FIELD OPERATION PLAN
Site Inspection of the Kiggins – Nisbet Mines
Clackamas County, Oregon

September 2003

FIELD OPERATIONS PLAN
Site Inspection of the Kiggins – Nisbet Mines
Clackamas County, Oregon

Principal Authors: *Dustin G. Wasley, PE, Managing Engineer*

Reviewed By: *John D. Martin, RG, Principal Geologist*
MaryAnn Amann, RG, Staff Geologist II

Prepared for: U.S. Forest Service
Mt. Hood National Forest

Prepared by: Cascade Earth Sciences
P.O. Box 14725
Spokane, Washington 99216
509-921-0290

PN: 2323022 / September 2003

TABLE OF CONTENTS

TABLES AND FIGURES

APPENDICES

1.0 INTRODUCTION

The United States Forest Service (USFS) has retained Cascade Earth Sciences (CES) to perform a Site Inspection (SI) at the Kiggins – Nisbet Mines (Site). The inspection will follow the US Environmental Protection Agency (EPA) guidelines for performing an SI. The purpose of the SI is to determine the potential threat to human health and the environment from issues identified during the Abbreviated Preliminary Assessment (APA) conducted by the USFS at the Site. The scope is to 1) identify potentially hazardous substances pertaining to onsite mining related activities, and 2) collect samples of natural media including soil, sediment, surface water, and the biota to determine the magnitude and extent of migration (if any) of hazardous substances from the Site.

This document comprises the Field Operations Plan, and includes a generic Work Plan for the Site, a site-specific Sampling and Analysis Plan (SAP), and an Investigation Derived Waste Plan (IDWP). In addition, a stand-alone site-specific Health and Safety Plan (HASP) has also been prepared for planned field activities and is included in Appendix A.

2.0 WORK PLAN

2.1 PRELIMINARY FIELD WORK

Field activities are scheduled to begin on Monday September 15, 2003, and continue through Friday September 19, 2003. The CES field team scheduled to perform work during field operations include:

Dustin Wasley, PE	Project Manager
John Martin, RG	Field Leader, Geologist
MaryAnn Amann, RG	Geologist
Mike Golden	Field Technician
Rone Brewer	Wildlife and Fisheries Biologist
Diane Brewster	Plant and Wildlife Biologist

All personnel who will be performing invasive activities (i.e., boring, sampling, etc.) during the field investigation are trained to work on hazardous waste operations as defined by the Occupational Safety and Health Act (OSHA) 1910.120. Other personnel who may periodically be on site may include:

Dennis Boles (USFS)	Contracting Officers Representative
Yvonne Sterud (USFS)	Contracting Officer

2.2 PLANNED FIELD ACTIVITIES

2.2.1 Inventory Site Features

The CES field team will inspect the Site and inventory mine-related features including: waste rock dumps, tailings dumps, structures, mine pits, adits, mine drainages, and other potential

sources of contamination or hazards. The inventory will include photographs, an assessment of condition, and a survey of each noted feature.

2.2.2 Waste Source, Soil, Sediment, Water, Benthic, and Tissue Sampling

Sampling activities at the Site will include collection of mining and milling waste; soil in the vicinity of mining and milling operations; soil in upgradient or background locations; surface water, sediment, and sediment pore-space water from the River. In addition, tissue samples of vegetation from waste sources and undisturbed areas will be collected at the Kiggins and Nisbet Mines. Benthic macroinvertebrates from the River will be collected, counted, and inventoried. Due to remoteness of the Site, it is believed that the air pathway is incomplete; therefore, air samples will not be collected as part of this SI.

Samples will be collected according to the procedures outlined in the Sampling and Analysis Plan (SAP) in Section 3. Samples will be collected from the locations described in Tables 1 and 2 and depicted on Figures 1 and 2. Proposed sampling locations are based on the specific sampling requirements as outlined in the Statement of Work (SOW). The location of all samples will be determined using a handheld GPS unit, with an accuracy of less than 1 meter. The surface water Stations will be surveyed and permanently marked with rebar and aluminum caps so they can be located by use of a GPS unit. Each Station number shall be clearly marked on the caps.

2.2.3 Site Survey

The spatial and vertical location of all source areas and significant mining-related features will be surveyed by a licensed surveyor in the state of Oregon. The spatial location will also be measured to a common datum. Vertical locations will be estimated by interpolation on USGS 7.5 minute quadrangle maps or a GPS unit. Important environmental features will also be surveyed.

A 5-foot contour map of overall site will be developed and a 2-foot contour map of the waste and tailings pile will be prepared. If feasible given the terrain, the survey will extend at least 100 feet beyond the perimeter of any visually disturbed areas in all directions of the Site or up to property lines if any exist less than 100 feet. In the event that the survey cannot extend 100 feet beyond the limits of the disturbed areas, the slope and distance will be estimated with the use of a clinometer.

The following features will be included on the map:

- The location of springs, seeps, slumps, drainages, and any other relevant geographical features such as faults, avalanche chutes;
- The location of the stream course;
- The locations and areas of floodplains for 100-year event, if feasible;
  The locations of riparian and wetland areas; and
- The locations for facilities, whether standing or dilapidated.

The surface water Stations will be surveyed and permanently marked with rebar and aluminum caps so they can be located by use of a GPS unit. Each Station number shall be clearly marked on the caps.

2.3 DOCUMENTATION

Field logbooks, documentation logs, and photographs will be used to document data collection activities. Information generated from field sampling activities will be documented on the appropriate forms, which include the following:

- field parameter log,
- chain-of-custody record,
- field notes, and
- location sketches.

Some operations, such as selection of sampling locations, may be altered based on what is discovered during field activities. The field team leader is responsible for recording information including weather conditions, field crew members, visitors to the site, samples collected, the date and time of sample collection, procedures used, any field data collected, and any deviations from this work plan.

2.4 POST ACTIVITIES

Prior to leaving the site, all disturbances to the environment will be minimized, and the Site will be left as close to its condition prior to performing SI field activities as possible. Trash, used equipment, and all other field materials will be removed. Prior to leaving the Site, the project team leader will be available to provide a briefing of the field activities to the client project manager.

3.0 SAMPLING AND ANALYSIS PLAN

The objective of the SI is to collect analytical and non-sampling data to identify hazardous substances at the Site and to determine whether hazardous substances have been released to the environment and whether substances have, or have the potential to, impact human health and the environment.

3.1 COLLECTION OF NON-SAMPLING DATA

Non-sampling data collection activities will include the verification of population and environmental information as well as reviewing and identifying new information. This will be accomplished by performing a thorough reconnaissance of the Site. Additional activities may be completed from the office; however, specific field activities include the following:

- Survey the spatial distribution and location of all source areas and significant onsite features;
- Determine the approximate dimensions and volume of all potential onsite source areas and note containment features;
- Determine the apparent overland flow paths for surface water;
- Determine the approximate distance to the nearest individual regularly occupied structure and the approximate distance to the nearest drinking water well, if possible; and

- Conduct a survey of wildlife, fisheries, benthic, and plant species that may be affected by a release at the Site, which is further discussed in Section 3.1.1. This will include both Threatened and Endangered (T&E) and Survey and Manage (S&M) species.

3.1.1 Wildlife, Fisheries, Benthic Macroinvertebrate and Botany Survey

The following tasks will be completed to address potential mine impacts on T&E species and species of concern (SOC) occupying habitats near the Site. A thorough survey of wildlife, fisheries, benthic macroinvertebrates, and botany will be conducted in the area immediately around the Site. The survey will consist of the following subtasks:

- Bird survey;
- Plant survey;
- Terrestrial macroinvertebrates, mammal, and herpetile survey;
- Stream assessment and fish survey; and
- Benthic macroinvertebrate survey and sampling (discussed in Section 3.2.4).

Phone calls will be made to state (Oregon Fish and Wildlife) and federal (USF&W and USFS) fish and wildlife agencies to contact biologists familiar with the Site and region. These biologists will be questioned regarding the terrestrial and aquatic species known to be or likely to be present. If documentation of this information is available, copies will be requested. If documents are available, but cannot be shipped, part of the field effort may be to visit agency offices to obtain, copy, or otherwise document the available information.

A search for rare, threatened, or endangered species will also be conducted. In addition, a list of SOC will also be requested from the USF&W and the USFS. Information obtained during the preliminary data gathering will be reviewed by field personnel prior to the field effort to provide an initial understanding of the ecology and species of concern.

3.1.1.1 Bird Survey

The afternoon prior to bird surveys, the Site will be visited to document and sketch the major habitat types (e.g., coniferous forest, mixed deciduous/coniferous forest, shrub, wetland/riparian, etc.) on and within approximately 100 meters of the Site. A maximum of four habitat types is predicted for the Site. If only two or three habitat types are identified, then the number of bird survey stations will be decreased appropriately, one in each habitat type. If more than four habitat types are documented, an attempt will be made to place the four survey stations such that more than one habitat type can be surveyed from a single survey station. If this is not possible, additional stations will be established to assure that surveys account for each major habitat type. The stations will be preferentially established on the border of the Site, such that both onsite and offsite conditions can be surveyed during a single survey period. Survey stations will be placed with consideration of mine features to maximize visibility of the survey area while minimizing the surveyor's potential disturbance of the birds. If no natural cover is available to conceal the surveyor, a portable viewing blind may be used. Survey stations will be field-marked with numbered stakes and indicated on a site map. Coordinates of each sample location will be documented using a Trimble Pro-XRS GPS unit.

Beginning at first light, a 15-minute bird survey will be conducted consecutively at each station. This will be repeated in the late afternoon/early evening after the Site has been unoccupied for at least an hour. If a second day of monitoring is needed, the bird surveys will be repeated in the morning and, if possible, the evening of the second day. Bird species will be identified using both visual and auditory cues, will be differentiated as onsite or offsite, and will be counted when possible. The results will be tallied on field data sheets and will include the species and number of individuals of each species noted onsite and offsite. Following a 15-minute survey from one location, the field biologist will walk to the next survey location and commence another 15-minute survey. An attempt will be made to conduct the surveys at a time and in areas (i.e., away from roadways) where human disturbances are minimal during the surveys.

3.1.1.2 Plant Survey

First, a site reconnaissance will be conducted to determine the major plant communities present on and in the near vicinity of the potentially impacted area. The identified communities will be sketched on maps of the mine sites. One plant survey location will be established within each identified major plant community. It is expected that two survey locations will be required for each of the two mine sites. If more than two plant communities are observed within the potentially impacted area, then additional survey locations will be established, one per community, for up to four plant communities. Survey locations will be placed in areas where the plants are considered representative of the identified plant community. Plant surveys will also be conducted at the three background locations to identify plant species in areas where site-related impacts are unlikely. The location of the background plant stations will correspond with the same location as the background soil location as described in Section 3.2.1.

Each sample location will be field-marked with a numbered stake and indicated on a Site map. If possible, coordinates of each sample location will be documented using a GPS unit. If use of the GPS unit is not possible due to interference with satellite signals by vegetation or other physical limitations, the locations will be estimated. For each sample plot a determination of herbaceous (including weeds), shrub, and tree species will be made within a 5-meter radius. Plants will be identified using *Flora of the Pacific Northwest* (Hitchcock and Cronquist, 1990) nomenclature and documented on field forms for each sample plot. The results of this field effort will be a list of the plant species present on and adjacent to the Site and the percent cover represented by each species. This will allow comparison of on-site to off-site vegetation based on the species, number of species, and percent cover. In addition, vegetation samples will be collected at each station as described under Section 3.2.5.

3.1.1.3 Terrestrial Macroinvertebrate, Mammal & Herbetile Survey

Two transects will be drawn on the Site map after an initial site reconnaissance. These transects will be placed across the entire mine to intersect as many as possible of the onsite plant communities and terrain types. One field biologist will walk slowly along the length of each transect observing the ground for indications of terrestrial macroinvertebrates, herpetiles, or mammals up to 5 meters on either side of the transect. Stones, logs, stumps, etc. along each transect will be moved when possible to thoroughly examine the site. Visual sightings of any animals or terrestrial invertebrates will be documented on field survey forms, as will indicators

of the presence of these species such as small mammal tunnels in grass, tracks, animal trails, etc. Any additional indicators of mammal presence (i.e., burrows) observed during the other Site surveys, but not located along the transects, will also be noted. The results of this effort will provide documentation of the presence or likely presence of particular invertebrates, small mammals, and herpetiles.

3.1.1.4 Stream Assessment and Fish Survey

The approach for the stream assessment will be primarily as described in the USEPA's Rapid Bioassessment Protocol For Use in Streams and Wadeable Rivers (RBP; USEPA 1999). This approach integrates habitat, water quality, and biological parameters; and, combined with the planned chemical analyses of water and sediment, will allow assessment and comparison of stream conditions and potential ecological effects upstream and downstream of the mines. Field biologists will visually inspect the length of the potentially impacted creek downstream, adjacent to, and upstream of the mines. The basic stream and riparian characteristics (i.e., riffle, pool, confluence, substrate, banks vegetation, etc.) will be plotted on a map at each surface water Station.

The RBP Physical Characterization and Habitat Assessment Field Data Sheet for high gradient streams (USEPA, 1999) will be completed for each Station or reach. The Habitat Assessment form provides for numeric classification of each reach based on the instream and riparian habitat characteristics. These data will allow comparison of basic water quality parameters between reaches. The locations of obvious inflow channels or pipes, connected wetlands, areas of runoff from the site to the stream, and apparent site related physical impacts will also be noted on field forms.

The presence of fish will be initially determined by phone interviews with local and regional biologists. During the field effort, field personnel will document visual observations of fish in the two creeks and attempt to identify the species. Seining techniques will be used. The presence of fish will be assessed during the field effort by several stealthy perpendicular approaches to the creek channel combined with careful visual examination for fish movement. Any observations of fish will be documented on field forms. The locations of fish spawning habitat, rearing habitat, and fish passage barriers will also be noted.

3.2 SAMPLING AND FIELD ACTIVITIES

Proposed field activities and sampling locations are based on the specific sampling requirements as outlined in the SOW and conversations with the USFS. A summary of sample collection, preservation and holding times is presented in Table 3. CES will contract with ACZ Labs in Steamboat Springs, Colorado, to perform a majority of the laboratory analysis. Arsenic speciation, low-level mercury, and methyl mercury analysis will be performed at Brooks Rand in Seattle, Washington. Tables 1 and 2 outline the analyses that will be conducted on water and solid media samples, as well as the number of samples from each media.

3.2.1 Waste Source and Soil Sampling

Waste source (i.e., waste rock and tailings piles) and background soil samples will be collected using a stainless steel hand auger. Proposed background soil sampling locations are depicted on Figure 2, however, these locations may be modified based on field observations. Waste source sampling locations will be determined in the field. A Niton XRF model 722 will be used to field screen the waste sources and mine area to identify areas of contamination. Borings will be advanced in the waste sources at the Site and samples will be collected every 4 to 5 feet. If possible, CES will sample the native soil interface beneath the waste piles. Borings will be logged for depth, lithology, and other characteristics prior to collecting the sample. Background samples will be collected from native soils below the organic horizon at minimal depth of 12-inches, if possible. Samples will be collected in plastic zipper lock-type bags. Approximately ½ gallon of sample material will be collected. Soil and waste rock samples will be placed in an iced cooler and kept at approximately 4^{o}C until arrival at the laboratory. Analytical requirements are presented in Table 2.

All soil and waste source samples will be analyzed for the following:

- pH, the 23 total metals target analyte list (TAL), As III, and Cr (III and VI);
    - Cr speciation samples will be held until total Cr results are received, if the total Cr results are below the lowest PRG or SLV, then the samples will not be analyzed for Cr speciation.
- Methyl mercury, acid-based accounting (ABAs) and the synthetic precipitation leaching procedure (SPLP) for RCRA metals will be analyzed on 50% of the waste source samples.

3.2.2 Surface Water and Pore-Water Sampling

Seven surface water stations (Stations) will be established in the River. Because the Fall Vein daylights in the River upstream of the Kiggins Mine and is likely contributing to the mercury load in the water and sediment, the Stations have been situated to isolate the water and sediment quality in the vicinity of the vein. Therefore, the exact location of the Stations is not known; Figure 1 depicts the approximately Station locations. The Station locations may be modified in the field, and additional Stations may be added if the proposed Stations are not sufficient to determine the impacts of the Fall Vein on the River. Each Station consists of two substations, one from a pool area and one from a riffle area. Surface water samples will only be collected in the nearest pool areas at each primary surface water Station. In addition, two surface water samples will also be collected from the stream that bisects the Kiggins Mine (one upstream of the mine and one at the mine) and from the adit at the Nisbet Mine. Surface water samples will be collected near depositional areas where water current is slower and there is greater retention time for the surface water to accumulate contaminants from sediment. If the stream is deep enough, the sample will be collected directly into the laboratory-supplied containers, otherwise samples will be collected using a decontaminated sampling beaker and the water will subsequently be decanted into the appropriate sample container supplied by the laboratory.

Pore-water samples will be collected at both substations (i.e., pool and riffle), if possible given the substrate. However, a pore-water sample will not be collected from the stream that bisects the Kiggins Mine and the Nisbet adit discharge because these waters are not expected to be suitable for aquatic life. CES field personnel will collect water from the pore space in stream gravels or sediment where the substrate is deep enough to insert the sampling device. Two pore

waters samples will be collected at each Station, one from a pool, and one from a riffle, for a total of eight samples. A PP-27, manufactured by MHE, stainless steel sampler will be used to collect the pore water samples. The PP-27 will be inserted in sediment to a depth at least 6-inches below the streambed, or at a depth determined appropriate in the field. Pore water will be extracted using either a syringe or peristaltic pump by attaching the device to the PP-27 sample-port. Water will be withdrawn at a low-flow sampling rate (50-200 milliliters per minute) in order to minimize entrapment of sediment.

Samples will be placed in an iced cooler and kept at approximately 4^{o}C until arrival at the laboratory. Surface water and pore-water samples will be analyzed according to Table 2. Special sampling and handling procedures will be followed for the low-level mercury analysis (EPA method 1631). In addition, wet field parameters (SC, pH, temperature, dissolved oxygen [DO], oxidation/reduction potential [ORP], and turbidity) will be measured at each Station using a Horiba U-22.

3.2.3 Sediment Sampling

Sediment samples will be collected from each pool and riffle area at each Station. The two samples from the pool and riffle area will NOT be composited. Sediment samples will be collected from 0-18 inches, unless bedrock is encountered. Transects will be also be established in order to collect representative sediment samples across the entire pool or riffle. Sediment samples will be collected by scooping sediment from depositional areas with a decontaminated stainless steel trowel or Shelby core sampler. The sediment will then be placed in a stainless steel bowl and mixed thoroughly, which will separate large gravels and water from the sediment. Sediment will then be placed in laboratory-supplied clean 16-ounce glass jars with Teflon lids. Samples will be placed in an iced cooler and kept at approximately 4^{o}C until arrival at the laboratory. Sediment samples will be analyzed according to Table 1.

3.2.4 Benthic Macroinvertebrate Sampling and Survey

The biological community evaluation methods described herein represent the Stream Macroinvertebrate Protocols presented in the ODEQ's Water Quality Monitoring Guidebook (ODEQ, 1997) and the USEPA's RBP (USEPA 1999). The Oregon Level 3 protocol provides a sensitive measure of stream condition using macroinvertebrate communities as the primary indicator. Four classes of stream conditions may be determined: no disturbance, slight disturbance, significant disturbance, and severe disturbance.

The streams will be sampled using the single habitat assessment within riffles and pools that contain similar substrate. Each of these two habitat types will be sampled, processed, and evaluated separately. To collect the sample, a D-ring kick-net will be placed into the stream with the flat part of the hoop perpendicular to the stream flow and resting on the bottom. The invertebrates will be collected by disturbing a 30 by 60 centimeter (cm) area of stream bottom to a depth of approximately 10 cm, directly upstream of the net so that the current carries the macroinvertebrates and debris into the net. Depth permitting, all substrate larger than five centimeters will be rubbed by hand to dislodge any clinging macroinvertebrates. Each 30 x 60 cm area that is sampled will be considered a "jab". The contents of the jab will be placed into a sieve bucket and the sampling procedure repeated at additional locations within that habitat type

until the appropriate number of jabs have been completed for a given sample. If pool areas contain inadequate flow and current for this method, sediment core samples may be collected and screened with a 500-micron mesh to remove invertebrates. Each core will be considered a jab. Following the appropriate number of jabs, the contents of the sieve bucket will be cleared of large debris and placed into a labeled sample jar containing preservative. The sampling procedures will proceed from downstream to upstream to minimize influences of disturbance to downstream sample reaches.

Each of the invertebrate samples will be sent to the lab for enumeration. The enumeration data from the laboratory will include all invertebrates in a sample up to approximately 300 individual invertebrates. The enumeration will be limited to this number to reduce unnecessary effort and provide similar sample sizes for each reach to promote effective comparisons between sample reaches. Identification will be to the genus and species level.

3.2.5 Tissue/Vegetation Sampling

Tissue samples of grasses/vegetation will be collected at the Site. CES will collect nine samples to assure a limited degree of statistical integrity: three samples from waste rock piles at each mine, and three samples in undisturbed areas (same location as the background soil samples). In order to compare the results of the vegetation samples to waste and soil sample results, vegetation samples will be collected from the same locations as background soil and waste samples. The type of vegetation to be sampled will be determined in the field; however, prior to field activities, CES will determine what plant species are likely to be present at and around the Site. Samples will be collected from the same native plant species that appear to be flourishing at the Site and at background stations and that are likely to be foraged on by terrestrial receptors (i.e. strawberries, etc.). If the same plant species cannot be located the Site and at background locations, then similar species will be sampled. For example, if strawberries are present at the Site, but is not growing at the background sampling locations, then a similar plant present at both the background location and the Site will be selected for sampling.

The samples will be collected into a gallon size zipper lock type bags. Samples will be placed in an iced cooler and kept at approximately 4^{o}C until arrival at the laboratory. Vegetation samples will be analyzed for the 23 total metals.

3.3 DECONTAMINATION METHODS

All sampling equipment (bowls, trowels, augers, etc.) will be stainless steel, and will be decontaminated before sampling. Equipment decontamination consists of a tap water rinse, a soap and tap water wash, a dilute HNO_3 rinse (10 parts DI water to 1 part concentrated HNO_3) and a DI water rinse followed by air drying. Decontamination water will be discharge directly to soils at the Site.

3.4 SAMPLING DESIGNATION AND LABELING

The following sample numbering system will be used to identify samples collected during field operations:

Waste, Soil and Vegetation Sample Number Example: KM-WR1-1-5'

Where:

KM	=	Kiggins Mine (NM = Nisbet Mine)
WR1	=	Waste Rock Pile 1
TP1	=	Tailings Pile 1
S	=	Soil
BGS	=	Background Soil
V	=	Vegetation
1	=	Sample Number
5'	=	Depth of sample from below ground surface

Water, Sediment and Pore-Water Sample Number Example: GC-SW-1P

Where:

OGF	=	Oak Grove Fork of the Clackamas River
SW	=	Surface Water
PW	=	Pore-Water
SS	=	Stream Sediment
1	=	Sample Number
P	=	Pool subsample (R = Riffle subsample)

All sample identification labels will be engraved onto an aluminum cap attached to rebar. The rebar will be installed into the ground surface to a depth of at least 8 inches. At locations where this is not possible, the rebar will be secured by placing rocks around it. An orange survey flag will also be placed near the stake to facilitate future sighting of the markers.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL PLAN

The following standards will be maintained during sampling and analysis to ensure that the data generated for the assessment meets data quality objectives outlined in *Data Quality Objectives for Remedial Response Activities, Development Process* (EPA, 1987). All laboratory and field data will be subject to EPA Level II quality assurance/quality control (QA/QC) standards. All values between the method detection limit (MDL) and the practical quantitation limit (PQL) will be noted on the laboratory analytical reports. Table 3 presents sampling information, analysis methods, preservation, and holding times.

4.1 FIELD QA/QC

According to USEPA Quality Assurance/Quality Control Guidelines, one duplicate and one equipment rinsate blank should be analyzed for each ten samples collected. The intent of these guidelines is to assess the precision of field sampling, and assure that contamination has not occurred in the field and that decontamination procedures were followed. However, based on the

number of samples being collected, the number of QA/QC samples has been decreased to two duplicate water samples (one surface water and one pore-water) and two equipment rinsate blanks in an effort to reduce analytical costs, while maintaining adequate QA/QC.

Equipment rinsate blank samples will be collected during sampling activities to test for cross-contamination between samples. The blank will be prepared by passing distilled water over decontaminated sampling equipment. Two rinsate samples will be collected from the decontaminated auger used to bore into the waste piles. The rinsate samples will be collected in the cleaned sampling bucket and then poured into the appropriate sample containers. The rinsate samples will be given unique labels. The samples will be analyzed for the 23 total recoverable metals.

All samples will be collected in laboratory-supplied jars and bottles, labeled and transported according to the protocol described above. A chain-of-custody will be maintained from the time of sample collection until the time the samples are received by the analytical laboratory. The chain-of-custody will be signed by anyone who accepts responsibility for the samples, except the shipper. Shipping documents will represent custody of the samples by the shipper.

4.2 LABORATORY QA/QC

The laboratory will follow all requirements for analysis and reporting under the EPA Level II protocols (USEPA, 1987), including, laboratory blanks, laboratory duplicates, matrix spikes and matrix spike duplicates. All samples will be analyzed within the holding times specified for the individual analytical procedure. All values between the MDL and the PQL will be noted on the laboratory analytical reports. Any sample analysis completed after the specified holding time will be noted in the laboratory analytical report. All analytical reports will be reviewed to see that all spikes, duplicates and lab blanks are within acceptable limits.

5.0 HEALTH AND SAFETY PLAN

The health and safety plan has been prepared as a separate document, and is included as Appendix A.

6.0 INVESTIGATION-DERIVED WASTES PLAN

CES does not expect to generate any hazardous wastes during this field investigation. A minor amount of wastes generated from decontamination procedures will be left on-Site. Cuttings from the drilling operations will also be left on the waste rock piles.

7.0 REFERENCES

Hitchcock, C.L. and A. Cronquist. 1990. Flora of the Pacific Northwest: An Illustrated Manual. University of Washington Press. Seattle, Washington.

USEPA, 1987. *Data Quality Objectives for Remedial Response Activities,* Volume 1- Development Process. EPA 540/G-87/004. U.S. Environmental Protection Agency.

USEPA, 1991. *Guidance for Performing Site Inspections Under CERCLA*

USEPA. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. Office of Water. Washington, D.C.

TABLES

Table 1. Water and Pore-Water Laboratory Analysis Summary
Kiggins - Nisbet Mine Site Inspection

Sample I.D.	Sample Location	Total Recoverable Metals 23 TAL	Dissolved Metals 23 TAL, filtered with 0.45 um	Low-Level Mercury	Methyl Mercury	Arsenic III and V	Chromium Specication (Field)	Hardness	pH	Sulfate	Total Dissolved Solids	Conductivity	Total Suspended Solids	Total Organic Carbon
Surface Water Samples														
OGF-SW-1P	Pool at Station 1	1		1	1	1	1	1	1	1	1	1	1	1
OGF-SW-2P	Pool at Station 2	1		1	1	1	1	1	1	1	1	1	1	1
OGF-SW-3P	Pool at Station 3	1		1	1	1	1	1	1	1	1	1	1	1
OGF-SW-4P	Pool at Station 4	1		1	1	1	1	1	1	1	1	1	1	1
OGF-SW-5P	Pool at Station 5	1		1	1	1	1	1	1	1	1	1	1	1
OGF-SW-6P	Pool at Station 6	1		1	1	1	1	1	1	1	1	1	1	1
OGF-SW-7P	Pool at Station 7	1		1	1	1	1	1	1	1	1	1	1	1
KM-SW-1	Onsite Drainage - Kiggins	1		1	1	1	1	1	1	1	1	1	1	
KM-SW-2	Onsite Drainage - Kiggins	1		1	1	1	1	1	1	1	1	1	1	
NM-SW-1	Adit Discharge - Nisbet	1		1	1	1	1	1	1	1	1	1	1	
Pore-Water Samples														
OGF-PW-1P	Pool at Station 1		1	1	1	1	1	1	1	1	1	1	1	
OGF-PW-1R	Riffle at Station 1		1	1				1	1	1	1	1	1	
OGF-PW-2P	Pool at Station 2		1	1	1	1	1	1	1	1	1	1	1	
OGF-PW-2R	Riffle at Station 2		1	1				1	1	1	1	1	1	
OGF-PW-3P	Pool at Station 3		1	1	1	1	1	1	1	1	1	1	1	
OGF-PW-3R	Riffle at Station 3		1	1				1	1	1	1	1	1	
OGF-PW-4P	Pool at Station 4		1	1	1	1	1	1	1	1	1	1	1	
OGF-PW-4R	Riffle at Station 4		1	1				1	1	1	1	1	1	
OGF-PW-5P	Pool at Station 5		1	1	1	1	1	1	1	1	1	1	1	
OGF-PW-5R	Riffle at Station 5		1	1				1	1	1	1	1	1	
OGF-PW-6P	Pool at Station 6		1	1	1	1	1	1	1	1	1	1	1	
OGF-PW-6R	Riffle at Station 6		1	1				1	1	1	1	1	1	
OGF-PW-7P	Pool at Station 7		1	1	1	1	1	1	1	1	1	1	1	
OGF-PW-7R	Riffle at Station 7		1	1				1	1	1	1	1	1	
QA/QA Samples														
OFG-SW-8P	Duplicate of OGF-SW-2P	1		1	1	1	1							
OFG-PW-8P	Duplicate of OGF-PW-2P		1	1	1	1	1							
OFG-SW-9P	Rinsate Blank	1												
OFG-SW-10P	Rinsate Blank	1												
OFG-SW-11P	Mercury Equip/air*			2										
	Total	13	15	28	19	19	19	24	24	24	24	24	24	7

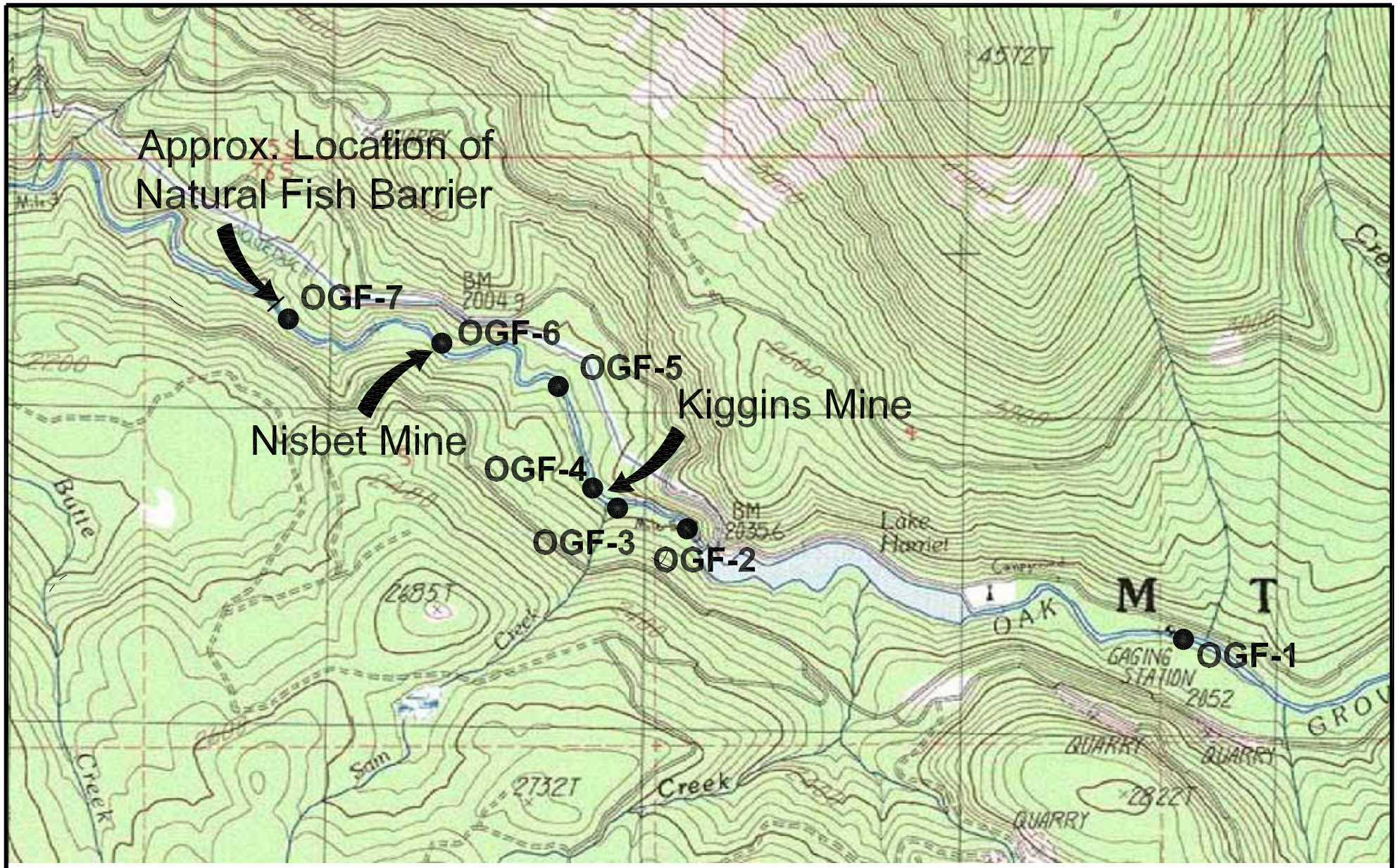
Table 2. Solid Media Laboratory Analysis Summary
Kiggins - Nisbet Mine Site Inspection

Sample I.D.	Sample Location	Total Metals 23 TAL	Plant	Methyl Mercury	Arsenic III	Chromium III & VI	pH	Acid Based Accounting	SPLP RCRA Metals	Grain Size (sand, silt, clay and gravel)	AVS/SEM	Clay Mineralization
Background Soil												
BGS-1	To be determined	1		1	1	1	1					
BGS-2	To be determined	1		1	1	1	1					
BGS-3	To be determined	1		1	1	1	1					
Waste Rock												
KM-WR-1	To be determined	1		1	1	1	1	1	1			
KM-WR-2	To be determined	1					1					
KM-WR-3	To be determined	1		1	1	1	1	1	1			
KM-WR-4	To be determined	1					1					
KM-WR-5	To be determined	1		1	1	1	1	1	1			
KM-WR-6	To be determined	1					1					
KM-WR-7	To be determined	1		1	1	1	1	1	1			
NM-WR-1	To be determined	1		1	1	1	1	1	1			
NM-WR-2	To be determined	1					1					
NM-WR-3	To be determined	1		1	1	1	1	1	1			
NM-WR-4	To be determined	1					1					
NM-WR-5	To be determined	1		1	1	1	1	1	1			
NM-WR-6	To be determined	1					1					
NM-WR-7	To be determined	1		1	1	1	1	1	1			
Sediment												
OGF-SS-1P	Pool at Station 1	1		1	1					1		1
OGF-SS-1R	Riffle at Station 1	1								1		
OGF-SS-2P	Pool at Station 2	1		1	1					1		1
OGF-SS-2R	Riffle at Station 2	1								1		
OGF-SS-3P	Pool at Station 3	1		1	1					1		1
OGF-SS-3R	Riffle at Station 3	1								1		
OGF-SS-4P	Pool at Station 4	1		1	1					1		1
OGF-SS-4R	Riffle at Station 4	1								1		
OGF-SS-5P	Pool at Station 5	1		1	1					1		1
OGF-SS-5R	Riffle at Station 5	1								1		
OGF-SS-6P	Pool at Station 6	1		1	1					1		1
OGF-SS-6R	Riffle at Station 6	1								1		
OGF-SS-7P	Pool at Station 7	1		1	1					1		1
OGF-SS-7R	Riffle at Station 7	1								1		
Vegetation												
BG-V-1	To be determined		1									
BG-V-2	To be determined		1									
BG-V-3	To be determined		1									
KM-V-1	To be determined		1									
KM-V-2	To be determined		1									
KM-V-3	To be determined		1									
NM-V-1	To be determined		1									
NM-V-2	To be determined		1									
NM-V-3	To be determined		1									
	Total	31	9	18	18	11	17	8	8	14	0	7

Table 3. Laboratory Sample Collection, Preservation and Holding Times
Kiggins - Nisbet Mine SI

Media	Laboratory Analysis	Analysis Method	Preservation	Holding Time
Water	TAL metals	EPA 6010B/ 7000 Series EPA 245.7 (Hg)	HNO_3; Ice to 4 ^oC	180 days/Hg 28 days
Water	Arsenic III & V	EPA 1632	HCL, Ice to 4 ^oC	28 days
Water	Chromium III & VI	SM-3500 Cr-D	Ice to 4 ^oC	24 hours
Water	Cyanide - total	EPA 335.4	NAOH, Ice to 4 ^oC	14 days
Water	Cyanide - WAD	SM4500-CN	Ice to 4 ^oC	14 days
Water	Hardness	SM 2340B	HNO3; Ice to 4 oC	180 days
Water	Sulfate	EPA 375.3	Ice to 4 ^oC	28 days
Water	Total Dissolved Solids	EPA 160.1	Ice to 4 ^oC	28 days
Water	Conductivity	EPA 120.1	Ice to 4 ^oC	Immediately
Water	Total Suspended Solids	EPA 160.2	Ice to 4 ^oC	Immediately
Water	Total Organic Carbon	EPA 415.1	H_2SO_4	28 days
Water	pH	EPA Method 150.1	Ice to 4 ^oC	Immediately
Solid	TAL metals	EPA 6010B/ 7000 Series EPA 7471A (Hg)	Ice to 4 ^oC	180 days/Hg 28 days
Solid	AVS/SEM	EPA 8/91 draft	Ice to 4 ^oC	28 days
Solid	Acid based accounting	EPA 600/2-78-054	Ice to 4 ^oC	28 days
Solid	SPLP	EPA 1312 and EPA 6010B	Ice to 4 ^oC	28 days
Solid	Grain Size	ASTM D 422 Hydrometer	Ice to 4 ^oC	28 days
Solid	Clay Mineralogy	x-ray diffraction	Ice to 4 ^oC	28 days
Solid	Paste pH	ASA No.9 10-2.31	Ice to 4 ^oC	28 days

FIGURES

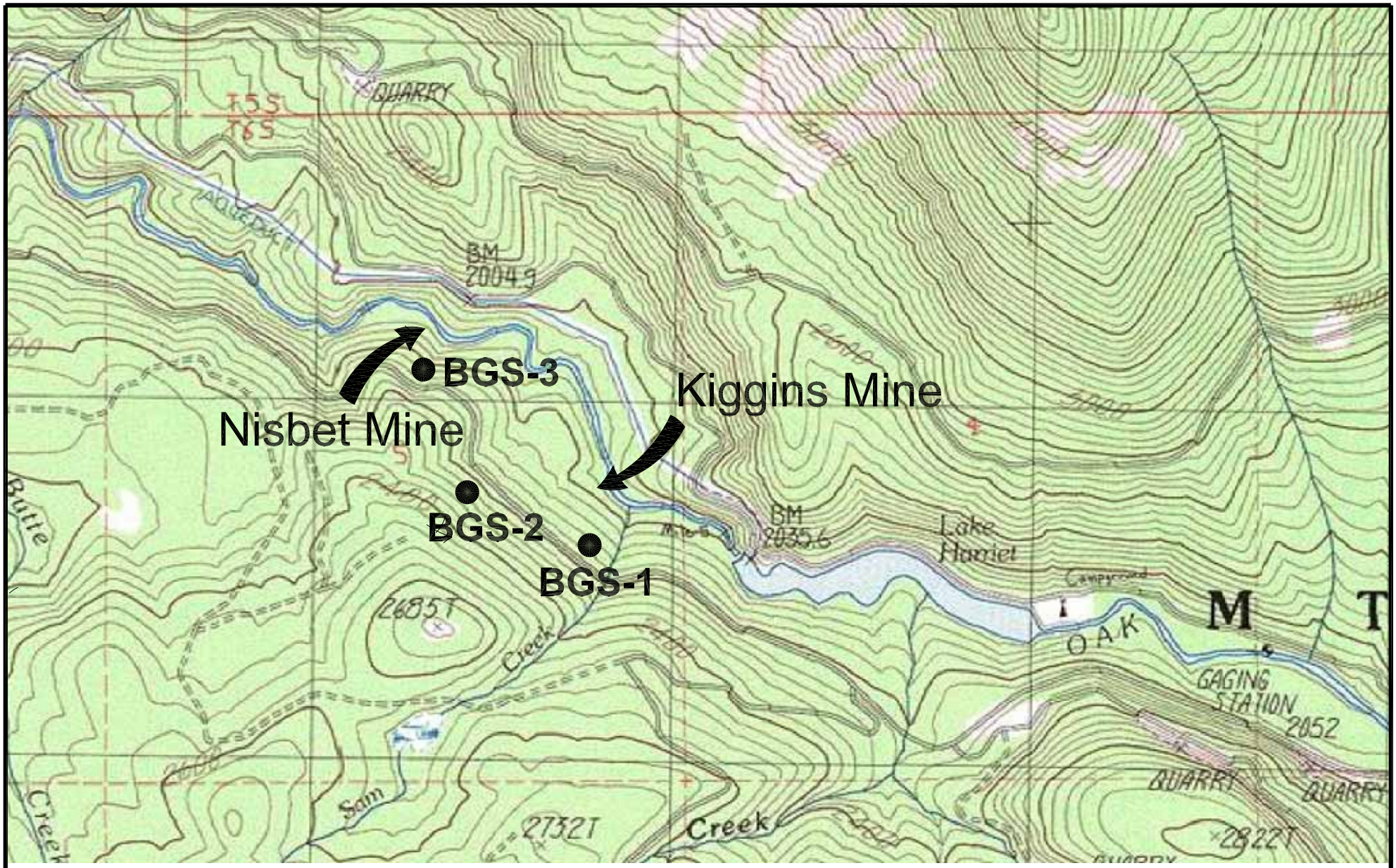


OREGON

OGF-6 ● Surface Water Station

NOT TO SCALE
CONTOUR INTERVAL = 40 FEET

PROJECT NUMBER: 2323022	Figure 1. Surface Water, Pore-Water and Sediment Sampling Locations
DATE: 09-02-03	
DWG BY: DGW / DWG NO: Fig 1 SW	KIGGINS - NISBET MINES SI U.S. FOREST SERVICE
PROJECT MANAGER: DGW	
REVISED:	CES CASCADE EARTH SCIENCES A Valmont Industries Company



OREGON

BGS-1 ● Background Soil Sample

NOT TO SCALE
CONTOUR INTERVAL = 40 FEET

PROJECT NUMBER: 2323022	Figure 2. Background Soil Sampling Locations
DATE: 09/02/03	
DWG BY: DGW / DWG NO: BGS-Fig	KIGGINS - NISBET MINES SI U.S. FOREST SERVICE
PROJECT MANAGER: DGW	
REVISED:	CES CASCADE EARTH SCIENCES A Valmont Industries Company

APPENDICES

Appendix A. Health and Safety Plan

Health and Safety Plan for
Kiggins-Nesbit Mine Site Inspection
Mt. Hood National Forest
Clackamas County, Oregon

EMERGENCY PHONE NUMBERS

Fire..... 911
Police..... 911
Ambulance..... 911
Emergency..... 911
Kaiser Permanente Hospital 503-652-2880
10180 Sunnyside Road
Clackamas, Oregon 97015
CES Corporate Safety Officer 541-812-6614

September 2003

Health and Safety Plan for
Kiggins-Nesbit Mine Site Inspection
Mt. Hood National Forest
Clackamas County, Oregon

Principal Authors: *Mary Ann Amann, RG, Staff Geologist II*

Reviewed by: *Dustin G. Wasley, PE, Managing Engineer*
John D. Martin, RG, Principal Geologist

Prepared For:

Dennis Boles, PE
USDA Forest Service
USFS Winema National Forest
2819 Dahlia Street
Klamath Falls, Oregon 97601

Site Address:

Kiggins-Nesbit Mine Sites
Mt. Hood National Forest
Clackamas County, Oregon

Prepared By:

Cascade Earth Sciences
225 South Holly Street
Medford, Oregon 97501
(541) 779-2280

PN: 2323022/September 2003

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

The United States Forest Service (USFS) has requested that Cascade Earth Sciences (CES) perform a Site Inspection (SI) at the Kiggins-Nesbit Mines (Sites) located in the Mt. Hood National Forest. The Sites are located east of the Ripplebrook Ranger Station, approximately 25 miles south of Estacada, Oregon. Field activities will be performed as part of the SI. This Health and Safety Plan (HASP) has been prepared for field activities scheduled to be performed at the Sites.

The focus of this HASP is to identify, evaluate and minimize potential health and safety hazards, as well as to provide emergency response to accidents during field operations at the Sites. The mines are former mercury mine and milling sites, and heavy metals have been identified in soil, surface water, and sediments at the Sites. The objectives of this HASP include the following:

- Identification and evaluation of potential hazards
- Definition of levels of protection required for the activities
- Formulation of emergency action plans
- Assurance of medical monitoring
- Assurance of personnel Hazardous Materials (HAZMAT) training
- Implementation of appropriate record keeping.

This HASP covers CES personnel working at the Sites who have the potential for exposure to hazardous waste, hazardous substances, or a combination of these materials. This HASP is intended to comply with the requirements of the Occupational Safety and Health Administration (OSHA) Standards as stated in 29 CFR 1910.120. Amendments to this HASP may be made as the contaminant profile is updated; a change in the work status or tasks is made; or as regulatory requirements dictate. Any changes will be brought to the attention of those covered under the plan through additional training.

This HASP addresses the procedures to be followed during the investigation of soil, stream sediment and surface water in the area near the Kiggins-Nesbit Mines. Activities associated with this HASP include collecting waste material, soil, stream sediment and surface and pore water samples. No other activities are covered by this HASP. All personnel working at these Sites will follow the safety provisions outlined in this plan. The CES Corporate Health and Safety Officer, Doug Wanta, is responsible for the implementation of this HASP, and all questions or concerns regarding site safety should be directed to him.

2.0 HAZARD ASSESSMENT

2.1 Chemical Hazards

The primary chemical hazard at the Sites is mercury. Mercury is a toxic element to humans and many higher animals. All chemical compounds containing mercury are toxic to humans. Inorganic mercury salts show a high acute toxicity with a variety of symptoms and damages. Organic mercury compounds, such as methyl mercury, are considered even more hazardous to humans because of their high chronic toxicity with respect to the nervous system. Methyl mercury is typically the dominant toxic mercury species in sediments.

Cinnabar, mercuric sulfide (HgS), is a stable, non-reactive naturally occurring mercury compound present at the Sites. It is resistant to oxidation and weathering and is extremely insoluble in water. Therefore, it enters the environment mainly in the form of mechanically degraded particulate matter.

The principal risk for mercury exposure to personnel at these Sites is through inhalation of mercury-bearing dusts. Refer to Section 7.0 for additional information.

2.2 Physical Hazards

A checklist of physical hazards is provided as follows:

Description	Hazard		Comments
	Yes	No	
Overhead Power Lines		X	None present at sites.
Heavy Equipment – Drill Rig – Hollow Stem Auger		X	Not performed at sites.
Buried Conduit		X	None present at sites.
Culvert-like conduit to supply air to mine	X		There is a danger of falling into the mine through this structure. Persons will avoid traversing near this hazard.
Uneven Ground	X		Appropriate precautions will be taken while traversing the area.
Fall Hazards	X		Appropriate precautions will be taken while traversing the area.
Steep Slopes	X		Appropriate precautions will be taken while traversing the area.
Stream Crossing	X		Care will be taken crossing the streams to enter the Sites.
Insects	X		Insects may be present at the Sites. Appropriate precautions will be taken while in the area.
Snakes		X	There are no poisonous snakes in the area
Rodent Nests/Droppings	X		Rodent nests/dropping may be present. Appropriate precautions will be taken while in the area.
Poison Oak		X	There is no poison oak in the area.
Ice	X		Ice may be present depending on weather conditions. Refer to Section 9.2.
Slippery Conditions	X		Slippery conditions may be present depending on weather conditions. Appropriate precautions will be taken while traversing the area.
Rain	X		Rain may exacerbate hazardous conditions. Refer to Sections 4.2 and 9.2.
Confined Space Hazard		X	None present at sites.
Potential Adit Collapse	X		There is the potential for adits to collapse. Appropriate precautions will be taken while traversing the sites. Adits will not be entered.
Abandoned Structures	X		There is the potential for abandoned buildings to collapse. Appropriate precautions will be taken while traversing the sites.

Abandoned structures are present at the Sites and may pose a danger due to collapse or the presence of unknown hazards within debris piles. As shown in the checklist, other physical

hazards at the Sites are primarily due to uneven terrain, steep slopes, stream crossing and human error. These include hazards such as operating a field vehicle in steep terrain with poor roads, twisting an ankle while traversing the slopes, slipping or tripping on obstructions, falls into collapsed underground mine workings, and exposure to the heat or cold. Activities will follow standard operating procedures and will be conducted in a safe and prudent manner.

2.3 Biological Hazards

Potential biological hazards for these Sites include poisonous spiders or plants. Care should be taken when moving rocks, logs, lumber or other items during sampling activities at the Sites. These items should be inspected prior to touching or moving.

3.0 PERSONNEL

The Corporate Health and Safety Officer for this project is John Martin of CES. In this capacity, Mr. Martin will oversee compliance with all applicable health and safety regulations. The designated Site Safety Officer, Mary Ann Amann, will oversee day-to-day site safety activities. Safety is affected by all parties or organizations involved. For this reason, the following key personnel and their organization have been identified:

Corporate H&S Officer	John Martin - CES	(541) 812-6614
Project Manager	Dustin Wasley - CES	(541) 601-9097
Site Safety Officer	Mary Ann Amann - CES	(541) 779-2280
Technical Advisor	John D. Martin - CES	(541) 812-6614
USFS/COR	Dennis Boles - USFS	(541) 947-6336

All site personnel will receive copies of the HASP for review. After review, each person will sign the Acknowledgement form included as Attachment A. The signed Acknowledgments and copies of hazardous waste training certificates will be attached to the HASP or otherwise available for inspection at the Sites.

4.0 PERSONAL PROTECTIVE EQUIPMENT (PPE) AND OTHER REQUIRED EQUIPMENT

The following basic safety equipment and PPE are required for level D operations at the Sites.

4.1 Summary of Equipment Required for this Project

- First aid kit
- 1 – A, B, C Fire extinguisher
- Cellular telephone – cellular coverage may not be available at remote locations
- Hand-held radios – in case no cellular coverage available
- Wash station to rinse particulates from exposed skin

4.2 Personal Protective Equipment (PPE) – Level D

- Work uniform with long pants and appropriate cold-weather gear (including rain protection)
- Steel-toed boots (leather or PVC)
- Outer gloves (green Viton or equivalent)
- Inner gloves, latex disposable
- Safety glasses
- Hard hat
- Disposable Tyvek coveralls (optional)

4.3 Personal Protective Equipment – Level C

- Half-face air-purifying respirator with HEPA cartridges
- Level D PPE as described above
- Disposable coveralls - Tyvek or equivalent (total body)

5.0 OPERATIONAL PROCEDURES

These guidelines are primarily intended to address site work involving soil, rock or sediment sampling. Sampling activities will require Level D PPE. Activities such as soil and groundwater sampling will be performed using appropriate PPE. The use of a hard hat and safety glasses may not be necessary for sampling. However, reasonable effort should be made to keep non-essential personnel away from sampling activities.

5.1 Physical Hazards

Sampling activities will require traversing steep slopes and crossing streams while carrying heavy packs. Care will be taken to reduce the potential for personal injury.

Sampling activities will be performed in Level D PPE.

All disposable PPE, including inner gloves, Tyvek coveralls, and tape will be placed in a plastic bag for later disposal. If needed, boots will be dry brushed clean and then washed with a mild detergent solution and rinsed. Gloves will be washed or replaced. Tools should be washed in a mild detergent solution and rinsed.

6.0 Decontamination / Disposal Procedures

Extensive decontamination procedures have been determined to be unnecessary for this project. However, should comprehensive decontamination become necessary due to Personal Protection Level upgrade, the SSO will devise a decontamination plan according to the table.

Personnel and equipment leaving the EZ shall be decontaminated. Level **C** decontamination protocol shall be used with the following decontamination stations:

LEVEL C DECONTAMINATION STEPS		LEVEL D DECONTAMINATION STEPS	
1	Equipment Drop	1	Equipment Drop
2	Outer Garment, Boots, and Glove Wash and Rinse	2	Glove and Boot Wash and Rinse
3	Disposable Garment, Boots, and Glove Removal	3	Disposable Garment, Outer Boot and Glove Removal
4	Cartridge Change (if necessary)	4	Field Wash
5	Remove Respiratory Protection		
6	Field Wash		

The following decontamination equipment is required at the drilling site.

DECONTAMINATION EQUIPMENT CHECKLIST			
X	Scrub Brushes	X	Garbage Bags
X	Waste Containers	X	Paper Towels
X	Soap		Isopropyl Alcohol
X	Plastic Tubs	X	Pump Spray Bottles
X	Plastic Drop Cloths	X	Pump Spray Bottles (water)

7.0 DISPOSITION OF DECONTAMINATION WASTES

All equipment and liquids used for decontamination shall be disposed of properly according to local, state and federal regulations. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures.

7.1 Standard Operating Procedures

The major pathway for the ingestion of mercury at the Sites is through inhalation of dust particles. Therefore, all activities should be done with minimal disruption of the soils and sediments. There will be no eating, drinking, smoking, gum or tobacco chewing, or applying of cosmetics in the field while investigative activities are conducted.

- The instructions of the Site Safety Officer will be followed.
- No horseplay will be tolerated.
- Work practices that minimize airborne release of contaminants will be used.
- Contact with waste material will be minimized.
- The hands and face of personnel must be thoroughly washed as soon as possible upon leaving the work area and before eating, drinking or other activities.

All involved personnel are responsible for reading and understanding the provisions of this Plan and will agree to abide by it. Their signature at the end of the HASP signifies their personal review and acceptance of this plan.

8.0 HAZMAT TRAINING

All persons conducting field investigations at the Sites must have at least 40 hours of hazardous waste operations training plus three (3) days of field experience, or be under the direct supervision of a trained experienced supervisor (29 CFR 1920.120). If initial training took place more than 12 months prior to the job, an 8-hour refresher course must be taken.

Copies of training certificates documenting the required training must be available at the Sites. The Site Safety Officer is responsible for inspecting documentation to ensure the requirements of this section are met.

9.0 MEDICAL MONITORING

Employees are required by Occupational Safety and Health Administration (OSHA) to have a full hazardous materials physical if exposed to concentrations of toxic substances above permissible exposure limits (PEL) for 30 or more days per year. It is the policy of CES that any person with the potential for exposure at or above the threshold limit value (TLV) will have a complete physical prior to being assigned to a task with the potential for exposure. The TLV for mercury is 1 mg/m^3 as dust particles. Sampling activities are not anticipated to disturb soils to the extent that wind-borne mercury dust of concentrations approaching the TLV will be of concern for field personnel. Medical monitoring for activities during the implementation of the Work Plan will not be required, although CES field staff are routinely managed under our medical monitoring program.

10.0 EMERGENCY RESPONSE PLAN AND SERVICES

In the unlikely event of a fire or explosion, proper action is required to safeguard personnel and the environment. Should a fire occur, emergency services will be immediately contacted (fire, police, etc.) by calling 911. In addition, site personnel will be notified of the problem. Only small fires may be extinguished by workers at the Sites. If the fire is too large, or if in doubt, the area will be evacuated. In the event of an accident or emergency during site work the following services are available:

Fire/Ambulance 911
Police 911
Emergency 911
Kaiser Permanente Hospital 503-652-2880
10180 Sunnyside Road
Clackamas, Oregon 97015
CES Corporate Safety Officer 541-812-6614

Hand-held radios will be made available to field personnel during implementation of the Work Plan. Radio contact will be made to the Mt. Hood National Forest office in the event of an emergency.

Maps and directions to the Pioneer Memorial Hospital are included in Attachment B.

11.0 WEATHER

11.1 Hot Weather

In hot weather, heat stress can be a serious hazard for workers at waste sites. Heat stress usually is a result of protective clothing decreasing natural body ventilation, although it may occur at any time work is being performed at elevated temperatures.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur. These reactions range from mild (fatigue, irritability, anxiety, and decreased dexterity) to fatal. Because heat stress is one of the most common and potentially serious illnesses that workers face, regular monitoring and other preventative measures are vital.

11.1.1 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by failure of heat regulating mechanisms of the body (i.e., the individual's temperature control system that causes sweating stops working correctly). If the victim is not cooled quickly, the body temperature will rise so high that brain damage and/or death may occur.

Symptoms – Red, hot, dry skin, although the person may have been sweating earlier; nausea, dizziness, confusion, extremely high body temperature, rapid respiratory and pulse rates, unconsciousness or coma.

Treatment – Cool the victim quickly. Call 911 for an ambulance. Soak the victim in cool but not cold water, sponge the body with cool water or pour water on the person to reduce the temperature to a safe level (102 °F).

11.1.2 Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. This condition is much less dangerous than heat stroke, but it must be treated.

Symptoms – Pale, clammy, moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit, and may be dizzy.

Treatment – Remove the person to a cool, air conditioned place, loosen clothing, place in a head-low position and provide bed rest. Consult a physician, especially severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink 1 to 2 cups of water immediately, and every 20 minutes thereafter, until symptoms subside. Total water consumption should be 1 to 2 gallons per day.

11.2 Cold Weather

All field activities are anticipated to be complete in advance of snow. If unexpected snow coverage makes it difficult to conduct sampling, field activities will be rescheduled as appropriate. Because weather conditions in the area can be unpredictable, preventative measures are included in this Health and Safety Plan.

The conditions that promote cold related illnesses are not always apparent. Therefore, it is essential that personnel wear appropriate clothing to protect against the elements. During extreme cold (<45 °F), raining or chilly wind conditions, personnel should wear appropriate clothing to protect hands, feet, and exposed body extremities, as well as the head and neck areas. If an employee becomes over exhausted due to exertion during extreme weather conditions, curtailing of activities should be considered rather than shedding protective clothing. All indications of cold-related illnesses will be treated immediately by the designated on-site first aid responder. The physical health of all on-site personnel will be monitored closely throughout all remedial activities.

11.2.1 Frostnip

Frostnip occurs when there is cooling of tissues, cheeks, chin, fingers, toes, and ears.

Symptoms – Pale, white, grayish, glassy patches and tissues soft and resilient.

Treatment – Use steady, firm pressure on the cooled area with a warm body part (e.g., put fingers in armpit, put toes against a friend's abdomen).

11.2.2 Frostbite

Frostbite occurs when there is freezing of body tissues. Frostbite most commonly affects the hands and feet.

Symptoms – Tissues pale, cold, solid; feels wood-like; tissues not resilient; grayish patches.

Treatment – Check breathing, airway, circulation. Protect frozen areas from further damage, but DO NOT thaw. If feet are frozen, they can be walked on if necessary. However, once they begin to thaw, DO NOT walk on them. Seek professional medical aid for re-warming. WARNING: Improper warming can increase tissue loss.

11.2.3 Hypothermia

Hypothermia is the lowering of body temperature to below normal levels. Hypothermia can occur in cool and wet or cold environments. Water, wet clothing, and wind accelerate heat loss.

Symptoms – Shivering, weakness, loss of coordination, difficulty performing tasks and making decisions, loss of consciousness, slow or absent breathing and heartbeat.

Treatment – Check breathing, airway, circulation. Protect from further heat loss by sheltering patient from wind and water. Replace wet clothing with dry if possible. Cover patient's head. WARNING: Jarring the patient can cause an abnormal heart rhythm. If mild signs/symptoms, add heat to the neck, armpits and groin. If moderate to severe signs and symptoms, prevent further heat loss and seek additional medical aid for re-warming.

11.3 Storms

Storms strong enough to endanger operations may require termination of sampling activities until the storm has passed. Storms are hazardous due to the potential for lighting strikes and falling trees. Electrical storms with high gusty winds are particularly hazardous to drilling towers. All activities involving this type of equipment should be halted until the danger is clearly past.

CASCADE EARTH SCIENCES

Mary Ann Amann, RG
Site Safety Officer

CASCADE EARTH SCIENCES

Dustin G. Wasley, PE
Managing Engineer

ATTACHMENTS

Attachment A. **Acknowledgement Form**
Attachment B. **Hospital Route Maps**

Attachment A.

Acknowledgement Form

ACKNOWLEDGEMENT

To Be Signed and Returned To

Cascade Earth Sciences (CES) Health and Safety Officer

I have received and carefully read the Site Health and Safety Plan (HASP) for the Site Inspection at the Kiggins-Nesbit Mines (the Sites). I agree to abide by these safety rules, regulations, and guidelines while working at the Sites. I understand that any violation of these rules may result in my removal from the work area.

I have had a 40-Hour Health and Safety Training course and an annual refresher course(s), and I have provided certificates of these courses to the Site Safety Officer.

Signature _____

Print Name _____

Signature _____ Date _____

Print Name _____

Signature _____ Date _____

Print Name _____

Signature _____ Date _____

Print Name _____

Signature _____ Date _____

Print Name _____

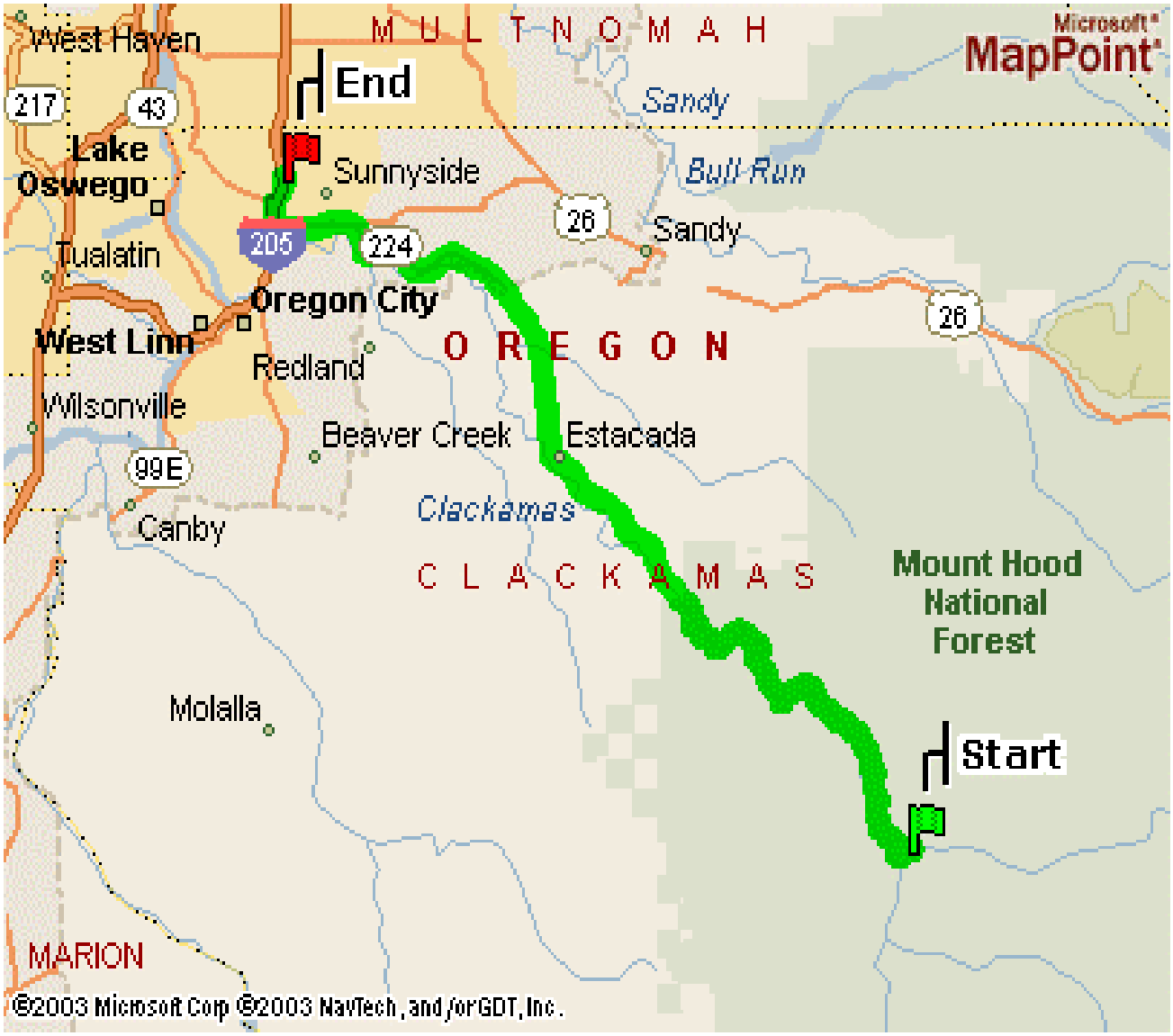
Safety Officer

Signature _____ Date _____

Print Name _____

Attachment B.

Hospital Route Map



Directions:
From the Site, Drive west to Ripplebrook.
Turn right (north) onto SR-224 (Clackamas Highway) and drive 43 miles to I-205.
Go north on I-205 towards Portland, 1.6 miles.
Take exit 14 – Sunnyside Road – turn Right onto Sunnyside Road and drive 0.2 miles.
Kaiser Permanente is at 10180 SE Sunnyside Road.
Telephone – (503) 652-2880

Appendix A.

Site Specific Health and Safety Plan