Rio Algom Mining LLC

April 15, 2016

Mr. David Pals
Bureau of Land Management
Moab Field Office
82 East Dogwood Avenue
Moab, UT 84532

Re: **Modification of the Plan of Operations, Lisbon Facility Hydrogeological Supplemental Site Assessment, Radioactive Material License Number UT 1900481**

Dear Mr. Pals:
Rio Algom Mining LLC (RAML) is submitting this Modification to the Plan of Operations to carry out the work detailed in *Work Plan for the Lisbon Facility Hydrogeological Supplemental Site Assessment, Radioactive Material License Number UT 1900481* (Work Plan) dated December 3, 2015 (INTERA, 2015). This Modification to the Plan of Operations is being submitted in accordance with 43 CFR 3809.401(b), adapted from *Format 4.3-1 – Plan of Operations*, provided in the BLM Handbook.

The proposed coring and monitoring well installation will further delineate the north and south contaminant of concern (COC) plumes and help characterize the Lisbon Valley Fault as a flow boundary and as an exposure pathway. Four core holes and seven new monitoring wells are proposed to address these issues and remain in compliance with the Radioactive Materials License issued through the Utah Division of Radiation Control.

This Modification to the Plan of Operations would allow for drilling and construction of up to seven additional groundwater monitoring wells and four core holes, two of which will be converted into monitoring wells (**Figure 1**). Each well will be accessed by roads that, where possible, will be improved existing roads but will require development of additional temporary access roads. The total new disturbance is expected to be less than 3 acres.

If you have any questions regarding this Modification to the Plan of Operations, please contact me (209-736-4803) or Kent Applegate (505-287-8851 x11).

Sincerely,
Rio Algom Mining LLC

Theresa Ballaine
Manager

CC: C. Kent Applegate
Attachment

Rio Algom Mining LLC

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BACKGROUND

This document is adapted from the Bureau of Land Management's (BLM) Format 4.3-1 – Plan of Operations (43 CFR 3809.401 (d)). Rio Algom Mining, LLC (RAML), has adapted this form for the purpose of describing proposed activity under the Surface Management Regulations at 43 CFR 3809.

The main objectives of the Work Plan submitted by INTERA Incorporated (INTERA) in 2015 for the Lisbon Facility are to install additional borings and monitoring wells that will 1) enable further delineation of the north and south contaminant of concern (COC) plumes and 2) enable further characterization of the Lisbon Valley Fault as a flow boundary and as an exposure pathway (INTERA, 2015). The Work Plan was developed in response to the Request for Information (RFI) issued by the Utah Division of Radiation Control (now Utah Division of Waste Management and Radiation Control [DWMRC]) dated October 17, 2014. This proposed action is critical to the final closure of the Lisbon Facility.

The RFI was based on DWMRC's review (DRC, 2014) of the July 22, 2014, report titled *Supplemental Site Assessment to Address Out-Of-Compliance Status at Trend Wells RL-1 and EF-8, Lisbon Facility* (Montgomery & Associates, 2014) (SSA Report) and the associated Stipulation and Consent Agreements between the Utah Department of Environmental Quality (DEQ) and RAML (DEQ, 2012, 2013). The DWMRC's comments clearly indicated the need for additional site investigation to define the groundwater flow system, the exposure pathways, and the geochemical processes that influence the occurrence and mobility of uranium, molybdenum, selenium, and arsenic in the vicinity of the Lisbon Facility (Site).

The comments provided by DWMRC stressed the importance of adding the following activities to the required third phase of Site characterization activities:

- Characterization of the Lisbon Valley Fault (LF) geochemistry and hydrogeology through collection of core data
- Detailed evaluation of geochemical data to delineate the origin of dissolved uranium in groundwater in the vicinity of the LF, especially its relationship to uranium potentially moving from the tailings impoundments
- Characterization and improved representation of model boundaries and associated boundary conditions, especially along the western and northern boundaries, leading to development of a Site water balance, delineation of exposure pathways, and a revision of the Conceptual Site Model (CSM).

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The Site investigation described in the Work Plan will provide a comprehensive understanding of the Site hydrogeological and geochemical systems, which will in turn provide a solid foundation for: (1) addressing the DWMRC's RFIs, (2) developing revised Alternate Concentration Limits (ACLs), and (3) transferring the Site to the Department of Energy (DOE).

The regulations at 43 CFR 3809.40l(b) require the operator to describe the proposed operations at a level of detail sufficient for the BLM to determine that operations would prevent unnecessary or undue degradation. The following sections will provide operator information, descriptions of operations and reclamation, the proposed monitoring plan, interim management plan, and reclamation cost estimate.

Part 1 - Operator Information

Mailing Address Rio Algom Mining LLC P.O. Box 218 Grants, NM 87020
Phone Number (505) 287-8851 ext. 11
Email address Kent.kc.Applegate@bhpbilliton.com
Taxpayer Identification Number
Unpatented Mining Claims (list the name and BLM serial number(s) of any unpatented mining claim(s) where disturbance would occur):
Other Federal, State, or Local Authorizations *other permits or licenses either applied for or been issued for this project:* *Finding of No Significant Impact, Environmental Assessment, DOI-BLM-UTY010-2013-00273-EA, June 2013 Amendment to Right-of-Way Grant, Serial Number UTU-80472, August 2013*
Point of Contact Kent Applegate (505) 287-8851 ext. 11

Part 2a - Description of Operations

This section provides a complete description of all equipment, devices, or practices proposed to use during operations.

Project Area Maps Included: *The project features are included in **Figure 1**, with more detail of each proposed monitoring well and core hole location depicted in **Figures 2a** through **2h**.*	x Exploration location x Drillsite/drill hole location(s) x Access routes, new and existing __ Mineral process facility layout __ Mining areas/underground workings __ Waste rock/tailing location __ Support facilities/building location/utility service __ Other:
Operating Plans Included: *Operating plans are described in the following paragraphs.*	__ Mining areas/underground workings __ Mineral processing facilities x Waste disposal x Water management plans x Rock characterization and handling plans x Quality assurance plans x Access route construction and use __ Pipelines, power lines or utility services __ Other:

Operating Plan

This field program will include installation of new wells, collection of core samples at selected core hole locations for physical and geochemical properties analysis, hydraulic testing in core holes and wells, and collection of groundwater samples for water quality analysis. **Figure 1** shows all of the existing monitoring wells as well as the proposed monitoring wells.

The primary purpose of this work is to conduct additional hydrogeological and geochemical evaluations by testing and sampling the proposed monitoring wells and core holes. A hydrogeological evaluation of the Site, in conjunction with the geochemical evaluation, will be performed to provide a better understanding of groundwater flow and solute transport and update the CSM. As part of the hydrogeological and geochemical evaluations, INTERA will conduct hydraulic testing to further characterize the hydraulic parameters controlling groundwater flow. In addition, INTERA will collect geochemical data from the well boreholes and core holes to be analyzed in the field, laboratory, and modeled to reduce the geochemical uncertainties in the existing CSM.

Exploration Location

The proposed monitoring well locations are on Bureau of Land Management (BLM) administered lands in San Juan County. The Site is located approximately 3.5 miles southeast of La Sal, Utah, in Sections 17, 18, 20, and 27 of T. 29 S., R. 24 E. This Site is in a phase of long-term groundwater monitoring. The location of the Site as well as the existing and proposed well locations are shown on **Figure 1**.

Prior to any drilling or construction activities, cultural and wildlife surveys will be conducted at the Site. The survey areas will include all new access roads and an area greater than the anticipated disturbance around each well pad (**Figures 2a-2h**). The total area surveyed will be approximately 20 acres. The contractor conducting the cultural survey will have an active cultural permit with the Utah BLM.

The wildlife survey will include identification of active Gunnison Prairie Dog towns, active raptor nesting, ground-nesting burrowing owls, invasive weeds, and other species of concern. The cultural and wildlife surveys will be completed and the reports will be submitted to the BLM Moab Field Office by the end of June, 2016.

Drillsite and Drill Hole Locations

The area of disturbance for the proposed well pads in this field program is expected to be approximately 2.07 acres (**Figures 2a-2h**). Each of the monitoring wells and core holes will have a well pad during drilling and testing activities that will be approximately 100 ft by 100 ft, approximately 10,000 square ft each (**Table 1**). The well pads will be removed of vegetation and graded. Non-native gravel material will be brought in to cover the well pad. A portion of the well pad will be reclaimed after the well is drilled and a portion will remain cleared of vegetation and obstacles to allow for access during groundwater monitoring events. Reclamation will entail ripping of compacted soils and the application of a native seed mix approved by BLM.

Due to the complexity of the Lisbon Valley Fault near the proposed MW-127/C-127 and MW-128/C-128 locations, two contingency locations have been proposed for the cultural and wildlife survey (**Figures 2e and 2h**). The final location for these well and core holes will be determined during field activities as more information about the Lisbon Valley Fault can be gathered. Although the proposed MW-127/C-127 location is a more ideal location for groundwater monitoring, there is concern that the Burro Canyon aquifer may not be present at this location based on available geologic maps (**Figure 2h**).

Table 1. Proposed monitoring well and core hole locations and disturbance areas.

Well ID	Type	Pad Size (sq ft)	New Road Length (ft)	Existing Road Length (ft)	UTM X	UTM Y
MW-123	Monitoring Well	10,000	137	--	2633158.79774	589149.183902
MW-124	Monitoring Well	10,000	300	1284	2629051.80346	594918.574434
MW-125/C-125	Monitoring Well /Core	10,000	471	690	2635922.08560	586616.694640
MW-126/C-126	Monitoring Well /Core	10,000	52	932	2632532.35040	589154.939375
C-127	Core	10,000	--	--	2627115.98870	594896.544343
MW-127	Monitoring Well	10,000	--	2944	2627129.84324	594904.212885
MW-127 Contingency	Contingency Location	--	--	--	TBD	TBD
C-128	Core	10,000	--	--	2630644.18444	591014.101189
MW-128	Monitoring Well	10,000		4339	2630658.50360	591023.642949
MW-128 Contingency	Contingency Location	--	1,084*	--	TBD	TBD
MW-129	Monitoring Well	10,000	319	1036	2631267.23749	593411.380978

*Road length not included in total disturbance calculations since it is a contingency location. If the MW-128 contingency location is used the total new road will be approximately 2,363 ft and the total expected new disturbance will be approximately 2.83 acres.

Access Routes

Temporary access roads to the new monitoring wells and core holes will be constructed to allow the drilling rig and support trucks access to the well sites (**Figure 2a-2h**). Existing roads, where present, will be used to minimize the need for creating new roads. The roads will be a maximum of 14 ft wide. Approximately 1,279 ft of new temporary access roads will be constructed and approximately 11,225 ft of existing roads will be graded and improved. The new roads will not be engineered nor require any culverts. The area of disturbance for new roads will be approximately 0.41 acres. The total area of new disturbance for this field program will be approximately 2.48 acres.

Monitoring Well Drilling and Installation

The monitoring wells will be drilled using a 50K air rotary drilling rig or equivalent type of drill rig. Three wells will be drilled with a nominal 8-inch diameter boring and completed as 4-inch wells and four wells will be drilled with a nominal 10-inch diameter boring and completed as 5-inch wells. All drilling will be conducted by a State-approved well driller, licensed in the State of Utah. All wells will be designed and constructed in accordance with Utah Division of Water Rights 2011 *State of Utah Water Well Handbook* and U.S Environmental Protection Agency (U.S. EPA, 1986) *RCRA Ground Water Monitoring Technical Enforcement Guidance Document*.

The drilling operations will be supported by a support truck and at least one other pickup truck. Plastic will be placed beneath the drill rig and roll-off bins to protect the ground surface from incidental spills. A nominal 8-inch or 10-inch diameter borehole will be drilled to the total depth of the well, **Table 2**. The estimated maximum depth of the wells is 215 feet, however the depths may change during drilling based on the geology encountered. Rock cuttings and drill fluid will be contained in a lined roll-off bin. All cuttings and fluids will be managed and disposed of according to DWRMC and other applicable regulations.

Table 2. Construction information for the proposed monitoring wells and core holes.

Well ID	Type	Formation	Depth	Screen Interval	Comments
MW-123	Monitoring Well	BCA	215	195-215	
MW-124	Monitoring Well	BCA	175	155-175	
C-125	Core	LF	180		Convert to MW-125
MW-125	Monitoring Well	LF	180	85-115	
C-126	Core	LF	180		Convert to MW-126
MW-126	Monitoring Well	LF	180	85-115	
C-127	Core	LF	100		Plug and Abandon
MW-127	Monitoring Well	BCA	70	5-70	
C-128	Core	LF	185		Plug and Abandon
MW-128	Monitoring Well	BCA	185	85-185	
MW-129	Monitoring Well	BCA	75	55-75	

Notes: BCA = Burro Canyon Aquifer, LF = Lisbon Valley Fault

The wells will be constructed with 4-inch or 5-inch diameter, flush threaded, schedule 80 poly vinyl chloride (PVC) blank casing and 20-ft long, 0.010-inch factory slotted schedule 80 PVC well screen. Centralizers will be placed every 60 ft within the blank casing intervals. A 20/40 washed silica sand or similar material will be placed in the annular space around the well screen and extend 2 ft above the top of the screen casing. A 3 to 5-foot layer of bentonite seal 3/8-inch pellets of chips hydrated with potable water in 1-ft lifts will be placed on top of the silica sand. The remainder of the borehole annulus will be filled with a neat cement grout to seal the well. The neat cement grout consists of one 94-pound sack of Portland cement and 4.7 pounds of powdered bentonite with no more than 6 gallons of clean water. The well will be completed with a 2.5-foot PVC casing stick up with PVC well cap. A 3-foot standard steel protective casing with a locking lid will be placed around the PVC stick up. A minimum 2-ft diameter concrete pad with a minimum 4-inch thickness will be installed around the PVC and steel above-ground completion. Four bollards will be placed around each well and installed with a 4-ft stick up and 2-ft below ground. All drill cuttings and fluid will be properly managed under the direction of Rio Algom and the DWMRC (see Waste Disposal section below for details).

Upon completion of well construction, the wells will be developed. Well development will consist of surging and bailing or pumping water from the well to clean the well screen and sand pack. All development water will be containerized and disposed of with an authorized facility in accordance with the requirements of the DWMRC.

Well Testing

After well development, will be MW-123, MW-124, MW-125, MW-126, C-127, C-128, MW-127, MW-128, and MW-129 will by hydraulically tested. Straddle-packer testing will be performed in the four core holes (C-125, C-126, C-127, and C-128) to quantify the hydraulic conductivity of the various rock units encountered in and near the fault. The specific type(s) of hydraulic tests performed in the straddled intervals will depend on the hydraulic conductivities encountered. Test intervals will likely be on the order of 5 to 10 ft long, and will be selected based on examination of the core, borehole flow meter testes, geophysical logs, and other available information so as to provide a clear understanding of the hydraulic properties of the various rock types in and adjacent to the fault.

MW-123, MW-124, and MW-129 will be tested using pneumatic slug testing method. MW-128 will be tested using a pneumatic sinusoidal test to provide information on the BCA hydraulic conductivity and the hydraulic role played by the Lisbon Valley Fault zone. To limit the pneumatic sinusoidal testing time to no more than two days, the tested well should be no farther than 50 ft from the fault. Well MW-126 or MW-116 may also be tested using the pneumatic sinusoidal method if it is determined during coring that the Wingate sandstone exists on the footwall side of the fault opposite the Burro Canyon aquifer.

An aquifer pumping test will be conducted in monitoring well MW-127 with the objectives of determining the hydraulic conductivity of the aquifer and the hydraulic role played by the Lisbon Valley Fault in that vicinity. Pneumatic testing will almost certainly not be possible in MW-127 because the water level in that well is expected to be less than 20 ft below the ground surface. All test water will be containerized and disposed of with an authorized facility in accordance with the requirements of the DWMRC.

Rock Characterization and Handling Plans

Cores will be collected from four core holes. Two of the core holes, C-125 and C-126, will be completed as monitoring wells, MW-125 and MW-126. The other two core holes, C-127 and C-128, will be plugged and abandoned following aquifer testing of nearby monitoring wells MW-127 and MW-128, respectively. The rock cores will be collected to document the geologic, structural, and geochemical characteristics of the geologic units near and within the Lisbon Valley Fault zone. The methods for collection, description, and handling of rock core described here are based on the geologic literature, including U.S. Department of the Interior, Bureau of Reclamation (1998), *Engineering Geology Field Manual*, Second Edition, Volume 1 (1998), and ASTM (1999, 2008).

Rock core will be obtained using a Speedstar 50K or 110K air rotary drilling rig (or equivalent) equipped with 94-mm wireline rock core drilling capability (94 mm core is approximately 3.7 inches in diameter), or HQ core (2.5-inch diameter) (ASTM, 1999). The boring diameter will be 156 mm or 6.14 inches. Core will be collected below the alluvial/bedrock contact from the entire bedrock interval. A temporary conductor casing may be installed within the alluvial interval and landed up to 5 feet into bedrock. Total depth of the borings is expected to be up to approximately 200 ft below ground surface (bgs). Actual total depth will be determined in the field based on depth of key intervals such as the Lisbon Valley Fault and geologic formation contacts.

The cores will be logged for rock type, fracturing, and mineralization. Core samples from selected intervals near and in the fault zone will be analyzed for petrography and whole rock chemistry. These data will be used to identify potential chemical impacts to groundwater from minerals within the fault zone.

Geophysical logging will be conducted in each of the four core holes (C-125, C-126, C-127, and C-128) and in the seven monitoring wells. The logging will be conducted using industry-standard methods for open-hole logging. The logging activities will be supervised by the project field geologist under the supervision of the project's Utah Professional Geologist.

Hydraulic tests will be conducted on the four core holes to evaluate zones exhibiting higher flow rates that could represent a preferential exposure pathway for COC's adjacent to the fault within the damage zone. Hydraulic testing of core holes may include borehole geophysics, straddle-packer testing, pneumatic hydraulic testing, aquifer testing of the entire open hole, and borehole flow meter tests. All test water will be containerized and disposed of with an authorized facility in accordance with the requirements of the DWMRC.

After the cores have been collected and the hydraulic tests have been conducted, two of the core holes (C-125 and C-126) will be converted to monitoring wells by reaming the hole to the 8.5-inch diameter using the same methods and equipment used to drill the other monitoring wells. Core holes, C-127 and C-128, will be left open and monitored while nearby MW-127 and MW-128 monitoring wells are tested, after which the core holes will be plugged and abandoned according to the requirements set forth in the *State of Utah Water Well Handbook* which are based on Utah Administrative Code R655-4 (Utah Division of Water Rights, 2011)..

Waste Disposal

All waste will be contained and transported offsite to an approved facility. The rock cuttings and drill fluid produced during drilling operations will be contained in a lined roll-off bin. All cuttings and fluids will be managed and disposed of at an authorized facility, in accordance with DWMRC requirements and other applicable regulations. Plastic will be placed beneath the drill rig and roll-off bins to protect the ground surface from incidental spills.

Water Management Plan

During well development of the new wells, surging and bailing techniques are used to prepare the well screen and sand pack, which does produce water. All water produced during development will be strictly contained and managed in accordance with the requirements of the DWMRC and other applicable regulations. The water will be containerized and transported to an authorized facility.

Aquifer testing may be conducted on both existing wells and newly installed wells to address uncertainties in the conceptualization of groundwater flow at the Site. The specific type(s) of hydraulic tests performed in the straddled intervals will depend on the hydraulic conductivities encountered. When possible, methods will be used which do not produce water, such as packer tests and pneumatic sinusoidal tests. If water is produced during aquifer testing it will be contained in a lined roll-off bin and transported to an authorized facility, in accordance with the requirements of the DWMRC. Plastic will be placed beneath the roll-off bins to protect the ground surface from incidental spills.

Groundwater sampling and analysis will begin after wells are developed and tested. Groundwater sampling is conducted using low-flow techniques, which minimizes the amount of water produced. The low-flow sampling will be conducted in accordance with the US EPA *Low-Flow (Minimal Drawdown) Ground-Water Monitoring Procedures* (Puls and Barcelona, 1996) and ASTM guidelines (ASTM, 2002). Sampling will be conducted by a dedicated sampling truck and all water produced during sampling activities will be containerized and transported to an authorized facility. Groundwater sampling will be conducted on a monthly to annual frequency in accordance with the approved Sampling and Analysis plan (RAML, 2015).

Quality Assurance Plans

All drilling, testing, and sampling procedures will be performed by qualified and trained personnel. All drilling will be conducted by a State-approved well driller, licensed in the State of Utah. All wells will be designed and constructed in accordance with Utah Division of Water Rights 2011 *State of Utah Water Well Handbook* and U.S Environmental Protection Agency (U.S. EPA, 1986) *RCRA Ground Water Monitoring Technical Enforcement Guidance Document*. RAML will provide written notice at least 14 days prior to commencing drilling to allow DWMRC representatives the opportunity to observe drilling, well installation, testing, and/or sampling activities.

All hydrogeological and geochemical evaluations will be conducted using approved methods as described in the Work Plan. The methods for collection, description, and handling of rock core described here are based on the geologic literature, including U.S. Department of the Interior, Bureau of Reclamation (1998), *Engineering Geology Field Manual*, Second Edition, Volume 1 (1998), and ASTM (1999, 2008). Groundwater sampling will be conducted according to the Sampling and Analysis Plan (RAML, 2015). The groundwater low-flow sampling will be conducted in accordance with the US EPA low-flow guidelines and ASTM guidelines. All equipment used for testing and sampling will follow the supplier’s operations and calibration specifications and will be documented as part of the QA records.

Quality assurance/quality control (QA/QC) procedures includes data quality objectives for data measurement, sampling procedures, sample and document custody procedures, laboratory analytical methods, internal quality control checks, data validation and reporting procedures, and corrective action procedures. QA/QC procedures will be conducted in the field and laboratory. Field procedures will include field documentation, blind code labeling, and collection of quality control samples including sample duplicates, sampling equipment blanks, and transport blanks. Laboratory QA/QC procedures will include completion of laboratory performance criteria including sample holing times, matrix spike/matrix duplicate recoveries, and laboratory method blank results.

Part 2b – Description of Reclamation and Schedule of Operations

Reclamation Plan Elements:	x Drill hole plugging procedures _ Closure of mine openings and reclamation x Regrading and reshaping plans _ Isolation & control of acid-forming/toxic materials x Topsoil salvage, handling and replacement x Vegetation reestablishment/weed control _ Wildlife habitat/ riparian area rehabilitation _ Removal/stabilization of buildings & support facilities _ Post-closure management _ Pit backfilling feasibility where pits are to be left open

Details of Reclamation Plan

The reclamation plan for the Site will follow the standards set forth in 43 CFR 3809.420. Reclamation will begin at the earliest feasible time after activities have ceased.

Drill hole plugging procedures

The core holes not converted to monitoring wells will be plugged and abandoned after field testing has occurred. Groundwater monitoring will be required for an extended period of time. When cessation of groundwater monitoring is approved by DWMRC, all core holes and monitoring wells will be plugged and abandoned according to the requirements set forth in the *State of Utah Water Well Handbook* which are based on Utah Administrative Code R655-4 (Utah Division of Water Rights, 2011).

Regrading and reshaping plans

The area of disturbance for the well pads in this field program is expected to be approximately 2.07 acres (Figures 2a-2h). Each of the monitoring wells and core holes will have a well pad during drilling and testing activities that will be approximately 100 ft by 100 ft, approximately 10,000 square ft each (Table 1). The well pads will be removed of vegetation and graded. Non-native gravel material will be brought in to cover the well pad to provide safe access during drilling and testing and to control invasive weeds. After drilling is complete, a portion of the well pad will be reclaimed. The well pad will be ripped, covered with native soil, and seeded. The well pad directly around the well will be left to ensure safe access to the well during the ongoing groundwater monitoring events.

Temporary access roads to the new monitoring wells and core holes will be constructed to allow the drilling rig and support trucks access to the well sites (**Figure 2a-2h**). Existing roads, where present, will be used to minimize the need for creating new roads. The access roads may require periodic grading to maintain access for ongoing groundwater monitoring activities. The roads will be a maximum of 14 ft wide to allow for the drilling equipment access. The new temporary roads will be constructed following natural contours and will not be engineered. Approximately 1,279 ft of new roads will be constructed and approximately 11,225 ft of existing roads will be graded and improved. The area of disturbance for new roads will be approximately 0.41 acres.

The total area of new disturbance for this field program will be approximately 2.48 acres.

Topsoil Salvage, Handling, and Replacement

The BLM Moab Field Office will be notified at least 48 hours before any reclamation activities begin. Cleared vegetation debris and topsoil from road and well pad work will be stockpiled for use during reclamation.

Vegetation re-establishment

After all hydrogeological and geochemical testing is complete, a portion of the well pads will be reclaimed and a portion will remain cleared of vegetation and obstacles to allow for safe access during groundwater monitoring events. Reclamation will entail ripping of compacted soils and the application of a native seed mix approved by the BLM Moab Field Office. When ongoing groundwater sampling activities are complete, all remaining well pads and roads will be ripped and seeded with a seed mix approved by the BLM Moab Field Office.

Schedule of Operations

The anticipated schedule of activities for the hydrogeologic investigation at the Site is as follows:

- Submit Plan of Operations Modification – April 2016
- Cultural and wildlife surveys complete – end of June 2016
- Drilling and testing activities – Summer/Fall 2016
- Plug and abandon C-127 and C-128 – Fall 2016
- Seeding/mulching well pads and roads not needed for the ongoing groundwater monitoring events – Fall 2016
- Sampling monitoring wells – TBD

Part 3 - Monitoring Plan

The following section provides a plan to monitor the effects of the operation. According to the BLM Handbook, the monitoring plan should be designed to do the following: (1) demonstrate compliance with the Plan of Operations and other environmental regulations, (2) provide early detection of potential problems, and (3) supply information that will assist with any needed corrective actions.

Resource Conditions to Monitor:	x Surface or groundwater quality/quantity __ Air quality x Vegetation or reclamation conditions __ Process facility containment performance __ Stability conditions __ Wildlife mortality __ Noise or light levels __ Other (include state requirements):
Monitoring Plan Elements:	x Type and location of monitoring devices x Sampling parameters and frequency x Analytical methods x Reporting procedures x Adverse monitoring result thresholds & procedures __ Other:

Monitoring Plan

Groundwater sampling will continue according to the procedures in the Sampling and Analysis Plan (SAP) (RAML, 2015) (**Appendix A**). The new monitoring wells will be added to the list of existing monitoring wells and will be sampled using the techniques from the (SAP). Confluence Environmental, Inc. (Confluence), will continue to provide groundwater sampling services. INTERA will field-supervise all comprehensive sampling events. Analytical services will continue to be provided by Energy Laboratories (Energy Labs).

INTERA will manage field parameter, water level, and geochemical data in the existing RAML Lisbon database. Field parameters and water levels supplied by Confluence will be checked for accuracy and manually entered into the database. Electronic data deliverables (EDDs) provided by Energy Labs will similarly be checked for accuracy against provided lab reports and imported into the database in a format consistent with the current database structure.

Data compiled in the database will be used to generate the annual groundwater monitoring report for the Site. The annual report will contain (in accordance with the DWMRC Radioactive Materials License #UT1900481, Amendment5, Condition 53G) sampling methodology; field parameter measurements; laboratory information; a data evaluation; data tables; concentration vs. time plots for the compliance wells; groundwater elevation contour maps; contaminant concentration contour maps for arsenic, molybdenum, selenium, and uranium; and a comparison of measured uranium concentrations to predicted concentrations in compliance wells. The Site groundwater flow and transport model is currently under revision. Information from these proposed monitoring wells is key to revising the Site groundwater flow and transport model. As soon as this revised model is approved by the DWMRC, it will be used to compare measured vs. predicted concentrations for uranium in compliance wells.

The sampling parameters and frequency, analytical methods, adverse monitoring result thresholds and procedures, and groundwater sampling reporting procedures are all described in the SAP (RAML, 2015) (**Appendix A**).

Reporting Procedures

Documentation of all 2016 field activities will be provided in a revised SSA Report. The SSA Report will include all documentation of well completion, as-built drawing and completion reports for the new wells will be submitted to the DWMRC. The as-built reports will be developed with direct supervision of a Professional Geologist licensed by the State of Utah. The completion report will include the following information:

- Detailed report of the field activities, including:
    - Drilling
    - Collection of core
    - Well installation
    - Development
    - Testing
    - Sampling
- Geologic logs with detailed lithology
- Physical properties of subsurface material
- Geophysical logs

- As-built drawings of each well

Vegetation or Reclamation Conditions

The reclamation conditions will be monitored in accordance with the requirements of 43 CFR 3809.420 to determine successful measures have been taken to plug and abandon drill holes, reshape the landscape, mitigate erosion, and establish native vegetation. After reclamation and revegetation activities have been completed, the BLM Moab Field Office will be notified so that they can conduct and inspection of the area.

Part 4 - Interim Management Plan

All Plans of Operations must include an Interim Management Plan that describes how the project area will be managed during periods of temporary closure (including periods of seasonal closure).

Interim Management Plan Elements:	__ Schedule of anticipated periods of closure __ Provisions to notify the BLM of unplanned or extended closures __ Measures to stabilize excavations and workings __ Measures to isolate or control toxic materials __ Provisions to store or remove equipment, supplies, or structures __ Measures to maintain the project area in a safe and clean condition __ Plans for monitoring site conditions during non-operation __ Other:

Interim Management Plan

The RAML Lisbon facility is currently a closed facility that is in the long-term monitoring phase. An Interim Management Plan is not applicable for this Site.

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Part 5 -Reclamation Cost Estimate

A reclamation cost estimate (RCE) is required to process Plan of Operations (43 CFR 3809.401 (d)). The RCE may be submitted with the Plan of Operations, or later at a time to be determined between you and the BLM. The following are general RCE requirements. The BLM is available to assist you in developing the cost estimate.

Reclamation Cost Estimate Elements:	x The RCE must cover the Reclamation Plan at any point in the project life x Calculate the RCE based on the BLM's cost to contract for the reclamation x Include all equipment use, supplies, labor, and power in direct costs ___ Include fluid management of any mill process solutions in direct costs x Allow for a contingency cost (10% of direct costs) x Allow for contractor profit (10% of direct costs) x Include contractor liability insurance (1.5% of total labor cost) ___ For direct costs over $100,000 add 3% for payment & performance bonds x Add 10% of direct costs for BLM contract administration & indirect costs

Reclamation Cost Estimate

The reclamation cost estimate is for the proposed Site investigation, which includes installation and testing of up to seven groundwater monitoring wells and four core holes, two of which will be converted into monitoring wells and the associated access roads. The reclamation cost estimate was developed using the BLM bond calculator. The reclamation cost estimate total for this Site investigation is $26,738 (**Appendix B**).

The proposed Modification of the Plan of Operations is submitted this date by:

4/15/16

Manager, Rio Algom Mining LLC

(Signature of operator or agent) Date

(Signature of co-operator or agent) Date

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Figures

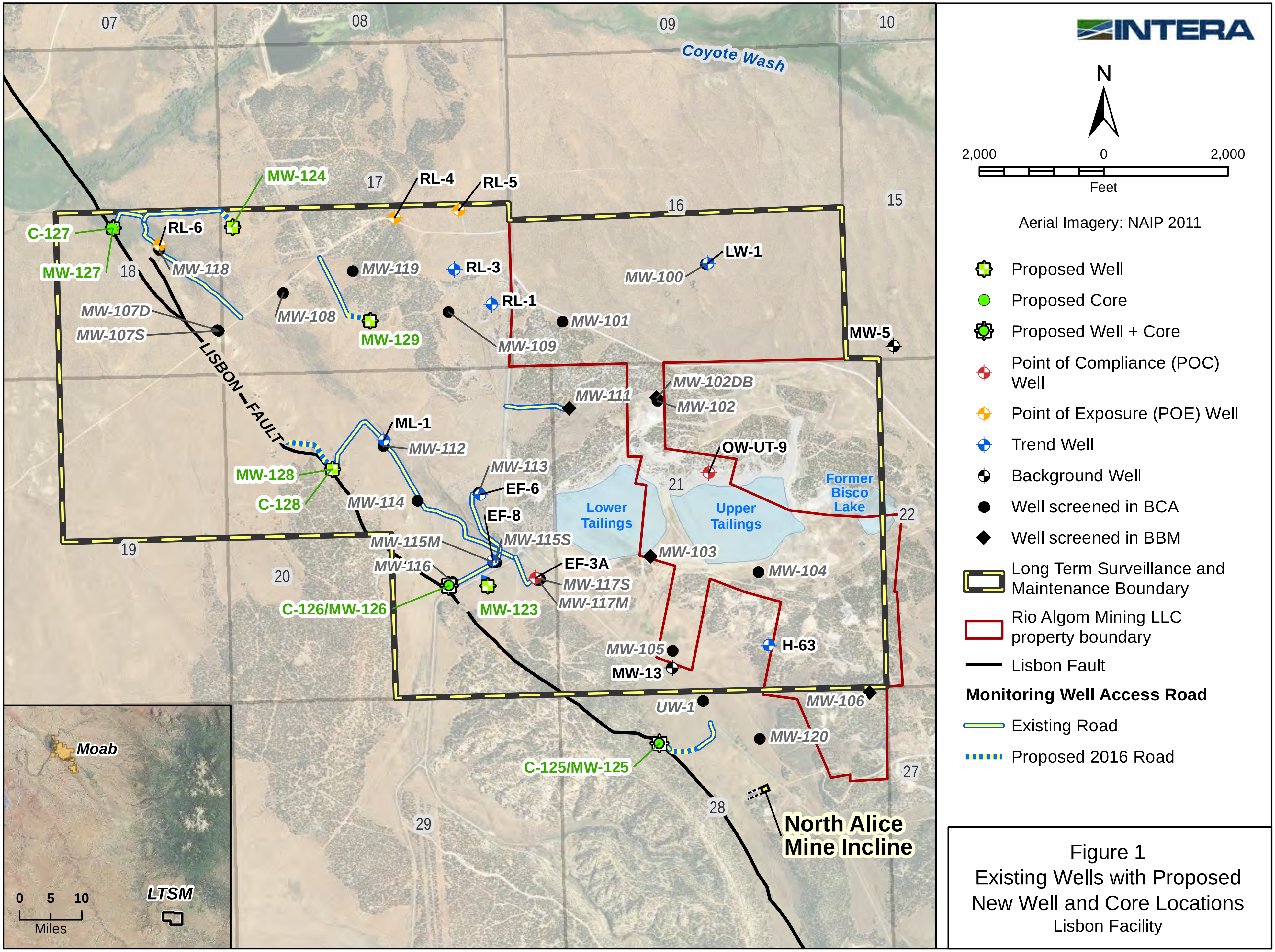

Figure 1
Existing Wells with Proposed New Well and Core Locations
Lisbon Facility

FILE: S:\ABQ\Rio_Lisbon_SupplmentalSiteCharacterization\Graphics\GIS\MapDocs\MonitoringWells_2016\01_SitePlan.mxd 3/23/2016

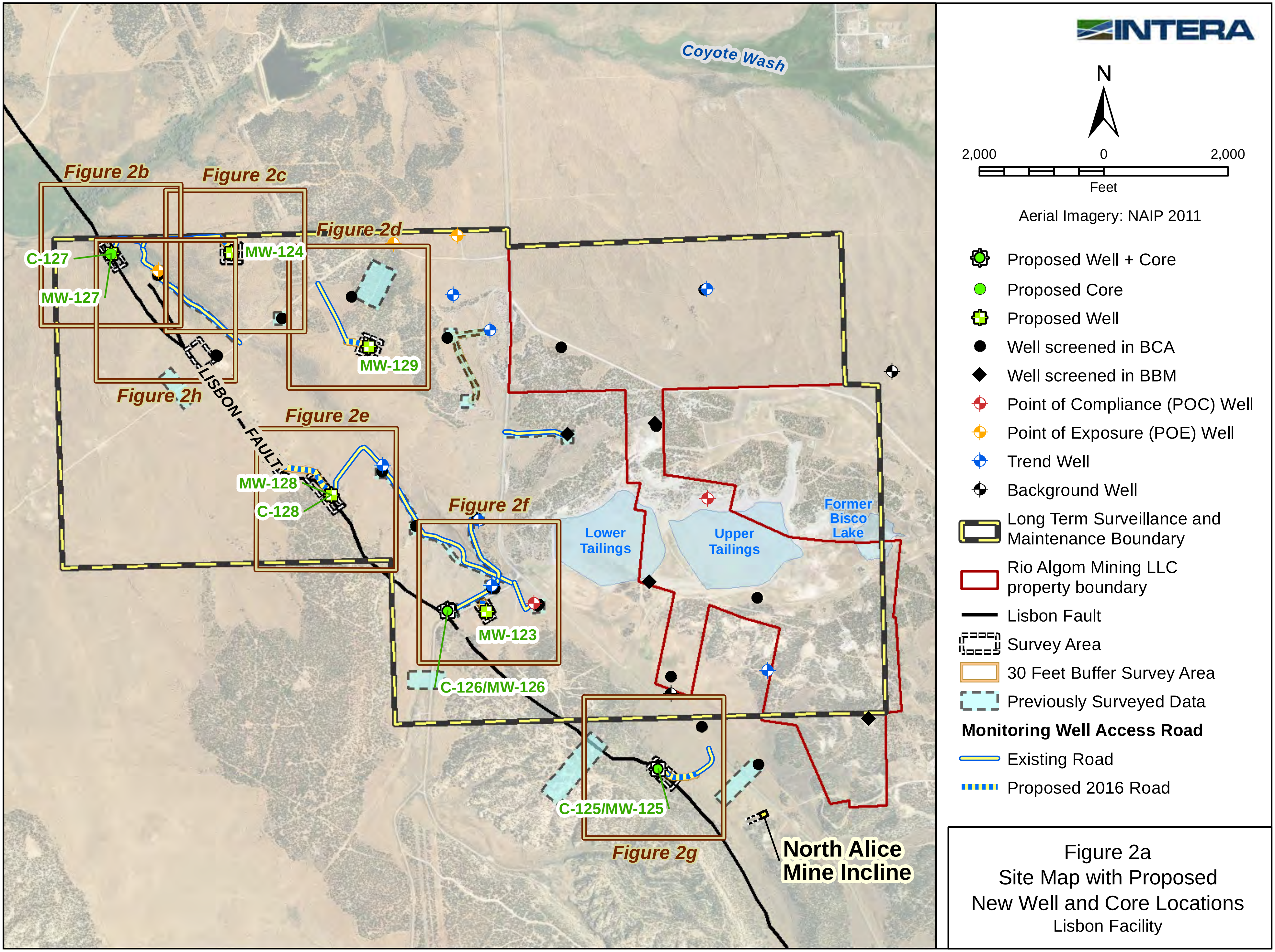

Figure 2a
Site Map with Proposed New Well and Core Locations
Lisbon Facility

S:\ABQ\Rio_Lisbon_SupplmentalSiteCharacterization\Graphics\GIS\MapDocs\MonitoringWells_2016\02a_Proposed_siteMap.mxd 3/24/2016

N

300 0 300

Feet

Aerial Imagery: NAIP 2011

Proposed Well

Proposed Core

Point of Exposure (POE) Well

Well screened in BCA

Long Term Surveillance and Maintenance Boundary

Proposed Well Pad

Lisbon Fault

Survey Area

Previously Surveyed Area

Monitoring Well Access Road

Existing Road

Figure 2b
Proposed New Well
and Core Locations
Lisbon Facility

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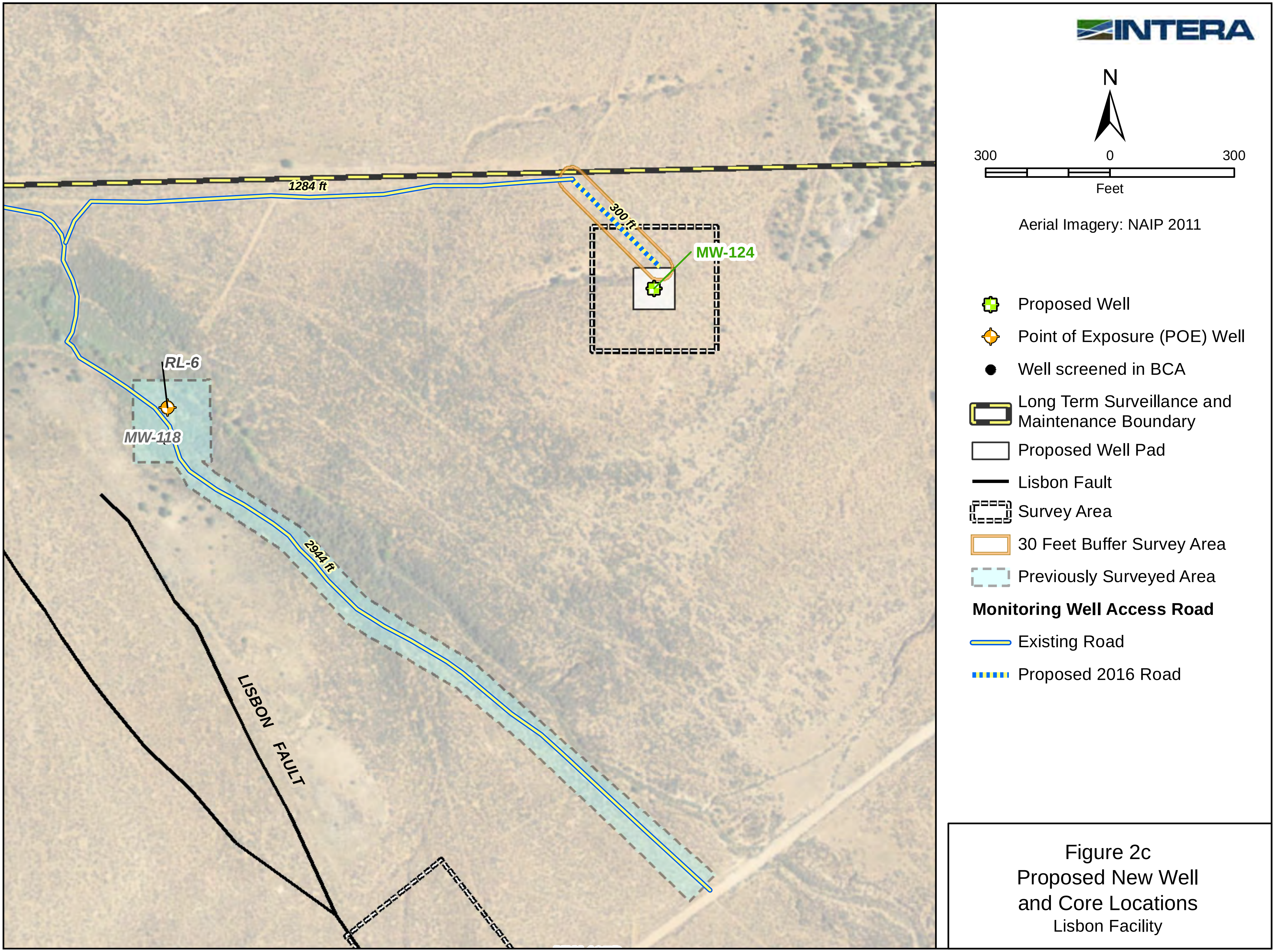

Figure 2c
Proposed New Well and Core Locations
Lisbon Facility

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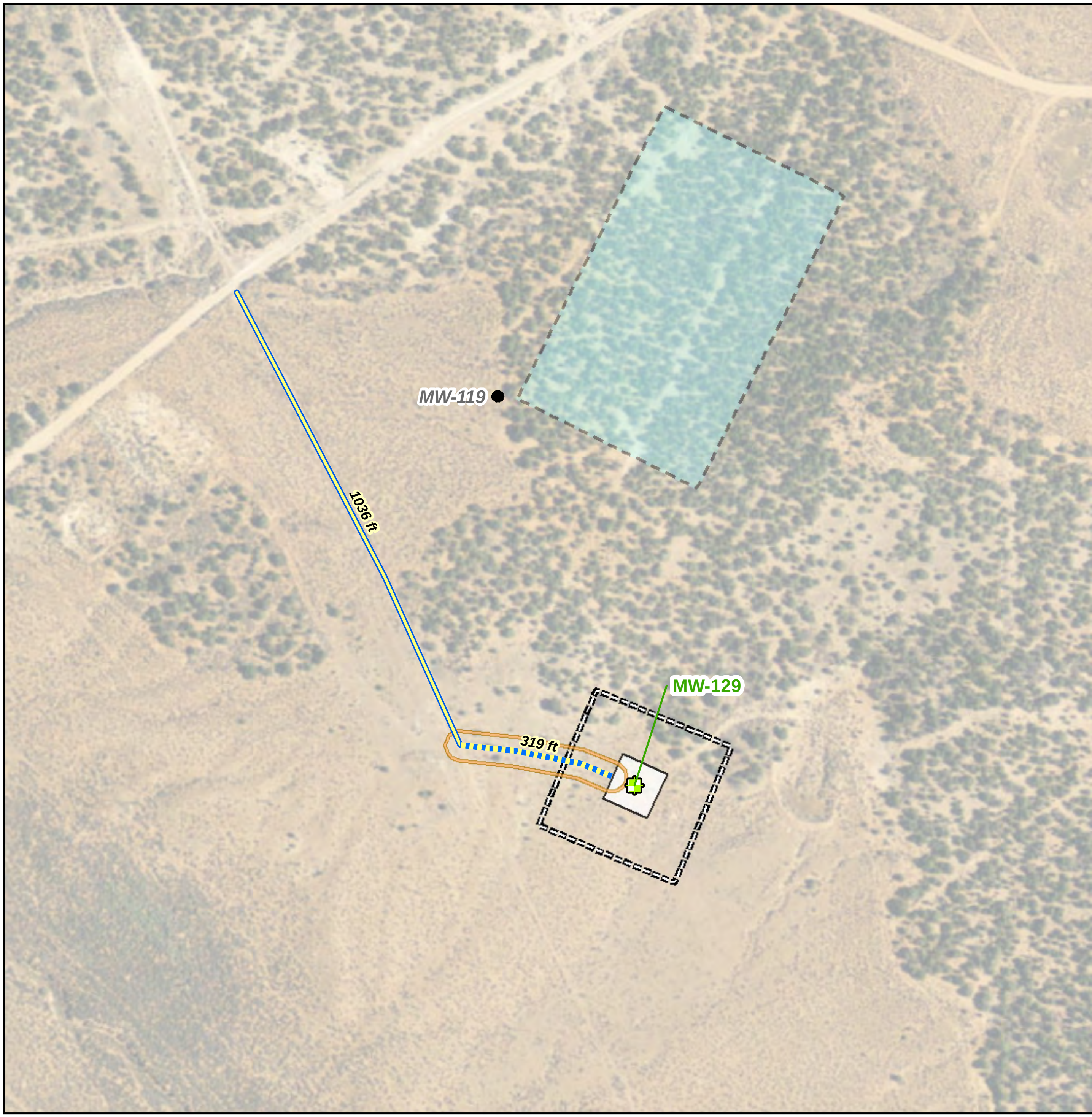

Figure 2d
Proposed New Well
and Core Locations
Lisbon Facility

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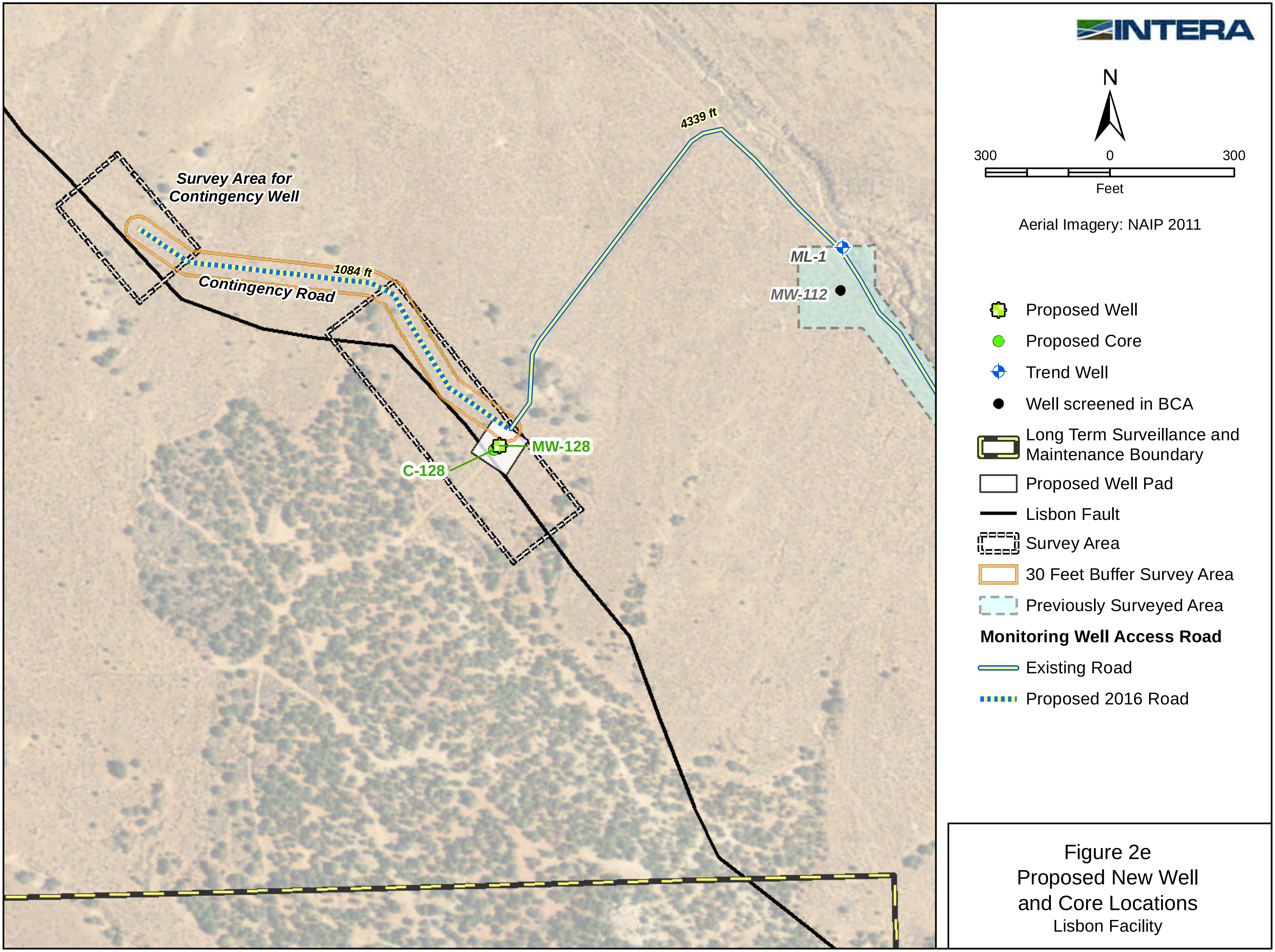

Figure 2e
Proposed New Well and Core Locations
Lisbon Facility

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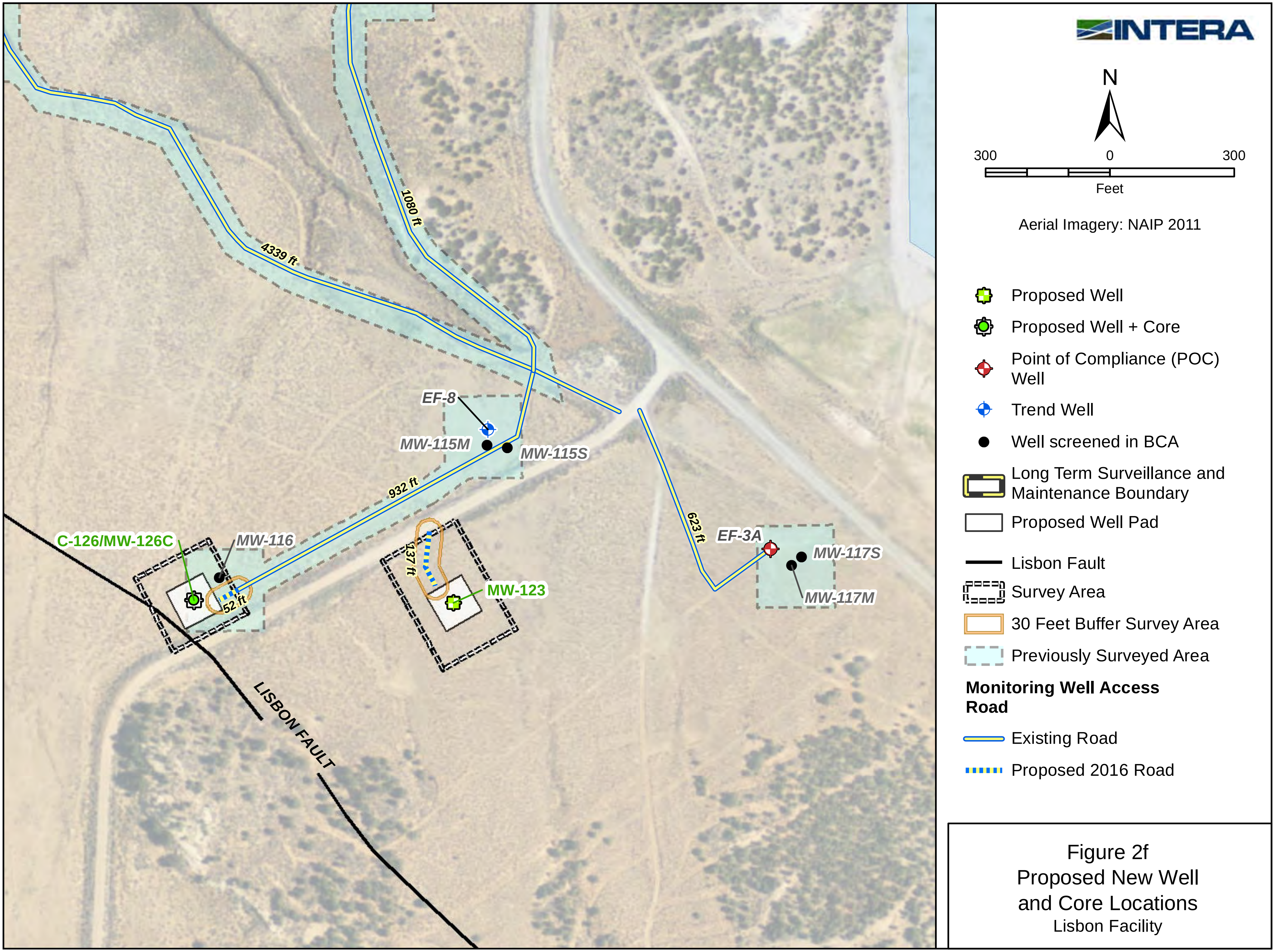

Figure 2f
Proposed New Well and Core Locations
Lisbon Facility

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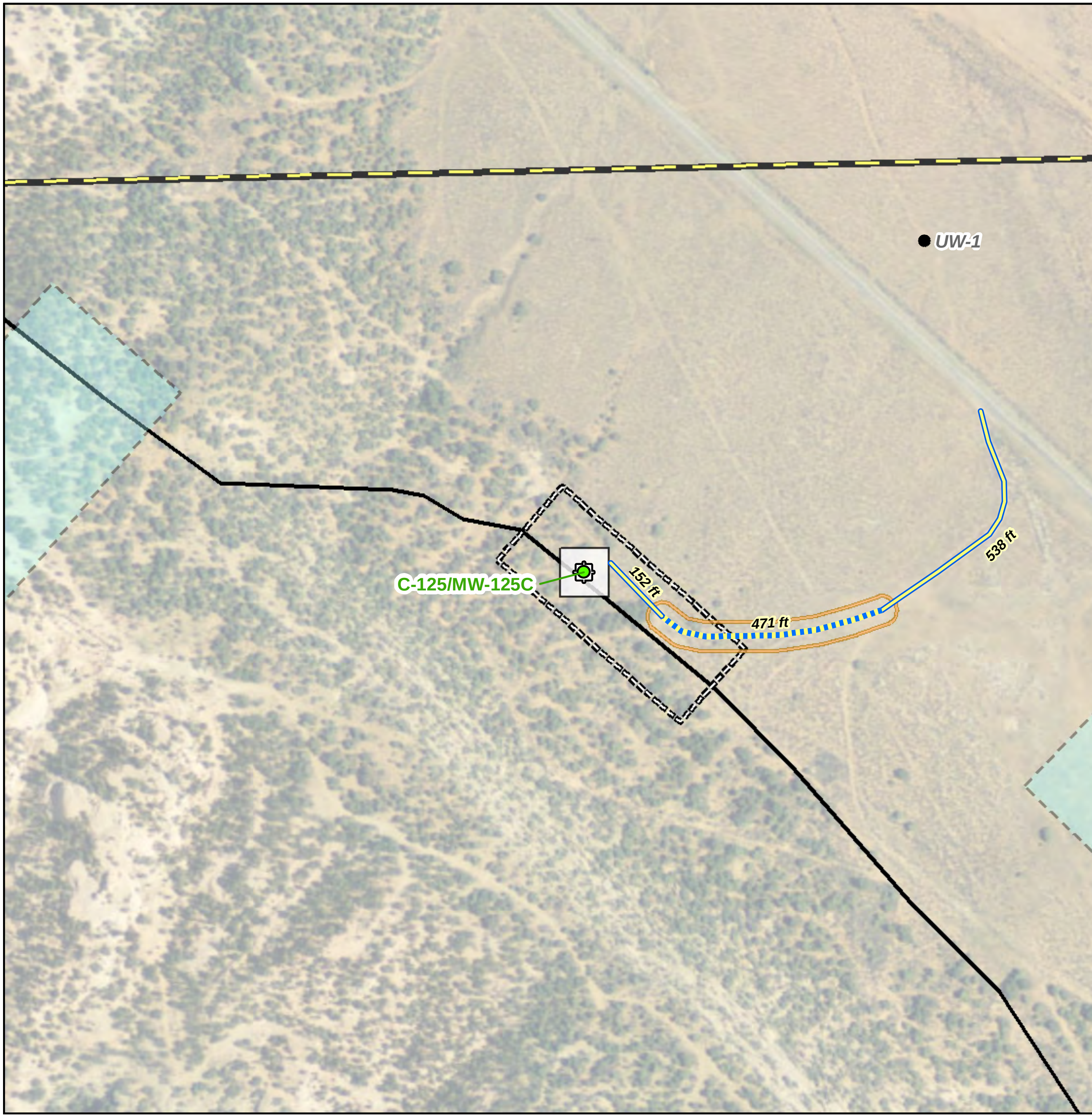

INTERA

N

300 0 300

Feet

Aerial Imagery: NAIP 2011

Proposed Well + Core

Well screened in BCA

Long Term Surveillance and Maintenance Boundary

Proposed Well Pad

Lisbon Fault

Survey Area

30 Feet Buffer Survey Area

Previously Surveyed Area

Monitoring Well Access Road

Existing Road

Proposed 2016 Road

Figure 2g
Proposed New Well and Core Locations
Lisbon Facility

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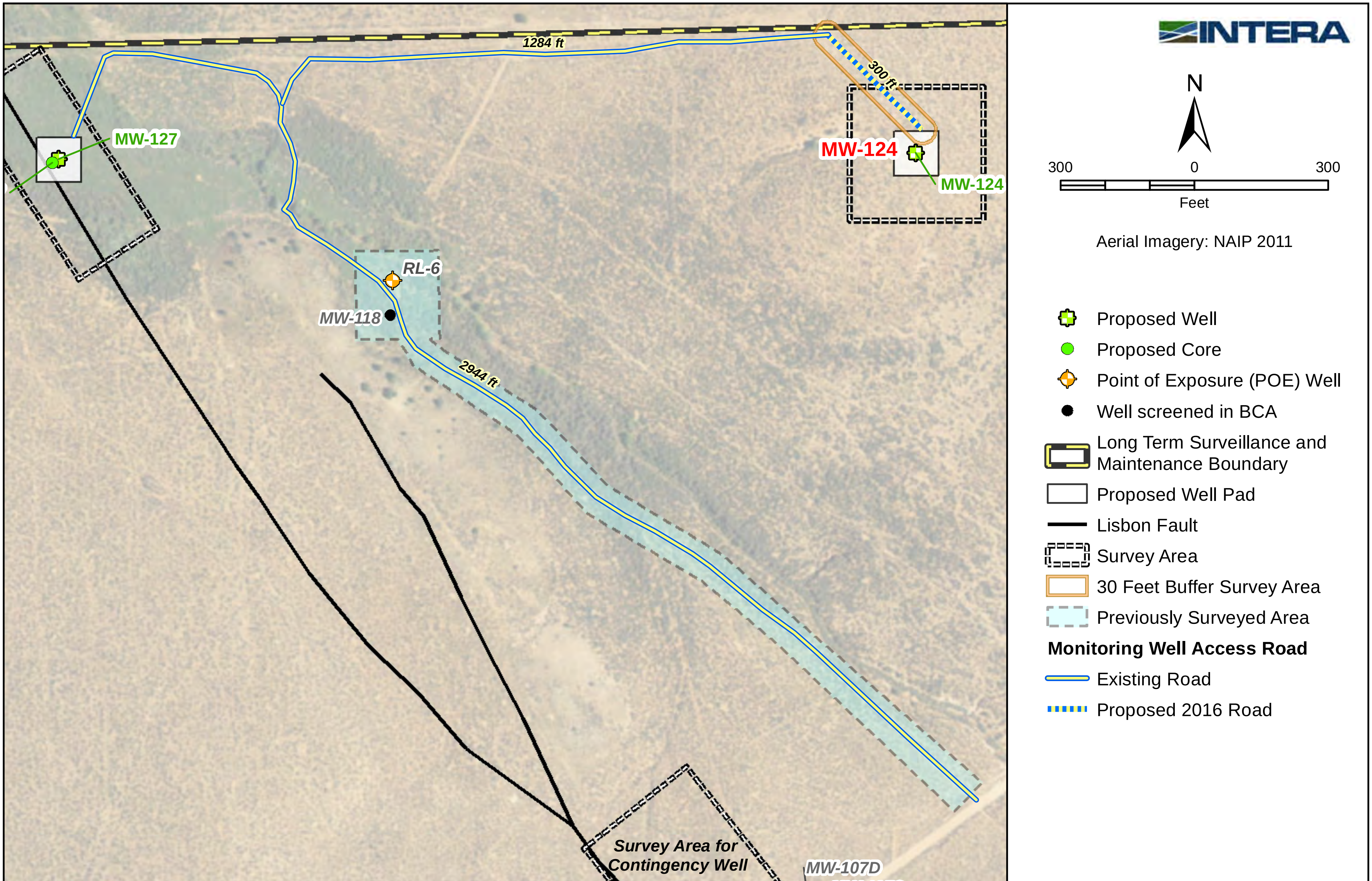

Figure 2h
Contingency New Well and Core Location
Lisbon Facility

Appendix A. Site-Wide Groundwater Sampling and Analysis Plan, Rio Algom Mining LLC, Lisbon Facility

Site-Wide Groundwater Sampling and Analysis Plan

Rio Algom Mining LLC, Lisbon Facility

November 2015

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TABLES

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ILLUSTRATION

Figure

ATTACHMENTS

Attachment

SITE-WIDE GROUNDWATER SAMPLING AND ANALYSIS PLAN
RIO ALGOM MINING LLC, LISBON FACILITY

1.0 INTRODUCTION

Rio Algom Mining LLC (RAML) and its contractors have prepared this Site-Wide Groundwater Sampling and Analysis Plan (SAP), dated November 2015, for groundwater monitoring at the Lisbon Facility (Site) located near La Sal, Utah (**Figure 1**). This document is an extension of the Groundwater Monitoring Plan Version 2.0 (GMP) submitted to the Utah Division of Waste Management and Radiation Control (DWMRC) dated July 31, 2015. The difference between this document and the GMP is that this document includes guidance for sampling 28 “hydrogeology study” wells in addition to the 14 compliance wells addressed in the GMP that are listed in the Site’s Radioactive Materials License (License No. UT1900481 [License]). This SAP provides the procedures for sampling all existing wells at the Site. Any new wells (associated with the Phase 3 Supplemental Site Assessment or other future field work) will be sampled according to the same protocols described in this SAP.

1.1 BACKGROUND

Groundwater monitoring is currently conducted at the Site to meet the requirements of DWMRC Radioactive Materials License #UT1900481, Amendment 5, Condition 53G (License) (DRC, 2014). This SAP provides guidance for sampling an additional 28 wells located on and around the Site known as the “hydrogeology study” wells. These wells are monitored as part of an ongoing characterization of the lateral and vertical extent of groundwater contamination in the area. Wells installed in the future will also be monitored under this SAP.

Depth to water measurements and groundwater samples are obtained from 42 monitoring wells in accordance with the License requirements and Site characterization project. The primary constituent of concern (COC) identified at the Site is uranium. Other COCs include molybdenum, selenium, and arsenic. Total dissolved solids (TDS), chloride, sulfate, bicarbonate, and pH are also monitored at the Site. Additional analytes for the hydrogeology Site characterization include aluminum, copper, cadmium, and zinc.

In a letter dated February 7, 2011, DWMRC requested that RAML conduct a hydrogeologic assessment to investigate out-of-compliance (OOC) conditions at the Site (DRC, 2011). At compliance wells RL-1 and EF-8, uranium concentrations had exceeded established Alternate Concentration Limits (ACLs), resulting in the OOC conditions. The investigation was conducted in 2012 and 2013 and included the construction of 27 new monitoring wells, hydraulic testing and analysis, groundwater sampling, and an evaluation of various representative groundwater sampling methods.

This SAP has been prepared to provide details on the Site groundwater sampling program and quality assurance and quality control (QA/QC) procedures for all of the Lisbon Site wells.

2.0 GROUNDWATER MONITORING PROGRAM

The following sections describe the monitoring well network and summarize the analytical requirements for all of the wells.

2.1 MONITORING WELL NETWORK

There are 14 compliance monitoring wells and 28 hydrogeology study wells on and near the Site. **Figure 1** shows the locations of these monitoring wells. Construction details for the monitoring wells are summarized in **Table 1.**

2.2 LONG-TERM GROUNDWATER MONITORING PLAN COMPLIANCE MONITORING PROGRAM

Fourteen monitoring wells are currently sampled in accordance with the Long-Term Groundwater Monitoring Plan (LTGMP). These wells are designated as compliance monitoring wells, which are defined further below:

- Point of Compliance (POC) wells: EF-3A and OW-UT-9
- Point of Exposure (POE) wells: RL-4, RL-5, and RL-6
- Trend wells: EF-6, EF-8, ML-1, RL-1, RL-3, H-63, and LW-1
- Background wells: MW-5 and MW-13

The License stipulates ACLs as the enforceable groundwater protection standards (concentration limits) for these 14 compliance monitoring wells. The compliance designation for each well and respective ACLs are provided in **Table 2. Table 3** presents the analytical methods for the samples collected within the License compliance and hydrogeology study programs.

2.2.1 Monitoring Schedule

The combined compliance monitoring and hydrogeology study monitoring event will be conducted during the fourth calendar quarter of 2015 and 2016. The monitoring events are expected to take approximately two weeks to complete and will be conducted by a water sampling contractor under the technical direction of INTERA personnel.

2.2.2 Groundwater Monitoring Parameters

As specified in the LTGMP, compliance groundwater monitoring includes depth to water level measurement and groundwater sampling. Groundwater samples will be analyzed for the COCs uranium, molybdenum, selenium, and arsenic, and indicator parameters including TDS, chloride, sulfate, bicarbonate, and pH. In addition to these parameters, all samples will also be analyzed for aluminum, copper, cadmium, and zinc. **Table 3** lists the sampling analytes, methods, holding times, and sample container requirements. Groundwater quality indicator parameters monitored in the field include temperature, pH, electrical conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity. Indicator parameter stabilization criteria are provided in the groundwater sampling standard operating procedure provided in **Attachment 1.** Drawdown of the water column in the well will also be monitored during the pre-sampling purge, as described in **Attachment 1.**

2.2.3 Reporting

Reports summarizing the results of the compliance groundwater monitoring program are submitted to DWMRC on an annual basis. Annual compliance monitoring reports are submitted on or before March 1 of each year. Reports are required to include the following information:

- Groundwater sampling methodology
- Field parameter measurements and copies of field sampling data sheets
- Laboratory reports and chain-of-custody documentation
- Data evaluation
- Data tables summarizing recent and historical monitoring data
- Groundwater contour map(s)
- Isoconcentration maps for arsenic, molybdenum, selenium, and uranium
- Time series plots depicting constituents and parameters: arsenic, molybdenum, selenium, uranium, bicarbonate, chloride, sulfate, pH, TDS, and water level elevation

Analytical results for the 28 hydrogeology well samples will be prepared for delivery to RAML and provided to the DWMRC as needed under the requirements of the on-going Site characterization program.

3.0 GROUNDWATER MONITORING PROCEDURES

Groundwater monitoring will be performed by qualified and trained personnel. Procedures for data acquisition QA/QC, groundwater level measurement, groundwater sampling and analysis, and sample control are described in the following sections.

3.1 QUALITY ASSURANCE PLAN

Groundwater sampling and analysis will be conducted in accordance with the Quality Assurance Plan (QAP) prepared for this SAP (**Attachment 2**). The QAP describes the personnel responsible for data collection and establishes the sampling and analytical protocols and documentation requirements to ensure the groundwater monitoring data are collected, reviewed, and analyzed in a consistent manner. The QAP includes data quality objectives for data measurement, sampling procedures, sample and document custody procedures, laboratory analytical methods, internal quality control checks, data validation and reporting procedures, and corrective action procedures.

QA/QC procedures will be conducted in the field and laboratory. Field procedures will include field documentation, blind code labeling, and collection of quality control samples including sample duplicates, sampling equipment rinsate blanks, and transport blanks. Laboratory QA/QC procedures will include completion of laboratory performance criteria including sample holding times, matrix spike/matrix spike duplicate recoveries, and laboratory method blank results. Laboratory and field QA/QC procedures will be conducted in accordance with the QAP.

3.2 GROUNDWATER LEVEL MEASUREMENT

During each monitoring event, manual depth-to-water measurements will be obtained from wells designated in the program using a decontaminated electronic water level indicator. Water levels will be measured to the nearest 0.01-foot from the designated measuring point marked on the top of the well casing. Measurements will be recorded immediately on a water level field data sheet (**Attachment 3**). Water level measurements will be obtained in as short a period of time as practical. Standard operating procedures for water level measurement are provided in **Attachment 1.**

3.3 GROUNDWATER SAMPLE COLLECTION

The following sections provide the procedures to be utilized during the collection of groundwater samples from monitoring wells.

3.3.1 Field Instrument Calibration

At the beginning of each day of sampling, field instruments will be calibrated following manufacturer's recommended procedures using known, standard solutions. Calibration procedures, date, and time will be recorded on field instrument calibration data sheets (**Attachment 3**). Back-up instruments will be available in case of malfunction. Instrument maintenance will be performed as deemed appropriate by the manufacturer.

3.3.2 Groundwater Sampling Methods

The low-flow minimal purge method is the recommended method of sampling for License compliance monitoring wells and the Site characterization hydrogeology wells. The low-flow method has been approved by the DWMRC (DRC, 2015) as long as the appropriate pumping rates, drawdown stabilization, and field parameter stabilization criteria are followed

(ASTM, 2002). However, RAML will implement the standard purge method or the low-permeabilty well method if the low-flow sampling criteria cannot be met (**Attachment 1**). Sampling information will be recorded on field sampling data sheets (**Attachment 3**). General procedures for recommended sample methods are described in the following sections. Standard operating procedures for sampling methods are provided in **Attachment 1.**

Low-Flow (Minimal Purge), Standard Purge, and Low-Permeability Well Sampling Methods

When the low-flow method is used, groundwater samples will be collected in general accordance with the US EPA *Low-Flow (Minimal Drawdown) Ground-Water Monitoring Procedures* (Puls and Barcelona, 1996) and *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations, Designation D 6771-02* (ASTM, 2002). A submersible pump will be placed at the midpoint of the well screen interval. Wells will be purged through disposable tubing at rates less than 500 milliliters per minute to minimize water level drawdown. During purging, field parameters (pH, specific conductance, temperature, oxidation-reduction potential [ORP], dissolved oxygen [DO], and turbidity) will be monitored through a flow-through cell and recorded on field sampling data sheets at 3-minute intervals. With stable water levels in the well, groundwater samples will be collected after field parameters have stabilized within ±0.1 standard units for pH, ±3 percent for specific conductance and temperature, ±10 millivolts for ORP, and ±10 percent for turbidity and DO. These stabilization criteria are also presented in **Attachment 1.**

The standard-purge method may be employed if the low-flow criteria cannot be met. Likewise, some wells may contain such small amounts of water and low recharge rates that the low-permeability purging and sampling method may be used. Please see **Attachment 1** for a description of each of these methods.

3.3.3 Sample Filtration

Samples collected for dissolved parameters will be field-filtered using a disposable, in-line, 0.45-micron filter. Water samples will be pumped through the filter attached directly to the discharge tubing of the groundwater pumping system. A new filter and tubing will be used for each sample. A separate sample from MW-116 will also be filtered with a 0.10-micron filter for evaluation of geochemical parameters.

3.3.4 Quality Control Sampling

QA/QC sampling will be conducted in accordance with the QAP for the Site (**Attachment 2**). QA/QC samples will consist of duplicate samples, split samples, and equipment rinsate blanks. QA/QC samples will be clearly identified on the field sampling forms.

Duplicate Samples

Duplicate groundwater samples will be collected at a frequency of 10 percent of the total number of groundwater samples collected during quarterly or semiannual events. Specific locations will be designated for collection of duplicate samples prior to the beginning of sample collection. The duplicate samples will be collected at the same locations as the corresponding primary samples and will be collected simultaneously using identical sampling techniques. Duplicate samples will be treated in an identical manner as the primary samples during storage, transportation, and analysis. The duplicate sample containers will be assigned an identification number in the field so that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis.

Laboratory Split Samples

Laboratory split groundwater samples will be collected by the Utah DWMRC in conjunction with the regular sample at designated wells. Typically, split samples are collected at a frequency of 5 percent of the total number of primary groundwater samples collected during semiannual events. At each location, a second set of sample containers will be filled and submitted to a different laboratory. The split samples will be submitted for equivalent analysis as the primary sample.

Equipment Rinsate Blanks

To assess the effectiveness of equipment decontamination procedures, equipment rinsate blanks will be collected at a frequency of 5 percent of the total number of primary groundwater samples collected during semiannual events. Equipment blanks will be prepared by pouring or pumping reagent-grade de-ionized water over or through sampling devices after decontamination procedures have been conducted. The water will be collected and transported to the laboratory for the equivalent analysis as the primary samples.

3.3.5 Sample Designation and Labeling

All groundwater samples collected from monitoring wells, including duplicate samples, will be given a unique blind four-digit sample identifier. Sample identifiers will be recorded on field sampling data sheets. Sample containers will be labeled with the sample identifier, data and time of sampling, and sampler's initials.

3.3.6 Equipment Decontamination Procedures

Before use at each location, the submersible pumps and depth-to-water sensors will be washed using a solution of water and Liqui-Nox™, rinsed with potable water, and rinsed a second time with distilled/deionized water. Disposable polyethylene tubing will be discarded after each well is sampled and replaced with new tubing. Samplers will use new, disposable gloves at each well location.

3.4 SAMPLE CONTROL

3.4.1 Sample Containers/Sample Handling

The sample containers will be prepared and provided by the analytical laboratory. Samples will be preserved consistent with conditions presented in **Table 3.** The type and size of container used for each parameter and the type of preservative added, if any, will be recorded on the field sampling data form. Sample containers will be placed in an ice-filled cooler immediately after sample collection. The sample containers will be kept closed, maintained under custody, and refrigerated until analysis. Maximum holding times from the time of sample collection until sample analysis are provided in **Table 3.**

3.4.2 Sample Custody

At the end of each sampling day and before samples are transferred offsite, sample information will be documented on the chain-of-custody/laboratory analysis request form. Once samples are collected, they will remain in the custody of the sampler or other authorized personnel until shipped to the laboratory. Upon transfer of sample possession to subsequent custodians, the persons transferring custody will sign the chain-of-custody form. During interstate transport, the chain-of-custody form will be placed in a resealable plastic bag and accompany each sample cooler to the laboratory. Signed and dated chain-of-custody seals will be placed on coolers prior to shipping. When the samples are received at the laboratory, the custody seal on the shipping container will be broken, and the condition of the samples will be recorded by the laboratory custodian. Chain-of-custody records will be included in the analytical report prepared by each laboratory.

The laboratory will also maintain a sample-tracking record that will follow each sample through the laboratory process. The sample-tracking record must show the dates of sample extraction or preparation and sample analysis.

3.4.3 Packaging and Shipping

Samples will be shipped to the analytical laboratory by overnight delivery. Samples will be packaged and shipped using the following procedures:

- Sample containers will be placed in resealable plastic bags in sealed, insulated coolers. A sufficient amount of ice will be placed around the samples.
- If used, glass bottles will be separated in the shipping container by shock-absorbent packaging material to prevent breakage.
- Sample shipments will be accompanied by chain-of-custody/laboratory analysis request forms, which will be sealed in plastic bags and placed inside each cooler.

3.5 LABORATORY ANALYSIS

Groundwater samples will be submitted for hydrochemical analysis to analytical laboratories certified by the State of Utah. Laboratory analyses will be performed using United States Environmental Protection Agency (US EPA)-approved methods. Samples will be analyzed for dissolved uranium, molybdenum, selenium, arsenic, aluminum, copper, cadmium, and zinc by US EPA Method 200.7_8 (US EPA, 1994); for TDS by Standard Method A2540 C (American Public Health Association [APHA], et al., 2012); for chloride and sulfate by US EPA Method 300.0 (US EPA, 1993); for bicarbonate as HCO_3 (alkalinity) by Standard Method A2320 B (APHA, et al., 2012); and for pH by Standard Method A4500-HB (APHA, et al., 2012). In addition to the required analyses, samples may also be analyzed for calcium, magnesium, potassium, and sodium by US EPA Method 200.7_8 (US EPA, 1994); carbonate as CO_3 by Standard Method A2320 B (APHA, et al., 2012); and specific conductance by Standard Method A2510 B (APHA, et al., 2012). Methods for required analyses are summarized in **Table 3.** Other analyses may be conducted for characterization purposes.

Laboratory QA/QC procedures will be conducted in accordance with the QAP (**Attachment 2**). Laboratory QA/QC procedures will include completion of laboratory performance criteria including sample holding times, matrix spike/matrix spike duplicate recoveries, and laboratory method blank analysis.

3.6 INVESTIGATION-DERIVED WASTE

Purge water and equipment decontamination water generated during groundwater sampling activities will be considered investigation-derived waste (IDW). Purge and decontamination water will be transported to a secured container on the RAML property and temporarily stored on-site. IDW will be transported and properly disposed at an appropriate facility following receipt of laboratory analytical results and disposal characterization. A RAML representative will sign and retain copies of all transport and disposal manifests.

4.0 REFERENCES CITED

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_____, 2015, **DRC Review of the Rio Algom Mining LLC, Lisbon Facility, Groundwater Monitoring Plan Version 2.0, July 31, 2015: Approval letter** sent to Anthony Baus, Rio Algom Mining LLC, August 19, 2015.

TABLES

TABLE 1. MONITORING WELL LIST, OCTOBER 2015
RIO ALGOM MINING LLC, LISBON FACILITY

No.	Well Status	Well I.D.	Ground Elevation (ft amsl)	Well Dia. (inches)	TD (ft btoc)	DTW (ft btoc)	Top Screen (ft btoc)	Base Screen (ft btoc)	Screen Length (ft)
1	License	EF-3A	6583.23	6	215	81.37	151	215	64
2	License	OW-UT-9	6705.6	6	142	122.89	120	140	20
3	License	RL-4	6682.94	5	178	156.48	138	178	40
4	License	RL-5	6687.96	5	188	151.91	151	188	37
5	License	RL-6	6463.3	5	20	16.02	9	19	10
6	License	EF-6	6569.12	4	137	70.71	107	137	30
7	License	EF-8	6574.42	4	244	73.73	213	243	30
8	License	ML-1	6531.81	4	157	41.95	137	156	19
9	License	RL-1	6654.18	5	125	116.28	105	125	20
10	License	RL-3	6705.91	5	185	170.13	165	185	20
11	License	H-63	6684.14	4	172	135.9	141	171	30
12	License	LW-1	6723.61	4	234	146.92	204	234	30
13	License	MW-13	6642.12	4	206	94.03	129	206	77
14	License	MW-5	6745.82	6	197	154.2	167	197	30
15	Hydrogeology	UW-1	6653.64	4	140	104.93	6553	6516	
	Hydrogeology	UW-1		4	140	104.93	100.64	137.64	37
16	Hydrogeology	MW-100	6724.19	4	204	146.92	6586	6521	
	Hydrogeology	MW-100		4	204	146.92	138.19	203.19	65
17	Hydrogeology	MW-101	6709.38	4	161	150.86	6570	6550	
	Hydrogeology	MW-101		4	161	150.86	139.38	159.38	20
18	Hydrogeology	MW-102	6701.46	4	137	125.04	6585	6565	
	Hydrogeology	MW-102		4	137	125.04	116.46	136.46	20
19	Hydrogeology	MW-102DB	6701.68	4	177	119.8	6556	6526	
	Hydrogeology	MW-102DB		4	177	119.8	145.68	175.68	30
20	Hydrogeology	MW-103	6662.56	4	113	82.51	6581	6551	
	Hydrogeology	MW-103		4	113	82.51	81.56	111.56	30
21	Hydrogeology	MW-104	6703.45	4	108	94.2	6635	6605	
	Hydrogeology	MW-104		4	108	94.2	68.45	98.45	30
22	Hydrogeology	MW-105	6622.46	4	136	73.04	6558	6488	
	Hydrogeology	MW-105		4	136	73.04	64.46	134.46	70
23	Hydrogeology	MW-106	6852.76	4	267	227.3	6616	6586	
	Hydrogeology	MW-106		4	267	227.3	236.76	266.76	30
24	Hydrogeology	MW-107S	6510.31	4	62	50.85	6480	6450	
	Hydrogeology	MW-107S		4	62	50.85	30.31	60.31	30
25	Hydrogeology	MW-107D	6510.59	4	82	50.94	6450	6430	
	Hydrogeology	MW-107D		4	82	50.94	60.59	80.59	20
26	Hydrogeology	MW-108	6513.14	4	170	24.78	6425	6345	
	Hydrogeology	MW-108		4	170	24.78	88.14	168.14	80
27	Hydrogeology	MW-109	6671.81	4	156	135.99	6548	6518	
	Hydrogeology	MW-109		4	156	135.99	123.81	153.81	30
28	Hydrogeology	MW-110	6622.05	4	142	133.99	6522	6482	
	Hydrogeology	MW-110		4	142	137.41	100.05	140.05	40
29	Hydrogeology	MW-111	6643.56	4	125.85	91.99	6569	6519	
	Hydrogeology	MW-111		4	125.85	91.99	74.56	124.56	50
30	Hydrogeology	MW-112	6534.56	4	141.8	44.79	6499	6394	
	Hydrogeology	MW-112		4	141.8	44.79	35.56	140.56	105
31	Hydrogeology	MW-113	6565.93	4	104.45	67.94	6508	6463	
	Hydrogeology	MW-113		4	104.45	67.94	57.93	102.93	45
32	Hydrogeology	MW-114	6553	4	199	57.49	6505	6355	
	Hydrogeology	MW-114		4	199	57.49	48	198	150
33	Hydrogeology	MW-115S	6576.36	4	126.9	75.31	6516	6451	
	Hydrogeology	MW-115S		4	126.9	75.31	60.36	125.36	65
34	Hydrogeology	MW-115M	6576.05	4	217	75.37	6451	6361	
	Hydrogeology	MW-115M		4	217	75.37	125.05	215.05	90
35	Hydrogeology	MW-116	6575.97	4	124	84.8	6474	6454	

TABLE 1. MONITORING WELL LIST, OCTOBER 2015
RIO ALGOM MINING LLC, LISBON FACILITY

No.	Well Status	Well I.D.	Ground Elevation (ft amsl)	Well Dia. (inches)	TD (ft btoc)	DTW (ft btoc)	Top Screen (ft btoc)	Base Screen (ft btoc)	Screen Length (ft)
	Hydrogeology	MW-116		4	124	84.8	101.97	121.97	20
36	Hydrogeology	MW-116	6575.97	4	124	84.8	6474	6454	
	Hydrogeology	MW-116		4	124	84.8	101.97	121.97	20
37	Hydrogeology	MW-117S	6584.63	4	126.7	82.25	6514	6459	
	Hydrogeology	MW-117S		4	126.7	82.25	70.63	125.63	55
38	Hydrogeology	MW-117M	6585.13	4	151.4	82.65	6461	6436	
	Hydrogeology	MW-117M		4	151.4	82.65	124.13	149.13	25
39	Hydrogeology	MW-118	6463.98	4	66.4	15.02	6454	6399	
	Hydrogeology	MW-118		4	66.4	15.02	9.98	64.98	55
40	Hydrogeology	MW-119	6588.13	4	90	70.19	6535	6515	
	Hydrogeology	MW-119		4	90	70.19	53.13	73.13	20
41	Hydrogeology	MW-120	6675.34	4	246.9	125.83	6560	6430	
	Hydrogeology	MW-120		4	246.9	125.83	115.34	245.34	130
42	Hydrogeology	MW-121	6593.27	4	201.85	198.49	6422	6392	
	Hydrogeology	MW-121		4	201.85	198.49	171.27	201.27	30
43	Hydrogeology	MW-122	6926.584	4	203	197.15	6770.584	6730.584	
	Hydrogeology	MW-122		4	203	197.15	156	196	40

TABLE 2. REGULATORY CONCENTRATION LIMITS FOR COMPLIANCE MONITORING WELLS
RIO ALGOM MINING LLC, LISBON FACILITY

WELL NAME	WELL DESIGNATION	ACTION LEVEL	REGULATORY CONCENTRATION LIMIT (mg/L)			
			Uranium	Arsenic	Selenium	Molybdenum
OW-UT-9	Point of Compliance	Alternate Concentration Limit	101.58	2.63	0.1	58.43
EF-3A	Point of Compliance	Alternate Concentration Limit	96.87	3.06	0.93	23.34
RL-4	Point of Exposure	Compliance	0.32	---	---	---
RL-5	Point of Exposure	Compliance	0.32	---	---	---
RL-6	Point of Exposure	Compliance	0.32	---	---	---
RL-1	Trend	Target Action Level	42.1	---	---	---
RL-3	Trend	Target Action Level	37.3	---	---	---
EF-6	Trend	Target Action Level	3.9	---	---	---
EF-8	Trend	Target Action Level	0.3	---	---	---
ML-1	Trend	Target Action Level	0.26	---	---	---
H-63	Trend	Target Action Level	0.06	---	---	---
LW-1	Trend	Target Action Level	0.028	---	---	---
MW-5	Background	Background	0.01	0.05	0.01	0.07
MW-13	Background	Background	0.02	0.066	0.01	0.05

Notes:
mg/L = milligrams per liter
--- = not applicable

TABLE 3. GROUNDWATER MONITORING ANALYTICAL METHODS
RIO ALGOM MINING LLC, LISBON FACILITY

PARAMETER	ANALYTICAL METHOD	LABORATORY REPORTING LIMIT (mg/L)	HOLDING TIME	CONTAINER AND SIZE	PRESERVATION METHOD
PRIMARY ANALYSES (REQUIRED)					
Uranium (dissolved)	EPA 200.7_8	0.0003	6 months	Plastic-250 mL	Field filter (0.45 micron) add nitric acid (HNO3) to pH<2, cool, <6oC
Arsenic (dissolved)	EPA 200.7_8	0.001	6 months		
Molybdenum (dissolved)	EPA 200.7_8	0.001	6 months		
Selenium (dissolved)	EPA 200.7_8	0.001	6 months		
Aluminum (dissolved)	EPA 200.7_8	0.100	6 months		
Copper (dissolved)	EPA 200.7_8	0.010	6 months		
Cadmium (dissolved)	EPA 200.7_8	0.010	6 months		
Zinc (dissolved)	EPA 200.7_8	0.010	6 months		
Chloride	EPA 300.0	1	28 days	Plastic-500 mL	Cool, <6^{o}C
Sulfate	EPA 300.0	1	28 days		
Bicarbonate, as $CaCO_3$	SM A2320 B	5	28 days		
Total Dissolved Solids	SM A2540 C	10	7 days		
Alkalinity	A2320B	5			
pH	SM A4500-H B	0.01	15 minutes[a]		
SUPPLEMENTAL ANALYSES (OPTIONAL)					
Calcium (dissolved)	EPA 200.7_8	1	6 months	Plastic-250 mL	Field filter (0.45 micron) add nitric acid (HNO_3) to pH<2, cool, <6^{o}C
Magnesium (dissolved)	EPA 200.7_8	1	6 months		
Potassium (dissolved)	EPA 200.7_8	1	6 months		
Sodium (dissolved)	EPA 200.7_8	1	6 months		
Iron (dissolved)	EPA 200.7_8	0.03	6 months		
Carbonate, as CO_3	SM A2320 B	5.00	28 days	Plastic-500 mL	Cool, <6^{o}C
Specific Conductance	SM A2510 B	5.00	28 days		

Notes:

[a] pH is measured in the field at the time of sample collection and checked in the laboratory.
mg/L = milligrams per liter
mL = milliliter
MW-116: filter with 0.45-micron and 0.1 micron filters (two samples)

ILLUSTRATION

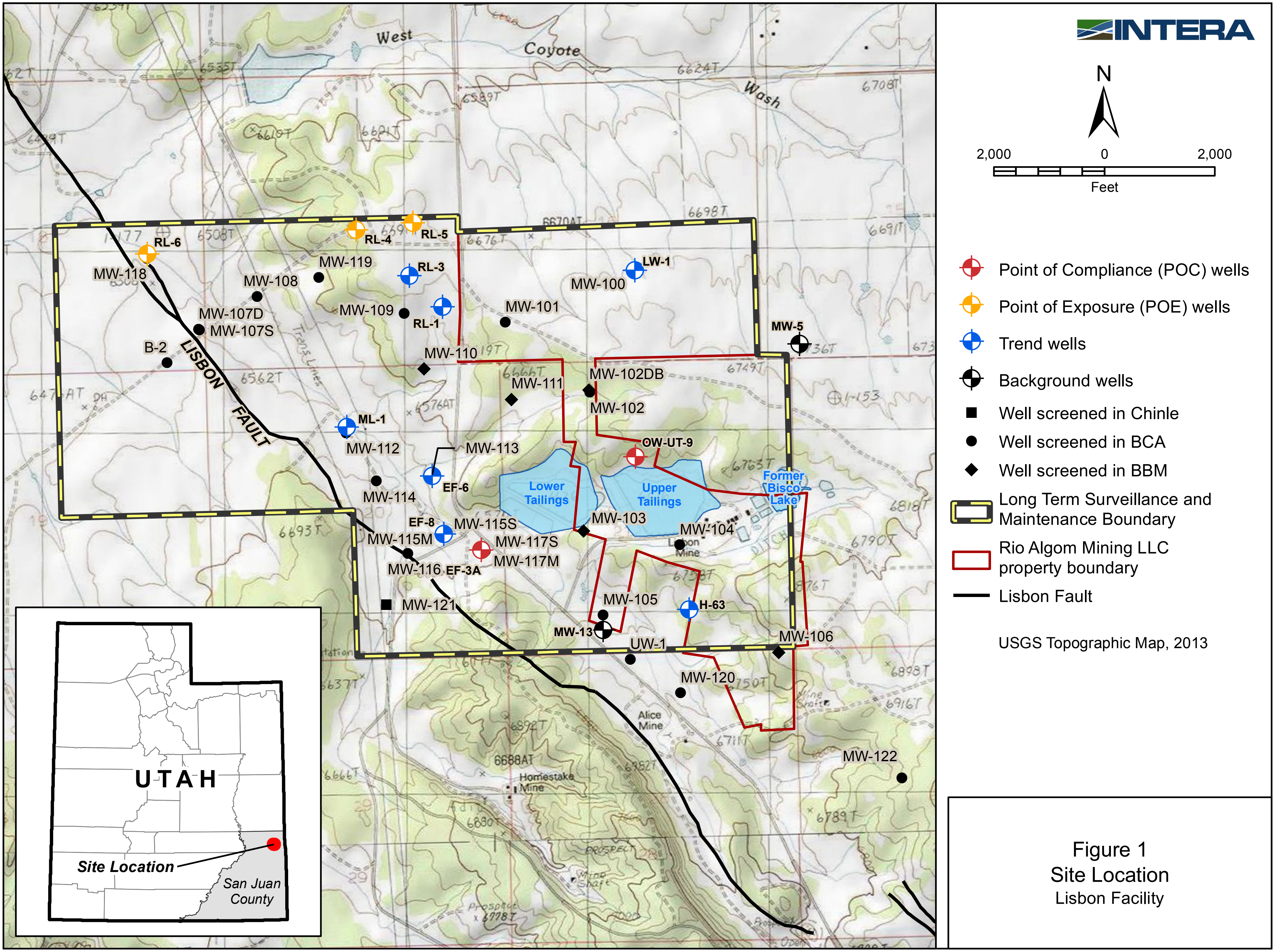

Figure 1
Site Location
Lisbon Facility

FILE: S:\Projects\Rio_Lisbon_SupplmentalSiteCharacterization\Graphics\GIS\MapDocs\Wells_INTERA_2015\Fig01_LocationMap.mxd 9/29/2015

ATTACHMENT 1

STANDARD OPERATING PROCEDURES
FOR GROUNDWATER MONITORING, ALL WELLS
LISBON, UTAH

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STANDARD OPERATING PROCEDURES FOR GROUNDWATER MONITORING, LICENSE COMPLIANCE AND HYDROGEOLOGY STUDY WELLS AT THE RIO ALGOM MINING LLC, LISBON FACILITY

1.0 SCOPE AND APPLICABILITY

The following sections describe standard operating procedures (SOPs) for measurement of water levels in wells and for collection of water quality samples from wells at the Rio Algom Mining, LLC Lisbon facility (RAML) in Lisbon, Utah.

The SOPs apply to groundwater sampling activities at the 14 wells designated as "license compliance wells" and the 28 "hydrogeology study wells." Sampling methods for the 14 license wells have be documented in the Groundwater Monitoring Plan (GMP) prepared by RAML dated July 31, 2015 and approved by the Utah Division of Waste Management and Radiation Control (DWMRC) in a letter dated August 19, 2015. Sampling methods for the additional 28 hydrogeology study wells will be identical to those used for the license wells (low-flow sampling and potentially the volume-based standard purge method) with the addition of a method for sampling low-permeability formation wells, as described in U.S. Environmental Protection Agency (EPA) and United States Geological Survey (USGS) sampling literature (Yeskis and Zavala, 2002 and Wilde, 2006). SOPs for water level monitoring and low-flow sampling, volume-based purge and sampling, and low-permeability formation well sampling are described in the following sections.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks shall be thoroughly evaluated prior to conducting field activities. The site-specific Health and Safety Plan (HASP) for the RAML facility provides a description of potential hazards and associated safety and control measures.

Field personnel must wear powder-free nitrile gloves while performing the procedures described in this SOP. Specifically, powder-free nitrile gloves must be worn while measuring water levels, preparing sample bottles, preparing and decontaminating sampling equipment, collecting samples, and packing samples. At a minimum, nitrile gloves must be changed prior to the collection of each sample, or as necessary to prevent the possibility of cross-contamination with the sample, the sample bottles, or the sampling equipment.

Field sampling equipment shall be decontaminated prior to each use. Although water level measurement and sampling should typically be conducted from least to most impacted location, field logistics may necessitate other sample collection priorities. When sampling does not proceed from least to most impacted location, extra precautions must be taken to ensure that appropriate levels of decontamination are achieved.

3.0 WATER LEVEL MEASURMENT PROCEDURES

Water levels will be measured in wells prior to sampling. Construction details and any previous measurements for each well will be reviewed by the field staff before obtaining measurements.

3.1 Materials and Equipment

The following equipment is needed to measure water levels and well depth. All equipment which comes in contact with the well should be decontaminated prior to commencing field activities.

- Records of well construction details and previous measurements
- Electronic water level indicator with accuracy of 0.01 feet
- Field log or data sheet
- Weighted tape graduated to the nearest 0.01 feet

3.2 Measuring Point

Well depth and water level measurements will be referenced from a measuring point, established and marked at the top of the inner casing of each monitoring well. Generally, this point will be on the north side of the top of the casing. The measuring point is permanently marked using an indelible marker or a notch cut into the casing. A licensed surveyor has surveyed the measuring point elevation of each monitoring well and referenced measurements to the local datum for location and elevation.

3.3 Water Level Measurements

Manual water level measurements will be obtained from wells with an electronic water level indicator prior to sampling. The SOP for measuring water levels with an electronic water level indicator is as follows:

1. Open the protective outer cover of the monitoring well and remove any debris that has accumulated around the riser near the well plug. If water is present above the top of the riser and well plug, remove the water prior to opening the well plug. Do not open the well until the water above the well head has been removed.
2. Allow well to equilibrate for at least 5 minutes before measuring the water level.
3. Using an electronic water level indicator accurate to 0.01 feet, determine the distance between the established measuring point and the surface of the standing water present in the well. Repeat as necessary until two successive readings agree to within 0.01 feet. Record date and time of each water level measurement and the serial number of the water level indicator used.
4. Measure the well total depth and record.
5. Decontaminate the water level indicator in preparation for next use.

The accuracy of electronic water level indicators may be verified at least annually as part of routine maintenance. The entire length of the graduated tape/cable will be compared to a steel surveyor's tape of the same or greater length to determine accuracy at 100-foot increments. Water level indicators will be checked more frequently if there is reason to suspect the tape/cable was stretched during field operations.

4.0 GROUNDWATER SAMPLE COLLECTION PROCEDURES

SOPs for purge and sample methods are described below.

4.1 Materials and Equipment

The following equipment is needed to collect groundwater samples from wells. All equipment which comes in contact with the well should be decontaminated prior to commencing field activities.

General Materials and Equipment:

- Monitoring instruction sheet for each site
- Field logbook
- Field sampling data sheets (FSDS)
- Site maps
- Health & Safety Plan

- Indelible black-ink pens and markers
- Sample labels
- Chain-of-custody forms
- Custody seals
- Shipping labels
- Water level meter
- pH/conductivity/temperature/ORP meter, turbidity meter, and dissolved oxygen meter
- Field test kits for ferrous iron, ferric iron, dissolved oxygen, etc.
- Insulated cooler(s)
- Laboratory-supplied sample containers
- Sample preservative (i.e. acid, base, etc.)
- Ice
- Decontamination equipment: Liquinox or similar, and jugs for potable water

Equipment for Low-Flow and Standard Purge Sampling:

- Variable rate electric submersible pump and controller and/or air- or gas-driven bladder pump
- Portable generator
- Flow-through cell
- Disposable discharge tubing

4.2 Low Flow Sample Method

U.S. EPA (2007) recommends the use of adjustable-rate bladder and electric submersible pumps during low-flow purging and sampling activities. The following SOPs assume that a non-dedicated electric variable rate submersible pump will be used to purge and sample wells by the low flow method. The following procedures are used for low flow sampling and based on the ASTM Standard Practice (2002):

4.2.1 Purging

1. Prepare sampling equipment including calibration of field meters prior to use.

2. Measure and record the depth to water to the nearest 0.01 feet as described above. Using the specific details of well construction and current water-level measurement, determine the pump set depth, typically the mid-point of the saturated well screen or other target sample collection depth adjacent to specific high-yield zones. If disposable tubing is to be used, cut appropriate length of disposable tubing from roll and attach to pump.
3. Remove the decontaminated pump from the pump holder and rinse the pump off with water. Slowly lower the pump into the well to the target depth. Record the depth of the pump intake after lowering the pump into the location of highest permeable zone, or mid-point of screen if there are no distinct lithologic units within the screened interval based on the geologic log for the well.
4. Connect the cable for the control box to the pump reel. Start the generator. Make sure the generator is kept downwind from the sampling system.
5. Connect the discharge tubing from the pump to the base of the flow-through cell. Place the probes for the calibrated field meters into the flow-through box. Attach small section of discharge tubing to the top of the flow-through cell and place end of hose into bucket to catch purge water.
6. Place water level probe in well and record static water level on the FSDS.
7. If the well has been previously sampled using low-flow purging and sampling methods, begin purging at the rate known to induce minimal drawdown. Frequently check the drawdown rate to verify that minimum drawdown is being maintained. If sampling the well for the first time, begin purging the well at the minimum pumping rate of 100 milliliters per minute (mL/min) and slowly increase the pumping rate to no more than 500 mL/min. Monitor and record drawdown in well (if any). Record data on FSDS.
8. Adjust flow rate to minimize drawdown up to a maximum of 25% of the distance between the top of the screen and the pump intake (the 25% rule) (ASTM, 2002) (i.e., if the screen is 20 ft long and the pump intake is set in the middle of the screen, the distance from top of screen to pump intake is 10 ft, and 25% of 10 ft is 2.5 ft.) Note that the 25% rule in the ASTM guidance is conservative, and the ASTM guidance also states that the actual distance from top of screen to pump intake is an acceptable drawdown. (Note also that this criterion assumes that the starting water level is located above the top of the screen by a distance greater than the distance from top of screen to pump intake. If the water level is below the top of the screen, then all of the water is assumed to be representative of aquifer conditions.) In practice, water quality indicator parameter stabilization is the primary stabilization criteria. If drawdown occurs which

exceeds the recommended criteria, but parameters stabilize after the required number of measurements and time, then document the drawdown and proceed with sampling. Document the details of purging, including the purge start time, rate, and drawdown on the FSDS and in the field logbook.

9. Start recording field parameters on the FSDS sheet every three minutes. Purging should continue at a constant rate until the parameters stabilize. Stabilization is considered achieved when three sequential measurements are within the ranges listed below, based on ASTM (2002) and Utah Division of Waste Management and Radiation Control[1] (DRC, 2015) guidance:

• pH	± 0.1 standard units
• Specific Conductance	± 3%
• Temperature	± 3%
• ORP	± 10 millivolts
• Turbidity	± 10% (DRC, 2015)
• Dissolved Oxygen	± 10% (DRC, 2015)

4.2.2 Sampling

1. After specified parameters have stabilized, reduce flow rate on control box to approximately 100 mL/min.

2. Disconnect discharge tubing base of flow-through cell, being careful to contain water within the cell. Cut off approximately 0.5 feet from end of discharge tubing. Place a bucket beneath sampling tube to catch water.

3. Fill necessary sample bottles. Label sample bottles with a unique sample number, time and date of sampling, the initials of the sampler, and the requested analysis on the label. Additionally, provide information pertinent to the preservation materials or chemicals used in the sample. Record comments pertinent to the color and obvious odor. Record sampling information on FSDS sheet and in field logbook.

4. Fill all sample containers with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container. Immediately seal each sample and place the sample on ice in a cooler to maintain sample temperature preservation requirements. Fill bottles in the following order:

   - Metals, and Radionuclides
   - Filtered Metals and Radionuclides
   - Other water-quality parameters.

[1] Formerly the Utah Division of Radiation Control (DRC).

5. Remove the pump from the well taking care that the tubing does not contact the ground while being retrieved. Decontaminate pump and tubing for next use.
6. Containerize and properly dispose of purge water and decontaminate water generated during sampling.

4.3 Volume Based (Standard Purge) Sample Method

If the low-flow purge criteria cannot be met, groundwater samples will be collected using the volume-based purge sampling method in accordance with procedures described in US EPA *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers* (Yeskis and Zavala, 2002) (DRC, 2015). The following SOPs assume that a non-dedicated electric variable rate submersible pump will be used to purge and sample wells by the volume-based method. The following procedures will be used for standard purge sampling:

4.3.1 Well Purging

1. Prepare sampling equipment including calibration of field meters prior to use.
2. Measure and record the depth to water to the nearest 0.01 feet as described above. Calculate a casing volume for the well based on the specific details of well construction, the current depth to water measurement, and casing diameter. For wells with multiple casing diameters, calculate the volume for each segment and use the sum of the values.
3. Remove the decontaminated pump from the pump holder and rinse the pump off with water. Slowly lower the pump into the well to the target depth. Set the pump immediately above the top of the well screen or 3 to 5 feet below the top of the water table. Lower the pump if the water level drops during purging. Record the depth of the pump intake after lowering the pump into location.
4. Connect the cable for the control box to the pump reel. Start the generator. Make sure the generator is kept downwind from the sampling system.
5. Purge the well until at least three casing volumes are removed. Maintain a purge rate so that recharge water is not entering the well in an agitated manner. Containerize all purge water.
6. Record field parameters periodically and after each casing volume is purged. Stabilization is considered achieved when three sequential measurements, collected three minutes apart, are within the ranges listed below:
   - pH ± 0.1 standard units
   - Specific Conductance ± 3%

- Temperature ± 3%
- ORP ± 10 millivolts
- Turbidity ± 10% (DRC, 2015)
- Dissolved Oxygen ± 10% (DRC, 2015)

If the indicator parameters have not stabilized after the removal of four casing volumes, field instruments will be recalibrated. If no problems are found, sampling can be conducted; however, the project manager will be notified and all information will be recorded in the field notebook and/or field purge record.

4.3.2 Sampling after Standard Purge

1. Collect samples within 2 hours of purging, if possible. It is acceptable to collect samples within 24 hours of purging.
2. Fill necessary sample bottles. Label sample bottles with a unique sample number, time and date of sampling, the initials of the sampler, and the requested analysis on the label. Additionally, provide information pertinent to the preservation materials or chemicals used in the sample. Record comments pertinent to the color and obvious odor. Record sampling information on FSDS sheet and in field logbook.
3. Fill all sample containers with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container. Immediately seal each sample and place the sample on ice in a cooler to maintain sample temperature preservation requirements.
4. Remove the pump from the well taking care that the tubing does not contact the ground while being retrieved. Decontaminate pump and tubing for next use.
5. Containerize and properly dispose of purge water and decon water generated during sampling.

4.4 Low Permeability Formation Sampling

The USGS recommends against sampling wells that pump dry or are slow to recover (Wilde, 2006). However, some wells on the Lisbon site and vicinity are known to be low-permeability formation wells, and sampling from these wells has been attempted in the past. The sampling method described in this SOP applies to wells completed in low-permeability formations that consequently do not readily recharge to the starting water level after purging. This SOP also applies to wells that contain so little water as to be difficult or impossible to purge and/or sample using standard pumping equipment, such as a bladder pump or an electric submersible pump (i.e., the wells contain only a few feet of water). EPA *Ground-Water Sampling*

Guidelines for Superfund and RCRA Project Managers (Yeskis and Zavala, 2002) provides guidance for sampling such wells:

> *. . . if a well has an open interval across the water table in a low permeability zone, there may be no way to avoid pumping and/or bailing a well dry (especially in those cases with four feet of water or less in a well and at a depth to water greater than 20 to 25 feet (which is the practical limit of a peristaltic pump)). In these cases, the well may be purged dry. The sample should be taken no sooner than two hours after purging and after a sufficient volume of water for a water-quality sample, or sufficient recovery (commonly 90%) is present (Herzog et al., 1988). (Yeskis and Zavala, 2002, p. 9)*

Purging such a well dry may be accomplished using any method available, including bailing, according to EPA. The maxim time allowable to achieve recovery to 90% of the starting water level is not provided in the EPA guidance, but is provided by the USGS, as follows:

> *After purging, the water level in the well should recover to approximately 90 percent of its starting water level before sampling should commence. In low-yield wells this can take several hours or longer, requiring potentially multi-day visits to complete a three-well-volume purge. The longer the recovery time, the lower the confidence that the samples to be collected can be considered representative of ambient aquifer water composition.*
>
> *RULE OF THUMB*
>
> *Do not sample wells at which recovery of water level after purging to 90 percent exceeds 24 hours. (Wilde, 2006, p. 94)*

Attempt the purge and sampling procedures as described in the following subsections.

4.4.1 Well Purging

1. Based on the above guidance, wells identified from past performance as low-permeability formation wells will be purged dry on a given sampling day.
2. The well will be checked 24 hours later to determine if the water level has recovered to at least 90% of its starting water level.
3. If the well has not recovered to 90% of its starting water level after a maximum of 24 hours, then the well will be identified as a well that should not be sampled under EPA and USGS guidance and that well will be recommended as a non-sampling well. The water level, if any, in the well, should still be gauged as part of the groundwater monitoring program.

4. If the water level has recovered to 90 percent or greater of the starting water level and sufficient water is available to fill the required sample containers, the well will be sampled using a bladder pump, electric submersible pump, or a bailer, with preference for the pumps as opposed to the bailer. (See below for sampling procedure).
5. If the well is sampled with a bailer, discharge the bailed sample into a separate container and collect one series of water quality indicator parameters. These parameters will be considered representative of aquifer conditions because all of the water present in the well has flowed into the well within the past 24 hours.
6. If the well is sampled with a pump, and sufficient water is available to use a flow-through cell, then record the water quality indicator parameters as shown below, to the extent that sufficient water is available to do so. If the quantity is limited, then record one measurement of each parameter and proceed to sample.
7. Stabilization is considered achieved when three sequential measurements are within the ranges listed below:
   - pH ± 0.1 standard units
   - Specific Conductance ± 3%
   - Temperature ± 3%
   - ORP ± 10 millivolts
   - Turbidity ± 10% (DRC, 2015)
   - Dissolved Oxygen ± 10% (DRC, 2015)

4.4.2 Sampling after Purge

1. Collect samples within 2 hours of purging, if possible. It is acceptable to collect samples within 24 hours of purging.
2. If not using a pump and flow-through cell, discharge the bailed sample directly into the sample container (if filtering is not required), or into a separate clean container such as a bucket or cubitainer, and transfer the water from that container to the sample bottles using a peristaltic pump (filtering, as needed).
3. Fill necessary sample bottles. Label sample bottles with a unique sample number, time and date of sampling, the initials of the sampler, and the requested analysis on the label. Additionally, provide information pertinent to the preservation materials or chemicals used in the sample. Record comments pertinent to the color and obvious odor. Record sampling information on the field sampling data sheet and in the field logbook.
4. Fill all sample containers with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container. Immediately seal each sample

and place the sample on ice in a cooler to maintain sample temperature preservation requirements.

5. Remove the pump from the well taking care that the tubing does not contact the ground while being retrieved. Decontaminate the pump and tubing for the next use.
6. Containerize and properly dispose of purge water and decontamination water generated during sampling.

4.4.3 Field Testing

Field test kits for specific constituent valence and concentration may be used. For example, ferrous and ferric iron, or dissolved oxygen, etc., may be requested.

Follow directions on the test kit package and record the results on the field form.

5.0 SELECT REFERENCES

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Yeskis, D. and Zavala, B., 2002, **Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers:** EPA 542-S-02-001, May 2002.

ATTACHMENT 2

QUALITY ASSURANCE PLAN

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TABLES

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ATTACHMENT 2

GROUNDWATER MONITORING QUALITY ASSURANCE PLAN
RIO ALGOM MINING LLC, LISBON FACILITY

1.0 INTRODUCTION

Rio Algom Mining LLC (RAML) and its contractors have prepared this data acquisition Quality Assurance Plan (QAP) for groundwater monitoring conducted at the Lisbon Facility (Site) located near La Sal, Utah. The QAP presents, in specific terms, the policies, organization, functions, and quality assurance/quality control (QA/QC) requirements designed to achieve the data quality goals described in the Groundwater Monitoring Plan, Version 2.0 (GMP) (RAML, 2015). The QAP was prepared in accordance with guidelines established in United States Environmental Protection Agency (U.S. EPA) publications, *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document* (September 1986), and *RCRA Ground-Water Monitoring: Draft Technical Guidance* (November 1992).

1.1 BACKGROUND

Uranium mining and milling occurred at the Site from 1972 to 1989. Seepage from two tailings impoundments constructed during mining impacted groundwater at the Site. Interim and formal groundwater corrective action programs (CAPs) were implemented at the Site from the early 1980s through 2003 to minimize the impact of tailings water seepage on groundwater quality.

In 2003, an application for Alternate Concentration Limits (ACLs) was prepared by RAML and approved by the U.S. Nuclear Regulatory Commission (NRC). The approved ACL application established groundwater compliance concentrations and resulted in a long-term monitoring remedy for the Site. Groundwater compliance monitoring began at the Site in 2004 in accordance with the Long Term Groundwater Monitoring Plan (LTGMP) (KOMEX, 2004).

Currently, all Site activities are conducted in accordance with Utah Division of Waste Management and Radiation Control (DWMRC) [1] Radioactive Materials License No. UT1900481, Amendment No. 5 (License) (DRC, 2014). Among other specifications, the License specifies groundwater compliance concentrations, monitoring and reporting requirements, and identifies the following constituents of concern (COCs) for groundwater: uranium, molybdenum, selenium, and arsenic. The License also requires groundwater monitoring for pH, total dissolved solids (TDS), chloride, sulfate, bicarbonate, and groundwater elevation.

1.2 GROUNDWATER MONITORING PROGRAM

Groundwater monitoring is currently conducted at the Site to meet the requirements of the License or other objectives. Depth to water measurements and groundwater samples are obtained from monitor wells, in accordance with the License or other monitoring requirements. The monitoring program is described in detail in the GMP.

1.3 PURPOSE AND OBJECTIVE

The QAP establishes the sampling and analytical protocols and documentation requirements to ensure the groundwater monitoring data are collected, reviewed, and analyzed in a consistent manner. The QAP includes data quality objectives for data measurement, sampling procedures, sample and document custody procedures, laboratory analytical

[1] Formerly the Utah Division of Radiation Control (DRC).

methods, internal quality control checks, data validation and reporting procedures, and corrective action procedures.

The QAP has been prepared for use by contractors who perform environmental services to ensure the data are scientifically valid and defensible. Compliance with this QAP is required for all staff participating in the monitoring program. The QAP shall be in the possession of the field team during all field activities. RAML and its subcontractors shall be required to comply with the procedures documented in this QAP in order to maintain comparability and representativeness of the data produced.

2.0 PROJECT ORGANIZATION

This QAP specifies roles for the Project Director, the QA Manager, and QC Monitors. The roles and responsibilities of these representatives and the project organization are described below.

2.1 PROJECT ROLES AND RESPONSIBILITY

2.1.1 Project Director

A representative of RAML will serve as project director. The project director oversees all Site activities and coordinates directly with regulatory authorities.

2.1.2 Quality Assurance Manager

The QA Manager is responsible for ensuring that the QA/QC protocols are properly employed. The QA Manager can be employed by RAML or its contractor. Typically, the QA Manager is not directly involved in the data generation (i.e., sampling or analysis) activities. The QA Manager is responsible for oversight of all aspects of QA/QC, including:

- Ensuring that the data generated during the monitoring program meet the specifications of the QAP;
- Auditing and reviewing QA/QC procedures; and
- Determining corrective measures when deviations from the QAP occur.

2.1.3 QC Monitors

The individuals who conduct field sampling activities and perform analyses in the laboratory are considered QC monitors. The responsibilities of field and laboratory personnel are described below.

Sampling QC Monitors

The Sampling QC Monitors are trained personnel qualified to perform all field sampling activities in accordance with this QAP. Sampling QC monitors also include support staff responsible for data processing and database management. The Sampling QC Monitors are responsible for the following:

- Ensuring that samples are collected, preserved, and transported as specified in the QAP;
- Checking that all sample documentation (labels, field data worksheets, chain-of-custody records,) is correct and transmitting that information, along with the samples, to the analytical laboratory in accordance with the QAP;
- Maintaining records of all samples, tracking those samples through subsequent processing and analysis, and, ultimately, where applicable, appropriately disposing of those samples at the conclusion of the program;
- Collecting quality control samples during the sampling event;
- Preparing QC and sample data for review by the QA Manager; and
- Preparing QC and sample data for reporting and entry into a computerized database, where appropriate.

Laboratory QC Monitors

Laboratory analysis QA/QC will be conducted by Laboratory QC Monitors employed by the contract analytical laboratory, in accordance with specific requirements of the laboratory's internal program. The Laboratory QC Monitors are responsible for the following:

- Training and qualifying personnel in specified QC and analytical procedures, prior to receiving samples;
- Receiving samples from the field and verifying that incoming samples correspond to the packing list or chain-of-custody sheet; and
- Verifying that QC and analytical procedures are being followed as specified in this QAP, by the internal QA/QC program, and in accordance with the requirements for maintaining National Environmental Laboratory Accreditation Program ("NELAP") certification.

2.2 PROJECT PERSONNEL

Project personnel who contribute to data acquisition and/or are responsible implementing QA/QC protocols are presented in **Table B-1**. If changes to project personnel are made, **Table B-1** will be updated and will be available to Utah DWMRC personnel upon request.

Table B-1. Project Personnel

COMPANY	PERSONNEL	PROJECT ROLE
Rio Algom Mining, LLC	Theresa Ballaine	Project Director
INTERA, Inc.	Cynthia Ardito Randy Arthur Robert Sengebush	Project Manager; Quality Assurance Manager Geochemist QC Monitor
Confluence Environmental	Josh Kerns	Senior Field Technician; Sampling QC Monitor
Energy Laboratories	Stephanie Waldrop	Analytical Project Manager; Analysis QC Monitor
MP Environmental	Jenny Orr	Waste Management Transportation Supervisor

3.0 QUALITY OBJECTIVES AND CRITERIA

The overall quality assurance objective for this monitoring program is to develop and implement sampling, sample handling, and analytical procedures that will provide data to fulfill the Site Data Quality Objectives (DQOs). DQOs for the groundwater monitoring program and the criteria for data quality measurement are described in the following sections.

3.1 DATA CATEGORIES

The groundwater monitoring program utilizes two general categories of data: (1) field screening data and (2) definitive data. Data categories are described as follows:

Field Screening Data

Field screening data are qualitative or semi-qualitative data obtained by use of approved field equipment. Data are generated by rapid methods of analysis with less rigorous sample preparation, calibration, and/or QC requirements than are necessary to produce definitive data. Physical test methods, including water level measurements and pH, specific conductance, temperature, turbidity, oxidation reduction potential (ORP), and dissolved oxygen measurements have been designated by definition as field screening methods.

Definitive Data

Definitive data are quantitative and are produced under controlled conditions using laboratory-grade instrumentation. Data are generated using rigorous analytical methods, such as approved US EPA reference methods. These methods have standardized QC and documentation requirements. Definitive data are not restricted in their use unless quality problems require data qualification.

3.2 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative statements that specify the field and laboratory data quality necessary to support specific decisions or regulatory actions. DQOs dictate the data type, quality, quantity, and uses needed to make decisions and are the basis for designing data collection activities. The DQOs for field screening data and definitive data obtained during the groundwater monitoring program are described below.

Field Screening Data

1) Measure water level and field parameters to determine formation aquifer stability prior groundwater sampling.
2) Obtain groundwater elevation measurements to assess groundwater flow paths and calculate hydraulic gradients for analytical purposes.

Definitive Data

1) Obtain groundwater quality data to monitor compliance with currently established ACLs.
2) Assess the geochemical conditions in the Burro Canyon Formation Aquifer.
3) Determine the concentration and extent of COCs in groundwater.
4) Obtain groundwater quality data to refine the conceptual Site model (CSM), support groundwater modeling, and develop new ACLs for the Site.

3.3 DATA QUALITY INDICATORS

The effectiveness of the QAP is measured by the quality of the data generated in the field and by the laboratory. Data quality will be assessed in terms of its precision, accuracy, representativeness, comparability, and completeness.

Precision

Precision measures the reproducibility of measurements. Precision is defined as the measure of variability that exists between individual sample measurements of the same property under identical conditions. Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate (two) or replicate (more than two) analyses and measures variability introduced by both the laboratory and field operations. Field duplicate samples will be analyzed to assess field and analytical precision. Precision is expressed as the relative percent difference (RPD) of a data pair and will be calculated by the following equation:

$$RPD = [(A-B)/((A+B)/2)] \times 100$$

In the above equation, A (original) and B (duplicate) are the reported concentrations for field duplicate samples analyses or the percent recoveries for analytical laboratory matrix spike and matrix spike duplicate samples.

Accuracy

Accuracy is defined as a measure of bias in a system or as the degree of agreement between a measured value and a known value. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS to a control limit. Accuracy will be evaluated by the following equation:

$$\% \text{ Recovery} = (|A-B|/C) \times 100$$

Where:

A = the concentration of the analyte in a sample
B = the concentration of the analyte in an unspiked sample
C = the concentration of spike introduced

Representativeness

Representativeness is defined as the degree to which a set of data accurately represents the characteristics of a population, parameter, conditions at a sampling point, or an environmental condition. Representativeness is determined by appropriate program design, and shall be achieved through use of the field, sampling, and analytical procedures outlined in this QAP.

Completeness

Completeness is defined as the percentage of valid data relative to the total number of measurements. Laboratory completeness is a measure of the number of samples submitted for analysis compared to the number of analyses found acceptable after review of the analytical data. Completeness for this project will be calculated using the following equation:

Completeness = (Number of valid data points/total number of measurements) x 100

Where the number of valid data points is the total number of valid analytical measurements based on the precision, accuracy, and holding time evaluation. Project completeness is determined at the conclusion of the data validation. The goal for data completeness is 100 percent for compliance-required analyses.

Comparability

Comparability is the confidence with which one data set can be compared to another data set. The objective for this QA/QC program is to produce data with the greatest possible degree of comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms shall support the assessment of comparability.

4.0 GROUNDWATER SAMPLING PROCEDURES

The procedures to be utilized during the collection of groundwater samples from existing monitoring wells are described in detail in Table 3 and Appendix D of the GMP. Table 3 shows the purge and sampling method designated as LF (low-flow). Appendix D provides Standard Operating Procedures (SOPs) for the low-flow sampling method. The following sections provide procedures specifically related to QA/AC protocols.

4.1 GROUNDWATER SAMPLING

4.1.1 Field Instrument Calibration

At the beginning of each day of sampling, the Sampling QC Monitor will inspect and calibrate field instruments following manufacturer's recommended procedures. Meters will be calibrated using known, standard solutions. Calibration procedures, date, and time will be recorded on field instrument calibration data sheets. Back-up instruments will be available in case of malfunction. Instrument maintenance will be performed as deemed appropriate by the manufacturer.

4.1.2 Sample Designation and Labeling

All groundwater samples collected from monitoring wells, including duplicate samples, will be given a unique blind 4-digit sample identifier. Sample identifiers will be recorded on field sampling data sheets. Sample containers will be labeled with the sample identifier, data and time of sampling, and sampler’s initials.

4.1.3 Sample Volumes, Containers, and Preservation

At a minimum, samples will be analyzed for dissolved uranium, molybdenum, selenium, and arsenic by US EPA Method 200.8, for TDS by standard method A2540 C, for chloride and sulfate by US EPA Method 300.0, for bicarbonate as HCO_3 by standard method A2320 B, and pH by standard method A4500-HB. In addition to the required analyses, samples may also be analyzed for calcium, magnesium, potassium, and sodium by US EPA Method 200.7, carbonate as CO_3 by standard method A2320 B, and specific conductance by standard method A2510 B. Standard methods for required analyses are summarized in **Table B-2**. Other analyses may be conducted for characterization purposes.

Sample volumes, container types, and preservation requirements for the analytical methods specified in the GMP are listed in **Table B-2**. The sample containers will be prepared and provided by the analytical laboratory. The type and size of container used for each parameter and the type of preservative added, if any, will be recorded on the field sampling data sheets (FSDSs). Sample containers will be placed in an iced cooler immediately after sample collection. The sample containers will be kept closed, maintained under custody, and refrigerated until analysis. Maximum holding times from the time of sample collection until sample analysis are provided in **Table B-2**.

Table B-2. Analytical Methods and Sampling Requirements

PARAMETER	ANALYTICAL METHOD	LABORATORY REPORTING LIMIT (mg/L)	HOLDING TIME	CONTAINER AND SIZE	PRESERVATION METHOD
PRIMARY ANALYSES (REQUIRED)					
Uranium (dissolved)	EPA 200.7_8	0.0003	6 months	Plastic-250 mL	Field filter (0.45 micron) add nitric acid (HNO3) to pH<2, cool, <6oC
Arsenic (dissolved)	EPA 200.7_8	0.001	6 months		
Molybdenum (dissolved)	EPA 200.7_8	0.001	6 months		
Selenium (dissolved)	EPA 200.7_8	0.001	6 months		
Aluminum (dissolved)	EPA 200.7_8	0.100	6 months		
Copper (dissolved)	EPA 200.7_8	0.010	6 months		
Cadmium (dissolved)	EPA 200.7_8	0.010	6 months		
Zinc (dissolved)	EPA 200.7_8	0.010	6 months		
Chloride	EPA 300.0	1	28 days	Plastic-500 mL	Cool, <6^{o}C
Sulfate	EPA 300.0	1	28 days		
Bicarbonate, as $CaCO_3$	SM A2320 B	5	28 days		
Total Dissolved Solids	SM A2540 C	10	7 days		
Alkalinity	A2320B	5			
pH	SM A4500-H B	0.01	15 minutes[a]		
SUPPLEMENTAL ANALYSES (OPTIONAL)					
Calcium (dissolved)	EPA 200.7_8	1	6 months	Plastic-250 mL	Field filter (0.45 micron) add nitric acid (HNO_3) to pH<2, cool, <6^{o}C
Magnesium (dissolved)	EPA 200.7_8	1	6 months		
Potassium (dissolved)	EPA 200.7_8	1	6 months		
Sodium (dissolved)	EPA 200.7_8	1	6 months		
Iron (dissolved)	EPA 200.7_8	0.03	6 months		
Carbonate, as CO_3	SM A2320 B	5.00	28 days	Plastic-500 mL	Cool, <6^{o}C
Specific Conductance	SM A2510 B	5.00	28 days		

Notes:

[a] pH is measured in the field at the time of sample collection and checked in the laboratory.

mg/L = milligrams per liter

mL = milliliter

MW-116: filter with 0.45-micron and 0.1 micron filters (two samples)

4.1.4 Sample Handling and Custody

At the end of each sampling day and before samples are transferred off site, sample information will be documented on the Chain-of-Custody/Laboratory Analysis Request form. Once samples are collected, they will remain in the custody of the sampler or other authorized personnel, until shipped to the laboratory. Upon transfer of sample possession to subsequent custodians, the persons transferring custody will sign the chain-of-custody form. During transport, the chain-of-custody form will be placed in a resealable plastic bag and accompany each sample cooler to the laboratory. Signed and dated chain-of-custody seals will be placed on coolers prior to shipping. When the samples are received at the laboratory, the custody seal on the shipping container will be broken and the condition of the samples recorded by the laboratory custodian. Chain-of-custody records will be included in the analytical report prepared by each laboratory.

Upon receipt of the samples, the laboratory will complete the chain-of-custody record. The condition of each sample container will be noted. The laboratory will also maintain a sample-tracking record that will follow each sample through the laboratory process. The sample-tracking record must show the dates of sample extraction or preparation, and sample

4.1.5 Packaging and Shipping

Samples will be shipped to the analytical laboratory by overnight delivery. Samples will be packaged and shipped using the following procedures:

- Sample containers will be placed in resealable plastic bags in a sealed, insulated cooler. A sufficient amount of ice will be placed around the samples.
- If used, glass bottles will be separated in the shipping container by shock-absorbent packaging material to prevent breakage.
- Sample shipments will be accompanied by a chain-of-custody/laboratory analysis request

form, which will be sealed in a plastic bag and placed inside each cooler.

4.2 QA/QC SAMPLES

Groundwater monitoring QA/QC samples will consist of duplicate samples, split samples, and equipment rinsate blanks. QA/QC samples will be clearly identified on the field sampling forms.

Duplicate Samples

A duplicate sample is a second sample collected at the same location as the original or primary sample. Duplicate sample results are used to assess precision of the sample collection process. Duplicate groundwater samples will be collected at a frequency of 10 percent of the total number of groundwater samples collected during an event. Specific locations will be designated for collection of duplicate samples prior to the beginning of sample collection. The duplicate samples will be collected at the same locations as the corresponding primary samples and will be collected simultaneously using identical sampling techniques. Duplicate samples will be treated in an identical manner as the primary samples during storage, transportation, and analysis. The duplicate sample containers will be assigned an identification number in the field so that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis.

Laboratory Split Samples

A split sample is a second sample collected at the same location as the original or primary sample, but submitted to a different laboratory. Laboratory split groundwater samples will be collected at a frequency of 5 percent of the total number of primary groundwater samples collected during an event. Specific locations will be designated for collection of split samples prior to the beginning of sample collection. Split samples will be collected at the same locations as the corresponding primary samples and will be collected simultaneously using identical sampling techniques. The split samples will be submitted for equivalent analysis as the primary sample.

Equipment Rinsate Blanks

An equipment rinsate blank is a sample of reagent-grade de-ionized water poured into or over or pumped through the sampling device, collected in a sample container, and transported to the laboratory for analysis. Equipment blanks are used to assess the effectiveness of equipment decontamination procedures. Equipment rinsate blanks will be collected at a frequency of 5 percent of the total number of primary groundwater samples collected during an event. Equipment blanks shall be collected immediately after the equipment has been decontaminated. The blank shall be analyzed for the equivalent analysis as the primary samples. If an analyte is detected in the equipment blank, the appropriate validation flag shall be applied to all sample results from samples collected with the affected equipment.

4.3 FIELD DOCUMENTATION

All data generated as part of the groundwater monitoring program must be able to withstand challenges to their validity, accuracy, and legibility. To meet this objective, field data will be recorded in standardized formats and in accordance with prescribed procedures. Documentation of data collection activities must meet the following minimum requirements:

- Data must be entered directly, promptly, and legibly.
- Handwritten data must be recorded in ink. All original data records include, as appropriate, a description of the data collected, units of measurement, unique sample identification (ID) and station or location ID (if applicable), name (signature or initials) of the person collecting the data, and date of data collection.

- Any changes to the original data entry must not obscure the original entry. The reason for the change must be documented, and the change must be initialed and dated by the person making the change.

4.3.1 Field Sampling Data Sheets

Documentation of observations and data from sampling provide important information about the sampling process and provide a permanent record for sampling activities. All observations and field sampling data will be recorded on the FSDSs. FSDSs will include the following information:

- Name of the site/facility
- Description of sampling event
- Location of sample (well name)
- Sampler's name(s) and initials(s)
- Date(s) and time(s) of well purging and sample collection
- Type of well purging equipment used (pump or bailer)
- Depth to groundwater before sampling
- Field measurements (pH, specific conductance, water temperature, ORP, turbidity)
- Calculated well casing volume, if applicable
- Volume of water purged before sampling
- Volume of water purged when field parameters are measured
- Description of samples taken
- Sample handling, including filtration and preservation
- Types of sample containers and preservatives
- Weather conditions and external air temperature

The FSDSs will include notes describing any other significant factors observed during the sampling event, including, as applicable: condition of the well cap and lock; water appearance, color, odor, clarity; presence of debris or solids; any variances from this procedure; and any other relevant features or conditions.

4.3.2 Chain-of-Custody and Analytical Request Record

A Chain-of-Custody and Analytical Request Record form, provided by the analytical laboratory, will accompany the samples being shipped to the laboratory. A Chain-of-Custody shall be completed for each set of samples apportioned to a shipping container and shall include the following information:

- Sampler's name
- Company name
- Date and time of collection
- Sample type (e.g., water)
- Sample location
- Number of sample containers in the shipping container
- Analyses requested
- Signatures of persons involved in the chain of possession
- Internal temperatures of the shipping container when opened at the laboratory
- Remarks section to identify potential hazards or to relay other information to the Analytical Laboratory.

5.0 LABORATORY ANALYTICAL PROCEDURES

All environmental analysis of groundwater samples will be performed by a contract analytical laboratory. The selected analytical laboratory is responsible for providing sample analyses for groundwater monitoring and for reviewing all analytical data to assure that data are valid and of sufficient quality.

5.1 ANALYTICAL LABORATORY REQUIREMENTS

The analytical laboratory will be chosen by RAML and must satisfy the following criteria: (1) certified by the State of Utah, (2) capable of performing the analytical methods set out in **Table B-2**, (3) experience in analyzing environmental samples with detail for precision and accuracy, and (4) operation of a stringent internal quality assurance and data validation program meeting NELAP certification requirements.

5.2 LABORATORY QUALITY CONTROL

All contract laboratories will conduct internal quality control for analytical services in accordance to NELAP standards. The purpose of the internal QA/QC program is to produce data of known quality that attain DQOs and that meet or exceed the requirements of the standard methods of analysis.

5.2.1 Method Detection Limits and Method Reporting Limits

Method Detection Limits

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory shall establish MDLs for each method and analyte for each instrument the laboratory plans to use for the project. The laboratory shall revalidate these MDLs at least once per 12-month period. The laboratory shall provide the MDL demonstrations upon request. Results less than or equal to the MDL shall be reported as the MDL value and flagged as not detected.

Method Reporting Limits

The analytical laboratory shall compare the results of the MDL demonstrations to the method reporting limits (MRLs) for each analytical method. The MDL may not be more than one-half the corresponding MRL. The laboratories shall also verify MRLs by including a standard at or below the MRL as the lowest point on the calibration curve.

5.2.2 Instrument Calibration

Analytical instruments shall be calibrated in accordance with the analytical methods. All analytes reported shall be present in the initial and continuing calibrations, and these calibrations shall meet the acceptance criteria. All results reported shall be within the calibration range. Records of standard preparation and instrument calibration shall be maintained and provided by the laboratory upon request. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards shall be traceable to standard materials.

5.2.3 Quality Control Samples

Laboratory QC sample analysis shall be conducted to assess the accuracy, precision, and quality of the data. Laboratory QC samples shall be included in the preparation batch with the field samples. An analytical batch is a number of samples that are similar in composition and that are extracted or digested at the same time and with the same lot of reagents. The following procedures shall be performed at least once with each analytical batch of samples:

Matrix Spike/Matrix Spike Duplicate Samples

A matrix spike (MS) and matrix spike duplicate (MSD) is an aliquot of sample spiked with known concentrations for requested analytes. The spiking occurs prior to sample preparation and analysis. Each analyte in the MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. The matrix spike sample serves as a check evaluating the effect of the sample matrix on the accuracy of analysis. The matrix spike duplicate serves as check of the analytical precision. If either the MS or the MSD is outside the QC acceptance limits, the appropriate validation flag shall be applied to the analytes in all related samples.

Method Blank

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank shall be carried through the complete sample preparation and analytical procedure and is used to document contamination resulting from the analytical process.

The presence of analytes in a method blank at concentrations equal to, or greater than, the MRL indicates a need for corrective action. Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples in the analytical batch shall be reprepared and reanalyzed. No analytical data shall be corrected for the presence of analytes in blanks. When an analyte is detected in the method blank and in the associated samples and corrective actions are not performed or are ineffective, the appropriate validation flag shall be applied to the sample results.

Interference Check Sample

The interference check sample (ICS), used in inductively coupled plasma (ICP) analyses only, contains both interfering and analyte elements of known concentrations and is used to verify background and interelement correction factors.

When the ICS results are outside the acceptance limits stated in the method, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, reanalyze the ICS. If the ICS result is acceptable, reanalyze all affected samples. If corrective action is not performed or the corrective action was ineffective, the appropriate validation flag shall be applied to all affected results.

5.2.4 Quality Control Procedures

Holding Time Compliance

All sample preparation and analysis shall be completed within the method-required holding times. The holding time for a sample begins at the time of sample collection. The preparation holding time is calculated from the time of sample collection to the time of completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup and/or volume reduction procedures. If no preparation (e.g., extraction) is required, the analysis holding time is calculated from the time of sample collection to the time of completion of all analytical runs, including dilutions, second column confirmations, and any required re-analyses. In methods requiring sample preparation prior to analysis, the analysis holding time is calculated from the time of preparation completion to the time of completion of all analytical runs, including dilutions, second column confirmations, and any required re-analyses. If holding times are exceeded and the analyses are performed, the results shall be flagged accordingly.

Standard Materials

Standard materials, including second source materials, used in calibration and to prepare samples shall be traceable to National Institute Standards and Technology (NIST), USEPA, American Association of Laboratory Accreditation (A2LA), or other equivalent approved source. Standard materials shall be current, and the following expiration policy shall be followed:

- The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date or one year from the date of receipt, whichever comes first.
- Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution or material or the date calculated from the holding time allowed by the applicable analytical method, whichever comes first.
- Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions.
- Expired standard materials shall be either revalidated prior to use or discarded.
- The laboratory shall label standard and QC materials with expiration dates.

Supplies and Consumables

The laboratory shall inspect supplies and consumables prior to their use in analysis in accordance with NELAP standards and the laboratory's internal QA/QC program. The materials description in the methods of analysis shall be used as a guideline for establishing the acceptance criteria for these materials. An inventory and storage system for these materials shall assure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

5.3 LABORATORY DOCUMENTATION

Documentation of all laboratory activities is critical for tracking data and evaluating data quality. The laboratory shall maintain written policies that define documentation requirements and procedures. Required documentation includes, but is not limited to, the following:

- Calibration and maintenance records for all instruments and equipment involved in the collection of environmental data;
- Preparation of calibration standards, spiking solutions, and dosing solutions such that each unique preparation can be tracked to the original material;
- Lot numbers for all standards, stock solutions, reagents, and solvents; and
- All sample processing or preparation for testing such that it is traceable to sample receipt records.

5.3.1 Laboratory Reports

A definitive data package shall be generated for each sampling event. The contracted laboratory's standard reporting format will be used and will include the following:

- All sample analyses and results of analyses. Any rejected data will be accompanied by explanations of the failure and the corrective action.
- The concentration, units, MDL, MRL, and any data qualifiers;
- The sample collection date, extraction date (if applicable), and analysis date;
- The field sample ID, laboratory sample ID, and the sample delivery group or analytical batch number; and
- All required QC data including detected concentrations, spike amounts (or concentrations), percent recoveries and the appropriate calculation of precision (relative percent difference [RPD], relative standard deviation [RSD]).

5.3.2 Electronic Data Deliverables

Analytical data will be submitted to the QC monitor and/or database manager in the form of an electronic data deliverable (EDD), in a uniform manner that meets the specified database requirements. Laboratory QC data shall be included in the data submission.

5.3.3 Record Keeping

The laboratory shall maintain electronic and hard copy records sufficient to recreate each analytical data package. The minimum records the laboratory shall keep contain the following:

- Chain-of-Custody forms;
- Initial and continuing calibration records including standards preparation traceable to the original material and lot number;
- Instrument tuning records (as applicable);
- Method blank results;
- Surrogate spiking records and results (as applicable);
- Spike and spike duplicate records and results;
- Laboratory records;
- Raw data including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports;
- Corrective action reports; and
- Laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of analysis of project samples.

5.4 DATA VERIFICATION, VALIDATION, AND REVIEW

The data verification, validation, and review procedures described in this section will ensure: (1) complete documentation is maintained, (2) transcription and data reduction errors are minimized, (3) the data are reviewed and documented, and (4) the reported results are qualified, if necessary. Laboratory data reduction and verification procedures are required to ensure the overall objectives of analysis and reporting meet method and project specifications.

5.4.1 Data Verification

The data verification process includes the initial review by the laboratory of the data packages to ensure that the analyses requested have been provided. Implementation of these procedures shall be defined in laboratory SOPs. The analyst performing the tests shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst (Laboratory QC Monitor) using the same criteria. Reviews must ensure the following:

- All data for project samples are reported accurately and completely;
- Sample analysis was conducted in accordance with required laboratory procedures and analytical methods; and
- Each data set is appropriately reviewed.

5.4.2 Data Validation

Data validation is the process of reviewing data and accepting, qualifying, or rejecting data on the basis of sound criteria using established U.S. EPA guidelines. Data are assessed for completeness and compliance with the requirements of the analytical methods. Validation by the laboratory will include a review of the following:

- Sample preparation information is correct and complete;

- Analysis information is correct and complete;
- Appropriate procedures were followed;
- Analytical results are correct and complete;
- QC samples are within established control limits;
- Blanks are within QC limits;
- Special sample preparation and analytical requirements have been met;
- Criteria for data quality have been met or deviations are documented in the package narrative and data flags have been appropriately applied; and
- Documentation is complete.

Each data package will include a comprehensive narrative detailing any QC exceedances and an explanation of qualifications of data results. Data qualification "flags" will be applied by the laboratory for data that do not meet quality criteria.

6.0 INTERNAL QUALITY CONTROL CHECKS AND PERFORMANCE AUDITS

The QA Manager will monitor the performance of the Sampling QC Monitors, and, to the extent practicable, the Laboratory QC Monitor to verify compliance with the QAP. In addition, the QA Manager and/or the Sampling QC Monitor will review and validate the analytical data generated by the laboratory to verify that it meets DQOs. Periodic system and performance audits may also be performed.

6.1 INTERNAL QC CHECK PROCEDURES

6.1.1 Duplicate, Split, and Blank Comparisons

Duplicate Samples

RPDs will be calculated to compare duplicate sample results to primary sample results. Non-conformance will occur if the RPD > 20%, unless the measured concentrations are less than five times the required detection limit. If non-conformance is observed, the QA Manager will determine if the deviation is indicative of a systematic issue which requires corrective action procedures described in **Section 7**. If the non-conformance appears to be an isolated incident, the QA Manager will:

- Notify the laboratory;
- Request the laboratory review all analytical results for transcription and calculation errors; and
- If the samples are within the holding time, the QA Manager may request the laboratory re-analyze the affected samples.

Equipment Rinsate Samples

The presence of analytes in an equipment rinsate blank will be considered a potential non-conformance condition. The QA Manager will determine if the non-conformance is indicative of a systematic issue which requires corrective action procedures described in Section 7. If the non-conformance appears to be an isolated incident, the QA Manager will:

- Notify the laboratory;
- Request the laboratory review all analytical results for transcription and calculation errors; and
- If the samples are within the holding time, the QA Manager may request the laboratory re-analyze the affected samples.

Split Samples

RPDs will be calculated to compare split sample results to primary sample results. Non-conformance will occur if the RPD > 20%, unless the measured concentrations are less than five times the required detection limits. If non-conformance is observed, the QA Manager will:

- Notify the laboratories;
- Request the laboratories review all analytical results for transcription and calculation errors; and
- If the samples are within the holding time, the QA Manager may request the laboratories re-analyze the affected samples.

6.1.2 Review of Laboratory Results and Procedures

Data review is conducted to assess the compliance of chemistry data with the DQOs defined in the QAP. Upon receipt of laboratory data packages, the QA Manager shall conduct a QA review including the following:

- Confirm that the analytical reports are complete, including all requested analyses, and results for each required constituent in each sample;
- Confirm that all reporting limits used by the laboratory are in conformance with the reporting limits presented in the GMP;
- Confirm that the analytical methods used by the laboratory are those specified in the GMP;
- Review the analytical reports to verify that the holding times for each method analysis were not exceeded; and
- Review the analytical reports to verify that the samples were received by the laboratory at a temperature no greater than the approved temperature specified in the GMP.

6.2 PERFORMANCE AUDITS

6.2.1 Field Program

The QA Manager, or a qualified person designated by the QA Manager or RAML, will conduct periodic internal audits of field activities. The audits will include inspection of field measurement records, field equipment calibration records, field sampling records, field instrument operation records, sample collection procedures, sample handling and shipping procedures, and chain-of-custody procedures. The audit will also include a check on the accuracy of data transfer from the laboratory records into the reporting spreadsheets.

Regulatory agencies may conduct external field audits. Field audits may be conducted at any time during the field operations and will be based upon the information presented in the QAP. The audits may or may not be announced at the discretion of the regulatory agencies.

6.2.2 Analytical Laboratory

All contract laboratories will conduct internal quality control for analytical services in accordance with NELAP standards. In-house and regulatory agency audits of laboratory systems and performance are a routine part of a laboratory QC program and shall be outlined in the laboratory's internal QA/QC plan. The audits consist of a review of the entire laboratory system and at a minimum, include examination of sample receiving; sample log-in; sample storage; sample chain-of-custody documentation procedures; sample preparation and analysis; and instrumentation procedures. The contract laboratory used for analysis of groundwater samples will be certified by the state of Utah for each parameter analyzed.

7.0 CORRECTIVE ACTIONS

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-quality-control performance that may affect the data quality. Corrective action should be taken for any procedural or systematic deficiencies or deviations noted in this QAP. All deviations from this QAP shall be documented in the applicable records and reported to the appropriate project management. Any corrective action that may have an impact on License conditions will be discussed with DWMRC prior to implementation. All proposed and implemented corrective action will be documented. If corrective actions are insufficient, the appropriate personnel may issue a stop work order until the problem can be resolved.

7.1 FIELD CORRECTIVE ACTION

During field activities, the field staff (Sampling QC Monitors) will be responsible for documenting and reporting all suspected technical and QA non-conformances and suspected deficiencies. The non-conformances and/or deficiencies will be documented and reported to the QA Manager. If the problem is associated with the field measurements or sampling equipment, the field staff will take the appropriate steps to correct the problem. Typical field procedures to correct problems include the following:

- Repeating the measurement to check for error.
- Making sure the meters or instruments are adjusted properly for the ambient conditions, such as temperature.
- Checking, recharging, or replacing batteries.
- Re-calibrating instruments.
- Replacing the meters or instruments used to measure field parameters.
- Stopping the work until the problem is corrected (if necessary).

If a non-conformance or problem requires a major adjustment to the field procedures as outlined in this QAP (e.g., changing sampling methodology), the RAML Project Director will notify DWMRC prior to initiating corrective actions. Modification to or replacement of the QAP to address major changes in field procedures will not occur without pre-approval by DWMRC.

7.2 LABORATORY CORRECTIVE ACTION

Corrective actions are required whenever unreliable analytical results prevent the quality control as specified by the method or the laboratory QAP from being met. The corrective action that is taken depends on the analysis and the non-conformance. NELAP provides an outline of the corrective actions that will be taken for problems associated with specific laboratory analyses. Corrective action will be taken if one of the following occurs:

- QC data are outside the acceptance criteria for precision and accuracy.
- Blanks contain contaminants above acceptance limits.
- Undesirable trends are detected in spike recoveries, or spike recoveries are outside the QC limits.
- There are unusual changes in detection limits.
- Inquiries concerning data quality are received from RAML.

Corrective actions are handled primarily at the bench level by the analyst who reviews the sample preparation or extraction procedures, performs the instrument calibration and analysis. If the problem persists or its cause cannot be identified, the matter will be referred to the department supervisor or QA department for further investigation. Once resolved, complete documentation of the corrective action procedure will be provided to the QA department. A summary of the corrective actions shall be included in the data package submitted to RAML. If further corrective actions are required to maintain compliance with

License requirements, DWMRC will be contacted for approval prior to implementation of the action.

7.3 DATA VALIDATION CORRECTIVE ACTION

Corrective actions may be initiated during data validation or data assessment. Potential corrective actions may include requesting re-sampling by the field team or reinjection/reanalysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team, how critical the data are to the project data quality objectives, and if corrective action is required to maintain compliance with License conditions. When the QA Manager or QC Monitor identifies a corrective action situation, the RAML Project Director will be notified and has final responsibility for developing an implementation plan for the corrective action. The RAML Project Director will contact the DWMRC for approval of the corrective action implementation plan prior to its execution. Some examples of occurrences that would likely require corrective actions and pre-approval by the DWMRC are outlined below:

- Analytical detection limits or practical quantification limits are above the approved ACL as identified in the License.
- Analytical results are flagged due to a holding time violation.
- Analytical results are greater than an ACL and trigger accelerated monitoring as described in the License.

The first example would result in review of the laboratory contract and analytical procedure to confirm that the detection limit is below the License ACL. If this is not the case, then the laboratory would be contacted and requested to re-run the sample in compliance with the measurement protocol after approval by the DWMRC. Resampling might occur if re-analyzing was not possible within the required holding time.

In the second two examples, it may be appropriate to resample the well in question within a specified date, submit the sample for analysis within the correct holding time, and to evaluate the results with respect to ACLs. The specific corrective action would require pre-approval by the DWMRC and would be documented and submitted to the RAML Project Director and the DWMRC.

8.0 REFERENCES CITED

KOMEX, 2004, **Long Term Groundwater Monitoring Plan, Application for Alternative Concentration Limits, Source Materials License SUA-1119, RAMC Lisbon Facility, La Sal, Utah:** February 19, 2004.

Rio Algom Mining LLC (RAML), 2015, **Groundwater Monitoring Plan, Rio Algom Mining LLC, Lisbon Facility**: July 31, 2015.

Utah Division of Radiation Control (DRC), 2014, **Radioactive Materials License UT 1900481 – DRC Transmittal of License Amendment 5:** letter sent to Theresa Ballaine, Rio Algom Mining LLC, December 17, 2014.

United States Environmental Protection Agency (US EPA), 1986. **RCRA Ground-Water Monitoring Technical Enforcement Guidance Document**, September 1986.

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ATTACHMENT 3

GROUNDWATER SAMPLING FIELD FORMS

Water Level Measurements

Job Number: Date: Client:

Site:

Well I.D.	Time	Dia	Depth to NAPL	Thickness of NAPL	Depth to water (DTW)	Total Depth (measured)	Total Depth (historical)	Ref Point (TOC/ TOB)	Screen	Depth top of HS set

Meter Calibration Log

EQUIPMENT MAKE	EQUIPMENT MODEL	SERIAL NUMBER	DATE	TIME	TEMP OF CALIBRATION STANDARD (°C or °F)	pH STANDARD	pH STANDARD	pH STANDARD	SPECIFIC CONDUCTANCE	ORP	DISSOLVED OXYGEN
						4	7	10	__________ µS/cm	__________ mV	__________ mg/L or %

Confluence Environmental, Inc.

ORP Values (degrees in C then value): 5:257.0 10:250.5 15:244.0 20:237.5 25:231.0 30:224.5 35:218.0 40:211.5

Purging And Sampling Data Sheet

Job#:	**Sampler:**	**Client:**
Well ID:	**Date** (DDOct2012)**:**	**Site:**

Weather Conditions: | **Sampler Signature:**

Well diam: 1/4" 1" 2" 3" 4" 6" Other: | **DTW:** | **Total Depth:**

Purge equip: ES - diam: Bladder Peri Waterra Positive Air Displacement Ext. System

disp bailer teflon bailer other: | **Tubing:** OD: New Dedicated NA

Purge method: 3-5 Case Volume Micro/Low-Flow Extraction Other:

Pump depth/ intake: MS | **Multipliers:** 1"= 0.04 2"= 0.16 3"= 0.37 4"= 0.65 5"=1.02 6"= 1.47 Radius^2 X 0.163

(TD - DTW X Multiplier = 1 Volume | 80% Recovery (TD - DTW X 0.20 + DTW)

1 Volume = _______ X _____ = _______ (Total Purge) | 80%= N/A

Time	Temp (ºC / ºF)	pH	SP Cond (mS / µS)	Turbidity (NTU)	Purge Rate (gal or mL/ min)	Volume Removed (gal / L)	DO (mg/l)	ORP (mv)	DTW	Notes

Did well dewater? YES NO | Total volume removed: (gal / L)

Sample method: Disp Bailer Hydrasleeve New Tubing Ext. Port Other:

Sample date:	Sample time:	DTW at sample:
Sample ID:	Lab:	Number of bottles:

Analysis:

Equipment blank ID @ | Field blank ID @

Duplicate ID:	Pre-purge DO:	Post purge DO:
$Fe2^{+}$:	Pre-purge ORP:	Post purge ORP:
NAPL depth:	Volume of NAPL:	Volume removed: ml

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Appendix B. BLM Bond Calculator Reclamation Cost Estimate

384	**Total Cost Calculations**											
385	Equipment rental, operating and other direct costs											
386		Op. Hrs	Mob. Hrs	Total Hrs	>1 day	Daily	Weekly	Monthly	Rental	Fuel, etc.	Operator	Total
387	Cat 246 skid-steer loader	0	0	0	$0	$0	$0	$0	$0	$0	$0	$0
388	Cat 315 excavator	0	0	0	$0	$0	$0	$0	$0	$0	$0	$0
389	Cat 420 backhoe loader	0	0	0	$0	$0	$0	$0	$0	$0	$0	$0
390	Cat 938 wheel loader	1	0	1	$870	$0	$0	$0	$870	$5	$24	$899
391	Cat 12 motor grader	2	0	2	$1,059	$0	$0	$0	$1,059	$20	$56	$1,135
392	Cat D6 dozer	8	0	8	$894	$0	$0	$0	$894	$135	$214	$1,243
393	Cat 770 haul truck	0	0	0	$0	$0	$0	$0	$0	$0	$0	$0
394	Cat TL642 forklift	0	0	0	$0	$0	$0	$0	$0	$0	$0	$0
395	John Deere 332 w/HD tiller	3	0	3	$306	$0	$0	$0	$306	$14	$72	$393
396	Kenworth 4000 gal water truck	5	0	5	$620	$0	$0	$0	$620	$72	$99	$792
397	Sullair 375 compressor, hose and hammer	0	0	0	$279	$0	$0	$0	$279	$0	$1	$280
398	International 4200 truck crane	0	0	0	$0	$0	$0	$0	$0	$0	$0	$0
399	Genie S45 Manlift	0	0	0	$0	$0	$0	$0	$0	$0	$0	$0
400	Labor cost (except equip opn and flat fees)	$112										$112
401	Total direct costs											$4,854
402												
403	Subcontract & materials											
404	Equip. mob/demob hauling			$0								
405	Drilling and blasting			$0								
406	Loading, etc. (flat fee)			$0								
407	Misc. hauling			$0								
408	Landfill fees			$158								
409	Materials			$1,266								
410	Disposal fees (contract)			$0								
411	HAZMAT site assessment, testing ,removal, etc.			$0								
412	Water well closure			$0								
413	Drill hole closure			$13,420								
414	Subcontract & materials total											$14,843
415	Contractor admin costs , % of direct costs			10%								$485
416	Contractor admin costs , % of subcontract & materials costs			10%								$1,484
417	Contractor profit, % of direct costs			10%								$485
418	Performance and Payment Bond (for contracts >$100,000)			3%								$0
419	Liability, % of labor			1.5%								$2
420	Contract total											$22,154
421	Contingency, % of contract total for projects > $100,000			10%								$0
422	BLM contract management fee, % of contract total			17.1%								$3,788
423	BLM indirect costs, % of BLM contract management fee			21.0%								$796
424	**TOTAL RECLAMATION COST**											**$26,738**