Appendix I

Vegetation Community Surveys

VEGETATION COMMUNITY SURVEY NARRATIVES AND DATA TABLES

DMTS FUGITIVE DUST RISK ASSESSMENT

PHASE II SAMPLING PROGRAM – June/July 2004

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Introduction

These narratives were prepared by Dawn Reeder, with observations by other team members, Liz Maier and Devin Harbke. Nomenclature, terminology, and methodology are described following the station-by-station narratives. A list of references is also included. The accompanying Tables I-1 through I-10 provide a plant list by station, a list of plant codes, and summaries of the survey results.

TT2 Transect, General Observations

Community Type:	Foothills mesic tussock tundra
Date of Visit:	June 16, 2004
Aspect:	Roughly north or northwest
Slope:	<5%
Dust Deposition:	Visible on foliage at roadside and within about 20 m of roadside
Soil pH:	6.9 (10 m), 6.8 (20 m), 6.0 (100 m), 4.8 (1000 m)

No formal vegetation characterization was performed for this transect. This transect is primarily mesic tussock tundra situated between North Fork New Heart and South Fork New Heart Creeks.

Qualitative observations: Both TT2-0010 and TT2-0100 appeared most floristically similar to TT5-0100. Both TT2-0010 and TT2-0100 appeared to be dominated by ERVA tussocks, BENA, and SAPL (which was taller near the road). LEPA, RUCH, and VAUL were abundant. Lower, wet spots featured CAAQ and ERAN. Photos show vegetation profile at these stations, dust deposition on roadside vegetation, and community surrounding impounded water at roadside. Absence of *Peltigera* lichen was noted at TT2-0010. Species noted on the master plant list (Table I-1) as occurring at TT2-0010 and TT2-0100 should not be considered complete.

TT2-1000 is markedly different from other TT-1000 mesic tussock tundra stations. It falls near a tall willow-dominated riparian corridor and appears to support more species diversity (40 species were noted during a quick reconnaissance in the small mammal trapping grid). ERVA tussocks were less pronounced and less regular throughout the mammal grid and forb diversity was greater. At least 2 species of shrub willow (SAPL and SALA) were present at up to 20% cover. SARE was ubiquitous where the microtopography rose above lower, wetter areas dominated by sedges. At least 3 more species of sedges may be present here compared to other 1000-meter stations. DRIN, LUAR, PAMA, and ASUM were present as well as unidentified composites and Ranunculaceae species. Species noted on the master plant list (Table I-1) as occurring at TT2-1000 should not be considered complete. I did not attempt to key out new sedges and most certainly missed grasses. Harbke notes that the underlying geological parent material at this station is “black shale” as opposed to “red shale” along TT5.

TT3-0010

Community Type: Foothills mesic tussock tundra / wet tundra mosaic

Date of Visit: June 18, 2004

Line Orientation: Parallel to road

Aspect:

Slope: <5%

Dust Deposition: Heavy

Soil pH: 7.1

Number of Vascular Species Recorded at Area Characterized: 16

Number of Vascular Species Represented in Microplots: 12

This is a good station for seeing the effects of road dust on mosses. Some areas that looked like bare soil were actually dead or desiccated mosses covered with dust. Microplot 5, for instance, had about 50 percent "bare ground," which was actually dead or dying mosses smothered with dust. Mosses seemed to have less loft than mosses farther from the road. Road gravel was present in seven microplots, whereas no lichens were found in any microplots. I believe Liz Maier found and sampled *Peltigera* lichens in the area after intense searching. VAUL, RUCH, ERVA, and BENA were the dominant vascular species. Dust deposition was visible on broadleaf and graminoid foliage—all plants appeared dull with dust. Signs of old herbivory were observed on VAUL and ERVA. Line intercept data was not collected because shrub profile generally did not exceed tussock height.

TT3-0100

Community Type: Foothills mesic tussock tundra

Date of Visit: June 20, 2004

Line Orientation: Parallel to road

Aspect:

Slope: Gentle

Dust Deposition: Trace, detectable by touch

Soil pH: 6.24 (duplicate was 6.36)

Number of Vascular Species Recorded at Area Characterized: 15

Number of Vascular Species Represented in Microplots: 12

Harbke, Maier, and Reeder walked from TT3-1000 to TT3-0100 and noted after crossing a drainage (at about 500 meters from DMTS road) that mosses became noticeably drier and lichens were less visually apparent. Even in fairly wet areas approaching TT3-0100 from the drainage feature, mosses and lichens on hummocks (frost boils) appeared quite desiccated. In the vegetation characterization area, mosses had reproductive bodies but seemed significantly less robust (had less loft, were drier, and less vividly colored) than

mosses at TT3-1000. Some differences were noted between types of mosses present at TT3-1000and TT3-0100.

TT3-1000 had areas blanketed with various vivid and robust mosses with an abundance of embedded foliose lichens, and similar microtopography at TT3-0100 had dead or desiccated mosses and lichens associated with notably defoliated VAUL and BENA. There appeared to be more discolored (bleached or browned) foliage on LEPA, EMI, and VAVI at this station in comparison with TT3-1000. Dust was not visible on foliage and did not rise when we disturbed the plants. Foliage felt gritty to the touch, however. It would appear (by our qualitative observations) that Thamnolia-type lichens are more tolerant of the road-dust influence than other types because they seem to be present here where others are absent.

I noted that young LEPA is encroaching on an area of stressed-looking moss in microplot 5. BENA and VAUL seemed taller here than at TT3-1000, with more complex vertical structure.

The significance of bleached, blackened, or browned vascular vegetation is uncertain here or at any other TT station. This phenomenon was common in reference areas, but perhaps not as prevalent.

Line intercept data was not collected because shrub profile did not exceed height of tussocks.

TT3-1000

Community Type: Foothills mesic tussock tundra

Date of Visit: June 20, 2004

Line Orientation: NNE

Aspect: Roughly NE

Slope: Gentle

Dust Deposition: None visible or otherwise detectable

Soil pH: 4.06

Number of Vascular Species Recorded at Area Characterized: 10

Number of Vascular Species Represented in Microplots: 10

A cow moose with 2 new calves moved east through the area as we approached in the helicopter.

Mosses and lichens are various and healthy. We recognized four major types of mosses and four major types of lichens in almost every microplot in the series – compare this to TT3-0100. Fruiting bodies were abundant on mosses. There appears to be a definite trend in moss and lichen coverage approaching the DMTS road from this station, although our sampling method may not be sensitive enough to quantify it.

Overall, the vascular community was typical—dominated by ERVA and low shrubs. I observed signs of herbivory on VAUL twigs in some microplots. A familiar orange "fungus" was present on LEPA foliage, as well as some browning. Line intercept data was not collected because shrub profile did not exceed height of tussocks.

TT5-0010

Community Type: Mesic to wet tussock tundra with tall shrub component

Date of Visit: June 12 & 13, 2004

Line Orientation: NE

Aspect: Roughly east or northeast

Slope: <5%

Dust Deposition: Heavy

Soil pH: 6.7

Number of Vascular Species Recorded at Area Characterized: 33

Number of Vascular Species Represented in Microplots: 25

My comments on "TT8 Transition Data" below apply to this station and the TT5 transect in general. This area is altered from its original community composition due to physical and chemical influences from the DMTS road and CSB loop road. Dust and gravel deposition are heavy on foliage and the ground surface. Road gravel was present in 7 of the microplots, and in 2 of those microplots reached the 5 to 25 percent cover class. Nevertheless, plants are flowering—some fairly robustly. Surface water is likely impounded near the road prism where it would not have been present before. This station is quite wet in areas.

Note that center point of vegetation line is not aligned with center point of mammal grid because the curvature of the CSB loop road influenced the normal site configuration. The vegetation line was offset to the northeast to keep it roughly parallel and equidistant from the road.

SAPL was dominant (in height and apparently in overall percent cover), sometimes tall and leggy, and decreased in height and density with distance from the DMTS road/CSB loop road intersection. SAPL appeared to have more persistent dead leaves than other SAPL shrubs observed at TT2 roadside, for example. BENA here and toward TT5-0100 appeared to have less foliage, more bare branches, and branches that were more brittle than BENA at TT5-1000 or TT5-2000.

TT5-0100

Community Type: Wet to mesic tussock tundra with tall shrub component

Date of Visit: June 15, 2004

Line Orientation: NE

Aspect: Roughly north or northeast

Slope: <5%

Dust Deposition: Heavy to moderate

Soil pH: 6.44

Number of Vascular Species Recorded at Area Characterized: 22

Number of Vascular Species Represented in Microplots: 15

My comments on "TT8 Transition Data" below apply to this station and the TT5 transect in general. This area is altered from its original community composition, apparently due to physical and chemical influences from the DMTS road and CSB loop road. Dust deposition is heavy to moderate on foliage and the ground surface.

Hydrophyte (wet soil-adapted) or disturbance-colonizing species began to drop out and the total number of species present decreased between TT5-0010 and TT5-0100. BENA became more prevalent and SAPL diminished. Moss coverage increased significantly between TT5-0010 and TT5-0100, whereas lichen coverage did not.

Note that center point of vegetation line is not lined up with center point of mammal grid because the CSB loop road affected the normal site configuration. The vegetation line was offset to the northeast to keep it roughly parallel and equidistant from the DMTS road and CSB loop road.

TT5-1000

Community Type: Coastal plain mesic tussock tundra

Date of Visit: June 13, 2004

Line Orientation: NE

Aspect: Roughly north or northeast

Slope: Gentle

Dust Deposition: None visible

Soil pH: 4.5

Number of Vascular Species Recorded at Area Characterized: 13

Number of Vascular Species Represented in Microplots: 11

The vegetation characterization area at this station is dominated by ERVA, LEPA, VAVI and BENA. Mosses in some microplots appeared quite desiccated or bleached. Based on observations made later at TS-REF-12, I likely missed some grasses in this area that weren't detectable until later in the season.

TT5-2000

Community Type: Coastal plain mesic tussock tundra

Date of Visit: June 15, 2004

Line Orientation: NE

Aspect: Difficult to discern in field

Slope: Difficult to discern in field

Dust Deposition: None visible

Soil pH: 4.5

Number of Vascular Species Recorded at Area Characterized: 10

Number of Vascular Species Represented in Microplots: 10

This community is dominated by ERVA, LEPA and VAUL. BENA, VAVI, and RUCH were also present within the same cover class but at a lower estimated coverage than the former. None of the microplots fell within low, wet ERAN-dominated areas, which were up to 3 square meters in size and scattered throughout the community.

Dwarf shrubs and mosses in the vegetation characterization area seemed quite dry, perhaps drought-stressed (browning on LEPA, bleaching on some mosses). This observation was common throughout the vegetation characterization area at the station and also in mesic tussock tundra reference areas. Dry, inactive tussocks were inhabited by crustose and fruiticose lichens.

Dwarf shrubs (BENA, VAUL) rarely exceeded ERVA tussocks in height. The stature and structure (high degree of inter-matting) of dwarf shrubs precluded effective use of the line-intercept method to estimate dominant shrub coverage. No line-intercept data were collected; however, I tried a quick point-intercept event to compare against microplot coverage estimates. This method detected the dominant vascular plants and dry blade cover in the community at somewhat lower percent coverages, although most coverages fell within the same cover class using the microplot method. Only 60 points were read for the point intercept method. Sources such as Elzinga et al. (1998) recommend sampling at least 300 points to generate statistically reliable data.

Based on observations made later at TS-REF-12, I likely missed some grasses in this area that weren't detectable until later in the season.

TT6-0010

Community Type: Hillslope mesic open shrubland

Date of Visit: June 25, 2004

Line Orientation: NNE

Aspect: Roughly NW

Slope: ~15%

Dust Deposition: Light to moderate, increasing from origin to end of vegetation line

Soil pH: 6.87

Number of Vascular Species Recorded at Area Characterized: 29

Number of Vascular Species Represented in Microplots: 25

This station is basically a sloping bench above a drainage (Buddy Creek). The immediate area was dominated by BENA, VAUL and SAPL. Moss coverage was high, but thinned out in patches where soils were shallow and well-drained. No visible dust deposition on foliage (although it was raining intermittently). Some foliage has a gritty feel, especially toward the center of the vegetation line. This area (TT6-0010 and TT6-0100) receives heavy wildlife use (bear and moose have been spotted here by the field team several times as we flew or drove past). VAUL in one microplot showed heavy herbivory. SAPL and BENA in another microplot were heavily browsed. A third microplot showed heavy blackening, bleaching, or drying on EMNI, VAUL, VAVI, and foliose lichens.

TT6-0100

Community Type: Hillslope mesic open shrubland

Date of Visit: June 21, 2004

Line Orientation: NNE

Aspect: Roughly N or NE

Slope: ~10%

Dust Deposition: None visible, but detected by touch

Soil pH: 5.59

Number of Vascular Species Recorded at Area Characterized: 29

Number of Vascular Species Represented in Microplots: 23

This station was dominated by BENA, SAGL, and CABI. Some of the taller willows looked beat up; partially defoliated, and heavily browsed. In general, mosses appeared abundant (mostly Hylocomium is my sense) as did lichens, including foliose lichens. Fruiticose lichens were present, but with fairly little Thamnolia relative to other transects close to the road.

TT6-1000

Community Type: Hillslope mesic open shrubland

Date of Visit: June 21, 2004

Line Orientation: N

Aspect: South, roughly

Slope: ~10%

Dust Deposition: None apparent

Soil pH: 6.65

Number of Vascular Species Recorded at Area Characterized: 53

Number of Vascular Species Represented in Microplots: 38

This is a very diverse vegetation characterization area, stretching from a CABI- and forb-dominated slope to a BENA, VAUL, SALA-capped knoll. Shrub coverage was tall and patchy, with BENA and SALA occurring mostly in the second half of the vegetation line, toward the top of a gentle rise. Where BENA was not present, DRIN was a nearly ubiquitous ground cover. Overall, BENA was the dominant vascular plant. Mosses and lichens appeared diverse and healthy, especially beneath BENA. Exposed rock was present generally at less than 5 percent cover, as well as wet mossy pockets that likely hold standing water following rains.

TT6-2000

Community Type:	Ridge / dry alpine tundra and mesic hillslope
Date of Visit:	June 22, 2004
Line Orientation:	No line
Aspect:	Roughly N or NW (please check if this data is important)
Slope:	~15% (please check, if important)
Dust Deposition:	None visible
Soil pH:	5.76

This station fell on a bench dominated by DROC. To get sedge, willow, and lichen tissue samples, we collected CAPO, SAPL, and *Peltigera* sp. from the adjacent mesic hillslope. Foliose lichens were very abundant on the hillslope with shrubs (BENA, SPBE) and sedges (CAPO). The species listed for this station on the master plant list (Table I-1) must be considered incomplete. This was a quick, weather-rushed visit, with no formal vegetation community characterization. I most certainly missed graminoids that were present.

TT7 Transect, General Observations

Community Type:	Ridge / dry alpine tundra and mesic hillslope
Date of Visit:	June 22 and July 4, 2004
Dust Deposition:	None visible

No formal vegetation characterization was performed for any station on this transect. The lists of plants for these stations (shown on the master plant list, Table I-1) should not be considered complete.

Qualitative observations from TT7-0010 on June 22, 2004. This station is on the lee side of the same ridgeline as TT7-1000. Aspect is south to southwest, and slope is likely greater than 15 percent, although we collected tissue and soil samples in a small flat "bowl." Game trails cross directly through the station, following contours below the ridgeline. Dropped antlers and caribou scat are present nearby. Dominant shrubs were BENA, SPBE, VAUL, LEPA. VAVI and CATE (live and dead) provided significant ground cover. A few SAPL shrubs and GEGL plants were also present. Dominant sedges were CAMI and CAPO. Some of the hillside vegetation (CATE, VAVI, LEPA) was in poor

condition (excessively dry, dead, bleached, or blackened). We surmised that this was due to the fact that snow is likely still present here until well into spring. Dust from the mine site may be dropping out of suspension and accumulating here, too, although we did not detect dust on the live or damaged foliage, even by examining it under the microscope. Maier remarked that that this "bowl" area and adjacent slope appeared to be lichen rich, but much of the lichen community was excessively dry, darkened, and dead.

Qualitative observations from TT7-1000 on June 22, 2004: This station is on the same ridgeline as TT7-0010, with an east to southeast aspect and a slope of 15 percent or greater. The vegetation community was typical—a low DROC-dominated community adapted to exposed, well-drained rocky substrate and high winds. The dominant sedge was CASC, but CAMI was also present. Several dwarf willow shrubs were present (SAPH, SARE, namely). Lichens were primarily crustose and fruiticose. This station is similar to Teck Cominco's nearby permanent ridgetop quadrat "W-3" and likely has a similar complement of vascular species, with the addition of several more because W-3 microplot locations are restricted to very exposed ground. Data from the W-3 quadrat and from other vegetation characterization efforts around the mine may provide suitable reference data for the TT7 transect (ENSR 1993 & 1994; RWJ 1998).

Qualitative observations from TT7-2000 on July 4, 2004: This is a ridgetop station south of "the volcano." The dominant plant was DROC, which provides most of the ground cover present. SAPH was the most common willow, but SARE and SAAR were also present. I collected SAPL and SARE from a sheltered area on the lee side of the ridge. CAMI and CASC were the dominant sedges. Crustose lichens were abundant on rock surfaces. This was a short, weather-rushed visit.

TT8-0010

Community Type: Foothills mesic tussock tundra with tall shrub component

Date of Visit: June 19, 2004

Line Orientation: ENE

Aspect: N

Slope: Slight

Dust Deposition: Heavy

Soil pH: 7.1

Number of Vascular Species Recorded at Area Characterized: 19

Number of Vascular Species Represented in Microplots: 13

This near-roadside station was dominated by BENA, LEPA, and SAPL in the shrub stratum, and CABI and PEFR/PEHY in the herb stratum. ERVA was somewhat less prevalent here than at the other TT8 stations, but still within the same cover class. Dry blades probably accounted for more of the canopy cover at this station than at the other TT8 stations. Mosses were present at a lower cover class than at either TT8-0100 or TT8-1000, and no lichens were detected in the microplot series. Dust deposition was heavy and visible on all foliage types. Road gravel was present in 7 of the microplots,

and in 2 of the microplots it reached the 5 to 25 percent cover class. Line intercept data for BENA and SAPL correlates well with average coverage estimates in microplots (i.e., both data fall in the same cover class).

TT8-0100

Community Type: Foothills mesic tussock tundra

Date of Visit: June 19, 2004

Line Orientation: ENE

Aspect: Roughly N

Slope: Gentle

Dust Deposition: Moderate to heavy

Soil pH: 6.9

Number of Vascular Species Recorded at Area Characterized: 14

Number of Vascular Species Represented in Microplots: 12

The field team traveled on foot between TT8-1000 (see below) and TT8-0100. Qualitative observations were recorded along the way: After crossing a small drainage and proceeding up-slope (the aspect changed from flat to approximately north sloping), the walking became easier. Tussocks generally became smaller and less robust as we approached TT8-0100, and mosses seemed somehow flatter (less loft and "squish") and browner. Lichens nearly disappeared altogether with the exception of *Thamnolia*. Maier noted that mosses were less diverse at this station than at TT8-1000, as well as less robust and notably browner. VAUL, BENA, and LEPA showed some signs of herbivory, but also simply had dead limbs. VAVI, in particular seemed browned and bleached. Harbke noted that a game trail parallels the vegetation line (to the south of the line). The vegetation line's origin lies in a drainage with flowing water, tall SAPL, and thick ERAN. RUCH seemed more prevalent at this station than at TT8-1000, but still fell within the same cover class. BENA sometimes exceeded the height of ERVA tussocks by several inches. Differences in vascular vegetation between TT8-0100 and TT8-1000 may be at least partially attributable to differences in slope and aspect. Aside from dust deposition, the physical presence of the road may be affecting natural drainage patterns in the tundra, altering soil moisture regimes, which in turn, may have caused the plant community to reorganize.

Caked dust on moss was recorded as "bare ground," but noted on field data form as dead, dust-laden moss. This station seemed particularly dusty relative to other 100-meter stations.

Line intercept data was not collected because shrub distribution was fairly uniform and coverage was perceived to be well-represented in the microplot series.

TT8-1000

Community Type: Foothills mesic tussock tundra

Date of Visit: June 19, 2004

Line Orientation: ENE

Aspect: Roughly N or NE

Slope: Gentle

Dust Deposition: None visible

Soil pH: 4.5

Number of Vascular Species Recorded at Area Characterized: 11

Number of Vascular Species Represented in Microplots: 10

This station featured a typical mesic tussock tundra community. ERVA tussocks were very robust and tall in some areas (perhaps up to 2.5 feet tall), with standing water around their bases. VAUL was the dominant shrub followed by LEPA. VAVI provided significant ground cover and was blooming particularly vigorously. Lichens were diverse and readily observable, especially on hummocky areas. Mosses were diverse and robust, but not detected in microplots in a higher cover class than they were detected at TT8-0100. No species were observed that were not captured in the microplot series, except scattered SAPL. SAPL height did not exceed height of tussocks. No line intercept data was collected at this station.

TT8 Transition Data ("Super Transect")

Community Type: Foothills mesic tussock tundra / wet tundra mosaic

Date of Visit: June 27, 2004

General qualitative trend observations are supported by one microplot per transition transect station; microplot data must be interpreted with care and augmented with qualitative observations. Other TT8 station data should be integrated and interpreted with super transect data with caution. For instance, we qualitatively observed that the number of vascular plant species increased as we approached the road. Comparison of TT8-0010, TT8-0100, and TT8-1000 data supports this observation. However, super transect microplot data does not necessarily prove out this trend because the plants are not distributed truly at random and any given microplot could have missed plants present in the community. We would need more microplots at each super transect station to nail down a trend in vascular plant occurrences and certainly for coverage.

Microplot data for mosses (and perhaps lichens) on the super transect might show a trend since they are arguably more consistently distributed across the landscape and more apt to be captured by a randomly-placed 1 x 1 meter microplot frame. I entered species occurrence data for the super transect microplots in the master plant list (Table I-1).

For a quality check and training, Maier and Reeder independently (informally) recorded microplot coverage estimates, and found good agreement between estimates.

Overall, the conspicuous patterns we observed were that soil pH and the number of vascular species in the community increased as we approached the DMTS road, and coverage and vitality of lichens and mosses (especially *Sphagnum*) decreased as we approached the DMTS road. This is consistent with findings of others researching the effects of the Dalton Highway on similar environs (Auerbach et al. 1997). We observed similar trends at TT5 and elsewhere.

Dust deposition was detectable by tactile examination of foliage within 150 meters of the road, and gravel spray was present within approximately 50 meters. McKendrick (in Truett & Johnson 2000) suggests that natural analogues to road dust and gravel deposition from roads are loess deposits from rivers or sand dunes and stream-deposited gravels. The introduced substrate and altered soil pH near the DMTS road as well as water impounded by the road prism presents an opportunity for a diversity of vascular species to become established there, primarily grasses, sedges, and forbs adapted to wet conditions, and shrubs, graminoids and forbs adapted to well-drained inorganic soils that mimic dynamic riverbank or ridge substrates. This is known as floristic relay—where changes in substrate and moisture conditions alter the original plant community composition—and the plant community composition responds accordingly. If the disturbance causing the alteration ceases and influences on substrate and moisture conditions are removed, the relative species composition may return to that of the original climax community over time. In this case, the mesic acidic tussock tundra community adjacent to the road has been altered to include plants more commonly expected near riverbanks, open shrubland hillslopes, and/or ridges (tall willow shrubs, certain dwarf willows, bearberry, tall polar grasses, fireweed, etc.), and to suppress plant forms less well adapted to inundation and/or well-drained soil conditions (mosses and lichens). Of course, there are also the direct physiological effects of the dust on the plants, which may cause more sensitive species to drop out of the community allowing others to increase.

The floristic relay effect appears to diminish quickly the farther you move from the road. It may be difficult to detect significant quantitative differences in community composition between dominant species moving away from the road along a single transect given the characterization method, but I think generalizations can be made, especially if the data are considered on a road-wide basis. We tracked the presence of major types of mosses and lichens in the microplots, which may prove useful in the big picture analysis.

TS-REF-5

Community Type:	Foothills mesic tussock tundra with tall shrub component
Date of Visit:	June 23, 2004
Line Orientation:	NE
Aspect:	Roughly N or NW
Slope:	Gentle
Dust Deposition:	None visible
Soil pH:	3.92

Number of Vascular Species Recorded at Area Characterized: 13

Number of Vascular Species Represented in Microplots: 12

We chose a vegetation line here in a gently sloping mesic tussock community with roughly a west to northwest aspect. The intent was to approximate the slope and aspect of many of the TT stations along the DMTS road in mesic tussock tundra in the reference area. Another consideration in the placement of Station TS-REF-5 was keeping field crew members within sight of each other for safety (people were working simultaneously at TP-REF-3).

Like most of the TT stations, this community is dominated by ERVA tussocks and dwarf shrubs (VAUL, LEPA, BENA). The primary herbaceous ground cover is RUCH, and matt-forming woody ground cover is dominated by EMNI and VAVI. Like some TT stations at 10 or 100 meters from the DMTS road, TP-REF-5 also has a tall shrub component (SAPL and BENA) and low wet areas dominated by ERAN. Diverse mosses and lichens were observed in all ten microplots.

Important context to consider when analyzing this vegetation data: The reference area is in the Noatak River drainage (draining southwest) and the TT stations are in the Wulik River drainage (draining northwest), making it difficult to find similar slope aspects in similar communities. The reference area is more topographically complex than the DMTS road corridor, affecting wind and water drainage patterns. Soil parent material in the reference area may be different than along the DMTS road corridor. Station TS-REF-5 vegetation line is near the crest of a low rise whereas the stations along the DMTS road corridor are generally down-gradient of the road prism (a physical barrier on the landscape). One might also make the distinction between the road corridor tundra and the reference station tundra as coastal plain type vs. foothills type. The slope of TS-REF-5 is probably steeper than at most TT tussock tundra stations.

Qualitative observations: Lichens seem to be significantly more abundant, various, and readily visible here than in comparable TT stations, but mosses probably exhibit less loft and coverage than at stations like TT8-1000 or TT3-1000, for instance. Tussocks here are probably lower and less densely spaced as well. RUCH cover is substantial, and its copious leaf litter is inter-bedded with lichens in most microplots. Signs of herbivory on VAUL were common, and to a lesser extent, on SAPL. EMNI, LEPA, and VAVI showed signs of browning we've so often observed at other stations. Some "bleaching" was observed on VAVI in or near microplots and at a snow accumulation area north of TP-REF-3. This is consistent with observations at TT7-0010 in the lee of a ridge where blackening and bleaching of dwarf shrub vegetation was severe.

Interesting to note is that the foliose lichen *Peltigera* sp. had fruiting bodies on it at this station, the first observation of fruiting bodies during the terrestrial program.

Species observed near the vegetation line but not represented in microplots: PEspp. (*Petasites* species) and CABI. These species are present at an estimated cover of less than 1 percent in the vegetation line area.

TS-REF-7

Community Type: Foothills mesic tussock tundra

Date of Visit: June 24, 2004

Line Orientation: NE

Aspect: Roughly NW or W

Slope: Gentle

Dust Deposition: None visible

Soil pH: 4.55

Number of Vascular Species Recorded at Area Characterized: 14

Number of Vascular Species Represented in Microplots: 14

The vegetation line at this station was offset from the original station coordinates (see Harbke notes for details) to fall in a mesic tussock tundra community representative of DMTS road corridor stations (namely 1000 meter stations). The same contextual considerations apply to data gathered at this station as apply to TS-REF-5.

This community is dominated by ERVA tussocks and dwarf shrubs (BENA, LEPA, VAUL), with RUCH as the primary herbaceous ground cover. Occasional tall shrubs (SAPL and BENA) reach heights in excess of tussocks. The vegetation line did not fall across any tall individual shrubs, but fell across low-profile individuals of both species. No line-intercept data was collected at this station because all tall shrub stratum species observed along the vegetation line were captured by microplots, and shrub species except SAPL are fairly well distributed throughout the community.

Diverse mosses and lichens were observed in all ten microplots. Low wet areas dominated by ERVA were scattered throughout the area characterized but were less common than at TS-REF-5. Less RUCH litter was present in microplots than at TS-REF-5.

Qualitative observations: The moss community at TS-REF-7 is more similar in appearance to the moss communities found at TT5-1000, TT5-2000, TT3-1000, and TT8-1000 than the moss community at TS-REF-5. The mosses at TS-REF-7 are well-developed, varied, and vigorous.

TS-REF-11

Community Type: Hillslope mesic open shrubland

Date of Visit: June 25, 2004

Line Orientation: 76 degrees (origin to end)

Aspect: Roughly NNW

Slope: ~10%

Dust Deposition: None visible

Soil pH: 5.3

Number of Vascular Species Recorded at Area Characterized: 34

Number of Vascular Species Represented in Microplots: 24

We attempted to locate this station in the reference area to approximate the aspect, slope, and community types of the TT6 transect stations. This area receives heavy wildlife use (similar to TT6-0010) as evidenced by game trails and heavy browsing/breakage on SAPL shrubs. Microplot and line-intercept shrub coverage data at this station correlate reasonably well (results fall within the same cover classes). Differences in plant community composition between this reference station and site stations should be interpreted with caution. Presence of scattered alder and spruce in this drainage and near the vegetation line indicate we are transitioning to another eco-region in the reference area. Other vegetation characterization efforts around the mine may provide additional suitable reference data for the TT6 transect (ENSR 1993 & 1994; RWJ 1998).

Browning and bleaching was observed on EMNI, VAVI, and LYCL, as well as loss of foliage, and possibly herbivory on VAUL. These phenomena seem to be ubiquitous at most or all site and reference stations regardless of detectable dust deposition.

TS-REF-12

Community Type: Coast plain mesic tussock tundra

Date of Visit: July 3 & 4, 2004

Line Orientation: NNE (~21 degrees)

Aspect: Roughly south or southwest

Slope: Gentle

Dust Deposition: None visible

Soil pH: 3.6

Number of Vascular Species Recorded at Area Characterized: 13

Number of Vascular Species Represented in Microplots: 13

This station was placed inland from CL-REF-2 to represent a vegetation reference for the TT5 transect, chiefly the TT5-1000 and TT5-2000 stations. Soil pH is lower than the TT5 stations. LEPA, ERVA, VAVI, and RUCH dominate the community (present at 100% frequency with up to 50% cover in the microplot series). This station and TT5-1000 and TT5-2000 have similar complements of dominant species.

Moss coverage was slightly higher at this reference station than at the TT5-1000 and TT5-2000 stations, although probably not significantly (cover class is the same across the three stations). Lichens at TT5-1000 are in a lower cover class than lichens at TS-REF-12 and TT5-2000. Mosses were diverse, but often quite dry or bleached in appearance. Foliose lichens were often crisp (dehydrated) and dull. LEPA and VAVI showed some browning in several microplots. Dry moss beds were densely occupied by

crustose and fruiticose lichens, as were the sides and tops of old inactive ERVA tussocks.

BENA and VAUL were present at this station only at the <5% cover class, as opposed to the 5 – 25% cover class at TT5-1000 and TT5-2000. BENA and VAUL distribution was also patchier in the microplot series at this station than at TT5-1000 and TT5-2000. This difference could be a function of the station's relative proximity to the seacoast and/or lower soil pH. RUCH is more dominant at this reference station than at TT5-1000 and TT5-2000. The differences between forbs and especially graminoids on species lists for TS-REF-12 and the TT5-1000 and 2000 stations may be an artifact of the timing of the characterization events, which may have affected identification at the site stations surveyed ealier.

Line intercept data was not collected because shrub profile did not exceed tussocks.

PLNL

Community Type: Lagoon fringe emergent

Date of Visit: June 28, 2004

Line Orientation: Roughly NW

Aspect: Roughly SW

Slope: Gentle (toward waterline)

Dust Deposition: None visible

Soil pH: 6.5

Number of Vascular Species Recorded at Area Characterized: 12

Number of Vascular Species Represented in Microplots: 7

We placed the vegetation line near the north end of Port Lagoon North roughly parallel to its east shoreline. Because the vegetation line is straight and the lagoon's shoreline is sinuous, the vegetation line traverses a good cross-section of the lagoon's fringe of emergent and nearshore vegetation.

Within the vegetation characterization area, the waterline and substrate immediately offshore were dominated by nearly monotypic stands of HIVU. Moving upland from the waterline, HIVU graded into DUFI with ARFU, ERAN, and DECA (in order of dominance). CAAQ was also present but none was recorded in the microplots. Forbs were present in trace or less than 5% cover classes and included RAHY and STCR. Most of the canopy cover was provided by dry graminoid blades. Two species of mosses were present, the same mosses present at all lagoon stations (including reference stations).

Maier and I noted that lagoon fringe CAAQ (this note applies to all lagoon sites) is smaller in stature, and its foliage more succulent and deeper green than CAAQ sampled on tussock tundra, at tundra ponds, or upland from lagoon fringes. Vouchers of lagoon fringe CAAQ key definitively in Hultén (1968) as CAAQ (and we have no doubt the genus is *Carex*); however because its physical characteristics differ markedly from

CAAQ collected elsewhere, this identification must be regarded as tentative. I provided Exponent with representative vouchers of all CAAQ "types" collected.

NLK

Community Type: Coastal lagoon fringe emergent

Date of Visit: June 30, 2004

Line Orientation: NW (~317 degrees)

Aspect: Roughly SW

Slope: Gentle (toward waterline)

Dust Deposition: None visible

Soil pH: 5.6

Number of Vascular Species Recorded at Area Characterized: 11

Number of Vascular Species Represented in Microplots: 10

CAAQ and DUFI are the dominant graminoids on the vegetation line at this station, occurring most often in the 25 – 50% cover class at 100% frequency in the microplot series. Dry blades and live moss contributed significantly to ground cover. At least two types of mosses were present. Other grasses (CADE, DECA, POAL) were present mostly at trace or <5% cover in microplots. Forbs in the families Cruciferae (mustard), Ranunculaceae (buttercup), and Caryophyllaceae (pink) were present mostly in the "trace" cover class at less than 100% frequencies.

NLF, General Observations

Community Type: Beach dune

Date of Visit: July 2, 2004

Line Orientation: No line – General qualitative observations only

Aspect: Roughly NE

Slope: ~5%

Dust Deposition: None visible

Soil pH: 7.3

Number of Vascular Species Estimated: 10

The vegetation community near NLF is a dune complex between North Lagoon and the Chukchi. The waterline is generally abiotic and the substrate is poorly sorted sandy gravel with few fines. The dominant vegetation is ELAR (see Master Plant list for other species present). More than 50% of the dune complex near NLF is bare substrate.

Beach dune complex vegetation at other lagoons, including reference lagoons, has similar complement of species dominated by ELAR, similar substrate, and similar percentage of bare ground.

CL-REF-1

Community Type: Coastal lagoon fringe emergent

Date of Visit: July 2, 2004

Line Orientation: NW (~309 degrees per Harbke)

Aspect: Roughly SW (toward waterline)

Slope: Gentle

Dust Deposition: None visible

Soil pH: 5.4

Number of Vascular Species Recorded at Area Characterized: 8

Number of Vascular Species Represented in Microplots: 8

The vegetation line at this station intersects lagoon fringe emergent vegetation where HIVU grades into ERAN, ARFU, and DUFI, making it a good reference for the vegetation community PLNL. This community is similar to PLNL with the addition of CACA2 (a new Carex species) and the absence of CAAQ until higher ground. Substrate is saturated throughout the vegetation line. The vegetation line lies approximately 100 to 300 feet from the waterline, roughly parallel to the slightly sinuous shore. Mesic tussock tundra lies approximately 300 feet northeast, up a low rise. The vegetation transition profile from just upland of the emergent vegetation band to mesic tussock tundra is similar that at PLNL and NLK.

On the beach dune side of this lagoon I observed signs of grazing on ARFU and Eleocharis sp.-type sedge.

CL-REF-2

Community Type: Coastal lagoon fringe emergent

Date of Visit: July 4, 2004

Line Orientation: Roughly NW

Aspect: Roughly SW (toward waterline)

Slope: Gentle

Dust Deposition: None visible

Soil pH: 4.7

Number of Vascular Species Recorded at Area Characterized: 11

Number of Vascular Species Represented in Microplots: 8

This reference station is most similar in vegetation profile to NLK. CAAQ was the dominant graminoid at the water's edge and on the vegetation line at CL-REF-2, presenting in at least the 5 – 25% cover class at 100% frequency in the microplots. The vegetation line area showed signs of heavy wildlife utilization: I observed bear scat and foliage disturbance (possibly bear or moose bedded down here), plenty of goose scat

(substantially more than at other lagoon stations), and patches of heavy grazing on CAAQ blades along the vegetation line. Some areas along the shore were almost turf-like in appearance due to grazing.

Much of the identification of graminoids in the microplots at this station was based on vegetative characteristics only (most plants lacked inflorescences). If vouchers with inflorescences were not available near the microplots for identification, vegetative plant parts were compared to flowering vouchers from other stations. I likely missed some unknown graminoid species here that appeared vegetatively similar to known species.

Across the lagoon at CL-REF-3 we observed goose scat and evidence of grazing on DECA.

NOMENCLATURE & TERMINOLOGY

Plant codes

> Plant codes used throughout these narratives and the summary tables consist of the first two letters of the genus and the first two letters of the species to form a four letter acronym. When the plant code would be duplicated for another species, the number "2" is added to the code, etc. When the plant is only identified to genus level, the first two letters of the genus are given in caps followed by "sp" in lowercase.

Plant nomenclature

> Nomenclature is from Hultén (1968), except SAPL - *Salix planifolia pulchra,* which is from Viereck & Little (1972). Since we initially keyed this willow using Viereck and dubbed it "SAPL," we continued, for consistency, to refer to it as SAPL throughout the remainder of the field work.

"Tall shrubs"

> In tussock tundra community means shrubs exceeding the height of tussocks. It is difficult to give an absolute height of such shrubs because the ground surface is so uneven.

"Low shrubs" or "dwarf shrubs"

> In tussock tundra community means shrubs generally do not exceed height of tussocks. It is difficult to give an absolute height of such shrubs because the ground surface is so uneven.

"Graminoids"

> I use this term for grasses and grass-like plants, including sedges and rushes.

"Broadleaf litter"

> Broadleaf vegetation is herbaceous or woody non-graminoid vascular vegetation (i.e., any vascular vegetation except graminoids). Litter is ground cover (fallen

leaves or twigs), but I also lumped dead foliage remaining on plants into this category. Also referred to as “woody debris” or “forb leaf litter.” Treat these terms as synonymous with “broadleaf litter.”

“Dry blades”

This category refers to dry or dead standing blades of ERVA tussocks, or other dried graminoid blades providing ground cover. It’s an important category to consider in combination with live ERVA to form an understanding of how much cover tussocks are providing in the microplots. In emergent graminoid communities on lagoon fringes, this category refers to non-decayed blade matter, dried blade matter. Also referred to as “dead blades” or “dead ERVA blades, etc.”

NOTES ON METHODOLOGY

Vegetation lines (not referred to as “transects” to avoid confusion with the term “Terrestrial Transect”) are oriented parallel to the DMTS road where possible. Vegetation lines are oriented with the “origin” toward the port direction on the road and the “end” toward the mine direction on the road. Slope and aspect are merely visually estimated.

A series of 10 microplots were placed on the left side of each vegetation line (left as you look “up” the line from its origin). Microplots were placed along a line beginning at a randomly-chosen distance from the origin and proceeding at 30-foot intervals thence. Microplot locations were marked with wood lath or pin flags. The bottom right corner of the microplot frame was placed against the marker at each microplot location with the right side of the microplot frame against the vegetation line.

Documentary photographs of each microplot were generally taken looking “up” the vegetation line (e.g., facing the end of the vegetation line), except where the photographer’s shadow would interfere with the photograph or the vegetation in the microplot could be better viewed from another angle. When the microplot photo direction was altered, it was noted in the photo log.

Live vascular cover is estimated in two-dimensions. In other words, any part of a live vascular plant’s canopy occurring under the canopy of a taller live vascular plant is not captured in the canopy estimate. Therefore, in plant communities with a high degree of vertical structure (layering), an expression of a plant’s cover in a microplot can also be an expression of its dominance (with height as an important factor). Remember that because we are estimating cover using cover classes, the total percent cover of live vascular plants in a microplot can exceed 100%.

Percent cover estimates for dry graminoid blades, broadleaf litter (including standing dead broadleaf vegetation), mosses, lichens, surface water, gravel, rock, and bare ground are also made using cover classes, but they are made independently from vascular plant canopy coverage. For instance, percent cover of mosses includes the total estimated cover of mosses in the microplot—mosses beneath the vascular plant canopy, beneath foliose lichens, plant litter, or any other recorded parameter.

Estimating live vascular cover for grasses and other vertically-oriented or narrow-leaved plants is particularly challenging. Vertically-oriented blades of graminoids do not occupy

much two-dimensional space and are more difficult to visually "group" in the microplot frame than broad-leaf vegetation, especially when they are uniformly spread across a microplot and vary in height. Consequently, it's easy to overestimate their coverage. Keep in mind that photographs of microplots are oblique (not a view straight down on the microplot) causing graminoids to appear to have more coverage than values estimated in the microplots.

The "trace" cover class was assigned to minute plants occurring only once in a microplot frame or to larger plants not rooted in the microplot frame but with a leaf or a blade contributing to canopy cover in the microplot. "Trace" was also assigned to a species that occurred in the microplot frame but was completely beneath the canopy of another vascular plant species. "Trace" designations are not included in canopy cover calculations but do figure into frequency, so using the trace cover class for plants present but over-canopied by others is a good way to account for them when characterizing a vegetation community even if the cover they contribute is negligible.

I noted species encountered in the vegetation characterization area but not represented in the microplot series. These species show up on the master plant list (Table I-1) for the stations where I saw them. I considered a plant to be "in the vegetation characterization area" if it fell near the vegetation line (within a few meters) and was within the same community type (or types) traversed by the vegetation line.

I did not begin identifying the different types of mosses and lichens within microplots until around June 20. Initially we attempted to identify lichens to genus level, but later switched to growth forms. Some mosses are only identified by their growth form. TT8 and TT6 have decent breakdowns of mosses and lichens, as do the reference area stations. Moss and lichen breakdowns were recorded on TT3-0100 and TT3-1000.

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Table I-1. Master list of plant species observed by transect station

Code	Species	Common Name	Family	TT20010	TT20100	TT21000	TT30010	TT30100	TT31000	TT50010	TT50100	TT51000	TT52000	TT60010	TT60100	TT61000	TT62000	TT70010	TT71000	TT72000	TT80010	TT80050	TT80100	TT80150	TT80200	TT80250	TT80300	TT80350	TT80400	TT80450	TT80500	TT80550	TT80600	TT80650	TT80700	TT80750	TT80800	TT80900	TT81000	TS-REF-5	TS-REF-7	TS-REF-11	TS-REF-12	PLNL	NLK	NLF	CL-REF-1	CL-REF-2
ACDE	*Aconitum delphinifolium*	Monkshood	RAN																	x																													
ANFR	*Antennaria friesiana alaskana*	Pussytoes	COM																	x																													
ANNA	*Anemone narcissiflora*	Anemone	RAN							x																																						
ANPO	*Andromeda polifolia*	Bog rosemary	ERI				x	x							x																									x	x						
ANsp	*Androsace* sp.	Primrose	PRI							x																																						
ANsp2	*Anemone* sp.	Anemone	RAN			x								x		x					x																											
ARAL	*Arctostaphylos alpina*	Bearberry	ERI											x					x		x		x																								
ARAR	*Artemesia arctica arctica*	Wormwood	COM													x	x																										x				
ARFU	*Arctophila fulva*	Pendent grass	GRA																																										x		x	x	x
ARLA	*Arctagrostis latifolia var. arundinaceae*	Polar grass	GRA				x			x	x										x																											
ARLA2	*Arctagrostis latifolia var. latifolia*	Polar grass	GRA											x	x	x																											x	x				
ARLE	*Arnica lessingii lessingii*	Arnica	COM				x									x				x																							x				
ASUM	*Astragalus umbellatus*	Milk vetch	LEG			x																																									
BENA	*Betula nana exilis*	Dwarf birch	BET	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
BUTR	*Bupleurum triradiatum*	Thoroughwax	UMB													x																															
CAAQ	*Carex aquatilis*	Carex	CYP	x	x	x	x	x		x	x		x										x				x	x	x	x		x	x	x						x				x	x			x
CABI	*Caryx bigelowii*	Bigelow's sedge	CYP	x	x	x			x	x	x	x	x		x	x					x	x	x	x	x			x			x					x	x	x	x	x	x	x	x	x				
CACA	*Calamagrostis canadensis canadensis*	Bluejoint grass	GRA																											x	x																
CACA2	*Carex canescens*	Sedge	CYP																																											x	x
CADE	*Calamagrostis deschampsioides*	Bluejoint grass	GRA																																									x	x			x
CAHO	*Calamagrostis holmii*	Bluejoint grass	GRA																																									x				
CAHY	*Cardamine hyperborea*	Mustard	CRU			x				x					x																																
CAMI	*Carex microchaeta*	Sedge	CYP											x		x		x	x	x																								x				
CAPO	*Carex podocarpa*	Sedge	CYP											x			x	x																														
CARO	*Carex rotundata*	Sedge	CYP				x	x										x																														
CASA	*Carex saxatilis laxa*	Sedge	CYP													x																												x				
CASC	*Carex scirpoidea*	Sedge	CYP														x		x	x																												
CAsp	*Calamagrostis* sp.	Bluejoint grass	GRA								x	x																																				
CAsp2	*Carex* sp.	Sedge	CYP																							x										x												
CATE	*Cassiope tetragonia*	Heather	ERI													x	x	x	x																								x					
CEBE	*Cerastrium beeringianum*	Mouse ear chickweed	CAR													x																																
COOF	*Cochlearia officinalis oblongifolia*	Scurvy grass	CRU																																											x		
DEBE	*Deschampsia beringensis*	Tufted hairgrass	GRA																																										x		
DECA	*Deschampsia caespitosa*	Tufted hairgrass	GRA																																									x	x		x	x
DEBR	*Delphinium brachycentrum*	Larkspur	RAN													x																																
DOOC	*Douglasia ochotensis*	Douglasia	PRI																x																													
DRFL	*Draba fladnizensis*	Mustard	CRU			x				x																																						
DRIN	*Dryas integrifolia integrifolia*	Dryas	ROS			x									x	x	x																														
DROC	*Dryas octopetala*	White mountain avens	ROS													x			x	x																												
DUFI	*Dupontia fischeri psilosantha*	Tundra grass	GRA																																									x	x		x	x
ELAR	*Elymus arenarius mollis*	Beach wildrye	GRA																																											x		
EMNI	*Empitrum nigrum hermaphorditum*	Crowberry	EMP		x	x	x	x	x	x		x	x	x	x	x	x		x		x	x	x	x	x					x		x	x	x	x	x	x	x	x	x	x	x				
EPLA	*Epilobium latifolium*	River beauty	ONA																																											x		
EQAR	*Equisetum arvense*	Horsetail	EQU				x								x	x																											x				
EQsp2	*Equisetum* sp.	Horsetail	EQU												x																																	
ERAN	*Eriophorum angustifolium subarcticum*	Cottongrass	CYP	x	x	x	x	x	x	x	x	x	x									x		x							x										x	x	x		x	x		x	
ERVA	*Eriophorum vaginatum*	Cottongrass	CYP	x	x	x	x	x	x	x	x	x	x		x						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x				
EUED	*Eutrema edwardsii*	Mustard	CRU			x																																									
FEAL	*Festuca altaica*	Fescue grass	GRA											x	x	x	x																										x				
FEBR	*Festuca brachyphylla*	Fescue grass	GRA																	x																												
FONLK2	Unknown forb, CRU Family	Unknown mustard	CRU																																										x		
FONLK3	Unknown forb, RAN Family	Unknown buttercup	RAN																																										x	x			
FOTT60010	Unknown forb	Unknown forb												x																														x				
FOTT60100	Unknown forb	Unknown forb													x																																	
FOTT61000-1	Unknown forb	Unknown forb												x	x	x																																

Table I-1. (cont.)

Code	Species	Common Name	Family	TT20010	TT20100	TT21000	TT30010	TT30100	TT31000	TT50010	TT50100	TT51000	TT52000	TT60010	TT60100	TT61000	TT62000	TT70010	TT71000	TT72000	TT80010	TT80050	TT80100	TT80150	TT80200	TT80250	TT80300	TT80350	TT80400	TT80450	TT80500	TT80550	TT80600	TT80650	TT80700	TT80750	TT80800	TT80900	TT81000	TS-REF-5	TS-REF-7	TS-REF-11	TS-REF-12	PLNL	NLK	NLF	CL-REF-1	CL-REF-2
FOTT61000-2	Unknown forb	Unknown forb														x																																
FOTT61000-3	Unknown forb, LEG Family	Unknown forb	LEG													x																																
GEGL	*Geniana glauca*	Glaucous gential	GEN														x	x																														
GRTT61000	Unknown grass	Unknown grass	GRA													x																																
HIAL	*Hierchloe alpina*	Holy grass	GRA			x				x	x			x	x	x	x		x	x	x																										
HIVU	*Hippuris vulgaris*	Mare's tail	HAL																																										x		x	x
HOPE	*Honckenya peploides major*	Seabeach sandwort	CAR																																										x		
LAGL	*Lagotis glauca minor*	Lagotis	SCR			x						x																																		
LAMA	*Lathyrus maritimus maritimus*	Beach pea	LEG																																										x		
LEPA	*Ledum palustre decumbens*	Labrador tea	ERI	x	x	x	x	x	x	x	x	x	x	x	x	x		x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
LIBO	*Linnaea borealis borealis*	Twin flower	CAP											x																																	
LOPR	*Loiseleuria procumbens*	Alpine azalea	ERI																																								x				
LUAR	*Lupinus arcticus*	Lupine	LEG			x										x	x																														
LUCO	*Luzula confusa*	Wood rush	JUN													x																																
LUMU	*Luzula multiflora multiflora*	Wood rush	JUN			x				x						x					x																										
LUWA	*Luzula wahlenbergii*	Wood rush	JUN																																								x	x			x
LYCL	*Lycopodium clavatum monostachyon*	Club moss	LYC																																							x				
MEMA	*Mertensia maritima maritima*	Oysterleaf, sea bluebell	BOR																																										x		
MIAR	*Minuartia arctica*	Sandwort	CAR											x		x	x			x																										
MYAL	*Myosotis alpestris asiatica*	Forget-me-not	BOR													x																														
OXMA	*Oxytropis maydelliana*	Oxytrope	LEG			x																																								
OXNI	*Oxytropis nigrescens bryophilia*	Oxytrope	LEG														x		x	x																										
PAMA	*Papaver macounni*	Alaska poppy	PAP			x										x																														
PECA	*Pedicularis capitata*	Lousewort	SCR			x				x																																				
PEFR/PEHY	*Petasites frigidus or hyperboreus*	Sweet coltsfoot	COM	x		x				x	x	x		x	x	x					x		x																		x	x	x				
PELA	*Pedicularis langsdorfii arctica*	Lousewort	SCR			x				x																																x				
PELA2	*Pedicularis labradorica*	Lousewort	SCR		x	x		x	x					x	x	x					x		x																		x	x	x				
PEOE	*Pedicularis oederi*	Oeder's lousewort	SCR		x	x		x		x																																				
PEsp	*Pedicularis* sp.	Lousewort	SCR			x								x					x																												
PHSI	*Phlox siberica*	Phlox	POL													x	x		x																												
POAC	*Polemonium acutiflorum*	Jacob's ladder	POL	x		x				x	x				x																												x				
POAL	*Poa alpigena*	Bluegrass	GRA																																										x			
POBI	*Polygonum bistorta plumosum*	Bistort	POL							x				x		x		x																												
POEG	*Potentilla egedii egedii*	Beach cinquefoil	ROS																																												x
POFR	*Potentilla fruiticosa*	Shrubby cinquefoil	ROS			x										x																														
POGL	*Poa glauca*	Tundra bluegrass	GRA													x																														
POLA	*Poa lanata*	Bluegrass	GRA			x				x	x										x																							x			
POsp	*Poa* sp.	Bluegrass	GRA											x	x																													x			
POVI	*Polygonum viviparum*	Alpine meadow bistort	POL							x						x																														
PRBO	*Primula borealis*	Primrose	PRI							x																																				
PYGR	*Pyrola grandiflora*	Wintergreen	PYR											x	x	x																											x			
RACO	*Ranunculus confervoides*	Buttercup	RAN																																										x		
RAHY	*Ranunculus hyperborealis hyperborealis*	Buttercup	RAN																																										x		
RALA	*Ranunculus lapponicus*	Buttercup	RAN							x																																	x				
RAsp	*Ranunculus* sp.	Buttercup	RAN							x						x																														
RHLA	*Rhododendron lapponicum*	Lapland rosebay	ERI								x					x																														
RUAR	*Rumex arcticus*	Sourdock	POL																																										x	x		
RUAR2	*Rubus arcticus arcticus*	Cloudberry (Salmonberry)[a]	ROS																																								x				
RUCH	*Rubus chamaemorus*	Cloudberry (Salmonberry)	ROS	x	x	x	x	x	x	x	x	x	x		x						x	x	x		x	x		x	x	x	x			x	x	x	x	x	x	x	x	x	x				
SAAL	*Salix alaxensis*	Feltleaf willow	SAL				x							x																																	
SAAN	*Saussurea angustifolia*	Saussurea	COM			x				x	x			x		x	x																										x			
SAAR	*Salix arctica*	Arctic willow	SAL			x				x	x								x	x																										
SABR	*Saxifraga bronchialis funstonii*	Spotted saxifrage	SAX													x			x	x																										
SAFU	*Salix fuscescens*	Bog willow	SAL					x															x									x														
SAGL	*Salix glauca*	Grayleaf willow	SAL												x	x																														

Table I-1. (cont.)

Code	Species	Common Name	Family	TT20010	TT20100	TT21000	TT30010	TT30100	TT31000	TT50010	TT50100	TT51000	TT52000	TT60010	TT60100	TT61000	TT62000	TT70010	TT71000	TT72000	TT80010	TT80050	TT80100	TT80150	TT80200	TT80250	TT80300	TT80350	TT80400	TT80450	TT80500	TT80550	TT80600	TT80650	TT80700	TT80750	TT80800	TT80900	TT81000	TS-REF-5	TS-REF-7	TS-REF-11	TS-REF-12	PLNL	NLK	NLF	CL-REF-1	CL-REF-2
SALA	*Salix lanata richardsonii*	Richardson willow	SAL			x								x	x	x	x																															
SAOV	*Salix ovalifolia*	Ovaleaf willow	SAL					x																																				x	x		x	x
SAPH	*Salix phlebophylla*	Skeletonleaf willow	SAL													x	x	x	x	x																												
SAPL	*Salix planifolia pulchra*	Diamondleaf willow	SAL	x	x	x	x			x	x	x		x	x	x	x	x		x	x		x						x		x								x	x	x	x					
SAPO	*Salix polaris*	Polar willow	SAL			x				x	x							x	x	x	x																										
SAPU	*Saxifraga punctata*	Brook saxifrage	SAX			x								x		x	x			x																							x				
SARE	*Salix reticulata*	Netleaf willow	SAL			x									x	x	x	x	x	x																											
SAsp3	*Salix* sp.	Dwarf willow	SAL																																								x				
SEPS	*Senecio pseudo-arnica*	Beach fleabane	COM																																									x			
SEsp	*Senecio* sp.	Senecio	COM													x																															
SETT61000	Unknown sedge, CYP Family	Unknown sedge	CYP													x																														
SOMU	*Solidago multiradiata*	Goldenrod	COM													x																														
SPBE	*Spirea beauverdiana*	Spirea	ROS											x			x	x																									x			
STCR	*Stellaria crassifolia*	Chickweed	CAR																																										x	x		x	x
STLA	*Stellaria laeta*	Chickweed	CAR	x		x				x	x			x	x	x					x																							x				
TRPH	*Tripleurosperum phaeocephalum*	Wild chamomile	COM																																										x		
VACA	*Valeriana capitata*	Valerian	VAL	x		x				x	x				x																												x				
VAUL	*Vaccinium uliginosum alpinum*	Alpine blueberry	ERI	x	x	x	x	x	x		x	x	x	x	x	x	x	x			x	x	x	x					x		x	x		x	x	x			x	x	x	x	x				
VAVI	*Vaccinium vitis-idaea minus*	Lingonberry	ERI	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
ZYEL	*Zygandenus elegans*	White camass	LIL													x																															

[a] Also known as Dwarf Nagoonberry (Pojar and MacKinnon 1994).

Table I-2. Summary of code names used for families

Family Code	Family Name	Family Name
BET	Betulaceae	Birch
BOR	Boraginaceae	Borage
CAP	Caprifoliaceae	Honeysuckle
CAR	Caryophyllaceae	Pink
COM	Compositae	Composite
CRU	Cruciferae	Mustard
EMP	Empetraceae	Crowberry
EQU	Equisetaceae	Horsetail
ERI	Ericaceae	Heath
GEN	Gentianaceae	Gentian
GRA	Graminaceae	Grass
HAL	Haloragaceae	Water Milfoil
JUN	Juncaceae	Rush
LEG	Leguminosae	Pea
LIL	Liliaceae	Lily
LYC	Lycopodiaceae	Club Moss
ONA	Onagraceae	Evening primrose
PAP	Papaveraceae	Poppy
PLY	Polygoniaceae	Buckwheat
POL	Polemoniaceae	Polemonium
PRI	Primulaceae	Primrose
PYR	Pyrolaceae	Wintergreen
RAN	Ranunculaceae	Crowfoot
ROS	Rosaceae	Rose
SAL	Salicaceae	Willow
SAX	Saxifragaceae	Saxifrage
SCR	Scrophulariaceae	Figwort
UMB	Umbelliferae	Parsely
VAL	Valerianaceae	Valerian

Table I-3. Summary of cover classes and frequencies for microplots on transect TT3

TT30010

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ANPO	3	4	3						0.8	10	70
ARLA	10								0.0	10	0
ARLE	9		1						0.3	10	10
BENA	0		4	4	2				**14.5**	10	**100**
CAAQ	5		4	1					**2.5**	10	50
CARO	10								0.0	10	0
EMNI	1	2	5	2					**4.3**	10	90
EQAR	9	1							0.0	10	10
ERAN	9		1						0.3	10	10
ERVA	0		3	5	2				**15.8**	10	**100**
LEPA	0	3	7						**1.8**	10	**100**
RUCH	0		1	5	4				**22.8**	10	**100**
SAAL	10								0.0	10	0
SAPL	10								0.0	10	0
VAUL	0			5	4	1			**28.8**	10	**100**
VAVI	1	6	3						0.8	10	90
Other Categories											
Broadleaf litter	0	1	2	6	1				**13.3**	10	**100**
Dry blades	0		2	5	2	1			**21.8**	10	**100**
Road gravel	3	3	3	1					**2.3**	10	70
Water	9			1					**1.5**	10	10
Moss	0		2	3	4	1			**26.3**	10	**100**
Lichen	10								0.0	10	0
Rock	8		2						0.5	10	20
Bare ground	8		1		1				**4.0**	10	20

16 Total number of species observed in area
12 Number of species represented in microplots

No line intercept data collected.

TT30100

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ANPO	3	4	2	1					**2.0**	10	70
BENA	0		4	3	3				**16.8**	10	**100**
CAAQ	4	1	4	1					**2.5**	10	60
CARO	9		1						0.3	10	10
EMNI	2	3	4	1					**2.5**	10	80
ERAN	7		2	1					**2.0**	10	30
ERVA	0		3	5	1			1	**20.5**	10	**100**
LEPA	0		3	6	1				**13.5**	10	**100**
PELA2	10								0.0	10	0
PEOE	10								0.0	10	0
RUCH	2		2	5	1				**11.8**	10	80
SAOV	9				1				**3.8**	10	10
SAFU	10								0.0	10	0
VAUL	0			5	5				**26.3**	10	**100**
VAVI	6	1	2	1					**2.0**	10	40
Other Categories											
Broadleaf litter	2		2	2	3	1			**21.0**	10	80
Dry blades	0		1	3	4	2			**32.3**	10	**100**
Road gravel	10								0.0	10	0
Water	5		1	1	1	2			**18.0**	10	50
Moss	1		2	1	3	2	1		**34.3**	10	90
Lichen	4	2	3	1					**2.3**	10	60
Rock	10								0.0	10	0
Bare ground	10								0.0	10	0

15 Total number of species observed in area
12 Number of species represented in microplots

No line intercept data collected.

TT31000

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
BENA	0		5	4	1				**11.0**	10	**100**
CABI	5	5							0.0	10	50
EMNI	3	2	3	2					**3.8**	10	70
ERAN	9		1						0.3	10	10
ERVA	0		2	7	1				**14.8**	10	**100**
LEPA	0		3	7					**11.3**	10	**100**
PELA2	9		1						0.3	10	10
RUCH	0	1	7	2					**4.8**	10	**100**
VAUL	0			5	4	1			**28.8**	10	**100**
VAVI	0		3	5	2				**15.8**	10	**100**
Other Categories											
Broadleaf litter	1		1	7	1				**14.5**	10	90
Dry blades	0			3	5	2			**35.8**	10	**100**
Road gravel	10								0.0	10	0
Water	10								0.0	10	0
Moss	0				10				**37.5**	10	**100**
Lichen	0	1	7	2					**4.8**	10	**100**
Rock	10								0.0	10	0
Bare ground	10								0.0	10	0

10 Total number of species observed in area
10 Number of species represented in microplots

No line intercept data collected.

Table I-4. Summary of cover classes and frequencies for microplots on transect TT5

TT50010

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ANNA	9		1						0.3	10	10
ANsp	9	1							0.0	10	10
ARLA	8	1	1						0.3	10	20
BENA	6		1	1	2				**9.3**	10	40
CAAQ	9		1						0.3	10	10
CABI	9		1						0.3	10	10
CAHY	10								0.0	10	0
DRFL	10								0.0	10	0
EMNI	9	1							0.0	10	10
ERAN	6	1	1	2					**3.3**	10	40
ERVA	2		3	5					**8.3**	10	80
HIAL	9	1							0.0	10	10
LEPA	6		4						1.0	10	40
LUMU	9		1						0.3	10	10
PECA	9	1							0.0	10	10
PEFR/PEHY	0	5	4		1				**4.8**	10	**100**
PELA	10								0.0	10	0
PEOE	10								0.0	10	0
POAC	5	4	1						0.3	10	50
POBI	10								0.0	10	0
POLA	3	1	3	3					**5.3**	10	70
POVI	8	2							0.0	10	20
PRBO	10								0.0	10	0
RALA	10								0.0	10	0
RAsp	10								0.0	10	0
RUCH	4	3	3						0.8	10	60
SAAN	9	1							0.0	10	10
SAAR	9	1							0.0	10	10
SAPL	3	1	3		1		2		**21.5**	10	70
SAPO	9		1						0.3	10	10
STLA	7	3							0.0	10	30
VACA	8	2							0.0	10	20
VAVI	8	1	1						0.3	10	20
Other Categories											
Broadleaf litter	1	3	2	2		1	1		**18.3**	10	90
Dry blades	0		3	1	1	5			**37.3**	10	**100**
Road gravel	3	1	4	2					**4.0**	10	70
Water	8		2						0.5	10	20
Moss	1	2	5	2					**4.3**	10	90
Lichen	10								0.0	10	0
Rock	10								0.0	10	0
Bare ground	1	5	3	1					**2.3**	10	90

33	Total number of species observed in area
25	Number of species represented in microplots

Line Intercept Data (% cover)

BENA	17
SAPL	19

TT50100

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ARLA	4	4	2						0.5	10	60
BENA	4			2	2	2			**23.0**	10	60
CAAQ	7	1	1	1					**1.8**	10	30
CABI	8	1	1						0.3	10	20
CAsp	9		1						0.3	10	10
ERAN	4		3	3					**5.3**	10	60
ERVA	1	1	5	2	1				**8.0**	10	90
HIAL	9	1							0.0	10	10
LEPA	10								0.0	10	0
PEFR/PEHY	0	1	5	4					**7.3**	10	**100**
POAC	1	4	5						**1.3**	10	90
POLA	0		9	1					**3.8**	10	**100**
RHLA	10								0.0	10	0
RUCH	0		6	4					**7.5**	10	**100**
SAAN	10								0.0	10	0
SAAR	10									10	0
SAPL	9		1						0.3	10	10
SAPO	10								0.0	10	0
STLA	4	3	3						0.8	10	60
VACA	8		1	1					**1.8**	10	20
VAUL	10								0.0	10	0
VAVI	10								0.0	10	0
Other Categories											
Broadleaf litter	0		3	6	1				**13.5**	10	**100**
Dry blades	0		1	1	3	4	1		**46.5**	10	**100**
Road gravel	10								0.0	10	0
Water	10								0.0	10	0
Moss	0			1	1	5	3		**62.0**	10	**100**
Lichen	6	3	1						0.3	10	40
Rock	10								0.0	10	0
Bare ground	10								0.0	10	0

22	Total number of species observed in area
15	Number of species represented in microplots

Line Intercept Data (% cover)

BENA	19
SAPL	5

Table I-4. Summary of cover classes and frequencies for microplots on transect TT5

TT51000											
Species Code	**Cover Class**								**% cover**	**check**	**freq.**
	0	**+**	**1**	**2**	**3**	**4**	**5**	**6**			
BENA	1		3	4	2				**14.3**	10	90
CABI	6		4						1.0	10	40
CAsp	9	1							0.0	10	10
EMNI	4	1	4	1					**2.5**	10	60
ERAN	6		2	2					**3.5**	10	40
ERVA	0		3	6	1				**13.5**	10	**100**
LAGL	10								0.0	10	0
LEPA	0		4	5	1				**12.3**	10	**100**
PEFR/PEHY	10								0.0	10	0
RUCH	2	2	6						**1.5**	10	80
SAPL	9	1							0.0	10	10
VAUL	1	1	3	5					**8.3**	10	90
VAVI	0		5	3	2				**13.3**	10	**100**
Other Categories											
Broadleaf litter	0	1	9						**2.3**	10	**100**
Dry blades	0			3	3	2	2		**45.3**	10	**100**
Road gravel	10								0.0	10	0
Water	10								0.0	10	0
Moss	0		1	3	4	1	1		**34.5**	10	**100**
Lichen		4	5	1					**2.8**	10	**100**
Rock	10								0.0	10	0
Bare ground	9	1							0.0	10	10
13	Total number of species observed in area										
11	Number of species represented in microplots										
No line intercept data collected.											

TT52000											
Species Code	**Cover Class**								**% cover**	**check**	**freq.**
	0	**+**	**1**	**2**	**3**	**4**	**5**	**6**			
BENA	4		1	3	2				**12.3**	10	60
CAAQ	3	2	5						**1.3**	10	70
CABI	8	2							0.0	10	20
EMNI	5		4		1				**4.8**	10	50
ERAN	9		1						0.3	10	10
ERVA	0		1	6	3				**20.5**	10	**100**
LEPA	0		2	7	1				**14.8**	10	**100**
RUCH	0	1	6	3					**6.0**	10	**100**
VAUL	0		2	7	1				**14.8**	10	**100**
VAVI	0		4	5	1				**12.3**	10	**100**
Other Categories											
Broadleaf litter	0		4	6					**10.0**	10	100
Dry blades	0			3	4	3			**38.3**	10	100
Road gravel	10								0.0	10	0
Water	10								0.0	10	0
Moss	0		1	3	1	5			**39.8**	10	**100**
Lichen	1		6	2	1				**8.3**	10	90
Rock	10								0.0	10	0
Bare ground	10								0.0	10	0
10	Total number of species observed in area										
10	Number of species represented in microplots										
No line intercept data collected.											

Table I-5. Summary of cover classes and frequencies for microplots on transect TT6

TT60010												
Species Code	**Cover Class**								**% cover**	**check**	**freq.**
	0	**+**	**1**	**2**	**3**	**4**	**5**	**6**			
ANsp2	8	2							0.0	10	20
ARAL	8		1		1				**4.0**	10	20
ARLA2	6	3	1						0.3	10	40
BENA	0			6	3	1			**26.5**	10	**100**
CAMI	5		5						**1.3**	10	50
CAPO	9		1						0.3	10	10
EMNI	6		1	3					**4.8**	10	40
FEAL	7		3						0.8	10	30
FOTT61000	9		1						0.3	10	10
FOTT60010	9	1							0.0	10	10
HIAL	10								0.0	10	0
LEPA	0	1	8	1					**3.5**	10	**100**
LIBO	8		2						0.5	10	20
MIAR	9		1						0.3	10	10
PEFR/PEHY	2	1	7						**1.8**	10	80
PELA2	6	1	3						0.8	10	40
PEsp	10								0.0	10	0
POBI	8	2							0.0	10	20
POsp	5	3	2						0.5	10	50
PYGR	8		2						0.5	10	20
SAAL	10								0.0	10	0
SAAN	9		1						0.3	10	10
SALA	8		1	1					**1.8**	10	20
SAPL	4	1	3	1	1				**6.0**	10	60
SAPU	9	1							0.0	10	10
SPBE	10								0.0	10	0
STLA	8	2							0.0	10	20
VAUL	1		1	2	4	2			**30.8**	10	90
VAVI	0	1	6	3					**6.0**	10	**100**
Other Categories											
Broadleaf litter	0		5	4		1			**13.5**	10	**100**
Dry blades	0	2	6	2					**4.5**	10	**100**
Road gravel	9		1						0.3	10	10
Water	10								0.0	10	0
Moss	0				1	1	7	1	**79.3**	10	**100**
Lichen	1		4	4	1				**10.8**	10	90
Rock	8	1	1						0.3	10	20
Bare ground	10								0.0	10	0

29	Total number of species observed in area
25	Number of species represented in microplots

Line Intercept Data (% cover)	
BENA	21
SAPL	14
SALA	0.2

TT60100												
Species Code	**Cover Class**								**% cover**	**check**	**freq.**
	0	**+**	**1**	**2**	**3**	**4**	**5**	**6**			
ANPO	9	1							0.0	10	10
ARLA2	8	1	1						0.3	10	20
BENA	4		1	1	4				**16.8**	10	60
CABI	0	1	4	4	1				**10.8**	10	**100**
CAHY	10								0.0	10	0
DRIN	8		1	1					**1.8**	10	20
EMNI	8	1	1						0.3	10	20
EQAR	7	2	1						0.3	10	30
EQsp2	9	1							0.0	10	10
ERVA	9		1						0.3	10	10
FEAL	10								0.0	10	0
FOTT60100	9	1							0.0	10	10
FOTT61000	7	3							0.0	10	30
HIAL	10								0.0	10	0
LEPA	5	2	3						0.8	10	50
PEFR/PEHY	2	5	3						0.8	10	80
PELA2	10								0.0	10	0
POAC	8	2							0.0	10	20
POsp	7	2	1						0.3	10	30
PYGR	9	1							0.0	10	10
RUCH	3	1	6						**1.5**	10	70
SALA	6		2	2					**3.5**	10	40
SAPL	10								0.0	10	0
SARE	9			1					**1.5**	10	10
SAGL	4			2	1		3		**32.3**	10	60
STLA	10								0.0	10	0
VACA	8	1	1						0.3	10	20
VAUL	6		1	2	1				**7.0**	10	40
VAVI	4	3	3						0.8	10	60
Other Categories											
Broadleaf litter	0		5	5					**8.8**	10	**100**
Dry blades	0	2	2	5	1				**11.8**	10	**100**
Road gravel	10								0.0	10	0
Water	10								0.0	10	0
Moss	0				1	5	2	2	**71.5**	10	**100**
Lichen	0		4	6					**10.0**	10	**100**
Rock	10								0.0	10	0
Bare ground	10								0.0	10	0

29	Total number of species observed in area
23	Number of species represented in microplots

Line Intercept Data (% cover)	
BENA	20
SAPL	2
SALA	3
SAGL	17
VAUL	5

Table I-5. Summary of cover classes and frequencies for microplots on transect TT6

TT61000											
Species Code	**Cover Class**								**% cover**	**check**	**freq.**
	0	**+**	**1**	**2**	**3**	**4**	**5**	**6**			
ANsp2	8	2							0.0	10	20
ARAR	9		1						0.3	10	10
ARLA2	9	1							0.0	10	10
ARLE	10								0.0	10	0
BENA	4	1			2	1	2		**30.8**	10	60
BUTR	10								0.0	10	0
CABI	3	3	1	2	1				**7.0**	10	70
CAMI	10								0.0	10	0
CASA	8	1		1					**1.5**	10	20
CATE	9			1					**1.5**	10	10
CEBE	10								0.0	10	0
DEBR	10								0.0	10	0
DRIN	6		1	2	1				**7.0**	10	40
DROC	10								0.0	10	0
EMNI	8	2							0.0	10	20
EQAR	6		2	2					**3.5**	10	40
FEAL	9		1						0.3	10	10
FOTT61000-1	8	1	1						0.3	10	20
FOTT61000-2	6	4							0.0	10	40
FOTT61000-3	8	1	1						0.3	10	20
GRTT61000	8		1	1					**1.8**	10	20
HIAL	10								0.0	10	0
LEPA	9		1						0.3	10	10
LUAR	9		1						0.3	10	10
LUCO	10								0.0	10	0
MIAR	8		2						0.5	10	20
MYAL	10								0.0	10	0
PAMA	9		1						0.3	10	10
PEFR/PEHY	9	1							0.0	10	10
PELA2	7		3						0.8	10	30
PHSI	10								0.0	10	0
POBI	5	2	3						0.8	10	50
POFR	9	1							0.0	10	10
POGL	8	2							0.0	10	20
POVI	7		3						0.8	10	30
PYGR	8	1	1						0.3	10	20
RAsp	8	2							0.0	10	20
RHLA	9			1					**1.5**	10	10
SAAN	7		2	1					**2.0**	10	30
SABR	10								0.0	10	0
SAGL	10								0.0	10	0
SALA	6			3		1			**10.8**	10	40
SAPH	10								0.0	10	0
SAPL	9			1					**1.5**	10	10
SAPU	6	3	1						0.3	10	40
SARE	4			3	3				**15.8**	10	60
SEsp	6	3	1						0.3	10	40
SETT61000	9		1						0.3	10	10
SOMU	10								0.0	10	0
STLA	8	2							0.0	10	20
VAUL	6		1	1	2				**9.3**	10	40
VAVI	7	2	1						0.3	10	30
ZYEL	10								0.0	10	0
Other Categories											
Broadleaf litter	0		2	6	1	1			**19.5**	10	**100**
Dry blades	0	2	3	4	1				**10.5**	10	**100**
Road gravel	10								0.0	10	0
Water	10								0.0	10	0
Moss	0			1	2	1	3	3	**70.0**	10	**100**
Lichen	1		3	4	2				**14.3**	10	90
Rock	9		1						0.3	10	10
Bare ground	10								0.0	10	0
53	Total number of species observed in area										
38	Number of species represented in microplots										
Line Intercept Data (% cover)											
BENA	27										
SAPL	1										
SALA	8										
VAUL	8										

Table I-6. Summary of cover classes and frequencies for microplots on transect TT8

TT80010

Species Code	Cover Class 0	+	1	2	3	4	5	6	% cover	check	freq.
ANsp2	10								0.0	10	0
ARAL	10								0.0	10	0
ARLA	10								0.0	10	0
BENA	0			2	7	1			**35.5**	10	**100**
CABI	1		2	5	2				**15.5**	10	90
EMNI	5	2	3						0.8	10	50
ERVA	3	1	3	3					**5.3**	10	70
HIAL	10								0.0	10	0
LEPA	0		5	5					**8.8**	10	**100**
LUMU	9		1						0.3	10	10
PEFR/PEHY	0	3	5	1	1				**6.5**	10	**100**
PELA2	9		1						0.3	10	10
POLA	10								0.0	10	0
RUCH	5	1	4						1.0	10	50
SAPO	10								0.0	10	0
SAPL	7		1	1		1			**8.0**	10	30
STLA	9	1							0.0	10	10
VAUL	6		4						1.0	10	40
VAVI	0	3	7						**1.8**	10	**100**
Other Categories											
Broadleaf litter	0	1	4	5					**8.5**	10	**100**
Dry blades	0			1	2	6	1		**55.0**	10	**100**
Road gravel	3	2	3	2					**3.8**	10	70
Water	9		1						0.3	10	10
Moss	0	1	3	4	2				**14.3**	10	**100**
Lichen	10								0.0	10	0
Rock	10								0.0	10	0
Bare ground	7		2	1					**2.0**	10	30

19 Total number of species observed in area
13 Number of species represented in microplots

Line Intercept Data (% cover)

BENA	29
SAPL	7

TT80100

Species Code	Cover Class 0	+	1	2	3	4	5	6	% cover	check	freq.
ARAL	10								0.0	10	0
BENA	0			4	5	1			**31.0**	10	**100**
CAAQ	9		1						0.3	10	10
CABI	1		3	4	2				**14.3**	10	90
EMNI	8			1	1				**5.3**	10	20
ERVA	2		3	3	2				**12.8**	10	80
LEPA	0			6	4				**24.0**	10	**100**
PEFR/PEHY	9	1							0.0	10	10
PELA2	9		1						0.3	10	10
RUCH	5		3	2					**3.8**	10	50
SAPL	9		1						0.3	10	10
SAFU	10								0.0	10	0
VAUL	8			2					**3.0**	10	20
VAVI	0		4	6					**10.0**	10	**100**
Other Categories											
Broadleaf litter	0		4	6					**10.0**	10	**100**
Dry blades	0				9	1			**40.0**	10	**100**
Road gravel	10								0.0	10	0
Water	6		2	2					**3.5**	10	40
Moss	0			2	5	3			**40.5**	10	**100**
Lichen	5	3	2						0.5	10	50
Rock	10								0.0	10	0
Bare ground	8		2						0.5	10	20

14 Total number of species observed in area
12 Number of species represented in microplots

No line intercept data collected.

TT81000

Species Code	Cover Class 0	+	1	2	3	4	5	6	% cover	check	freq.
BENA	0		5	5					**8.8**	10	**100**
CAAQ	6		3	1					**2.3**	10	40
CABI	5		3	2					**3.8**	10	50
EMNI	5		2	3					**5.0**	10	50
ERAN	9		1						0.3	10	10
ERVA	0		2	5	1	2			**24.3**	10	**100**
LEPA	0		3	5	2				**15.8**	10	**100**
RUCH	2	2	5	1					**2.8**	10	80
SAPL	10								0.0	10	0
VAUL	1	1	1	4	2	1			**20.0**	10	90
VAVI	0		3	4	3				**18.0**	10	**100**
Other Categories											
Broadleaf litter	0	1	8	1					**3.5**	10	**100**
Dry blades	0			1	7	2			**40.3**	10	**100**
Road gravel	10								0.0	10	0
Water	6		1	3					**4.8**	10	40
Moss	0		1	1	3	3	2		**48.8**	10	**100**
Lichen	0		8	2					**5.0**	10	**100**
Rock	10								0.0	10	0
Bare ground	10								0.0	10	0

11 Total number of species observed in area
10 Number of species represented in microplots

No line intercept data collected.

Table I-7. Cover classes for supplemental single microplots on transect TT8

Species Code	STATION TT8 TRANSECT MICROPLOT DISTANCES (meters)															
	50	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900
ERVA	2	2	3	2	3	2	2	2	2	2	3	1	2	2	2	2
BENA	3	2	2	2	2	2	2	2	2	2	2	1	1	1	0	0
LEPA	2	3	2	3	3	3	2	2	3	2	3	2	2	1	2	2
VAVI	1	1	1	1	1	2	1	2	2	1	2	2	2	2	2	2
EMNI	1	1	1	0	0	0	1	0	1	0	1	1	2	1	2	1
CABI	2	2	2	0	0	0	0	0	1	0	0	3	0	1	1	0
RUCH	1	0	1	1	0	2	2	2	3	0	0	1	2	2	2	2
CAAQ	0	0	0	0	0	1	2	1	0	1	2	0	1	0	0	1
VAUL	2	2	0	0	0	0	2	0	2	3	0	2	1	3	0	1
CACA	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
SAPL	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
CAsp2	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
ERAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SAFU	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Other Categories																
Broadleaf litter	2	2	1	2	1	2	3	2	2	2	1	2	2	2	2	1
Dry blades	3	3	3	3	4	2	3	2	2	1	4	3	2	3	3	2
Road gravel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Moss	4	3	3	2	3	3	3	4	4	4	3	3	5	4	4	5
Lichen	0	0	0	0	1	1	0	1	1	0	1	2	2	1	2	1
Rock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bare ground	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table I-8. Summary of cover classes and frequencies for microplots at terrestrial reference stations

TS-REF-5

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ANPO	5	3	2						0.5	10	50
BENA	3	1	3	3					**5.3**	10	70
CABI	9	1							0.0	10	10
EMNI	0	1	4	5					**8.5**	10	**100**
ERAN	9		1						0.3	10	10
ERVA	0		6	3		1			**12.3**	10	**100**
LEPA	0	1	2	5	2				**15.5**	10	**100**
PEFR/PEHY	10								0.0	10	0
PELA2	9		1						0.3	10	10
RUCH	0			4	6				**28.5**	10	**100**
SAPL	9		1						0.3	10	10
VAUL	0			1	8	1			**37.8**	10	**100**
VAVI	0	3	5	2					**4.3**	10	**100**
Other Categories											
Broadleaf litter	0			1	5	4			**45.3**	10	**100**
Dry blades	0		4	4	1	1			**17.0**	10	**100**
Road gravel	10								0.0	10	0
Water	7	1	2						0.5	10	30
Moss	0			3	2	4	1		**45.5**	10	**100**
Lichen	0			7	3				**21.8**	10	**100**
Rock	10								0.0	10	0
Bare ground	10								0.0	10	0

13	Total number of species observed in area
12	Number of species represented in microplots

Line Intercept Data (% cover)

BENA	6
SAPL	0.7

TS-REF-7

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ANPO	7	2	1						0.3	10	30
ARLA2	8	1	1						0.3	10	20
BENA	0	1	1	6	2				**16.8**	10	**100**
CABI	3		7						**1.8**	10	70
EMNI	1		4	5					**8.5**	10	90
ERAN	9		1						0.3	10	10
ERVA	0			8		2			**24.5**	10	**100**
LEPA	0		1	8	1				**16.0**	10	**100**
PEFR/PEHY	8	1		1					**1.5**	10	20
PELA2	7	1	2						0.5	10	30
RUCH	0	2	1	5	2				**15.3**	10	**100**
SAPL	8		1	1					**1.8**	10	20
VAUL	3			1	5	1			**26.5**	10	70
VAVI	0	2	4	4					**7.0**	10	**100**
Other Categories											
Broadleaf litter	0	1	1	8					**12.3**	10	**100**
Dry blades	0			5	3	2			**31.3**	10	**100**
Road gravel	10								0.0	10	0
Water	6	1	3						0.8	10	40
Moss	0			1	4	3	2		**52.3**	10	**100**
Lichen	0	1	3	6					**9.8**	10	**100**
Rock	10								0.0	10	0
Bare ground	10								0.0	10	0

14	Total number of species observed in area
14	Number of species represented in microplots

No line intercept data collected.

Table I-8. Summary of cover classes and frequencies for microplots at terrestrial reference stations

TS-REF-11

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ARAR	7	2	1						0.3	10	30
ARLA2	4	3	3						0.8	10	60
ARLE	8	1	1						0.3	10	20
BENA	6			2	2				**10.5**	10	40
CABI	2	4	2	2					**3.5**	10	80
CAMI	7	2	1						0.3	10	30
CASA	10								0.0	10	0
CATE	9	1							0.0	10	10
EMNI	0	2	5	1	2				**10.3**	10	**100**
EQAR	2	2	5	1					**2.8**	10	80
FEAL	9		1						0.3	10	10
FOTT60010	9	1							0.0	10	10
LEPA	3		1	6					**9.3**	10	70
LOPR	10								0.0	10	0
LUWA	10								0.0	10	0
LYCL	9		1						0.3	10	10
PEFR/PEHY	5	2	2	1					**2.0**	10	50
PELA	10								0.0	10	0
PELA2	10								0.0	10	0
POAC	10								0.0	10	0
POBI	9	1							0.0	10	10
POsp	9	1							0.0	10	10
PYGR	10								0.0	10	0
RALA	9	1							0.0	10	10
RUCH	4	3	3						0.8	10	60
RUAR2	10								0.0	10	0
SAAN	10								0.0	10	0
SAPL	3		1	1	4	1			**23.0**	10	70
SAPU	10								0.0	10	0
SAsp3	9		1						0.3	10	10
SPBE	10								0.0	10	0
STLA	9	1							0.0	10	10
VACA	9	1							0.0	10	10
VAUL	0			2	5	3			**40.5**	10	**100**
VAVI	1	2	7						**1.8**	10	90
Other Categories											
Broadleaf litter	0		2	6	2				**17.0**	10	**100**
Dry blades	0	4	2	2	2				**11.0**	10	**100**
Road gravel	10								0.0	10	0
Water	9		1						0.3	10	10
Moss	0			1	3	6			**50.3**	10	**100**
Lichen	2	2		2	4				**18.0**	10	80
Rock	9		1						0.3	10	10
Bare ground	10								0.0	10	0

35	Total number of species observed in area
24	Number of species represented in microplots

Line Intercept Data (% cover)

BENA	7
SAPL	17

TS-REF-12

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
BENA	8			2					**3.0**	10	20
CAAQ	5	1	4						1.0	10	50
CABI	7		3						0.8	10	30
CAHO	9		1						0.3	10	10
EMNI	9			1					**1.5**	10	10
ERAN	4	1	4	1					**2.5**	10	60
ERVA	0		1	7	2				**18.3**	10	**100**
LEPA	0			7	3				**21.8**	10	**100**
LUWA	6		4						1.0	10	40
POLA	9	1							0.0	10	10
RUCH	0		3	6	1				**13.5**	10	**100**
VAUL	5		3	2					**3.8**	10	50
VAVI	0		1	9					**13.8**	10	**100**
Other Categories											
Broadleaf litter	0		2	6	2				**17.0**	10	**100**
Dry blades	0			2	6	2			**38.0**	10	**100**
Road gravel	10								0.0	10	0
Water	10								0.0	10	0
Moss	0				7	3			**45.0**	10	**100**
Lichen	0		5	3	1	1			**15.8**	10	**100**
Rock	10								0.0	10	0
Bare ground	8		2						0.5	10	20

13	Total number of species observed in area
13	Number of species represented in microplots

No line intercept data collected.

Table I-9. Summary of cover classes and frequencies for microplots at lagoon and lagoon reference stations

PLNL

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ARFU	5		3	2					**3.8**	10	50
CAAQ	10								0.0	10	0
CADE	10								0.0	10	0
DECA	9		1						0.3	10	10
DUFI	5	1		2	2				**10.5**	10	50
ERAN	6		3		1				**4.5**	10	40
FONLK	10								0.0	10	0
HIVU	0		1	1		2	6		**65.3**	10	**100**
RAHY	5	3	2						0.5	10	50
RUAR	10								0.0	10	0
SAOV	10								0.0	10	0
STCR	6	3	1						0.3	10	40
Other Categories											
Broadleaf litter	10								0.0	10	0
Dry blades	5	1	1	1		1	1		**16.5**	10	50
Littoral matter	10								0.0	10	0
Water	2				1		3	4	**68.3**	10	80
Moss	6	1	1	2					**3.3**	10	40
Lichen	10								0.0	10	0
Detritus/fines	3		5	2					**4.3**	10	70
Rock	10								0.0	10	0
Sand/gravel	10								0.0	10	0

12	Total number of species observed in area
7	Number of species represented in microplots

No line intercept data collected.

NLK

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
CAAQ	0			1	8	1			**37.8**	10	**100**
CADE	5		4	1					**2.5**	10	50
DECA	6	1	3						0.8	10	40
DUFI	0			1	8	1			**37.8**	10	**100**
FONLK2	5	2	3						0.8	10	50
FONLK3	6	2	2						0.5	10	40
POAL	8	2							0.0	10	20
RACO	6	2	1	1					**1.8**	10	40
RUAR	9		1						0.3	10	10
SAOV	10								0.0	10	0
STCR	1	2	7						**1.8**	10	90
Other Categories											
Broadleaf litter	10								0.0	10	0
Dry blades	0				2	4	4		**66.5**	10	**100**
Littoral matter	5	1	3	1					**2.3**	10	50
Water	10								0.0	10	0
Moss	0		2	1	4	2	1		**38.0**	10	**100**
Lichen	10								0.0	10	0
Detritus/fines	0		10						**2.5**	10	**100**
Rock	10								0.0	10	0
Sand/gravel	9			1					**1.5**	10	10

11	Total number of species observed in area
10	Number of species represented in microplots

No line intercept data collected.

Table I-10. Summary of cover classes and frequencies for microplots at lagoon reference stations

CL-REF-1

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ARFU	0			6	3	1			**26.5**	10	**100**
CACA2	2	4	2		2				**8.0**	10	80
DECA	7	1	2						0.5	10	30
DUFI	2		1	3	4				**19.8**	10	80
ERAN	1	1	3	2	3				**15.0**	10	90
HIVU	0	3	3	4					**6.8**	10	**100**
SAOV	9	1							0.0	10	10
STCR	7	2	1						0.3	10	30
Other Categories											
Broadleaf litter	0		2	6	2				**17.0**	10	**100**
Dry blades	0	4	2	2	2				**11.0**	10	**100**
Littoral matter	10								0.0	10	0
Water	9		1						0.3	10	10
Moss	0			1	3	6			**50.3**	10	**100**
Lichen	10								0.0	10	0
Detritus/fines	0		6	4					**7.5**	10	**100**
Rock	9		1						0.3	10	10
Sand/gravel	10								0.0	10	0

8	Total number of species observed in area
8	Number of species represented in microplots

No line intercept data collected.

CL-REF-2

Species Code	Cover Class								% cover	check	freq.
	0	+	1	2	3	4	5	6			
ARFU	4	4	1	1					**1.8**	10	60
CAAQ	0			3	3		4		**49.8**	10	**100**
CACA2	7		2	1					**2.0**	10	30
CADE	7		1	2					**3.3**	10	30
DECA	7		3						0.8	10	30
DUFI	4			1	4	1			**22.8**	10	60
HIVU	10								0.0	10	0
LUWA	10								0.0	10	0
POEG	7	2	1						0.3	10	30
SAOV	10								0.0	10	0
STCR	8	2							0.0	10	20
Other Categories											
Broadleaf litter	10								0.0	10	0
Dry blades	0	1	4	3	1	1			**15.5**	10	**100**
Littoral matter	9		1						0.3	10	10
Water	10								0.0	10	0
Moss	0		1	2	5	2			**34.5**	10	**100**
Lichen	10								0.0	10	0
Detritus/fines	0		4	5	1				**12.3**	10	**100**
Rock	9			1					**1.5**	10	10
Sand/gravel	9				1				**3.8**	10	10

11	Total number of species observed in area
8	Number of species represented in microplots

No line intercept data collected.