



Pebble Project

NORTHERN DYNASTY MINES INC.

**DRAFT ENVIRONMENTAL BASELINE STUDIES
FIELD SAMPLING PLAN**

**CHAPTER 7. NATURALLY OCCURRING CONSTITUENTS
IN SURFACE SOIL, SEDIMENT, VEGETATION,
AND FISH**

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Acronyms

| | |
|------|--------------------------------------|
| ABR | Alaska Biological Research |
| °C | degrees Celsius |
| CAS | Columbia Analytical Services Ltd. |
| COC | chain of custody |
| DQOs | data quality objectives |
| EPA | U.S. Environmental Protection Agency |
| FSP | field sampling plan |
| GIS | geographical information system |
| GPS | global positioning system |
| NCA | North Creek Analytical |
| NDM | Northern Dynasty Mines Inc. |
| oz | ounce |
| QA | quality assurance |
| QC | quality control |
| QAPP | quality assurance project plan |
| SGS | SGS Environmental Services, Ltd. |
| Shaw | Shaw Alaska, Inc. |
| SLR | SLR Alaska |
| USGS | U.S. Geological Survey |

1. Introduction

This field sampling plan (FSP) provides guidance for collection of data on trace elements in soil and vegetation at the Pebble Project mine site. The FSP was prepared by SLR Alaska (SLR) at the direction of Northern Dynasty Mines Inc. (NDM). The purpose of the FSP is to update field procedures for conducting a study of naturally occurring constituents in surface soil and vegetation which was begun in 2004. The field work for this study in 2005 will involve collecting samples of surface soil, subsurface soil, terrestrial vegetation, and aquatic vegetation for analysis of naturally occurring trace elements and petroleum hydrocarbons.

2. Project Background

2.1 Project Purpose and Scope

The scope of the trace elements study allows for analysis of the spatial and temporal variability of trace elements and anions at the mine site. Also, a subset of soil samples will be analyzed for biogenic petroleum hydrocarbons to provide a baseline in the event of any potential petroleum-related releases in the future.

Based on the Bureau of Land Management's cadastral survey system of township-range-section, the mine site encompasses an area of 160 square miles. In 2004, to determine landforms and environmental media common to these landforms, 50 one-square-mile cells were randomly selected from a grid of 160 such cells which represented coverage of the mine-site area. Five landforms were identified, with 10 environmental media common to those land forms.

In 2004, the types and relative abundance of the different habitats was unknown, thus samples sites were located based on landform (e.g., geology, vegetative coverage). For 2005 studies, the approach will be slightly different because the number of samples collected will be based primarily on habitat type rather than on landform. Several locations in 2004 had insufficient vegetation for collection or had only one or two species in sufficient abundance for collection. Therefore, a different approach was developed to ensure the best representative coverage of various plant species of interest. Alaska Biological Research (ABR) has compiled habitat information, and a total of seven broad habitat types have been identified. Based on research and reconnaissance conducted during the 2004 sampling season, the areal extent of the seven habitat types will be considered in light of the 10 environmental media, and the identification of grids used as specific sampling locations will be modified appropriately.

Before soil and vegetation sampling begins, general sample locations in selected sections from the random grid system will be translated into latitude/longitude coordinates and transferred to a navigational global positioning system (GPS) on a helicopter. The majority of sampling locations will be randomly selected while ensuring that adequate coverage is provided for each of the habitat types. Some pre-planning will be required to identify an appropriate number of grids within each habitat type while keeping the total number of samples consistent with those from 2004. Where possible and relevant, the same locations sampled in 2004 will again be sampled in 2005 to provide an indication of annual variability in trace element concentrations in soil and vegetation. Final locations of 2005 sampling sites will be provided to the project team prior to beginning field work.

Defensible documentation and characterization of the existing natural levels of trace elements, anions, and petroleum hydrocarbons present in environmental media prior to mining operations will be generated. These baseline data will be used as part of the evaluation of future potential impacts to these media during operation, closure, and long-term site monitoring for the mine.

Risk aspects related to mine development and operation, including dust generation, will be considered to ensure that the sampling program and data-quality objectives for estimating natural

levels of trace elements and other chemicals in surface soil and vegetation will support a human health and/or ecological risk assessment.

2.2 Project Site Description

The Pebble Project site is located in southwestern Alaska in the headwater areas of the Koktuli River and Upper Talarik Creek. Mine operations will include open-pit mining, construction of earthen impoundment dams, tailings piles, gravel roads, and pads. These developments will traverse archetypical landscapes and ecological habitats. The landforms and associated habitats common to the region are characterized by specific surface soils and vegetation types.

3. Project Scope and Objectives

3.1 Objectives

The objectives of the trace elements study are as follows:

- Continue and update field procedures established in the 2004 study of naturally occurring constituents in surface soil and vegetation.
- Continue collecting baseline data to provide defensible documentation of the natural levels of trace elements and petroleum hydrocarbons in surface soil and vegetation, including their spatial and temporal variability, present prior to mining operations.
- Determine organic content in surface soils to support long-term site-monitoring objectives.

The information to be gathered in this trace elements study is key to understanding current conditions at the mine site and surrounding areas. It will provide a baseline for the evaluation of future, potential environmental impacts to soil and plants during mine operation and closure and will support long-term site-monitoring objectives.

3.2 Sample Analysis Summary

To achieve the objectives outlined above, the baseline study program includes a comprehensive data-collection effort across environmental media. SLR is responsible for collection of surface and subsurface soil, and aquatic and terrestrial vegetation samples at the mine site in 2005.

Soil samples will be appropriately documented and packaged and sent to SGS Environmental Services, Ltd. (SGS) in Anchorage, Alaska. The Columbia Analytical Services (CAS) laboratory in Kelso, Washington, will act as the quality assurance (QA) laboratory for the soil samples.

Vegetation samples will be appropriately documented and packaged and then sent to the CAS laboratory. The North Creek Analytical (NCA) laboratory in Portland, Oregon, will act as the QA laboratory for vegetation samples.

Samples will be analyzed for the trace elements listed in Table 1 by the indicated analysis methods.

TABLE 1. TRACE ELEMENT CONSTITUENTS AND ANALYTICAL METHODS

| CONSTITUENT | METHOD |
|--------------------------------------|---------------------|
| Soil | |
| Metals ¹ | SW6010B/6020 |
| Mercury | SW7471A |
| Diesel Range/Residual Range Organics | AK102/103 |
| Ammonia as N | SM4500NH3G |
| Cyanide, Total | SM4500CN |
| Organic Carbon | E415.1 |
| Vegetation | |
| Metals ¹ | SW6010B/6020/E200.8 |
| Mercury | SW7471A |
| Ammonia as N | SM4500NH3G |
| Cyanide, Total | E335.2 |

1. Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Pb, K, Mg, Mn, Mo, Na, Ni, Sb, Se, Sn, Tl, V, Zn

SW U.S. EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Third edition, September 1986.

SM Standard Methods for the Examination of Water and Wastewater, 20th Edition.

E Methods for Chemical Analysis of Inorganic Substances in Environmental Samples, EPA/600/R-93-100, August 1993, and Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91-010, June 1991.

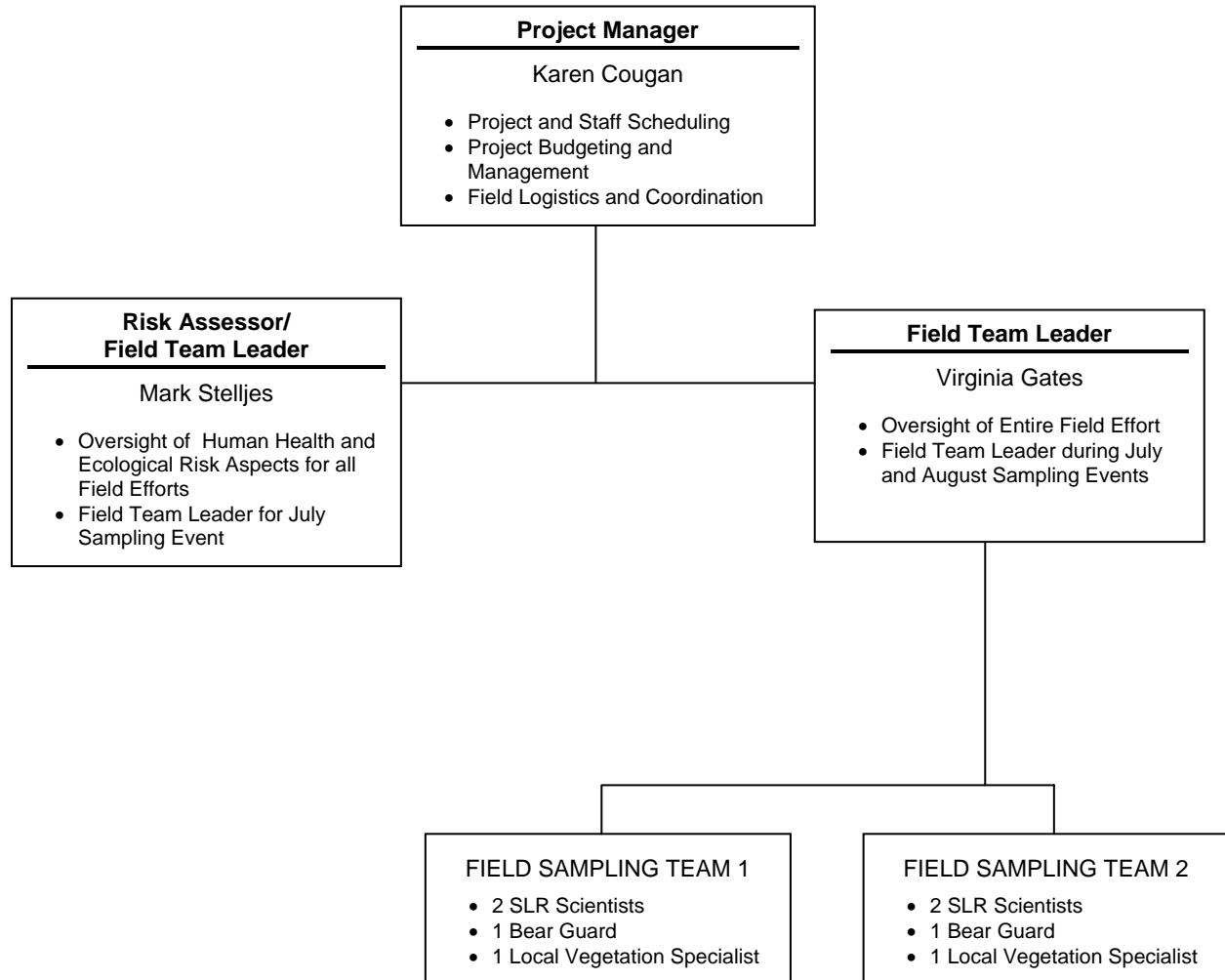
AK Methods for Determination of Aromatic and Aliphatic Hydrocarbons in Diesel and Residual Range Organics. Version 6-30-98.

3.3 Field Activities

As part of the 2005 field season, sampling events at the mine site will occur once in July and once in late August. This will include two soil and terrestrial vegetation sampling events and one aquatic vegetation sampling event (August only). The soil sampling event in August will include only locations that are determined to be necessary for further data evaluation.

4. Project Organization and Responsibility

The soil and vegetation sampling events will be conducted by SLR under direct contract to NDM. The following organizational chart outlines project management roles and responsibilities.



5. 2005 Sampling Program

The 2005 field sampling season will consist of two sampling events. During each sampling event, primary and quality control (QC) samples of soil and vegetation will be collected. In both July and August, approximately 88 soil samples will be collected at the mine site. During July, approximately 78 upland vegetation samples will be collected, while approximately 90 upland vegetation samples will be collected in the August (the additional 20 samples represent berry or fruit samples). During each sampling event, at 10 percent of the locations, duplicate (QC) and triplicate (QA) soil and vegetation samples will be collected. For collection of soil and vegetation samples, equipment blanks will also be prepared at a frequency of 5 percent of the primary samples. The sampling matrix is summarized in Table 2.

TABLE 2. 2005 SAMPLING SUMMARY

| Medium | Number of Samples | Sampling Frequency | Number of Primary Samples | Number of Duplicates (QC Samples) | Number of Triplicates (QA Samples) | Total Lab Samples |
|------------------------|--------------------|--------------------|---------------------------|-----------------------------------|------------------------------------|-------------------|
| Surface Soil | 80 | 2 | 160 | 9 | 9 | 196 |
| Subsurface Soil | 8 | 2 | 16 | 1 | 1 | 20 |
| Terrestrial Vegetation | 78/98 ¹ | 2 | 176 | 9 | 9 | 212 |
| Aquatic Vegetation | 18 | 1 | 18 | 2 | 2 | 22 |

1. Values reflect July and August sampling events without/with the additional 20 samples in August representing berries.

Before sampling begins, general sample locations in sections selected from the random grid system will be translated into longitude/latitude coordinates and transferred to a navigational GPS on the helicopter. Geographic coordinates collected for each sampling location will be recorded in a format compatible with the existing geographical information system (GIS) for the project to allow creation of maps depicting sampling locations.

The field team will use the helicopter to locate each section, where up to three sample locations will be staked, flagged, marked with the sample identification, and recorded by GPS. Field teams will begin sample collection immediately after the locations are recorded.

6. Sample Collection and Handling

These requirements are designed to maximize sample quality and to meet the stated data-quality objectives for the project (e.g., precision, accuracy, comparability, completeness, and representative quality). Sample methodologies and procedures for each type of environmental media to be encountered are described below.

Sampling for this project will be conducted in accordance with U.S. Environmental Protection Agency (EPA) and Alaska Department of Environmental Conservation guidelines for quality assurance and quality control (QA/QC). Procedures for compliance with QA/QC requirements are described in the Pebble Project *Draft Environmental Baseline Studies, 2005 Final Quality Assurance Project Plan* (NDM, 2005).

In all cases, sample collection procedures will be followed to minimize contamination of samples, to prevent cross-contamination between samples, and to ensure sample validity by following proper preservation and storage procedures in the field.

Photo documentation of each sample site will be done.

6.1 Sampling Procedures

6.1.1 Surface Soil Sampling

One surface soil sample will be collected at each sample location during one of the two sampling events. Surface soil samples will be collected to a depth of 0.5 feet using hand tools, such as stainless steel or disposable polyethylene shovels or trowels. If an organic mat occurs at the surface, the mat will be removed before the soil sample is collected. The field sampling team will remove rocks and twigs from the samples. For each sample, an 8-ounce (oz) jar will be filled, if possible, or at least 50 grams will be collected (a minimum of 25 grams is necessary to meet laboratory requirements for data quality objectives [DQOs]). As described in the Pebble Project 2005 quality assurance project plan (QAPP; NDM, 2005), equipment blanks for soil media will be prepared at a frequency of 5 percent (1 for every 20 samples) using a deionized-water rinse after an Alconox wash. This will be done for the total metals analyses only, consistent with the QAPP.

The investigation-derived waste is expected to consist of sampling waste. This waste will be disposed of as follows:

- Sampling waste—which could include used nitrile gloves, plastic baggies, tape, paper towels, plastic wrapping, and aluminum foil—will be transported to and disposed of in Iliamna in approved receptacles.
- Excess sampling media—which could include removed soil—will be returned to the sample location and raked level after sampling.

6.1.2 Subsurface Soil Sampling

All soil sampling will once per sampling location, either in July or August 2005, concurrent with vegetation sampling events. Soil and vegetation samples will be co-located.

At approximately 10 percent of the surface-soil sample locations (eight locations), deeper samples, from the 0.5- to 1.5-foot interval, will be collected using hand tools, such as stainless steel or disposable polyethylene shovels or trowels. The field sampling team will remove rocks and twigs from the soil samples. For each sample, an 8 oz jar will be filled if possible, or at least 50 grams of subsurface soil will be collected (minimum for DQO is 25 grams). Equipment blanks will be prepared as discussed above for surface soils and at the same frequency.

Appropriate numbers of samples will be collected based on the areal extent of the basic habitat types. It is likely that no more than one subsurface sample will be collected from each habitat type.

The investigation-derived waste is expected to consist of sampling and storage devices, including nitrile gloves, plastic baggies, tape, paper towels, plastic wrapping, and aluminum foil. These wastes will be transported to and disposed of in Iliamna in approved receptacles.

Excess sampling media, which could include excavated soil, will be returned to the sample location and raked level after sampling.

6.1.3 Terrestrial Vegetation Sampling

Sampling for vegetation in 2005 will occur in two events, one in July and one in August. These vegetation sampling events will be concurrent with soil sampling events and, during August, will focus mostly on collecting berries not available during the July sampling event. Vegetation samples will be collected from the same locations as soil samples.

At the mine site, plant uptake of trace elements is the mechanism of most interest to the trace-elements characterization program. The purpose of two separate vegetation sampling periods is to address the different browse available in July and in August. For example, in early summer, willow shrubs have new growth and are beginning to flower, while in the fall, fruits have developed on the plants. Trace-element uptake into berries differs from uptake into new growth. As a result, the dietary concentrations of trace elements in edible plant parts is likely different throughout the growing season and can be characterized by the two sampling periods.

At each sample site, a sample plot encompassing a 10-foot radius from the soil sample location will be designated. Within each sample area, the vegetation species present will be documented. Four to eight species at each location will be sampled and may include moss, lichen, grass, shrub, or berry-producing plants, depending on the type and density present.

Both vegetation and berry samples will be collected, where available. It is expected that berry samples will be available only in the August sampling event. Non-woody material will be collected from the plants to ensure that edible portions of the plant species are analyzed (leaves and browsable twigs and shoots will be aggregated, and berries and fruits will be kept separate from vegetative plant material). Material will be collected from the plants using stainless steel clippers and nitrile-gloved hands; the material will be placed into sealed plastic bags.

To evaluate the contribution of metals to the sample from use of stainless steel clippers, an equipment blank of deionized water used to rinse the blade between samples will be collected and analyzed for trace elements. A similar blank will be collected from the blades used to homogenize the plant samples and analyzed by the laboratory. Where possible, each sample will represent a composite of approximately 50 grams within a taxonomic group (genus or species) from at least three plants. The analytical method requires at least 25 grams to meet DQOs.

Each sample will represent a taxonomic group (genus or species) identified at the mine site in 2004 surveys. In 2004, few trees were present at the mine site. Wherever possible, willows will be sampled as representative of tree species. Primary species to be sampled include fireweed (representing forbs), various species of sedges, caribou moss (representing lichens), green terrestrial moss (represent mosses), and bog blueberry and willow (representing shrubs). Selection of these particular species was based on overall dominance, bio-uptake potential, use as wildlife forage, and/or subsistence use.

The investigation-derived waste is expected to consist of sampling and storage devices, including nitrile gloves, plastic baggies, tape, paper towels, plastic wrapping, and aluminum foil. These wastes will be transported to and disposed of in Iliamna in approved receptacles.

Excess sampling media, which could include removed vegetative tissue, will be returned to the sample location and made level with a shovel after sampling.

6.1.4 Aquatic Vegetation Sampling

One aquatic vegetation event is scheduled for 2005. This will occur in August, concurrent with the second soil and terrestrial vegetation sampling events.

Aquatic vegetation samples will be collected from four to six lakes and ponds. Where possible, these lakes and ponds will be the same as those to be sampled by HDR Alaska, Inc., as part of their sediment sampling program. Methods will be similar to those outlined above for terrestrial vegetation, with one major difference. Human subsistence use and moose browse include the roots and tubers of aquatic plants; therefore, where feasible, roots and tubers of aquatic plants will be collected in addition to vegetative portions above the water-line. Vegetative portions above the water-line will be kept separate from roots and tubers for analysis.

Different tools than those used for terrestrial plant collection may be necessary to clip and collect aquatic vegetation, depending on the location of the vegetation (e.g., edge of lake versus deeper areas) and the type of plant (e.g., grasses need to be clipped at the sediment surface, while flowering plants can be clipped above the water surface, if sufficient mass is available). Above-water samples will be collected with nitrile-gloved hands and/or stainless steel clippers. Approximately 100 grams of edible browse above the water-line or sediment layer will be collected at each selected sampling point and placed into sealable plastic bags.

For roots and tubers, either the entire plant will be pulled out of the lake/pond and the roots and tubers collected, or a shovel or similar device will be used to pull out the roots and tubers for collection.

The investigation-derived waste is expected to consist of sampling and storage devices, including nitrile gloves, plastic baggies, tape, paper towels, plastic wrapping, and aluminum foil. These wastes will be transported to and disposed of in Iliamna in approved receptacles.

Excess sampling media, which could include removed vegetative tissue, will be returned to the sample location after sampling.

6.2 Sampling Equipment Decontamination

All non-disposable sample-collection equipment that comes into contact with a sample will be decontaminated by means specified in the 2005 QAPP (NDM, 2005). At a minimum, sampling-equipment decontamination will consist of the following:

1. Rinse in tap water or deionized water.
2. Wash with a solution of Alconox mixed with deionized water.
3. Double rinse in deionized water.

The purpose of the water and Alconox wash is to remove all visible particulate matter. The deionized-water rinse removes the detergent. These procedures will be followed between samples. Gloves will also be changed between samples to prevent possible cross-contamination.

6.3 Sample Handling

During each sampling event, Shaw Alaska Inc. (Shaw) will have one to three field staff stationed in Iliamna. All analytical samples will be delivered to the Shaw field staff, who will pack and ship the samples to the appropriate laboratory in accordance with the procedures outlined in the 2005 QAPP (NDM, 2005). To preserve soil and vegetation sample integrity from collection to receipt by Shaw, all coolers will contain blue ice in accordance with the QAPP.

6.3.1 Sample Volumes, Container Types, and Preservation Requirements

The appropriate number and type of sample bottles/containers will be ordered from the relevant laboratories prior to each sampling event. Surface and subsurface soil samples will be collected in accordance with Table 3, which shows volume, container type, and preservation measures.

TABLE 3. SAMPLE BOTTLE SCHEDULE AND SAMPLING PARAMETERS FOR SOIL COLLECTION

| Bottle Type (SGS) | Bottle Type (CAS) | Analysis | Preservative ³ | Hold Time | Required Temp |
|-------------------|-------------------|--------------------------------|---------------------------|---|---------------|
| (1) 8 oz | (1) 8 oz | Diesel/residual range organics | None | 14 days to extraction, 40 days to analysis of extract | 4°C |
| (1) 8 oz | | Total metals ¹ | None | 6 Months | None |
| | | Total mercury | None | 28 Days | 4°C |
| | | Cyanide | None | 28 Days ² | 4°C |
| (1) 4 oz | (1) 4 oz | Ammonia as N | None | 28 Days | 4°C |
| (1) 8 oz | (1) 8 oz | Chloride, fluoride, sulfate | None | 28 Days | 4°C |
| (1) 4 oz | (1) 4 oz | Total organic carbon | None | 180 Days | 4°C |

oz – ounce: lab weighed and tared

1. Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Sb, Se, Sn, Ti, Zn

2. As per EPA methods factsheet titled “Total Petroleum Hydrocarbons, Reactive Cyanide, Reactive Sulfide, Ignitability, and Corrosivity”

3. Holding time is from the date of preparation.

Aquatic and terrestrial vegetation samples will be collected in accordance with Table 4, which shows volume, container type, and preservation measures.

TABLE 4. SAMPLE BOTTLE SCHEDULE AND SAMPLING PARAMETERS FOR VEGETATION COLLECTION

| Tissue Type | Minimum Sample Amount (grams) | Container Type CAS/NCA) | Analysis | Lab Method | Hold Time | Required Temp |
|-------------|-------------------------------|-------------------------|---------------------------|--------------|----------------------|---------------|
| Vegetation | 25 | Sealable plastic bag | Total Metals ¹ | SW6010B/6020 | 6 Months | None |
| | | | Total Cyanide | None | 28 Days ² | 4°C |
| | | | Mercury (total) | SW7471 | 28 Days | 4°C |

1. Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Pb, K, Mg, Mn, Mo, Na, Ni, Sb, Se, Sn, Ti, V, Zn

2. As per EPA methods factsheet titled “Total Petroleum Hydrocarbons, Reactive Cyanide, Reactive Sulfide, Ignitability, and Corrosivity”

6.3.2 Sample Identification

Each sample container will have a waterproof label large enough to contain the information needed to easily identify each sample. The information to be included on each label will include the project name, date, time, preservative (if added), sample identification code, analysis, and

sampler’s initials. Each sampling location also will be identified by the sampler on a field form. The sample identification codes will be formatted to indicate sample date (month and year), location, matrix, and number, as follows:

0105CR199ASL001

Where:

- 0105 is the date as month/year
- CR199A is the location identification
- SL is the matrix code for surface soil
- 001 is a sequential sample number

The matrix codes to be used:

- SL – Surface soil
- SS – Subsurface soil
- TP – Terrestrial plant tissue
- AP – Aquatic plant tissue

For field duplicates, the sequential sample number will be 201, and for triplicates it will be 301.

For vegetation samples, a two- or three-letter code for each species will be added as a suffix to the sample identification code—for example, 0804TE12TP001Pm is a sample of *picea mariana* (or black spruce) from location TE12 collected in August 2004. The two- or three-letter suffixes to be used for sample designation are listed in Tables 5 and 6.

TABLE 5. TERRESTRIAL PLANT SPECIES NAMES AND ID SUFFIXES

| COMMON NAME | SPECIES NAME | SAMPLE ID SUFFIX |
|----------------------------|----------------------------|------------------|
| Trees | | |
| Black spruce | <i>Picea mariana</i> | Pm |
| White spruce | <i>Picea glauca</i> | Pg |
| Mountain hemlock | <i>Tsuga mertensiana</i> | Tm |
| Quaking aspen | <i>Populus tremuloides</i> | Pt |
| Paper birch (Kenai birch) | <i>Betula papyrifera</i> | Bp |
| Shrub birch | <i>Betula nana</i> | Bn |
| Balsam poplar | <i>Populus balsamifera</i> | Pb |
| Common juniper | <i>Juniperus communis</i> | Jc |
| Mountain alder/Sitka alder | <i>Alnus crispa</i> | Ac |
| Shrub or dwarf birch | <i>Betula nana</i> | Bn |

| COMMON NAME | SPECIES NAME | SAMPLE ID SUFFIX |
|----------------------------------|---|------------------|
| Prickly rose | <i>Rosa acicularis</i> | Ra |
| Tundra rose | <i>Dasiphora floribunda</i> | Df |
| Trailing black currant | <i>Ribes laxiflorum</i> | RI |
| Northern red currant | <i>Ribes triste</i> | Rt |
| Skunk or northern black currant | <i>Ribes glandulosum or hudsonianum</i> | Rg or Rh |
| Bog blueberry | <i>Vaccinium uliginosum</i> | Vu |
| Early blueberry | <i>Vaccinium ovalifolium</i> | Vo |
| Feltleaf willow | <i>Salix alaxensis</i> | Sa |
| Barren-ground willow | <i>Salix brachycarpa</i> | Sb |
| Diamond-leaf willow | <i>Salix planifolia</i> | Sp |
| Willow (species not identified) | <i>Salix sp.</i> | Ssp |
| Shrubby cinquefoil (tundra rose) | <i>Dasiphora floribunda</i> | Df |
| Red-fruit bearberry | <i>Arctostaphylos rubra</i> | Ar |
| Bog rosemary | <i>Andromeda polifolia</i> | Ap |
| Rusty menziesii | <i>Menziesia ferruginea</i> | Mfe |
| Canadian burnet | <i>Sanguisorba canadensis</i> | Sca |
| Dwarf dogwood | <i>Cornus canadensis</i> | Cc |
| Salmonberry | <i>Rubus spectabilis</i> | Rs |
| Elderberry | <i>Sambucus racemosa</i> | Sr |
| Narrow leaf Labrador tea | <i>Ledum palustre</i> | Lp |
| Sweet gale | <i>Myrica gale</i> | Mg |
| Crowberry | <i>Empetrum nigrum</i> | En |
| Lingonberry (low bush cranberry) | <i>Vaccinium vitis-idaea</i> | Vv |
| Grasses | | |
| Alaska cotton or cotton grass | <i>Eriophorum scheuchzeri</i> | Es |
| Beach rye | <i>Leymus mollis</i> | Lm |
| Sedge (species not identified) | <i>Carex sp.</i> | Ss |
| Short stalk sedge | <i>Carex microchaeta</i> | Cm |
| Northern water sedge | <i>Carex aquatilis</i> | Ca |
| Blue joint grass | <i>Calamagrostis sp.</i> | Cs |

| COMMON NAME | SPECIES NAME | SAMPLE ID SUFFIX |
|------------------------------|--------------------------------|------------------|
| Forbs | | |
| Worm wood | <i>Artemisia tilesii</i> | At |
| Fireweed | <i>Chamerion angustifolium</i> | Ca |
| Cloudberry | <i>Rubus chamaemorus</i> | Rc |
| Wild celery (putchkie) | <i>Angelica genuflexa</i> | Ag |
| Iris | <i>Iris setosa</i> | Is |
| Cow parsnip | <i>Heracleum maximum</i> | Hm |
| Lupine | <i>Lupinus nootkatensis</i> | Ln |
| Sour dock | <i>Rumex arcticus</i> | Rar |
| Wild rhubarb | <i>Polygonum alaskanum</i> | Pa |
| False hellebore | <i>Veratrum viride</i> | Vvi |
| Eskimo potato | <i>Hedysarum alpinum</i> | Ha |
| Wild sweet pea | <i>Hedysarum mackenzii</i> | Hm |
| Marsh five finger | <i>Comarum palustre</i> | Cp |
| Beautiful Jacob's ladder | <i>Polemonium pulcherrimum</i> | Ppu |
| Fringed willow herb | <i>Epilobium ciliatum</i> | Epc |
| Monkshood | <i>Aconitum delphinifolium</i> | Ad |
| Partridgefoot | <i>Luetkea pectinata</i> | Lpe |
| Alaska spirea | <i>Spiraea stevenii</i> | Sst |
| Trailing raspberry | <i>Rubus pedatus</i> | Rp |
| Northern yarrow | <i>Achillea borealis</i> | Ab |
| Golden rod | <i>Solidago decumbens</i> | Sd |
| Star flower | <i>Trientalis europea</i> | Te |
| Rose root/stone crop | <i>Rhodiola rosea</i> | Sro |
| Devil's club | <i>Opolopanax horridus</i> | Oh |
| Beach lovage | <i>Ligusticum scoticum</i> | Ls |
| Horse tail | <i>Equisetum pratense</i> | Ep |
| Ferns and Fern Allies | | |
| Lady fern | <i>Athyrium filix-femina</i> | Af |
| Spreading wood fern | <i>Dryopteris expansa</i> | De |

| COMMON NAME | SPECIES NAME | SAMPLE ID SUFFIX |
|-----------------------------------|----------------------------------|------------------|
| Mosses | | |
| Green terrestrial moss | <i>Ptelium crista casttensis</i> | Pcc |
| Club moss | <i>Lycopodium annotinum</i> | La |
| Stair-step moss | <i>Hylocomium splendens</i> | Hs |
| Lichens | | |
| Reindeer lichen or caribou "moss" | <i>Cladina rangiferina</i> | Cr |

TABLE 6. AQUATIC PLANT SPECIES NAMES AND SUFFIXES

| COMMON NAME | SPECIES NAME | SAMPLE ID SUFFIX |
|-----------------------------------|--|------------------|
| Yellow pond lily | <i>Nuphar polysepalum</i> | Npo |
| Water hemlock | <i>Cicuta douglasii</i> | Cdo |
| Mare's tail | <i>Hippuris vulgaris</i> | Hvu |
| Coon's tail or hornwort | <i>Ceratophyllum demersum</i> | Cde |
| Narrow-leaved bur-reed | <i>Sparganium angustifolium</i> | San |
| Giant bur-reed | <i>Spariganium eurycarpum</i> | Seu |
| Common cattail | <i>Typha latifolia</i> | Tia |
| Broad-leaved water plantain | <i>Alisma plantago-aquatica</i> | Apa |
| Arum-leaved arrowhead | <i>Sagittaria cuneata</i> | Scu |
| Water smartweed | <i>Polygonum amphibium</i> | Ppe |
| Clasping-leaf pondweed | <i>Potamogeton perfoliatus</i> | Sp |
| Fries' pondweed | <i>Potamogeton friesil</i> | Pfr |
| Thread-leaved pondweed | <i>Potamogeton filiformis</i> | Pfi |
| Vernal water-starwort | <i>Callitriche verna</i> | Cve |
| Spiked water-milfoil | <i>Myriophyllum spicatum</i> | Msp |
| Large-leaved white water-crowfoot | <i>Ranunculus aquatilis</i> | Raq |
| Yellow water-crowfoot | <i>Ranunculus gmelinii</i> | Rgm |
| Common duckweed | <i>Lemna minor</i> | Lmi |
| Bladderwort | <i>Utricularia (vulgaris, minor or intermedia)</i> | Utr |

6.4 Sample Custody

Sample custody procedures will be followed in the field, in the laboratory, and during transport. The procedures take into account the nature of the samples, the maximum holding times, and shipping options from Iliamna to the laboratories.

Once collected, the samples will remain within sight of the sampler or will be secured until the samples are handed over to and prepared for shipment by Shaw personnel. Samples collected by SLR will be yielded to Shaw field staff at the end of each sampling day. SLR will have labeled each sample with the following:

- SLR's name.
- Sample or location identification.
- Sample data and time.
- Required analyses.
- Sample type: primary, duplicate (QC), triplicate (QA).

Shaw field staff will prepare the chain-of-custody (COC) form and labels using E-chain (an electronic COC application). They will also be responsible for packaging and shipping samples to the appropriate laboratories. SLR is responsible for providing Shaw with sufficient frozen blue ice and packaging materials to properly transport samples collected during each sampling event.

Each time a sample cooler changes hands, both the sender and the receiver will sign and date the COC form. The laboratory will forward the original to the analytical QA/QC manager. Shaw's field team will verify all COC forms before sample shipment and will make a copy of each to maintain a duplicate set of records. The following information is to be included on the COC form:

- Sample identification code.
- Signature of sampler.
- Date and time of collection.
- Project name.
- Type of sample.
- Number and type of containers.
- Sample preservation method.
- Sample analysis requested.
- Inclusive dates of possession.
- Signature of receiver.

The consulting company's name, addresses, and phone number is required on the COC. Laboratories will be instructed to invoice NDM and to mail reports to:

Jane Whitsett
Shaw Alaska Inc.
2000 West International Airport Road, Suite A-11
Anchorage, AK 99502

Other COC components will include sample labels, field notebooks, sample shipment receipts, and the laboratory logbook.

6.5 Field Quality Control Samples

6.5.1 Field Duplicates

Field duplicate samples will be collected at 10 percent of soil and vegetation sample locations. See Section 5 for specific number of duplicates planned for collection in each medium.

6.5.2 Field Triplicates

Field triplicate samples will be collected at 10 percent of soil and vegetation sample locations. See Section 5 for specific number of triplicates planned for collection in each medium.

7. Measurement of Field Parameters

7.1 Parameters

At each sample site, plants and soil types will be identified and approximate ambient temperature and weather conditions will be recorded.

7.2 Equipment Calibration and Field-Procedures Quality Control

No equipment requiring calibration will be used for the trace elements soil and vegetation sampling program.

The field team leader will review data measured in the field, and senior personnel will perform final validation by checking procedures used in the field and reviewing field forms for completeness and accuracy. The field team leader is responsible for ordering appropriate corrective actions when deemed necessary. All field corrective actions will be recorded in the field logbook.

7.3 Equipment Maintenance and Decontamination

Field team managers are responsible for field equipment testing, inspection, and maintenance decisions. Equipment will be maintained in good operating condition. Sampling equipment will be decontaminated as detailed in Section 6.2.

8. Record Keeping

The field team leader will be responsible for overseeing that adequate detail is recorded on the field forms. The forms will contain sufficient information so that all field activity can be reconstructed without relying on the memory of the field crew.

8.1 Field Logbooks

Field forms will be the primary method of record keeping; however, each sampling team may also keep a separate field logbook for additional notes.

8.2 Field Forms

A modified version of CH2M Hill's 2004 field forms will be used during the 2005 sampling events. All pertinent field survey and sampling information will be recorded on field forms during each day of the field effort and at each sample site. Comprehensive information on the sampling site and respective samples collected at each site will be recorded by the field crew. This information includes site and sampling GPS positions, field observations, field measurements, sample identification, sample duplicates, and date and time the samples were collected.

Field forms will be maintained for each task. Field forms will consist of waterproof pages, written in indelible ink, with every appropriate area marked. All corrections will consist of initialed, single-line-out deletions, and blank pages will be marked as such with a diagonal line across the page, when appropriate.

Strict custody procedures will be maintained with the field forms used. No accountable documents will be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. While being used in the field, forms will remain with the field team and will be secured on a clip board or, at a minimum, with rubber bands at all times.

The field team leader will review all data before leaving the sampling station. Upon completion of the field effort, forms will be filed in an appropriately secure manner in a notebook labeled "original data." These forms will remain with the task manager. Photocopies of the original data will be used as working documents. Completed field forms will be kept on file for future reference.

9. Field Performance and System Audits

SLR will perform field performance and system audits at a minimum during one soil and one vegetation sampling event. The field performance and system audit will be conducted by a senior-level SLR employee. The audit will evaluate if field procedures are being correctly implemented and will also identify any additional measures that may be taken to improve field data collection, as warranted.

10. References

CH2M Hill. 2004. Baseline Environmental/Impact Assessment Studies for Trace Elements Work Plan. Prepared for Northern Dynasty Mines Inc., by CH2M Hill. October 2004.

Northern Dynasty Mines Inc. (NDM). 2005. Draft Environmental Baseline Studies, 2005 Final Quality Assurance Project Plan.

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