



**Vegetation Sampling and
Analysis Plan**

Haul Road Fugitive Dust Study

Red Dog Mine, Alaska

Prepared for

Teck Cominco Alaska Inc.
Anchorage, Alaska



Vegetation Sampling and Analysis Plan

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Acronyms and Abbreviations

DMTS	Delong Mountain Transportation System
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
the haul road	Delong Mountain Transportation System Road
IDW	investigation-derived waste
NPS	National Park Service
the port	DMTS Port facility
SAP	sampling and analysis plan
SOP	standard operating procedure

Vegetation Sampling and Analysis Plan

Haul Road Fugitive Dust Study

Introduction

The Red Dog Mine is located approximately 50 miles east of the Chuckchi Sea, in the western end of the Brooks Range of northern Alaska (see Figure 1). Ore containing lead and zinc is milled at the Red Dog Mine to produce lead and zinc concentrates in a powder form. These concentrates are hauled year-round from the Red Dog Mine via the Delong Mountain Transportation System (DMTS) Road (the haul road) to concentrate storage buildings at the DMTS Port facility (the port), where they are stored for later loading onto ships during the summer months.

The haul road is a 52-mile long, 30-ft wide all-weather gravel-surface overland haul road connecting the Red Dog Mine with the port (see Figure 2). The road was constructed in 1987–1988 using a 6-ft-thick gravel bed laid over a geotextile mat placed directly on the original ground surface. The haul road includes nine bridges spanning drainages along the way between the port and the Red Dog Mine. The DMTS is owned by Alaska Industrial Development and Export Authority, which has contracted with Teck Cominco for its use, operation, and maintenance (NPS 2001).

Although fugitive dust control has been a high priority over the years, some releases have occurred along the DMTS haul road as indicated by the National Park Service (NPS) moss data from 2000 (Ford and Hasselbach 2001). Cominco is in the process of implementing additional dust control measures, including truck washing, new trucks, stilling curtains in the truck dumping bin, and potentially a new road surface (Hi-Float).

The objective of this sampling program is to expand on the moss sampling work conducted by NPS in order to broaden the understanding of potential ecological effects of fugitive dust from the Red Dog Mine, the port, and the haul road. This sampling program is designed to establish a relationship between moss sample results and sample results for other forage species, and to link vegetation sampling stations with road dustfall collection and road surface sampling stations (see Exponent 2001b) in order to facilitate evaluation of source/receptor relationships. As part of the program described herein, moss samples will be collected using collection and processing methods similar to those used by NPS (Hasselbach 2001, pers. comm.), including collecting the same species of moss. The vegetation sampling will be expanded to include other wildlife forage species that were not sampled as part of the NPS study. The vegetation sampling outlined in this sampling and analysis plan (SAP) is considered to constitute the preliminary phase of the ecological effects evaluation. A second phase of work may be conducted next year, if warranted, based on the results of this investigation.

This SAP describes sampling work for collection of vegetation (moss, lichen, willow, and berries) along transects perpendicular to the haul road, near former spill areas along the haul

road, and within the port operations area. Sampling of the road surface itself, materials used for resurfacing the road, and water used for dust control on the road will also be performed, as described in the road SAP (Exponent 2001b). Laboratory testing and analysis of plant matter will be performed for inorganic chemical parameters (e.g., metals). All sampling activities and laboratory work will be conducted in general accordance with the U.S. Environmental Protection Agency's (EPA's) *Environmental Investigations, Standard Operating Procedure and Quality Assurance Manual* (U.S. EPA 1997). Specific methods for performing field tasks are described in the following sections.

The SAP is organized into the following sections:

- Introduction
- Vegetation Sampling Methods
- Haul Road Vegetation Sampling Locations
- Port Site Vegetation Sampling Locations
- Spill Site Vegetation Sampling Locations
- Equipment Decontamination
- Sample Identification System
- Field Data Reporting
- Analytical Methods
- Disposal of Investigation-derived Waste
- Field Schedule
- References.

In addition, a health and safety plan is provided in Appendix A and a standard operating procedure (SOP) is provided in Appendix B.

Vegetation Sampling Methods

For consistency with previous moss sampling conducted by NPS, collection methods used by NPS researchers will be followed in this sampling effort, with some minor modifications. The target moss species for collection is the stair-step moss (*Hylocomium splendens*). A single sample of moss will be collected from designated sample locations (see Tables 1–3). Moss samples will be collected, aged, and processed in accordance with established NPS procedures. These procedures will be conveyed to Exponent sampling team members by a member of the summer 2001 NPS crew in one or more training sessions held prior to the start of the sampling event. Sample collection and handling will be performed using powderless latex or Nitrile

gloves and forceps. Samples will be returned from the field to a processing tent¹ where they will be picked clean of debris and transferred to pre-labeled Ziploc™ storage bags bearing a unique sample identification number (as described in the section entitled *Sample Identification System*). After collection of each sample, the containers will be sealed and placed on ice. Chain-of-custody forms will be completed and signed by the field representative and shipped with the samples to the analytical laboratory. Sample packaging and chain-of-custody procedures are provided in SOP 2 (Appendix B). Samples will not be air-dried onsite prior to shipment to the analytical laboratory, as discussions with laboratory staff (Eric Crecelius, Batelle Marine Sciences Laboratory, Sequim, Washington) have indicated that analytical results will not be affected if samples are not air-dried. At approximately 5 percent of the sample locations (i.e., 4 stations), a second moss sample will be collected as close as possible to the original sample to serve as a field duplicate. The randomly selected sites for collection of field duplicates are identified in Tables 1–3.

Designated sampling locations will be located in the field using global positioning system (GPS) equipment. Upon reaching the pre-determined sampling location, the sample of *H. splendens* will be collected from within a 2-m radius of the sample location. If sufficient moss is not found within a 2-m radius, the two-person sampling crew should separate and walk away from the designated sampling location in opposite directions perpendicular to the original transect, but at the same distance from the haul road as the original location. For example, if no sample can be found at a transect point 100 m from the haul road, the crew should walk, in both directions, a strip perpendicular with the original transect lying 100 m from the haul road. If, after walking for a pre-determined search time, such as 15–20 minutes, the team members have not found a sufficient moss sample, they should move 5–10 m more distant from the road and walk a second strip back toward the original sampling location while still searching for vegetation samples. Samples found as close as possible to the originally designated sampling location should be collected for analysis, and a GPS reading should be taken at the alternate location and noted in the field logbook. If no sample can be located along either the outbound or inbound search strip, then vegetation collection will not be performed at that location and shall be so noted in the field notebook. Due to the limited time available for performing the fieldwork, alternative sampling stations will not be used in the event that a vegetation sample is not obtainable at the originally identified location. No soil samples will be collected at vegetation sampling locations, as the focus of this investigation is on metal concentrations in plants, not their relationship to soil concentrations. A GPS recording will be taken at the location ultimately used to collect the moss sample, and the co-ordinates will be noted in the field notebook. The location will also be identified with a flagging stake in case re-sampling is required at a later date.

At a subset of moss sampling locations, as denoted in Tables 1–3, sampling of other plant species will also be conducted. Sampling will target three plants: willows (*Salix* spp., leaves only), reindeer lichen (*Cladina* spp.), and berries. The exact species of berries to be collected will need to be determined by field crews based on an initial reconnaissance. However, the species most likely to be present include blueberry (*Vaccinium* spp.), crowberry (*Empetrum nigrum*) and possibly salmonberry (*Rubus chamaemorus*) in areas near the coast. Sample

¹ Protocols for prevention of cross contamination when entering or working in the processing tent will be determined during onsite training of field crews.

collection and handling will be performed using powderless latex or Nitrile gloves and forceps or scissors. Samples will be returned from the field to a processing tent where they will be picked clean of debris and transferred to pre-labeled Ziploc™ storage bags (for willow and lichen samples) or pre-cleaned, wide-mouth glass jars with Teflon®-lined lids (for berry samples) bearing a unique sample identification number. After collection of each sample, the containers will be sealed and placed on ice. Chain-of-custody forms will be completed and signed by the field representative and shipped with the samples to the analytical laboratory. Sample packaging and chain-of-custody procedures are provided in SOP 2 (Appendix B). The procedure for identifying locations for collection of these plant species shall be the same as that used for moss collection; starting within 2 m of the initial GPS location and moving to a strip transect search, if necessary, to find an adequate sample. A GPS recording will be taken at the location ultimately used to collect each plant sample, and the co-ordinates will be noted in the field notebook, although the locations will not be flagged. Due to the limited time available for performing the fieldwork, alternative sampling stations will not be used in the event that any or all of these other plant species are not obtainable at the originally identified location.

A helicopter will be used to transport field crews to transect points that are distant from the road (i.e., transect stations at 1,000 and 2,000 m from the road). If a helicopter is used, it should land at a sufficient distance from the proposed sampling location such that any dust blown into the air by the helicopter's rotors does not become re-deposited on the vegetation to be sampled. When field crews are searching for plants on foot, care must be taken to ensure that they do not step on plants to be sampled. Any vegetation that is crushed under foot by field crews should not be included in samples designated for chemical analysis.

Haul Road Vegetation Sampling Locations

Plant sampling will be conducted at each of the seven haul road stations where road surface core, shoulder soil, and dustfall samples are to be collected (Exponent 2001b). These seven stations (two near the port facility, three along the haul road, and two near the Red Dog Mine site) are listed in Table 1, and station locations are illustrated in Figure 2.

At all sampling locations, transects will be established perpendicular to the haul road, randomly oriented to lie either north or south of the road. Transect locations and orientations are shown on Figure 2. If, in the opinion of the field sampling crew, the transect location or orientation poses difficulties for sample collection, minor adjustments to the transect location may be made before sampling begins. All such deviations from this SAP should be noted in the field logbook and GPS coordinates of the new transect location should be recorded. At the three station locations near the port facility and the three station locations along the haul road, vegetation samples will be collected along the transect at distances of 3, 100, and 1,000 m from the roadway edge. Moss samples will be collected at all three points on all five of these transects. Other plant species (willow, lichens, berries) will be collected at one randomly selected transect in the port area and at one randomly selected transect on the section of the haul road between Cape Krusenstern National Monument and the Red Dog Mine facility boundary (Figure 2). For the two sampling transects near the Red Dog Mine facility, transects will have sampling points at four distances from the road: 3, 100, 1,000, and 2,000 m. These transects are extended in length to better characterize the extent of fugitive dust deposition on vegetation in the region of

the Red Dog Mine. Moss samples will be collected at all four points on both these transects. The three other plant species will be collected at all four points on one randomly selected transect (Figure 2). Moss samples from all seven transects will be analyzed for the following constituents: arsenic, lead, zinc, cadmium, calcium, aluminum, iron, and magnesium. Other vegetation samples will only be analyzed for lead, zinc, cadmium, and calcium. The total number of samples to be collected and the analyte list are summarized in Table 4.

Port Site Vegetation Sampling Locations

Vegetation sampling at the Red Dog port site will be conducted to better characterize the extent of fugitive dust dispersion and deposition within the port area and to supplement NPS data collected around the perimeter of the port boundary. Locations for vegetation sampling are based on the sampling grid established within the port area for the Air Sciences zinc and lead dust environmental deposition study conducted between 1998 and 2000. Based on the Air Sciences grid system, a total of 14 locations have been identified where moss sampling will be conducted (Table 2 and Figure 2). At each grid location, which will be located by GPS, the sample of *H. splendens* will be collected from within a 2-m radius of the sample location. If sufficient moss is not found within a 2-m radius, the sampling radius will be expanded in 1-m intervals up to a maximum of 20 m from the original sampling location until a sufficient sample has been obtained. If no sample can be located within a 20-m radius, then moss collection will not be performed at that location and shall be so noted in the field notebook. No soil samples will be collected at vegetation sampling locations. Other plant species (willow, lichens, berries) will be collected at four randomly selected locations where moss sampling also occurs, as denoted in Table 2. All plant samples collected will be analyzed for lead, zinc, calcium, and cadmium. The total number of samples to be collected and the analyte list are summarized in Table 4.

Spill Site Vegetation Sampling Locations

This component of the investigation involves collecting moss samples from 10 selected sites along the haul road where spills of ore materials have occurred. These 10 sites were selected as a representative mix of spills that occurred in winter and summer months (spills on snow versus on tundra), and for which sufficiently detailed information is available to locate them fairly precisely for sampling. The 10 selected locations are identified in Table 3 and Figure 2. At each spill site, the vegetation sampling crew will identify the spill location using the GPS coordinates listed in Table 3, and available spill records. At each spill location, a point approximately 10 m in the prevailing downwind direction of the spill location will be identified, and a sample of *H. splendens* moss will be collected from within a 2-m radius of that identified location. If sufficient moss is not found within a 2-m radius, the sampling radius will be expanded in 1-m intervals up to a maximum of 20 m from the original sampling location until a sufficient sample has been obtained. If no sample can be located within a 20-m radius, then moss collection will not be performed at that location and shall be so noted in the field notebook. No soil samples will be collected at vegetation sampling locations. No other plant species will be collected at the spill sites. All moss samples collected will be analyzed for lead,

zinc, calcium, and cadmium. The total number of samples to be collected and the analyte list are summarized in Table 4.

Equipment Decontamination

All reusable sampling equipment will be decontaminated prior to collection of each sample. Procedures for management and disposal of waste generated during equipment decontamination are described in the section titled *Disposal of Investigation-derived Waste*.

In the field, when moving between sampling locations along a transect, forceps should be cleaned with deionized water sprayed from a squirt bottle and wiped dry with clean paper towels. In the processing tent, sampling equipment, such as forceps and stainless-steel bowls, will be washed using a scrub brush in a solution of Alconox and water. Following the wash, equipment will be rinsed in tap water, and then rinsed with deionized water from a spray bottle.

Sample Identification System

Each sample will be assigned a unique sample number. Samples will be numbered using the following nomenclature.

Haul Road Vegetation Sampling Locations

There are seven transects identified along the haul road where sampling will occur and which correspond with locations where road surface and dustfall samples will be collected. All haul road transect samples will be identified with a standard alphanumeric code format as follows: HR-aa-bb-c, where:

- HR = haul road sample
- aa = a two-digit number between 01 and 07 identifying the specific transect, where 01 designates the transect closest to the port facility and subsequently higher numbers designate the next occurring transect as one moves along the haul road from the port toward the Red Dog Mine site (see Figure 2)
- bb = a two-digit number between 01 and 04 that identifies the sampling point along the transect as follows:
 - 01: Sample collected at 3-m location
 - 02: Sample collected at 100-m location
 - 03: Sample collected at 1,000-m location
 - 04: Sample collected at 2,000-m location (only used at the two transects nearest the Red Dog Mine site)

- c = a one-letter code to identify the type of vegetation sample collected as follows:
 - M: moss (for the stations where a second moss sample is collected as a field duplicate, the code M2 should be used to designate the duplicate sample)
 - L: lichen
 - W: willow
 - B: berry
- Therefore, as an example, a moss sample collected at the 100-m location on the transect nearest the Red Dog Mine site would be assigned the sample identification number HR-07-02-M

Port Vegetation Sampling Locations

There are 14 grid co-ordinate locations within the port area where vegetation samples will be collected. All port area vegetation samples will be identified with a standard alphanumeric code format as follows: PO-aa-b, where:

- PO = Port area sample
- aa = A two-digit number between 01 and 24 identifying the specific grid sampling location, as identified on Figure 2
- b = a one-letter code to identify the type of vegetation sample collected as follows:
 - M: moss (for the stations where a second moss sample is collected as a field duplicate, the code M2 should be used to designate the duplicate sample)
 - L: lichen
 - W: willow
 - B: berry

Spill Site Vegetation Sampling Locations

There are 10 spill sites where vegetation sampling will occur. All spill sites have been identified by Teck Cominco with a numeric designation, as shown on Figure 2. All spill site vegetation samples will be identified with a standard alphanumeric code format as follows: SP-aa-M, where:

- SP = spill site area sample
- aa = the two-digit number assigned to the spill site by Teck Cominco (for sites numbered between 1 and 9, a leading zero should be added to the assigned spill site number) (see Figure 2)
- M = a one-letter code to identify the type of vegetation sample collected as a moss sample (only moss will be sampled at spill sites). For the stations where a second moss sample is collected as a field duplicate, the code M2 should be used to designate the duplicate sample.

Field Data Reporting

Sampling activities will be documented in a field log book. Detailed information to be recorded in the logbook will include:

- Date and time of sample collection
- Sample number
- Location of sample (e.g., mileage, GPS coordinate locations, spill site number, as appropriate)
- Sample type (i.e., plant species)
- Brief description of the habitat characteristics of the sampling location, noting the topography, approximate extent of vegetative coverage, plant species diversity, any incidental observations of wildlife species, and any other pertinent ecological information
- Photographs of the vicinity of the sample stations (not all sample locations need to be photographed), typical habitat types around sample locations, and unusual physical or ecological conditions at any sampling site should be obtained
- Weather conditions
- Description of any deviation from the SAP (as applicable)
- Personnel conducting the activity.

Quality assurance and quality control documentation, including sample tags and chain-of-custody forms, will be completed. Samples will be delivered to the analytical laboratory using standard chain-of-custody procedures.

Analytical Methods

The vegetation samples will be tested for metals. The number of inorganic constituents to be analyzed depends on the sample (refer to the sampling discussions in the previous sections). Analytical methods and sample volume requirements are summarized in the quality assurance project plan (Exponent 2001a).

All metals analyses for vegetation samples will be performed using EPA Method 6020 (inductively coupled plasma-mass spectrometry). Moss, willow, and lichen sample results will be reported by dry weight and berry sample results will be reported both by wet weight and dry weight.

Disposal of Investigation-derived Waste

Wastes generated during the sampling program are expected to be non-hazardous. Investigation-derived waste (IDW) generated during sampling is expected to include decontamination water containing residual solid materials and used personal protective equipment (e.g., gloves, paper towels). Liquid IDW generated from decontamination will be disposed of on the road surface. Solid IDW (e.g., used personal protective equipment) will be placed in plastic garbage bags and disposed of in the Red Dog Mine or port solid waste collection facilities.

Field Schedule

Week of 8/11–8/17	Two-person onsite crew	Dust collector installation Road surface sampling
Week of 8/18–8/24	Two-person onsite crew	Road surface sampling Material/water source sampling
	Two vegetation crews	Vegetation sampling Haul road spill site sampling
Week of 8/25–8/31	Two vegetation crews	Vegetation sampling

References

Exponent. 2001a. Quality assurance project plan, haul road fugitive dust study, Red Dog Mine, Alaska. Prepared for Teck Cominco Alaska Inc., Anchorage, AK. Draft. Exponent, Bellevue, WA.

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Figures

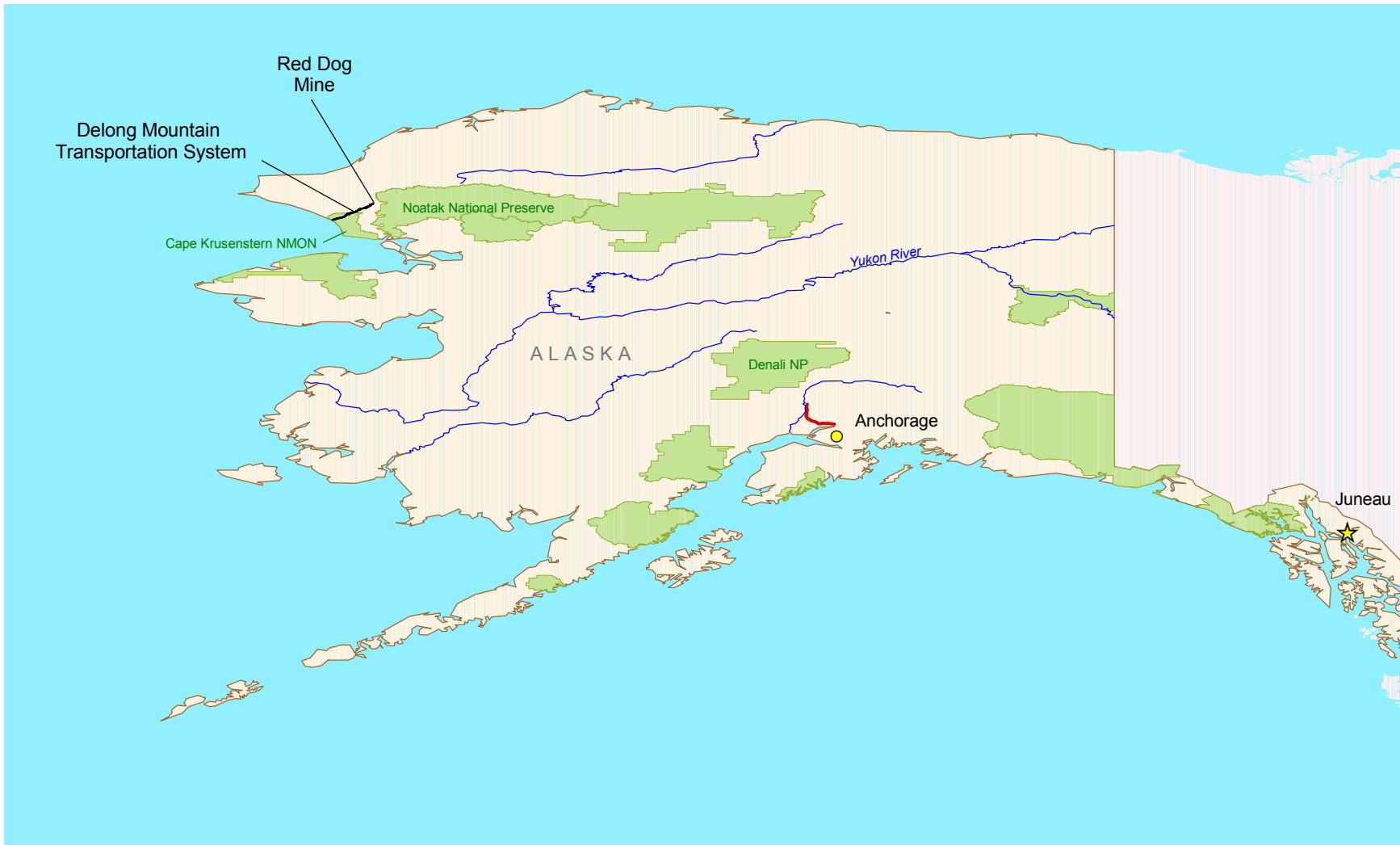


Figure 1. Location map

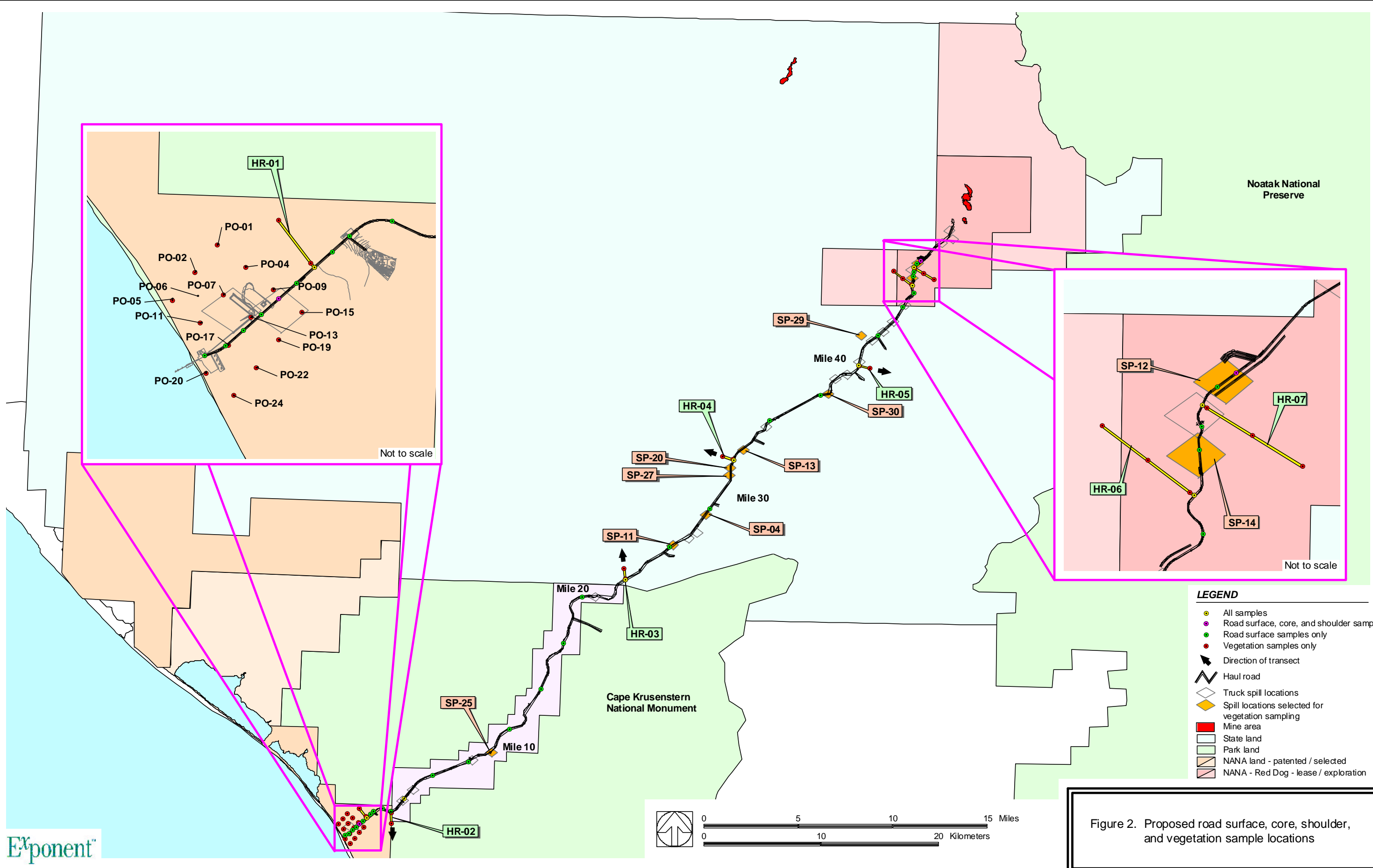


Figure 2. Proposed road surface, core, shoulder, and vegetation sample locations

Tables

Table 1. Planned haul road vegetation sample identifiers, coordinates, and species collection requirements

Station ID	Geographic Coordinates				Plant Sample to be Collected				
	X Degrees	X Minutes	Y Degrees	Y Minutes	Moss	Moss Duplicate Sample	Willow	Lichen	Berry
HR-01-01 ^a	-164	0.61	67	35.54	yes		b	b	b
HR-01-02 ^a	-164	0.70	67	35.58	yes		b	b	b
HR-01-03 ^a	-164	1.51	67	35.96	yes		b	b	b
HR-02-01 ^a	-163	57.71	67	35.86	yes		b	b	b
HR-02-02 ^a	-163	57.71	67	35.80	yes		b	b	b
HR-02-03 ^a	-163	57.62	67	35.33	yes		b	b	b
HR-03-01 ^a	-163	30.31	67	46.74	yes	yes	c	c	c
HR-03-02 ^a	-163	30.32	67	46.80	yes		c	c	c
HR-03-03 ^a	-163	30.50	67	47.28	yes		c	c	c
HR-04-01 ^a	-163	17.53	67	52.35	yes		c	c	c
HR-04-02 ^a	-163	17.66	67	52.36	yes		c	c	c
HR-04-03 ^a	-163	18.89	67	52.51	yes		c	c	c
HR-05-01 ^a	-163	2.61	67	56.77	yes		c	c	c
HR-05-02 ^a	-163	2.47	67	56.76	yes		c	c	c
HR-05-03 ^a	-163	1.21	67	56.66	yes		c	c	c
HR-06-01 ^a	-162	56.21	68	0.47	yes		d	d	d
HR-06-02 ^a	-162	56.32	68	0.50	yes		d	d	d
HR-06-03 ^a	-162	57.36	68	0.79	yes		d	d	d
HR-06-04 ^a	-162	58.47	68	1.10	yes		d	d	d
HR-07-01 ^a	-162	56.05	68	1.30	yes		d	d	d
HR-07-02 ^a	-162	55.93	68	1.27	yes	yes	d	d	d
HR-07-03 ^a	-162	54.82	68	1.03	yes		d	d	d
HR-07-04 ^a	-162	53.58	68	0.75	yes		d	d	d

Note: Station ID endings -01, -02, -03, and -04 correspond to transect distances of 3, 100, 1,000, and 2,000 m from the edge of the road.

^a Vegetation sampling stations corresponding to roadway surface core, shoulder soil, and dustfall sampling stations.

^b Choose one transect to collect each vegetation type, or all may be collected from one transect if possible.

^c Choose one of transects 3, 4, or 5 to collect each vegetation type, or all may be collected from one transect if possible.

^d Choose either transect 6 or 7 to collect each vegetation type, or all may be collected from one transect if possible.

Table 2. Planned port site vegetation sample identifiers, coordinates, and species collection requirements

Station ID	Geographic Coordinates				Plant Sample to be Collected				
	X Degrees	X Minutes	Y Degrees	Y Minutes	Moss	Moss Duplicate Sample	Willow ^a	Lichen ^a	Berry ^a
PO-01	-164	2.95	67	35.72	yes				
PO-02	-164	3.46	67	35.46	yes				
PO-03	-164	2.26	67	35.52	yes				
PO-04	-164	3.99	67	35.20	yes				
PO-05	-164	2.78	67	35.26	yes				
PO-06	-164	1.58	67	35.32	yes				
PO-07	-164	3.30	67	35.00	yes				
PO-08	-164	2.10	67	35.06	yes				
PO-09	-164	0.89	67	35.13	yes				
PO-10	-164	2.61	67	34.80	yes				
PO-11	-164	1.40	67	34.86	yes				
PO-12	-164	3.12	67	34.54	yes	yes			
PO-13	-164	1.92	67	34.60	yes				
PO-14	-164	2.44	67	34.34	yes				

^a Choose four stations each (not necessary that they all be collected at the same station).

Table 3. Planned spill site vegetation sample identifiers, coordinates, and species collection requirements

Station ID	Geographic Coordinates				Plant Sample to be Collected				
	X Degrees	X Minutes	Y Degrees	Y Minutes	Moss	Moss Duplicate Sample	Willow	Lichen	Berry
4	-163	20.72	67	49.83	yes				
11	-163	24.66	67	48.41	yes				
12	-162	55.55	68	1.51	yes				
13	-163	16.36	67	52.83	yes				
14	-162	56.18	68	0.84	yes				
20	-163	17.92	67	52.01	yes				
25	-163	45.84	67	38.72	yes	yes			
27	-163	18.01	67	51.64	yes				
29	-163	2.29	67	58.16	yes				
30	-163	6.17	67	55.48	yes				

Table 4. Summary of vegetation sampling for the haul road fugitive dust study

Area	Number of Sample Transects (or grid locations)	Number of Locations per Transect	Number of Samples				Analytes	
			<i>Hylocomium</i>	Willow	Lichen	Berry	<i>Hylocomium</i>	All Other Plant Species
Haul Road								
Transects corresponding to road stations	7	3, except for 3 transects near mine site where there will be 4 locations	23 + 2 field duplicates	10	10	10	As, Pb, Zn, Cd, Ca, Al, Fe, Mg	Pb, Zn, Cd, Ca
Port Site	14	1	14 + 1 field duplicate	4	4	4	Pb, Zn, Cd, Ca	Pb, Zn, Cd, Ca
Spill Sites	10	1	10 + 1 field duplicate	0	0	0	Pb, Zn, Cd, Ca	N/A
Total Number (including duplicates)			51	14	14	14		

Appendix A

Health and Safety Plan

Health and Safety Plan

- a.) **Site:** Cominco Red Dog Mine, near Kotzebue, Alaska
- b.) **Client:** Cominco
- c.) **Work Dates:** August 10–September 1, 2001
- d.) **Staff:** Scott Shock, Liz Maier, subcontractor Chris Schadt
- e.) **Summary of All Proposed Activities:** Collect data from mine files, collect soil and vegetation samples, train and provide guidance to Cominco subcontractors to do sampling on haul road.
- f.) **Project Number:** 8601997.001
- g.) **Project Manager:** Walt Shields
- h.) **New Project or Project with an Existing Health and Safety Plan:** New project
- i.) **Type of Facility or Site:** Haul road for zinc and lead mine
- j.) **Proposed Site-Safety Officer:** Scott Shock, then Liz Maier following Scott's departure
- k.) **List of Potential Hazardous Chemicals and Concentrations (if available):** Lead and other heavy metals in dust on the haul road and plant surfaces. Airborne dust is expected to be very minimal, as the sampling is occurring during the rainy season, and it has been raining every day.
- l.) **List of Potential Physical Hazards:** Moving equipment, primarily trucks on the haul road; slip and trip hazards; cold weather, rain, and wind chill (i.e., hypothermia); bears.
- m.) **Do Client Health and Safety Procedures Need to Be Followed?** Follow Cominco policies on haul road travel and activities, including the use of two-way radios for contact between vehicles, or to contact the emergency response team.
- n.) **Proposed Level of Protection:** Modified Level D with steel-toed rubber boots and gloves. Two-person sampling teams (one person as lookout) and air horns will be used for bear protection.
- o.) **List of Chemicals that Will Be Used (decontamination, preservatives, field tests):** Detergent will be used in decontamination. Sample bottles may contain acid as a preservative.

Appendix B

Standard Operating Procedure

SOP 2 SAMPLE PACKAGING AND SHIPPING

Specific requirements for sample packaging and shipping must be followed to ensure the proper transfer and documentation of environmental samples collected during field operations. Procedures for the careful and consistent transfer of samples from the field to the laboratory are outlined herein.

EQUIPMENT REQUIRED

Specific equipment or supplies necessary to properly pack and ship environmental samples include the following:

- Sealable airtight bags
- Plastic garbage bags
- Coolers
- Bubble wrap
- Fiber reinforced packing tape
- Scissors
- Chain-of-custody seals
- Airbills for overnight shipment
- Chain-of-custody record/sample analysis request forms.

PROCEDURE

The following steps should be followed to ensure the proper transfer of samples from the field to the laboratories:

1. Appropriately document all samples using proper logbooks and chain-of-custody record/sample analysis request forms (example provided in Attachment 2-1).

2. Make sure all applicable laboratory quality control sample designations have been made on the chain-of-custody record/sample analysis request forms. Samples that will be archived for future possible analysis should be clearly identified on the chain-of-custody record/sample analysis request form. Such samples should also be labeled on the chain-of-custody record/sample analysis request form as “Do Not Analyze: Hold and archive for possible future analysis” as some laboratories interpret “archive” to mean continue holding the residual sample after analysis.
3. Notify the laboratory contact and the project QA/QC coordinator that samples will be shipped and the estimated arrival time. Send copies of all chain-of-custody record/sample analysis request forms to the QA/QC coordinator.
4. Samples will be placed in secure onsite storage or remain in the possession of the sampling personnel before shipment. Any temporary sample storage areas will be locked and secured to maintain sample integrity and chain-of-custody requirements.
5. Clean the outside of all dirty sample containers to remove any residual material that may lead to cross-contamination.
6. Check sample containers against the chain-of-custody record/sample analysis request form to ensure all samples intended for shipment are accounted for.
7. Choose the appropriate size cooler (or coolers) and line with bubble wrap.
8. Fill the cooler with the samples, separating glass containers with bubble wrap. After all samples have been added to the cooler, use bubble wrap to fill any empty space to keep the samples from shifting during transport.
9. After the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it shut with fiber-reinforced packing tape. If the cooler has a drain at the bottom, it should be taped shut in the same manner.
10. Fill out the chain-of-custody/sample analysis request form and retain the back copy of the form for the project records before sealing the cooler. Store the signed chain-of-custody record/sample analysis request forms in a sealable bag and tape them to the inside of the cooler lid. For a shipment containing multiple coolers, indicate on the outside of this cooler “Chain-of-Custody Inside.”
11. As security against unauthorized handling of the samples, apply one or two chain-of-custody seals across the opening of the cooler lid (example provided in Attachment 2-1). Be sure the seals are properly affixed to the cooler so they are not removed during shipment.

12. Label the cooler with destination and return addresses, and add other appropriate stickers, such as “This End Up,” “Fragile,” and “Handle With Care.”
13. If an overnight courier is used, fill out the airbill as required and fasten it to the top of the cooler. The identification number sticker should be taped to the lid, because tracking problems can occur if a sticker is removed during shipment.

ATTACHMENT 2-1

**Example Chain-of-Custody
Record/Sample Analysis
Request Form, and Label and
Custody Seal**

CHAIN OF CUSTODY RECORD/SAMPLE ANALYSIS REQUEST FORM

Project: (Name and Number)					Exponent [®]			Environmental Group					
Exponent Contact: _____ Office: _____					Samplers:								
Ship to: _____					Analyses Requested						Extra Container	Archive	Remarks
Lab Contact/Phone: _____													
Sample No.	Tag No.	Date	Time	Matrix									
Matrix Code: GW - Groundwater SL - Soil SD - Sediment SW - Surface water OTHER - Please identify codes _____					Priority: <input type="checkbox"/> Normal <input type="checkbox"/> Rush Rush time period _____								
Shipped via: <input type="checkbox"/> FedEx/UPS <input type="checkbox"/> Courier Other _____					Condition of Samples Upon Receipt: _____				Custody Seal Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> None				

Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
(Signature) (Signature)

Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
(Signature) (Signature)

Exponent[®]
OFFICIAL SAMPLE SEAL

SAMPLE NO.

DATE

SIGNATURE

PRINT NAME AND TITLE

Exponent[®]

SAMPLE NO.

SITE NAME

DATE

TIME

SAMPLER

PRESERVATIVE

TAG NO. **25101**