WORK PLAN
for

LIMITED ACCESS SEASON TREATMENT
LEVIATHAN MINE SITE POND 4

MARCH 2010

Prepared for

U.S. Army Corps of Engineers
Environmental Protection Agency Region 9

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LIST OF ATTACHMENTS

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A Site Health and Safety Plan

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LIST OF ACRONYMS

AMSL	Above Mean Sea Level
CAM	California Assessment Manual
CUD	Channel Underdrain
DI	Distilled
DS	Delta Seep
EPA	U.S. Environmental Protection Agency, Region 9
gpm	gallons per minute
HAZCOM	Hazard Communication
HOA	Hand, Off, Automatic (switch)
HDPE	High Density Polyethylene
hp	horsepower
ICP	Inductively Coupled Plasma
IDL	Instrument Detection Limits
LAS	Limited Access Season
ma	milliamp
mg/L	milligrams per liter
MCP	Motor Control Panel
MDL	Method Detection Limit
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSDS	Material Safety Data Sheets
NIST	National Institute of Standards and Technology
ORP	Oxidation Reduction Potential
OSHA	Occupational Safety and Health Act
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limits
PVC	polyvinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
%R	Percent Recovery

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RCTS™	Rotating Cylinder Treatment System™
RPD	Relative Percent Difference
RL	Reporting Limits
SB	sludge bin
SHSP	Site Health and Safety Plan
Site	Leviathan Mine Site
SMP	Site Management Plan
STLC	California Soluble Threshold Limit Concentration
TCLP	Toxicity Characteristic Leaching Procedure
TSM	Tailgate Safety Meeting
TTLC	California Total Threshold Limit Concentration
UL	Underwriters Laboratory
USACE	U.S. Army Corps of Engineers
USFS	United States Forest Service
VFD	Variable Frequency Drive
WET	Waste Extraction Test

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1.0 Introduction

1.1 Site Description and Background

The Leviathan Mine Site (Site) is an inactive sulfur mine located on the eastern slope of the Sierra Nevada mountain range in Alpine County, California at an elevation of approximately 7,000 feet above mean sea level (AMSL) within the Humboldt-Toiyabe National Forest. The Site is located about 25 miles southeast of South Lake Tahoe, California, six miles east of Markleeville, California, and three miles west of the California-Nevada border as shown in Figure 1-1 General Site Location Map – Hospital Map. Leviathan Mine is located adjacent to Leviathan Creek. Leviathan Creek is a major tributary to Bryant Creek which is a tributary to the East Fork Carson River. Mining occurred sporadically at Leviathan Mine from the 1850s to the 1960s. Since the 1950s, releases of acid solutions and metals from Leviathan Mine have degraded water quality in Leviathan Creek, Bryant Creek, and the East Fork Carson River. During the 1980s the State of California graded parts of the Site, and constructed ponds to contain acid solutions. Part of the grading included construction of concrete channels and a channel underdrain (CUD) system to separate Leviathan Creek waters from mine wastes and acid solutions at the Site. After the grading was complete, four sources of acid solutions to the surface water were identified: Adit and Pit Underdrain, Aspen (Overburden) Seep, CUD, and Delta Seep (DS).

During most years, ponds contain winter discharges from the CUD and pit underdrain, with the contained water treated and discharged to Leviathan Creek during the summer months. Discharge from Aspen Seep is treated year-round in a bioreactor system. Discharges from the CUD and DS are collected, treated, and discharged during the treatment season (May through October, depending on the weather) and are returned to Leviathan Creek without treatment during the remainder of the year (November through April, depending on the weather).

Occurrence of cold weather (temperatures consistently below 30 degrees) and precipitation typically prevent consistently extending the treatment season earlier than May 31 and later than October 1. Early (before May 31) and late (after October 1) treatment is referred to as limited access season (LAS) treatment. LAS treatment provides a significant benefit to the watershed downstream from Leviathan Mine. Water quality measurements and numerical counts of macroinvertebrates downstream from Leviathan Mine consistently show improvements for those years in which the pH of the watershed did not drop significantly early in the season as runoff diminished. Similar improvements in watershed health were observed when the treatment season was extended to late autumn. The commitment of responsible parties to performing LAS treatment has varied during the past several years. Currently, responsible parties are consistently performing LAS treatment. However, the U.S. Environmental Protection Agency (EPA) Region 9 intends to ensure that the benefits of LAS treatment will continue to be realized by being prepared to perform LAS treatment should responsible parties choose not to perform LAS treatment in the future.

This LAS Water Treatment Work Plan (Work Plan) is presented on behalf of the U.S. Army Corps of Engineers (USACE) and the EPA for LAS water treatment that may be conducted at the Site beginning in 2010.

1.2 Trigger Conditions

Trigger conditions for EPA performance of LAS treatment include provisions in the Administrative Settlement Agreement and Order On Consent for Removal Action (AOC) (EPA 2009), flow and chemical conditions in Leviathan Creek, and road conditions that limit access. These trigger conditions are described below.

AOC Conditions. Paragraph 50 (g) of the AOC states that Atlantic Richfield may request permission from EPA to operate during the spring or winter portion of the LAS. Permission to operate during fall/winter LAS must be made 5 days prior to commencing LAS operations; and permission to operate during the winter/spring LAS must be made at least 10 days prior to commencing LAS operations. According to Paragraph 50 (h) of the AOC, if EPA decides to perform LAS treatment, Atlantic Richfield has 7 days from receipt of such notice to request authorization from EPA to initiate capture of DS and CUD flows. Thus, under the AOC, EPA may decide to conduct LAS interception and treatment of CUD and DS flows, particularly if notice of intent to perform LAS interception and treatment is not received from Atlantic Richfield.

Flow and Chemical Conditions. Flow and chemical conditions used to identify the need to initiate LAS treatment include the flow in Leviathan Creek, CUD, and Delta Seep; and pH and specific conductance of Leviathan Creek at Station 15. Near real time flow monitoring information for the CUD and Leviathan Creek at Station 15 is available from the USGS at http://waterdata.usgs.gov/ca/nwis/current?type=flow. EPA maintains a data sonde with satellite link at Station 15, and the information can be viewed at http://eureka-data.com/USEPAR9Lab/. Comparison of the flow in Leviathan Creek, CUD flow, and timing of the decrease in pH and increase in specific conductance of Leviathan Creek as spring runoff declines from 2008 and 2009 showed that as the total flow of Leviathan Creek decreased below about 1.5 cfs, the water quality as indicated by pH and SC began to decline. These water quality declines occurred at a CUD discharge of about 32 gpm in 2008, and 26.5 gpm in 2009. During the fall, the water quality in Leviathan Creek declines almost immediately after return of CUD and DS flows to Leviathan Creek.

Road Conditions. Safe and successful completion of LAS treatment is contingent on road conditions. Prior to mobilization in spring or demobilization in fall, road conditions will be monitored to assess the ability for personnel, supplies, and equipment to safely travel to and from the site. Use of the road, and performance of LAS treatment will be in accordance with USFS requirements and the accident protection program. It is possible that road conditions could change and interfere with the ability to continuously operate the treatment system in the LAS, and/or prolong mobilization/demobilization efforts.

In summary, EPA will perform LAS treatment when, in accordance with the AOC, Atlantic Richfield chooses not to perform LAS treatment; the flow and chemical conditions in Leviathan Creek show that CUD and DS flows are causing a decline of water quality; and road conditions support safe access to and from the site for personnel, equipment, and supplies in accordance with USFS requirements.

1.3 Work Plan Organization

This Work Plan describes Site management (Section 2.0), Site transition-equipment mobilization (Section 3.0), system installation (Section 4.0), start-up and optimization (Section 5.0), treatment (Section 6.0), sludge management and disposal (Section 7.0), demobilization-site transition (Section 8.0), sampling (Section 9.0), quality assurance (Section 10), and reporting (Section 11). A Site Health and Safety Plan (SHSP) detailing safety protocols to be followed during performance of the work is included as Attachment A. Figures and tables follow the text.

2.0 Site Management

The Site Management Plan (SMP) included herein identifies: 1) key personnel involved in the project; 2) emergency contacts; 3) procedures for controlling Site access, operational and emergency communications, defined work areas, materials management, and decontamination procedures; and 4) a proposed project schedule. All workers and visitors who enter the Site during field activities are required to adhere to the provisions specified in the Work Plan and SHSP. The intent of the SMP is to clearly define Site requirements that will promote the efficient, safe, and coordinated completion of Site work.

2.1 Key Personnel

A brief description of the individual entities' roles and principal contacts and/or designees is provided below. Key project personnel are listed below, with the persons designated as having primary responsibility for implementation of this SMP in bold.

Burleson Consulting, Inc. (Burleson). Burleson will provide oversight, including but not limited to planning, scheduling, and coordinating the project team and communication with USACE and EPA. Burleson will provide subcontractor oversight during field activities at the Site. Burleson's key personnel are:

Project Manager:	**Gregory J. Reller, PG**	**(916) 984-4651**
Biologist/Site Safety Coordinator:	Kevin Ghalambor	(916) 984-4651
Health and Safety Officer:	David Elskamp, CIH	(916) 984-4651

Ionic Water Technologies, Inc. (IWT). IWT will provide subcontracting services in support of Limited Access Season (LAS) water treatment at the site. At times when Burleson personnel are not onsite, the IWT Project Manager will assume the responsibilities of the Site Safety Coordinator. IWT's key personnel are:

Project Manager:	**Dr. Tim Tsukamoto**	**(775) 321-8101**
Site Supervisor / Field Technician	Vance Weems	(775) 321-8101
Field Technician	Harold Wilson	(775) 321-8101
Field Technician	Jacob Kockler	(775) 636-2433

Emergency Contacts:

Alpine County Sheriff (will relay call to Police, Ambulance, Fire Department)	(530) 694-2231
Emergency Assistance (When using a cell phone, 911 calls are directed to CHP. For fastest response call the Alpine County Sheriff)	911
Carson Valley Medical Center 1107 Hwy. 395 Gardnerville, NV 89410	(775) 782-1600
Barton Memorial Hospital, 2170 South Avenue (corner of 4th Street) South Lake Tahoe, CA 96150	(530) 541-3420
Care Flight – Emergency Helicopter Service 450 Edison Way Reno, NV 89502	(800) 648-4888
National Response Center (NRC) (Toxic Chemical Releases/Spills)	(800) 424-8802
Tim Tsukamoto, Ph.D., Project Manager IWT, Reno, NV	(775) 846-9659
Vance Weems, Site Supervisor/Field Technician IWT, Reno, NV	(775) 762-2091

2.2 Communications

Burleson has evaluated communications requirements to support LAS treatment activities. Communications requirements are divided into operational and emergency communications.

2.2.1 Operational Communications

Operational communications are designed to facilitate safe and efficient work and movement at the Site. Burleson and IWT staff will have direct communications capability using hand-held radio units, cellular telephones, and satellite phones, as required. IWT will have primary responsibility for Site communications.

2.2.2 Emergency Communications

Emergency communications are designed to alert emergency responders in the event of an emergency (including but not limited to property damage, vandalism, trespass, personal injury, fire, and hazardous material spill). Burleson and IWT will maintain cellular/satellite telephone contact onsite during field work. In the event of an emergency, Site personnel will immediately implement an emergency response plan, notifying the appropriate emergency responders. The

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on-site safety coordinator will report the incident/accident as specified in the SHSP as soon as safely possible after initiating emergency response.

2.3 Site Safety

Worker safety will be the primary concern throughout the LAS. Site workers will be required to adhere to safety procedures outlined in the SHSP (Attachment A). All Burleson and IWT field personnel will be in compliance with Occupational Safety and Health Act (OSHA) 1910.120 for hazardous materials operations. A tailgate safety meeting (TSM) will be conducted prior to initiation of on-site activities each day. The TSM will identify activities planned for the day, required personal protective equipment (PPE), chemical, physical, and biological hazards posed by equipment and environmental factors and the work practices necessary to mitigate these hazards, and emergency response procedures. Special emphasis will be placed on specific emergency protocols (emergency response system notification, first aid procedures, egress, and route to the nearest medical aid) in the event that an accident or injury occurs at the Site. All Site workers will be required to participate in the daily TSM. If a worker is not onsite at the time of the meeting, the site safety coordinator will provide the worker with a safety meeting summary.

2.4 Site Access and Security

Access to the Site during field activities will be controlled in order to maintain worker safety at the Site. During the field work, Burleson and IWT will maintain a command post. The command post will be a portable job shack, if feasible to mobilize, near the south end of Pond 4 at the proposed location of the rotating cylinder treatment system (RCTS™). During mobilization a designated vehicle will operate as the command post (Figure 2-1 – Site Plan). The command post will maintain emergency instructions (including telephone numbers, Site location, and hospital route map), the SHSP with associated Hazard Communication (HAZCOM), material safety data sheets (MSDS) and sign in/out sheets as a record of all Site visitors and workers. The sign-in/out sheets will be clearly posted, and will require Site visitors and workers to state their onsite activities, time in, and time out. All Site visitors and workers will be briefed on field activities and Site safety procedures prior to entering the work area. To maintain Site security during non-working times, the gate controlling access to the Site will be locked. All proposed visitors are required to have written permission from an appropriate party in order to access the Site.

2.5 Site Preparation, Use, Maintenance, and Permits

In order to ensure worker safety and environmental protection, specific work areas and practices will be developed prior to activities. Work areas will include a command post (mobile job shack, if feasible, or designated vehicle), treatment system containment area, an equipment fueling/maintenance area, a parking area, and a decontamination station. Site entry and exit areas and traffic patterns will also be identified. The command post will be near the proposed location of the RCTS™ containment area at the southern end of Pond 4. A temporary earthen containment berm will be constructed in which the treatment system will be installed. The containment berm will act as a secondary containment for the treatment system in the event of a tank, RCTS™, or pipe failure. A parking area for vehicular traffic (worker and visitor vehicles) will be established near the command post. An information board, with emergency instructions

and sign-in/out sheets clearly visible, will be established at the command post. An equipment fueling/maintenance area will be established in the same vicinity, predominantly for the fueling and maintenance of generator systems. Decontamination areas will be identified and established onsite, if necessary.

The locations of specific work areas are subject to change upon arrival and inspection of the Site prior to beginning field work. U.S. Forest Service (USFS) road/access permits are required for the Site and are discussed in more detail in Section 3.0 (Site Transition-Equipment Mobilization).

2.6 Equipment and Materials

Equipment and materials will be brought to the Site to provide water treatment. Equipment will include light and medium vehicles, machines, and tools required to mobilize, install, and operate the RCTS™. Use of the following equipment and materials are anticipated:

- Bulldozer or other snow removal equipment
- Backhoe, Materials – Temporary Earthen Containment Berm Construction
- Gradall All Terrain Forklift – Mobilization, Equipment Unloading
- Mobile Job Shack (if conditions allow) - Command Post
- Diesel Generator
- Diesel Storage Tank
- Diesel Fuel
- Water Pumps and Piping
- Lime Delivery System
- Hydrated Lime
- RCTS™ Treatment System
- Sludge Bins (SB) and Bags
- Light and Medium Vehicles and Trailers (Materials, Equipment, SB Delivery)
- Portable Water Tank – Mob/Demob Decontamination
- Electrical Components and Wiring
- Heat Trace, Insulation, and Cover
- Portable generator for operation of standard hand tools
- Standard hand tools
- Appropriate PPE

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Equipment which has the potential to start a fire will be equipped with a fire extinguisher (UL rated 2-A/10- B-C). A shovel and an axe or Pulaski will be located at the command post. Equipment and materials brought to the Site to perform the field activities will be inspected and approved, as required. IWT will facilitate such inspections in order to prevent project delays.

2.7 Decontamination Procedures

Prior to mobilization, equipment used onsite will be cleaned to prevent introduction of noxious weeds to the Site. The equipment will be visually inspected upon arrival at the Site to document prior decontamination. Equipment that has come into contact with potentially contaminated soil will be decontaminated upon completion of field work, prior to demobilization. Equipment will be decontaminated onsite by removing large clumps of soil or debris, followed by pressure washing with water from a portable water tank. Decontamination fluids are not anticipated to contain significant concentrations of heavy metals, and will be allowed to infiltrate into the ground at the decontamination area.

2.8 Project Schedule

Project start-up activities for the LAS must be flexible in order to accommodate weather site conditions, and timing of the notice to proceed. Schedules are provided for two scenarios, a longer time frame which accounts for the lead time associated with procurement of the major components of the system and 30 days or more notice that EPA will perform LAS treatment, and an expedited time frame which assumes purchase of major components has occurred and equipment is staged for mobilization in Reno, NV or has been stored on site, to provide services with a minimal (5 to 10 days) notice that EPA will perform LAS treatment.

Long Time Frame. The following LAS schedule outlines activities that will be required to maintain continuous treatment of the CUD and DS flows during the LAS:

- System Component Procurement – 6 weeks prior to notification
- Notification – 30 days
- Site Transition / Mobilization – 5-7 days
- System Installation 7-10 days
- Start-up and Optimization – 5 days
- Treatment – As Requested
- Sludge Management and Disposal –continuous during treatment 7-10 days upon completion of treatment.
- Demobilization / Site Transition – 5-7 days

Under long time frame 84 to 91 to days would elapse from notification to system startup.

Expedited Time Frame. An expedited time frame assumes that major system components have been procured and are staged in Reno for mobilization or have been pre-mobilized to the site and stored. The expedited time frame essentially eliminates the procurement period.

- Notification – 5 days
- Site Transition / Mobilization – 5-7 days – Clear roads for vehicle access
- System Installation 7-10 days
- Start-up and Optimization – 5 days
- Treatment – As Requested
- Sludge Management and Disposal –continuous during treatment 7-10 days upon completion of treatment.
- Demobilization / Site Transition – 5-7 days

Under an expedited time frame, 17 to 22 days would elapse from notification to system startup.

In both scenarios it is preferable to procure system components and mobilize in the fall

3.0 Site Transition / Mobilization

IWT and Burleson will coordinate transition of the Site for LAS treatment. IWT and Burleson will communicate, as necessary, with representatives of Atlantic Richfield, State of California, US Forest Service, EPA, and USACE in conference calls, meetings, and coordinated Site visits, as required, to ensure a seamless transition in treatment system operations. The treatment system will be designed so as not to inhibit the operation and activities of the onsite High Density Sludge (HDS) system and personnel, and with the expressed goal of extending the treatment of CUD and DS waters for the improvement of water quality in Leviathan Creek.

3.1 Mobilization

This Work Plan focuses on spring mobilization. It is assumed that fall mobilization would be scheduled to occur when autumn weather is best. It is the stated goal of this work plan to extend the treatment of the CUD and DS flows to the extent that treatment can be performed safely. Mobilization of equipment and materials is anticipated to begin in early spring, possibly requiring snow removal and plowing of the access road to the Site. In addition, continued maintenance of the access road may be required for Site access and consumable deliveries.

Spring mobilization will begin with consensus of the involved parties, and should not require more than 5 days. If it is believed that snow removal and mobilization cannot be performed in 5 days, then scheduling will be postponed accordingly. Several Site visits may be required to evaluate conditions for mobilization.

Road permits are required for access to the Site and will be secured prior to the beginning of work. This will be coordinated with the USFS, and other parties, as necessary. Road maintenance and access will be performed at such a time as to limit or not damage the existing road; as such the decision to mobilize must include the approval of all applicable parties. Any damage associated with the mobilization of treatment equipment will be identified, reported, and repaired in coordination with the appropriate parties.

Burleson and Ionic anticipate that mobilization of treatment system components will be achieved through the use of 4 wheel drive light vehicles, medium weight vehicles (sludge bin delivery, and lime delivery), bumper tow trailers, and an all-terrain Gradall forklift.

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4.0 System Installation

System installation will begin after sufficient equipment and materials have been safely transported to the Site. System installation is diagrammed in Figure 4-1 Treatment System Detail Plan. The system will include the following components:

- Command Post
- CUD and DS Flow Capture and Conveyance
- Treatment System Containment Berm
- RCTS™ Treatment System
- Generators
- SB, Sludge Bag
- SB Dewatering Line to Pond 4
- Pond 4 Discharge Line
- Heat Trace, Insulation, and Cover

4.1 Command Post

A Mobile Job Shack will be rented and delivered to the Site, if feasible, as the Treatment System Command Post. The command post will be the center of Site activities as stated in Sections 2.4 and 2.5. The command post will also provide shelter for on-site personnel during system installation and the treatment.

A designated vehicle will act as the temporary command post until such time that a portable job shack can be delivered to the Site as conditions permit.

4.2 CUD and DS Flow Capture and Conveyance

IWT intends to utilize the existing capture tanks at the Site because the installation of additional tanks would be difficult without extensive Site preparation.

IWT will utilize 480 volt, 3 phase Variable Frequency Drive (VFD)-controlled submersible pumps and level sensors (4-20 milliamp [mA] level transducer) which will be installed through the top of the existing capture tanks. Pumps will be controlled to deliver a consistent flow to the treatment system which will help to prevent freezing. Piping will also be routed through the top of the existing tanks. There will be no changes or alterations to the currently installed system. Further, installation and operation of the pumps and level controls shall be performed in such a manner as to not inhibit the operation of, or access to the existing treatment system. Submersible heaters will be installed in each of the tanks to prevent freezing and damage to equipment.

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Captured flows from the CUD and DS will be pumped to the treatment system with appropriately sized submersible pumps (approximate maximum flow rate 40-60 gallons per minute [gpm] each) through high density polyethylene (HDPE) welded pipe.

Flows in the CUD and DS vary. The project goal is to capture and treat up to 80 gpm depending on influent chemistry. Flow meters and totalizers will be installed according to manufacturers' specifications for both the DS and CUD flows. Flow monitoring will assist in operational treatment and will record totals for the treatment period.

HDPE piping will be used for conveyance of water because of its ease of installation, cost, and ease of disassembly and re-use. Piping will follow the existing road from the DS and CUD capture tanks and be routed on the west side of Pond 4 near existing piping without limiting access to any portion of the installed HDS system at the Site and continue to the proposed RCTS™ location at the southern end of Pond 4.

4.3 Treatment System Containment Berm

A treatment system containment berm will be constructed in which lime slurry tanks, the dosing tank, RCTS™ units, effluent capture tank and pump, and piping will be installed. The containment berm will be of sufficient size and capacity to contain the total volume of the treatment system (approximately 4,000 gallons) in the event of a treatment system failure. This area will be designated as an exclusion zone, accessible to trained personnel only.

A sump well will be constructed to allow water to enter the sides of the well, which will house a float-controlled submersible pump that will convey water to Pond 4. The sump well will be covered to prevent snow accumulation and freezing of the containment area sump pump and level controls.

The area within the containment berm will not be lined. The LAS treatment system is a temporarily installed system which will be decommissioned at the conclusion of each treatment season. The proposed location is a parking area utilized during seasonal treatment by sub-contractors and visitors. Presence of a liner within the containment area will present a safety risk (slips and falls) in the treatment exclusion zone. A liner would also make restoration of the area to pre-LAS site conditions more difficult.

4.4 RCTS™ Treatment System Installation

RCTS™ units and treatment system components will be installed at the southern end of Pond 4. Currently this location is utilized for vehicle parking at the Site. See Figure 2 – Site Plan.

The RCTS™ will consist of lime slurry storage tanks, IWT Lime Grinder Pump(s), a pH dosing tank, pH probes and controllers, motor control, electrical system disconnect panels, RCTS™ units, RCTS™ effluent capture basin, polymer dosing system (optional), a treatment effluent capture tank and pump, and piping.

Diesel generators and diesel fuel storage tanks will be installed within separate, secondary containments as close as safely and reasonably possible to the treatment system.

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The command post, electrical control panels and switches will be located outside the treatment system containment exclusion zone.

A narrative description of the LAS Treatment System follows:

- Lime Slurry Storage Tanks and Mixers

  Lime slurry tanks will be installed on the east side of the containment, the closest point to the access road and command post. Lime slurry will be mixed by hand using hydrated lime in 35 or 50 lb. bags. Initially, influent water will be used to mix the lime slurry. After treatment begins, RCTS™ effluent will be used to mix the lime slurry. A "T" and valve will be installed in the system effluent water pipe just after the effluent capture tank submersible pump which will allow transfer of water to the lime slurry tank for the purposes of slurry make-up. It is the goal of the treatment system design to store and mix lime slurry at a concentration to facilitate continued treatment for a 2-day period. The lime slurry tank will be cone bottomed and constructed of HDPE having approximately 1,000-gallon capacity. A valve and flexible high pressure hose will be installed at the base of the tank for transfer of lime slurry to the lime grinder pump. For tank fill, the flexible line will be disconnected from the grinder and the fill line then connected which will clean the lime supply line while filling the tank. Mixer mounts will be installed on the top of the lime slurry storage tank. The lime slurry tank mixer will use a 1 ½ horsepower (hp) 480V 3 phase, properly guarded and grounded motor designed for use in a tank of this volume and type. The mixer will provide continuous agitation and suspension of lime slurry. The mixer will be controlled through Hand, Off, Automatic (HOA) switches and controls located in the Motor Control Panel (MCP) near the command post.

- IWT Lime Grinder Pump – Lime Delivery System

  An IWT Lime Grinder Pump ("Grinder Pump") will be used for the conveyance of lime slurry from the lime slurry storage tank to the pH dosing tank. The Grinder Pump eliminates clogging associated with lime scale. A 2-inch flexible, high pressure hose valve will be connected to the slurry tank bulkheads. The lime slurry manifold will be built to be serviceable for cleaning and maintenance. The manifold will utilize valves to allow continuous operation of the treatment system during the lime slurry make-up process. The Grinder Pump is driven by a 2 hp 480V 3 phase motor. The grinder pump will cycle on and off according to signals received from the output relay of the pH controller to maintain the treatment target pH in the dosing tank. Pump power will be provided through HOA switches and controls located in the MCP.

- pH Dosing Tank and Mixer

  A 2,400-gallon vertical open top tank constructed of HDPE will be used for pH dosing. The dosing tank will be installed in the treatment system containment berm reasonably close to the RCTS™ units and lime slurry storage tank, allowing access and egress. Influent water pipes will enter the top of the tank and be secured to the mixer mounting bracket to prevent siphoning from occurring in the event of a system upset. Influent water will be mixed with lime slurry to the prescribed treatment pH and gravity flow from the dosing tank to the RCTS™ units. Flanged tank bulkheads, pipe, and connections

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will be constructed of schedule 80 polyvinyl chloride (PVC). A mixer mounting bracket will be installed on the top of the tank to support a 2 hp 480V 3 phase mixer to maintain consistent agitation in the tank. The dosing tank mixer will be controlled with an HOA switch on the MCP located near the command post.

- pH Probes and Controller

  The lime delivery system will be pH controlled. A submersible pH probe will be installed at the top of the dosing tank near the outfall flow to the RCTS™ units. The probe will send a 4-20 mA signal to the controller located in the command post. The pH controller output relay will control the operation of the lime grinder pump at the MCP.

- RCTS™ Units

  Initially, two RCTS™-60HS™ units will be installed for aeration/oxidation and lime mixing. RCTS™ units will be installed inside the treatment system containment berm with the influent end of the units facing east. Schedule 80 PVC piping and flange tank bulkheads will be installed and will allow gravity flow from the dosing tank to the RCTS™ units. Each RCTS™-60 HS™ unit has a hydraulic capacity of 500 gallons and water levels in the RCTS™ units are maintained with a stand pipe inside the RCTS™ containment. Schedule 80 PVC piping and flange tank bulkheads will be installed to allow gravity flow from the RCTS™ units to an effluent capture basin. Each RCTS™ unit will utilize a 2 to 10 hp VFD- controlled 480 V 3 phase electric motor and gear reducer. VFDs will be installed to provide soft-start capabilities and to control RCTS™ rotor speed for system optimization. The RCTS™ drive motors will be operated by HOA switches located in the MCP.

- RCTS™ Effluent Capture Basin, Pump, and Piping

  Effluent from the RCTS™ will be captured in an HDPE basin which will be installed on the west end of the containment area. The effluent will be pumped to SBs located at the north end of Pond 4. Schedule 80 PVC pipe, flange bulkheads, and fittings will provide gravity flow from the RCTS™ units to the capture basin. Level controls will be installed in the basin and used in coordination with a VFD to control submersible pump speed and provide a consistent flow at a pressure set to maximize sludge bag efficiency. The effluent capture basin pump will be 480 V 3 phase and will be controlled by an HOA switch and VFD at the MCP. A trough heater may be installed in the effluent capture basin to help prevent freezing. The effluent capture basin will also include system overflow features to route overflow directly to Pond 4.

- Polymer Dosing System (Optional)

  A polymer dosing system may be utilized to enhance the performance of the sludge capture system, if required. The polymer dosing system would consist of a small solution tank constructed of HDPE, mixer, and solution delivery pump.

- Sludge Bags and Bins

  Sludge bags (geo-textile bags) and bins will be utilized for the separation and capture of sludge from treated water. The SBs will be located near the current SB sump at the northern end of pond 4. The bins will be installed as close to the access road as possible to facilitate delivery and removal of bins. Sludge bags will have a 1½-inch flange which

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will be connected to the 1½″ HDPE line from the treatment system effluent pump. Water will be conveyed from the SBs to Pond 4.

- Pond 4 – pH buffering pond

  Pond 4 will be utilized for pH buffering prior to treated water discharge. Sampling points around Pond 4 will be utilized to monitor the treatment system pH. Pond 4 will also allow storage capability in the event of a system upset.

- Pond 4 Discharge Pumps and Piping

  A 480 V 3 phase pump will be installed on the west side of Pond 4 for effluent discharge. The pump will be controlled through an HOA switch and VFD in the MCP. It is the objective of the LAS project to maintain a consistent discharge flow to the extent reasonably possible.

4.5 Generator Installation

Diesel generators will be used for power generation at the Site. The generators will be installed and maintained according to manufacturers specifications. The generators will be located in secondary containment vessels to control any spills. The generators will utilize a diesel storage tank, also with secondary containment, to facilitate continuous treatment and limit diesel delivery intervals. A transfer switch will be installed to provide back-up power generation in the event of a generator failure.

4.6 Heat Trace and Insulation

Influent and effluent piping will be heat traced and insulated to prevent freezing. Heat trace and insulation will be installed according to manufacturer's specifications and will be assembled to be easily disassembled, where required, after the treatment period. Heat trace will be installed at the time of pipe installation; insulation will be installed after the piping has been checked for leaks and deemed operationally sound.

5.0 Start-Up and Optimization

5.1 Start-Up

Start-up will begin with a quality control (QC) and assurance review of the treatment system installation. All aspects of the treatment system will be inspected and tested, as required, to assure proper operation and will be recorded on a start-up inspection form. The start-up inspection will include but not limited to:

- Visual inspection of all tanks and piping for leaks and abnormalities.
- Visual inspection of RCTS™ units for leaks and abnormalities.
- Inspection of the electrical system to confirm proper installation and operation of all electrical components. Includes operational information such as voltage and amperage draw for each component, and grounding checks of each component.

- Calibration of flowmeters, level transducers, and pH probe and controller to manufacturer's specifications.

5.2 Optimization

Historical data from previous treatment at the Site utilizing RCTS™ technology will be reviewed and used as a baseline for the beginning of the optimization process. Due to extensive historical data of RCTS™ operation at the Site the optimization process is not expected to require more than 5 days. A testing protocol will be established for the following optimization parameters:

- Identify and establish treatment system operational pH
  - Primary field HACH™ testing
  - Optional atomic adsorption operational sampling
  - Certified lab analysis
- Determine aeration/oxidation (residence time) requirements
- Identify operational lime slurry concentrations and lime efficiencies
- Evaluate sludge capture effectiveness

Through the use of historical data and field measurements, IWT will identify and establish the operational pH of the treatment system. The operational pH of the system is anticipated be at or near a pH of 8.3. This pH is based on reported operating information from Atlantic Richfield, 2009 and IWT, 2006. The testing protocol will sample system effluent at various pH levels and flow rates to establish the system target pH. LAS treatment system discharge objectives are presented in Table 5-1.

Samples from optimization testing will be analyzed in the field using HACH 2800 field equipment. IWT will utilize a handheld YSI 556 for field measurements of temperature, pH, dissolved oxygen, specific conductance, and oxidation reduction potential (ORP).

Operational analysis and sampling may be performed to confirm field data prior to or concurrent with the beginning of operational treatment.

IWT will determine the system residence time required for aeration/oxidation of the water to be treated. Oxidation requirements are a limiting factor in the treatment of the CUD and DS waters; this optimization testing will help determine if two RCTS™-60HS units will be capable of providing the necessary aeration to flows in excess of 80 gpm, as may be the case with spring run-off flows.

IWT will evaluate and identify a lime slurry concentration for treatment operation. There are two objectives for this evaluation: (1) to limit worker exposure to hydrated lime through engineered slurry storage capacity; and (2) to maximize lime efficiency and reduce sludge production and system fouling.

IWT will optimize the sludge capture system by identifying the maximum flow rate that can be achieved in each bag and bin while effectively removing sludge and expanding the treatment system accordingly.

Table 5-1 Limited Access Season Discharge Objectives

	LAS Discharge Objectives		Analytical Detection Limits
Parameter	**Average**	**Maximum**	**EPA 200.8/3010 A SW-846 6020A**
pH	6.0 – 9.0 s.u	6.0 – 9.0 s.u	Field Measurement
Aluminum	2.0 mg/L	4.0 mg/L	0.050
Arsenic	0.15 mg/L	0.34 mg/L	0.0005
Cadmium	0.004 mg/L	0.009 mg/L	0.00025
Chromium	0.031 mg/L	0.97 mg/L	0.0005
Copper	0.016 mg/L	0.026 mg/L	0.0005
Iron	1.0 mg/L	2.0 mg/L	0.020
Lead	0.005 mg/L	0.136 mg/L	0.0005
Nickel	0.094 mg/L	0.84 mg/L	0.0005
Selenium*	0.005 mg/L	Not Promulgated	0.0005
Zinc	0.21 mg/L	0.21 mg/L	0.0050

Notes:
All concentrations based on dissolved fraction
s. u. = standard units
*Concentration of selenium based on total recoverable fraction
mg/L = milligrams per liter

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6.0 Treatment

Treatment will begin after start-up and optimization have been completed. Burleson and IWT will supply personnel qualified to meet the stated requirements for all aspects of working at the Site, (see HSP at Attachment A). Treatment operations will include but may not be limited to:

- TSM, documentation, and record keeping
- Treatment system visual and operational inspections
- Treatment system maintenance
- Lime slurry make-up
- Monitoring and reporting
- Sample collection
- Coordination of sludge handling, transportation, and disposal

All work will be conducted in accordance with applicable regulations. Personnel are required to wear appropriate PPE as detailed in the HSP. Burleson and IWT will provide weekly operational reporting which will detail field work performed.

Treatment system visual and operational inspections and associated maintenance will be performed on each day that personnel are onsite. Inspections will be documented and recorded accordingly.

Lime slurry make-up will be an integral part of treatment system operations and is a top safety concern at the Site. As such, Burleson and IWT personnel will be trained to safely mix the lime slurry. On-site personnel will wear appropriate PPE, as mandated in the HSP, and will adhere to the lime slurry make-up process checklist at all times.

A monitoring plan will be developed during the start-up/optimization phase of the project which will identify treatment system monitoring points. Daily monitoring duties will include but may not be limited to:

- Operational conditions at the Site, (weather, safety)
- DS, CUD flow totals and rates
- DS, CUD field parameters (untreated)
- Lime slurry volume and use rate
- Diesel volume and use rate
- Generator daily inspection
- pH probe drift check and calibration

- Individual RCTS™ unit field parameters (RCTS™ effluent)
- Sludge bag and bin volumes and capacities
- Sludge bag and bin effluent water field parameters
- Pond 4 volume and capacity
- Pond 4 field parameters at multiple locations
- Discharge field parameters at prescribed intervals

Monitoring information will be recorded on field forms and in field notebooks, and will be summarized in weekly operational reporting.

7.0 Sampling and Analysis Plan

Sampling of water is necessary to document the effectiveness of the LAS treatment activities. Effectiveness will be evaluated by comparing RCTS™ effluent concentrations to the treatment objectives in Table 5-1. Sampling of influent from the DS, CUD, and combined influent will also be performed. Comparison of influent and effluent chemistry will support evaluation of treatment system efficiency. Influent and effluent samples will be analyzed using the analytical methods identified in Table 5.1, with detection limits at or below the numerical criteria for each metal. Verification of the accuracy and representativeness of laboratory analyses is discussed in the Quality Assurance Project Plan (QAPP) in Section 7.2 of this work plan. Analyses for field parameters (pH, specific conductance, temperature, and ORP) will be performed using field water quality meters maintained and calibrated in accordance with manufacturers instructions.

Sampling of sludge is necessary to characterize the sludge for disposal and to document the metal contents for mass balance evaluations.

A significant amount of information exists to support design of an optimum sampling and analysis plan. This information is from implementation of RCTS™ at Pond 4 site since 2004 (Atlantic Richfield 2004 to 2009). During 2004 and 2005, TKT Consulting, now Ionic performed treatment of Pond 3 water during LAS conditions (TKT Consulting 2005 and 2006). These experiences and the resulting information allow confidence that the RCTS™ technology should meet the treatment objectives. Based on analysis of information from previous sampling at the site, AMEC (2009) showed that field measurement of pH and iron were excellent indicators of RCTS™ effectiveness at treating combined CUD and DS flows, and that treatment system effluent could be discharged with confidence in meeting the treatment objectives based on maintaining the pH and iron concentrations within specified limits. Thus, the optimization data can be compared to this existing information and used to identify field parameter measurements useful to guide decisions regarding treatment status and discharge. Additional sampling and laboratory analysis will be performed to provide documentation that the discharged water complies with treatment objectives.

Personnel will collect samples according to the sampling plan outlined in Table 7-1. Samples will be collected by immersing the sample container in the water body to be sampled, or by

carefully filling the sample container from flowing water at a sample point. Care will be taken to prevent overfilling containers that contain preservative. Preserved containers may be filled by pouring from unpreserved containers triple-rinsed with the water to be sampled, if necessary.

Table 7-1 Sampling Plan

Sample Point and Type	# of Samples	Frequency
Opt – RCTS™ Optimization	5	Single sampling event during optimization
DS-Delta Seep	1	Weekly or as flow conditions warrant
CUD – Channel Underdrain	1	Weekly or as flow conditions warrant
Comb – Combined DS and CUD flows	1	Weekly or as flow conditions warrant
SB – Sludge Bin	1	Weekly or at sludge bag change intervals as deemed necessary
Disc - Discharge	1	Weekly
Sludge	1	Single sample prior to each sludge transportation and disposal event

Sampling will be performed according to the procedures outlined below.

7.1 Sample Integrity Requirements

This section discusses the sample integrity requirements for labeling, containerization, preservation, handling, shipment, and holding times that must be followed during LAS treatment. These procedures were developed in accordance with EPA guidance (EPA 1991) and SW-846 criteria (EPA 1997).

7.1.1 Sample Labeling and Location Designations

Information pertinent to environmental samples, including specific field collection data, names of sampling personnel, and field observations, shall be recorded in a permanently bound field logbook. Sample identification numbers will be linked to the sampling location according to the sample designation scheme described below. Each sample container will be labeled with a unique sample identification number prior to field analysis or shipment to a fixed laboratory. The following sample numbering system will be used for all samples:

Sample Date – Location – Time – Type – Preparation – QC Code

Where:

Sample Date = *"MM/DD/YY" for month/day/year*

Location	=	*"DS" for Delta Seep, "CUD" for Channel Underdrain, "Comb" for combined DS and CUD, "SB" for Sludge Bin, "Dis" for Discharge, "Opt" for Optimization samples which will also have an locating identifier which is as yet undetermined.*
Time	=	*"13:24" Time sample was pulled in military notation*
Type	=	*"W" for water, "S" for sludge*
Preparation	=	*"G" for grab, "C" for composite*
QC Code	=	*"MS/MSD" for matrix spike/matrix spike duplicate, "DUP" for field duplicate.*

For example, 03/19/10-DS-08:00-WG-DUP would designate a duplicate water grab sample collected from the DS at 8:00 am on March19, 2010.

7.1.2 Sample Containerization, Preservation, and Holding Times

Table 7-2 presents containerization, preservation, and holding time requirements for each parameter to be analyzed by the laboratory. Container sizes have been selected to allow for adequate sample volume for the required analysis. All containers will be obtained from the laboratory, and the laboratory will place the appropriate amount of preservatives in each container before shipment.

Holding times were identified from the analytical methods. The holding time is the duration a sample can be held, from the time it is collected until the time it is analyzed, and still produce acceptable results.

Table 7-2 Sampling Containerization, Preservation, Holding Times and Method

Analysis	Method	Matrix	Sample Volume Required	Holding Time	Preservation
Total and Dissolved Metals	200.8/6020 A (ICP-MS)	Water	500 milliliter poly bottle	180 days	Nitric Acid pH<2 Cool to 4 ºC
Total Metals	EPA 3050B/ 200.7/6010 A (ICP)	Sludge	16 ounce glass jar	180 days	Cool to 4 ºC
Soluble Threshold Limit Concentration Metals	CA Title 22 Chapter 11, App 2	Sludge	16 ounce glass jar	180 days	Cool to 4 ºC
Toxicity Characteristic Leaching Potential Metals	EPA 1311	Sludge	16 ounce glass jar	180 days	Cool to 4 ºC

7.1.3 Sample Handling and Shipment

Field personnel will follow chain-of-custody procedures for each sample collected. Samples will be protected from direct sunlight. Sample custody will begin when samples are collected. Samples will be wrapped and placed in a cooler or other appropriate container and maintained in the possession of the sampler or transferred to the possession of the designated field sample custodian. Sample custody and transfer will be documented on a chain-of-custody form. A line item on the field chain-of-custody form will be completed and initialed by the field sample custodian when a cooler has been filled with wrapped samples.

When all line items are completed or when the samples are picked up, the field sample custodian will sign and date the chain-of-custody form, list the time, and confirm the completeness of all descriptive information contained on the form.

The following information will be completed on the chain-of-custody form:

Project Name:	Leviathan Pond 4 LAS Treatment
Project Number:	TBD
Destination:	TBD
Technical Contact:	Enter the printed name, email and telephone for the technical contact.
Samplers:	Enter the printed name and signatures for all personnel who participated in collecting the samples.
Matrix:	Enter the sample matrix (water or soil).
Sampling Location:	Enter the assigned sample location number.
Preservation:	Enter the preservation required.
Date:	Enter the sample collection date.
Time:	Enter the time of the actual sample collection.
Number of Containers:	Enter the total number of sample containers for a given location.

All samples will be packaged and labeled for shipment in compliance with current transportation regulations. Only metal or plastic coolers will be used to ship hazardous waste samples. Each cooler will be lined with two plastic bags. Styrofoam, bubble wrap, or other packing materials will be used to absorb shock.

After the containers are packaged, the inner plastic bag around the samples will be sealed by twisting the top and securely taping the bag closed to prevent leaks. The inner plastic bag will be sealed with a signed custody seal. Chain-of-custody forms and any other shipping and sample documentation will accompany the shipment. These documents will be enclosed in a waterproof plastic bag and taped to the underside of the cooler lid.

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Each cooler prepared for shipment will be securely taped shut. Reinforced or other suitable tape (such as duct tape) will be wrapped at least twice around the cooler, near each end, where the hinges are located. A minimum of two custody seals will be placed on the sample shipping containers.

When selecting means of shipping samples, field personnel will ensure that samples will not exceed allowable holding times. When commercial common carriers are used to ship samples, all samples will be shipped for overnight delivery.

When a sample shipment is received, the laboratory sample custodian will assume custody of the samples and the shipping container will be inspected for warning labels and security breaches before it is opened. The sample custodian will open the container and carefully check the contents for evidence of breakage or leaking. The contents of the container will be inspected for chain-of-custody record forms and other information or instructions. The temperature of the cooler will be noted on the chain-of-custody record form, along with the date and signature of the person making the entry. After the sample custodian verifies that all information on the sample labels is correct and that it correlates with the information on the chain-of-custody record form, the custodian will sign the acknowledgment receipt form. The chain-of-custody record will be retained in the laboratory project file, and a copy will be returned to the Burleson project chemist to verify receipt.

Any discrepancy between the samples and the chain-of-custody information, any broken or leaking sample containers, or any other abnormal situation will be reported to the laboratory project manager. The Burleson project chemist will immediately be informed of any problem, and corrective action options will be discussed and implemented. The problem and its resolution will be noted on a corrective action form, which will be initialed and dated by the sample custodian.

The following identifying information will be entered into the laboratory's database or a bound sample logbook:

- Date of receipt
- Sample number
- Project number
- Analyses required

Each shipment of samples received at the laboratory will be assigned a work order number. Each sample container in the shipment will be given a unique sample number that includes the work order number and an identifying code. A laboratory sample label specifying the unique identifier will be attached to each container. A work order will be prepared that specifies the samples to be analyzed, the analysis required, QC requirements, and any other necessary information. The work order, accompanied by a copy of the chain-of-custody record, will be given to the group leaders, who schedule the digestions and analyses to meet applicable holding times or client schedules. For most analyses, sample preparation data and analysis results are entered into computer spreadsheets capable of generating analytical report forms and QC summary forms.

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Samples will be stored in secure, designated refrigerated areas, as required for the analysis to be performed. A logbook or form will be maintained for each refrigerated area, and the temperature will be recorded each working day. The logbook will be used to document whenever a sample is removed from, or replaced, in the storage area.

7.2 Quality Assurance and Quality Control

Throughout the data acquisition and treatability study activities, Burleson will implement quality control systems including review of deliverables by senior staff, review of laboratory documentation by a project chemist, completing field documentation, and following field sampling protocols described in this Work Plan.

Necessary quality assurance/quality control (QA/QC) measures are based on the anticipated uses of the data. Data from this work will be used to support objectives identified in Sections 3.0 and 4.0 of this Work Plan. QA/QC samples for the project laboratory will consist of duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples collected in the field. Duplicate samples will be submitted blind to the laboratory. Rinsate samples will not be necessary, because water samples will be collected directly into pre-cleaned sample containers provided by the analytical laboratory.

7.2.1 Analytical Procedures and Calibration

This section presents the process used to select analytical methods and provides a brief description of the methods, including a summary of the procedure and calibration requirements. Samples collected during the LAS treatment will be analyzed for the required parameters by the methods specified in Table 5-1.

7.2.1.1 Analytical Methods

When selecting appropriate analytical methods, Burleson considered specific analytes of interest, sample matrices, and minimum detectable concentrations needed to achieve the project objectives. This section provides a brief summary of the laboratory analyses for total metals, the main parameter for this investigation, as well as other physical and chemical properties of soil.

7.2.1.2 Metals

Aqueous and sludge samples will be analyzed for total metals using EPA Method 200.8/SW-846 Method 6020A, with digestion of the sample according to EPA 200.8 or SW-846 Method 3010A for water and Method 3050B for sludge.

Sludge samples will also analyzed for CAM 17 metals list (also known as Soluble Threshold Limit Concentration [STLC] metals) plus iron, manganese, and mercury, following preparation using the Title 22 California WET procedures.

Method 200.8 /SW-846 6020A uses ICP/MS analysis, which measures ions produced by a radio-frequency inductively coupled plasma. After sample preparation, the analyte species originating in the liquid are nebulized and the resulting aerosol is transported by argon gas into the plasma torch. The ions produced by the high temperatures are entrained in the plasma gas and separated on the basis of their mass-to-charge ratio by a mass spectrometer.

Extraction Methods 200.8 and 3010A prepare aqueous samples for determining the presence of total metals using ICP/MS. Method 3050B prepares soil samples for total metals. Samples are vigorously digested on a hot plate with nitric acid, followed by dilution with hydrochloric acid.

The STLC WET preparation utilizes a buffered weak acid leach to mimic leaching under landfill conditions. Solid samples are filtered, and mixed with a sodium citrate solution at a ratio of 10 times solution to solid sample volume, and vigorously agitated for 48 hours, followed by filtering, recombined with the initial filtrate, and the volume adjusted and acidified with nitric acid. These solutions will be agitated with the sample and analyzed for the CAM-17 list of metals.

7.2.1.3 Calibration Procedures and Frequency

Initial and continuing calibration requirements for analysis of the analytical methods are summarized in Table 6.

7.2.2 Data Reduction, Review, and Reporting

Correct data reduction and review equations and procedures must be used to verify that all field and laboratory data results are scientifically valid, defensible, and comparable. The following sections describe the data reduction, review, and reporting procedures that will be used in the evaluation.

7.2.2.1 Data Reduction

Each analytical method contains detailed instructions and equations for calculating compound concentrations or parameters. Data will be reduced using procedures given in analytical methods.

Field personnel or laboratory analysts responsible for measurements will enter raw data into logbooks or on data sheets. In accordance with standard document control procedures, the laboratory will maintain on file the original copies of all data sheets and logbooks containing raw data, signed and dated by the responsible analyst. Separate instrument logs also will be maintained by the laboratory to enable reconstruction of run sequences for individual instruments. The laboratory will maintain all data on file or electronically stored for 7 years in a secure archive location that can be accessed only by designated laboratory personnel.

The laboratory will store all residual samples and sample extracts until the data are reviewed or as directed by Burleson.

7.2.2.2 Data Review

Individual analysts will verify completion of the appropriate data forms and the completeness and correctness of data acquisition and reduction. The laboratory group leader or designee will review calculations daily and will inspect laboratory notebooks and data sheets weekly to verify accuracy, completeness, and adherence to specified analytical method protocols. Calibration and QC data will be examined daily by individual analysts and the laboratory supervisor. The group leader and QA manager or designee will verify that all instrument systems are in control and that QA objectives for precision, accuracy, representativeness, and completeness criteria and detection limits are being met.

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Analytical outlier data are defined as QC data that are outside of a specific QA objective range for precision or accuracy for a given analytical method. If QC data are outside of control limits, the laboratory supervisor will investigate to determine the likely causes of the problem. If necessary, the sample will be reanalyzed, and only the reanalyzed results will be reported. If the problem is deemed to be in the matrix, both initial and reanalyzed results will be reported and identified in the laboratory report. If reanalysis is not feasible, initial analysis results will be reported and the results will be flagged and identified in the laboratory report.

The laboratory project manager and QA manager will be responsible for initial laboratory data review. The Burleson project manager, Greg Reller, and the Burleson project chemist will be responsible for post-laboratory review of laboratory data.

7.2.2.3 Reporting

The laboratory project manager, the Burleson project manager, and the Burleson project chemist will approve the completed laboratory report before it is used to prepare the report. The laboratory will submit the standard analytical report, with QC summaries for each analysis, including the following:

- Case narrative, including a statement of samples received, description of any deviation from technology evaluation plan-specified procedures, explanation of any data qualifiers used, and any problems encountered during analysis.
- Computer-generated report forms to report sample results in the units specified in the analytical methods.
- A QC summary report, including summary forms for MS/MSDs, all laboratory blank samples, and laboratory check samples. The report must identify all QC outliers and must contain a detailed discussion of each outlier and any associated impact on data quality.
- Chain-of-custody forms.

In accordance with standard document control procedures, the laboratory will maintain on file the original copies of all data sheets and logbooks containing raw data, signed and dated by the responsible analyst. The laboratory will maintain separate instrument logs to enable run sequences to be reconstructed for individual instruments.

7.2.3 Calculation of Data Quality Indicators

This section presents specific calculations that will be used to describe the following data quality indicators: precision, accuracy, representativeness, completeness, and detection limits.

7.2.3.1 Precision

Precision is the measure of the reproducibility of the results. Precision will be estimated by analyzing duplicate matrix spike samples. The MS sample is the measured concentration in a spiked sample aliquot. The relative percent difference (RPD) between analyte levels measured in the MS sample and matrix spike duplicate (MSD) samples will be calculated using the following equation:

$$RPD = \frac{(MS - MSD) \times 100}{0.5(MS + MSD)}$$

RPD = Relative percentage difference
ABS = Absolute value
MS = Matrix spike
MSD = Matrix spike duplicate

7.2.3.2 Accuracy

Accuracy is the measure of how well the data compare to the true value. Accuracy will be estimated by calculating the percent recovery (%R) of laboratory MS samples, using the following equation:

$$\%R = \frac{(MS - S) \times 100}{Spike}$$

Where:

%R = Percent recovery
MS = Matrix Spike (measured concentration in spiked sample aliquot)
S = Measured concentration in sample (unspiked) aliquot
Spike = Concentration of known amount of analyte added to sample

7.2.3.3 Representativeness

Representativeness is the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is maximized by ensuring that sampling locations are selected properly and that a sufficient number of samples are collected.

7.2.3.4 Completeness

Completeness is the measure of the percentage of the data that can be used to evaluate project objectives. Completeness will be reported as the percentage of all measurements judged to be representative and useful. The following equation will be used to determine completeness:

$$\%C = (V/T) \times 100$$

Where:

%C = Percent completeness
V = Number of measurements judged to be valid
T = Total number of measurements

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7.2.3.5 Detection Limits

Detection limits are the minimum concentrations that can be accurately and routinely measured by an analytical system. Generally, a detection limit is determined by the analysis of several samples of water spiked with low concentrations of target analytes. Results for each method are reported based on the laboratory's reporting limits (RL), which are based on the method and instrument detection limits (IDL). RL are generally higher than the detection limits and can be further elevated based on sample matrix interferences.

Most methods include IDL, which are the instrument manufacturers stated values that can be detected above instrument noise. IDLs are minimum concentrations that can be measured for pure compounds in reagent water.

The method detection limit (MDL) is defined as "the measured concentration that is known with 99 percent certainty to be greater than analytical system noise." The MDL is considered to be the lowest concentration that can be routinely measured; its greatest limitation is the noise of the analytical measurement system. Most analytical methods include MDL values that should be achieved for pure compounds in reagent; however, analyte background matrix or individual target analytes at high concentration may prevent quantitation of other elements or compounds at low levels. The laboratory will determine MDLs for each method. For each method, seven replicate analyses are conducted. The standard deviation of the replicates is calculated and multiplied by the 99 percent Students t-Test value (3.143). The actual detection limit is defined as the concentration at which there is 99 percent certainty that an actual signal (not analytical system noise) is present. The detection limit study in effect at the time samples arrive at the laboratory will ensure that detection limits required for this project are achievable. Data from the most recent study documenting current detection limits will be available during data review.

RLs are based on the samples analyzed and reflect necessary dilutions based on sample matrix interferences, concentrations of analyte, and the extraction methods. The RL are based on values that the laboratory can reliably detect, called practical quantitation limits (PQLs) or also known as MDLs for each method.

Section 5.2 specifies QA objectives for detection limits for the metals to be analyzed as part of this investigation. Actual detection limits may be higher than QA objectives, however, because of non analyte background or individual target analytes at high concentrations in soil. Burleson will assess the impact of higher detection limits on the usefulness of the data and will work with the laboratory to achieve lower detection limits, if needed.

7.2.4 Measurement Quality Objectives

The overall Measurement Quality Objective (MQO) for this investigation is to produce well-documented data of known quality. Quality is measured by the data's precision, accuracy, representativeness, and completeness criteria, and detection limits. If analytical data fail to meet the MQOs described in this section (for example, because of matrix interferences), Burleson will explain the reasons for such failure in the project report. This report also will describe any limitations on the usefulness of the data.

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7.2.4.1 Corrective Actions

The following corrective actions may be taken for data that do not meet MQOs:

- verify that the analytical measurement system was in control,
- thoroughly check all calculations,
- use data qualifiers (flags), and
- reanalyze affected samples, if authorized by USACE and if a sufficient quantity of sample is available.

7.2.4.2 Precision and Accuracy

Precision and accuracy goals depend on the types of samples, analyses, and ultimate use of the analytical data. Table 7-3 summarizes precision and accuracy goals for all analyses.

For the metals listed in Table 7-3, accuracy will be evaluated from MS/MSD samples as %R. In addition, laboratory control samples (LCS), prepared from a different stock solution than the calibration standards and traceable to established standards, will be analyzed with each sample batch, and the %R calculated. Precision will be evaluated as the RPD between MS/MSD results. Precision also will be evaluated using laboratory duplicates. An RPD will be calculated for each analyte in the duplicate pair.

7.2.4.3 Detection Limits

Expected detection limits for metal analytes, as listed in Table 7-3, are based on historical MDL studies by the laboratory and experience with the type of matrix being analyzed within the evaluation. Method blank results will be reported only at concentrations greater than the detection limit to decrease reporting of low-level blank contamination. Data from the most recent MDL study and individual data packages will be available during data review.

7.2.4.4 Completeness

Completeness is an assessment of the amount of valid data obtained from a measurement system compared to the amount of data expected. The percent completeness is calculated as follows: the number of samples yielding acceptable data is divided by the total number of samples to be collected, and the value obtained is then multiplied by 100. The MQO for the degree of completeness is 90 percent. If completeness is less than 90 percent, Burleson will document why this objective was not met and the impact of a lower percentage, if any, on the project.

7.2.4.5 Representativeness

For this project, representativeness involves sample size, sample volume, and sampling locations. The QA goal is to obtain an adequate number of samples that represent the media and its properties at the time of collection. The volume of sample collected also depends on the analytical method chosen, allowing for QC sample analysis and reanalysis, if needed. Method blanks are also an indicator of representativeness. If target compounds are not detected in method blank samples, then target compounds detected in analytical samples are representative of the sample, rather than laboratory or cross-contamination.

Table 7-3 Measurement Quality Objectives for Analytical Parameters for Water and Soil

Analyte	Analytical Method	Soil Detection Limit [a] mg/kg	Water and STLC Detection Limit [a] µg/L	Precision (RPD) [b]	Accuracy (% R) [c]
Metals Analysis					
Antimony	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Arsenic	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Barium	EPA 200.8/SW-846 6020A	5	5	25	75 to 125
Beryllium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Cadmium	EPA 200.8/SW-846 6020A	0.25	0.25	25	75 to 125
Calcium	EPA 200.8/SW-846 6020A	100	100	25	75 to 125
Chromium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Cobalt	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Copper	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Iron	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Lead	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Magnesium	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Manganese	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Mercury	EPA 200.8/SW-846 6020A	0.05	0.05	25	75 to 125
Molybdenum	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Nickel	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Potassium	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Selenium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Silver	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Sodium	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Thallium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Vanadium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Zinc	EPA 200.8/SW-846 6020A	5.0	5.0	25	75 to 125

Analyte	Analytical Method	Soil Detection Limit [a] mg/kg	Water and STLC Detection Limit [a] µg/L	Precision (RPD) [b]	Accuracy (% R) [c]
Inorganic Parameters					
pH	EPA 150.1	pH units	0.1	10	0.1 % bias
SC	EPA 120.1	µmho	1	10	5% bias

Notes:
a = Detection limits may be higher for samples with elevated contaminant concentrations. TOC detection limits may vary depending on instrument system's precision.
b = Precision as RPD
c = Accuracy as % R of matrix spikes
%R Percent recovery
RPD Relative percent difference
SW-846 Test Methods for Evaluating Solid Waste/Chemical Methods (EPA 1997)
SM Standard Methods for Chemical Analysis of Water and Wastes (EPA 1983)
mg/L Milligram per liter
µg/L Microgram per liter

7.2.4.6 Comparability

Data comparability will be maximized by using standard EPA analytical methods, when possible. Procedures for all planned methods are specified, and any deviations from the methods will be documented. All results will be reported down to the detection limit in the standard units shown in Table 7-3 or in the units specified in the method. Laboratory calibrations for metal analysis will be based on National Institute of Standards and Technology standards. Comparability also will be maximized by use of consistent sample collection techniques and analytical methods.

7.2.5 Laboratory Quality Control Requirements

Laboratory QC checks are designed to determine analytical precision and accuracy, demonstrate the absence of interferences and contamination from glassware and reagents, and ensure comparability of data. Laboratory QC checks consist of LCSs, method blank samples, MS/MSD samples, laboratory duplicate samples, and other checks specified in the methods. The laboratory also will complete initial calibrations and continuing calibration checks according to specified analytical methods (see Table 6). Laboratory internal QC checks are summarized in Table 8. Table 8 also indicates the required frequency, acceptance criteria, and the corrective action for each QC check. Each of these checks and their frequencies are discussed below.

7.2.5.1 Laboratory Control Samples

LCSs consist of reagent water that has been spiked with standard reference materials at a known concentration. LCSs are analyzed with each analytical batch or once every 20 samples, for each parameter, whichever is more frequent. LCSs for metal analysis will consist of a mixture of the required total metals of interest. LCSs also will be used to verify laboratory accuracy in the absence of chemical matrix interferences related to field samples.

7.2.5.2 Method Blank Samples

Method blank samples will verify that analytical procedures do not introduce contaminants that affect analytical results. Method blank samples will be prepared by adding all reagents to reagent water for aqueous samples. This blank sample then will undergo all of the procedures required for sample preparation. The method blank sample will be analyzed with field samples prepared under identical conditions.

7.2.5.3 Laboratory Duplicate Samples

A laboratory duplicate sample is used as laboratory method for precision. A second aliquot of a sample is measured and labeled as a duplicate. This sample is digested and analyzed in the same manner as all of the other samples. Results of the original sample and the duplicate sample are compared, and an RPD value is calculated. The QC limit for the RPD is 20 percent.

8.0 Reporting

Reporting will occur in two formats. Information submittals will include duplicates of field data sheets, field notes, and summary analytical data transmitted within 10 working days of completion of each week's field effort and within 10 days receipt of laboratory analysis. Information submittals will document performance of field work.

8.1 Field Notes and Logbooks

Field personnel will record all information pertinent to LAS treatment in a field logbook. The field logbook will be water-resistant, and all entries will be made in indelible ink. Each page of the logbook will be initialed and dated by the person making the entries. Logbooks are accountable field documents and serve as a chronological representation of the sampling program. Sufficient detail will be included in the logbook to summarize sampling and field measurement activities without relying on the recorder's memory. If any corrections are necessary in the logbook, the error will be lined out with a single line and the correction will be initialed by the field personnel. At the end of the field day, blank space in the field notebook will be lined out, initialed, and dated. Examples of typical field logbook entries include the following:

- Personnel present
- Daily temperature and other climatic conditions
- Field measurements, activities, and observations
- Referenced sampling location description (in relation to a stationary landmark) and maps
- Sample collection methods and equipment
- Date and time of sample collection
- Types of sample containers used
- Sample identification and cross-referencing
- Sample types and preservatives used
- Analytical parameters
- Sampling personnel
- Site sketches
- Visitors to the Site

8.2 Photographs

Digital photographs taken during the on-site activities will be numbered to correspond to field logbook entries. The name of the photographer, date, time, location, and photograph description will be entered sequentially in the field logbook as photographs are taken. Adequate field logbook notations will be retained to account for custody of digital information.

9.0 Sludge Management and Disposal

Sludge from treated waters will be separated, contained, and disposed of through the use of geo-textile bags and bins.

Appropriate PPE will be worn at all times when handling treatment sludge.

Sludge generated during lime treatment of combined CUD and DS flows will be tested and compared to federal hazardous waste characteristics and California Water Code Section 13172 criteria to determine whether they are hazardous. Regulatory threshold limits for determining if the treatment solids are hazardous are presented in Table 9.1.

Table 9-1 Treatment Solids Hazardous Characterization Limits

Parameter	STLC Extract mg/L	TCLP Extract mg/L	TTLC mg/kg
Al	NP	NP	NP
Sb	15	NP	500
As	5	5	500
Ba	100	100	10,000
Be	0.75	NP	75
Cd	1	1	100
Ca	NA	NA	NA
Cr	560	5	2,500
Co	80	NP	8,000
Cu	25	NP	2,500
Fe	NP	NP	NP
Pb	5	5	1,000
Mg	NA	NA	NA
Hg	0.2	0.2	20
Mo	350	NP	3,500
Ni	20	NP	2,000
Se	NA	NA	NA
Ag	NA	NA	NA
Ti	7	NP	700
V	24	NP	2,400
Zn	250	NP	5,000

Notes:
STLC – California Soluble Threshold Limit Concentration
TCLP – Toxicity Characteristic Leaching Procedure
TTLC – California Total Threshold Limit Concentration
NP – not promulgated
TTLC regulatory limits based on wet weight concentrations

10.0 Demobilization/Site Transition

At the conclusion of LAS treatment, equipment and materials will be demobilized and a site transition will occur. This will be a coordinated effort between Burleson, IWT, Atlantic Richfield, and contractors responsible for the operation of the currently installed HDS system. Daily communication concerning scheduling, traffic patterns, and on-site personnel will be recorded.

Demobilization will be similar to the mobilization process with some exceptions. Burleson and IWT anticipate that LAS treatment will resume at the conclusion of seasonal operation of the HDS plant. Equipment purchased for the LAS plant will be stored onsite in the flat area to the west of Pond 3. Rented and leased equipment such as the command post, generators, and sludge bins will be decontaminated and removed from the site for the period of time the HDS plant is in operation.

10.1 Site Transition Special Considerations

This section will detail site transition planning considerations which IWT and Burleson have identified.

10.1.1 Site Communications/Traffic Coordination

Site communication and traffic coordination will be paramount in the mobilization and demobilization of the LAS treatment system. IWT and Burleson will coordinate on a weekly schedule to detail site activities including traffic considerations. The Site Safety Coordinator will communicate with all other parties onsite to ensure site control and access, and with Atlantic Richfield and its contractors to coordinate site transition. The Site Safety Coordinator will participate in Atlantic Richfield safety and planning meetings, as necessary, to ensure worker safety during the transition periods.

10.1.2 CUD/DS Capture and Conveyance

The LAS CUD/DS capture and conveyance system will be installed in such a manner to not inhibit the operation of the currently installed HDS capture systems to the extent practical. The temporarily installed system will be removed from service and decommissioned at the client's sole request and at such time that the currently installed HDS capture system is operational. Storage or demobilization of the treatment system and components will also be at the client's discretion. Documented records will be kept, (photos and descriptions) of the capture systems prior to and at the conclusion of LAS treatment. Capture tanks and systems will be maintained and cleaned to Atlantic Richfield's satisfaction.

10.1.3 Sludge Bin, Relocation, Removal

The LAS treatment system will utilize the existing SB sump installed onsite. IWT intends to use a portion of the SB sump until such time that they may be relocated to the treatment system containment berm or other identified area for the continued de-watering of treatment sludge. At such time that the sludge is deemed "solid" and may be transported as a "solid" rather than a

"liquid", sludge bags will be removed for proper off site disposal, and bins will be decontaminated and removed from the site.

10.1.4 Pond 4 Water Levels

Pond 4 will be closely monitored prior to and at the conclusion of LAS treatment. Special care will be taken to document LAS treatment activities in order to provide assurance that additional Pond 4 sludge volume will be minimized. Discharge of the final volume of treated water from Pond 4 will be coordinated with Atlantic Richfield to ensure a smooth transition to HDS treatment.

10.1.5 Pre/Post LAS Site Conditions

Site conditions will be documented prior to, during, and at the conclusion of LAS treatment. IWT and Burleson will record conditions with photos and narrative description, with particular attention to those issues which might impede seasonal water treatment at the site.

10.1.6 Decontamination

Decontamination is the process of washing equipment and materials for the purpose of preventing contamination and exposure to possibly harmful contaminants outside of the treatment area. A decontamination process will be adhered to during the decommissioning phase of the LAS treatment. The focus of the decontamination process will be on SB equipment, sludge transportation, and treatment system equipment. Sampling and monitoring equipment will also be decontaminated prior to use.

The containment berm area will act as a decontamination zone for treatment system equipment. All treatment system equipment used or exposed to contaminants will be thoroughly cleaned, packaged, and stored on site or transported off site.

The SB holding area on site will be utilized as a decontamination zone for equipment used to transport sludge off site.

The following materials may be used for the decontamination process.

- Pressure Washer Equipment
- Handheld pressurized sprayer
- Scrub brushes
- Buckets
- Biodegradable soap
- Tap water/Distilled (DI) Water
- Plastic Bags
- PPE

General equipment decontamination procedures are summarized below.

- Sampling equipment, meters, and monitoring equipment will be decontaminated before initial use and after each use in the field with a combination of brushes, soap and DI water.
- Treatment system equipment will be brushed, scrubbed with mixture of biodegradable soap and tap water, and rinsed to remove adhering soil. A hand pressurized sprayer or pressure washer may also be used.
- Sludge transport containers and trucks will be brushed, scrubbed with mixture of biodegradable soap and tap water, and rinsed to remove adhering sludge. A pressure washer and portable water tank may also be used for the decontamination of trucks exposed to sludge, particularly for the cleaning of equipment undercarriages.
- Equipment and materials will be allowed to air dry on site prior to removal.

Decontamination waste will be disposed of in coordination with sludge waste transport and disposal or sequestered on site at the client's request. Wash and rinse water from the decontamination of equipment will be contained in the treatment system berm area and be allowed to infiltrate the ground surface area, or pumped to Pond 4. Disposable PPE and decontamination equipment will be double bagged and disposed of at a municipal landfill.

11.0 References

AMEC. 2009. 2009 Removal Action Work Plan, Leviathan Mine Site, Alpine County, California. March 1.

~~2004 to 2009.~~ Atlantic Richfield Company. 2004 to 2009. Early Response Action Completion Reports.

US Environmental Protection Agency. 2009. Administrative Settlement Agreement and Order On Consent for Removal Action, Leviathan Mine, Alpine County California. Respondent: Atlantic Richfield Company.

TKT Consulting LLC. 2005. Technical Memorandum Prepared for the Lahontan Regional Water Quality Control Board: Pond 3 Emergency Treatment. July 14.

TKT Consulting LLC. 2006. Data Summary Report Prepared for The Lahontan Regional Water Quality Control Board: Pond 3 Emergency Treatment at the Leviathan Mine 2006. September.

Tables

Table 7-3 Measurement Quality Objectives for Analytical Parameters for Water and Soil

Metals Analysis					
Analyte	**Analytical Method**	**Soil Detection Limit [a] mg/kg**	**Water and STLC Detection Limit [a] µg/L**	**Precision (RPD) [b]**	**Accuracy (% R) [c]**
Antimony	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Arsenic	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Barium	EPA 200.8/SW-846 6020A	5	5	25	75 to 125
Beryllium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Cadmium	EPA 200.8/SW-846 6020A	0.25	0.25	25	75 to 125
Calcium	EPA 200.8/SW-846 6020A	100	100	25	75 to 125
Chromium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Cobalt	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Copper	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Iron	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Lead	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Magnesium	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Manganese	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Mercury	EPA 200.8/SW-846 6020A	0.05	0.05	25	75 to 125
Molybdenum	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Nickel	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Potassium	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Selenium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Silver	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Sodium	EPA 200.8/SW-846 6020A	20	20	25	75 to 125
Thallium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Vanadium	EPA 200.8/SW-846 6020A	0.5	0.5	25	75 to 125
Zinc	EPA 200.8/SW-846 6020A	5.0	5.0	25	75 to 125

Table 7. Measurement Quality Objectives for Analytical Parameters for Water and Soil

Inorganic Parameters					
Analyte	**Analytical Method**	**Measurement Unit**	**Water| Detection Limit [a]**	**Precision (RPD) [b]**	**Accuracy (% R)[c]**
pH	EPA 150.1	pH units	0.1	10	0.1 % bias
SC	EPA 120.1	µmho	1	10	5% bias

Notes:

a = Detection limits may be higher for samples with elevated contaminant concentrations. TOC detection limits may vary depending on instrument system's precision.

b = Precision as RPD

c = Accuracy as % R of matrix spikes

%R Percent recovery

RPD Relative percent difference

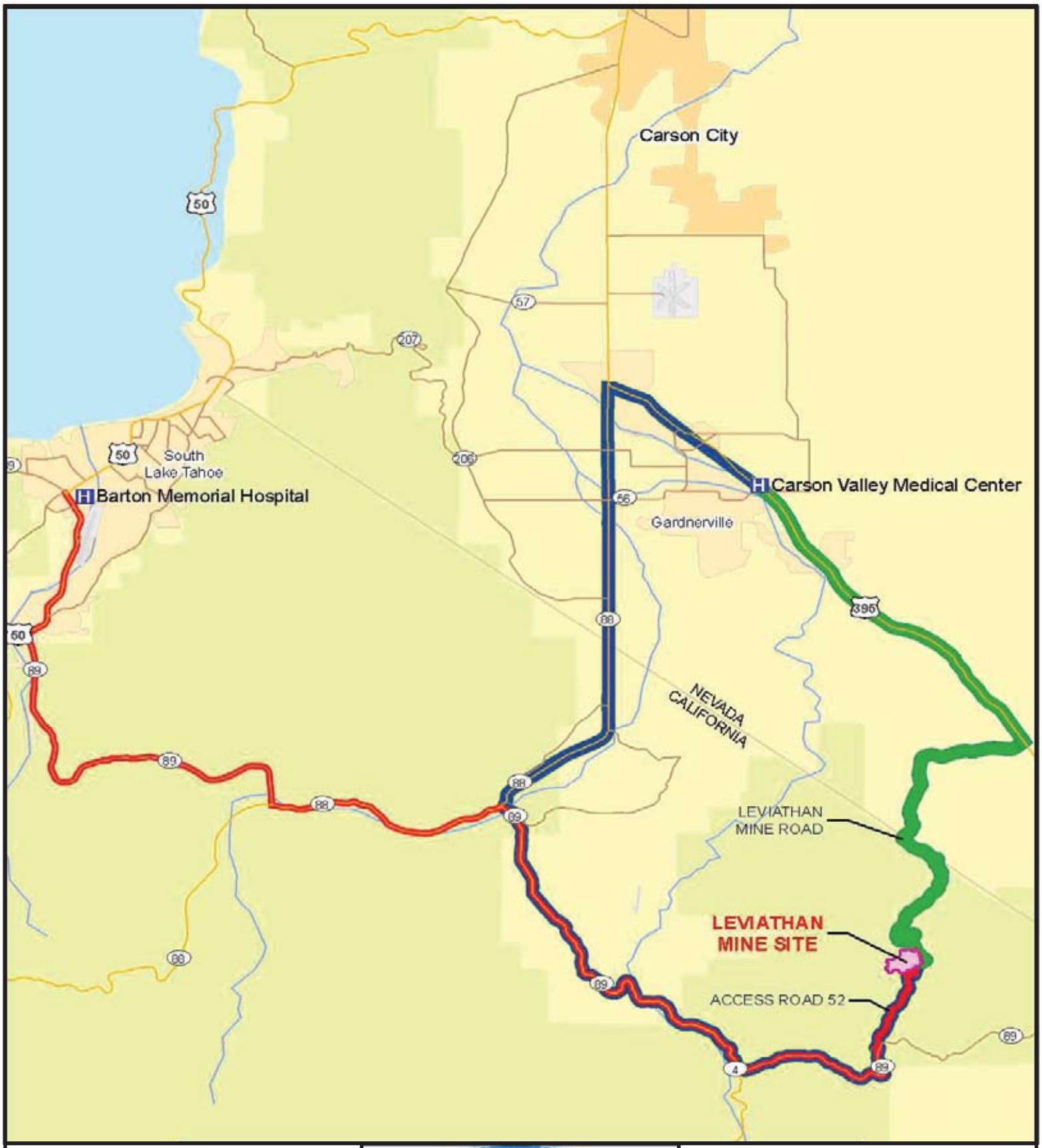
SW-846 Test Methods for Evaluating Solid Waste/Chemical Methods (EPA 1997)

SM Standard Methods for Chemical Analysis of Water and Wastes (EPA 1983)

mg/L Milligram per liter

µg/L Microgram per liter

Figures



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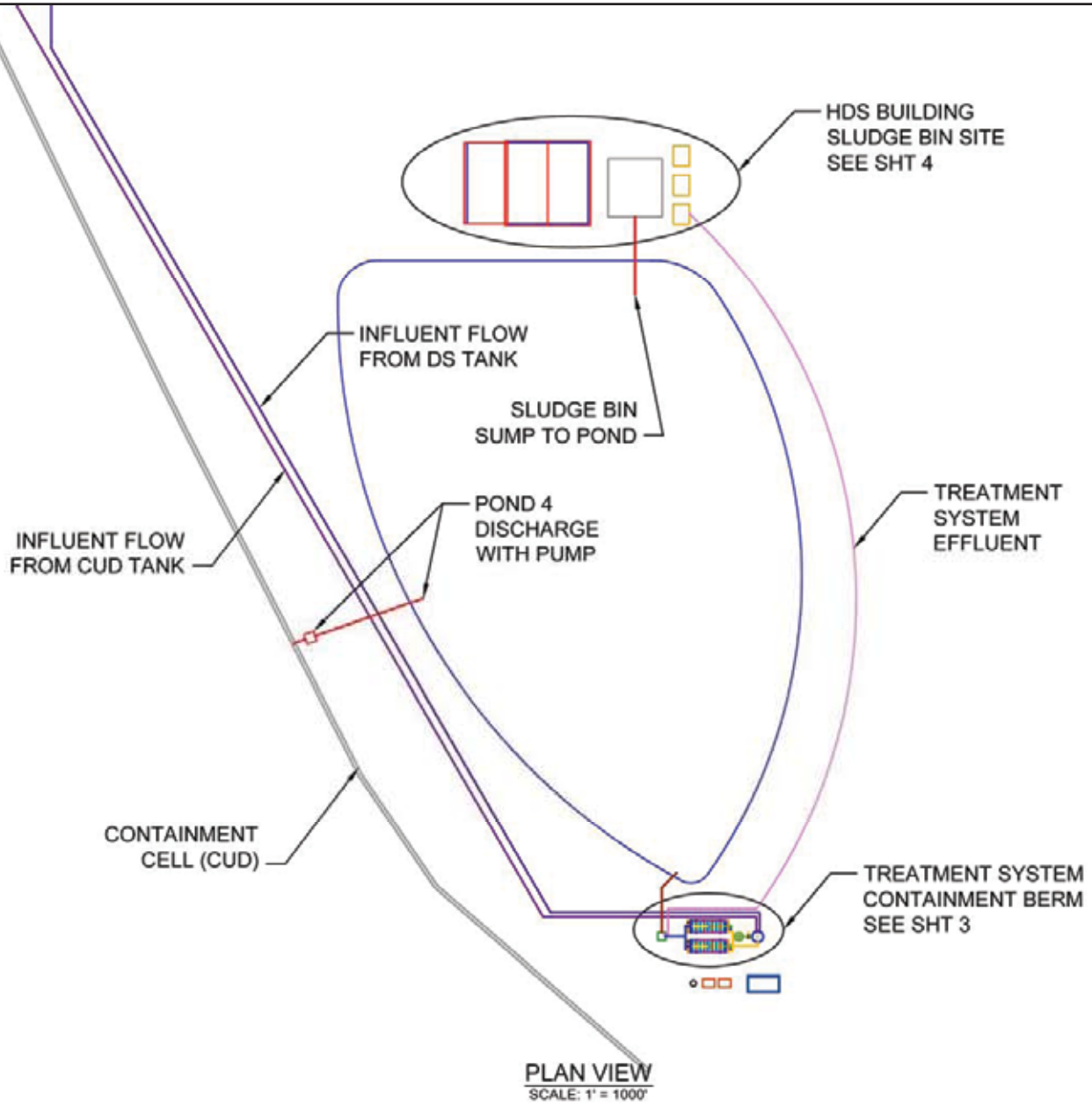
Ionic Water Technologies

Figure 1-1
Site Location and Hospital Route
Limited Access Season Treatment
Leviathan Mine
Alpine County, California



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Ionic Water Technologies

Figure 2-1
Site Plan
Limited Access Season Treatment
Leviathan Mine
Alpine County, California

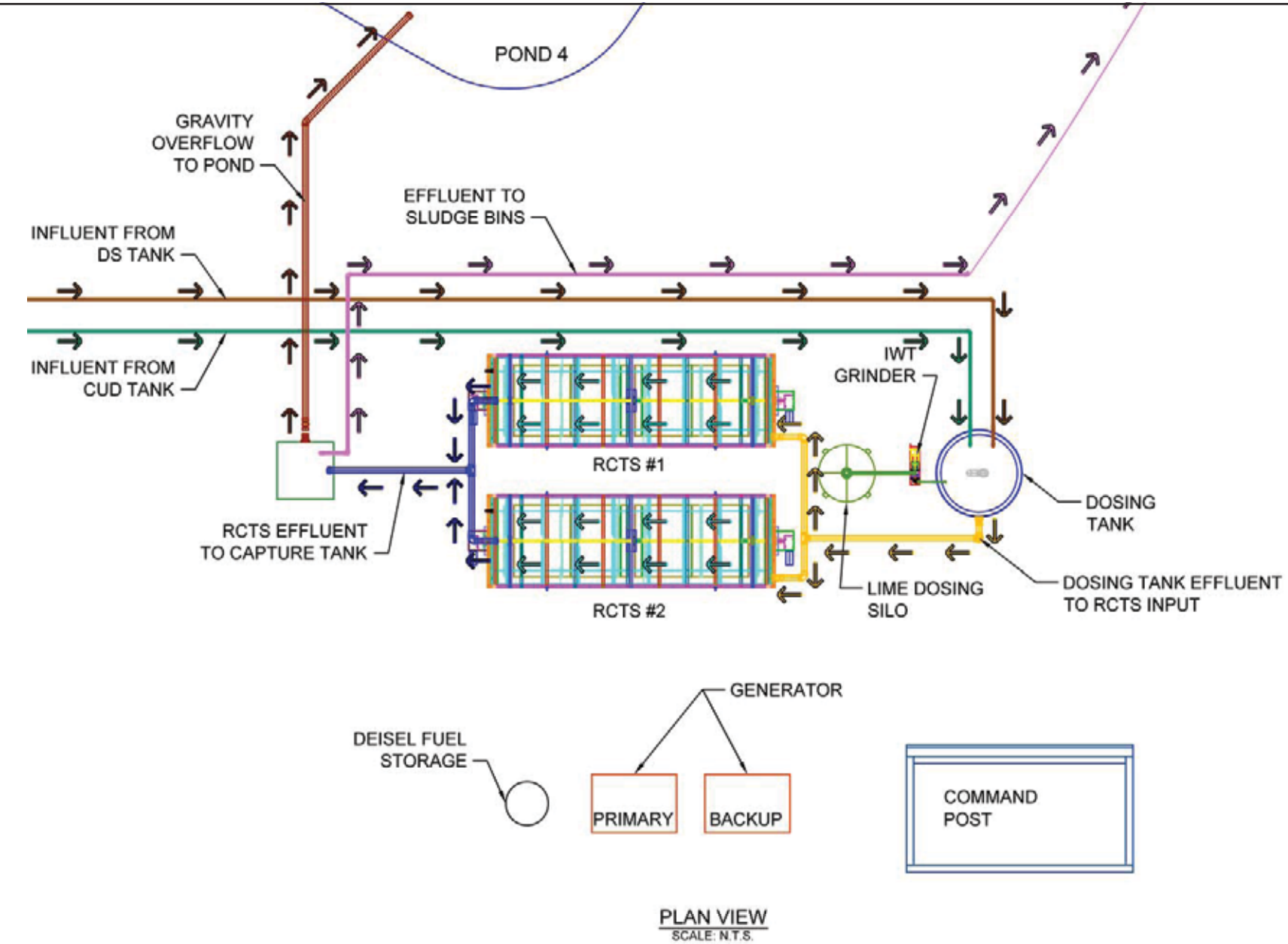

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Figure 4-1
Treatment System Details
Limited Access Season Treatment
Leviathan Mine
Alpine County, California

Appendix A

(To be provided separately)