319-85-7	beta-BHC (Hexachlorocyclohexane)	3,200	1.7	UR
319-86-8	delta-BHC (Hexachlorocyclohexane)		1.7	UR
58-89-9	gamma-BHC (Lindane)	4,400	1.7	UR
76-44-8	Heptachlor	1,300	1.7	UR
309-00-2	Aldrin	340	2.0	UJ
1024-57-3	Heptachlor epoxide	630	1.7	UR
959-98-8	Endosulfan I		1.7	UR
60-57-1	Dieldrin	360	3.3	UR
72-55-9	4,4-DDE		0.37	J
72-20-8	Endrin	610,000	3.3	UR
33213-65-9	Endosulfan II		1.8	J
72-54-8	4,4-DDD		3.3	UR
1031-07-8	Endosulfan sulfate		1.9	J
50-29-3	4,4-DDT		5.0	J
72-43-5	Methoxychlor	10,000,000	17	UR
53494-70-5	Endrin ketone		5.4	J
7421-93-4	Endrin aldehyde		3.3	UR
5103-71-9	alpha-Chlordane		1.7	UR
5103-74-2	gamma-Chlordane		0.10	J
8001-35-2	Toxaphene	5,200	170	UR
12674-11-2	Aroclor-1016	82,000	33	UR
11104-28-2	Aroclor-1221	2,900	67	UR
11141-16-5	Aroclor-1232	2,900	33	UR
53469-21-9	Aroclor-1242	2,900	33	UR
12672-29-6	Aroclor-1248	2,900	51	UJ
11097-69-1	Aroclor-1254	2,900	33	UR
11096-82-5	Aroclor-1260	2,900	33	UR

Results equal to or greater than EPA, Region III Industrial Screening criteria are shown in bold.

bgs - below ground surface

NA - Not Applicable

Q - Qualifier

ug/kg - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.

UJ - The reported amount is estimated because Quality Control criteria were not met.
Element or compound was not detected.

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

R - Reported value is "rejected."

U - The analyte was not detected above the laboratory quantitation limit.

Table 11
PCBs/Pesticides in Groundwater
SLC Redwood Dump
Targeted Brownfields Assessment

	Sample Number	N/A	RRD-4		RRD-5		RRD-7		RRD-8	
	Traffic Number	N/A	HW 922		HW925		HW929		HW933	
	Sample Location	N/A	Northeast portion of RRD, north of east bench		Northern portion of RRD, west of east bench		Central portion of RRD, north of switch yard		Central portion of RRD, east of switch yard	
	Site Address	N/A	500 South and Delong Street		500 South and Delong Street		500 South and Delong Street		500 South and Delong Street	
	Sample Date	N/A	6/20/2000		6/20/2000		6/21/2000		6/21/2000	
	Sample Type	MCL or EPA Region III Tap Water Screening Criteria	Groundwater		Groundwater		Groundwater		Groundwater	
Cas No.	Analyte	µg/L	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
319-84-6	alpha-BHC (Hexachlorocyclohexane)	0.011	0.050	U	0.0016	J	0.050	U	0.050	U
319-85-7	beta-BHC (Hexachlorocyclohexane)	0.037	0.050	U	0.050	U	0.050	U	0.050	U
319-86-8	delta-BHC (Hexachlorocyclohexane)		0.050	U	0.050	U	0.050	U	0.050	U
58-89-9	gamma-BHC (Lindane)	0.2	0.050	U	0.050	U	0.050	U	0.050	U
76-44-8	Heptachlor	0.4	0.050	U	0.050	U	0.050	U	0.050	U
309-00-2	Aldrin	0.0039	0.050	U	0.050	U	0.050	U	0.050	U
1024-57-3	Heptachlor epoxide	0.2	0.050	U	0.050	U	0.050	U	0.050	U
959-98-8	Endosulfan I		0.050	U	0.050	U	0.050	U	0.050	U
60-57-1	Dieldrin	0.0042	0.10	UJ	0.10	U	0.10	UJ	0.0032	J
72-55-9	4,4-DDE		0.10	U	0.10	U	0.10	U	0.10	U
72-20-8	Endrin	2	0.10	U	0.10	U	0.10	U	0.10	U
33213-65-9	Endosulfan II		0.10	U	0.10	U	0.10	U	0.10	U
72-54-8	4,4-DDD		0.10	U	0.10	U	0.10	U	0.10	U
1031-07-8	Endosulfan sulfate		0.10	U	0.10	U	0.10	U	0.10	U
50-29-3	4,4-DDT		0.10	U	0.10	U	0.10	U	0.10	U
72-43-5	Methoxychlor	40	0.50	U	0.50	U	0.50	U	0.50	U
53494-70-5	Endrin ketone		0.10	U	0.10	U	0.10	U	0.10	U
7421-93-4	Endrin aldehyde		0.0024	J	0.00078	J	0.002	J	0.10	U
5103-71-9	alpha-Chlordane		0.050	U	0.050	U	0.050	U	0.050	U
5103-74-2	gamma-Chlordane		0.50	U	0.050	U	0.050	U	0.050	U
8001-35-2	Toxaphene	0.061	5.0	U	5.0	U	5.0	U	5.0	U
12674-11-2	Aroclor-1016	0.96	1.0	U	1.0	U	1.0	U	1.0	U
11104-28-2	Aroclor-1221	0.033	2.0	U	2.0	U	2.0	U	2.0	U
11141-16-5	Aroclor-1232	0.033	1.0	U	1.0	U	1.0	U	1.0	U
53469-21-9	Aroclor-1242	0.033	1.0	U	1.0	U	1.0	U	1.0	U
12672-29-6	Aroclor-1248	0.033	1.0	U	1.0	U	1.0	U	1.0	U
11097-69-1	Aroclor-1254	0.033	1.0	U	1.0	U	1.0	U	1.0	U
11096-82-5	Aroclor-1260	0.033	1.0	U	1.0	U	1.0	U	1.0	U

Results equal to or greater than EPA Region III Tap Water Screening criteria are shown in bold.
bgs - below ground surface
NA - Not Applicable
NM - Not Measured
Q - Qualifier
ug/L - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
UJ - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
R - Reported value is "rejected"
U - The analyte was not detected above the laboratory quantitation limit.

Table 12
PCBs/Pesticides in Surface Water
SLC Redwood Road Dump
Targeted Brownfields Assessment

	Sample Number	N/A	RRD-SW-1		RRD-SW-2		RRD-SW-3		RRD-SW-4		RRD-SW-5	
	Traffic Number	N/A	HX437		HX435		HX434		HX438		HX439	
	Sample Location	N/A	Southern portion of canal		Central portion of canal		Northern portion of canal		Northern portion of wetlands		Duplicate of SW-4	
	Sample Date	N/A	6/23/2000		6/23/2000		6/23/2000		6/23/2000		6/23/2000	
	Sample Type	MCL or EPA Region III Tap Water Screening Criteria	Surface Water		Surface Water		Surface Water		Surface Water		Surface Water	
Cas No.	Analyte	µg/L	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
319-84-6	alpha-BHC (Hexachlorocyclohexane)	0.011	0.050	U	0.0036	J	0.0081	J	0.050	U	0.050	U
319-85-7	beta-BHC (Hexachlorocyclohexane)	0.037	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
319-86-8	delta-BHC (Hexachlorocyclohexane)		0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
58-89-9	gamma-BHC (Lindane)	0.2	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
76-44-8	Heptachlor	0.4	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
309-00-2	Aldrin	0.0039	**0.024**	J	**0.020**	J	**0.050**	J	**0.044**	J	0.050	U
1024-57-3	Heptachlor epoxide	0.2	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
959-98-8	Endosulfan I		0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
60-57-1	Dieldrin	0.0042	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
72-55-9	4,4-DDE		0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
72-20-8	Endrin	2	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
33213-65-9	Endosulfan II		0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
72-54-8	4,4-DDD		0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
1031-07-8	Endosulfan sulfate		0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
50-29-3	4,4-DDT		0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
72-43-5	Methoxychlor	40	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
53494-70-5	Endrin ketone		0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
7421-93-4	Endrin aldehyde		0.0049	J	0.10	U	0.0077	J	0.0054	J	0.0038	J
5103-71-9	alpha-Chlordane		0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
5103-74-2	gamma-Chlordane		0.050	U	0.050	U	0.050	J	0.050	U	0.050	U
8001-35-2	Toxaphene	0.061	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
12674-11-2	Aroclor-1016	0.96	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
11104-28-2	Aroclor-1221	0.033	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
11141-16-5	Aroclor-1232	0.033	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
53469-21-9	Aroclor-1242	0.033	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
12672-29-6	Aroclor-1248	0.033	1.0	U	1.0	U	1.6	U	1.8	U	1.0	U
11097-69-1	Aroclor-1254	0.033	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
11096-82-5	Aroclor-1260	0.033	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U

Results equal to or greater than EPA Region III Tap Water Screening criteria are shown in bold.
bgs - below ground surface
NA - Not Applicable
NM - Not Measured
Q - Qualifier
ug/L - parts per billion

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
UJ - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
R - Reported value is "rejected."
U - The analyte was not detected above the laboratory quantitation limit.

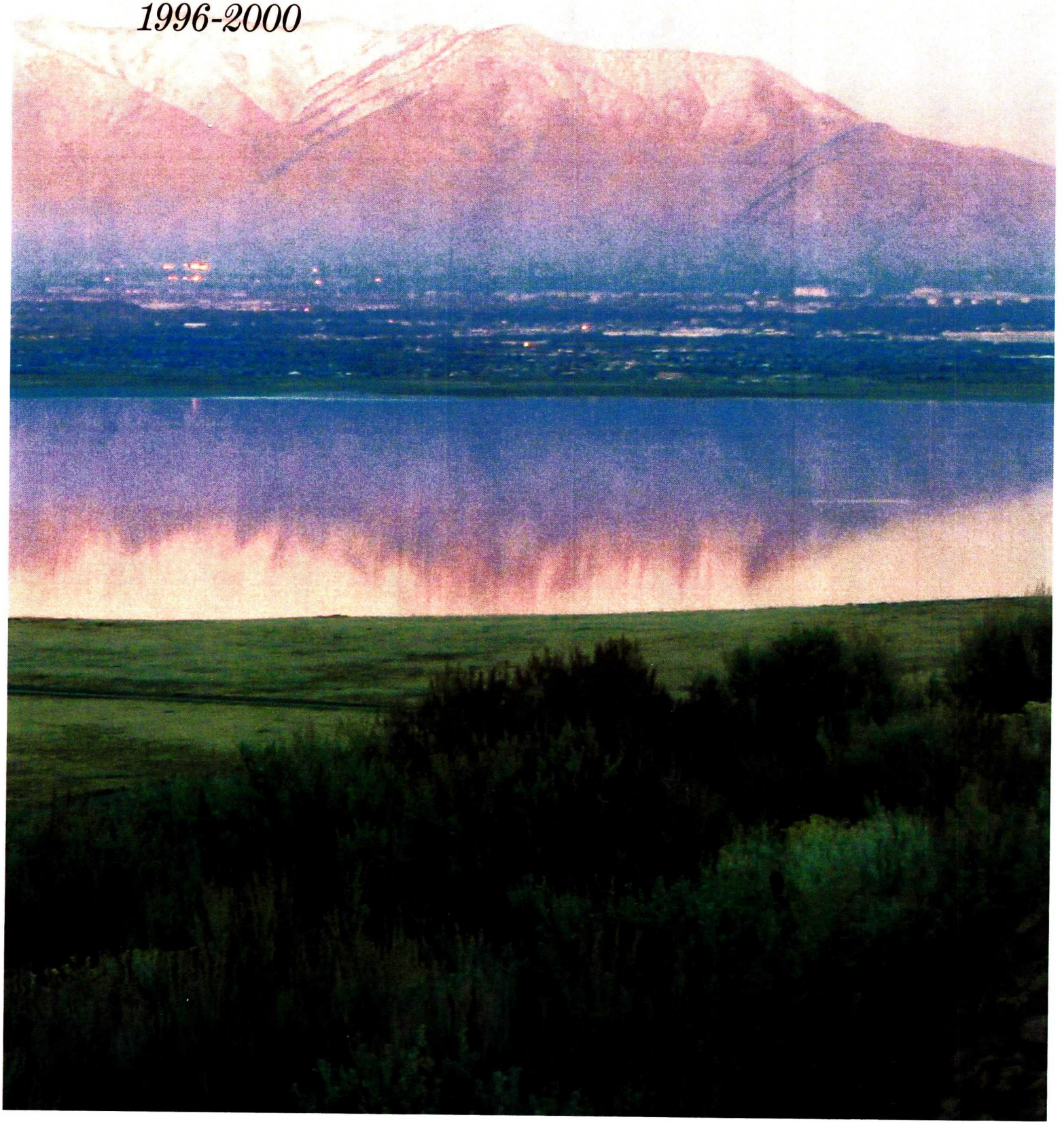
APPENDIX D

ASSESSMENT OF CONTAMINANTS IN THE WETLANDS AND OPEN WATERS OF THE GREAT SALT LAKE, U.S. FISH AND WILDLIFE SERVICE, SECTION 7

U.S. Fish & Wildlife Service

Assessment of Contaminants in the Wetlands and Open Waters of the Great Salt Lake, Utah

1996-2000



7.0 CONTAMINANT ASSESSMENT OF SEDIMENTS IN THE NORTHWEST OIL DRAIN "DELTA", FARMINGTON BAY, 2000

7.1 Introduction

The Northwest Oil Drain (NWOD) was built in the early part of the 20th century as part of the Salt Lake City's irrigation and flood water control system and to transport waste waters from heavy industries located in the northwest quadrant of the city. Currently, flows are a combination of return flows from canals originally diverted from the Jordan River, storm waters, treated wastewater effluents from the Salt Lake City Wastewater Treatment Plant (SLC WWTP) and treated wastewaters from several refineries still in operation in the area. Prior to the implementation of controls under water quality regulations beginning with the 1972 Water Pollution Control Act, the NWOD carried untreated wastewaters from a variety of industries in the northwest quadrant, including the refineries, feed lots, tanneries, metal fabricating and plating operations, chemical manufacturing plants, and other "heavy industries." The former name of the NWOD, still currently in use, is "the Sewage Canal."

The NWOD enters the Great Salt Lake within one of the most intensely managed and productive waterfowl habitats on the GSL, the Farmington Bay Waterfowl Management Area (FBWMA) which is owned and operated by the Utah Department of Natural Resources Division of Wildlife Resources (UDNR- DWR). The outlet of the NWOD forms a delta of sediments which reach out several kilometers into the bay, and is located between two of the main waterfowl management impoundments of the FBWMA, the Turpin Unit to the north and the Crystal Unit to the south (**Figure 7-1**). Although the shoreline of the GSL varies considerably depending on lake level, the delta is typically shallowly inundated over much of its area, and is vegetated with emergent and submerged aquatic wetland plants. There are typically a large number and variety of avian species foraging and nesting in the area, with large populations of American avocets, black-necked stilts, white-faced ibis, and American coots foraging in the sediments.

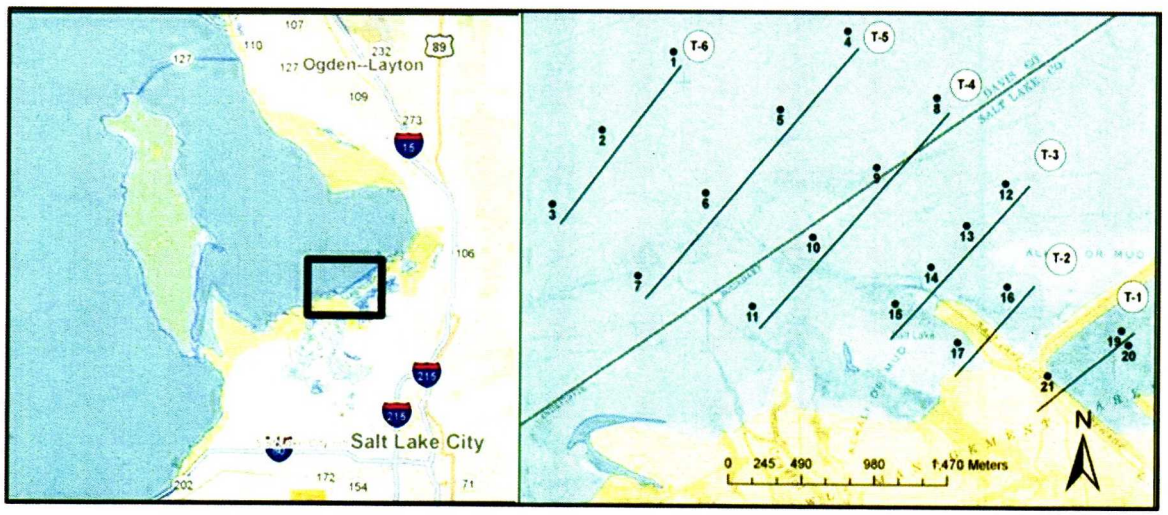
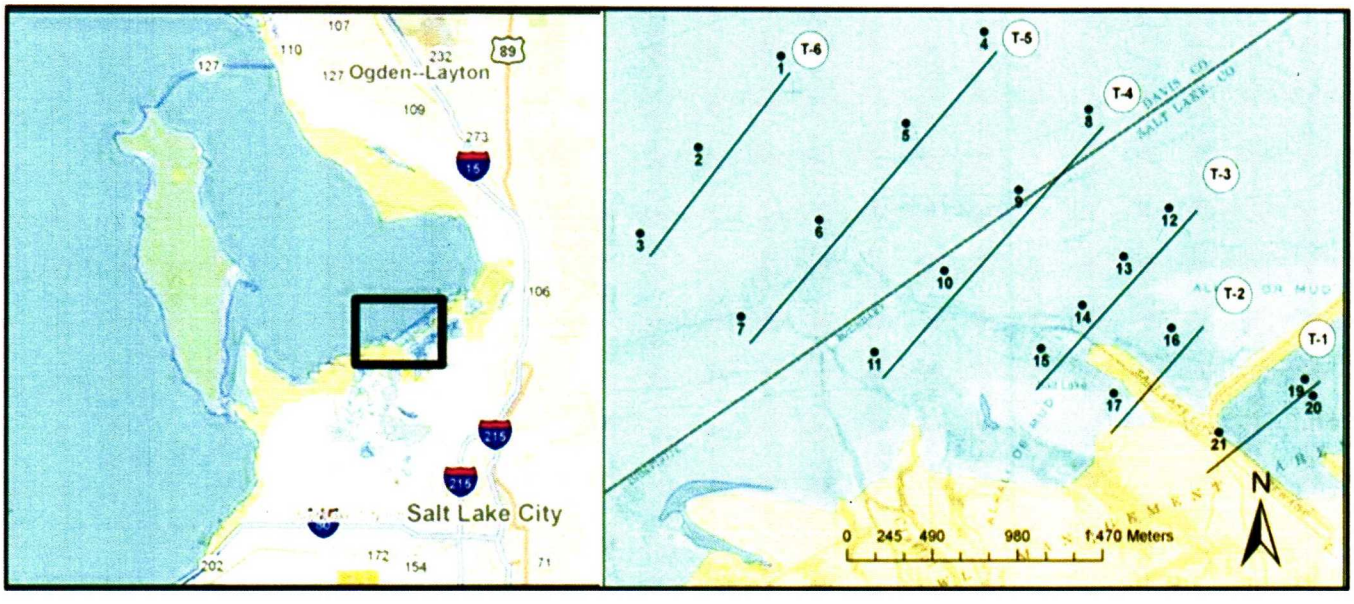


Figure 7-1. Location of the Northwest Oil Drain (NWOD) within Farmington Bay and location of sediment samples (and transects) within the NWOD delta.



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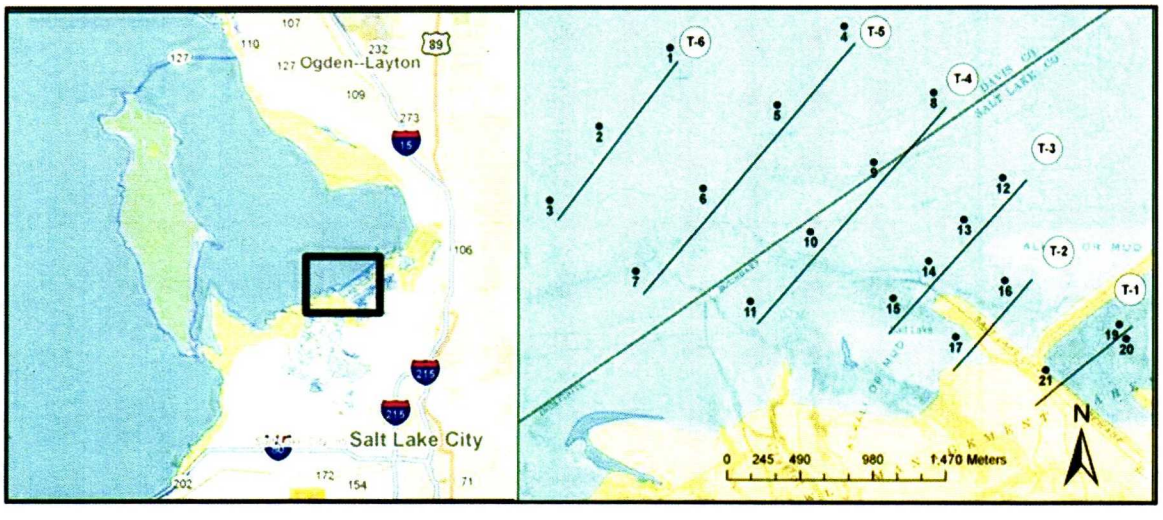

Figure 7-1. Location of the Northwest Oil Drain (NWOD) within Farmington Bay and location of sediment samples (and transects) within the NWOD delta.

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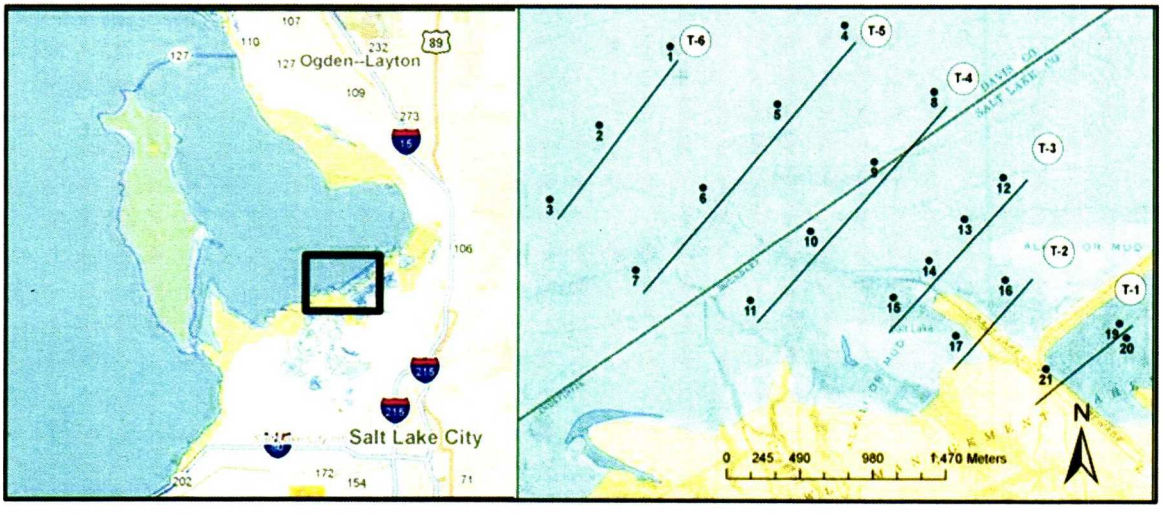

Figure 7-1. Location of the Northwest Oil Drain (NWOD) within Farmington Bay and location of sediment samples (and transects) within the NWOD delta.

Beginning in the late 1990's, the U.S. EPA and the Utah Department of Environmental Quality (UDEQ) began conducting remedial investigations of the NWOD under the Comprehensive Environmental Response, Liability and Compensation Act (CERCLA). These investigations came to the Service's attention after much of the sampling for the 1996-1997 GSL Wetlands Contaminant assessment had been completed. However, based on data that had been collected in relevant locations (summarized below, and shown in **Figure 7-2**), the Service recommended that the NWOD remedial investigation include the submerged portion in Farmington Bay to address avian exposure to contaminants in the delta and characterize risks to avian populations. The study detailed in this section was undertaken by the Service in order to gather data to help in this process. However, the regulatory agencies declined to extend the investigation due to a variety of factors. The upstream segments of the NWOD canal were cleaned up during approximately 2002 – 2005, but the delta of the NWOD remains unaddressed to date.

7.2 Study Location and Methods

Twenty sediment sampling locations were chosen for this investigation and sampled in 2000. Eighteen of the sampling points were located at the mouth of the NWOD where it empties out into Farmington bay near the southwest end of the impoundment dike between the Crystal Unit (to the south) and the Turpin Unit (to the north) in the FBWMA (**Figure 7-1**). Two additional samples were located upgradient of the shoreline of Farmington Bay as it existed in 2000, within the Turpin Unit. These samples were located to

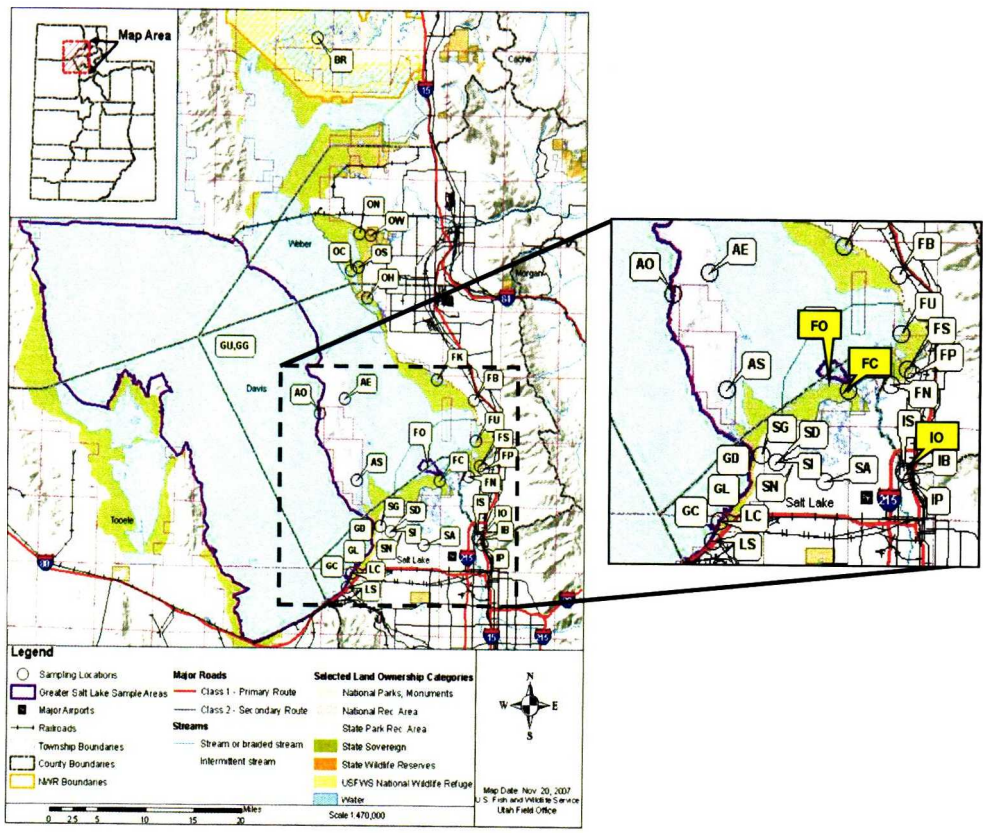

Figure 7-2. Sampling locations of 1996-1997 Great Salt Lake Wetlands Contaminants Assessment; sites relevant to the Northwest Oil Drain highlighted in yellow.

characterize contamination that may have been deposited in the Turpin Unit during the early 1980's, when several years of historically high precipitation had resulted in flooding of the GSL shoreline. The samples were arranged in transects that ran parallel to the shoreline and extended out into Farmington Bay. The first transect (T-1) included the two points within the Turpin Unit, and the second (T-2) was the first transect located within Farmington Bay. A total of six transects, spaced approximately 500 meters apart, extended about 2.5 km into Farmington Bay. Sediments in the four shore-most transects (T-1 through T-4) were located under less than 30 cm of water; these were sampled with decontaminated stainless steel scoops according to procedures outlined in Section 3. The last two transects (T-5 and T-6) were under approximately 1.0 – 1.5 meters of water, and were sampled with a stainless steel ponar dredge from a canoe. All samples were collected into chemically clean borosilicate glass jars, and handled, transported and stored as described in Section 3. Samples were analyzed for 19 metals, 25 organochlorine compounds (including total PCBs); and 25 polynuclear aromatic hydrocarbons (PAHs) including both non-alkylated and alkylated PAHs. Two isomers of tetrachlorobenzene (TCB; 1,2,3,4- and 1,2,4,5-isomers), were also included in the analysis. Analytical laboratories and methods are described in Section 3.

Analytical results were compared with the freshwater Consensus-based Sediment Screening Guidelines (CBSSG) threshold effect concentrations (TECs) and probable effect concentrations (PECs) used to evaluate the GSL wetland sediments. (MacDonald et al. 2000) and see Section 4.1). Concentrations of selenium were evaluated against the sediment guidelines in (National Irrigation Water Quality Program 1998) because these guidelines directly address adverse effects to avian species. Concentrations of Al, Ba, Mn, and V were compared with concentrations identified in "SQuiRT" (Screening Quick Reference Tables) produced by the National Oceanic and Atmospheric Administration (NOAA;(Buchman 1999). Ecologically-based screening concentrations could not be identified for Be and B, so concentrations of these elements were compared with mean "background" concentrations in western U.S soils (Shacklette & Boerngen 1984) as a way of roughly identifying elevated concentrations compared with these "background" values. No reference values were identified for Fe, Mg, Mo and Sr. For organics, available TEC and PEC concentrations (MacDonald et al., 2000 and NOAA, 1999) were used as screening benchmarks. Although these benchmarks are not available for all of the compounds that were analyzed, they are available for constituents that are typically of greatest concern for ecological toxicity. Since organic constituents tend to co-occur with each other, we believed that elevated concentrations of compounds with screening concentrations would tend to "drive" the evaluation, so no attempt was made to identify additional benchmarks for compounds not addressed by the CBSG or SQuiRT references.

7.3 Results and Discussion

Trace Elements-
All data from the metals analysis in the Oil Drain Delta sediments are presented in **Appendix Table D-1**. All elements but Hg, Mo and Se were detected in every sample, with Mo the least frequently detected, in less 50% of the samples.

The geometric means of 14 metals exceeded their respective TECs, out of the 15 metals for which TECs could be identified (**Table 7-1**). Only the geometric mean concentrations of Cr, Mn and Vn did not exceed these lower benchmarks. All 20 samples exceeded the TECs for a number of metals of concern including As, and Pb; 19 of the 20 samples exceeded the TEC for mercury (Table 7-1). The geometric mean concentration of lead (Pb) exceeded the higher threshold PEC, and a high frequency of samples exceeded the PECs for Pb and Cu. Seven of the 20 sediment samples exceeded the PEC for Hg.

In addition to the number of exceedences of the sediment benchmarks, the spatial distribution of contaminant concentrations was also of interest. Copper, Pb and Zn collectively tended to have the highest concentrations from Transect 3 (T-3) outward (**Figure 7-3**); Hg exhibited the same trend (**Figure 7-4**).

Table 7-1 Summary of trace elements (mg/kg, dry weight) and exceedences of reference values in sediments of the Northwest Oil Drain Delta(n = 20) in Farmington Bay, Great Salt Lake, 2000.

Constituent	Gmean[a]	max	Reference Values[c]	# > TEC	# > PEC
Aluminum	*10,882*	*16,989*	[2,600 / 25,550][1]	20	0
Arsenic	*25.8*	**43.0**	[9.8 / 33][2]	20	5
Barium	*220*	305	[48 / --][3]	20	--
Beryllium	*0.71*	1.96	[0.68 / --][4]	15	--
Boron	*100*	141	[23 / --][4]	20	--
Cadmium	*1.56*	**10.9**	[0.99 / 4.98][2]	13	3
Chromium	36.3	**310**	[43.4 / 111][2]	8	3
Copper	*137*	**268**	[31.6 / 149][2]	19	12
Iron	12,023	18,703	[--]	--	--
Lead	**193**	**453**	[35.8 / 128][2]	20	16
Magnesium	28,981	38,311	[--]	--	--
Manganese	*322*	443	[400 / 630][1]	3	0
Mercury	*0.97*	**6.17**	[0.18 / 1.06][2]	19	7
Molybdenum	NC[b]	17.4	[--]	--	--
Nickel	17.0	36.5	[22.7 / 48.6][2]	4	0
Selenium	*1.22*	2.48	[1 / 4][5]	14	0
Strontium	745	2710	[--]	--	--
Vanadium	*30.7*	112	[50 / --][1]	1	--
Zinc	*275*	**932**	[121 / 459][2]	17	5

KEY:

Value	Value exceeds TEC
Value	Value exceeds PEC

NOTES:

(a)One half the detection limit was used to calculate geometric means for Hg and Se
(b)NC = Geometric mean not calculated
(c)[--] = No reference values identified

KEY TO EFFECTS LEVELS:

1) "Background" and lowest Threshold Effect Level (Buchman 1999)
2) Threshold Effects and Probable Effects concentrations (MacDonald et al. 2000)
3) Apparent Effects Threshold in marine sediments (Buchman 1999)
4) Mean concentrations in U.S. soils (Shacklette & Boerngen 1984); not a threshold value.
5) "Background" and toxicity threshold (National Irrigation Water Quality Program 1998)

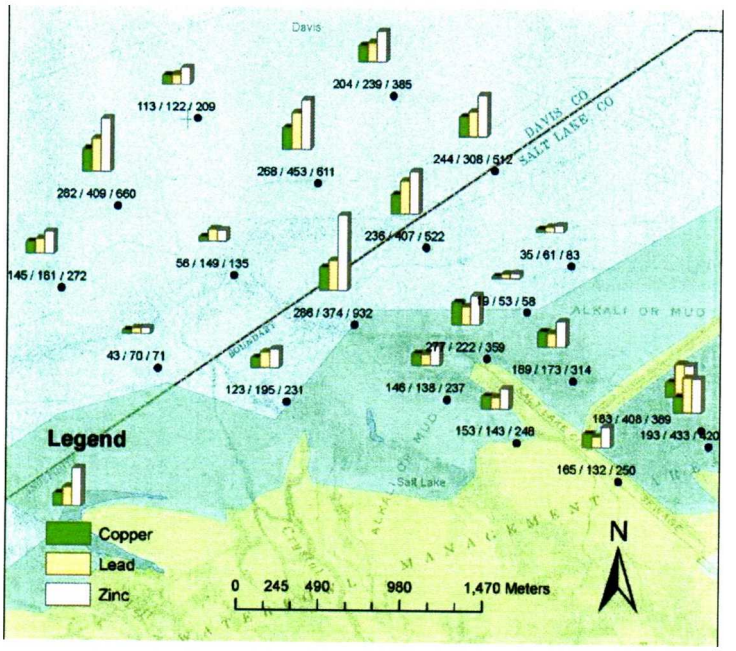

Figure 7-3. Spatial distribution of copper, lead and zinc (mg/kg dry weight) in sediments, Northwest Oil Drain Delta of the Great Salt Lake, 2000. Probable effects concentrations (PECs) = 149 mg/kg (Cu), 128 mg/kg (Pb) and 459 mg/kg (Zn).

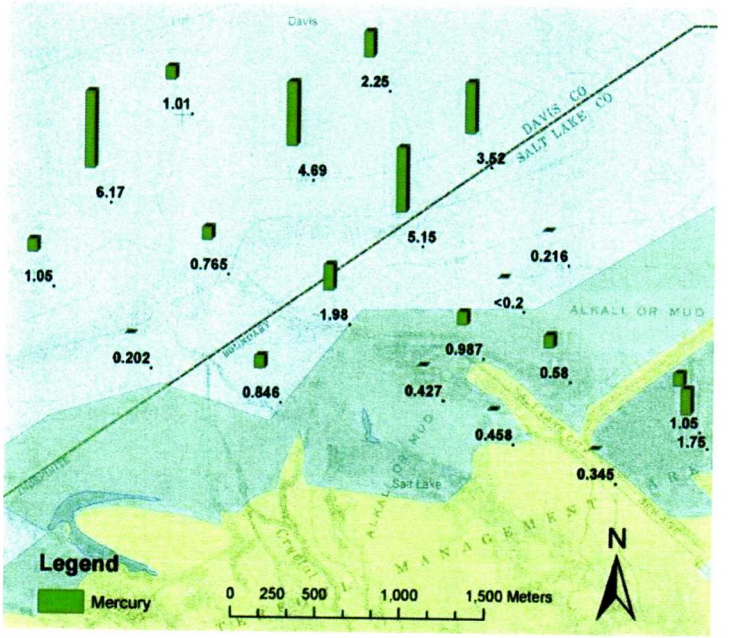

Figure 7-4. Spatial distribution of mercury (mg/kg dry weight) in sediments, Northwest Oil Drain Delta of the Great Salt Lake, 2000. Probable effects concentration (PEC) = 1.06 mg/kg.

Organics-PCBs, DDTs, other chlorinated hydrocarbons
All data from the analysis of organic constuents in the NWOD Delta sediments are presented in **Appendix Tables D-2** (OCs and PCBs), **D-3** (non-alkylated PAHs) and **D-4** (alkylated PAHs).

Total PCBs and DDTs were detected in all 20 samples. Total PCB (t-PCB) concentrations ranged from 0.043 – 5.55 mg/kg (geometric mean 0.293 mg/kg), with 19 of 20 samples exceeding the TEC of 0.060 mg/kg and five exceeding the PEC of 0.680 mg/kg. Echoing the contaminant distribution observed for trace metals, the highest detected concentrations of total PCB occurred the furthest off-shore in Transect 6 (**Figure 7-5**).

All six isomers of DDT were detected in NWOD delta sediments, with the isomers of DDD (*o,p'*-DDD and *p,p'*-DDD) the most frequently occurring, in 18 of 20 samples (**Table 7-2**). Maximum detected concentrations of all six isomers exceeded their respective PECs, and geometric mean concentrations of *o,p'*-DDD and *p,p'*-DDE exceeded their TECs (0.005 mg/kg and 0.003 mg/kg, respectively). In contrast to total PCB concentrations, which had a distinct peak in Transect 6 (furthest off-shore), concentrations of DDTs were more evenly distributed throughout the sampling grid (shown as total DDT in **Figure 7-6**).

Non-DDT organochlorines were also detected in NWOD delta sediments, with chlordanes (alpha chlordane, gamma chlordane, cis- and trans- isomers of nonachlor) present at the highest concentrations in this group. This was similar to trends observed in wetland sediments around the GSL during the 1996-1996 contaminants assessment, but concentrations tended to be higher in the NWOD delta. Geometric mean concentrations of alpha chlordane slightly exceeded the TEC (0.0033 mg/kg vs. the TEC of 0.0032 mg/kg). Spatial trends for these compounds were consistent with that seen for other constituents analyzed, with the highest concentrations being present in the furthest off-shore transect, T-6 (**Table 7-3**).

Polynuclear aromatic hydrocarbons (PAHs)
Both alkylated and non-alkylated PAHs were analyzed in NWOD delta sediments. This was done to provide data for a "fingerprint" analysis of PAHs, which can provide information as to the origin and/or source of these compounds, but this analysis was not performed. Complete data from these analyses are provided in **Appendix Tables D-3** (alkylated PAHs) and **D-4** (non-alkylated PAHs). Howver, sediment screening benchmarks are only available for non-alkylated PAHs, so only these compounds are discussed below. Total PAHs (t-PAH), calculated as the summed concentration of all PAHs (using a value of ½ the detection limit for samples with non-detected concentrations) were also evaluated. Two isomers of tetrachlorobenzene (TCB) were also evaluated; sediment screening benchmarks are not available for these compounds either.

As expected, PAHs were widely distributed in the Oil Drain delta with all 25 of the non-alkylated PAHs analyzed detected in at least one sample and with 16 of the 25 detected in all sediment samples. At least one PAH was present >TEC in each of the 20 samples. Nine PAH compounds had mean concentrations in at least one transect that exceeded their respective TECs and the mean concentration of dibenz(*a,h*)anthracene exceeded the PEC in one transect (T-5) (**Table 7-4**),. Three PAH compounds, and t-PEC had maximum detected concentrations > PEC in at least one sample. While PAH concentrations exceeded TECs throughout the sampling grid, the spatial distribution concentrations was similar to that observed previously, the highest concentrations detected at the off-shore edge of the grid (**Figure 7-7**).

Conclusions and Recommendations
The majority of trace elements of concern (e.g., Hg, Cu, Pb, Zn) as well as chlorinated OCs and PAHs were detected in NWOD delta sediments at levels that exceeded threshold sediment toxicity concentrations for individual compounds. These concentrations are known to adversely impact both sediment-dwelling organisms and birds that forage on them.

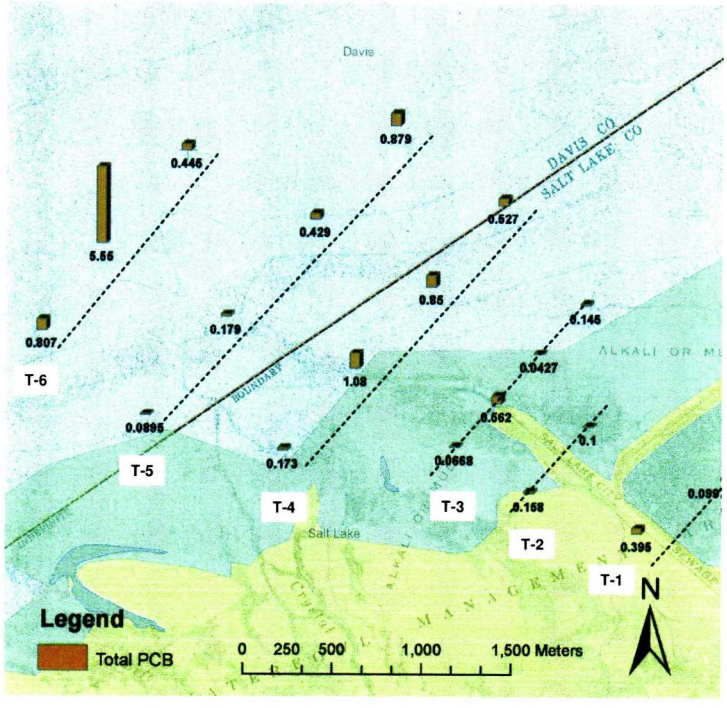

Figure 7-5. Spatial distribution of total PCBs (mg/kg dry weight) in sediments, Northwest Oil Drain Delta of the Great Salt Lake, 2000. Probable effect concentration (PEC) =0.680 mg/kg.

Table 7-2. Summary of DDT isomer concentrations (mg/kg dry weight) in sediments, Great Salt Lake Oil Drain Delta, 2000. Transects are numbered from T-1 (onshore) to T-6 (offshore).

DDT Metabolite	# Detects (of 20)	Geo. Mean Conc.	Max. Conc. (Transect #)	(#) ≥ PEC conc.	Transects ≥ PEC	(#) ≥ TEC conc.
o,p'-DDD	18	*0.006*	0.101 (T-4)	(4) ≥ 0.028	6,5,4	(10) ≥ 0.005
p,p'-DDD	18	*0.008*	0.116 (T-1)	(5) ≥ 0.028	6,5,4	(8) ≥ 0.005
o,p'-DDE	7	NC	0.059 (T-4)	(1) ≥ 0.031	4	(5) ≥ 0.003
p,p'-DDE	17	*0.004*	0.079 (T-1)	(2) ≥ 0.031	6,4	(10) ≥ 0.003
o,p'-DDT	12	0.003	0.200 (T-4)	(2) ≥ 0.063	5,4	(5) ≥ 0.004
p,p'-DDT	4	NC	0.101 (T-4)	(1) ≥ 0.063	4	(4) ≥ 0.004
Total DDTs (summed)	NA	*.0352*	0.360 (T-4)	(0) ≥ 0.572	*None*	(20) ≥ 0.005

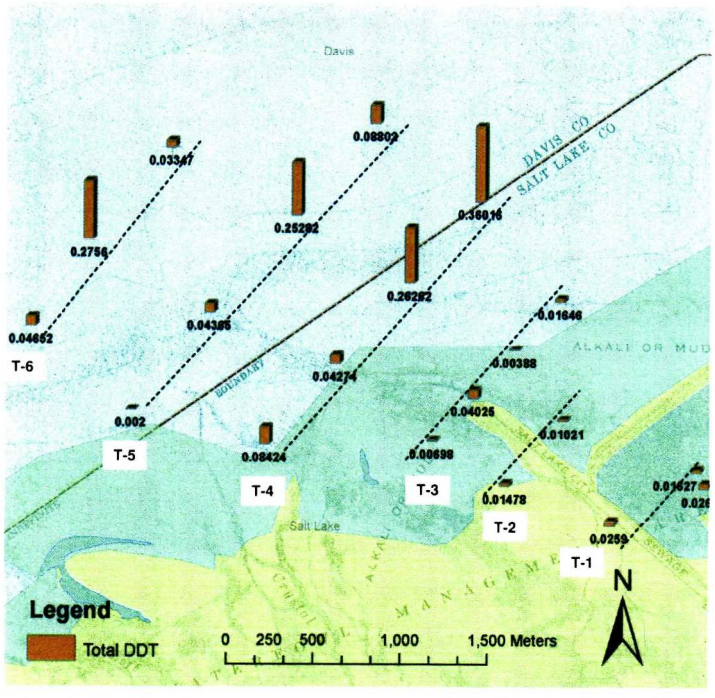

Figure 7-6. Spatial distribution of total DDTs (summed concentrations of o,p'- and p,p'-isomers of DDD, DDE and DDT; mg/kg dry weight) in sediments, Northwest Oil Drain Delta of the Great Salt Lake. Probable effect concentration (PEC) =0.572 mg/kg

Table 7-3. Concentrations of frequently detected chlorinated organic compounds in sediment samples (mg/kg dry weight) compared with sediment screening benchmarks, Northwest Oil Drain Delta, 2000.

	alpha chlordane	gamma chlordane	cis-nonachlor	trans-nonachlor
Threshold Effects Concentration (TEC)	*0.0032*	*0.0032*	*0.0025*	*0.0025*
Probable Effects Concentration (PEC)	**0.018**	**0.018**	**0.016**	**0.016**
All Data (20 samples)				
# detections	15	12	12	10
max conc.	**0.067**	**0.128**	**0.026**	**0.031**
geomean conc	*0.00334*	0.00234	0.00170	0.00160
% ≥ PEC	13%	17%	8%	10%
% ≥ TEC	73%	58%	67%	70%
Transect 6 (offshore; 3 samples)				
# detections	3	3	3	3
max conc.	**0.067**	**0.128**	**0.026**	**0.031**
geomean conc	*0.0107*	**0.0215**	*0.0052*	*0.0056*
% ≥ PEC	33%	33%	33%	33%
% ≥ TEC	100%	100%	66%	66%

Table 7-4. Geometric mean concentrations of non-alkylated PAHs in sediments by transect, Northwest Oil Drain Delta of the Great Salt Lake, 2000. All concentrations given in mg/kg (ppm) dry weight.

	onshore < < ---				*--- > >offshore*				
PAHs with SQGs	**T-1**	**T-2**	**T-3**	**T-4**	**T-5**	**T-6**	**TEC**	**PEC**	***TEC/ PEC source***
2-methylnaphthalene*	*0.073*	*0.022*	0.012	*0.051*	*0.044*	*0.038*	0.020	0.201	*(1)*
Benzo(a)anthracene	0.083	0.027	0.013	*0.078*	*0.060*	*0.148*	0.108	1.05	*(2)*
Dibenz(a,h)anthracene*	0.129	0.016	0.012	*0.074*	**0.138**	0.019	0.033	0.135	*(2)*
acenaphthalene*	*0.045*	*0.011*	*0.020*	*0.023*	*0.016*	*0.021*	0.006	0.128	*(1)*
acenaphthene	0.029	0.015	0.005	*0.007*	0.004	0.018	0.007	0.089	*(1)*
anthracene*	*0.146*	0.031	0.018	*0.137*	*0.146*	*0.123*	0.057	0.845	*(2)*
benzo(a)pyrene	0.159	0.038	0.021	0.076	0.085	0.090	0.150	1.45	*(2)*
benzo(b)fluoranthene	0.052	0.046	0.028	0.154	0.155	0.082	0.240	13.4	*(4)*
benzo(e)pyrene*	*0.221*	0.058	0.042	*0.324*	*0.473*	0.095	0.150	1.45	*(4)*
benzo(g,h,i)perylene	*0.337*	0.057	0.032	*0.219*	*0.329*	0.089	0.170	3.20	*(3)*
benzo(k)fluoranthene	0.014	0.013	0.006	0.037	0.023	0.021	0.240	13.4	*(3)*
chrysene	0.160	0.075	0.051	*0.451*	*0.308*	*0.202*	0.166	1.29	*(2)*
fluoranthene	0.087	0.051	0.017	0.086	0.038	0.105	0.423	2.23	*(2)*
fluorene	0.024	0.014	0.004	0.019	0.012	0.023	0.077	0.536	*(2)*
indeno(1,2,3-cd)pyrene	0.117	0.033	0.019	0.112	0.161	0.047	0.200	3.20	*(2)*
naphthalene	0.032	0.014	0.008	0.021	0.017	0.019	0.176	0.561	*(2)*
phenanthrene	0.103	0.043	0.019	0.106	0.057	*0.250*	0.204	1.17	*(1)*
pyrene	0.189	0.096	0.045	*0.453*	*0.268*	*0.356*	0.195	1.52	*(2)*
Total PAH (summed)	2.53	0.772	0.435	*3.38*	*2.79*	*3.07*	1.61	22.8	*(2)*
#PAH>TEC	*7*	*2*	*1*	*9*	*8*	*7*			
#PAH>PEC					**1**				

KEY:

value	value > TEC
value	value > PEC

NOTES

Threshold Effects Concentrations (TECs) and Probable Effects Concentrations (PECs) from sources as noted:

(1) Canadian Council of Ministers of the Environment (CCME, 1999)

(2) Consensus-Based Sediment Quality Guidelines (MacDonald, et al, 2000)

(3) Guidelines for the Protection and management of sediments in Ontario, Canada (Ontario, 1993

(4) TECs and PECs for benzo(e)pyrene and benzo(b)fluoranthene were assigned based on chemical structural similarity to benzo(a)pyrene (CBSQG) and benzo(k)flouranthene (CBSQG), respectively

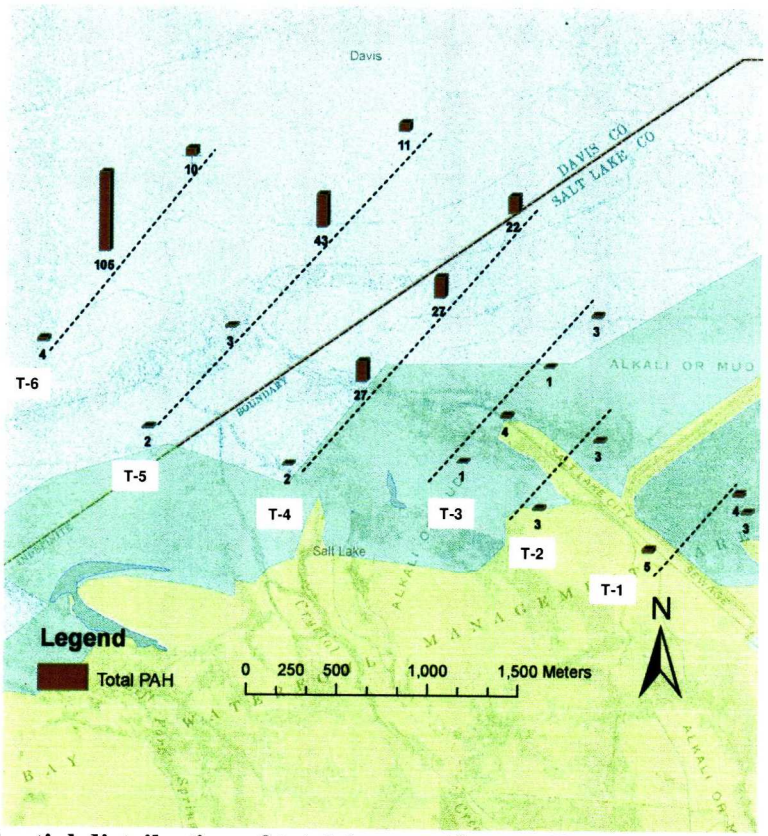

Figure 7-7. Spatial distribution of total (summed) non-alkylated PAH concentrations (mg/kg dry weight) in sediments, Northwest Oil Drain Delta of the Great Salt Lake, 2000. Threshold effect concentration (TEC) =1.61 mg/kg; probable effects concentration (PEC) =22.8 mg/kg.

While sediment TECs are commonly interpreted as conservative because adverse effects are "not expected" below them, an evaluation of the individual studies that form their basis indicates that adverse effects have been observed at or even below these thresholds in certain cases (D. Wall, USFWS, personal communication). Additionally, individual TECs/PECs do not address cumulative (additive or synergistic) toxicity. We found mean concentrations of 14 of 15 metals, and organic compounds including total PCBs, DDT isomers, chlordane and several PAHs (including total PAH) to be present above TECs, and nearly half of the samples had levels of some of the most toxic constituents (Pb, Hg, t-PAH) exceeding "probable" effects levels. Cumulatively, these data suggest that sediment-dwelling invertebrate and plant communities could be impaired in the NWOD delta. These impairments can lead to a decrease in abundance and diversity of food items for avian fauna that occur in the FBWMA, where the NWOD delta is located.

However, despite possible impairment, sediment-dwelling organisms and plants are present in the NWOD delta, because some of the most abundant species in the area, which are adapted to the difficult environmental conditions of the GSL's estuarine wetlands (e.g., high salinity, low oxygen, high temperatures) are also pollutant tolerant. Avian usage of food resources in the NWOD delta is also a function of the surrounding, less polluted habitats in the FBWMA, which are managed specifically for

avian productivity. These conditions create a pathway for birds to be exposed to contaminants in the NWOD delta both through consumption of food items (e.g., the gut contents of macroinvertebrates, sediments attached to roots and other plant matter) and through consumption of sediments adhering to these food items. This "incidental" sediment ingestion can range from 3 – 10% of total dietary intake depending on species (Hui & Beyer 1998; Beyer et al. 2008).

The highest concentrations of almost all constituents were observed in the farthest off-shore transects. Thus, while the "nature" of contamination in the NWOD delta is better characterized as a result of this study, the "extent" of the contamination is not. Because the location of the GSL shoreline fluctuates greatly with small changes in lake elevation, the areas around the farthest transects may be exposed at lower lake levels, subsequently increasing exposure risk to benthic foraging birds.

Mercury concentrations in avian eggs collected in the Crystal Unit in 1996-1997 (discussed in Section 4.4) seem to indicate that birds exposed to sediments in this area would have increased risk of ecologically adverse effects. Elevated t-Hg concentrations were observed in black-necked stilt and American coot, both of which are highly sediment exposed and are commonly observed in the NWOD delta. However, in our follow-up investigation, which addressed a piscivorous species, Forsters' tern (see Section 6), elevated mercury concentrations were not observed. We believe this indicates that mercury uptake in the Farmington Bay wetlands does not occur through the food-chain (i.e., biomagnification through successive trophic levels) but is instead more an issue of direct sediment exposure.

APPENDIX E

SAMPLING AND ANALYSIS PLAN/QUALITY ASSURANCE PROJECT PLAN, REVISION 0, NORTHWEST OIL DRAIN, 2011, EPA

2011 Site Investigation
Technical Memorandum
Revision 0
Final
Northwest Oil Drain
Salt Lake County, Salt Lake City, Utah

Prepared For:

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Acronym List

AVS	Acid Volatile Sulfides
CDM	Camp Dresser Mckee
COPC	Contaminants of Potential Concern
EPA	United States Environmental Protection Agency
ESAT	Environmental Services Assistance Team
FBWMA	Farmington Bay Waterfowl Management Area
GSL	Great Salt Lake
HQ	Hazard Quotient
mg/kg	milligrams per kilogram
ug/kg	micrograms per kilogram
NWOD	Northwest Oil Drain
O&G	Oil and Grease
PAHs	Polycyclic Aromatic Hydrocarbons
SAP	Sampling and Analysis Plan
SEM	Simultaneously Extracted Metals
TPH-DRO	Total Petroleum Hydrocarbons – Diesel Range Organics
USFWS	United States Fish and Wildlife Service

1.0 Introduction

This document serves as the technical memorandum for the site investigation that took place on September 19, 2011 at the Farmington Bay Waterfowl Management Area (FBWMA) in support of the Northwest Oil Drain Superfund Site. Figure 1shows the sampling locations for the 2011 site investigation. The study was designed to determine the nature and extent of the contaminants of potential concern (COPC) within sediments of the FBWMA. The investigation included the assessment of COPCs in the flowing portion of the Northwest Oil Drain and non-flowing portion of the Great Salt Lake. All samples were collected per the procedures set forth in the *Sampling and Analysis Plan/Quality Assurance Project Plan for the Northwest Oil Drain* dated September 2011 (SAP). Any deviations from the plan are identified in the body of this document. The COPCs for the site are also identified in the SAP (ESAT 2011) and consist of lead, mercury, Total Petroleum Hydrocarbons-Diesel Range Organics (TPH-DRO), Polycyclic Aromatic Hydrocarbons (PAHs), and Oil and Grease (O&G). Action Levels for TPH-DRO (100 mg/kg) and O&G (300 mg/kg) were previously proposed by the Northwest Oil Drain (NWOD) working group for other portions of the canal and accepted by the Environmental Protection Agency and the State of Utah (Stantec Consulting Inc., 2003).

The goals of this sampling event were to provide data to determine the nature and extent of metals and petroleum-related contamination in the FBWMA and to allow comparison of these data to clean-up criteria established for the NWOD and risk-based screening benchmarks for benthic invertebrates. This Technical Memorandum addresses these goals and also aims to determine the relationship between historical and current data where sampling locations are co-located and to determine if the extent of contamination was indeed captured during the 2011 site investigation. Historical data were obtained from Camp Dresser Mckee (CDM) and United States Fish and Wildlife Service (USFWS). The 2011 data set was collected by the United States Environmental Protection Agency (EPA) and Region 8 Environmental Services Assistance Team (ESAT).

1.1 Background

The NWOD is a set of canals constructed in the 1920s for the transport and disposal of waste refinery oils, other industrial wastewater effluents, sewage, and storm water. The canals were used extensively throughout the 1950s. There are two primary canals, several small tributary canals entering from the industrialized area to the east, as well as larger tributaries (e.g., City Drain) from the south. The two primary canals were used for industrial waste, and a lesser canal which was used for sewage. The NWOD begins near downtown Salt Lake City, and proceeds northwesterly toward the FBWMA and the Great Salt Lake (GSL). The length of the canal is approximately 15 linear miles. A large portion of the southern end of the canal system is no longer in use, although the remainder of the canal system still receives treated municipal and industrial wastes.

The Rose Park Subdivision was constructed on top of a section of the southern end of the canal system. Approximately 35 homes and a school exist directly above the old canal. The NWOD surfaces northwest of Rose Park, where it is an ephemeral open ditch referred to as the "non-

flowing" or abandoned section. There is too little water in this section of the canal to generate a constant flow; however, water ponds in places during wet periods. The Salt Lake City municipal water treatment plant effluent discharges into the NWOD at approximately 1500 North and 1200 West streets. At this point the NWOD has year-round flow. This is referred to as the "flowing" section of the NWOD. Various surface drains discharge into the NWOD, so that the water body gains volume as it flows towards the Great Salt Lake. Based on information contained in the expanded site characterization (CDM, 1999), the sludge from the oil drain contained heavy metals, including arsenic, chromium, copper, lead, mercury, selenium, and numerous organic compounds including PAHs.

Regulatory Actions

Removal actions were conducted by the NWOD Working Group under an Administrative Order on Consent for approximately 8.6 miles of the oil drain in 2004 and 2005. These actions consisted of removal and disposal of sediments from the upper 2.2 miles extending from Boy Scout Drive downstream to the city drain and removal and side-cast of sediments from approximately 3000 feet north of the concrete bridge at FBWMA upstream for 5.75 miles. The overall objective of these removal actions was to:

- Minimize current risk to human health and the environment from sediments
- Restore the conveyance capacity of the NWOD

Design work for sediment removal from Segments 2 and 3 is on-going. The recommended clean-up levels for TPH-Diesel Range Organics (DRO) is 100 mg/kg and 300 mg/kg for O&G. Action Levels for TPH-DRO and O&G were previously proposed by the NWOD working group for other portions of the canal and accepted by the Environmental Protection Agency and the State of Utah (Stantec Consulting Inc., 2003). An additional objective is to reduce total lead concentrations as stated in the "*Action Memorandum*"(EPA, 2003a).

Current Land Use

The land surrounding the southern end of the NWOD is industrial or residential. After the NWOD passes the I-215 and Redwood Road intersection, land use becomes predominantly agricultural. Plowed fields and livestock grazing are visible on both sides of the NWOD. As the NWOD approaches the Great Salt Lake, it passes through land previously owned by a duck club, which has since been turned over to the Utah Division of Wildlife Resources. The duck club historically managed the area for wildlife, waterfowl production, and hunting. Upon leaving the duck club property, the NWOD enters FBWMA and flows 15 miles or more before reaching the Great Salt Lake. The FBWMA is currently owned and managed by the Utah Division of Wildlife Resources. The NWOD is currently managed by both Salt Lake County and Salt Lake City. The water level in Farmington Bay has receded over the last decade exposing more upland and drain as compared to 1999 when EPA conducted its initial studies regarding the northern extent of the NWOD. The exposed canal as well as the mouth, where the NWOD discharges into Farmington Bay, is clearly discernible and samples were collected from key locations where contamination was suspected.

2.0 Nature and Extent of Contamination

This section presents the distribution of COPCs identified in the 2011 site investigation for the 0-6" and 12-18" depth intervals. No data were collected for the 6-12" interval. Additional samples were collected from depths of 12-18" at stations FBWMA-17-11, FBWMA-010-11, FBWMA-007-11, and FBWMA-005-11. Note that these location designations have been truncated from those outlined in the SAP. Instead of using the full numeric year at the end of each location designation, only the last two digits were used.

Comparisons were made to co-located sampling locations previously studied by CDM and USFWS. Two locations were selected as reference sites, FBWMA-024-11 and FBWMA-025-11, based on their distance from the impacted area as well as a review of historical documentation indicating that areas further north of the FBWMA had lower COPC levels. Results from the 2011 site investigation are shown in Tables 1 through 3. Historical comparison data from the previous studies conducted by CDM and the USFWS are shown in Table 4. A map depicting the 2011 sampling locations is included in Figure 1.

2.1 Lead

Results from the 2011 site investigation 0-6" depth interval showed that lead concentrations ranged from 28 mg/kg at sampling location FBWMA-021-11 to 325 mg/kg at sampling location FBWMA-019-011 (Table 1). The highest concentrations of lead were noted near the mouth of the canal at sampling locations FBWMA-018-11, FBWMA-019-11, and FBWMA-020-11. Lead concentrations at these sites were 234 mg/kg, 325 mg/kg, and 291 mg/kg, respectively. These locations are approximately 2061 feet to 2615 feet from the mouth of the canal (approximate sampling location FBWMA-021-11). As distance increases from the mouth of the canal outward past the three sampling locations mentioned above, lead concentrations decrease. Most notable decreases in lead concentrations were to the west of the mouth of the canal at sampling locations FBWMA-001-11, FBWMA-002-11, and FBWMA-023-11, where concentrations were typically less than 100 mg/kg. For samples collected at 12-18", lead concentrations ranged from 8.9 mg/kg to 34.7 mg/kg. Results for the 0-6" and 12-18" depths are shown in Table 1.

2.2 Mercury

Mercury concentrations in the 0-6" depth interval ranged from 0.077 mg/kg at site FBWMA-010-11 to 5.3 mg/kg at site FBWMA-019-11 (Table 1). As seen in the lead results for sediment, the highest concentrations of mercury were noted at sampling locations FBWMA-018-11, FBWMA-019-11, and FBWMA-020-11, with mercury concentrations of 2.7 mg/kg, 5.3 mg/kg, and 4 mg/kg, respectively. For sites that were sampled at the 12-18" depth interval, mercury concentrations ranged from 0.077 mg/kg to 0.24 mg/kg. The reference samples at sampling locations FBWMA-024-11 and FBWMA-025-11had concentrations of 0.343 mg/kg and 0.30 mg/kg.

2.3 PAH

Total PAH values for the 0-6" depth interval ranged from 39 ug/kg to 7330 ug/kg (Table 2). Worth noting are the PAH values at sampling locations FBWMA-018-11, FBWMA-019-11, FBWMA-020-11, and FBWMA-022-11 which have total PAH values far exceeding those measured at the other sampling locations during the 2011 site investigation. For the 12-18" depth interval, the total PAH values ranged from 62.4 ug/kg to 116.7 ug/kg. The reference sampling locations FBWMA-024-11 and FBWMA-025-11 had total PAH values of 79.1 ug/kg and 86.7 ug/kg, respectively, and were sampled at the 0-6" depth interval. For each non-detected individual PAH compound, a value of ½ the detection limit was used in the total PAH calculation.

2.4 TPH-DRO

TPH-DRO concentrations for the 0-6" and 12-18" depth intervals were above the action level of 100 mg/kg accepted for the NWOD for all sampling locations (Table 3). TPH-DRO concentrations for the 0-6" depth interval ranged from 124 mg/kg at sampling location FBWMA-003-11 to 10,900 mg/kg at sampling location FBWMA-020-11. The highest concentrations were observed at sampling locations FBWMA-018-11, FBWMA-019-11, and FBWMA-020-11, with concentrations ranging from 5,320 mg/kg to 10,900 mg/kg. For the 12-18" depth interval, TPH-DRO concentrations ranged from 134 mg/kg to 301 mg/kg. The reference sampling locations FBWMA-024-11 and FBWMA-025-11 had TPH-DRO concentrations of 798 mg/kg and 376 mg/kg, respectively.

2.5 Oil and Grease

Table 3 shows that O&G were detected at concentrations above the NWOD action level of 300 mg/kg at sampling locations FBWMA-010-11 (628 mg/kg), FBWMA-013-11 (406 mg/kg), and FBWMA-019-11 (654 mg/kg). O&G were not detected at any other sampling locations during the 2011 event. Figure 2 shows the locations where O&G were detected.

2.6 Historical Comparisons

Results from historical sampling locations co-located with the 2011 sampling locations were available for five sites for mercury and lead. Sampling locations from the 2011 site investigation were compared to USFWS data from 1999 and CDM data from 1998 (Table 4). No comparisons were made for total PAH, TPH-DRO, or O&G since no historical data were available in the original dataset. This may have been due to lost or misplaced samples, unreported data, or because the analysis for these chemicals was not performed. Comparisons were made between historical sampling location 00ODSE03 and the 2011 sampling location FBWMA-009-11. Even though the sampling locations do not match up identically, they are believed to be within close enough proximity to one another to give a useable comparison. Figure 1 shows the sampling locations from the 2011 sampling events and the co-located sampling locations.

3.0 Evaluation of Hazard Quotients

3.1 Data manipulation

The analytical data for TPH-DRO, O&G, lead, and mercury in the 25 surface and 4 subsurface sediment samples collected in 2011were used "as is" in the evaluation, even though all of the Pb values, and four of the Hg values, were flagged as "J" (i.e., estimated). All of the reported concentrations of Pb, Hg (except for one value), and TPH-DRO were also present above their analytical detection limits. A mercury concentration was reported as non-detect in one of the four subsurface sediment samples, but a value of ½ the detection limit was used for data analysis purposes. Only three of the 25 surface sediment samples and none of the four subsurface sediment samples had O&G levels above the detection limit. The database used in the assessment reported the remaining 26 O&G values as "0", with no level of detection indicated. Therefore, these values could not be evaluated further.

The total PAH level in each sediment sample was calculated by summing the concentrations for the following individual PAHs: acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(a)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene. All non-detects for PAH analytes were included in the calculations at one-half of their detection limits.

3.2 Benchmarks

As discussed in Section 1.0 (Introduction), the action levels for TPH-DRO (100 mg/kg) and O&G (300 mg/kg) proposed by the NWOD Working Group were available for use in the data analysis presented in the next subsection.

No such values were proposed for lead, mercury, or total PAHs. Instead, the consensus-based Threshold Effect Concentrations (TECs) developed by MacDonald et al. (2000) were retained for use in the data analysis. These TECs are as follows: lead = 35.8 mg/kg, mercury = 0.18 mg/kg, and total PAHs = 1,610 µg/kg. They should be considered conservative since TECs represent concentrations at which no adverse effects to benthic invertebrates are expected.

3.3 Data analysis

The analytical data for the sediment samples collected from the FBWMA in September 2011 were interpreted in two different ways, as follows:

- *Hazard quotients (HQs)*

  HQs were calculated for the 25 surface and the four subsurface sediment samples by dividing each contaminant level by its respective benchmark. Hence,

$$HQ = \frac{[\text{contaminant}]}{\text{benchmark}}$$

HQs have no units. A value > 1.0 indicates the potential for unacceptable risk to benthic invertebrates. A value <1.0 indicates that levels of risk are acceptable.

- *Correlation analysis*

A correlation analysis was performed on the analytical data of the 25 surface sediment samples to determine if a relationship existed between the concentrations of four of the five contaminants (note: O&G was excluded because only three detected data points were available). The following correlations were performed:

- Pb vs. Hg
- Pb vs. TPH-DRO
- Pb vs. total PAHs
- Hg vs. TPH-DRO
- Hg vs. total PAH
- TPH-DRO vs. total PAHs

Six figures (see further below) were prepared to illustrate the results of this analysis. Each figure also provides the value for r^2 and the statistical significance. The r^2 represents the coefficient of determination, which indicates the proportion (or percentage) of the total variation for the variable on the Y-axis which is accounted for by the fitted model.

4.0 Interpretation

4.1 HQs for surface sediments

Table 5 summarizes the HQs for the 25 surface sediments collected from FBWMA.

Table 8 provides the analytical data used to calculate these HQs. The data can be summarized as follows:

Lead

- The HQs exceeded 1.0 in all 25 surface sediment samples, except for sample FBWMA-021-11.

- The HQs for the two reference samples (i.e., FBWMA-024-11 and FBWMA-025-11) both equaled 2.8 and exceeded many of the Pb HQs for the site samples.

- The HQs were noticeably higher in four sediment samples, namely FBWMA-018-11, FBWMA-019-11, FBWMA-020-11, and FBWMA-022-11.

Mercury

- The HQs exceeded 1.0 in all 25 surface sediment samples, except for samples FBWMA-013-11 and FBWMA-021-11.

- The HQs for the two reference samples (i.e., FBWMA-024-11 and FBWMA-025-11) equaled 1.9 and 1.7, respectively, and were among the lowest measured in the 25 surface sediment samples.

- The HQs were noticeably higher in three sediment samples, namely FBWMA-018-11, FBWMA-019-11, and FBWMA-020-11.

TPH-DRO

- The HQs exceeded 1.0 in all 25 surface sediment samples.

- The HQs for the two reference samples (i.e., FBWMA-024-11 and FBWMA-025-11) equaled 8.0 and 3.8, respectively. The reference HQ of 8.0 exceeded many of the DRO HQs of the site samples.

- The HQs were noticeably higher in four sediment samples, namely FBWMA-018-11, FBWMA-019-11, FBWMA-020-11, and FBWMA-022-11.

Oil & Grease

- Concentrations above the detection limit were available for only three of the 25 surface sediment samples, resulting in HQs ranging between 1.4 and 2.2. HQs could not be derived for either one of the reference samples due to the lack of detection. Not enough O&G data were available to identify patterns or draw conclusions.

Total PAHs

- Sixteen of 23 HQs fell below 1.0. Two samples (FBWMA-15-11 and FBWMA-016-11) were destroyed during shipping to the analytical laboratory. Therefore no data were available to develop HQs for those two samples.

- The HQs for the two reference samples (i.e., FBWMA-024-11 and FBWMA-025-11) were among the lowest measured in the 25 surface sediment samples. They equaled 0.05 and 0.1, respectively.

- The HQs equaled or exceeded 1.0 in sediment samples FBWMA-002-11 (1.0), FBWMA-018-11 (1.3), FBWMA-019-11 (2.3), FBWMA-020-11 (4.6), and FBWMA-022-11 (1.4).

4.2 HQs for subsurface sediments

Table 6 summarizes the HQs for the four subsurface sediments collected from the FBWMA. Table 9 provides the analytical data used to calculate the HQs. The HQs for all five contaminants in all four subsurface sediment samples were lower than the HQs for the same five contaminants in the surface sediment samples collected at the same locations. When compared to their surface sample counterparts, subsurface sediment HQs decreased by <2 to 10.

4.3 Correlations

Figures 3 through 8 show the correlation analyses for the contaminant levels measured in the 25 surface sediment samples collected in 2011. Each figure includes a vertical and horizontal line to indicate the sediment benchmarks for the two contaminants included in the correlation analysis. Note that, by definition, all the data points located to the right of the vertical sediment benchmark line and/or above the horizontal sediment benchmark line have HQs > 1.0. The results can be summarized as follows:

- A statistically significant relationship was found between the concentrations of Pb and Hg ($r^2 = 0.91$, $p < 0.0001$; see Figure 3) and between the concentrations of TPH-DRO and total PAHs ($r^2 = 0.89$, $p < 0.0001$; see Figure 8). The r^2's were substantially lower, but still statistically significant (all p's < 0.0001), between individual metals and organics (see Figures 4 to 7).

- All six figures showed four data points (indicated by an asterisk) with consistently higher contaminant levels. The highest three concentrations came from samples FBWMA-018-11, FBWMA-019-11, and FBWMA-020-11. These three samples were collected next to each other and appear to represent a distinct area of elevated contamination in the FBWMA, what we will refer to as a "hot spot" from this point forward. The remaining high concentration was observed at FBWMA-022-11, located at the mouth of the NWOD. This location may also represent an additional "hot spot".

- Table 7 shows that the strength of the relationships presented in Figures 3 through 8 was largely driven by these four "hot spot" samples. The r^2 dropped substantially in all six correlations when the four "hot spot" data points were removed from the analysis. The statistical significance was also eliminated in four of the six comparisons. This observation further strengthened the view that the sediment at and around these four sampling locations may need further attention.

5.0 Uncertainties

Uncertainties, which are inherent in any evaluation of this nature, need to be identified in order to provide context to the risk management decision-making process. The major uncertainties are discussed below.

- The HQs for Pb, Hg, and total PAHs were calculated using the consensus-based TECs developed by MacDonald et al. (2000). MacDonald et al. (2000) also developed consensus-based Probable Effects Concentrations (PECs), which represent levels at which an effect to benthic invertebrates becomes possible. The PECs are as follows: Pb = 128 mg/kg, Hg = 1.06 mg/kg, and total PAHs = 22,800 µg/kg. A review of the analytical data presented in Table 8 showed the following patterns:

    - The Pb levels in surface sediment just exceeded the PEC for Pb in samples FBWMA-010-11 (135 mg/kg), FBWMA-012-11 (132 mg/kg), and FBWMA-015-11 (129 mg/kg). Greater exceedances of the PEC for Pb were observed in samples FBWMA-018-11 (234 mg/kg), FBWMA-019-11 (325 mg/kg), FBWMA-020-11 (291 mg/kg), and FBWMA-022-11 (162 mg/kg). It was noteworthy that the Pb levels in the two reference samples (FBWMA-024-11 and FBWMA-025-11) were both relatively high at 102 mg/kg each.

    - The Hg levels in surface sediment exceeded the PEC for Hg only in samples FBWMA-018-11 (2.7 mg/kg), FBWMA-019-11 (5.3 mg/kg), and FBWMA-020-11 (4.0 mg/kg).

    - The total PAH levels did not exceed the PEC for total PAHs in any of the 25 surface sediment samples. This pattern suggested that total PAHs were unlikely to be a major risk driver at the FBWMA.

- It was not known if the cleanup goals for TPH-DRO and O&G were originally derived to protect benthic invertebrates. The HQs implicitly assumed that the cleanup goals were risk-based, even though this could not be verified.

- The Pb and TPH-DRO levels measured in the two reference sediment samples were higher than over half of the Pb and TPH-DRO levels measured in the samples collected from the FBWMA area affected by the NWOD. This observation suggested that the FBWMA may be impacted by other contaminant sources not associated with the NWOD, or that contamination from the NWOD migrated farther into the bay than expected. The

presence of relatively high levels of Pb and TPH-DRO in the reference samples represented an uncertainty that should be considered in the management decision-making process. For example, the Pb level in the reference samples equaled 102 mg/kg but 132 mg/kg in sample FBWMA-012-11 (see Table 8). The difference between these two values (132-102 = 30 mg/kg) represents the direct contribution of Pb from the NWOD at this sampling location. This value fell below the TEC for Pb (35.8 mg/kg), which suggested no potential for *site-related* risk, even though the HQ for Pb in FBWMA-012-11 equaled 3.7 (see Table 5).

- No data exist about the bioavailability of the target contaminants to the benthic invertebrate community at the FBWMA. The bioavailability of divalent metals (which includes Pb but not Hg) in sediments is a function of Acid Volatile Sulfides (AVS), Simultaneously Extracted Metals (SEM), and the fraction of organic carbon (f_{oc}) present in the samples (EPA, 2005). The bioavailability of total PAHs in sediments is a function of the organic carbon content of the sample (EPA, 2003b). These variables were not measured in any of the sediment sample collected for the current study. Hence, it was not possible to quantify the bioavailability (and hence the potential for toxicity) of Pb, Hg, and total PAHs to the benthic invertebrate community and help determine if the HQs represented actionable or only hypothetical risk.

- This study compared sediment contaminant levels to TECs and generic cleanup goals. These benchmarks were assumed to protect benthic invertebrates, but did not provide any information on the potential for risk to waterfowl that may feed in the bay and may come in direct or indirect contact with the contaminated sediment. Such an evaluation would need more data related to water depth, the type and abundance of benthic invertebrates or other food items, the kind of bird species present at the FBWMA, the feeding strategies of these bird species, and other exposure-related issues, such as contaminant bioavailability and food chain accumulation. This lack of information represents an important uncertainty that should be considered in the management decision-making process.

6.0 Conclusions

In September 2011, TechLaw collected sediment samples at 25 locations from the FBWMA in the general vicinity of where the NWOD enters in the GSL. Twenty five samples were collected at the sediment surface (0-6" deep) and four more samples were collected from the subsurface (12-18" deep). All of the samples were analyzed for metals, TPH-DRO, O&G, and PAHs. Total PAH was calculated for each sample as the sum of 16 individual PAHs.

The contaminant levels in the surface and subsurface sediment samples were compared against conservative ecotoxicity-based screening benchmarks (Pb, Hg, and total PAHs) or sediment cleanup goals (TPH-DRO and O&G) to calculate HQs and assess the potential for unacceptable risk to benthic invertebrates. A correlation analysis was also used to determine if the levels of Pb, Hg, TPH-DRO and total PAHs measured in surface sediments were associated to each other.

The major findings of the investigation were as follows:

- The contaminant levels in the 23 site-related and two reference surface sediment samples routinely exceeded the ecotoxicity-based screening benchmarks for Pb and Hg (and total PAHs to a much lesser degree). The level of TPH-DRO in all of the sediment samples, including the two reference samples, exceeded its cleanup goal.

- FBWMA-018-11, FBWMA-019-11, and FBWMA-020-11were the three most contaminated surface sediment samples. They were located in the same general area and appeared to represent a distinct area of elevated contamination associated with past releases from the NWOD, which we have termed a "hot spot" for the purposes of this report. Sample FBWMA-022-11, which was the fourth most impacted sample, was collected within the canal just north of the previous sections where remedial action was conducted. The area represented by FBWMA-022-11, as well as the other areas that were sampled during this investigation, were not included in the previous remedial action and should be representative of historical deposition from the drain.

- High r^2's and statistically significant relationships were found between the concentrations of Pb and Hg ($r^2 = 0.91$), and between the concentrations of TPH-DRO and total PAH ($r^2 = 0.87$) using the full 25 surface sediment sample dataset. Weaker but still significant relationships were found between the metals and the organics in the same dataset. However, removing the four "hot spot" samples from the analysis eliminated the statistical significance in four of the six comparisons, which confirmed that the sediment around the four "hot spot" sampling locations may require special attention in the future.

- The contamination measured in the four subsurface (12-18") sediment samples was substantially lower than that measured in the four surface (0-6") sediment samples collected from the same location. This pattern suggested that the historic contaminants released by the NWOD may be mostly confined to the "biotic active zone" in the top 6" of the sediment in the FBWMA.

Not enough data were available to determine if the exceedances of the various benchmarks and cleanup goals observed in this study represented actionable risk. However, there is enough information to suggest that sediment in Farmington Bay is potentially impacted by contaminants from the NWOD. Additional investigation should be performed by the NWOD working group to determine whether an actionable risk to the environment exists. This may include (but is not limited to) measuring AVS, SEM, and f_{oc}, and sediment toxicity testing. Sediment exposure to other receptors, such as migratory birds, may need to be evaluated as well. Finally, two points should be considered during the planning process for future investigation associated with the NWOD: 1) the FBMWA may be impacted by other contamination sources not associated with the NWOD, and 2) contamination from the NWOD may have migrated further into the Bay than expected.

7.0 References

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Table 1. Analytical Results for Metals (mg/kg) - 2011 Northwest Oil Drain Site Investigation

Location	Depth	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
FBWMA-001-11	0-6 inches	2340	8.4UJ	11.5J+	122	0.7U	0.7U	234000J	7J+	2.2J	45J+	3180	54.8J	12800J	180J+	0.31	3.7J	1230	3.4J	1.4U	5270	3.5U	9J	59.3J+
FBWMA-002-11	0-6 inches	3150	9.2UJ	14.6J+	167	0.77U	1.2	212000J	10.9J+	7.4J	58.5J+	4040	64.4J	16300J	205J+	0.3	9.2J	1550	4.5J	2	6260	0.27J	16.4J	78.1J+
FBWMA-003-11	0-6 inches	9180	11UJ	21.2J+	211	0.94U	0.94U	185000J	15.9J+	4.4J	52.2J+	9620	77.9J	23700J	367J+	0.36	9.6J	3820	4.4J	1.9U	8080	4.7U	20.4J	107J+
FBWMA-004-11	0-6 inches	7380	17UJ	24.1J+	226	1.4U	2.3	205000J	29.8J+	5.1J	133J+	8730	110J	28400J	407J+	0.95	11.8J	3640	4.3J	5	13000	7U	25.1J	210J+
FBWMA-005-11	0-6 inches	7080	17UJ	23.6J+	258	1.4U	1.8	174000J	21.6J+	4.1J	121J+	7980	73.8J	31500J	370J+	0.34	11.5J	3680	3.9J	2.9	13900	6.9U	24.1J	158J+
FBWMA-005-11	12-18 inches	8010	9.9UJ	22.4J+	239	0.83U	0.86	168000J	13.7J+	3.9J	34.4J+	7850	34.7J	26800J	341J+	0.24	8J	3380	3.8J	1.7U	10900	4.1U	18.9J	78.6J+
FBWMA-006-11	0-6 inches	7600	12UJ	21.1J+	135	1.8U	2.1	135000J	25.9J+	4.2J	125J+	8480	80.4J	26400J	347J+	0.43	11.3J	3780	4.3J	3.6U	14500	9.1U	24J	189J+
FBWMA-007-11	0-6 inches	8130	17UJ	30.5J+	260	1.4U	1.4U	178000J	19.6J+	4.1J	73.2J+	8980	74.8J	24000J	370J+	0.42	9.8J	3690	4.9J	2.9U	11800	7.1U	20.5J	128J+
FBWMA-007-11	12-18 inches	10300	13UJ	31.1J+	237	1.1U	1.1U	190000J	15.8J+	4.3J	34.1J+	10300	30.5J	26000J	407J+	0.15J	9.6J	4290	3.3J	2.1U	9260	5.3U	30.8J	76.2J+
FBWMA-008-11	0-6 inches	10800	12UJ	21.8J+	208	0.99U	0.99U	198000J	15.9J+	4.4J	51J+	16700	104J	24700J	391J+	0.57	9.9J	4280	3.3J	2U	7860	4.9U	21.6J	136J+
FBWMA-009-11	0-6 inches	9610	24UJ	23.1J+	238	2U	3.1	143000J	36.5J+	5.4J	155J+	18880	117J	26300J	402J+	8.84	13.9J	4330	5.6J	5.2	14300	10U	28.9J	246J+
FBWMA-010-11	0-6 inches	10200	16UJ	21.8J+	226	1.3U	2.3	185000J	28.8J+	5.1J	134J+	11600	135J	24100J	377J+	0.95	11.5J	4900	3.5J	4.3	10700	6.5U	22.8J	238J+
FBWMA-010-11	12-18 inches	10300	12UJ	22.3J+	225	0.97U	0.97U	195000J	14.2J+	4.4J	22.1J+	10700	20.4J	26700J	420J+	0.077J	9.6J	4470	3.1J	1.9U	10400	4.9U	10.4J	67.6J+
FBWMA-011-11	0-6 inches	9710	18UJ	23.4J+	264	1.5U	2.2	140000J	27.9J+	4.7J	125J+	10300	85.9J	33400J	440J+	0.46	13.1J	4470	4.1J	3.6	12800	7.5U	28.9J	188J+
FBWMA-012-11	0-6 inches	11700	20UJ	25.1J+	239	1.6U	2.5	143000J	38.1J+	5.8J	147J+	13100	132J	25800J	412J+	0.95	13.2J	4840	4.7J	5.4	10600	8.2U	26.2J	246J+
FBWMA-013-11	0-6 inches	3240J	8.4U	16.7J+	185J+	0.16J+	0.67J+	160000J	8.6J+	2.8J+	29.1J+	5230J	49.9J	20600J	278J+	0.11J	4.5J+	1140J	3.7J+	1.8J+	3330J	3.5U	9.7J+	62.2J+
FBWMA-014-11	0-6 inches	9050J	16U	21.7J+	243J+	0.42J+	2.2J+	130000J	25.2J+	4.6J+	115J+	9780J	83.4J	33100J	430J+	0.53	12.3J+	4110J	4.2J+	3.6J+	10800J	6.7U	26.6J+	182J+
FBWMA-015-11	0-6 inches	10000J	17U	20.6J+	213J+	0.44J+	2.3J+	142000J	28.2J+	5J+	134J+	11600J	129J	25800J	375J+	0.79	11.8J+	4260J	3.8J+	4.3J+	10900J	7.1U	24.8J+	232J+
FBWMA-016-11	0-6 inches	9040J	18U	21.6J+	219J+	0.41J+	2.2J+	122000J	25.5J+	4.8J+	114J+	9640J	85.6J	30900J	402J+	0.61	11.8J+	4070J	3.4J+	3.8J+	10800J	7.6U	26.3J+	184J+
FBWMA-017-11	0-6 inches	11000J	16U	31.5J+	186J+	0.47J+	1.4J+	154000J	23.7J+	5.2J+	62.9J+	11400J	80.5J	26300J	430J+	0.44	14.9J+	4340J	3.7J+	3J+	8180J	6.7U	25J+	127J+
FBWMA-017-11	12-18 inches	11300J	11U	25.8J+	212J+	0.5J+	0.46J+	66500J	14.2J+	5J+	12.1J+	11900J	8.9J	29300J	472J+	0.19U	10.5J+	4670J	2.4J+	1.9J	8780J	4.8U	21.1J+	57.4J+
FBWMA-018-11	0-6 inches	11200J	17U	20.7J+	346J+	0.66J+	4.9J+	98700J	79.5J+	7.3J+	220J+	14180J	234J	22200J	348J+	2.7	18.3J+	4690J	3.5J+	16.6J+	9860J	7.1U	31.4J+	445J+
FBWMA-019-11	0-6 inches	8980J	11U	20.2J+	317J+	0.8J+	10.5J+	96300J	117J+	8.1J+	349J+	14100J	325J	16600J	252J+	5.3	38.8J+	3400J	3.3J+	24.9J+	5750J	4.5U	63.2J+	576J+
FBWMA-020-11	0-6 inches	12880J	15U	21.1J+	258J+	1.5J+	7.7J+	104000J	103J+	8.3J+	224J+	16380J	291J	19980J	322J+	4	27.2J+	5040J	3.3J+	19.1J+	9350J	6.1U	79.3J+	529J+
FBWMA-021-11	0-6 inches	10880J	10U	26.8J+	252J+	0.41J+	0.73J+	221000J	14.9J+	4.7J+	23.2J+	10880J	28.4J	38900J	338J+	0.098J	10.3J+	3390J	3.8J+	1.7J+	3180J	4.4U	21.8J+	73.3J+
FBWMA-022-11	0-6 inches	9490J	11U	12.4J+	218J+	0.45J+	3.1J+	90200J	78J+	5.2J+	178J+	11800J	182J	17600J	284J+	0.75	18.7J+	3850J	3.1J+	10.9J+	10400J	4.8U	20.7J+	274J+
FBWMA-023-11	0-6 inches	2640J	8.5U	16.8J+	228J+	0.12J+	0.38J+	226000J	4.8J+	2.8J+	28.6J+	3500J	42.4J	30700J	467J+	0.19	4J+	1370J	3.8J+	1.4J	6160J	3.5U	11.5J+	54.8J+
FBWMA-024-11	0-6 inches	12400J	20U	17.3J+	173J+	0.51J+	1.7J+	130000J	23.4J+	6.2J+	99.2J+	13800J	102J	28500J	698+	0.34	14J+	4270J	3.3J+	3.4J	3660J	8.4U	29.9J+	183J+
FBWMA-025-11	0-6 inches	14880J	15U	17.5J+	175J+	0.63J+	1.4J+	123000J	21J+	5.8J+	79.5J+	15500J	162J	32400J	463J+	8.3	12.7J+	5220J	2.8J+	2.5J	4920J	6.3U	28.7J+	157J+

Notes:
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+ = The result is an estimated quantity, but the results may be biased high.

Table 2. Analytical Results for Polyaromatic Hydrocarbons (ug/kg dry weight) - 2011 Northwest Oil Drain Site Investigaion

Location	Depth	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene
FBWMA-001-11	0-6 inches	6.3	1.8J	6U	6.6	5.4J	2.9J
FBWMA-002-11	0-6 inches	77U	19J	21J	63J	110	110
FBWMA-003-11	0-6 inches	6.7U	6.7U	6.7U	4J	6.7J	3.1J
FBWMA-004-11	0-6 inches	99U	99U	99U	99U	99U	99U
FBWMA-005-11	0-6 inches	94U	94U	94U	94U	94U	94U
FBWMA-005-11	12-18 inches	5.6U	5.6U	5.6U	5.6U	2.4J	3J
FBWMA-006-11	0-6 inches	120UJ	120UJ	120UJ	120UJ	120UJ	120UJ
FBWMA-007-11	0-6 inches	9.8U	9.8U	9.8U	5.4J	8.7J	6J
FBWMA-007-11	12-18 inches	7.2U	1.5J	7.2U	1.8J	2.1J	7.2U
FBWMA-008-11	0-6 inches	6.7U	6.7U	6.7U	3.4J	4.2J	2J
FBWMA-009-11	0-6 inches	130UJ	130UJ	130UJ	130UJ	130UJ	130UJ
FBWMA-010-11	0-6 inches	40U	40U	40U	33J	63	39J
FBWMA-010-11	12-18 inches	6.4U	6.4U	6.4U	4.4J	7.8	5.1J
FBWMA-011-11	0-6 inches	110U	110U	110U	110U	110U	110U
FBWMA-012-11	0-6 inches	10U	10U	10U	11	16	13
FBWMA-013-11	0-6 inches	14U	14U	3J	45	19	32
FBWMA-014-11	0-6 inches	90U	90U	90U	90U	90U	90U
FBWMA-017-11	0-6 inches	9.2U	9.2U	9.2U	7.2J	7.1J	5.8J
FBWMA-017-11	12-18 inches	6.3U	6.3U	6.3U	6.3U	6.3U	6.3U
FBWMA-018-11	0-6 inches	93U	93U	93U	110	96	160
FBWMA-019-11	0-6 inches	120U	120U	110J	140	210	550
FBWMA-020-11	0-6 inches	320U	470	250J	550	400	310J
FBWMA-021-11	0-6 inches	8.4	3.6J	3.7J	35	12	10
FBWMA-022-11	0-6 inches	76U	76U	32J	100	160	120
FBWMA-023-11	0-6 inches	4.5U	4.5U	4.5U	4.5U	4.5U	0.97J
FBWMA-024-11	0-6 inches	11U	11U	11U	11U	11U	3J
FBWMA-025-11	0-6 inches	7.6U	7.6U	7.6U	2.4J	2.8J	5.3J

Notes:

U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

Table 2. Analytical Results for Polyaromatic Hydrocarbons (ug/kg dry weight) - 2011 Northwest Oil Drain Site Investigaion

Location	Depth	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene
FBWMA-001-11	0-6 inches	6	6U	1.4J	18	6UJ
FBWMA-002-11	0-6 inches	130	86	31J	310	77U
FBWMA-003-11	0-6 inches	9.2	6.7U	1.7J	16	6.7UJ
FBWMA-004-11	0-6 inches	99U	99U	99U	44J	99U
FBWMA-005-11	0-6 inches	94U	94U	94U	94U	94U
FBWMA-005-11	12-18 inches	7	5.6U	1.3J	13	5.6UJ
FBWMA-006-11	0-6 inches	120UJ	120UJ	120UJ	120UJ	120UJ
FBWMA-007-11	0-6 inches	9.4J	9.8U	9.8U	20	9.8UJ
FBWMA-007-11	12-18 inches	3.7J	7.2U	7.2U	6J	7.2UJ
FBWMA-008-11	0-6 inches	7.7	6.7U	1.4J	14	6.7U
FBWMA-009-11	0-6 inches	130UJ	130UJ	130UJ	47J	130UJ
FBWMA-010-11	0-6 inches	55	43	9.7J	120	40U
FBWMA-010-11	12-18 inches	8.4	7.1	1.6J	17	6.4U
FBWMA-011-11	0-6 inches	110U	110U	110U	27J	110U
FBWMA-012-11	0-6 inches	19	17	3.5J	35	10UJ
FBWMA-013-11	0-6 inches	34	110	5.1J	49	50J
FBWMA-014-11	0-6 inches	90U	90U	90U	26J	90U
FBWMA-017-11	0-6 inches	10	10	2.7J	20	9.2UJ
FBWMA-017-11	12-18 inches	6.3U	6.3U	6.3U	6.3U	6.3U
FBWMA-018-11	0-6 inches	180	270	34J	400	100
FBWMA-019-11	0-6 inches	430	270	78J	490	140
FBWMA-020-11	0-6 inches	260J	150J	320U	590	110J
FBWMA-021-11	0-6 inches	16	5.7UJ	3.7J	30	11J
FBWMA-022-11	0-6 inches	150	110	38J	410	76U
FBWMA-023-11	0-6 inches	1.9J	4.5U	4.5U	3.2J	4.5U
FBWMA-024-11	0-6 inches	5.5J	11U	2.7J	5.4J	11U
FBWMA-025-11	0-6 inches	8.1	7.6UJ	3.2J	11J	7.6UJ

Notes:

U = The analyte was analyzed for, b

J = The result is an estimated quanti

Table 2. Analytical Results for Polyaromatic Hydrocarbons (ug/kg dry weight) - 2011 Northwest Oil Drain Site Investigaion

Location	Depth	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	Total PAHs
FBWMA-001-11	0-6 inches	13	6U	6U	6U	46	21J	131
FBWMA-002-11	0-6 inches	120	28J	48J	77U	170	330	1395
FBWMA-003-11	0-6 inches	12	6.7U	6.7U	6.7U	19	16J	97
FBWMA-004-11	0-6 inches	99U	99U	99U	99U	99U	33J	869
FBWMA-005-11	0-6 inches	94U	94U	94U	94U	94U	94U	940
FBWMA-005-11	12-18 inches	3J	5.6U	5.6U	5.6U	5.6U	7.5J	57
FBWMA-006-11	0-6 inches	120UJ	120UJ	120UJ	120UJ	120UJ	120UJ	1200
FBWMA-007-11	0-6 inches	11	9.8U	9.8U	9.8U	14	22J	117
FBWMA-007-11	12-18 inches	4.5J	7.2U	7.2U	7.2U	8.2	8.1J	60
FBWMA-008-11	0-6 inches	10	6.7U	6.7U	6.7U	12	14	80
FBWMA-009-11	0-6 inches	130UJ	130UJ	130UJ	130UJ	130UJ	41J	1128
FBWMA-010-11	0-6 inches	67	40U	40U	40U	66	140	648
FBWMA-010-11	12-18 inches	9.1	6.4U	6.4U	6.4U	17	20	100
FBWMA-011-11	0-6 inches	110U	110U	110U	110U	110U	110U	1017
FBWMA-012-11	0-6 inches	17	10U	13	10U	26	39J	187
FBWMA-013-11	0-6 inches	14J	14U	58	14U	14U	45J	296
FBWMA-014-11	0-6 inches	90U	90U	90U	90U	90U	90U	836
FBWMA-017-11	0-6 inches	8.5J	9.2U	9.2U	9.2U	11	18J	105
FBWMA-017-11	12-18 inches	6.3U	6.3U	6.3U	6.3U	6.3U	6.3U	63
FBWMA-018-11	0-6 inches	89J	93U	150	93U	93U	340	1574
FBWMA-019-11	0-6 inches	180	120U	260	120U	120U	580J	2650
FBWMA-020-11	0-6 inches	480	320U	160J	320U	2300	820J	6200
FBWMA-021-11	0-6 inches	11	15	16	5.7U	140	39	309
FBWMA-022-11	0-6 inches	170	39J	76J	76U	200	460	1811
FBWMA-023-11	0-6 inches	1.5J	4.5U	4.5U	4.5U	6.5	2.3J	37
FBWMA-024-11	0-6 inches	3.7J	11U	11U	11U	11U	3.8J	82
FBWMA-025-11	0-6 inches	7.3J	2.3J	7.1J	7.6U	8.5	9.7J	65

Notes:

U = The analyte was analyzed for, bı

J = The result is an estimated quanti

Table 3. Analytical Results for TPH-DRO/Oil and Grease (mg/kg dry weight) - 2011 Northwest Oil Drain Site Investigation

Location	Sample Depth	TPH-DRO	Oil & Grease[a]
FBWMA-001-11	0-6 inches	181	0
FBWMA-002-11	0-6 inches	152	0
FBWMA-003-11	0-6 inches	124	0
FBWMA-004-11	0-6 inches	521	0
FBWMA-005-11	0-6 inches	539	0
FBWMA-005-11	12-18 inches	134	0
FBWMA-006-11	0-6 inches	559	0
FBWMA-007-11	0-6 inches	361	0
FBWMA-007-11	12-18 inches	145	0
FBWMA-008-11	0-6 inches	253	0
FBWMA-009-11	0-6 inches	1180	0
FBWMA-010-11	0-6 inches	1360	628
FBWMA-010-11	12-18 inches	139	0
FBWMA-011-11	0-6 inches	425	0
FBWMA-012-11	0-6 inches	573	0
FBWMA-013-11	0-6 inches	392	406
FBWMA-014-11	0-6 inches	2360	0
FBWMA-015-11	0-6 inches	1790	0
FBWMA-016-11	0-6 inches	797	0
FBWMA-017-11	0-6 inches	1130	0
FBWMA-017-11	12-18 inches	301	0
FBWMA-018-11	0-6 inches	5320	0
FBWMA-019-11	0-6 inches	6140	654
FBWMA-020-11	0-6 inches	10900	0
FBWMA-021-11	0-6 inches	329	0
FBWMA-022-11	0-6 inches	4080	0
FBWMA-023-11	0-6 inches	330	0
FBWMA-024-11	0-6 inches	798	0
FBWMA-025-11	0-6 inches	376	0

a: In many cases the result fell below the dectection limit, but was reported by the analytical laboratory as "0". No detection limit was provided.

Table 4. Historical Data from Collocated Sampling Locations - 2011 Northwest Oil Drain Site Investigation

Sampling Locations and Source	Lead (mg/kg)	Mercury (mg/kg)	Total PAH (ug/kg)	TPH-DRO (mg/kg)	Oil and Grease (mg/kg)
FBWMA-022-11 (EPA,2011)	162	0.75	2179	4080	Not Detected[3]
98NW-WET13-NSO-06 (CDM, 1998)	132	1.9	No Comparable Data[1]	No Data[2]	No Data
FBWMA-021-11 (EPA,2011)	28.4	0.098	351.7	329	Not Detected
00ODSE06 (USFWS)	149	0.765	No Comparable Data	No Data	No Data
FBWMA-020-11 (EPA,2011)	291	4	7330	10900	Not Detected
00ODSE02 (USFWS)	409	6.17	No Comparable Data	No Data	No Data
FBWMA-009-11 (EPA,2011)	117	0.84	998	1180	Not Detected
00ODSE03 (USFWS)	181	1.05	No Comparable Data	No Data	No Data
FBWMA-012-11 (EPA,2011)	132	0.95	234.5	573	Not Detected
00ODSE01 (USFWS)	122	1.01	No Comparable Data	No Data	No Data

Notes:
1 = Historical data for a location that is comparable to that of the 2011 site investigation was not available.
2 = No data was collected as a part of this investigation.
3 = The analyte was not detected in the sample above the method detection limit.

Table 5. Hazard Quotients for Surface Sediment Samples - 2011 Northwest Oil Drain Site Assessment

Location	Lead	Mercury	TPH-DRO	O&G	Total PAH
Reference Locations					
FBWMA-24-11	**2.8**	**1.9**	**8.0**	--	0.05
FBWMA-25-11	**2.8**	**1.7**	**3.8**	--	0.1
Site Locations					
FBWMA-001-11	**1.5**	**1.7**	**1.8**	--	0.1
FBWMA-002-11	**1.8**	**1.7**	**1.5**	--	**1.0**
FBWMA-003-11	**2.2**	**2**	**1.2**	--	0.1
FBWMA-004-11	**3.1**	**5.3**	**5.2**	--	0.5
FBWMA-005-11	**2.1**	**1.9**	**5.4**	--	0.5
FBWMA-006-11	**2.2**	**2.4**	**5.6**	--	0.6
FBWMA-007-11	**2.1**	**2.3**	**3.6**	--	0.1
FBWMA-008-11	**2.9**	**3.2**	**2.5**	--	0.1
FBWMA-009-11	**3.3**	**4.7**	**11.8**	--	0.6
FBWMA-010-11	**3.8**	**5.3**	**13.6**	**2.1**	0.5
FBWMA-011-11	**2.4**	**2.6**	**4.3**	--	0.5
FBWMA-012-11	**3.7**	**5.3**	**5.7**	--	0.1
FBWMA-013-11	**1.4**	0.6	**3.9**	**1.4**	0.3
FBWMA-014-11	**2.3**	**2.9**	**23.6**	--	0.4
FBWMA-015-11	**3.6**	**4.4**	**17.9**	--	NA
FBWMA-016-11	**2.4**	**3.4**	**8.0**	--	NA
FBWMA-017-11	**1.7**	**2.4**	**11.3**	--	0.1
FBWMA-018-11	**6.5**	**15.0**	**53.2**	--	**1.3**
FBWMA-019-11	**9.1**	**29.4**	**61.4**	**2.2**	**2.3**
FBWMA-020-11	**8.1**	**22.2**	**109**	--	**4.6**
FBWMA-021-11	0.8	0.5	**3.3**	--	0.2
FBWMA-022-11	**4.5**	**4.2**	**40.8**	--	**1.4**
FBWMA-023-11	**1.2**	**1.1**	**3.3**	--	0.02

Notes:

- - = analyzed but was reported as "0" as value fell below the Method Detection Limit (MDL), even though the MDL was not reported. Hazard Quotient could not be calculated

NA = not analyzed and HQ could not be calculated

Bold values reflect HQ>1

Table 6. Surface and Subsurface Sediment Hazard Quotient Comparison - 2011 Northwest Oil Drain Site Investigation

Location	Lead		Mercury		TPH-DRO		O&G		Total PAH	
Sampling Depth	0-6"	12-18'	0-6"	12-18'	0-6"	12-18'	0-6"	12-18'	0-6"	12-18'
FBWMA-005-11	**2.1**	0.97	**1.9**	**1.3**	**5.4**	**1.3**	--	--	0.5	0.04
FBWMA-007-11	**2.1**	0.9	**2.3**	0.8	**3.6**	**1.5**	--	--	0.1	0.04
FBWMA-010-11	**3.8**	0.6	**5.3**	0.4	**13.6**	**1.4**	--	--	0.5	0.1
FBWMA-017-11	**1.7**	0.2	**2.4**	0.5	**11.3**	**3.0**	--	--	0.1	0.03

Notes:

- - = analyzed but no value reported and HQ could not be calculated

NA = not analyzed and HQ could not be calculated

Bold values reflect HQ>1

Table 7. Coefficients of Determination (r^2) for Surface Sediment Samples - 2011 Northwest Oil Drain Site Investigation

Comparison[a]	All data, including "hot spots"[b]	All data, excluding "hot spots"[c,d]
Pb vs. Hg	0.91	0.76
Pb vs. TPH-DRO	0.78	0.18
Pb vs. total PAHs	0.66	0.01
Hg vs. TPH-DRO	0.74	0.22
Hg vs. total PAHs	0.66	0.05
TPH-DRO vs. total PAHs	0.89	0.03

Notes:

a = See Figures 3-8

b = See r2 values provided in Figures 3-8

c = Correlation analysis not shown

d = the "hot spots" consist of sampes FBWMA-018-11, FBWMA-019-11, FBWMA-020-11, and FBWMA-022-11

Table 8. Analytical Data and Hazard Quotients for Surface Sediment Samples (0-6") - 2011 Northwest Oil Drain Site Investigation

Benchmark[a]	Lead 35.8 mg/kg			Mercury 0.18 mg/kg			TPH-DRO 100 mg/kg			Oil and Greasse 300 mg/kg			Total PAH 1610 ug/kg		
		Value			Value			Value			Value			Value	
Sample location	Result	Used	HQ	Result	Used	HQ	Result	Used	HQ	Result[b]	Used	HQ	Result	Used	HQ
Reference Locations															
FBWMA-024-11	102J	102	2.8	0.34	0.34	1.9	798	798	8.0	0	0	0.0	79.1	79.1	0.05
FBWMA-025-11	102J	102	2.8	0.3	0.3	1.7	376	376	3.8	0	0	0.0	86.7	86.7	0.1
Site Locations															
FBWMA-001-11	54.8J	54.8	1.5	0.31	0.31	1.7	181	181	1.8	0	0	0.0	140	140.1	0.1
FBWMA-002-11	64.4J	64.4	1.8	0.3	0.3	1.7	152	152	1.5	0	0	0.0	1653	1653	**1.0**
FBWMA-003-11	77.9J	77.9	2.2	0.36	0.36	2.0	124	124	1.2	0	0	0.0	111	111.15	0.1
FBWMA-004-11	110J	110	3.1	0.95	0.95	5.3	521	521	5.2	0	0	0.0	770	770	0.5
FBWMA-005-11	73.8J	73.8	2.1	0.34	0.34	1.9	539	539	5.4	0	0	0.0	752	752	0.5
FBWMA-006-11	80.4J	80.4	2.2	0.43	0.43	2.4	559	559	5.6	0	0	0.0	960	960	0.6
FBWMA-007-11	74.8J	74.8	2.1	0.42	0.42	2.3	361	361	3.6	0	0	0.0	136	135.7	0.1
FBWMA-008-11	104J	104	2.9	0.57	0.57	3.2	253	253	2.5	0	0	0.0	92.2	92.15	0.1
FBWMA-009-11	117J	117	3.3	0.84	0.84	4.7	1180	1180	11.8	0	0	0.0	998	998	0.6
FBWMA-010-11	135J	135	3.8	0.95	0.95	5.3	1360	1360	13.6	0	0	0.0	756	755.7	0.5
FBWMA-011-11	85.9J	85.9	2.4	0.46	0.46	2.6	425	425	4.3	0	0	0.0	852	852	0.5
FBWMA-012-11	132J	132	3.7	0.95	0.95	5.3	573	573	5.7	0	0	0.0	235	234.5	0.1
FBWMA-013-11	49.9J	49.9	1.4	0.11J	0.11	0.6	392	392	3.9	0	0	0.0	492	492.1	0.3
FBWMA-014-11	83.4J	83.4	2.3	0.53	0.53	2.9	2360	2360	23.6	0	0	0.0	701	701	0.4
FBWMA-015-11	129J	129	3.6	0.79	0.79	4.4	1790	1790	17.9	0	0	0.0	--[c]	--c	--
FBWMA-016-11	85.6J	85.6	2.4	0.61	0.61	3.4	797	797	8.0	0	0	0.0	--	--	--
FBWMA-017-11	60.5J	60.5	1.7	0.44	0.44	2.4	1130	1130	11.3	0	0	0.0	128	127.9	0.1
FBWMA-018-11	234J	234	6.5	2.7	2.7	15.0	5320	5320	53.2	0	0	0.0	2162	2161.5	1.3
FBWMA-019-11	325J	325	9.1	5.3	5.3	29.4	6140	6140	61.4	0	0	0.0	3678	3678	2.3
FBWMA-020-11	291J	291	8.1	4	4	22.2	10900	10900	109	0	0	0.0	7330	7330	4.6
FBWMA-021-11	28.4J	28.4	0.8	0.098J	0.098	0.5	329	329	3.3	0	0	0.0	352	351.7	0.2
FBWMA-022-11	162J	162	4.5	0.75	0.75	4.2	4080	4080	40.8	0	0	0.0	2179	2179	1.4
FBWMA-023-11	42.4J	42.4	1.2	0.19	0.19	1.1	330	330	3.3	0	0	0.0	38.9	38.87	0.02

Notes:

a = Benchmark sources: Pb, Hg and PAH: MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31; TPH and Oil and Grease: Cleanup level developed for the Northwest Oil Drain and reported in the Removal Action Work Plan (Stantec, 2003).

b: The result fell below the dectection limit, but was reported by the analytical laboratory as "0". No detection limit was provided.

c: No data was provided, therefore no HQ could be calculated.

J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

Note that "result" indicates the analytical result reported by the laboratory. "Value used" indicates the numeric value used to calculate the hazard quotient.

Bold type indicates HQ>1.

Table 9. Analytical Data and Hazard Quotients for Subsurface Sediments (12-18") - 2011 Northwest Oil Drain Site Investigation

Benchmark[a]	Lead 35.8 mg/kg			Mercury 0.18 mg/kg			TPH-DRO 100 mg/kg			Oil and Greasse 300 mg/kg			Total PAH 1610 ug/kg		
		Value			Value			Value			Value			Value	
Sample location	Result	Used	HQ	Result	Used	HQ	Result	Used	HQ	Result[b]	Used	HQ	Result	Used	HQ
FBWMA-005-11	34.7J	34.7	0.97	0.24	0.24	**1.3**	134	134	**1.3**	0	0	0.0	62.4	62.4	0.04
FBWMA-007-11	30.5J	30.5	0.9	0.15J	0.25	0.8	145	145	**1.5**	0	0	0.0	64.7	64.7	0.04
FBWMA-010-11	20.4J	20.4	0.6	0.077J	0.077	0.4	139	139	**1.4**	0	0	0.0	116.7	116.7	0.1
FBWMA-017-11	8.9J	8.9	0.2	0.19U	0.095	0.5	301	301	**3.0**	0	0	0.0	50.4	50.4	0.03

Notes:

a = Benchmark sources: Pb, Hg and PAH: MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31; TPH and Oil and Grease: Cleanup level developed for the Northwest Oil Drain and reported in the Removal Action Work Plan (Stantec, 2003).

b: The result fell below the dectection limit, but was reported by the analytical laboratory as "0". No detection limit was provided.

U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

Note that "result" indicates the analytical result reported by the laboratory. "Value used" indicates the numeric value used to calculate the hazard quotient. Bold type indicates HQ>1.

Figure 3: Relationship between lead and mercury levels in surface sediments (0-6") collected at the Farmington Bay Waterfowl Management Area in September 2011

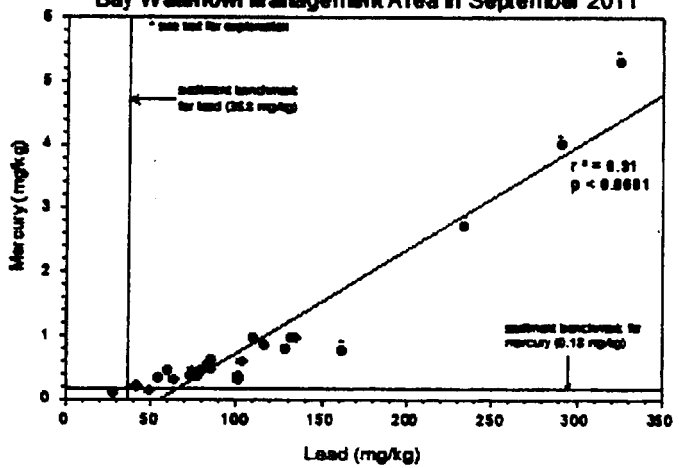


Figure 4: Relationship between lead and TPH-DRO levels in surface sediments (0-6") collected at the Farmington Bay Waterfowl Management Area in September 2011

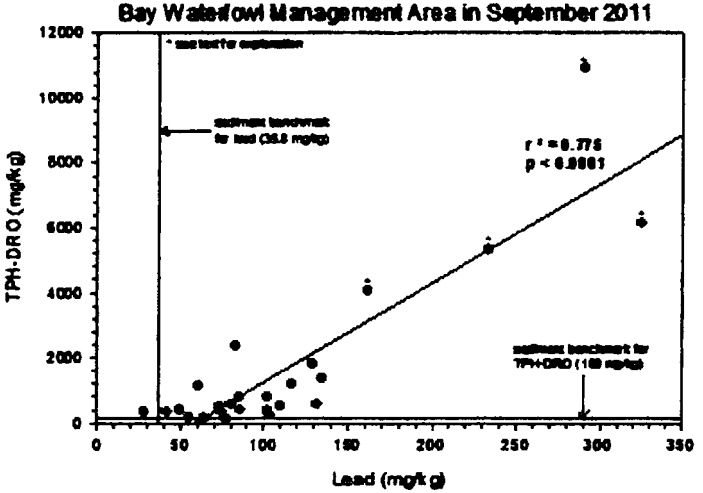


Figure 5: Relationship between lead and Total PAHs in surface sediments (0-6") collected at the Farmington Bay Waterfowl Management Area in September 2010

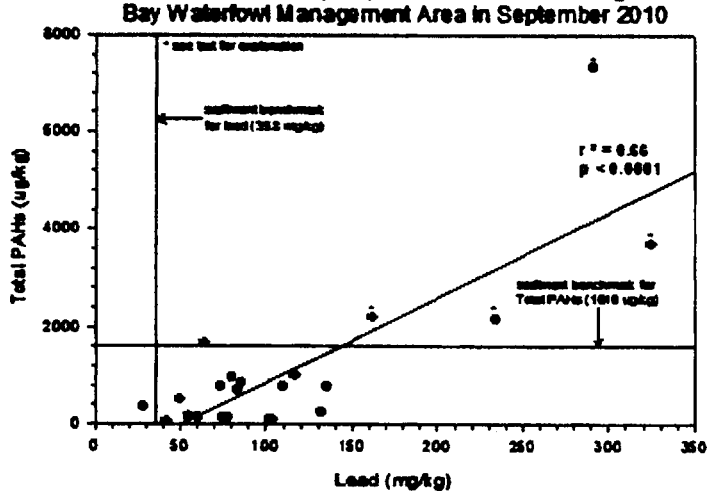


Figure 6: Relationship between mercury and TPH-DRO levels in surface sediments (0-6") collected at the Farmington Bay Waterfowl Management Area in September 2011

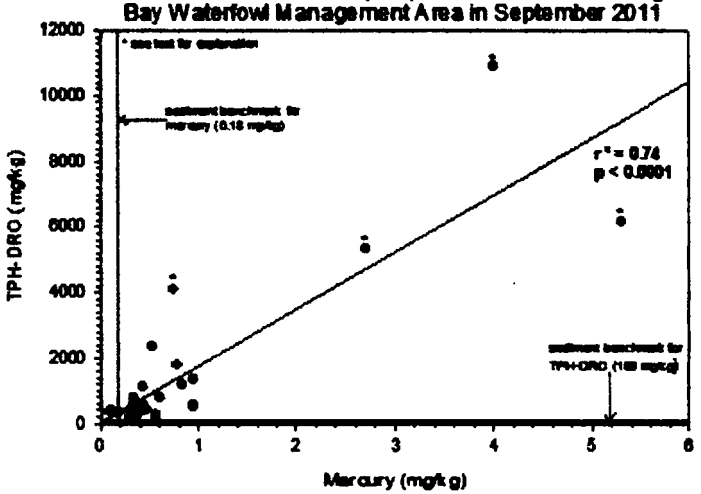


Figure 7: Relationship between mercury and Total PAHs in surface sediments (0-6") collected at the Farmington Bay Waterfowl Management Area in September 2011

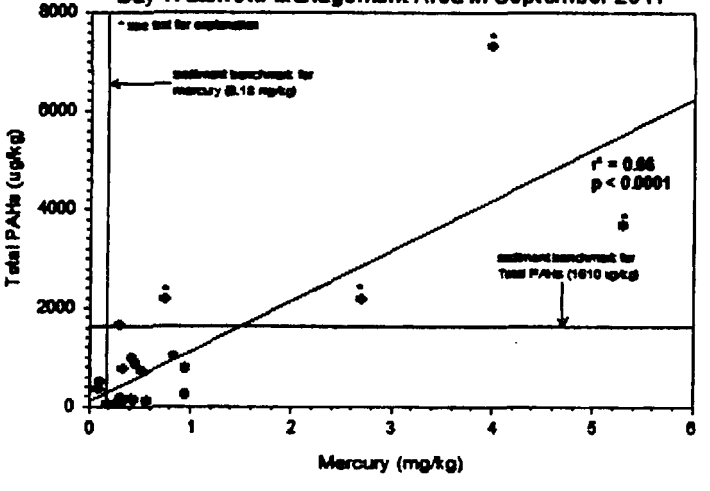
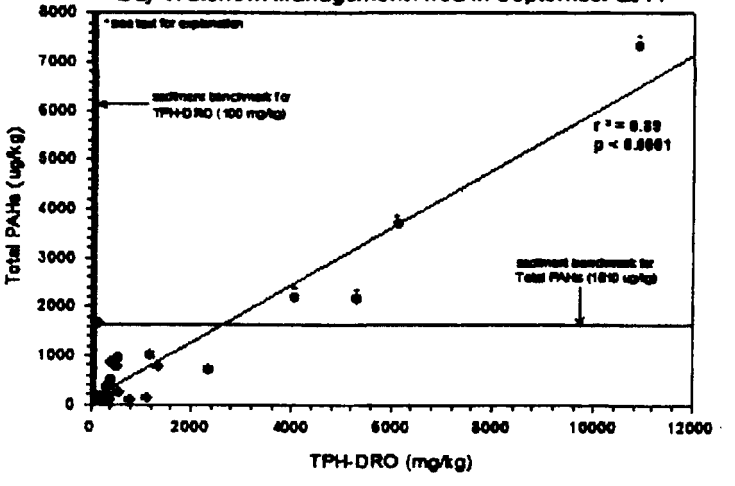
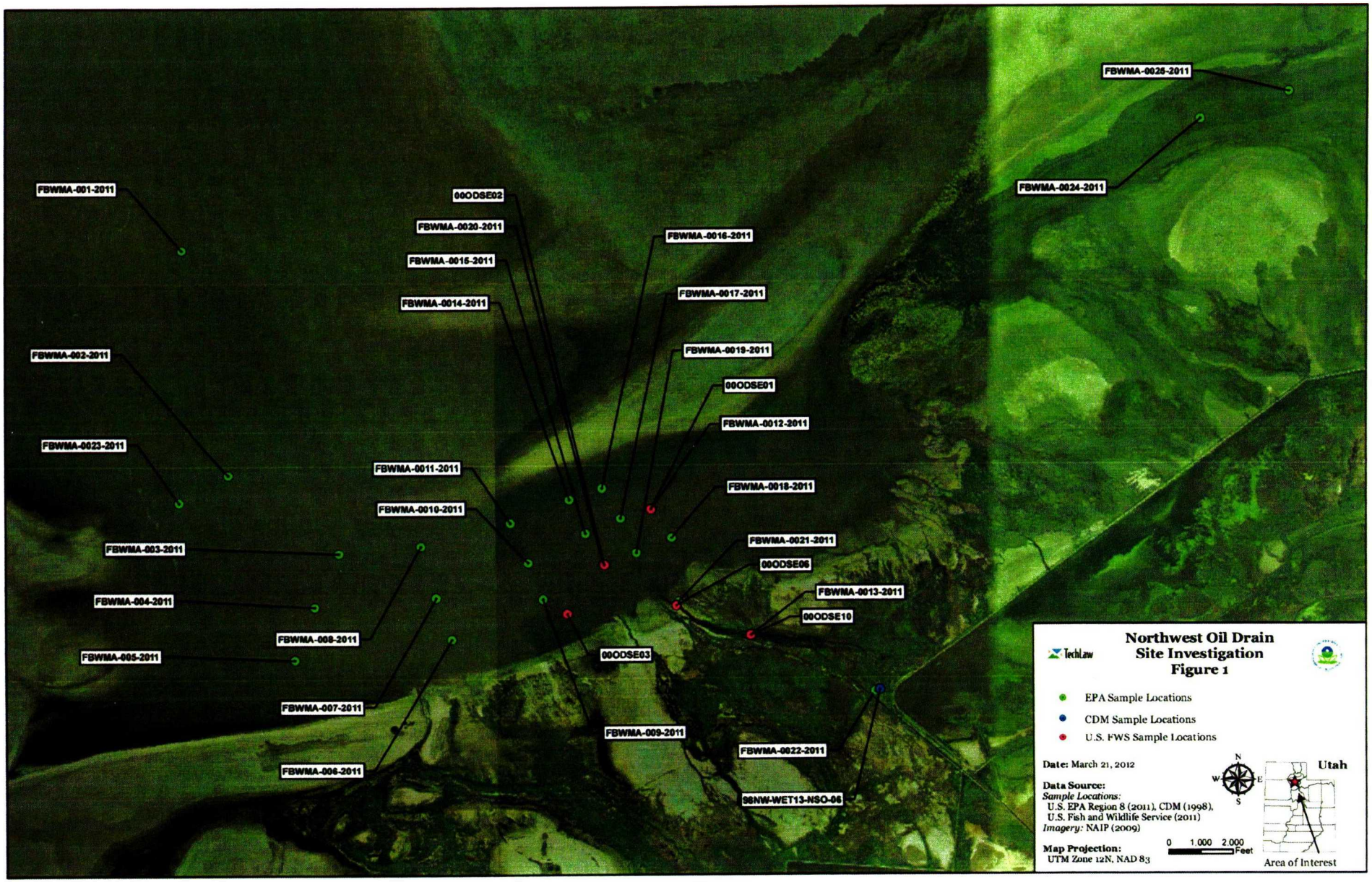


Figure 8: Relationship between TPH-DRO and Total PAHs in surface sediments (0-6") collected at the Farmington Bay Waterfowl Management Area in September 2011

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FBWMA-0023-2011
FBWMA-003-2011
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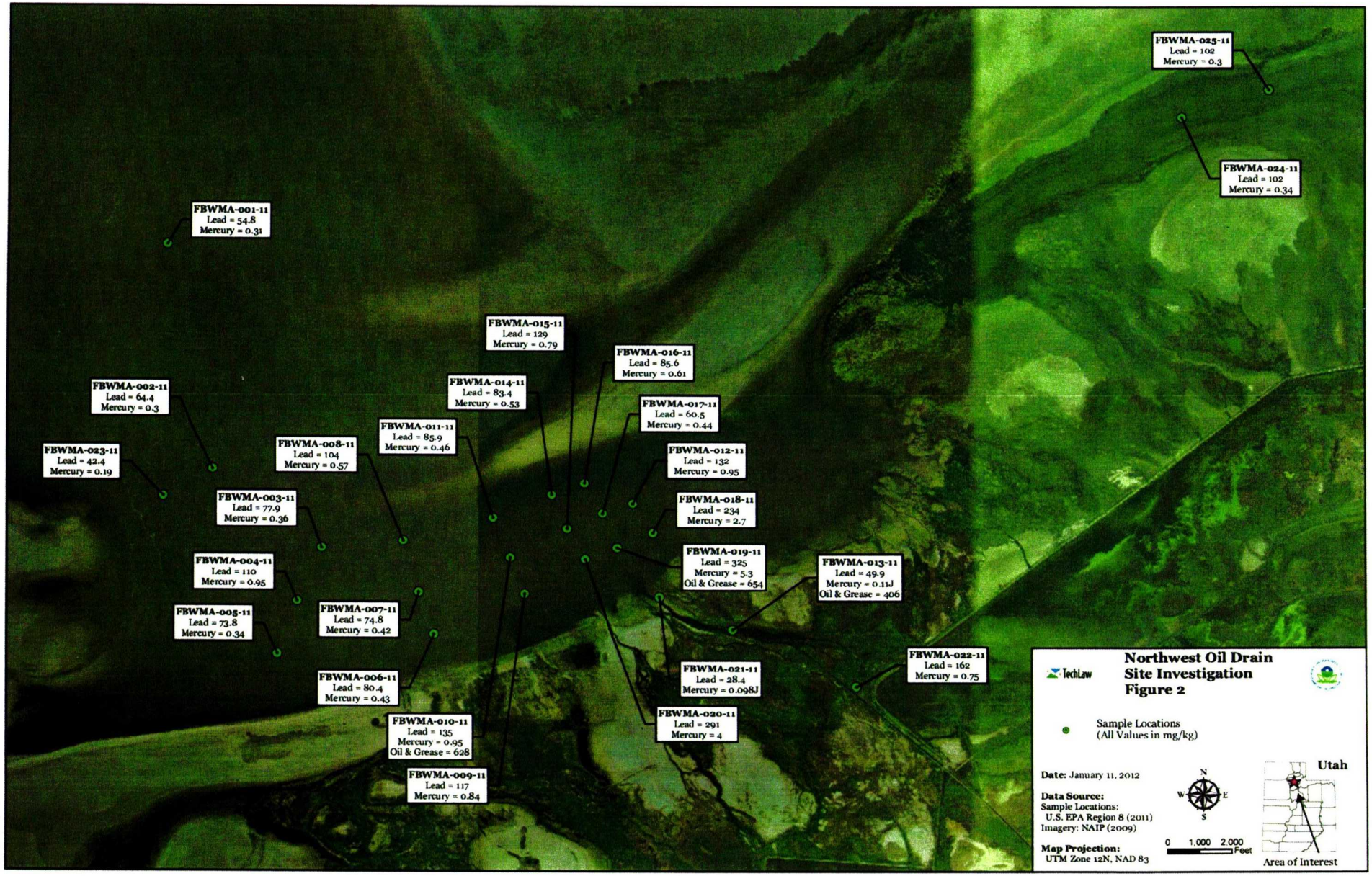
FBWMA-005-2011
FBWMA-006-2011
FBWMA-007-2011
FBWMA-008-2011
00ODSE02
FBWMA-0020-2011
FBWMA-0015-2011
FBWMA-0014-2011
FBWMA-0011-2011
FBWMA-0010-2011
00ODSE03
FBWMA-009-2011
FBWMA-0016-2011
FBWMA-0017-2011
FBWMA-0019-2011
00ODSE01
FBWMA-0012-2011
FBWMA-0018-2011
FBWMA-0021-2011
00ODSE06
FBWMA-0013-2011
00ODSE10
FBWMA-0022-2011
96NW-WET13-NSO-06
FBWMA-0025-2011
FBWMA-0024-2011
Northwest Oil Drain
Site Investigation
Figure 1
TechLaw
EPA Sample Locations
CDM Sample Locations
U.S. FWS Sample Locations
Date: March 21, 2012
Data Source:
Sample Locations:
U.S. EPA Region 8 (2011), CDM (1998),
U.S. Fish and Wildlife Service (2011)
Imagery: NAIP (2009)
Map Projection:
UTM Zone 12N, NAD 83
N
W
E
S
0 1,000 2,000
Feet
Utah
Area of Interest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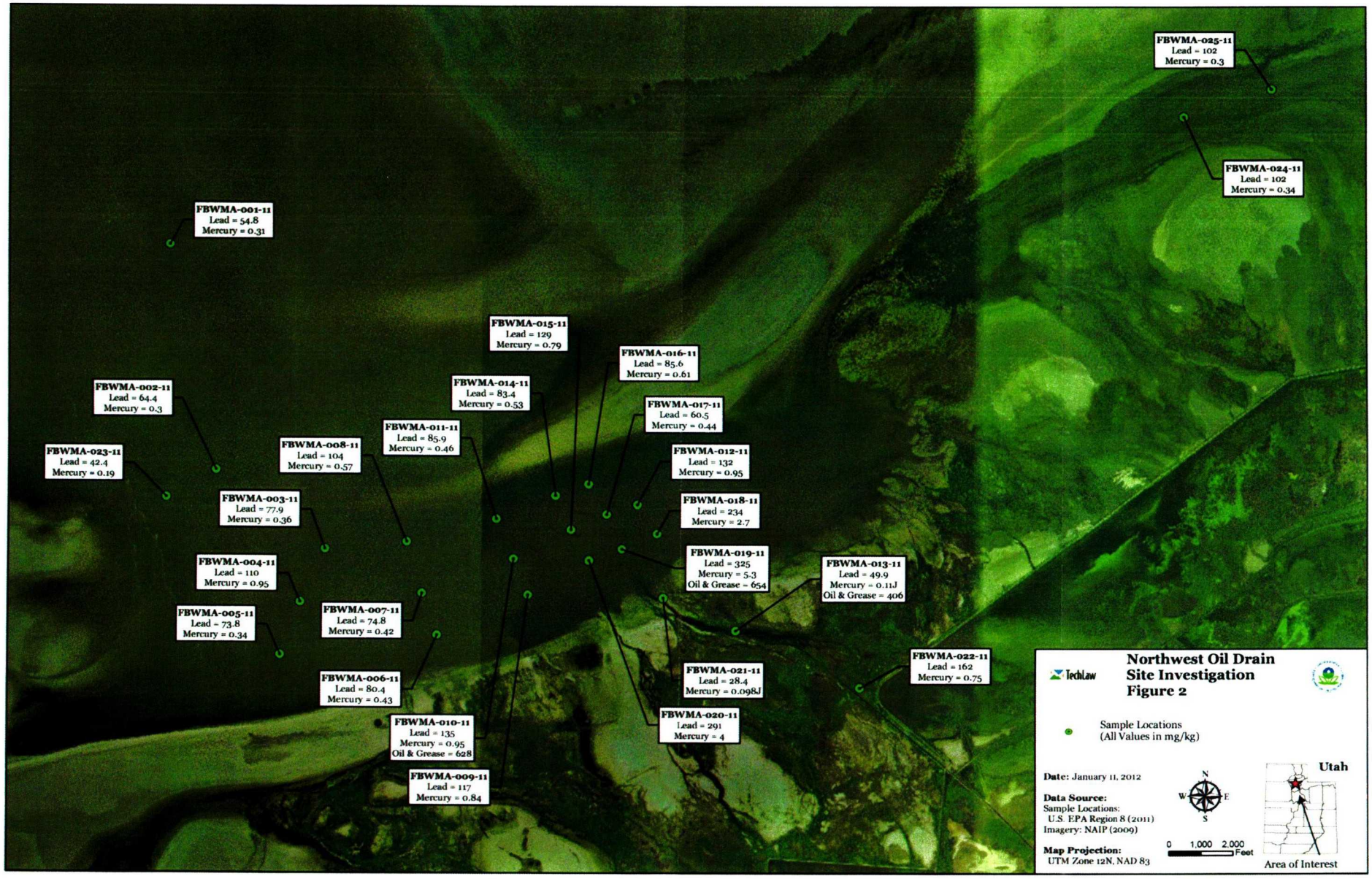
Lead = 54.8
Mercury = 0.31
FBWMA-002-11
Lead = 64.4
Mercury = 0.3
FBWMA-003-11
Lead = 77.9
Mercury = 0.36
FBWMA-004-11
Lead = 110
Mercury = 0.95
FBWMA-005-11
Lead = 73.8
Mercury = 0.34
FBWMA-006-11
Lead = 80.4
Mercury = 0.43
FBWMA-007-11
Lead = 74.8
Mercury = 0.42
FBWMA-008-11
Lead = 104
Mercury = 0.57
FBWMA-009-11
Lead = 117
Mercury = 0.84
FBWMA-010-11
Lead = 135
Mercury = 0.95
Oil & Grease = 628
FBWMA-011-11
Lead = 85.9
Mercury = 0.46
FBWMA-012-11
Lead = 132
Mercury = 0.95
FBWMA-013-11
Lead = 49.9
Mercury = 0.11J
Oil & Grease = 406
FBWMA-014-11
Lead = 83.4
Mercury = 0.53
FBWMA-015-11
Lead = 129
Mercury = 0.79
FBWMA-016-11
Lead = 85.6
Mercury = 0.61
FBWMA-017-11
Lead = 60.5
Mercury = 0.44
FBWMA-018-11
Lead = 234
Mercury = 2.7
FBWMA-019-11
Lead = 325
Mercury = 5.3
Oil & Grease = 654
FBWMA-020-11
Lead = 291
Mercury = 4
FBWMA-021-11
Lead = 28.4
Mercury = 0.098J
FBWMA-022-11
Lead = 162
Mercury = 0.75
FBWMA-023-11
Lead = 42.4
Mercury = 0.19
FBWMA-024-11
Lead = 102
Mercury = 0.34
FBWMA-025-11
Lead = 102
Mercury = 0.3
TechLaw
Northwest Oil Drain
Site Investigation
Figure 2
Sample Locations
(All Values in mg/kg)
Date: January 11, 2012
Data Source:
Sample Locations:
U.S. EPA Region 8 (2011)
Imagery: NAIP (2009)
Map Projection:
UTM Zone 12N, NAD 83
N
W
E
S
0 1,000 2,000
Feet
Utah
Area of Interest


FBWMA-025-11
Lead = 102
Mercury = 0.3
FBWMA-024-11
Lead = 102
Mercury = 0.34
FBWMA-001-11
Lead = 54.8
Mercury = 0.31
FBWMA-015-11
Lead = 129
Mercury = 0.79
FBWMA-016-11
Lead = 85.6
Mercury = 0.61
FBWMA-014-11
Lead = 83.4
Mercury = 0.53
FBWMA-002-11
Lead = 64.4
Mercury = 0.3
FBWMA-017-11
Lead = 60.5
Mercury = 0.44
FBWMA-011-11
Lead = 85.9
Mercury = 0.46
FBWMA-023-11
Lead = 42.4
Mercury = 0.19
FBWMA-008-11
Lead = 104
Mercury = 0.57
FBWMA-012-11
Lead = 132
Mercury = 0.95
FBWMA-003-11
Lead = 77.9
Mercury = 0.36
FBWMA-018-11
Lead = 234
Mercury = 2.7
FBWMA-004-11
Lead = 110
Mercury = 0.95
FBWMA-019-11
Lead = 325
Mercury = 5.3
Oil & Grease = 654
FBWMA-013-11
Lead = 49.9
Mercury = 0.11J
Oil & Grease = 406
FBWMA-005-11
Lead = 73.8
Mercury = 0.34
FBWMA-007-11
Lead = 74.8
Mercury = 0.42
FBWMA-022-11
Lead = 162
Mercury = 0.75
FBWMA-021-11
Lead = 28.4
Mercury = 0.098J
FBWMA-006-11
Lead = 80.4
Mercury = 0.43
FBWMA-020-11
Lead = 291
Mercury = 4
FBWMA-010-11
Lead = 135
Mercury = 0.95
Oil & Grease = 628
FBWMA-009-11
Lead = 117
Mercury = 0.84
TechLaw
Northwest Oil Drain
Site Investigation
Figure 2
Sample Locations
(All Values in mg/kg)
Date: January 11, 2012
Data Source:
Sample Locations:
U.S. EPA Region 8 (2011)
Imagery: NAIP (2009)
Map Projection:
UTM Zone 12N, NAD 83
N
W
E
S
0 1,000 2,000
Feet
Utah
Area of Interest

APPENDIX F

CHAIN OF CUSTODY FORMS

1516039

USEPA CLP COC (LAB COPY)

DateShipped: 6/9/2015

CarrierName:

AirbillNo:

CHAIN OF CUSTODY RECORD

Case #: 45330

Cooler #:

MH0AA9

No: 8-052715-123805-0002

Lab: ALS Laboratory Group - Salt Lake City

Lab Contact: Roxy Olson

Lab Phone: 801-266-7700

COPY Originalin SDG MH0AA0

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
UTD980961502-0001	MH0AA0	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1000 (HNO3 pH<2) (1)	RD-SW-01	06/09/2015 11:05	Good
UTD980961502-0002	MH0AA1	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1001 (HNO3 pH<2) (1)	RD-SW-02	06/09/2015 10:45	
UTD980961502-0003	MH0AA2	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1002 (HNO3 pH<2) (2)	RD-SW-03	06/09/2015 10:25	
UTD980961502-0004	MH0AA3	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1003 (HNO3 pH<2) (1)	RD-SW-04	06/09/2015 10:00	
UTD980961502-0005	MH0AA4	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1004 (HNO3 pH<2) (1)	RD-SW-05	06/09/2015 10:12	
UTD980961502-0006	MH0AA5	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1005 (HNO3 pH<2) (1)	RD-SW-06	06/09/2015 09:30	
UTD980961502-0007	MH0AA6	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1006 (HNO3 pH<2) (1)	RD-SW-07	06/09/2015 09:30	
UTD980961502-0009	MH0AA9	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1009 (4 C) (1)	RD-SE-01	06/09/2015 11:05	
UTD980961502-0010	MH0AB0	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1010 (4 C) (2)	RD-SE-02	06/09/2015 10:45	
UTD980961502-0011	MH0AB1	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1011 (4 C) (1)	RD-SE-03	06/09/2015 10:25	

Sample(s) to be used for Lab QC: UTD980961502-0003 Tag 1002

Shipment for Case Complete? Y

Samples Transferred From Chain of Custody #

Analysis Key: ICP-MS=CLP ICP-MS Metals, ICP-AES=CLP ICP-AES Metals

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
	N. Taylor	6/9/15 1500	DATAC	06/09/2015 15:16	Good

1516039

USEPA CLP COC (LAB COPY)

CHAIN OF CUSTODY RECORD

No: 8-052715-123805-0002

DateShipped: 6/9/2015

CarrierName:

AirbillNo:

Case #: 45330

Cooler #: MH0AA9

Lab: ALS Laboratory Group - Salt Lake City

Lab Contact: Roxy Olson

Lab Phone: 801-266-7700

COPY Originalin SDG MH0AA0

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
UTD980961502-0001	MH0AA0	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1000 (HNO3 pH<2) (1)	RD-SW-01	06/09/2015 11:05	Good
UTD980961502-0002	MH0AA1	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1001 (HNO3 pH<2) (1)	RD-SW-02	06/09/2015 10:45	
UTD980961502-0003	MH0AA2	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1002 (HNO3 pH<2) (2)	RD-SW-03	06/09/2015 10:25	
UTD980961502-0004	MH0AA3	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1003 (HNO3 pH<2) (1)	RD-SW-04	06/09/2015 10:00	
UTD980961502-0005	MH0AA4	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1004 (HNO3 pH<2) (1)	RD-SW-05	06/09/2015 10:12	
UTD980961502-0006	MH0AA5	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1005 (HNO3 pH<2) (1)	RD-SW-06	06/09/2015 09:30	
UTD980961502-0007	MH0AA6	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1006 (HNO3 pH<2) (1)	RD-SW-07	06/09/2015 09:30	
UTD980961502-0009	MH0AA9	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1009 (4 C) (1)	RD-SE-01	06/09/2015 11:05	
UTD980961502-0010	MH0AB0	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1010 (4 C) (2)	RD-SE-02	06/09/2015 10:45	
UTD980961502-0011	MH0AB1	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1011 (4 C) (1)	RD-SE-03	06/09/2015 10:25	

Sample(s) to be used for Lab QC: UTD980961502-0003 Tag 1002

Shipment for Case Complete? Y

Samples Transferred From Chain of Custody #

Analysis Key: ICP-MS=CLP ICP-MS Metals, ICP-AES=CLP ICP-AES Metals

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
		6/9/15 1500	OATAL	06/09/2015 15:16	Good

1516037

USEPA CLP COC (LAB COPY)

DateShipped: 6/9/2015
CarrierName:
AirbillNo:

CHAIN OF CUSTODY RECORD

Case #: 45330 MH0AA0
Cooler #:

No: 8-052715-123805-0002

Lab: ALS Laboratory Group - Salt Lake City
Lab Contact: Roxy Olson
Lab Phone: 801-266-7700

Sample Identifier	CLP Sample No.	Matrix/Sampler	Coll. Method	Analysis/Turnaround (Days)	Tag/Preservative/Bottles	Location	Collection Date/Time	For Lab Use Only
UTD980961502-0001	MH0AA0	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1000 (HNO3 pH<2) (1)	RD-SW-01	06/09/2015 11:05	Good
UTD980961502-0002	MH0AA1	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1001 (HNO3 pH<2) (1)	RD-SW-02	06/09/2015 10:45	
UTD980961502-0003	MH0AA2	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1002 (HNO3 pH<2) (2)	RD-SW-03	06/09/2015 10:25	
UTD980961502-0004	MH0AA3	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1003 (HNO3 pH<2) (1)	RD-SW-04	06/09/2015 10:00	
UTD980961502-0005	MH0AA4	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1004 (HNO3 pH<2) (1)	RD-SW-05	06/09/2015 10:12	
UTD980961502-0006	MH0AA5	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1005 (HNO3 pH<2) (1)	RD-SW-06	06/09/2015 09:30	
UTD980961502-0007	MH0AA6	Surface Water/ NEIL TAYLOR	Grab	ICP-MS(21)	1006 (HNO3 pH<2) (1)	RD-SW-07	06/09/2015 09:30	
UTD980961502-0009	MH0AA9	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1009 (4 C) (1)	RD-SE-01	06/09/2015 11:05	
UTD980961502-0010	MH0AB0	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1010 (4 C) (2)	RD-SE-02	06/09/2015 10:45	
UTD980961502-0011	MH0AB1	Sediment/ NEIL TAYLOR	Grab	ICP-AES(21)	1011 (4 C) (1)	RD-SE-03	06/09/2015 10:25	

Sample(s) to be used for Lab QC: UTD980961502-0003 Tag 1002

Shipment for Case Complete? Y

Samples Transferred From Chain of Custody #

Analysis Key: ICP-MS=CLP ICP-MS Metals, ICP-AES=CLP ICP-AES Metals

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
	N. Taylor	6/9/15 1500	DATAL	06/09/2015 15:16	Good

10555

APPENDIX G

WESTON SOLUTIONS DATA VALIDATION REPORTS AND LABORATORY RESULTS

Weston Solutions, Inc.
1435 Garrison Street
Suite 100
Lakewood, CO 80215
303-729-6100 Fax 303-729-6101
www.westonsolutions.com

6 August 2015

Ryan Dunham
U.S. EPA, Region 8
1595 Wynkoop St
Denver, CO 80202

RE: Redwood Road Dump
TDD 0004/1506-06

Dear Mr. Dunham:

Please find attached the data validation report for Sample Delivery Groups MH0AA0 and MH0AA9 for the Redwood Road Dump site. This report has been prepared by START chemists in accordance with TDD 1506-06.

If you have any questions or require additional information, please contact me by phone at 303-729-6124 or by email at natalie.quiet@westonsolutions.com.

Very truly yours,

WESTON SOLUTIONS, INC.

Natalie Quiet
Project Team Lead

Enclosures: Data Validation Report

DCN: W0252.4B.00530

DATA VALIDATION REPORT

Redwood Road Dump

SAMPLE DELIVERY GROUP: MH0AA9

Prepared by

MEC^X
12269 East Vassar Drive
Aurora, CO 80014

I. INTRODUCTION

Task Order Title:	Redwood Road Dump
Contract Task Order:	20408.012.004.0252.00
Sample Delivery Group:	MH0AA9
EPA Project Manager:	Ryan Dunham
Weston Project Manager:	Natalie Quiet
TDD No.:	0004/1506-06
Case No.:	45330
Matrix:	Sediment
QC Level:	Stage 4
No. of Samples:	4
No. of Reanalyses/Dilutions:	0
Laboratory:	CHEMTECH

Table 1. Sample Identification

Location ID	CLP ID	Lab Sample Name	Matrix Type	Collection Date	Method
RD-SE-01	MH0AA9	1516039001	Sediment	06/09/2015 11:05:00	ICP_AES
RD-SE-02	MH0AB0	1516039002	Sediment	06/09/2015 10:45:00	ICP_AES
RD-SE-03	MH0AB1	1516039005	Sediment	06/09/2015 10:25:00	ICP_AES
RD-SE-04	MH0AB2	1516039006	Sediment	06/09/2015 10:00:00	ICP_AES

II. Sample Management

The samples were received at the laboratory above the temperature limits of 4°C ±2°C, at 16°C; however, as the samples had insufficient time to chill, no qualifications were required. The samples were received intact, on ice, and properly preserved. The chains-of-custody (COCs) were appropriately signed and dated by field and laboratory personnel. Custody seals were present and intact upon receipt at the laboratory.

No issues were noted by the laboratory in the case narrative. The reviewer noted Sample Log-In Sheet reported that sample tags were absent and were not listed on the COC; however, the reviewer noted the tags were listed on the COC. Additionally, the reviewer noted that no sample was designated for quality control (QC) analyses. The laboratory chose a sample for QC analyses.

Data Qualifier Reference Table

Qualifier	Organics	Inorganics
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit. The associated value is the quantitation limit or the estimated detection limit for dioxins or PCB congeners.	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit. The associated value is the sample detection limit or the quantitation limit for perchlorate only.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
J+	Not applicable	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, and may have a potential positive bias.
J-	Not applicable	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, and may have a potential negative bias.
UJ	The analyte was not deemed above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.	The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification."	Not applicable.

Qualifier	Organics	Inorganics
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	Not applicable.
R	The data are unusable. The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet quality control criteria. The presence or absence of the analyte cannot be verified.	The data are unusable. The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet quality control criteria. The presence or absence of the analyte cannot be verified.

Qualification Code Reference Table

Qualifier	Organics	Inorganics
H	Holding times were exceeded.	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.	The sequence or number of standards used for the calibration was incorrect
C	Calibration %RSD or %D was noncompliant.	Correlation coefficient is <0.995 or calibration was noncompliant.
R	Calibration RRF was <0.05.	%R for calibration is not within control limits.
B	Presumed contamination as indicated by the preparation (method) blank results.	Presumed contamination as indicated by the preparation (method) or calibration blank results.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.	Laboratory Control Sample %R was not within control limits.
L1	LCS/LCSD RPD was outside control limits.	LCS/LCSD RPD was outside control limits.
Q	MS/MSD recovery was poor.	MS recovery was poor.
Q1	MS/MSD RPD was outside control limits.	MS/MSD RPD was outside control limits.
E	Not applicable.	Duplicates showed poor agreement.
I	Internal standard performance was unsatisfactory.	ICP ICS results were unsatisfactory.
A	Not applicable.	ICP Serial Dilution %D were not within control limits.
M	Tuning (BFB or DFTPP) was noncompliant.	ICPMS tune was not compliant.
T	Presumed contamination as indicated by the trip blank results.	Not applicable.
+	False positive – reported compound was not present.	Not applicable.
-	False negative – compound was present but not reported.	Not applicable.
F	Presumed contamination as indicated by the FB or ER results.	Presumed contamination as indicated by the FB or ER results.
F1	Field duplicate results were outside the control limit.	Field duplicate results were outside the control limit.
$	Reported result or other information was incorrect.	Reported result or other information was incorrect.

Qualifier	Organics	Inorganics
?	TIC identity or reported retention time has been changed.	Not applicable.
D	The analysis with this flag should not be used because another more technically sound analysis is available.	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.	Post Digestion Spike recovery was not within control limits.
*II, *III	Unusual problems found with the data that have been described in Section II, "Sample Management," or Section III, "Method Analyses." The number following the asterisk (*) will indicate the report section where a description of the problem can be found.	Unusual problems found with the data that have been described in Section II, "Sample Management," or Section III, "Method Analyses." The number following the asterisk (*) will indicate the report section where a description of the problem can be found.

III. Method Analyses

A. Contract Laboratory Program Statement of Work for Inorganic Superfund Methods, ISM01.3—Metals

Reviewed By: P. Meeks
Date Reviewed: July 27, 2015

The samples listed in Table 1 for this analysis were validated based on the guidelines outlined in the *Quality Assurance Project Plan for U. S. EPA Region 8 CERCLA Site Assessment* (2013), *United States Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganic Superfund Methods, ISM01.3* (2005), and the *National Functional Guidelines for Inorganic Superfund Data Review* (2010).

- Holding Times: The six-month analytical holding time was met.
- Calibration:
    - Initial calibration: Five standards and a blank were analyzed for all analytes. All non-zero initial calibration results were within ±30% of the true values. Linear regression initial calibration correlation coefficients were ≥0.995 and the intercepts were less than the reporting limits. Although required by the method to be below the RL, the lowest non-zero standards were at the RL. As nondetected data were reported at the RL, no qualifications were deemed necessary.
    - Initial (ICV) and continuing calibration (CCV) verification: ICV and the CCV recoveries were within 90-110%.
- Blanks: There were detects in the method blank and CCBs, but none were sufficient to qualify the site samples.
- Interference Check Samples (ICSA/B): The ICSA and ICSAB recoveries for the analytes were within the 80-120% or ±2× the RL, whichever was greater. No analytes were detected in the ICSAs at concentrations indicative of matrix interference.
- Laboratory Control Samples (LCS): LCS recoveries were within 70-130%.
- Laboratory Duplicates: A laboratory duplicate analysis was performed on sample MH0AB0. The antimony results exceeded the control limit of ± the reporting limit (RL) and the lead (78%) and magnesium (46%) RPDs exceeded the control limit; therefore, results for these analytes were qualified as estimated, "J," for detects and, "UJ," for nondetects in the samples. The remaining results were within the control limits of RPDs ≤20% for results ≥5× the (RL) and ±RL for results <5× the RL

- Matrix Spike: A matrix spike analysis was performed on sample MH0AB0. Results were not assessed when the native concentration exceeded the spike amount by 4× or more. Recoveries for arsenic (136%), manganese (126%), and zinc (134%) were above the control limit; therefore, detects for these analytes in the samples were qualified as estimated with a potential high bias, "J+." The antimony recovery was below the control limit at 25%; therefore, antimony detected in the samples was qualified as estimated with a potential low bias, "J-." As the post digestion spike recovery for antimony was acceptable, nondetected antimony in sample MH0AB2 was qualified as estimated, "UJ," instead of being rejected. The remaining recoveries were within 75-125%.

- Post Digestion Spike: A post digestion spike analysis was performed on sample MH0AB0 for the analytes with matrix spike recovery outliers. The recoveries were within the control limits of 75-125%.

- Serial Dilution: A serial dilution analysis was performed on sample MH0AB0. Results were not assessed unless the native concentration was nominally 50× the MDL. The applicable percent differences (%Ds) were within the control limit of ≤10%.

- Sample Result Verification: Calculations were verified and the sample results reported on the sample result summary were verified against the raw data. No transcription errors or calculation errors were noted. Reported nondetects are valid to the reporting limit; however, the EDD appeared to report nondetects to the method detection limit.

  In order to report the analyte within the linear range of the calibration, calcium was reported from 2× dilutions in samples MH0AA9, MH0AB0, and MH0AB1.

  The laboratory electronic data deliverable (EDD) contained two field listing sample results: LAB_RESULT and FINAL_RESULT. The FINAL_RESULT field reported the sample result with too many significant digits. The LAB_RESULT field primarily contained the results reported on the Form Is in the data package, but results requiring rounding were not rounded.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

  - Field Blanks and Equipment Rinsates: No field blank or equipment rinsate samples were identified in this SDG.

  - Field Duplicates: There were no field duplicate samples identified in this SDG.

Validated Sample Result Forms: MH0AA9

Analysis Method *Metals by ICP-AES*

Sample Name MH0AA9 **Matrix Type:** Sediment **Result Type:** Field_Sample

Lab Sample Name: 1516039001 **Sample Date:** 06/09/2015 11:05:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	4730	21.0	7.2	mg/kg			
Antimony	7440-36-0	4.1	6.3	1.7	mg/kg	J*	J-	Q, E
Arsenic	7440-38-2	20.2	1.0	0.28	mg/kg	*	J+	Q
Barium	7440-39-3	153	21.0	0.07	mg/kg			
Beryllium	7440-41-7	0.31	0.52	0.07	mg/kg	J	J	
Cadmium	7440-43-9	0.88	0.52	0.02	mg/kg			
Calcium	7440-70-2	64700	1050	9.7	mg/kg	D		
Chromium	7440-47-3	16.9	1.0	0.03	mg/kg			
Cobalt	7440-48-4	4.2	5.2	0.09	mg/kg	J	J	
Copper	7440-50-8	84.2	2.6	0.18	mg/kg			
Iron	7439-89-6	10400	10.5	2.6	mg/kg			
Lead	7439-92-1	73.6	1.0	0.25	mg/kg	*	J	E
Magnesium	7439-95-4	15100	525	5.1	mg/kg	*	J	E
Manganese	7439-96-5	294	1.6	0.13	mg/kg	*	J+	Q
Nickel	7440-02-0	8.4	4.2	0.07	mg/kg			
Potassium	7440-09-7	1480	525	11.8	mg/kg			
Selenium	7782-49-2	3.7	3.7	0.77	mg/kg	U	U	
Silver	7440-22-4	0.19	1.0	0.13	mg/kg	J	J	
Sodium	7440-23-5	1790	525	6.4	mg/kg			
Thallium	7440-28-0	2.6	2.6	0.31	mg/kg	U	U	
Vanadium	7440-62-2	14.4	5.2	0.14	mg/kg			
Zinc	7440-66-6	247	6.3	0.17	mg/kg	*	J+	Q

Sample Name MH0AB0 **Matrix Type:** Sediment **Result Type:** Field_Sample

Lab Sample Name: 1516039002 **Sample Date:** 06/09/2015 10:45:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	6210	20.7	7.1	mg/kg			
Antimony	7440-36-0	1.8	6.2	1.7	mg/kg	J*	J-	Q, E
Arsenic	7440-38-2	22.8	1.0	0.28	mg/kg	*	J+	Q
Barium	7440-39-3	231	20.7	0.07	mg/kg			
Beryllium	7440-41-7	0.32	0.52	0.07	mg/kg	J	J	
Cadmium	7440-43-9	1.4	0.52	0.02	mg/kg			
Calcium	7440-70-2	55000	1034	9.5	mg/kg	D		
Chromium	7440-47-3	21.1	1.0	0.03	mg/kg			

Analysis Method *Metals by ICP-AES*

Cobalt	7440-48-4	4.7	5.2	0.09	mg/kg	J	J	
Copper	7440-50-8	126	2.6	0.18	mg/kg			
Iron	7439-89-6	11700	10.3	2.6	mg/kg			
Lead	7439-92-1	123	1.0	0.25	mg/kg	*	J	E
Magnesium	7439-95-4	11700	517	5.1	mg/kg	*	J	E
Manganese	7439-96-5	286	1.6	0.12	mg/kg	*	J+	Q
Nickel	7440-02-0	11.1	4.1	0.07	mg/kg			
Potassium	7440-09-7	2170	517	11.6	mg/kg			
Selenium	7782-49-2	1.5	3.6	0.75	mg/kg	J	J	
Silver	7440-22-4	1.5	1.0	0.12	mg/kg			
Sodium	7440-23-5	939	517	6.3	mg/kg			
Thallium	7440-28-0	2.6	2.6	0.31	mg/kg	U	U	
Vanadium	7440-62-2	15.9	5.2	0.13	mg/kg			
Zinc	7440-66-6	298	6.2	0.17	mg/kg	*	J+	Q

Sample Name MH0AB1 **Matrix Type:** Sediment **Result Type:** Field_Sample

Lab Sample Name: 1516039005 **Sample Date:** 06/09/2015 10:25:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	12800	26.7	9.2	mg/kg			
Antimony	7440-36-0	2.3	8.0	2.1	mg/kg	J*	J-	Q, E
Arsenic	7440-38-2	15.7	1.3	0.36	mg/kg	*	J+	Q
Barium	7440-39-3	250	26.7	0.09	mg/kg			
Beryllium	7440-41-7	0.67	0.67	0.09	mg/kg			
Cadmium	7440-43-9	1.7	0.67	0.03	mg/kg			
Calcium	7440-70-2	97200	1337	12.3	mg/kg	D		
Chromium	7440-47-3	24.3	1.3	0.04	mg/kg			
Cobalt	7440-48-4	8.7	6.7	0.12	mg/kg			
Copper	7440-50-8	92.6	3.3	0.23	mg/kg			
Iron	7439-89-6	19800	13.4	3.3	mg/kg			
Lead	7439-92-1	72.5	1.3	0.32	mg/kg	*	J	E
Magnesium	7439-95-4	15300	668	6.6	mg/kg	*	J	E
Manganese	7439-96-5	412	2.0	0.16	mg/kg	*	J+	Q
Nickel	7440-02-0	18.9	5.3	0.09	mg/kg			
Potassium	7440-09-7	4590	668	15.0	mg/kg			
Selenium	7782-49-2	1.9	4.7	0.98	mg/kg	J	J	
Silver	7440-22-4	1.3	1.3	0.16	mg/kg	U	U	
Sodium	7440-23-5	1130	668	8.2	mg/kg			
Thallium	7440-28-0	3.3	3.3	0.40	mg/kg	U	U	
Vanadium	7440-62-2	30.6	6.7	0.17	mg/kg			
Zinc	7440-66-6	211	8.0	0.21	mg/kg	*	J+	Q

Analysis Method Metals by ICP-AES

Sample Name MH0AB2 **Matrix Type:** Sediment **Result Type:** Field_Sample

Lab Sample Name: 1516039006 **Sample Date:** 06/09/2015 10:00:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	8160	21.2	7.3	mg/kg			
Antimony	7440-36-0	6.4	6.4	1.7	mg/kg	U*	UJ	Q, E
Arsenic	7440-38-2	8.6	1.1	0.29	mg/kg	*	J+	Q
Barium	7440-39-3	106	21.2	0.07	mg/kg			
Beryllium	7440-41-7	0.56	0.53	0.07	mg/kg			
Cadmium	7440-43-9	0.64	0.53	0.02	mg/kg			
Calcium	7440-70-2	52600	531	4.9	mg/kg			
Chromium	7440-47-3	13.8	1.1	0.03	mg/kg			
Cobalt	7440-48-4	5.1	5.3	0.09	mg/kg	J	J	
Copper	7440-50-8	41.4	2.7	0.18	mg/kg			
Iron	7439-89-6	12600	10.6	2.7	mg/kg			
Lead	7439-92-1	36.9	1.1	0.25	mg/kg	*	J	E
Magnesium	7439-95-4	20400	531	5.2	mg/kg	*	J	E
Manganese	7439-96-5	206	1.6	0.13	mg/kg	*	J+	Q
Nickel	7440-02-0	10.8	4.2	0.07	mg/kg			
Potassium	7440-09-7	2580	531	11.9	mg/kg			
Selenium	7782-49-2	3.7	3.7	0.78	mg/kg	U	U	
Silver	7440-22-4	1.1	1.1	0.13	mg/kg	U	U	
Sodium	7440-23-5	554	531	6.5	mg/kg			
Thallium	7440-28-0	2.7	2.7	0.32	mg/kg	U	U	
Vanadium	7440-62-2	20.5	5.3	0.14	mg/kg			
Zinc	7440-66-6	80.4	6.4	0.17	mg/kg	*	J+	Q

DATA VALIDATION REPORT

Redwood Road Dump

SAMPLE DELIVERY GROUP: MH0AA0

Prepared by

MEC^X
12269 East Vassar Drive
Aurora, CO 80014

I. INTRODUCTION

Task Order Title:	Redwood Road Dump
Contract Task Order:	20408.012.004.0252.00
Sample Delivery Group:	MH0AA0
EPA Project Manager:	Ryan Dunham
Weston Project Manager:	Natalie Quiet
TDD No.:	0004/1506-06
Case No.:	45330
Matrix:	Water
QC Level:	Stage 4
No. of Samples:	7
No. of Reanalyses/Dilutions:	0
Laboratory:	CHEMTECH

Table 1. Sample Identification

Location ID	CLP ID	Lab Sample Name	Matrix Type	Collection Date	Method
RD-SW-01	MH0AA0	1516037001	Water	06/09/2015 11:05:00	ICP_MS
RD-SW-02	MH0AA1	1516037002	Water	06/09/2015 10:45:00	ICP_MS
RD-SW-03	MH0AA2	1516037003	Water	06/09/2015 10:25:00	ICP_MS
RD-SW-04	MH0AA3	1516037006	Water	06/09/2015 10:00:00	ICP_MS
RD-SW-05	MH0AA4	1516037007	Water	06/09/2015 10:12:00	ICP_MS
RD-SW-06	MH0AA5	1516037008	Water	06/09/2015 09:30:00	ICP_MS
RD-SW-07	MH0AA6	1516037009	Water	06/09/2015 09:30:00	ICP_MS

II. Sample Management

The samples were received at the laboratory above the temperature limits of 4°C ±2°C, at 16°C; however, as the samples had insufficient time to cool from the field to the laboratory, no qualifications were required. The samples were received intact, on ice, and properly preserved. The chain-of-custody was appropriately signed and dated by field and laboratory personnel. Custody seals were present and intact upon receipt at the laboratory.

The laboratory noted no issues in the case narrative. The reviewer noted Sample Log-In Sheet reported that sample tags were absent and were not listed on the COC; however, the reviewer noted the tags were listed on the COC.

Data Qualifier Reference Table

Qualifier	Organics	Inorganics
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit. The associated value is the quantitation limit or the estimated detection limit for dioxins or PCB congeners.	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit. The associated value is the sample detection limit or the quantitation limit for perchlorate only.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
J+	Not applicable	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, and may have a potential positive bias.
J-	Not applicable	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, and may have a potential negative bias.
UJ	The analyte was not deemed above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.	The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification."	Not applicable.

Qualifier	Organics	Inorganics
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	Not applicable.
R	The data are unusable. The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet quality control criteria. The presence or absence of the analyte cannot be verified.	The data are unusable. The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet quality control criteria. The presence or absence of the analyte cannot be verified.

Qualification Code Reference Table

Qualifier	Organics	Inorganics
H	Holding times were exceeded.	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.	The sequence or number of standards used for the calibration was incorrect
C	Calibration %RSD or %D was noncompliant.	Correlation coefficient is <0.995 or calibration was noncompliant.
R	Calibration RRF was <0.05.	%R for calibration is not within control limits.
B	Presumed contamination as indicated by the preparation (method) blank results.	Presumed contamination as indicated by the preparation (method) or calibration blank results.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.	Laboratory Control Sample %R was not within control limits.
L1	LCS/LCSD RPD was outside control limits.	LCS/LCSD RPD was outside control limits.
Q	MS/MSD recovery was poor.	MS recovery was poor.
Q1	MS/MSD RPD was outside control limits.	MS/MSD RPD was outside control limits.
E	Not applicable.	Duplicates showed poor agreement.
I	Internal standard performance was unsatisfactory.	ICP ICS results were unsatisfactory.
A	Not applicable.	ICP Serial Dilution %D were not within control limits.
M	Tuning (BFB or DFTPP) was noncompliant.	ICPMS tune was not compliant.
T	Presumed contamination as indicated by the trip blank results.	Not applicable.
+	False positive – reported compound was not present.	Not applicable.
-	False negative – compound was present but not reported.	Not applicable.
F	Presumed contamination as indicated by the FB or ER results.	Presumed contamination as indicated by the FB or ER results.
F1	Field duplicate results were outside the control limit.	Field duplicate results were outside the control limit.
$	Reported result or other information was incorrect.	Reported result or other information was incorrect.

Qualifier	Organics	Inorganics
?	TIC identity or reported retention time has been changed.	Not applicable.
D	The analysis with this flag should not be used because another more technically sound analysis is available.	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.	Post Digestion Spike recovery was not within control limits.
*II, *III	Unusual problems found with the data that have been described in Section II, "Sample Management," or Section III, "Method Analyses." The number following the asterisk (*) will indicate the report section where a description of the problem can be found.	Unusual problems found with the data that have been described in Section II, "Sample Management," or Section III, "Method Analyses." The number following the asterisk (*) will indicate the report section where a description of the problem can be found.

III. Method Analyses

A. Contract Laboratory Program Statement of Work for Inorganic Superfund Methods, ISM01.3—Metals

Reviewed By: P. Meeks
Date Reviewed: July 27, 2015

The samples listed in Table 1 for this analysis were validated based on the guidelines outlined in the *Quality Assurance Project Plan for U. S. EPA Region 8 CERCLA Site Assessment* (2013), *United States Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganic Superfund Methods, ISM01.3* (2005), and the *National Functional Guidelines for Inorganic Superfund Data Review* (2010).

- Holding Times: The six-month analytical holding time was met.

- Tuning: The mass calibration and resolution check criteria were met. Tuning solution %RSDs affecting sample results were ≤5% and masses of interest were calibrated to ≤ 0.1 atomic mass unit (amu).

- Calibration:

  - Initial calibration: Five standards and a blank were analyzed for all analytes. All non-zero initial calibration results were within ±30% of the true values. Linear regression initial calibration correlation coefficients were ≥0.995 and the intercepts were less than the reporting limits. Although required by the method to be below the RL, the lowest non-zero standards were at the RL. As nondetected data were reported at the RL, no qualifications were deemed necessary.

  - Initial (ICV) and continuing calibration (CCV) verification: ICV and the CCV recoveries were within 90-110%.

- Blanks: Results listed in the table below were qualified as nondetected, "U," at the reporting limits. There were other detects in the method blank and CCBs, but none were sufficient to qualify the site samples.

Analyte	Method Blank (µg/L)	CCB (µg/L)	Qualified Samples
Antimony	0.30	N/A	MH0AA5, MH0AA6
Beryllium	0.070	N/A	All samples
Chromium	0.33	N/A	All samples except MH0AA0
Cobalt	0.043	N/A	All samples except MH0AA0

Analyte	Method Blank (µg/L)	CCB (µg/L)	Qualified Samples
Silver	0.062	N/A	All samples
Thallium	0.13	N/A	MH0AA0, MH0AA5, MH0AA6
Cadmium	N/A	0.16	MH0AA0, MH0AA5, MH0AA6
Lead	N/A	0.20	MH0AA5, MH0AA6

- Interference Check Samples (ICSA/B): The ICSA and ICSAB recoveries for the analytes were within the 80-120% or ±2× the RL, whichever was greater. No analytes were detected in the ICSAs at concentrations indicative of matrix interference.

- Laboratory Control Samples (LCS): LCS recoveries were within 70-130%.

- Laboratory Duplicates: A laboratory duplicate analysis was performed on sample MH0AA2. The results were within the control limits of RPDs ≤20% for results ≥5× the RL and ±RL for results <5× the RL

- Matrix Spike: A matrix spike analysis was performed on sample MH0AA2. The interferents, which are not required in the spike mix, were not spiked. The recoveries were within 75-125%.

- Post Digestion Spike: No post digestion spike analyses were performed on a sample from this SDG.

- Serial Dilution: A serial dilution analysis was performed on sample MH0AA2. Results were not assessed unless the native concentration was nominally 50× the MDL. The %D for arsenic exceeded the control limit at 11%; therefore, arsenic in the samples, all detects, was qualified as estimated, "J." The remaining percent differences (%Ds) were within the control limit of ≤10%.

- Internal Standards Performance: All sample internal standard intensities were within the control limits of 60-125% of the calibration blank.

- Sample Result Verification: Calculations were verified and the sample results reported on the sample result summary were verified against the raw data. No transcription errors or calculation errors were noted. Reported nondetects are valid to the reporting limit; however, the EDD appeared to report nondetects to the method detection limit.

  In order to report the analyte within the linear range of the calibration, calcium in samples MH0AA5 and MH0AA6 was reported from 2× dilutions and sodium in all samples was reported from 5× dilutions.

The laboratory electronic data deliverable (EDD) contained two field listing sample results: LAB_RESULT and FINAL_RESULT. The FINAL_RESULT field reported the sample result with too many significant digits. The LAB_RESULT field primarily contained the results reported on the Form Is in the data package, but results requiring rounding were not rounded.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: No field blank or equipment rinsate samples were identified in this SDG.

    - Field Duplicates: Samples MH0AA5 and MH0AA6 were identified as field duplicate samples. All detects were in common and the RPDs for analytes detected above the reporting limit were less than 30%.

Validated Sample Result Forms: MH0AA0

Analysis Method *Metals by ICP-MS*

Sample Name MH0AA0 **Matrix Type:** Water **Result Type:** Field_Sample

Lab Sample Name: 1516037001 **Sample Date:** 06/09/2015 11:05:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	1290	20.0	1.2	ug/L			
Antimony	7440-36-0	3.4	2.0	0.04	ug/L			
Arsenic	7440-38-2	54.8	1.0	0.35	ug/L	*	J	A
Barium	7440-39-3	104	10.0	0.03	ug/L			
Beryllium	7440-41-7	0.12	1.0	0.02	ug/L	J	U	B
Cadmium	7440-43-9	0.22	1.0	0.03	ug/L	J	U	B
Calcium	7440-70-2	96600	500	10.3	ug/L			
Chromium	7440-47-3	3.9	2.0	0.08	ug/L			
Cobalt	7440-48-4	1.5	1.0	0.01	ug/L			
Copper	7440-50-8	17.6	2.0	0.26	ug/L			
Iron	7439-89-6	2130	200	6.2	ug/L			
Lead	7439-92-1	12.8	1.0	0.10	ug/L			
Magnesium	7439-95-4	59400	500	0.70	ug/L			
Manganese	7439-96-5	191	1.0	0.01	ug/L			
Nickel	7440-02-0	5.6	1.0	0.06	ug/L			
Potassium	7440-09-7	28100	500	1.4	ug/L			
Selenium	7782-49-2	1.8	5.0	0.78	ug/L	J	J	
Silver	7440-22-4	0.12	1.0	0.01	ug/L	J	U	B
Sodium	7440-23-5	341000	2500	7.0	ug/L	D		
Thallium	7440-28-0	0.095	1.0	0.04	ug/L	J	U	B
Vanadium	7440-62-2	7.0	5.0	0.66	ug/L			
Zinc	7440-66-6	45.8	2.0	0.46	ug/L			

Sample Name MH0AA1 **Matrix Type:** Water **Result Type:** Field_Sample

Lab Sample Name: 1516037002 **Sample Date:** 06/09/2015 10:45:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	258	20.0	1.2	ug/L			
Antimony	7440-36-0	2.6	2.0	0.04	ug/L			
Arsenic	7440-38-2	61.1	1.0	0.35	ug/L	*	J	A
Barium	7440-39-3	71.7	10.0	0.03	ug/L			
Beryllium	7440-41-7	0.048	1.0	0.02	ug/L	J	U	B
Cadmium	7440-43-9	1.0	1.0	0.03	ug/L	U	U	
Calcium	7440-70-2	85400	500	10.3	ug/L			
Chromium	7440-47-3	1.3	2.0	0.08	ug/L	J	U	B

Analysis Method *Metals by ICP-MS*

Cobalt	7440-48-4	0.96	1.0	0.01	ug/L	J	U	B
Copper	7440-50-8	6.7	2.0	0.26	ug/L			
Iron	7439-89-6	902	200	6.2	ug/L			
Lead	7439-92-1	3.5	1.0	0.10	ug/L			
Magnesium	7439-95-4	55300	500	0.70	ug/L			
Manganese	7439-96-5	183	1.0	0.01	ug/L			
Nickel	7440-02-0	4.5	1.0	0.06	ug/L			
Potassium	7440-09-7	27500	500	1.4	ug/L			
Selenium	7782-49-2	1.8	5.0	0.78	ug/L	J	J	
Silver	7440-22-4	0.06	1.0	0.01	ug/L	J	U	B
Sodium	7440-23-5	356000	2500	7.0	ug/L	D		
Thallium	7440-28-0	1.0	1.0	0.04	ug/L	U	U	
Vanadium	7440-62-2	5.1	5.0	0.66	ug/L			
Zinc	7440-66-6	14.7	2.0	0.46	ug/L			

Sample Name MH0AA2 **Matrix Type:** Water **Result Type:** Field_Sample

Lab Sample Name: 1516037003 **Sample Date:** 06/09/2015 10:25:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	363	20.0	1.2	ug/L			
Antimony	7440-36-0	2.8	2.0	0.04	ug/L			
Arsenic	7440-38-2	89.5	1.0	0.35	ug/L	*	J	A
Barium	7440-39-3	80.5	10.0	0.03	ug/L			
Beryllium	7440-41-7	0.033	1.0	0.02	ug/L	J	U	B
Cadmium	7440-43-9	1.0	1.0	0.03	ug/L	U	U	
Calcium	7440-70-2	69700	500	10.3	ug/L			
Chromium	7440-47-3	1.5	2.0	0.08	ug/L	J	U	B
Cobalt	7440-48-4	0.85	1.0	0.01	ug/L	J	U	B
Copper	7440-50-8	8.9	2.0	0.26	ug/L			
Iron	7439-89-6	925	200	6.2	ug/L			
Lead	7439-92-1	3.7	1.0	0.10	ug/L			
Magnesium	7439-95-4	44300	500	0.70	ug/L			
Manganese	7439-96-5	117	1.0	0.01	ug/L			
Nickel	7440-02-0	4.1	1.0	0.06	ug/L			
Potassium	7440-09-7	29100	500	1.4	ug/L			
Selenium	7782-49-2	1.9	5.0	0.78	ug/L	J	J	
Silver	7440-22-4	0.062	1.0	0.01	ug/L	J	U	B
Sodium	7440-23-5	451000	2500	7.0	ug/L	D		
Thallium	7440-28-0	1.0	1.0	0.04	ug/L	U	U	
Vanadium	7440-62-2	10.2	5.0	0.66	ug/L			
Zinc	7440-66-6	18.5	2.0	0.46	ug/L			

Analysis Method Metals by ICP-MS

Sample Name MH0AA3 **Matrix Type:** Water **Result Type:** Field_Sample

Lab Sample Name: 1516037006 **Sample Date:** 06/09/2015 10:00:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	124	20.0	1.2	ug/L			
Antimony	7440-36-0	2.2	2.0	0.04	ug/L			
Arsenic	7440-38-2	49.8	1.0	0.35	ug/L	*	J	A
Barium	7440-39-3	68.2	10.0	0.03	ug/L			
Beryllium	7440-41-7	0.021	1.0	0.02	ug/L	J	U	B
Cadmium	7440-43-9	1.0	1.0	0.03	ug/L	U	U	
Calcium	7440-70-2	76500	500	10.3	ug/L			
Chromium	7440-47-3	0.86	2.0	0.08	ug/L	J	U	B
Cobalt	7440-48-4	0.66	1.0	0.01	ug/L	J	U	B
Copper	7440-50-8	4.9	2.0	0.26	ug/L			
Iron	7439-89-6	776	200	6.2	ug/L			
Lead	7439-92-1	1.6	1.0	0.10	ug/L			
Magnesium	7439-95-4	49900	500	0.70	ug/L			
Manganese	7439-96-5	123	1.0	0.01	ug/L			
Nickel	7440-02-0	3.7	1.0	0.06	ug/L			
Potassium	7440-09-7	22300	500	1.4	ug/L			
Selenium	7782-49-2	1.5	5.0	0.78	ug/L	J	J	
Silver	7440-22-4	0.025	1.0	0.01	ug/L	J	U	B
Sodium	7440-23-5	406000	2500	7.0	ug/L	D		
Thallium	7440-28-0	1.0	1.0	0.04	ug/L	U	U	
Vanadium	7440-62-2	5.1	5.0	0.66	ug/L			
Zinc	7440-66-6	6.3	2.0	0.46	ug/L			

Sample Name MH0AA4 **Matrix Type:** Water **Result Type:** Field_Sample

Lab Sample Name: 1516037007 **Sample Date:** 06/09/2015 10:12:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	96.4	20.0	1.2	ug/L			
Antimony	7440-36-0	2.2	2.0	0.04	ug/L			
Arsenic	7440-38-2	42.9	1.0	0.35	ug/L	*	J	A
Barium	7440-39-3	60.9	10.0	0.03	ug/L			
Beryllium	7440-41-7	1.0	1.0	0.02	ug/L	U	U	B
Cadmium	7440-43-9	1.0	1.0	0.03	ug/L	U	U	
Calcium	7440-70-2	74000	500	10.3	ug/L			
Chromium	7440-47-3	0.82	2.0	0.08	ug/L	J	U	B
Cobalt	7440-48-4	0.61	1.0	0.01	ug/L	J	U	B
Copper	7440-50-8	4.1	2.0	0.26	ug/L			
Iron	7439-89-6	725	200	6.2	ug/L			

Analysis Method *Metals by ICP-MS*

Lead	7439-92-1	1.4	1.0	0.10	ug/L			
Magnesium	7439-95-4	46500	500	0.70	ug/L			
Manganese	7439-96-5	114	1.0	0.01	ug/L			
Nickel	7440-02-0	3.5	1.0	0.06	ug/L			
Potassium	7440-09-7	19800	500	1.4	ug/L			
Selenium	7782-49-2	0.95	5.0	0.78	ug/L	J	J	
Silver	7440-22-4	0.019	1.0	0.01	ug/L	J	U	B
Sodium	7440-23-5	343000	2500	7.0	ug/L	D		
Thallium	7440-28-0	1.0	1.0	0.04	ug/L	U	U	
Vanadium	7440-62-2	4.6	5.0	0.66	ug/L	J	J	
Zinc	7440-66-6	15.6	2.0	0.46	ug/L			

Sample Name MH0AA5 **Matrix Type:** Water **Result Type:** Field_Sample

Lab Sample Name: 1516037008 **Sample Date:** 06/09/2015 09:30:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes
Aluminum	7429-90-5	73.3	20.0	1.2	ug/L			
Antimony	7440-36-0	0.91	2.0	0.04	ug/L	J	U	B
Arsenic	7440-38-2	15.4	1.0	0.35	ug/L	*	J	A
Barium	7440-39-3	62.2	10.0	0.03	ug/L			
Beryllium	7440-41-7	0.023	1.0	0.02	ug/L	J	U	B
Cadmium	7440-43-9	0.078	1.0	0.03	ug/L	J	U	B
Calcium	7440-70-2	118000	1000	20.6	ug/L	D		
Chromium	7440-47-3	1.9	2.0	0.08	ug/L	J	U	B
Cobalt	7440-48-4	0.56	1.0	0.01	ug/L	J	U	B
Copper	7440-50-8	7.6	2.0	0.26	ug/L			
Iron	7439-89-6	719	200	6.2	ug/L			
Lead	7439-92-1	0.83	1.0	0.10	ug/L	J	U	B
Magnesium	7439-95-4	41500	500	0.70	ug/L			
Manganese	7439-96-5	60.2	1.0	0.01	ug/L			
Nickel	7440-02-0	4.7	1.0	0.06	ug/L			
Potassium	7440-09-7	29200	500	1.4	ug/L			
Selenium	7782-49-2	1.5	5.0	0.78	ug/L	J	J	
Silver	7440-22-4	0.040	1.0	0.01	ug/L	J	U	B
Sodium	7440-23-5	446000	2500	7.0	ug/L	D		
Thallium	7440-28-0	0.064	1.0	0.04	ug/L	J	U	B
Vanadium	7440-62-2	1.9	5.0	0.66	ug/L	J	J	
Zinc	7440-66-6	19.0	2.0	0.46	ug/L			

Sample Name MH0AA6 **Matrix Type:** Water **Result Type:** Field_Sample

Lab Sample Name: 1516037009 **Sample Date:** 06/09/2015 09:30:00

Analyte	CAS No	Result Value	Sample Adjusted CRQL	Sample Adjusted MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Notes

Analysis Method *Metals by ICP-MS*

Aluminum	7429-90-5	71.4	20.0	1.2	ug/L			
Antimony	7440-36-0	0.91	2.0	0.04	ug/L	J	U	B
Arsenic	7440-38-2	15.3	1.0	0.35	ug/L	*	J	A
Barium	7440-39-3	62.0	10.0	0.03	ug/L			
Beryllium	7440-41-7	0.018	1.0	0.02	ug/L	J	U	B
Cadmium	7440-43-9	0.054	1.0	0.03	ug/L	J	U	B
Calcium	7440-70-2	117000	1000	20.6	ug/L	D		
Chromium	7440-47-3	1.9	2.0	0.08	ug/L	J	U	B
Cobalt	7440-48-4	0.56	1.0	0.01	ug/L	J	U	B
Copper	7440-50-8	7.7	2.0	0.26	ug/L			
Iron	7439-89-6	734	200	6.2	ug/L			
Lead	7439-92-1	0.82	1.0	0.10	ug/L	J	U	B
Magnesium	7439-95-4	41300	500	0.70	ug/L			
Manganese	7439-96-5	59.2	1.0	0.01	ug/L			
Nickel	7440-02-0	4.7	1.0	0.06	ug/L			
Potassium	7440-09-7	29000	500	1.4	ug/L			
Selenium	7782-49-2	1.6	5.0	0.78	ug/L	J	J	
Silver	7440-22-4	0.035	1.0	0.01	ug/L	J	U	B
Sodium	7440-23-5	436000	2500	7.0	ug/L	D		
Thallium	7440-28-0	0.064	1.0	0.04	ug/L	J	U	B
Vanadium	7440-62-2	1.8	5.0	0.66	ug/L	J	J	
Zinc	7440-66-6	18.4	2.0	0.46	ug/L			