APPENDIX C

FIELD SAMPLING PLAN

1.0 INTRODUCTION

The Field Sampling Plan (FSP) describes procedures that will be used to assure that samples are representative of the physical and chemical characteristics of the site media collected.

The purpose of sampling activities associated with the FSP are to comply with sampling required in the final closure plans for the sites and confirmation sampling to ensure that the current construction plan complies with the final closure plans.

The following activities are required by the final closure plans.

- Analysis of sludge from process ponds at Golden Butte
- Analysis of soils potentially contaminated with petroleum hydrocarbons at both sites

The following activities are required for confirmation of the construction plan

- Characterization of cover soils
- Percolation test of infiltration field

2.0 SOILS AND SEDIMENT SAMPLING

Soils and sediment sampling includes:

- Pond sediments;
- Soils potentially contaminated by petroleum hydrocarbons; and,
- Characterization of cover soils.

All Samples will be collected in accordance with SOP-1, *Soil Sample Collection*, included in Attachment 1.

2.1 POND SEDIMENT SAMPLING

Solids from the bottom of the Barren, Crushed Ore and Run-of-Mine ponds will be sampled following removal of water contained in the ponds. Data from the analysis of the sediments will be provided to the BLM. Sediments will be incorporated into the evaporation basins as described in the Section 4.0 of the 2004/2005 Reclamation Work Plan (MWH, 2004).

2.1.1 Sample Collection

Composite samples will be collected from each of the three site process ponds at Golden Butte. Each sample will consist of a minimum of four aliquots of approximately equal volume and will contain material from the full depth of solids. The aliquots shall be located over the extent of the solids deposition area and to be representative of all materials present. The composite sample shall contain a minimum of 500 grams of material. Sampling equipment will be rinsed between aliquots and decontaminated between samples.

2.1.2 Sample Analysis

Samples will be tested using the Synthetic Precipitation Leaching Procedure (SPLP) with the leachate analyzed for Nevada Profile II parameters. Nevada Profile II parameters and required detection limits are shown in Table 2.1.

TABLE 2.1
NEVADA PROFILE II PARAMETERS

Parameter	Fraction	Method	Detection Limit	Units
GENERAL CHEMISTRY AND ANIONS				
Alkalinity		EPA 310.1	2.0	mg/l (as $CaCO_3$)
Chloride		EPA 325.2	1.0	mg/l
Fluoride		EPA 340.2	0.1	mg/l
Nitrate (NO3+NO2 as N)		EPA 353.2	0.02	mg/l
pH		EPA 150.1	0.1	mg/l
Phosphorus (total as P)		EPA 365.1	0.01	mg/l
Sulfate		EPA 375.3	10.0	mg/l
WAD Cyanide		SM 45001-CN	0.01	mg/l
Total Dissolved Solids (TDS)		EPA 160.1	10	mg/l
CATIONS AND TRACE METALS				
Aluminum	Dissolved	EPA 6010B, ICP	0.03	mg/l
Antimony	Dissolved	EPA 6020, ICP-MS	0.0002	mg/l
Arsenic	Dissolved	EPA 6020, ICP-MS	0.0005	mg/l
Barium	Dissolved	EPA 6010B, ICP	0.003	mg/l
Beryllium	Dissolved	EPA 6020, ICP-MS	0.0001	mg/l
Bismuth	Dissolved	EPA 6010B, ICP	0.1	mg/l
Boron	Dissolved	EPA 6010B, ICP	0.001	mg/l
Cadmium	Dissolved	EPA 6020, ICP-MS	0.0001	mg/l
Calcium	Dissolved	EPA 6010B, ICP	0.2	mg/l
Chromium	Dissolved	EPA 6010B, ICP	0.01	mg/l
Cobalt	Dissolved	EPA 6010B, ICP	0.01	mg/l
Copper	Dissolved	EPA 6010B, ICP	0.01	mg/l
Gallium	Dissolved	EPA 6010B, ICP	0.1	mg/l
Iron	Dissolved	EPA 6010B, ICP	0.01	mg/l
Lead	Dissolved	EPA 6020, ICP-MS	0.0001	mg/l
Lithium	Dissolved	EPA 6010B, ICP	0.02	mg/l
Magnesium	Dissolved	EPA 6010B, ICP	0.2	mg/l
Manganese	Dissolved	EPA 6010B, ICP	0.005	mg/l
Mercury	Dissolved	EPA 7470,CVAA	0.0002	mg/l
Molybdenum	Dissolved	EPA 6010B, ICP	0.01	mg/l
Nickel	Dissolved	EPA 6010B, ICP	0.01	mg/l
Potassium	Dissolved	EPA 6010B, ICP	0.30	mg/l
Selenium	Dissolved	EPA 6020, ICP-MS	0.0015	mg/l
Silver	Dissolved	EPA 6010B, ICP	0.005	mg/l
Sodium	Dissolved	EPA 6010B, ICP	0.30	mg/l
Strontium	Dissolved	EPA 6010B, ICP	0.00005	mg/l
Thallium	Dissolved	EPA 6020, ICP-MS	0.00005	mg/l
Tin	Dissolved	EPA 6010B, ICP	0.1	mg/l
Titanium	Dissolved	EPA 6010B, ICP	0.005	mg/l
Vanadium	Dissolved	EPA 6010B, ICP	0.005	mg/l
Zinc	Dissolved	EPA 6010B, ICP	0.01	mg/l

2.2 PETROLEUM HYDROCARBON CONTAMINATED SOILS

Soils potentially contaminated with petroleum hydrocarbons exist in the vicinity of the diesel tank pads at both sites. Visibly impacted soils and construction material will be removed and placed on the heap leach pads. Following removal of contaminated materials, confirmation samples from around the diesel tank pads will be collected and analyzed for extractable Total Petroleum Hydrocarbons (TPH) (EPA M8015) to confirm the removal of all contaminated soils.

Three samples will be collected from areas where contaminated materials were removed. The samples will be collected from the three areas showing the most signs of petroleum contamination. The samples will be collected from approximately the center of the removal area. The top 0.1 foot of material will be collected over an area necessary to fill the sample container provided by the laboratory.

Additional material will be removed from any area that has a TPH concentration exceeding 100 mg/kg. Following the removal of the additional material, a confirmation sample will be collected from the removal area and submitted to the laboratory for TPH analysis. This procedure will be repeated until all laboratory samples have a TPH concentration of less than 100 mg/kg.

2.3 BORROW SOILS ANALYSIS

Soil samples will be collected of materials used to cover the Crushed Ore and Run-of-Mine Heap Leach Pads. Samples collected from the borrow source will be analyzed for the parameters listed below.

- Particle size analysis, without hydrometer (ASTM D-422)
- Atterburg Limits (ASTM D-4318)

Results of the geotechnical testing will be used to determine similarity of borrow soil to the soils at borrow sources BS-02 and BS-03.

A minimum of two composite samples will be collected from the borrow source. The samples will be collected from hand dug test pits. The test pits will be dug to a minimum of three feet or until refusal. A representative composite sample will be collected from each the test pit.

3.0 PERCOLATION TEST

A percolation test will be performed in the area of the Golden Butte infiltration field for the purposes of confirming infiltration field sizing calculations. Percolation test procedures are based on Nevada Administrative Code Section 444.796.

3.1 PERCOLATION HOLE PREPARATION

The hole must be dug or bored to the proposed depth of the absorption trench. The hole must have vertical sides and have a horizontal dimension of 4 to 12 inches. The bottom and sides of the hole must be carefully scratched with a sharp-pointed instrument to expose the natural soil interface. All loose material must be removed from the bottom of the hole, which must then be covered with 2 inches of coarse sand or gravel when necessary to prevent scouring. Any soil which has sloughed into the hole before or during the percolation test must be removed.

3.2 PERCOLATION TEST PROCEDURES

All data is to be collected on a field data sheet and/or in a field book. Items to be recorded are listed below:

- Description of materials removed from the hole;
- Dimensions of the hole;
- Depth to bottom of hole;
- Description of aggregate;
- Depth to top of aggregate;

- Start and end time of presoak;
- Time and depth of water or depth to water for measurements made during determination of appropriate test procedures;
- Test method used; and,
- Time and depth of water or depth to water for all measurements

3.2.1 Determination of appropriate percolation test procedure

In conducting a percolation test, the following flow chart must be used to determine which test procedure to follow:

1) Fill the percolation hole with water to a depth of at least 12 inches over the aggregate. Determine the time needed for the water to seep away completely.

↓

2) Fill the percolation hole with water again to a depth of at least 12 inches over the aggregate. Determine if the water seeps away in 10 minutes or less.

↓ ↓

3a) If water is left in the percolation hole after 10 minutes, proceed with the PRESOAKING PROCEDURE, followed by the SLOW PERCOLATION TEST PROCEDURE.

3b) If the water has completely seeped away after 10 minutes, proceed with the FAST PERCOLATION TEST PROCEDURE.

3.2.2 Fast percolation test procedure

The following flow chart illustrates the fast percolation test procedure:

1) Fill the percolation hole with water to a level that is no more than 6 inches over the aggregate.

↓

2) From a fixed reference point, determine, at 10-minute intervals, how much the water drops over the next 60 minutes. If 6 inches of water seeps away in less than 10 minutes, a shorter interval between measurements must be used.

↓

3) Refill the hole as necessary to prevent all water from seeping away. The level of the water must never exceed 6 inches in depth over the aggregate.

↓

4) The amount of the drop in the level of the water recorded for the final 10-minute period must be used to determine the percolation rate.

NOTE: The minimum time in which a fast percolation test may be completed is 1 hour. The level of the water must never exceed 6 inches over the aggregate during a fast percolation test.

3.2.3 Presoaking procedure for slow percolation test

The following flow chart illustrates the presoaking procedure for a slow percolation test:

1) Fill the percolation hole with clear water to a minimum depth of 12 inches over the aggregate.

↓

2) Maintain at least 12 inches of water over the aggregate in the hole for 4 hours.

↓

3) Any water remaining in the hole at the end of the 4-hour period must be allowed to seep away. Do not remove the water.

↓

4) Let the hole sit for not less than 16 hours or more than 30 hours. Swelling of the soil will occur during this period. The SLOW PERCOLATION TEST PROCEDURE must begin no sooner than 16 hours and no later than 30 hours after the end of the 4-hour soaking period.

3.2.4 Slow percolation test procedure

The following flow chart illustrates the slow percolation test procedure:

1) Fill the percolation hole with water to a maximum depth of 6 inches over the aggregate.

↓

2) From a fixed reference point, measure the drop in the level of the water at 30-minute intervals, for a total of 4 hours. If the first 6 inches of water seeps away in less than 30 minutes, the interval between measurements must be reduced to 10 minutes and the length of the test must be reduced to 1 hour.

↓

3) Fill the hole to a maximum depth of 6 inches over the aggregate as often as necessary to prevent the hole from becoming empty.

↓

4) The amount of the drop in the level of the water during the last interval must be used to determine the percolation rate, except that if two successive measurements do not vary more than 1/16 inch, the test may be stopped and the percolation rate may be determined.

ATTACHMENT 1

SOP-1
SOIL SAMPLE COLLECTION

STANDARD OPERATING PROCEDURE

SOP-1

SOIL SAMPLE COLLECTION

1.0 INTRODUCTION

This standard operating procedure (SOP) describes methods and equipment commonly used for collecting environmental samples of near-surface soil and mine waste material media for either on-site examination and chemical testing or for laboratory analysis. It also describes procedures for sample handling, labeling and documentation.

The information presented in this SOP is generally applicable to all environmental sampling of near-surface soil and mine waste material except where the analyte(s) may interact with the sampling equipment.

Specific sampling problems may require the adaptation of existing equipment or design of new equipment. Every field investigation must be conducted in accordance with an approved quality assurance project plan (QAPP). The QAPP identifies the minimum procedures required to assure that goals for precision, accuracy, completeness, representativeness, and comparability of data generated are satisfied. In addition to the QAPP, every field program must have a site-specific field sampling plan (FSP) that defines the proper procedures to be followed in the collection, preservation, identification and documentation of environmental samples and field data.

The same care must be exercised in implementing field investigations and sampling programs that are exercised in planning the program design and analyzing samples in the laboratory. No analytical result is better than the sample from which it was obtained.

Specific organizations and agencies with guidelines and standard procedures that were used include:

- U.S. Environmental Protection Agency (EPA)
- State of Nevada (U.S.) Division of Environmental Protection (NDEP)
- American Society of Testing and Materials (ASTM)
- U.S. Department of the Interior, Geological Survey (USGS)

2.0 DEFINITIONS

Surface soil: The soil that exists down from the surface approximately one foot (12-inches). Depending on application, the soil interval to be sampled will vary.

Grab Sample: A discrete portion or aliquot taken from a specific location at a specific point in time.

Composite: Two or more subsamples taken from a specific media and site a specific point in time. The subsamples are collected and mixed, then a single average sample is taken from the mixture.

Spoon/Scoop: A small stainless steel or Teflon utensil approximately 6- to 8-inches in length with a stem-like handle.

Trowel: A small stainless steel or Teflon shovel approximately 6- to 8-inches in length with a slight curve across the blade. The trowel has a stem-like handle. Samples are collected with a spooning action.

3.0 SAMPLING PROCEDURES

3.1 BACKGROUND

Near-surface soil and mine waste material samples are collected to determine the physical properties and the type(s) and level(s) of contamination. These samples may be collected as part of an investigation plan, site-specific sampling plan, and, or as a screen for "hot spots", which may require more extensive sampling. Sediment(s) and sludge(s) that have been exposed by evaporation, stream rerouting, or any other means are collected by the same methods as those for surface soil(s). Typically, the top one-inch of material, including vegetation, are carefully removed before collection of the sample.

Representativeness is a qualitative description of the degree to which an individual sample accurately reflects population characteristics or parameter variations at a sampling point. It is therefore an important element not only for assessment and quantification of environmental impact to, or posed by, the site, but also for providing information for engineering design and construction. Proper sample location selection and proper sample collection methods are important to ensure that a representative sample has been taken. To collect representative samples, sampling bias related to site selection; sampling frequency; sample collection; sampling devices; and sample handling, preservation, and identification must be minimized.

3.2 DEFINING THE SAMPLING PROGRAM

Factors that shall be considered in developing a sampling program for near-surface soil include study objectives; accessibility; site topography; physical characteristics of the medium; point and diffuse sources of contamination; and personnel and equipment available to conduct the investigation(s).

3.3 SAMPLE COLLECTION

The following steps must be followed when preparing for sample collection:

- The collection points shall be stated, located on a map, and referenced in the field logbook.
- Processes for verifying depth of sampling must be specified in the site-specific field sampling plan.
- Place clean plastic sheeting on a flat, level surface near the sampling area, if possible, and place decontaminated equipment to be used on the plastic. Cover all equipment and supplies with clean plastic sheeting when not in use.
- A clean, decontaminated trowel, scoop, or spoon will be used for each sample collection.

The selection of sampling equipment depends on the site conditions and sample type required. The most frequently used samplers are:

- Hand auger
- Trowel
- Scoop or spoon
- Back-hoes
- Drill rigs

A trowel, scoop/spoon or hand auger are used most often.

The criteria for selecting a sampler include:

- Ease of disposal and, or decontamination.
- Relative expense (if the item is to be disposed of).
- Ease of operation, particularly if personnel protection required is above Level D.
- Reactivity/contaminating potential - Stainless steel, Teflon, or polyethylene sampler are preferred (in that order). Back-hoes may be used to collect samples from shallow trench walls; the bucket must be free of rust, grease and point. Only soil which has not been in contact with the bucket may be sampled.

3.3.1 Direct Collection

The following procedure will be used to collect near-surface soil and mine waste material samples.

- Identify a minimum of three sub-samples of the soil material of interest.
- Collect approximately two (2) pounds of soil material (0 to 12-inch depth) at each sub-sample location and composite into a large, decontaminated stainless steel mixing bowl or high-density polyethylene (HDPE) bucket.
- Prepare a composite sample by thoroughly mixing the sub-sample material.
- Fill the pre-labeled sample container the composited material.
- Upon completion of the sampling, the excess material removed from the hole and not used as sample will be used to backfill the hole.
- After each composite sample is obtained, all equipment used in the sampling process, including shovels, trowels, spoons, and bowls will be decontaminated prior to reuse.

3.3.2 Decontamination of Field Equipment

The sample collection equipment will be decontaminated at each monitoring location. The following guidelines will be used to decontaminate sampling equipment:

- Gross contamination on equipment will be scraped off at the sampling site.
- Equipment that will not be damaged by water will be washed with the Alconox (or a comparable non-phosphate), biodegradable detergent. Equipment will be triple rinsed with potable water followed by a triple distilled or de-ionized water rinse.
- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water, and rinsed with distilled or de-ionized water. Care will be taken to prevent any equipment damage.
- All non-dedicated equipment will be decontaminated between each sample location. When purging groundwater monitoring wells, meter probes will be rinsed with distilled or de-ionized water between each casing volume measurement. After collecting the sample follow the full decontamination procedures.

- Rinse and detergent waters will be replaced with new solutions between sampling events.

Following decontamination, equipment will be placed in a clean area or in clean plastic bags to prevent contact with soils/sediments and airborne material that could contaminate a future sample.

4.0 SAMPLE HANDLING AND FIELD DOCUMENTATION

The purpose of this section is to define the standard protocols for sample handling, documentation and chain-of-custody. The use of proper documentation and chain-of-custody procedures will assure that the adequacy of the sample collection methods and handling can be evaluated.

4.1 SAMPLE HANDLING

4.1.1 Sample Containers

Proper sample preparation practices will be observed to minimize sample contamination and potential repeat analyses due to anomalous analytical results. Prior to sampling, sample bottles will be obtained directly from the analytical laboratory, or laboratory supply-house. The bottles will be labeled (see following section) to indicate the type of sample and sample matrix to be collected. Sample bottles can be either pre-preserved from the laboratory or preservatives can be added in the field during sample collection. In general, 0.5-liter or 1-liter polyethylene or glass bottles will be used for the sample bottles that will be submitted for analysis of general chemical constituents, major inorganic constituents and metals.

Laboratory sample containers will be filled one by one at the monitoring location, secured with the container lid, and any excess soil wiped off the exterior. Immediately after collection, the containers will be placed in field coolers with ice. Glass containers will be wrapped with bubble wrap or other appropriate shipping material to prevent breakage.

4.1.2 Sample Preservation

Samples are preserved in order to prevent or minimize chemical changes that could occur during transit and storage. Sample preservation should be performed immediately upon sample collection to assure that laboratory results are not compromised by improper coordination of preservation requirements and holding times. Samples will be preserved immediately and stored on ice in coolers prior to shipping. Sample preservation requirements are based on the most current publication of 40 CFR, Part 136.3 (U.S. Federal Register).

For all samples, preservation by cooling to 4°C is required immediately after collection while the samples are held for shipment and during shipment to the laboratory.

4.1.3 Sample Holding Times

Sample holding times are established to minimize chemical changes in a sample prior to analysis and, or extraction. A holding time is defined as the maximum allowable time between sample collection and analysis and, or extraction, based on the nature of the analyte of interest and chemical stability factors.

In general, soil or solid matrices do not have holding times. However, most samples will be shipped to the analytical laboratory in iced coolers within 48 hours of collection, if conditions permit.

4.1.4 Sample Preparation and Shipping

After collection, samples will be labeled and prepared as described above, and placed on ice in an insulated cooler. The sample containers should be placed in re-sealable plastic storage bags. Samples should be stored in an upright position. Coolers sent to the analytical laboratories should be chilled with ice. The coolers will be taped shut and chain-of-custody seals will be attached to the outside of the cooler to assure that the cooler cannot be opened without breaking the seal.

4.2 FIELD DOCUMENTATION

Documentation establishes procedures, identifies written records, enhances and facilitates sample tracking, standardizes data entries, and identifies and establishes authenticity of the sample data collected. Proper documentation also:

- Assures that all essential and required information is consistently acquired and preserved;
- Documents timely, correct, and complete analysis;
- Satisfies quality assurance requirements;
- Establishes chain-of-custody;
- Provides evidence for court proceedings; and,
- Provides a basis for further sampling.

4.2.1 Sample Labels

Samples collected will be identified by a sample tag attached to the sample bottle. A sample tag or label will be completed and attached to each laboratory sample container just before it is filled. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preservative (if any)
- Sample type (including if raw or field filtered)

Because a variety of preservatives and analytical methods will be employed, care must be taken to avoid mislabeling the containers. If possible, labels should be covered with plastic tape to minimize smudging and ink runs.

4.2.2 Sample Identification

Each sample will be given a unique identification number. This number will identify the date of sampling, sample matrix, the location identification number, and, if appropriate, a quality control suffix. To avoid confusion between primary samples and quality control samples, duplicate samples will be designated with a "D", triplicate samples will be designated with a "T", field blank samples will be designated with a "B", and equipment blanks will be designated with a "E" suffix in the station identification name. For example:

station identification number-quality control suffix

SW-2-D

The above sample identification represents a soil duplicate sample collected at SW-2.

4.2.3 Field Documentation

Appropriate field records will be completed in a bound field logbook and, or field data sheets at each site at the time of sample collection. All aspects of sample collection and handling as well as visual observations will be documented in the field logbooks. In general, field logbooks as well as field data records should:

- Record, identify and describe all pertinent sampling and monitoring activities.

- Record quantitative and qualitative information for each sample collected.
- Record and describe all field team activities, including observations and events.

At a minimum, the following information will be recorded in the field at each monitoring station:

- Site location
- Sampler name(s)
- Date and time of sample collection
- Sample identification number(s)
- Type of sample (soil, mine waste material, sediment)
- Field measurements, if applicable (paste pH and conductivity)
- Sample handling
- How sample collected (e.g. grab, composite)
- Number and type of any QA/QC samples collected
- Sample depth
- Weather conditions, including recent precipitation and approximate air temperature
- Field observations, including any unusual conditions or activities in the area

Changes or deletions in the field logbook should be lined out with a single strike mark and remain legible. Sufficient information should be recorded to allow the sampling event to be reconstructed without relying on the collector's memory. All field notebooks and data forms will be signed at the end of each day.

4.2.4 Chain-of-Custody

A chain-of-custody (COC) record is used to record the custody and transfer of all samples. The field sampler will be responsible for the care and custody of the water quality samples until they are transferred to a licensed courier. The sampler's responsibility will include:

- Labeling and sealing all sample containers (including custody seals, when appropriate);

- Properly packing the samples with ice for shipment to the laboratory;

- Notifying the courier about a sample pick-up and preparing any airbills for shipping samples to the laboratory;

- Initiating chain of custody forms; and,

- Notifying the laboratory of all sample shipments.

A chain-of-custody form will accompany each sample cooler and include the following information.

- Project name or number
- Sampler's name and signature
- Sample identification number(s)
- Date and time of sample collection
- Sample matrix
- Number of sample containers
- Analyses requested
- Method of shipment (with airbill number if applicable)

- Any additional instructions for the laboratory

Upon receipt, laboratory personnel will inspect the samples and record their condition and temperature on the chain-of-custody form. The laboratory will immediately report the presence of broken custody seals to MWH's project laboratory liaison. The laboratory liaison, after consulting with the Project Manager and the laboratory's project manager, will decide whether or not to analyze the samples. Decision criteria that will be used to help in determining if the samples should be analyzed include:

- If the cooler custody seal is broken is there any sort of documentation that may indicate who broke the seal, e.g., a customs declaration, or a notation from the shipping company;
    - ➢ The samples can be analyzed
- If the cooler appears intact, and the samples inside are ok, e.g., the individual bottle custody seals are intact;
    - ➢ The samples can be analyzed
- If the cooler custody seal, and the individual bottle seal(s) have been compromised;
    - ➢ Then the samples <u>should not</u> be analyzed

The COC forms will be completed by the laboratory and forwarded with the final laboratory results.

4.3 SAMPLING CONTACT

Field sampling activities will be preformed by MWH. All sampling will be performed under the direction of Mr. Jay Pennington of MWH, the project manager. Mr. Pennington's address and phone number are provided below:

Mr. Jay Pennington
MWH
1250 Lamoille Hwy, Unit 734
Elko, NV 89801
Tel. (775) 738-2310

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