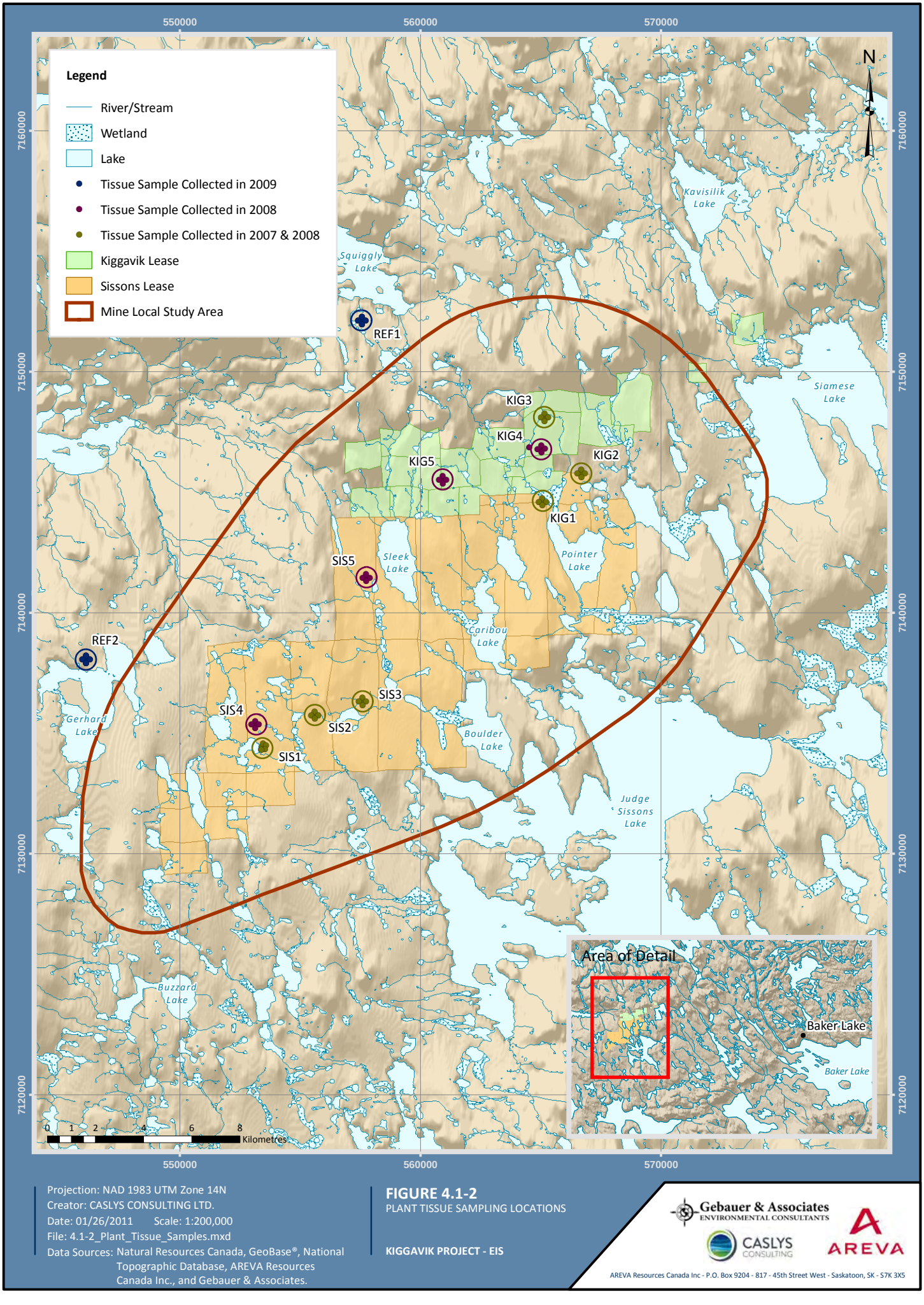

Projection: NAD 1983 UTM Zone 14N
Creator: CASLYS CONSULTING LTD.
Date: 01/26/2011 Scale: 1:200,000
File: 4.1-2_Plant_Tissue_Samples.mxd
Data Sources: Natural Resources Canada, GeoBase®, National Topographic Database, AREVA Resources Canada Inc., and Gebauer & Associates.

FIGURE 4.1-2
PLANT TISSUE SAMPLING LOCATIONS

KIGGAVIK PROJECT - EIS

Gebauer & Associates ENVIRONMENTAL CONSULTANTS
CASLYS CONSULTING
AREVA

AREVA Resources Canada Inc - P.O. Box 9204 - 817 - 45th Street West - Saskatoon, SK - S7K 3X5

4.2 Results

4.2.1 Description of Ecological Land Classification Units

Earlier efforts followed similar concepts of classifying vegetation types in the area surrounding the Kiggavik Project, although using different approaches (Table 4.2-1). Historical studies qualitatively grouped vegetation associations based on physiognomy (general appearance) of the vegetation and not species groupings (Beak 1987b). Initial baseline work completed in 2007 identified updated vegetation communities based only on satellite images.

Table 4.2-1 Comparison of Land Classification Systems Used in Current and Historical Studies

1980s Ecological Land Survey (Major Vegetation Associations)[(a)]	2007 Ecological Landscape Classification	Current Ecological Land Classification Units
Rock Barrens	Water	Water
Lichen Steppe	Bare Ground	Disturbance
Lichen-Heath	Bedrock Lichen	Cloud/Shadow
Moss-Heath	Heath Boulder	Sand
Dwarf Shrub	Heath Tundra	Gravel
Sedge Meadow	Riparian Low Shrub	Rock Association
Tussock Meadow	Sedge Wetland	Wet Graminoid
	Tussock-Hummock	Graminoid Tundra
	Willow-Boulder	Graminoid/Shrub Tundra
		Shrub Tundra
		Shrub/Heath Tundra
		Heath Tundra
		Heath Upland
		Heath Upland/Rock Complex
		Lichen Tundra

NOTES:
[(a)] Beak 1987b

For this Vegetation and Soils Baseline Report (VSBR), the classification scheme was designed to identify ecologically relevant ELC units that will help facilitate discussion of wildlife habitat utilization, development of wildlife habitat suitability ratings, and future discussion of potential Project-related impacts. The ELC units identified for the Kiggavik Project also correspond to the GN classification scheme, allowing comparison to other regional data.

Descriptions of ELC units are based on observable features, species composition (in conjunction with terrain features), and/or ecological conditions in the immediate vicinity. Terrain and soil features (discussed in Section 5.2.3) are the basis for, and control the development of, plant communities. At the same time, since plant communities overlay terrain features, several community types may occur in the same geographic area. For example, boulders bear a complex lichen flora, yet the boulders themselves may be completely surrounded by Heath Tundra. Alternatively, Heath Tundra mats may be perched on boulders and surrounded by a boulder field. Each defined unit is simply a human effort to label, categorize, and define situations that occur as a continuum in the natural world.

A description of the vegetative communities in each of the ELC units of the Mine LSA, access road LSAs and RSA is provided below (more detailed lists of species present in each unit are provided in Section 4.2.3). Detailed data on the vegetation cover observed in each survey plot are provided in Attachment C. The percentages recorded for each category of vegetation and cover type are independent of one another and are not intended to add up to 100%. A complete list of plant species, including scientific and common names, is provided in Attachment D.

Water: Water features identified in the imagery. Typically, water bodies greater than 0.75 hectare (ha) in size and rivers greater than 75 m wide are distinguishable in Landsat imagery (Photo 4.2-1).

Photo 4.2-1 Ecological Land Classification Unit – Water

Disturbance: Anthropogenic disturbance on the landscape, located primarily near the community of Baker Lake (Photo 4.2-2).

Photo 4.2-2 Ecological Land Classification Unit – Disturbance

Cloud/Shadow: Areas of cloud and associated shadows present within the source Landsat image (Photo 4.2-3).

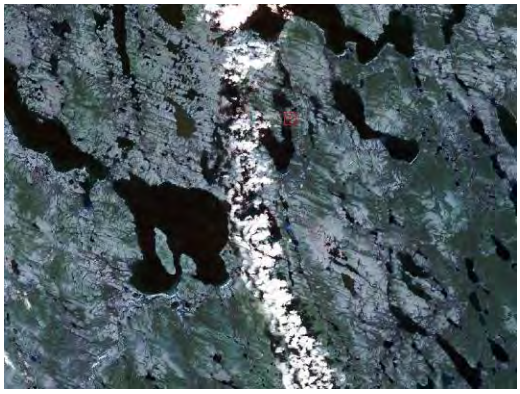

Photo 4.2-3 Ecological Land Classification Unit – Cloud/Shadow

Sand: Areas of exposed sand typically found in dry river or lake beds, or beach ridge uplands (Photo 4.2-4).

Photo 4.2-4 Ecological Land Classification Unit – Sand

Gravel: Areas of exposed gravel typically found in dry river or lake beds, eskers or beach ridge uplands (Photo 4.2-5).

Photo 4.2-5 Ecological Land Classification Unit – Gravel

Rock Association: Areas of bedrock outcrops and boulder fields (Photo 4.2-6).

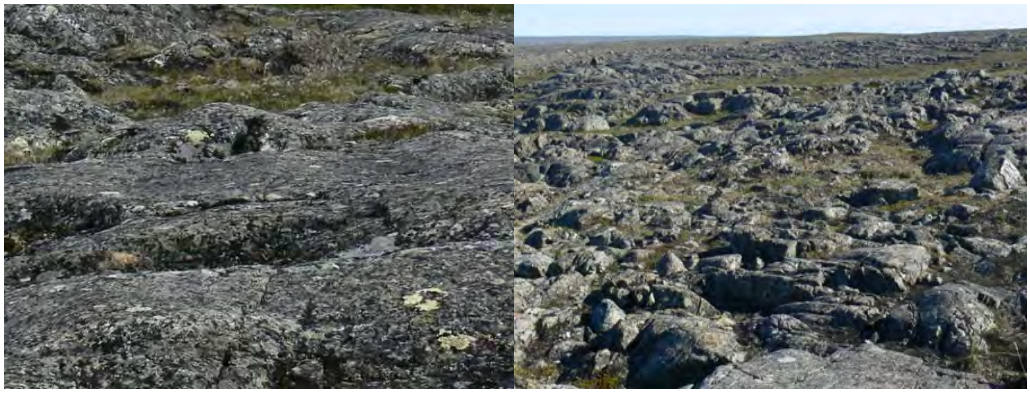

Photo 4.2-6 Ecological Land Classification Unit – Rock Association

Wet Graminoid: Wet Graminoid (Sedge Wetland) communities occur in poorly drained areas (hygric moisture regime) and around water features. Water sedge (*Carex aquatilis)* and tall cottongrass (*Eriophorum angustifolium*) are dominant species. Moss is also present (Photo 4.2-7).

Photo 4.2-7 Ecological Land Classification Unit – Wet Graminoid

Graminoid Tundra: Graminoid Tundra consists of sedge communities that occur on more mesic areas. The unit includes tussock/hummock formations and is usually found on peat substrates. Dominant plant species include mesic *Carex* species, but also small amounts of water sedge, tall cottongrass, and shrub and forb species.

Photo 4.2-8 Ecological Land Classification Unit – Graminoid Tundra

Graminoid/Shrub Tundra: A transition between Graminoid Tundra areas and Shrub Tundra communities, the Graminoid/Shrub Tundra unit occurs in moist areas (mesic moisture regime) and consists of shrubs (25% or more) that are less than 40 cm in height. Graminoids, moss, and some lichen species are also present (Photo 4.2-9).

Photo 4.2-9 Ecological Land Classification Unit – Graminoid/Shrub Tundra

Shrub Tundra: Shrub Tundra has a mesic moisture regime and consists of communities that are composed of at least 50% shrub such as dwarf birch (*Betula glandulosa*) and diamond leaf willow (*Salix planifolia*). The understory can consist of some lichen and herb layers and moss may be present (Photo 4.2-10).

Photo 4.2-10 Ecological Land Classification Unit – Shrub Tundra

Shrub/Heath Tundra: A transitional unit between Shrub Tundra areas and Heath Tundra communities, it occurs on well to moderately drained soils (mesic-xeric moisture regime) and consists of between 30 to 50% shrubs that are less than 40 cm tall. Graminoids, moss, and some lichen species may be present (Photo 4.2-11).

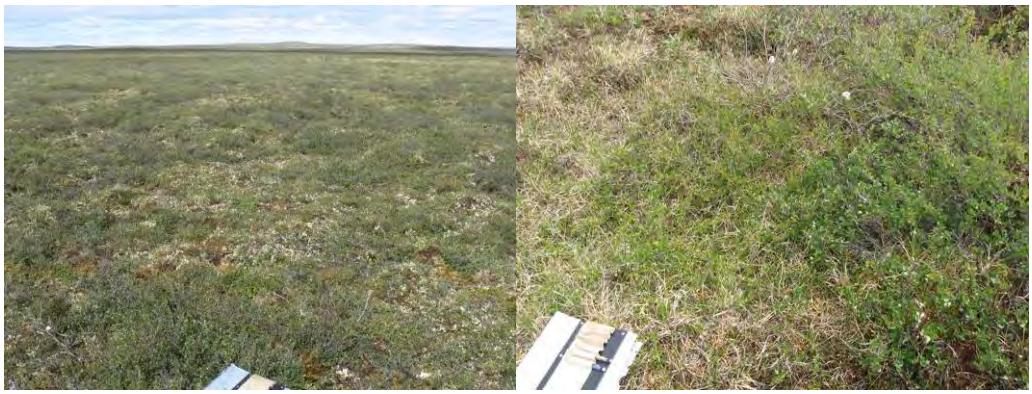

Photo 4.2-11 Ecological Land Classification Unit – Shrub/Heath Tundra

Heath Tundra: Heath Tundra occurs on well to moderately drained soils (mesic-xeric moisture regime) and is dominated by ericaceous shrubs, lichens and some graminoids. Vegetative cover typically exceeds 70% with less than 30% rock. Erect shrubs are present but to a lesser degree than the Shrub/Heath Tundra unit (less than 30%) (Photo 4.2-12).

Photo 4.2-12 Ecological Land Classification Unit – Heath Tundra

Heath Upland: Heath Upland occurs on well drained soils (xeric moisture regime) and is dominated by ericaceous shrubs, lichens and some graminoids. Typically, a rocky substrate is present (i.e., boulders, cobble, gravel, sand) but consists of over 70% vegetative cover. Bog blueberry (*Vaccinium uliginosum*), white arctic mountain heather (*Cassiope tetragona*), northern Labrador tea (*Ledum decumbens*), black crowberry (*Empetrum nigrum*) and ballroom dervish, a lichen (*Cetraria nivalis*) are the dominant species (Photo 4.2-13).

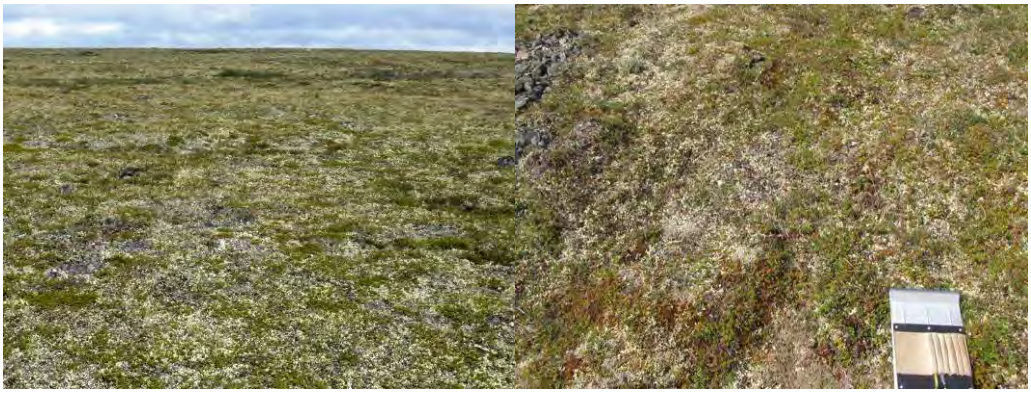

Photo 4.2-13 Ecological Land Classification Unit – Heath Upland

Lichen Tundra: Lichen Tundra communities develop on well drained and poorly developed soils (xeric moisture regime). The substrate is typically sand, gravel or cobble and most often associated with esker ridges and ridged moraine landforms. Green witch's hair lichen (*Alectoria ochroleuca*), *Bryoria nitidula*, crinkled snow lichen (*Cetraria cucullata*), Iceland moss (*Cetraria islandica*), ballroom dervish, and lesser green reindeer lichen (*Cladina mitis*) are the dominant species in the Lichen Tundra unit (Photo 4.2-14).

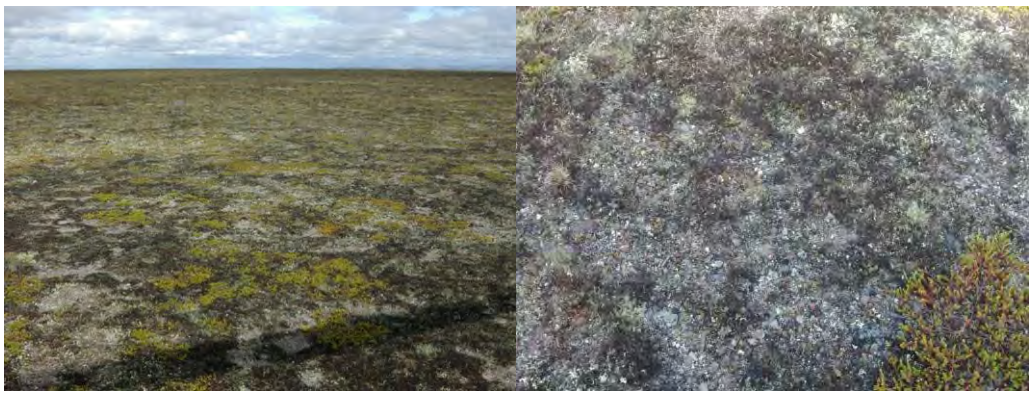

Photo 4.2-14 Ecological Land Classification Unit – Lichen Tundra

Heath Upland/Rock Complex: A transition between Heath Upland and rock features (bedrock outcrops or boulder fields), this unit is dominated by ericaceous shrub and lichen communities with rock or boulder substrate. The spectral signatures of this unit closely resemble, and therefore can be highly confused with, either parent communities (Photo 4.2-15).

Photo 4.2-15 Ecological Land Classification Unit – Heath Upland/Rock Complex

4.2.2 Distribution of Ecological Land Classification Units

The ELC developed for this baseline study provides a starting point for future analysis. For example, ELC units can be used to derive wildlife habitat suitability maps or to assess the quantity of different ELC units affected by future development.

The distribution of ELC units in the Mine LSA is illustrated in Figure 4.2-1 while ELC units in the RSA and along the access road LSAs are illustrated in Figure 4.2-2. The percentage breakdown of the ELC units found in the Mine LSA and RSA is compared in Table 4.2-2 and Figure 4.2-3A and B. The ELC units for each of the four access road options (North AWAR, South AWAR, Winter Access Road [South] and Winter Access Road [North]) are compared in Table 4.2-3 and Figure 4.2-4A to D.

Table 4.2-2 Percentages of Ecological Land Classification Units in the Mine Local Study Area and Regional Study Area

ELC Units	Mine LSA		RSA	
	hectare	%	hectare	%
Water	6,079	13.5	251,161	25.6
Disturbance	0	0	556	0.1
Cloud/Shadow	0	0	2,029	0.2
Sand	6	0	1,852	0.2
Gravel	83	0.2	6,979	0.7
Rock Association	40	0.1	10,130	1.0
Wet Graminoid	3,126	6.9	71,126	7.2
Graminoid Tundra	5,933	13.2	123,189	12.5
Graminoid/Shrub Tundra	4,626	10.3	79,603	8.1
Shrub Tundra	2,698	6.0	41,639	4.2
Shrub/Heath Tundra	3,716	8.3	59,255	6.0
Heath Tundra	16,216	36.0	241,679	24.6
Heath Upland	1,238	2.8	31,304	3.2
Heath Upland/Rock Complex	670	1.5	46,536	4.7
Lichen Tundra	578	1.3	15,820	1.6
Total	45,009	100	982,859	100

In both the Mine LSA and RSA, Heath Tundra is the most common ELC land unit, covering at least one-quarter of the land surface in both areas, although the Mine LSA does have a higher percentage of Heath Tundra than the RSA. The other main difference between the two study areas is that the RSA has over 10% more water cover, and over twice as much Heath Upland/Rock Complex. In general, the ELC analysis demonstrates the representativeness of the LSA. The second most common vegetated ELC unit is Graminoid Tundra, which is found in both study areas in similar amounts (around 13%). ELC units with less than one percent coverage in both the RSA and Mine LSA are the Disturbance, Sand, Gravel and Rock Association ELC units.

The breakdown of ELC units within the four road alignments located in the RSA are similar. Heath Tundra is the most common vegetated unit, with greatest coverage along the North AWAR. Graminoid Tundra is the next most common. As expected, both of the Winter Access Road LSAs have much more water coverage than the other access road LSAs. All four access road LSAs have low amounts of Disturbance, Sand, Gravel and Rock Association areas.

ELC units found within 100 m and 200 m of potential quarry sites are presented in Table 4.2-4 and Table 4.2-5, respectively. Potential quarry sites have been identified along the North AWAR and Winter Access Road (South). Quarry locations are included in Figure 4.2-5. The ELC breakdown for quarries will provide important information on habitat type and suitability for particular wildlife species when making decisions on what quarries will be developed in the future.

Table 4.2-3 Percentages of Ecological Land Classification Units along all Access Road Local Study Areas

ELC Units	North AWAR LSA		South AWAR LSA		Winter Access Road (South) LSA		Winter Access Road (North) LSA[(a)]	
	hectare	%	hectare	%	hectare	%	hectare	%
Water	7,655	14.7	8,710	16.3	20,827	37.1	8,681	29.2
Disturbance	76	0.1	0	0	0	0.0	0	0.0
Cloud/Shadow	86	0.2	198	0.4	203	0.4	51	0.2
Sand	32	0.1	85	0.2	248	0.4	13	0.0
Gravel	146	0.3	400	0.7	508	0.9	50	0.2
Rock Association	479	0.9	113	0.2	172	0.3	195	0.7
Wet Graminoid	3,118	6.0	5,771	10.8	5,490	9.8	2,136	7.2
Graminoid Tundra	9,144	17.6	9,189	17.2	8,269	14.7	4,691	15.8
Graminoid/Shrub Tundra	3,087	5.9	6,457	12.1	5,051	9.0	2,868	9.6
Shrub Tundra	1,694	3.3	1,747	3.3	1,776	3.2	1,049	3.5

Table 4.2-3 Percentages of Ecological Land Classification Units along all Access Road Local Study Areas

ELC Units	North AWAR LSA		South AWAR LSA		Winter Access Road (South) LSA		Winter Access Road (North) LSA[(a)]	
Shrub/Heath Tundra	3,066	5.9	2,974	5.6	2,683	4.8	1,579	5.3
Heath Tundra	18,146	34.9	13,568	25.4	8,134	14.5	6,455	21.7
Heath Upland	1,287	2.5	1,519	2.8	952	1.7	413	1.4
Heath Upland/Rock Complex	3,159	6.1	1,903	3.6	1,097	2.0	1,195	4.0
Lichen Tundra	857	1.6	814	1.5	681	1.2	382	1.3
Total	52,032	100	53,448	100	56,091	100	29,758	100

NOTES:

[(a)] The Winter Access Road (North) is currently only considered as a partial segment connecting to other alignments.

Table 4.2-4 Ecological Land Classification Units within 100 m of Potential Quarry Sites

Quarry #	Unit	Water	Wet Graminoid	Graminoid Tundra	Graminoid/ Shrub Tundra	Shrub Tundra	Shrub/Heath Tundra	Heath Tundra	Heath Upland	Heath Upland/ Rock Complex	Lichen Tundra	Gravel	Rock
Q1	ha	0.00	0.06	0.01	0.00	0.00	0.00	0.39	0.02	2.30	0.00	0.00	0.38
	%	0.00	1.91	0.32	0.00	0.00	0.00	12.24	0.48	73.13	0.00	0.00	11.92
Q2	ha	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.26	2.31	0.00	0.00	0.19
	%	0.00	0.00	0.00	0.00	0.00	0.00	12.40	8.27	73.37	0.00	0.00	5.96
Q3	ha	0.00	0.13	0.13	0.00	0.00	0.00	0.80	0.68	1.14	0.04	0.24	0.00
	%	0.00	3.98	3.98	0.00	0.00	0.00	25.46	21.56	36.12	1.27	7.64	0.00
Q3A	ha	0.00	0.29	0.73	0.00	0.00	0.01	1.93	0.00	0.19	0.00	0.00	0.00
	%	0.00	9.30	23.05	0.00	0.00	0.32	61.37	0.00	5.96	0.00	0.00	0.00
Q4	ha	0.00	0.05	0.17	0.00	0.00	0.00	0.87	0.00	1.93	0.12	0.00	0.00
	%	0.00	1.59	5.34	0.00	0.00	0.00	27.81	0.00	61.51	3.75	0.00	0.00
Q5	ha	0.00	0.25	0.32	0.00	0.00	0.05	0.31	0.07	2.15	0.00	0.00	0.00
	%	0.00	7.95	10.10	0.00	0.00	1.43	9.94	2.31	68.28	0.00	0.00	0.00
Q6	ha	0.00	0.00	0.14	0.00	0.00	0.00	1.38	0.45	0.44	0.24	0.25	0.25
	%	0.00	0.00	4.30	0.00	0.00	0.00	43.98	14.26	13.94	7.57	7.97	7.97
Q7	ha	0.06	0.27	1.09	0.03	0.00	0.22	1.00	0.00	0.47	0.00	0.00	0.00
	%	1.99	8.43	34.77	1.03	0.00	6.92	31.82	0.00	15.04	0.00	0.00	0.00
Q8	ha	0.06	0.22	0.34	0.00	0.00	0.29	0.66	0.08	1.43	0.00	0.06	0.00
	%	1.83	7.09	10.68	0.00	0.00	9.32	21.04	2.47	45.58	0.00	1.99	0.00
Q9	ha	0.00	0.00	0.23	0.00	0.00	0.00	0.64	0.00	1.34	0.00	0.10	0.83
	%	0.00	0.00	7.26	0.00	0.00	0.00	20.33	0.00	42.66	0.00	3.19	26.56
Q10	ha	0.00	0.00	0.10	0.00	0.00	0.00	0.93	0.06	1.48	0.00	0.00	0.60
	%	0.00	0.00	3.24	0.00	0.00	0.00	29.38	1.74	46.60	0.00	0.00	19.04
Q11	ha	0.00	0.00	0.40	0.00	0.00	0.00	1.34	0.00	0.96	0.00	0.00	0.44
	%	0.00	0.00	12.83	0.00	0.00	0.00	42.71	0.00	30.52	0.00	0.00	13.94
Q12	ha	0.00	0.08	0.19	0.00	0.04	0.07	0.36	0.28	1.70	0.06	0.00	0.38
	%	0.00	2.47	5.89	0.00	1.27	2.07	11.30	8.91	54.18	1.99	0.00	11.93
Q13	ha	0.00	0.20	0.02	0.00	0.00	0.00	0.06	0.05	1.51	0.06	0.00	1.24
	%	0.00	6.28	0.64	0.00	0.00	0.00	1.99	1.51	48.13	1.99	0.00	39.46
Q14	ha	0.08	0.23	0.23	0.00	0.00	0.00	0.49	0.24	1.26	0.19	0.00	0.43
	%	2.47	7.42	7.34	0.00	0.00	0.00	15.47	7.58	40.11	5.98	0.00	13.64
Q15	ha	0.00	0.00	0.23	0.00	0.00	0.00	0.57	0.00	1.98	0.00	0.00	0.36

Table 4.2-4 Ecological Land Classification Units within 100 m of Potential Quarry Sites

Quarry #	Unit	Water	Wet Graminoid	Graminoid Tundra	Graminoid/ Shrub Tundra	Shrub Tundra	Shrub/Heath Tundra	Heath Tundra	Heath Upland	Heath Upland/ Rock Complex	Lichen Tundra	Gravel	Rock
	%	0.00	0.00	7.24	0.00	0.00	0.00	18.22	0.00	63.09	0.00	0.00	11.46
Q16	ha	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.73	0.00	0.00	2.13
	%	0.00	0.00	0.00	0.00	0.00	0.00	8.91	0.00	23.31	0.00	0.00	67.78
Q16A	ha	0.00	0.28	0.52	0.00	0.00	0.00	1.12	0.00	1.13	0.08	0.00	0.00
	%	0.00	9.00	16.65	0.00	0.00	0.00	35.62	0.00	36.10	2.63	0.00	0.00
Q17	ha	0.00	0.13	0.00	0.00	0.00	0.00	0.30	0.00	2.73	0.00	0.00	0.02
	%	0.00	3.95	0.00	0.00	0.00	0.00	9.40	0.00	86.18	0.00	0.00	0.47
Q17A	ha	0.00	0.24	0.19	0.00	0.00	0.00	0.06	0.00	1.32	0.00	0.00	1.34
	%	0.00	7.56	5.89	0.00	0.00	0.08	1.99	0.00	41.93	0.00	0.00	42.56
Q17B	ha	0.12	0.44	0.44	0.00	0.00	0.00	0.72	0.15	0.90	0.06	0.00	0.31
	%	3.83	14.04	13.88	0.00	0.00	0.00	22.97	4.78	28.71	1.83	0.00	9.97
Q17C	ha	0.00	0.00	0.29	0.04	0.00	0.06	1.41	0.00	1.27	0.06	0.00	0.02
	%	0.00	0.00	9.22	1.19	0.00	1.99	44.83	0.00	40.30	1.99	0.00	0.48
Q18	ha	0.00	0.05	0.02	0.00	0.00	0.00	0.19	0.00	1.81	0.00	0.00	1.07
	%	0.00	1.59	0.72	0.00	0.00	0.00	5.98	0.00	57.53	0.00	0.00	34.18
Q19	ha	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	2.04	0.00	0.00	1.10
	%	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	65.00	0.00	0.00	34.84
Q20	ha	0.00	0.03	0.00	0.00	0.05	0.00	0.55	0.00	2.15	0.02	0.01	0.34
	%	0.00	0.88	0.08	0.00	1.43	0.00	17.42	0.00	68.42	0.64	0.40	10.74
Q21	ha	0.00	0.41	0.31	0.00	0.00	0.05	0.00	0.00	1.46	0.00	0.00	0.93
	%	0.00	12.87	9.85	0.00	0.00	1.51	0.00	0.00	46.39	0.00	0.00	29.39
Q22	ha	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	1.96	0.00	0.00	0.94
	%	0.00	0.00	0.00	0.00	0.00	0.00	7.72	0.00	62.26	0.00	0.00	30.02
Q23	ha	0.00	0.06	0.00	0.12	0.31	0.33	2.26	0.06	0.00	0.00	0.00	0.00
	%	0.00	1.91	0.00	3.91	9.73	10.37	72.09	1.99	0.00	0.00	0.00	0.00
Q24	ha	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.19	0.71	0.00	0.00	0.00
	%	0.00	0.00	0.08	0.00	0.00	0.00	71.36	5.97	22.59	0.00	0.00	0.00
Q25	ha	0.00	0.05	0.36	0.00	0.00	0.00	1.46	0.37	0.34	0.38	0.19	0.00
	%	0.00	1.43	11.54	0.00	0.00	0.00	46.38	11.85	10.74	12.09	5.97	0.00
Q26	ha	0.00	0.00	0.17	0.04	0.00	0.00	0.70	0.45	0.73	0.00	1.06	0.00
	%	0.00	0.00	5.42	1.20	0.00	0.00	22.15	14.26	23.19	0.00	33.78	0.00

Table 4.2-4 Ecological Land Classification Units within 100 m of Potential Quarry Sites

Quarry #	Unit	Water	Wet Graminoid	Graminoid Tundra	Graminoid/ Shrub Tundra	Shrub Tundra	Shrub/Heath Tundra	Heath Tundra	Heath Upland	Heath Upland/ Rock Complex	Lichen Tundra	Gravel	Rock
Q27	ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.14
	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Q28	ha	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.88	2.01	0.13	0.00	0.06
	%	0.00	0.00	0.00	0.00	0.00	0.00	1.99	27.91	64.11	3.99	0.00	1.99
Q29	ha	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.75	0.50	0.00	1.63	0.00
	%	0.00	0.00	0.00	0.00	0.00	4.00	4.00	24.00	16.00	0.00	52.00	0.00
Q30	ha	0.00	0.06	0.94	0.06	0.00	0.00	2.13	0.00	0.00	0.00	0.00	0.00
	%	0.00	1.96	29.41	1.96	0.00	0.00	66.67	0.00	0.00	0.00	0.00	0.00

NOTES:
ha = hectare

Table 4.2-5 Ecological Land Classification Units within 200 m of Potential Quarry Sites

Quarry #	Unit	Water	Wet Gram.	Gram. Tundra	Gram. / Shrub Tundra	Shrub Tundra	Shrub/ Heath Tundra	Heath Tundra	Heath Upland	Heath Upland/ Rock Complex	Lichen Tundra	Sand	Gravel	Rock
Q1	ha	0.00	0.06	0.49	0.16	0.01	0.00	4.71	0.36	6.10	0.31	0.00	0.00	0.38
	%	0.00	0.48	3.90	1.27	0.08	0.00	37.44	2.86	48.49	2.46	0.00	0.00	3.02
Q2	ha	0.00	0.00	0.13	0.00	0.00	0.06	4.04	2.32	5.18	0.55	0.00	0.00	0.31
	%	0.00	0.00	1.03	0.00	0.00	0.48	32.09	18.43	41.14	4.37	0.00	0.00	2.46
Q3	ha	0.00	0.26	0.21	0.00	0.00	0.01	4.79	3.30	2.69	0.16	0.01	1.00	0.15
	%	0.00	2.07	1.67	0.00	0.00	0.08	38.08	26.23	21.38	1.27	0.08	7.95	1.19
Q3A	ha	0.00	0.50	1.25	0.15	0.11	0.57	9.73	0.00	0.19	0.10	0.00	0.00	0.00
	%	0.00	3.97	9.92	1.19	0.87	4.52	77.22	0.00	1.51	0.79	0.00	0.00	0.00
Q4	ha	0.00	0.13	1.03	0.46	0.25	0.10	4.67	0.00	5.58	0.36	0.00	0.00	0.00
	%	0.00	1.03	8.19	3.66	1.99	0.79	37.12	0.00	44.36	2.86	0.00	0.00	0.00
Q5	ha	0.00	0.38	0.61	0.00	0.19	0.28	6.06	0.50	4.52	0.06	0.00	0.00	0.00
	%	0.00	3.02	4.84	0.00	1.51	2.22	48.10	3.97	35.87	0.48	0.00	0.00	0.00
Q6	ha	0.16	0.50	2.61	0.66	0.00	0.00	6.14	0.91	0.44	0.65	0.00	0.25	0.25
	%	0.00	0.48	3.90	1.27	0.08	0.00	37.44	2.86	48.49	2.46	0.00	0.00	3.02
Q7	ha	0.67	1.19	4.16	0.56	0.00	2.55	2.86	0.00	0.50	0.08	0.00	0.00	0.00
	%	5.33	9.47	33.09	4.46	0.00	20.29	22.75	0.00	3.98	0.64	0.00	0.00	0.00
Q8	ha	2.46	0.76	1.32	0.06	0.25	1.73	3.60	0.13	2.19	0.00	0.00	0.06	0.00
	%	19.59	6.05	10.51	0.48	1.99	13.77	28.66	1.04	17.44	0.00	0.00	0.48	0.00
Q9	ha	0.00	0.19	2.38	0.07	0.00	0.13	2.68	0.54	4.53	0.26	0.00	0.31	1.46
	%	0.00	1.51	18.96	0.56	0.00	1.04	21.35	4.30	36.10	2.07	0.00	2.47	11.63
Q10	ha	0.00	0.39	2.16	0.00	0.06	0.06	4.88	0.44	3.60	0.31	0.00	0.00	0.66
	%	0.00	3.11	17.20	0.00	0.48	0.48	38.85	3.50	28.66	2.47	0.00	0.00	5.25
Q11	ha	0.00	0.06	1.11	0.00	0.00	0.24	9.01	0.06	1.63	0.01	0.00	0.00	0.44
	%	0.00	0.48	8.84	0.00	0.00	1.91	71.74	0.48	12.98	0.08	0.00	0.00	3.50
Q12	ha	1.19	0.68	2.04	0.49	0.31	0.38	4.11	0.38	2.51	0.09	0.00	0.00	0.41
	%	9.45	5.40	16.20	3.89	2.46	3.02	32.64	3.02	19.94	0.71	0.00	0.00	3.26
Q13	ha	0.00	1.41	2.34	0.26	0.00	0.13	1.92	0.13	4.48	0.06	0.00	0.00	1.85
	%	0.00	11.21	18.60	2.07	0.00	1.03	15.26	1.03	35.61	0.48	0.00	0.00	14.71
Q14	ha	0.19	1.00	2.01	0.14	0.00	0.00	2.27	1.12	4.39	0.23	0.00	0.15	1.07
	%	1.51	7.96	15.99	1.11	0.00	0.00	18.06	8.91	34.92	1.83	0.00	1.19	8.51
Q15	ha	0.00	0.06	2.87	0.16	0.00	0.00	4.29	0.08	3.78	0.07	0.00	0.00	1.25

Table 4.2-5 Ecological Land Classification Units within 200 m of Potential Quarry Sites

Quarry #	Unit	Water	Wet Gram.	Gram. Tundra	Gram. / Shrub Tundra	Shrub Tundra	Shrub/ Heath Tundra	Heath Tundra	Heath Upland	Heath Upland/ Rock Complex	Lichen Tundra	Sand	Gravel	Rock
	%	0.00	0.48	22.85	1.27	0.00	0.00	34.16	0.64	30.10	0.56	0.00	0.00	9.95
Q16	ha	0.00	0.32	0.77	0.22	0.00	0.00	2.72	0.20	4.50	0.06	0.00	0.00	3.80
	%	0.00	2.54	6.12	1.75	0.00	0.00	21.60	1.59	35.74	0.48	0.00	0.00	30.18
Q16A	ha	0.00	0.77	3.81	0.23	0.00	0.00	4.08	0.04	3.40	0.25	0.00	0.00	0.00
	%	0.00	6.12	30.29	1.83	0.00	0.00	32.43	0.32	27.03	1.99	0.00	0.00	0.00
Q17	ha	0.00	0.13	0.08	0.00	0.00	0.02	3.02	0.08	8.37	0.05	0.00	0.00	0.83
	%	0.00	1.03	0.64	0.00	0.00	0.16	24.01	0.64	66.53	0.40	0.00	0.00	6.60
Q17A	ha	0.00	0.50	2.61	0.22	0.00	0.13	1.68	0.07	5.31	0.06	0.00	0.00	1.99
	%	0.00	3.98	20.76	1.75	0.00	1.03	13.37	0.56	42.24	0.48	0.00	0.00	15.83
Q17B	ha	0.56	1.28	2.84	0.06	0.06	0.04	5.23	0.31	1.56	0.30	0.00	0.00	0.31
	%	4.46	10.20	22.63	0.48	0.48	0.32	41.67	2.47	12.43	2.39	0.00	0.00	2.47
Q17C	ha	0.00	0.13	1.76	0.21	0.06	0.19	6.91	0.00	2.78	0.49	0.00	0.00	0.06
	%	0.00	1.03	13.98	1.67	0.48	1.51	54.88	0.00	22.08	3.89	0.00	0.00	0.48
Q18	ha	0.00	0.94	1.78	0.15	0.00	0.08	2.16	0.09	6.13	0.00	0.00	0.00	1.24
	%	0.00	7.48	14.16	1.19	0.00	0.64	17.18	0.72	48.77	0.00	0.00	0.00	9.86
Q19	ha	0.00	0.08	0.84	0.00	0.00	0.06	3.25	0.14	5.96	0.09	0.00	0.00	2.14
	%	0.00	0.64	6.69	0.00	0.00	0.48	25.88	1.11	47.45	0.72	0.00	0.00	17.04
Q20	ha	0.00	0.65	1.12	0.31	0.31	0.23	2.21	0.88	4.73	0.06	0.00	0.50	1.58
	%	0.00	5.17	8.90	2.46	2.46	1.83	17.57	7.00	37.60	0.48	0.00	3.97	12.56
Q21	ha	0.00	1.45	1.70	0.04	0.00	0.19	0.32	0.14	6.65	0.01	0.00	0.00	2.08
	%	0.00	11.53	13.51	0.32	0.00	1.51	2.54	1.11	52.86	0.08	0.00	0.00	16.53
Q22	ha	0.05	0.46	0.25	0.00	0.00	0.00	1.02	1.16	6.86	0.00	0.00	0.05	2.75
	%	0.40	3.65	1.98	0.00	0.00	0.00	8.10	9.21	54.44	0.00	0.00	0.40	21.83
Q23	ha	0.00	0.14	0.16	0.80	0.94	1.33	9.12	0.06	0.00	0.00	0.00	0.00	0.00
	%	0.00	1.12	1.27	6.37	7.49	10.60	72.67	0.48	0.00	0.00	0.00	0.00	0.00
Q24	ha	0.20	0.24	0.75	0.14	0.06	0.01	8.74	1.14	1.06	0.22	0.00	0.00	0.00
	%	1.59	1.91	5.97	1.11	0.48	0.08	69.59	9.08	8.44	1.75	0.00	0.00	0.00
Q25	ha	0.00	0.06	2.00	0.00	0.00	0.00	7.02	1.00	0.51	1.79	0.00	0.19	0.00
	%	0.00	0.48	15.91	0.00	0.00	0.00	55.85	7.96	4.06	14.24	0.00	1.51	0.00
Q26	ha	0.00	0.00	0.76	1.25	0.15	0.14	4.84	2.36	1.28	0.44	0.00	1.35	0.00
	%	0.00	0.00	6.05	9.94	1.19	1.11	38.50	18.77	10.18	3.50	0.00	10.74	0.00

Table 4.2-5 Ecological Land Classification Units within 200 m of Potential Quarry Sites

Quarry #	Unit	Water	Wet Gram.	Gram. Tundra	Gram. / Shrub Tundra	Shrub Tundra	Shrub/ Heath Tundra	Heath Tundra	Heath Upland	Heath Upland/ Rock Complex	Lichen Tundra	Sand	Gravel	Rock
Q27	ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	11.81
	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.55	0.00	0.00	0.00	0.00	95.45
Q28	ha	0.00	0.00	0.06	0.13	0.06	0.06	1.38	1.88	8.50	0.13	0.00	0.00	0.38
	%	0.00	0.00	0.50	1.00	0.50	0.50	10.95	14.93	67.66	1.00	0.00	0.00	2.99
Q29	ha	0.00	0.00	0.00	0.00	0.00	0.13	0.50	6.13	1.56	0.44	0.00	3.75	0.06
	%	0.00	0.00	0.00	0.00	0.00	1.00	3.98	48.76	12.44	3.48	0.00	29.85	0.50
Q30	ha	0.00	0.13	2.81	0.81	0.00	0.00	8.56	0.25	0.00	0.06	0.00	0.00	0.00
	%	0.00	0.99	22.28	6.44	0.00	0.00	67.82	1.98	0.00	0.50	0.00	0.00	0.00

4.2.3 Plant Species

4.2.3.1 Overview of Plant Species Presence

Field surveys have identified 199 plant species and 74 lichen species in the Kiggavik RSA since 1979 (see complete listing of all species observed in Attachment D).The list includes hybrids and intergrades, but not species identified only to genus level. Field observations on plant abundance, diversity and health within the Project LSAs and anticipated footprints indicate that these variables are consistent with what would be expected in similar habitats/areas in the RSA and surrounding Arctic environments.

The most recent surveys completed in 2008/09 identified 116 vascular plant species, as well as 32 species of lichens and fungi (these totals include any individual plant identifications, even to genus level only). Of these plants, the following species were identified for the first time (see Attachment D for species details):

- four shrub/heath species;
- fifteen forb species;
- ten graminoid species;
- one fern; and
- eight lichens.

Plant species observed in the different ELC units are detailed in Attachment E. The total number of plant species and the average number of species per survey plot are summarized in Table 4.2-6 for each of the surveyed ELC units. In terms of species diversity, Graminoid Tundra has the highest average number of species, and Gravel has the lowest. Also included in Table 4.2-6 are some historic data on total number of species. A direct comparison between historical and current data is difficult because of differences in methods and study areas.

Table 4.2-6 Summary of Plant Species Presence by Ecological Land Classification Unit (2008/09)

ELC Unit	Total # Species	Average # Species per Survey Plot	Number of Survey Plots
Water	ND	ND	0
Disturbance	ND	ND	0
Cloud/Shadow	ND	ND	0
Sand	ND	ND	0
Gravel	25	10.8	5
Rock Association	55	13.3	19
Wet Graminoid	75	12.0	42
Graminoid Tundra	99	23.2	46
Graminoid/Shrub Tundra	64	15.6	21
Shrub Tundra	83	15.9	42
Shrub/Heath Tundra	69	20.3	19
Heath Tundra	96	19.3	66
Heath Upland	86	18.3	47
Heath Upland/Rock Complex	75	15.5	55
Lichen Tundra	37	17.7	12
Total (2008/2009)	148	ND	ND
Total (1991)[(a)]	178	ND	ND
Total (1990)[(b)]	62	ND	ND
Total (1987-1989)	137	ND	ND
Total (pre 1987)	86	ND	ND

NOTES:
[(a)] Identification of some lichen species not confirmed
[(b)] Sissons area only
ND = No data

4.2.3.2 Inuit Quajimajatuqangit

Inuit Quajimajatuqangit (IQ) studies completed as part of the baseline program discussed the use of certain plant species as food, medicine, shelter, and other human uses. During focus group

discussions, *Elders noted that a number of sweet plants were harvested for food* (IQ-BLE 2009). *Cowberries* (likely *Vaccinium vitis-idaea*]), *blueberries, cloudberries* (likely *Rubus chamaemorus*), *'black' berries* (likely *Empetrum nigrum*) *and 'red' berries* (latin name uncertain) *were gathered in the past and are still used today*. *Dried cloudberry leaves are used to make tea and roots of certain bushes were used to cure stomach aches*. *Edible purple flowers* (possibly saxifrage) *are consumed as are certain roots that are white and taste like carrots* (latin name unknown) *and a tundra moss* (latin name unknown) *is boiled to make a hot beverage* (IQ-CIYA 2009). Elders commented during focus groups that *traditional cures were no longer used* (IQ-BLE 2009).

IQ interviews did not identify particular places for collecting plants; rather it was noted that plants were everywhere. *The area around Sissons Lake was noted to be particularly good for red berries* (IQ-BLE 2009). *Plants are typically gathered by Elders from August to September*.

An AREVA diet survey contacted a total of 189 residents in 2009/10, representing 89 households (20% of all households, or 23% of the total adult population in Baker Lake) (see Technical Appendix 9A of this EIS). The survey was completed to estimate consumption levels of country foods as well as associated values for Baker Lake residents. The study estimated that 40% of households are engaged in plant collecting, although most households (87%) are likely not engaged regularly (one a day or two every now and then, likely during day trips and weekends). The study noted that this type of occasional involvement did not reflect a low level of commitment or harvesting. Almost seven percent of households indicated they had purchased wild berries over the course of the year.

4.2.3.3 Rare Plants and Plant Communities

Rare and endangered species are ranked federally through the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the *Species at Risk Act* (*SARA*). COSEWIC is an arms-length committee of experts that designates rare species as being Extinct, Extirpated, Endangered, Threatened, or of Special Concern. Extinct species no longer exist anywhere in the world, whereas Extirpated species no longer exist in the wild in Canada, but occur elsewhere. Endangered species face imminent extirpation or extinction, Threatened species are likely to become endangered if limiting factors are not reversed, and species of Special Concern are particularly sensitive to human activities or natural events but are not yet Endangered or Threatened. *SARA* officially lists certain species ranked by COSEWIC on Schedule 1, which requires measures to be implemented that protect and recover the listed species. Only species that have been formally added to Schedule 1 receive full federal protection. If a Schedule 1 species is identified in a development project, special measures to protect and recover such a listed species would be required for projects reviewed under territorial and federal review processes.

SARA Schedule 2 and 3 identify species that need to be assessed by COSEWIC within a particular timeframe. These species are not yet legally protected under *SARA*, but are of special concern from a wildlife management perspective. Within a project review process, Schedule 2 and 3 species may

require proactive special measures in case their status changes and they become legally protected under *SARA* Schedule 1.

Species at risk or of concern according to relevant territorial and federal listings are presented in Table 4.2-7. Only two plant species listed under the *SARA* are found in Nunavut, and neither of these species is assumed to have been observed to date (see Table 4.2-7). Felt-leaf willow (listed as *Salix alaxensis*) was observed in 2008/09 surveys, and has also likely been observed in the Kiggavik RSA in the past (the species name was noted as being observed in pre-1989 vegetation surveys, although the common name was identified as 'river willow' [see Attachment D]). Although the common name is the same, the *SARA* Schedule 1 listing for felt-leaf willow is for *Salix salicola*. Presumably the plant observed in the Kiggavik RSA is a different species. Species listed under Schedule 1 require legal protection. No other plant species identified by *SARA* and COSEWIC has been recorded in the LSAs or RSA during any of the Kiggavik studies or for the adjacent Meadowbank Project to date. Although it is possible that some rare non-vascular species (e.g., lichens) may be present, very little is known of non-vascular plant distribution in the Arctic, and most species are difficult to identify.

Seven vascular plant species of restricted range are known or expected to occur in the area (Cody 1979; McJannet et al. 1993, 1995), but none are considered to be rare or of special concern: greyleaf willow (*Salix glauca*), mountain heather (*Phyllodoce breweri*), alpine pussytoes (*Antennaria alpine*), marsh marigold (*Caltha palustris*), Rocky Mountain cinquefoil (*Potentilla rubricaulis*), Bell's crazyweed (*Oxytropis arctica* var. *bellii*) and diapensia (*Diapensia lapponica*). The latter two species were recorded during field surveys in the Kiggavik RSA. Bell's crazyweed was observed near Schultz Lake, and diapensia was observed in a survey plot in the Mine LSA (Figure 4.2-6).

Table 4.2-7 Species at Risk Observed or Expected in Kiggavik Regional Study Area

Plant Species	Scientific Name	Presence in Kiggavik RSA	COSEWIC Status[(a)]	SARA Status[(b)]
Felt-leaf Willow	*Salix salicicola*	Not likely[(c)]	Special Concern	Schedule 1
Porsild's Bryum	*Mielichhoferia macrocarpa*	Not observed	Threatened	Threatened

NOTES:

(a) COSEWIC 2009, internet site

(b) *SARA* 2009, internet site

(c) Felt-leaf willow has been reported, but was identified under the scientific name *Salix alaxensis*, presumably a different species than the above (reported in pre-1987 data [Beak 1987b], for surveys in 1987/89 [Wickware 1989], and in 2008/09 field surveys)

4.2.4 Plant Tissue Chemistry

Plant tissue collected from 2007 to 2009 was analyzed for metals and radionuclides in individual tissue types. Sampled tissue included primarily sedge, lichen, and berry as well as some 2007 foliage samples collected from birch, willow and blueberry bush. Mean concentrations for each tissue type are summarized in Table 4.2-8A to D, for Mine LSA samples (collected in 2007/08) and RSA samples (collected in 2009). Radionuclide concentrations of Cesium-137 and Strontium-90 from lichen samples collected in 2011 are presented in Table 4.2-8E. Complete vegetation chemistry data are provided in Attachment F.

Because of differences in sampling and analytical methods, measured parameters, composited samples, and the incompleteness of some available datasets, comparisons to available historical data are limited. The current dataset collected from 2007 to 2009 provides more relevant information on baseline conditions that can be used in future assessments. A summary of historical plant chemistry data is presented in Table 4.2-13. Sampling in the mid-1980s measured elevated radium-226 (and other radionuclides) activity in plant tissue samples, near ore body showings in the Mine LSA. Elevated activities appeared to be limited to the immediate area around the showing (Svobada et al. 1985).

Table 4.2-8A Plant Tissue Chemistry Data (Berries) for Mine Local Study Area and Regional Study Area (2007-2009)

		Mine LSA (2007/08)					RSA (2009)				
					Range					Range	
Parameter	Units	n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Aluminum	ug/g	50	7.2	14	<2	75.2	2	5.1	2.1	3.6	6.5
Antimony	ug/g	50	0.010	0.015	<0.010	<0.10	2	0.050	0	<0.1	<0.1
Arsenic	ug/g	50	0.0078	0.0071	<0.010	0.026	2	0.025	0	<0.05	<0.05
Barium	ug/g	50	4.4	6.4	0.813	27	2	10	0.78	9.9	11
Beryllium	ug/g	50	0.045	0.015	<0.01	<0.10	2	0.0050	0	<0.01	<0.01
Boron	ug/g	6	27	17	14	60	2	5.0	0	5	5
Cadmium	ug/g	50	0.037	0.078	<0.005	0.36	2	0.013	0.011	<0.01	0.02
Chromium	ug/g	50	0.46	0.92	<0.10	4.94	2	0.25	0	<0.5	<0.5
Cobalt	ug/g	50	0.017	0.016	<0.02	0.067	2	0.023	0.025	<0.01	0.04
Copper	ug/g	50	1.2	1.4	0.537	7	2	4.4	0.14	4.3	4.5
Iron	ug/g	6	17	6.6	12	30	2	10	0	10	10
Lead	ug/g	50	0.012	0.0077	<0.01	0.05	2	0.030	0	0.03	0.03

Table 4.2-8A Plant Tissue Chemistry Data (Berries) for Mine Local Study Area and Regional Study Area (2007-2009)

Parameter	Units	Mine LSA (2007/08)					RSA (2009)				
					Range					Range	
		n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Manganese	ug/g	50	50	69	6.07	310	2	75	21	60	90
Mercury	ug/g	50	0.0034	0.0080	<0.0010	<0.05	ND	ND	ND	ND	ND
Molybdenum	ug/g	50	0.092	0.22	<0.010	1.5	2	0.075	0.035	<0.1	0.1
Nickel	ug/g	50	0.51	0.65	<0.1	2.99	2	0.70	0.29	0.49	0.9
Selenium	ug/g	50	0.091	0.025	<0.05	<0.20	2	0.025	0	<0.05	<0.05
Silver	ug/g	6	0.0050	0	<0.01	<0.01	2	0.005	0	<0.1	<0.1
Strontium	ug/g	50	0.92	1.4	0.179	7.2	2	11	7.4	5.6	16
Thallium	ug/g	50	0.0074	0.0066	<0.010	<0.05	2	0.025	0	<0.05	<0.05
Tin	ug/g	50	0.11	0.062	<0.05	0.336	2	0.025	0	<0.05	<0.05
Titanium	ug/g	6	0.25	0.28	0.06	0.79	2	0.19	0.078	0.13	0.24
Uranium	ug/g	50	0.0017	0.0015	<0.002	0.0059	2	0.0050	0	<0.01	<0.01
Vanadium	ug/g	50	0.050	0	<0.1	<0.1	2	0.050	0	<0.1	0.1
Zinc	ug/g	50	17	12	1.31	40.4	2	8.9	1.6	7.8	10
Bismuth	ug/g	44	0.015	0	<0.03	<0.03	ND	ND	ND	ND	ND
Calcium	ug/g	44	273	100	88.6	479	ND	ND	ND	ND	ND
Lithium	ug/g	44	0.050	0	<0.10	<0.10	ND	ND	ND	ND	ND
Magnesium	ug/g	44	84	11	51.2	108	ND	ND	ND	ND	ND
Moisture	%	50	87	1.2	84.7	89.8	2	82	2.5	80.65	84.19
Lead-210	Bq/g	16	0.0071	0.0044	<0.002	0.014	2	0.060	0.041	0.031	0.089
Polonium-210	Bq/g	16	0.0068	0.0039	0.002	0.014	2	0.0085	0.0035	0.006	0.011
Radium-226	Bq/g	16	0.0011	0.0009	<0.0005	0.004	2	0.0020	0	0.002	0.002
Thorium-230	Bq/g	16	0.0017	0.0010	<0.0004	<0.005	2	0.0010	0	<0.002	<0.002
Thorium-232	Bq/g	10	0.0025	0.0002	<0.004	<0.005	2	0.0010	0	<0.002	<0.002
NOTES:											

Table 4.2-8A Plant Tissue Chemistry Data (Berries) for Mine Local Study Area and Regional Study Area (2007-2009)

Parameter	Units	Mine LSA (2007/08)					RSA (2009)				
					Range					Range	
		n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Data are for samples collected at locations indicated in Figure 4.1-2.											
All 2007 LSA samples run individually for both metals and radionuclide analysis.											
All 2008 LSA samples run individually for metals analysis; 44 LSA berry samples were combined into 10 composite samples for radionuclide analysis; 100 LSA sedge/lichen samples from 2008 were combined into 35 composite samples and 20 discrete samples for radionuclide analysis.											
All 2009 RSA samples run individually for metals and radionuclide analysis.											
ND = No data											
n = Sample size											
SD = Standard deviation											

Table 4.2-9B Plant Tissue Chemistry Data (Berries) for Mine Local Study Area and Regional Study Area (2007-2009)

Parameter	Units	Mine LSA (2007/08)					RSA (2009)				
					Range					Range	
		n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Aluminum	ug/g	56	178	276	16	1640	10	116	72	66	310
Antimony	ug/g	56	0.021	0.011	<0.020	<0.10	10	0.050	0	<0.1	<0.1
Arsenic	ug/g	56	0.091	0.069	<0.020	0.405	10	0.051	0.028	<0.05	0.09
Barium	ug/g	56	47	33	10.1	243	10	55	34	19	130
Beryllium	ug/g	56	0.16	0.061	<0.01	<0.40	10	0.015	0.015	<0.01	0.05
Boron	ug/g	6	2.5	0.55	2	3	10	0.70	0.26	<1	1
Cadmium	ug/g	56	0.11	0.059	0.019	0.296	10	0.10	0.055	0.03	0.21
Chromium	ug/g	56	1.4	3.0	<0.2	17.9	10	0.25	0	<0.5	<0.5
Cobalt	ug/g	56	0.25	0.55	<0.060	3.84	10	0.15	0.11	0.05	0.37
Copper	ug/g	56	2.1	1.1	0.6	6.19	10	1.2	0.51	0.56	2.4
Iron	ug/g	6	160	97	78	310	10	126	122	50	470
Lead	ug/g	56	0.69	1.0	0.104	6.96	10	0.77	0.80	0.29	3

Table 4.2-9B Plant Tissue Chemistry Data (Berries) for Mine Local Study Area and Regional Study Area (2007-2009)

Parameter	Units	Mine LSA (2007/08)					RSA (2009)				
					Range					Range	
		n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Manganese	ug/g	56	199	119	27	652	10	202	73	90	350
Mercury	ug/g	56	0.035	0.023	0.0041	0.1	ND	ND	ND	ND	ND
Molybdenum	ug/g	56	0.28	0.52	<0.030	3.41	10	0.055	0.016	<0.1	0.1
Nickel	ug/g	56	1.3	1.6	<0.30	9.09	10	0.49	0.25	0.21	0.94
Selenium	ug/g	56	0.32	0.12	<0.05	<0.80	10	0.025	0	<0.05	<0.05
Silver	ug/g	6	0.034	0.049	<0.01	0.13	10	0.0085	0.0078	<0.01	0.03
Strontium	ug/g	56	13	6.8	4.17	44.5	10	33	32	6.8	100
Thallium	ug/g	56	0.019	0.0078	<0.020	0.069	10	0.025	0	<0.05	<0.05
Tin	ug/g	56	0.083	0.024	<0.05	<0.20	10	0.047	0.058	<0.05	0.21
Titanium	ug/g	6	6.5	3.2	3.2	11	10	4.8	4.4	2.2	17
Uranium	ug/g	56	0.37	2.4	<0.006	18.1	10	0.014	0.011	<0.01	0.04
Vanadium	ug/g	56	0.36	0.66	<0.20	4.67	10	0.20	0.15	<0.1	0.6
Zinc	ug/g	56	28	9.2	10.9	60	10	19	3.6	13	24
Bismuth	ug/g	50	0.067	0.10	<0.060	0.726	ND	ND	ND	ND	ND
Calcium	ug/g	50	3431	1663	933	10700	ND	ND	ND	ND	ND
Lithium	ug/g	50	0.30	0.62	<0.20	4.34	ND	ND	ND	ND	ND
Magnesium	ug/g	50	532	156	212	1080	ND	ND	ND	ND	ND
Moisture	%	56	34	20	9.98	68	ND	ND	ND	ND	ND
Lead-210	Bq/g	34	0.45	0.085	0.26	0.64	10	0.58	0.068	0.48	0.71
Polonium-210	Bq/g	34	0.40	0.079	0.15	0.58	10	0.53	0.11	0.36	0.65
Radium-226	Bq/g	34	0.010	0.030	<0.001	0.18	10	0.0045	0.0031	<0.001	0.011
Thorium-230	Bq/g	34	0.0095	0.041	<0.0005	0.24	10	0.0020	0.0014	<0.003	0.006
Thorium-232	Bq/g	28	0.0025	0	<0.005	<0.005	10	0.0015	0	<0.003	<0.003
NOTES:											

Table 4.2-9B Plant Tissue Chemistry Data (Berries) for Mine Local Study Area and Regional Study Area (2007-2009)

Parameter	Units	Mine LSA (2007/08)					RSA (2009)				
					Range					Range	
		n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Data are for samples collected at locations indicated in Figure 4.1-2.											
All 2007 LSA samples run individually for both metals and radionuclide analysis.											
All 2008 LSA samples run individually for metals analysis; 44 LSA berry samples were combined into 10 composite samples for radionuclide analysis; 100 LSA sedge/lichen samples from 2008 were combined into 35 composite samples and 20 discrete samples for radionuclide analysis.											
All 2009 RSA samples run individually for metals and radionuclide analysis.											
ND = No data											
n = Sample size											
SD = Standard deviation											

Table 4.2-10C Plant Tissue Chemistry Data (Sedges) for Mine Local Study Area and Regional Study Area (2007-2009)

Parameter	Units	Mine LSA (2007/08)					RSA (2009)				
					Range					Range	
		n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Aluminum	ug/g	56	65	116	3.4	839	10	59	40	1.4	140
Antimony	ug/g	56	0.016	0.012	<0.02	<0.10	10	0.050	0	<0.1	<0.1
Arsenic	ug/g	56	0.057	0.091	<0.02	0.51	10	0.034	0.019	<0.05	0.07
Barium	ug/g	56	36	21	8.51	97	10	71	29	8.9	110
Beryllium	ug/g	56	0.10	0.044	<0.01	<0.40	10	0.012	0.014	<0.01	0.05
Boron	ug/g	6	9.0	3.3	5	15	10	3.3	2.2	<1	7
Cadmium	ug/g	56	0.045	0.032	<0.01	0.171	10	0.066	0.050	<0.01	0.18
Chromium	ug/g	56	1.1	3.2	<0.20	22.8	10	0.25	0	<0.5	<0.5
Cobalt	ug/g	56	0.16	0.19	0.02	0.868	10	0.15	0.094	<0.01	0.29
Copper	ug/g	56	2.2	0.91	0.602	4.4	10	2.4	1.1	0.37	4.3
Iron	ug/g	6	112	101	16	300	10	87	53	4.8	220
Lead	ug/g	56	0.19	0.20	0.02	0.947	10	0.41	0.20	0.02	0.71
Manganese	ug/g	56	159	108	39.9	560	10	400	306	50	1100
Mercury	ug/g	56	0.012	0.010	0.002	0.0445	ND	ND	ND	ND	ND

Table 4.2-10C Plant Tissue Chemistry Data (Sedges) for Mine Local Study Area and Regional Study Area (2007-2009)

Parameter	Units	Mine LSA (2007/08)					RSA (2009)				
					Range					Range	
		n	Mean	SD	Min	Max	n	Mean	SD	Min	Max
Molybdenum	ug/g	56	0.57	0.89	<0.02	4.8	10	0.58	0.32	0.05	1.1
Nickel	ug/g	56	1.1	1.7	0.24	12.5	10	0.81	0.43	0.06	1.6
Selenium	ug/g	56	0.21	0.085	<0.05	<0.80	10	0.025	0	<0.05	<0.05
Silver	ug/g	6	0.025	0.033	<0.01	0.09	10	0.0050	0	<0.01	<0.01
Strontium	ug/g	56	8.4	5.0	1.99	25.1	10	35	35	1.6	110
Thallium	ug/g	56	0.013	0.0050	<0.02	<0.05	10	0.025	0	<0.05	<0.05
Tin	ug/g	56	0.068	0.10	<0.05	0.82	10	0.025	0	<0.05	<0.05
Titanium	ug/g	6	0.68	1.0	0.11	2.7	10	1.7	1.8	0.06	6
Uranium	ug/g	56	0.44	2.1	<0.004	13.9	10	0.016	0.013	<0.01	0.04
Vanadium	ug/g	56	0.17	0.24	<0.10	1.73	10	0.080	0.079	<0.1	0.3
Zinc	ug/g	56	19	14	6.89	100	10	42	23	3.6	70
Bismuth	ug/g	50	0.035	0.0088	<0.06	<0.12	ND	ND	ND	ND	ND
Calcium	ug/g	50	1767	963	542	5960	ND	ND	ND	ND	ND
Lithium	ug/g	50	0.14	0.12	<0.20	0.89	ND	ND	ND	ND	ND
Magnesium	ug/g	50	413	121	183	740	ND	ND	ND	ND	ND
Moisture	%	56	53	13	15.6	70.67	ND	ND	ND	ND	ND
Lead-210	Bq/g	33	0.18	0.12	0.007	0.46	10	0.32	0.092	0.14	0.43
Polonium-210	Bq/g	33	0.14	0.083	0.012	0.29	10	0.26	0.078	0.12	0.38
Radium-226	Bq/g	33	0.014	0.045	0.001	0.26	10	0.0047	0.0025	<0.001	0.008
Thorium-230	Bq/g	33	0.0075	0.021	<0.0005	0.12	10	0.0014	0.0009	<0.002	0.004
Thorium-232	Bq/g	27	0.0034	0.0036	<0.004	0.02	10	0.0011	0.0002	<0.002	<0.003

NOTES:

Data are for samples collected at locations indicated in Figure 4.1-2.

All 2007 LSA samples run individually for both metals and radionuclide analysis.

All 2008 LSA samples run individually for metals analysis; 44 LSA berry samples were combined into 10 composite

Table 4.2-10C Plant Tissue Chemistry Data (Sedges) for Mine Local Study Area and Regional Study Area (2007-2009)

Parameter	Units	Mine LSA (2007/08)					RSA (2009)				
		n	Mean	SD	Range		n	Mean	SD	Range	
					Min	Max				Min	Max
samples for radionuclide analysis; 100 LSA sedge/lichen samples from 2008 were combined into 35 composite samples and 20 discrete samples for radionuclide analysis.											
All 2009 RSA samples run individually for metals and radionuclide analysis.											
ND = No data											
n = Sample size											
SD = Standard deviation											

Table 4.2-11D Plant Tissue Chemistry Data (Foliage) for Mine Local Study Area (2007)

Parameter	Units	n	Mean	SD	Range	
					Min	Max
Aluminum	ug/g	18	33	25	8.6	100
Antimony	ug/g	18	0.050	0	<0.1	<0.1
Arsenic	ug/g	18	0.031	0.025	<0.05	0.13
Barium	ug/g	18	87	30	55	160
Beryllium	ug/g	18	0.0050	0	<0.01	<0.01
Boron	ug/g	18	12	3.6	9	21
Cadmium	ug/g	18	1.2	1.5	0.08	5
Chromium	ug/g	18	0.27	0.082	<0.5	0.6
Cobalt	ug/g	18	0.42	0.30	0.05	1
Copper	ug/g	18	6.8	2.1	4.3	12
Iron	ug/g	18	28	5.2	22	37
Lead	ug/g	18	0.11	0.058	0.04	0.21
Manganese	ug/g	18	488	302	100	1300
Mercury	ug/g	18	0.025	0	<0.05	<0.05
Molybdenum	ug/g	18	0.12	0.16	<0.1	0.6
Nickel	ug/g	18	1.8	1.0	0.57	4.1
Selenium	ug/g	18	0.025	0	<0.05	<0.05

Table 4.2-11D Plant Tissue Chemistry Data (Foliage) for Mine Local Study Area (2007)

Parameter	Units	n	Mean	SD	Range	
					Min	Max
Silver	ug/g	18	0.011	0.014	<0.01	0.05
Strontium	ug/g	18	18	13	5	47
Thallium	ug/g	18	0.025	0	<0.05	<0.05
Tin	ug/g	18	0.027	0.0082	<0.05	0.06
Titanium	ug/g	18	4.2	12	0.3	49
Uranium	ug/g	18	0.0053	0.0012	<0.01	0.01
Vanadium	ug/g	18	0.16	0.41	<0.1	1.8
Zinc	ug/g	18	132	98	32	380
Bismuth	ug/g	ND	ND	ND	ND	ND
Calcium	ug/g	ND	ND	ND	ND	ND
Lithium	ug/g	ND	ND	ND	ND	ND
Magnesium	ug/g	ND	ND	ND	ND	ND
Moisture	%	18	53	3.0	48.25	58.63
Lead-210	Bq/g	18	0.11	0.028	0.057	0.16
Polonium-210	Bq/g	18	0.089	0.025	0.045	0.13
Radium-226	Bq/g	18	0.0043	0.0029	0.0012	0.014
Thorium-230	Bq/g	18	0.00063	0.0004	<0.0004	0.002
Thorium-232	Bq/g	ND	ND	ND	ND	ND

NOTES:
Data are for samples collected at locations indicated in Figure 4.1-2.
All samples run individually for both metals and radionuclide analysis.
Samples consisted of foliage collected from willow, birch and blueberry bush.
ND = No data
n = Sample size
SD = Standard deviation

Table 4.2-11D Plant Tissue Chemistry Data (Foliage) for Mine Local Study Area (2007)

Parameter	Units	n	Mean	SD	Range	
					Min	Max

Table 4.2-12E Cesium-137 and Strontium-90 Concentrations in Lichen Samples (2011)

Parameter	Units	Sample Location		
		KIG4	SIS1	REF2
Cesium-137	Bq/g	0.06	0.05	0.05
Strontium-90	Bq/g	0.05	0.02	0.04

Table 4.2-13 Summary of Historic Plant Tissue Chemistry Studies in the Mine Local Study Area and Regional Study Area

Year (original reference)	Location	Plant Type	Parameters	Concentration Ranges (for parameters included in Table 4.2-8)
1979 (Speller et al. 1979)	LSA	Lichens	Metals, radionuclides	(data not available)
	RSA	Lichens	Metals, radionuclides	(data not available)
1983 (Kershaw et al. 1983)	LSA (transects)	Lichens (*Dactylina arctica, Cetraria cucullata, cetraria nivalis*)	Metals, radionuclides	Iron: 25 to 200 ug/g Titanium: 3 to 35 ug/g Lead: 1 to 14 ug/g Nickel: 1 to 6 ug/g Copper: 4 to 7 ug/g Uranium: <1 ug/g
1985 (Svobada et al. 1985)	LSA (near ore body)	Berries (*Arctostaphylos alpine, Vaccinium uliginosum, V. visis-idaea, Empetrum nigrum*)	Radionuclides	Radium-226: 1.4 (±1.7) to 20.05 (±2.29) Bg/g
		Lichens (species not identified)	Radionuclides	Radium-226: <DL to 2.2 (±0.27)
		Sedges (species not identified)	Radionuclides	Radium-226: 0.09 (±0.09) to 34.52 (±3.96)
	LSA (transects)	Composite samples	Radionuclides	N/A
	RSA (various areas)	Composite samples	Radionuclides	N/A
1988 (Beak 1988)	LSA	Composite samples	Metals	N/A
	RSA (Skinny Lake)	Composite samples	Metals	N/A
1991 (Geomatics 1991)	Mine LSA (upwind, downwind)	Lichens	Radionuclides	(data not available)

NOTES:
DL = Detection limit
N/A = Not applicable (composite samples are not comparable to current baseline dataset)