



# **Taseko Prosperity Gold-Copper Project**

## **Appendix 5-5-1**

## **Appendix I Prosperity Mine Project Wetland Survey:**

### **Field Data Report**

#### **Wetland Ecosystems**

Targeted wetland surveys were carried out in the summer of 2006 in combination with TEM field data collection in all three study areas. The objective was to ensure that wetland areas were described in a comprehensive manner. Wetland plots were sampled in the minesite, in the transmission corridor and in the access road corridor with classification following *Wetlands of BC* (Mackenzie and Moran 2004).

Several field guides were used to help identify vegetation and ecosystems during field programs such as *Plants of the Southern Interior BC* (Parish, Coupe and Lloyd 1996). The *Illustrated Flora of BC* was used to confirm voucher specimen identifications in the lab with the aid of a compound microscope (Douglas et al 1998-2002). Bryophytes were identified in the field with guidance from *Some Common Mosses of BC* and *Field Guide to the Liverwort Genera of Pacific North America* (Schofield 1992; Schofield 2002).

Tree, shrub, herb, graminoid, and moss species were recorded at all field plots depending on inspection requirements as per Luttmerding et al (1990). For a list of all species encountered in the Project area, see Appendix 5-5-J. Plot locations were established using GPS and the site was assigned a wetland ecosystem or site class. If a site represented a small, unusual microsite that was too small to map, the larger wetland ecosystem type was mapped.

The majority of the wetland field sampling was conducted in late June 2006 with additional wetland visits in early August 2006. In addition to data collected during 2006 field surveys, historical information collected during previous vegetation studies and relevant to the study area were also used to guide ecosystem classification. Historical information included data collected in support of terrestrial ecosystem mapping and feasibility studies for the Prosperity Project located in Appendix 5-5-B (Madrone 1999).

#### **Definition of Wetland**

Wetland ecosystems in the project area range from minerogenous fens in the minesite to saline meadows in the transmission corridor to productive swamps and floodplain forests along the access road. These wetland ecosystems are important for wildlife habitat, nutrient cycling, and hydrological function. Wetland class and distribution are a function of climate, landscape position, topography and substrate.

The recent publication, “Wetlands of British Columbia” defines wetlands as, *areas where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development... and have a relative abundance of hydrophytes (moisture-loving plants) in the vegetation community and/or soils featuring ‘hydric’ (water saturated) characters* (Mackenzie and Moran 2004).

### **Minesite Wetlands**

Wetland ecosystems in the minesite RSA are minerogenous systems typically situated at positions in the landscape lower than adjacent mineral terrain, such that water and mineral elements are introduced by groundwater or littoral sources in addition to atmospheric sources. These wetlands depend on the strength of their linkage with the regional water system and the physical and chemical nature of the geological environment (National Wetlands Working Group 1988).

Wetlands in the minesite study area mainly consist of fens and herbaceous meadows (Table I.1-1). Fens are either dominated by sedges or by willows and scrub birch with moderate covers of brown mosses. Beaked sedge (*Carex utriculata*) and water sedge (*Carex aquatilis*) are the most common sedges with local populations of grey sedge (*Carex canescens*) and russet sedge (*Carex saxatilis*).

Barclay's willow (*Salix barclayi*) is the most common willow species with sub-dominant shrubs such as scrub birch (*Betula nana*) and grey-leaved willow (*Salix glauca*). Brown mosses, represented by *Calliergon* spp. and *Drepanocladus* spp., have significant cover in fens and meadows.

Uncommon types of wetlands also occur in the minesite study area but are too small to map. For instance, standing open water within sedge fen wetlands are surrounded by small-flowered bulrush (*Scirpus microcarpus*). In other areas, the sedge fens have muddy sections with common spike-rush (*Eleocharis palustris*) and seaside arrow-grass (*Triglochin maritima*).

Herbaceous meadows and shrub-carrs are less common than fens in the minesite footprint, but dominate fluvial plains that feed and drain Fish Lake. For instance, north and south of Fish Lake rich meadows with various flowering herbs, sedges, and willow species are common adjacent to fluvial channels. The provincially blue-listed bird's foot buttercup (*Ranunculus pedatifidus* ssp. *affinis*) (CDC 2006) is associated with the herbaceous meadows.

### **Transmission Corridor Wetlands**

Wetlands in the transmission corridor include fens, marshes, saline meadows, shrub-carrs, and forested swamps spanning several biogeoclimatic zones (IDFdk3, IDFdk4, ESSFxv2, SBPSxc). The most common wetlands in the IDF subzones are sedge and willow-dominated fens (Table I.1-1).

Saline meadows in the transmission corridor are particularly vulnerable to livestock grazing damage and non-native grass species encroachment. These meadows are important for wildlife habitat yet are limited in distribution in the province (MacKenzie and Moran 2004).

### **Access Road Wetlands**

Wetlands in the access road study area mirror the minesite wetlands, represented by fens and herbaceous meadows, but also include tall shrub swamps and floodplain ecosystems along the Chilcotin River (Table I.1-1 and Table I.1-2).

**Table I.1-1 Wetland Ecosystems Mapped in the Vegetation RSA**

BEC Unit	Ecosystem Name	Map and Wetland Code	Conservation Status	Minesite	Transmission Corridor	Access Road	Wetland Class
SBPSxc	Water sedge - Beaked sedge fen	BF - Wf01	yellow	X	X	X	Fen
	Scrub birch - Water sedge fen	BW - Wf02	Yellow	no	X	X	Fen
	Willow - Scrub birch - Sedge fen	WW - Wf04	yellow	X	X	X	Fen
	Scrub birch - Buckbean - Shore sedge fen	WS - Wf07	yellow	no	X	no	Fen
	Scrub birch - Buckbean - Hook moss	BH - Wf08	yellow	no	X	no	Fen
	Beaked sedge - Water sedge marsh	BM - Wm01	yellow	no	X	X	Marsh
	Baltic rush marsh	RM - Wm07	yellow	no	X	X	Marsh
	Drummond's willow - Sedge swamp	DS - Ws04	yellow	X	X	no	Swamp
	MacCall's willow - Beaked sedge	TS - Ws05	blue	no	X	x	Swamp
	Scrub birch - Kinnikinnick shrub carr	BK - Sc01	yellow	no	X	X	Shrub-carr
	Grey-leaved willow - Glow moss shrub carr	WM - Sc02	yellow	X	X	X	Shrub-carr
	Alkali saltgrass meadow	GR - Gs01	yellow	no	X	no	Saline meadow
	Nuttall's alkaligrass - Foxtail barley	AF - Gs02	red	no	X	X	Saline meadow
	Baltic rush - Field sedge meadow	RS - Gs03	blue	no	X	X	Saline meadow
	Sxw - Horsetail - Glow moss	SH - 05	yellow	X	X	X	Swamp
	Sxw - Horsetail - Meadowrue	SM - 06	blue	X	X	X	Swamp
	Open Water	OW - 00		X	X	X	Open water
	Yellow pond-lily	YL - 00		X	X	X	Open water
	MSxv	Water sedge - Beaked sedge fen	BF - Wf01	yellow	X	X	no
Scrub birch - water sedge fen		BW - Wf02	yellow	no	X	no	Fen
Willow - Scrub birch - Sedge fen		WS - Wf04	yellow	X	X	no	Fen

BEC Unit	Ecosystem Name	Map and Wetland Code	Conservation Status	Minesite	Transmission Corridor	Access Road	Wetland Class
	Shore sedge - buckbean - hook moss fen	MS - Wf08	blue	no	X	no	Fen
	Drummond's willow - Sedge swamp	DS - Ws04	yellow	X	X	no	Swamp
	Scrub birch - Kinnikinnick - shrub-carr	BK - Sc01	yellow	no	X	no	Shrub-carr
	Grey-leaved willow - Glow moss shrub carr	WM - Sc02	yellow	X	X	no	Shrub-carr
	Sxw - Horsetail - Crowberry	SH - 08 (Ws07)	yellow	X	X	no	Swamp
	Sxw - Labrador tea - Willow	ST - 09	yellow	X	X	no	Swamp
	Open Water	OW - 00		X	X	no	Open water
	Yellow pond-lily	YL - 00		X	X	no	Open water
IDFdk3	Water sedge - Beaked sedge fen	BW - Wf01	yellow	no	X	no	Fen
	Scrub birch - Water sedge fen	SW - Wf02	yellow	no	X	no	Fen
	Awned sedge marsh	AS - Wm03	red	no	no	no	Marsh
	Cattail marsh	CT - Wm05	blue	no	X	no	Marsh
	Great bulrush marsh	BU - Wm06	yellow	no	X	no	Marsh
	Baltic rush marsh	RM - Wm07	yellow	no	X	no	Marsh
	Scrub birch - Kinnikinnick - shrub-carr	BK - Sc01	yellow	no	X	no	Shrub-carr
	Nuttall's alkaligrass - Foxtail barley	AF - Gs02	red	no	X	no	Saline meadow
	MacCalla's willow - Beaked sedge swamp	MB - Ws05	blue	no	no	no	Swamp
	Seaside arrow-grass marsh	AG - 00	red	no	no	no	Marsh
IDFdk4	Water sedge - Beaked sedge fen	BW - Wf01	yellow	no	X	X	Fen
	Scrub birch - Water sedge fen	SW - Wf02	yellow	no	X	X	Fen
	Great bulrush marsh	BU - Wm06	blue	no	X	X	Marsh
	Baltic rush marsh	RM - Wm07	yellow	no	X	X	Marsh

BEC Unit	Ecosystem Name	Map and Wetland Code	Conservation Status	Minesite	Transmission Corridor	Access Road	Wetland Class
	MacCalla's willow - Beaked sedge swamp	TS - Ws05	blue	no	X	X	Swamp
	Scrub birch - Kinnikinnick - shrub-carr	BK - Sc01	yellow	no	X	X	Shrub-carr
	Nuttall's alkaligrass - Foxtail barley	AF - Gs02	red	no	X	X	Saline meadow
	Baltic rush - Field sedge meadow	RS - Gs03	blue	no	no	X	Saline meadow
	Sxw - Horsetail - Glow moss	SH - 10	yellow	no	X	X	Swamp
	Pond	PD - 00		no	no	X	Open water
	Open Water	OW - 00		no	X	X	Open water
IDFxm	Water sedge - Beaked sedge fen	BF - Wf01	yellow	no	no	no	Fen
	Common spike rush marsh	CM - Wm04	blue	no	X	no	Marsh
	Water sedge - Beaked sedge marsh	SM - Wm01	yellow	no	X	no	Marsh
	MacCalla's willow - Beaked sedge swamp	TS - Ws05	blue	no	no	no	Swamp
	Sxw - Horsetail - Glow moss	SH - 09 (Ws07)	yellow	no	X	no	Swamp
	Alkali saltgrass meadow	GR - Gs01	yellow	no	X	no	Saline meadow
SBPSmk	Water sedge - Beaked sedge fen	BW - Wf01	yellow	no	X	no	Fen
ESSFxv	Water sedge - Beaked sedge fen	FB - Wf01	yellow	no	X	no	Fen
	Scrub birch - Water sedge fen	WB - Wf02	yellow	no	X	no	Fen
	Grey-leaved willow - Glow moss shrub carr	GS - Sc02	yellow	no	X	no	Shrub-carr
	Subalpine fir - Horsetail - Glow moss	FH - 08	yellow	no	X	no	Swamp
	Engelmann spruce - trapper's tea - Glow moss	SW - 09	yellow		X		Swamp
	Engelmann spruce - Willow - Glow moss	HM - 10	yellow		X		Swamp
	Open Water	OW - 00		no	X	no	Open water

## Fens

### Water sedge – Beaked sedge Fen (Map code BF & BW; Wf01)

These fens are common in the IDFdk3, IDFdk4, IDfxm, MSxv, SBPSmk and SBPSxc, and occur as small pocket wetlands or up to several hectares in size. These fen ecosystems are inundated (up to 40 cm) in early growing season, but standing water usually disappears by mid-August. Soil organic accumulations are usually greater than 50 cm over mineral soil. A continuous cover of beaked sedge and water sedge characterizes this ecosystem. Northern manna grass may be present in wetter microsites. Hook mosses are common (*Drepanocladus* spp.). Aquatic species such as buttercups, water-milfoil, bladderwort, duckweed and water smartweed may also be present. These fens are located in groundwater-fed basins and protected lake or pond margins. Water sedge – beaked sedge fens are very common throughout all study areas, especially in the minesite where they occupy 218ha (4.5%) of the minesite local study area.

### Water sedge – Beaked sedge Fen (Map code FB; Wf01)

These sedge wetlands occur in the ESSFxv2 and are found in depressions where organic material has built up. Drainage is imperfect to very poor and the soil moisture of these sites varies both spatially and seasonally. Beaked sedge with water sedge form continuous cover, often up to 80%. Bluejoint and slimstem reedgrass are noticeably scattered throughout and shrubs such as grey-leaved and Barclay's willows and scrub birch are very sparse and are hidden within the sedges. Sickle moss may form a cover of up to 20% but moss cover is often not well developed. Water sedge – beaked sedge fens in ESSFxv2 only occur in the transmission corridor.



### Scrub birch – Water sedge fen (Map code BW & SW & WB; Wf02)

These peatland fens are one of the most common wetlands in the IDFdk3, IDFdk4, MSxv and SBPSxc of the central interior. They are often the dominant component of large peatlands, with fluctuating water tables and hummocky terrain where shrubs grow on organic microsites. Scrub birch and bog willow dominate the raised hummocks, with beaked and water sedge and marsh cinquefoil abundant in the herb layer. Common hook moss and fuzzy hypnum are the dominant moss species and can cover large areas. These fens are located in groundwater-fed basins, gradual seepage slopes, and protected lake or pond margins. Scrub birch – water sedge fens are only present in the transmission corridor and access road study areas.

### Willow - Scrub birch - Sedge fen (Map code WS & WW; Wf04)

These shrub fens are common wetlands in the MSxv and SBPSxc subzones. Barclay's willow, scrub birch and grey-leaved willow are the most common low shrubs in this wetland. Sedges, usually dominated by water and beaked sedges, form a dense cover of greater than 60%. In some sites the shrubs were lower than the sedges while in others they were up to one metre in height and very noticeable. Bluejoint reedgrass is quite common and scattered herbs may include large-leaved avens, coltsfoot and Sitka burnet but herb diversity and coverage is much lower than in the shrub carr (WM). There is a thick moss cover dominated by glow moss, golden fuzzy and *Drepanocladus* spp. Spruce in the tree and shrub layers form a noticeable but sparse component at a few sites but the total tree species cover is always less than 10% in total. Shrub fens occur on organic blankets or veneers in depressional areas. These fens are located in groundwater-fed basins, gradual seepage slopes, and protected lake or pond margins. Scrub birch – water sedge fens are common throughout all study areas, especially in the minesite where they occupy 217ha (4.5%) of the minesite local study area.



## **Saline meadows**

### Alkali saltgrass – Nuttall’s alkaligrass (Map code GR; Gs01)

These uncommon saline meadows in the IDFXm occur on the edges of small pothole wetlands and shallow lakes where evaporation accumulates salts. Early season flooding is followed by surface drying, occasionally leaving a distinct salt crust. Only salt tolerant plants are found such as alkali saltgrass, alkali cordgrass, seablite, tufted white prairie aster, Sandberg’s bluegrass, foxtail barley, Nuttall’s alkaligrass, field sedge and Baltic rush. These meadows only occur in the transmission corridor.

### Nuttall’s alkaligrass – Foxtail barley (Map code AF; Gs02)

These alkaline ecosystems occur in the IDFdk3 and IDFdk4. This saline meadow may have standing water during spring flood but become dry by mid-growing season. The mineral soils have little organic accumulation, and are saline. Salt crusts are frequently evident when surfaces become dry. This meadow type has few species and a low total plant cover, usually less than 50% as high salinity levels restrict plant growth. Characteristic vegetation includes alkali saltgrass, Nuttall’s alkaligrass, foxtail barley, seablite, northern mannagrass, and Nevada bulrush. Nuttall’s alkaligrass – Foxtail barley sites are red-listed (BC CDC 2006a). These meadows occur in both the transmission corridor and access road, but not the minesite.

### Baltic rush - Field sedge meadow (Map code RS; Gs03)

These meadows are common in the IDFdk4 and SBPSxc subzones. They are found adjacent to wetlands in seasonally flooded and slightly alkaline depressions, and on slightly raised edges around ponds, marshes or fens. Patches of scrub birch shrub-carrs often occur between field sedge meadows and the forest edge. Field sedge (*Carex praeegracilis*) is common on these sites as is Baltic rush, silverweed, tufted hairgrass and foxtail barley. Baltic rush - Field sedge meadow are blue-listed (BC CDC 2006a). These meadows are only present in the transmission corridor and access road study areas.

### Baltic rush meadow (Map code RM; Wm07)

Common in the Chilcotin Plateau (IDFdk3, IDFdk4 and SBPSxc), the Baltic rush saline meadows are found in alkaline or saline depressions that have seasonally fluctuating water tables, and are in contained basins with little to no recharge. The soils are fine textured with ~10cm organic surface, which remain damp most of the year, and have salt/alkali crust when dry. These are attractive to wildlife as mineral licks. Baltic rush dominates, with marsh cinquefoil, field sedge, and Nuttall’s alkaligrass secondary, with greater diversity and abundance on drier sites. These meadows occur in both the transmission corridor and access road, but not the minesite.

## **Marshes**

### Great bulrush (Map code BU; Wm06)

These deep marshes usually surround shallow open water and are permanently inundated in the IDFdk3, IDFdk4 and SBPSxc. The dominant plant species is the great bulrush, while plant associates may include greater bladderwort, duckweed and water smartweed. The edge of the marsh is often bordered by a narrow band of sedge fen or Baltic rush. These marshes occur in both the transmission corridor and access road, but not the minesite.

## **Shrub-carrs**

### Scrub birch – Kinnikinnick - shrub-carr (Map code BK; Sc01)

This shrub-carr ecosystem is found in cold, dry zones in frost prone basins that have moist, cold substrates, namely the IDFdk3, IDFdk4 and SBPSxc. Mounding is typical with shrubs growing on dry, organic microsites in the hummocky terrain. Subsurface water is common in the spring, but they are generally dry for most of the year. These ecosystems have a high diversity of flora, and the shrub layer is dominated by scrub birch, short-fruited and grey-leaved willows. Kinnikinnick and matmuhly grass dominate the herb layer, as well as field sedge, wild strawberry, Baltic rush, yarrow, and showy pussytoes. These shrub-carrs occur in both the transmission corridor and access road, but not the minesite.

### Grey-leaved willow - Glow moss shrub carr (Map code WM; Sc02)

These ecosystems occur in the MSxv and SBPSxc subzones. Grey-leaved willow and scrub birch form a dense shrub layer that is about one to two metres in height. Cover is usually greater than 60%. Other shrubs, such as Barclay's willow, hoary willow may have sparse cover. In some sites, scattered black twinberry, prickly rose and short-fruited willow inhabits the shrub layer. The odd spruce or pine sapling may occur. Beaked sedge and water sedge are usually present but are significantly less abundant (< 30% cover) than in the sedge wetlands. Other herbaceous species are very diverse, but individual cover is low. Coltsfoot, both arrow-leaved and sweet, occurs most consistently while asters, northern gentian, meadowrue, large-leaved avens, yarrow, wild strawberry, graceful cinquefoil and marsh valerian commonly occur. Moss cover is often rather insignificant with glow moss, followed by fuzzy golden moss, being the most common species. These shrub-carrs are located in groundwater-fed basins where cold air precludes establishment of trees. They are often situated at the edge of fens or in the case of the minesite along Fish Creek. Grey-leaved willow - Glow moss shrub-carrs are relatively common throughout all study areas, especially in the minesite where they occupy 91ha (1.9%) of the minesite local study area.



#### Grey-leaved willow – Glow moss shrub (Map code GS; Sc02)

These shrub-carr units occur in colder and wetter sites of the ESSFxv2 and consist of grey-leaved willow and scrub birch growing on elevated mounds. The herb layer is diverse, with kinnikinnick, aster, fireweed, strawberry, meadowrue and marsh valerian. This ecosystem is also accompanied by a well-developed moss layer of glow moss and marsh thread-moss. Grey-leaved willow – Glow moss shrub-carr\_in the ESSFxv2 only occur in the transmission corridor.

#### **Swamps and Forested Wetlands**

##### Drummond's willow - Sedge swamp (Map code DS; Ws04)

This ecosystem is uncommon occurring only in the MSxv and SBPSxc subzone. Tall shrubs of Drummond's, grey-leaved and tea-leaved willows separate these wetlands from other shrub fens identified. Isolated pine and spruce saplings may occur. Black twinberry, black gooseberry and scrub birch will be scattered as low shrubs. Herbs vary in species from site to site but can include leafy aster, field mint, Sitka burnet, meadowrue, violets, fireweed and large leaved avens. Beaked and water sedge can also be common. The moss layer is poorly developed or absent. These ecosystems are limited to streamside locations on fluvial deposits. The sites are level to very gently sloping in toe positions. Drainage is imperfect but flooding occurs and soils are regosols. Rich nutrient conditions are reflected in mull humus forms. Drummond's willow - Sedge swamps occur along stream channels in the minesite and transmission corridor; they are replaced by the MacCalla's

willow – Beaked sedge swamp in the access road study area. In the minesite, these swamps are only found north of Fish Lake along Fish Creek in the SBPSxc subzone, where they only occupy 2.7ha (0.056%) of the minesite local study area.

MacCalla’s willow – Beaked sedge swamp (Map code MB & TS; Ws05)

These ecosystems occur in the IDFdk3, IDFdk4, IDFXm and SBPSxc subzones and distribute nutrients and sediments from surface and subsurface water flow from small creeks or wetlands. Standing water is shallow (<20 cm) and usually absent by mid-season. This species rich association (hybrid white spruce, willow, sedge, wintergreen, bedstraw, aster, manna grass, bluejoint and mosses) is dominated by tall willows although willow and sedge species vary between locations. Plant cover and ecosystem structure is also quite variable depending on frequency and severity of flooding. Water sedge, beaked sedge, and Sartwell’s sedge are usually present in wet depressions. Other plants may include grey-leaved willow, tea-leaved willow, Mackenzie’s willow, MacCall’s willow, slimstem reedgrass, glow moss, sickle moss, *Mnium rugicum*, hybrid white spruce, pink wintergreen, small bedstraw, boreal aster and fowl manna grass. MacCalla’s willow – Beaked sedge swamps are blue-listed (BC CDC 2006a). MacCalla’s willow – Beaked sedge swamp occur in the transmission corridor and access road where there is an abundance of near-surface groundwater along in-active floodplain channels, slope breaks, and lake margins.

Sxw – Horsetail forested wetland (Map code SH; IDFXm/09; Ws07)

This ecosystem includes the wettest forested sites of the IDFXm. They occur at the toe of slopes and in depressions where a water table is near the surface. These sites often occur at the edge of non-forested wetlands and on low terraces of larger streams. The forest canopy is dominated by hybrid white spruce and is often patchy. The undergrowth is shrubby and contains several moist-to wet-site herbaceous species such as common horsetail, common mitrewort, and trailing raspberry. Abundant horsetail distinguishes the vegetation of these sites. Sxw – Horsetail forested wetland only occurs in the transmission corridor.

Sxw – Horsetail – Glow moss forested wetland (Map code SH; IDFdk3/09, IDFdk4/10, SBPSxc/05; Ws07)

These wetlands occur in the IDFdk3, IDFdk4 and SBPSxc on wet toe slope positions and depressions, often adjacent to non-forested wetlands or streams. A water table is typically near the surface and soils are usually gleyed. The forest canopy is usually dominated by large, widely spaced white spruce trees, often growing on raised microsites. The undergrowth has abundant common horsetail or meadow horsetail. Other wet-site species that are more abundant in this site series include nodding wood-reed, palmate coltsfoot, soft-leaved sedge and glow moss. Some sites in this series are forested wetlands. Sxw – Horsetail – Glow moss forested wetland occurs throughout all study areas; in the minesite it only occupies 29ha (0.6%) of the local study area.

Sxw - Horsetail – Crowberry forested wetland (Map code SH; MSxv/08; Ws07)

These very open canopy spruce stands occur in the MSxv and are found adjacent to willow wetlands. They have a shrub layer of willow with minor components of scrub birch, black twinberry, prickly rose and Labrador tea. Common horsetail and sedges separate this ecosystem from slightly drier ones. Other herbs include bluejoint reedgrass, slimstem reedgrass, sweet coltsfoot, mitrewort, fireweed, nagoonberry, twinflower, grass-of-parnassus, Sitka burnet, and rein orchid. Mosses are abundant and are dominated by sphagnum, glow moss and leafy mosses. These ecosystems are transitional from wetland to closed forest and occur on level to depressional sites where organic materials have accumulated. Sxw – Horsetail – Crowberry forested wetland occurs in the minesite and transmission corridor study areas in the MSxv subzone. In the minesite it occupies 84.3ha (1.75%) of the local study area.



Sxw - Horsetail – Meadowrue forested wetland (Map code SM; SBPSxc/06)

These ecosystems occur as narrow bands of forest in wet sites adjacent to stream channels or in moist depressions. Seepage water is almost continuous and the soils are nutrient rich. Spruce, balsam poplar and lodgepole pine all occur in the main tree canopy, which has a 15% cover. Trembling aspen can occur also in the understory. Shrubs are sparse but include black twinberry, high-bush cranberry, rose and soopolallie. Herbs are abundant and lush, with a 30% cover of meadowrue. Baneberry, common horsetail, star-flowered false solomon's seal and cow-parnsnip are common. Other herbs include arctic lupine, bracted lousewort, northern bedstraw and trailing raspberry. Sxw - Horsetail –

Meadowrue forested wetlands are blue-listed (BC CDC 2006a) and occur in all study areas in the SBPSxc subzone. This ecosystem does not occur in the minesite local study area, but does occur in the regional study area occupying 94.6 ha, nearly 2% of the RSA.



Sxw - Labrador tea –Willow forested wetland (Map code ST; MSxv/09)

This forested wetland ecosystem is very uncommon and only occurs in small patches in depressions and toe slope positions adjacent to willow wetlands in the MSxv. The mature forest canopy is usually open and dominated by hybrid white spruce with scattered lodgepole pine and subalpine fir. They have a shrub layer of Labrador tea, bog-laurel, black twinberry and scrub-birch. Mosses are abundant and are dominated by sphagnum, glow moss and leafy mosses. These ecosystems have poor drainage and develop on deep organic materials. Sxw - Labrador tea - Willow forested wetland occurs in the minesite and transmission corridor study areas in the MSxv subzone. In the minesite it only occupies 2.9ha (0.06%) of the local study area.



Subalpine fir - Horsetail –Glow moss forested wetland (Map code FH; ESSFxv2/08)

These forested wetland ecosystems are found on wet lower and toe slope positions, and in depressions with near-surface water tables with gleyed or strongly mottled soils. The forest canopy is well spaced and dominated by lodgepole pine and Engelmann spruce. Shrub cover is sparse and includes scattered willows, subalpine fir, common juniper, and black twinberry. These sites are distinguished from other wet sites by a high cover of common horsetail. Other characteristic herbs include bluejoint, pink wintergreen, arrow-leaved groundsel, western meadowrue, globeflower, and dwarf scouring-rush. The moss/lichen layer is typically dominated by *Drepanocladus* species, glow moss, sphagnum moss, and golden fuzzy fen moss. B1 – Horsetail – Glow moss forested wetland only occurs in the transmission corridor of ESSFxv2 subzone.

Se – Trapper’s tea – Glow moss forested wetland (Map code SW; ESSFxv2/09)

These forested wetland ecosystems are found in the ESSFxv2 and occupy lower slopes and slight depressions where persistent, slow-moving subsurface seepage is common. The surface of these sites is hummocky with the water table near the soil surface throughout the growing season. The mature forest canopy is relatively open and dominated by Engelmann spruce with scattered subalpine fir. Trapper’s tea is abundant and forms the dominant cover in the shrub layer. Herb cover is relatively sparse and consists of species characteristic of mesic sites, such as bunchberry and twinflower, on the tops of hummocks and species of wetter sites, such as horsetail, coltsfoot, and cow parsnip, in microdepressions. The moss layer is nearly continuous and dominated by

glow moss and sphagnum moss. Se – Trapper's tea – Glow moss forested wetland only occurs in the transmission corridor of ESSFxv2 subzone.

#### Se – Willow – Glow moss forested wetland (Map code HM; ESSFxv2/10)

These forested wetlands are found in the ESSFxv2 on lower and toe slope positions with a near-surface water table or abundant near surface seepage water. The mature forest canopy is open and most commonly dominated by Engelmann spruce with scattered subalpine fir and Engelmann spruce in the understory, primarily on raised microsites. These sites are characterized by a well-developed shrub layer dominated by willows and scrub birch. Wet-site forbs dominate the herb layer including common horsetail, dwarf scouring rush, western meadowrue, arrow-leaved groundsel, sedges, and coltsfoot. The moss/lichen layer covers most of the surface and consists primarily of glow moss, golden fuzzy fen moss, and leafy mosses. Se – Willow – Glow moss forested wetland only occurs in the transmission corridor of ESSFxv2 subzone.

### **Shallow Open Water**

#### Open Water (Map code OW)

Open water ecosystems occur in all subzones and have a year-round presence of water, although in summer some will almost dry out. Intermittent ponds/wetlands are not considered open water. This water is less than two meters deep and vegetation cover is less than 5%. Emergent vegetation may consist of yellow pond lily, Robin's pondweed, duckweed, and milfoils. Open water areas are very small in size and relatively uncommon throughout all study areas. In the minesite open water only occupies 2.4ha (0.05%) of the minesite local study area.

#### Yellow pond-lily – Robbin's pondweed (Map code YL or OW)

This ecosystem occurs in the minesite area in shallow water at the edge of Fish Lake usually in 30-120cm of water. Vegetation cover is low 5 - 30%. Yellow pond lily and Robin's pondweed, duckweed, milfoils and other aquatic vegetation can be found on or just beneath the surface. This ecosystem represents a variation of open water habitat, but has been delineated to illustrate lake edges where emergent vegetation exists. It has only been mapped in the minesite study area. Yellow pond-lily – Robbin's pondweed occupies 16ha (0.3%) of the minesite local study area.

### **Riparian Ecosystems**

Riparian ecosystems are defined as areas adjacent to streams, lakes and wetlands that are wet enough or inundated frequently enough to develop and support natural vegetative cover distinct from the vegetation in neighbouring freely-drained upland sites (Stevens et al. 1995). Riparian areas are structurally complex and provide conditions for a diversity of plants and animals. Riparian areas depend on adjacent terrestrial habitats to support a broad array of ecological functions including, large organic debris input, root systems for bank stability, and overhanging vegetation to moderate temperature. Because these

linkages are generally found within one tree height of a stream<sup>1</sup> (Stevens et al. 1995), a buffer of 30m (assumed average high-site tree height in the RSA) has been applied to all lakes, streams and wetlands to define this KIR.

Riparian ecosystems have been identified and delineated using data from TRIM, the TEM for the minesite and access road and the SEI mapping for the transmission corridor. Riparian ecosystems have been modeled as both swamps and marshes (from TRIM), and hygric/hydric site series (from TEM or SEI).

Several floodplain and gully riparian ecosystems, occur in the Prosperity project area that are directly linked to the hydrological function of the riparian systems and these have therefore been included within the riparian ecosystem KIR (Table I.1-2).

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<sup>1</sup> For the purpose of this assessment a stream is defined by watercourses marked on the 1:20,000 TRIM used as a basis for modeling the riparian ecosystems VEC.

### ***Baseline Case***

There are three situations that make up the definition of a riparian area for the purposes of addressing riparian ecosystems in the Taseko project area. Firstly, adjacent to wetlands are transition zones that represent a gradual change in plant composition, changes to plant abundance, and a decrease in soil moisture. Differences in soil moisture and plant types results in a microclimate distinct and generally more productive than the lower wetland ecosystem and drier upland ecosystem (Stevens et al. 1995). The minesite riparian areas are exclusively defined by wetland transition zones as opposed to the transmission corridor and access road which also have specific flood associations and gully associations.

Secondly, in addition to areas surrounding obvious wetlands are riparian ecosystems that are inundated during seasonal floods, called flood associations. Flood associations (or flood ecosystems) are non-wetland areas that occur on regularly flooded riparian sites with well-drained soils. Flood associations (Riparian ecosystems) are maintained by a combination of annual flooding, erosion and deposition. These ecosystems are dynamic. Flood associations occur on river floodplains or wave-washed beaches and may be positioned on the lower bench, middle bench or high bench. Low bench flood associations are shrub-dominated, a rich herb layer, and have prolonged flooding and erosion/deposition events (e.g. Drummond's willow – Bluejoint flood association; map code DB; F105). Middle bench flood associations consist of a mixture of tall shrubs, deciduous trees and regenerating coniferous shrubs (e.g., Cottonwood – Red-osier dogwood flood association; map code CR; Fm02). High bench flood associations are dominated by conifer trees and are relatively more stable than low and middle bench ecosystems (MacKenzie and Moran 2004).

Thirdly, in the transmission corridor and access road study areas, forested ecosystems may exist in gullied terrain and therefore have riparian values (referred to as Gully Associations). Gully associations occur along stream and drainage channels in lower to upper slope positions. These ecosystems are also geomorphically dynamic receiving seasonal water influences and sediment erosion and deposition. Gully associations are generally more shrubby with respect to their vegetation composition and contain more deciduous trees than surrounding forests.

### **Minesite Riparian Areas**

The riparian areas of the Taseko minesite study area generally lie in the transition zones from wetland to upland forest. The riparian systems are situated at positions in the landscape adjacent to mineral terrain, providing water and mineral elements through groundwater flow. Riparian zones are linked to the regional water system and provide habitat, forage and nutrients for a wide range of plants and animals (Stevens, Backhouse and Eriksson 1995). Riparian areas in the minesite study area mainly consist of scattered trees, a well-developed shrub layer and diverse herbs and mosses. Riparian areas are represented by transition zones adjacent to minesite wetlands as well as isolated streams and lakes (Table I.1-2).

### Transmission Corridor Riparian Areas

Riparian areas in the transmission corridor include wetland transition zones adjacent to fens, marshes, saline meadows, shrub-carrs, and forested swamps spanning several biogeoclimatic zones (IDFdk3, IDFdk4, ESSFvx2, SBPSxc). Flood association riparian ecosystems are common near Big Creek transmission corridor. Gully associations are not common, but occur sporadically across sloping terrain with drainage channels (Table I .1-2).

### Access Road Riparian Areas

Riparian areas in the access road study area not only occupy transition zones adjacent to wetlands, but also include tall shrub swamps and floodplain ecosystems along the Chilcotin River (Table I.1-2). The only gully association in the access road is the Spruce – Feathermoss – Ragged moss ecosystem.

**Table I.1-2 Riparian Ecosystems Mapped in the Vegetation RSA**

BEC Unit	Ecosystem Name	Map and Wetland Code	Conservation Status	Minesite	Transmission Corridor	Access Road	Wetland Class
SBPSxc	Drummond's willow – Bluejoint flood association	DB - FI05	yellow	no	X	X	Riparian
	Lake	LA		X	X	X	Open water
MSxv	Drummond's willow - Bluejoint flood association	DB - FI05	yellow	no	X	X	Riparian
	Lodgepole pine - Trapper's tea - Crowberry gully	LTg - 05	red	no	X	no	Riparian
	Lake	LA		X	X	X	Open water
IDFdk3	None						
IDFdk4	Drummond's willow - Bluejoint flood association	DB - FI05	yellow	no	X	X	Riparian
	Cottonwood - Wood rose - Mountain alder flood assoc.	CW - Fm01	yellow	no	X	no	Riparian
	Spruce - Feathermoss - Ragged moss gully	SFg - 09	yellow	no	X	X	Riparian
	Lake	LA		X	X	X	Open water
IDFxm	Drummond's willow - Bluejoint flood association	DB - FI05	yellow	no	no	X	Riparian

BEC Unit	Ecosystem Name	Map and Wetland Code	Conservation Status	Minesite	Transmission Corridor	Access Road	Wetland Class
	Cottonwood - Dogwood flood association	CR - Fm02	yellow	no	no	X	Riparian
	Spruce - Snowberry - Prickly rose gulley	SSg - 08	red	no	X	no	Riparian
SBPSmk	None						
ESSFxv	None						
BGxw	Douglas fir Douglas maple gulley	DMg - 05	yellow	no	X	no	Riparian

### **Flood Associations**

#### Drummond's willow – Bluejoint flood association (Map code DB; F105)

These ecosystems occur in the IDFdk4, IDfxm, MSxv and SBPSxc subzones. This ecosystem occurs along gently meandering creeks as well as creeks with moderate currents. It is commonly found at lower elevations, along small, low-gradient streams and floodplain benches. Drummond's willow sites can be deeply flooded during the spring freshet but are much elevated above the midseason water table (MacKenzie and Moran, 2004).

Drummond's willow (*Salix drummondiana*) forms a continuous canopy, with other shrubs such as twinberry (*Lonicera involucrata*) occurring in the understory. The herb layer has a high cover of bluejoint (*Calamagrostis canadensis*). This low bench flood association typically has at least a 20cm capping of silt over gravel, reflecting the lower energy of the adjacent creek but is otherwise variably developed, often with open patches of recently deposited fluvial materials. Soils are nearly always salty to fine-sandy textured Cumuli Regosols (MacKenzie and Moran, 2004). These ecosystems are common along slower moving portions of Big Creek and tributaries, portions of Work, Minton, Tete Angela, and other creeks in the transmission corridor and access road RSAs.

#### Cottonwood – Wood rose – Mountain alder flood association (Map code CW; Fm01)

This flood association is uncommon in the dry, warm climates of the Southern Interior and Southern Interior Mountains, where it occurs adjacent to streams, rivers, and lakes on sandy-gravelly flats that are part of the active floodplain. Flood events are short during the spring freshet and may not occur every year. Cottonwood (*Populus balsamifera*) forms an open canopy with a dense to open understory. A diversity of shrubs is common, with red-osier dogwood (*Cornus stolonifera*), snowberry (*Symphoricarpos albus*), and roses (*Rosa sp.*) being prominent. The herb layer is variable both in composition and total cover. Most sites have star-flowered false Solomon's-seal (*Maianthemum stellatum*), scouring rush (*Equisetum hyemale*), asters (*Aster sp.*), and blue wildrye (*Elymus glaucus*). Kentucky bluegrass (*Poa pratensis*) is common on grazed

sites. The moss layer is usually absent. Soils are commonly coarse-textured at depth with a loamy or sandy surface horizon. Cumulic Regosols or gleyed Brunisols are typical soil types. This ecosystem is mapped on portions of Big Creek (transmission corridor) where there is considerable high energy flow, small rivers (MacKenzie and Moran, 2004).

#### Cottonwood – Red-osier dogwood flood association (Map code CR; Fm02)

The Cottonwood – Red-osier dogwood flood association is the most common middle bench community of low elevations throughout the Interior on suitable sites. It occurs on sandy or gravelly fluvial materials adjacent to streams and rivers with short flood durations followed by continual sub irrigation. Cottonwood (*Populus balsamifera*) forms an open canopy with scattered interior spruce. Red-osier dogwood (*Cornus stolonifera*) and mountain alder (*Alnus incana*) are dominant in the shrub layer, but frequently with some cover of high-bush cranberry (*Viburnum edule*), prickly rose (*Rosa acicularis*), and twinberry (*Lonicera involucrata*). Along smaller river systems, red-osier dogwood is often sparse and mountain alder dominates. The herb layer can be well developed or sparse depending on recent flood history, but common horsetail (*Equisetum arvense*) usually persists. The moss layer is always poorly developed. Soils are Cumulic Regosols or Gleyed Brunisols (MacKenzie and Moran, 2004). This ecosystem is mapped along the Chilcotin River (Access Road). and represents classic cottonwood floodplain stands.

#### **Forested Gully Associations**

##### Lodgepole pine – Trapper’s tea – Crowberry gully (Map code LTg; 05)

Pine dominates the open tree canopy in mature sites, however in gully situations; hybrid spruce is also a common tree species. Gully ecosystem associations contain Trapper’s tea (*Ledum glandulosum*) in the shrub layer together with pine and spruce regeneration. Other shrubs that are common in gullies include black twinberry, prickly rose, soopollalie, and willow species. The herb layer is varied but grouseberry, crowberry and twinflower are most abundant. Others herbs include bunchberry, bracted lousewort, fireweed, yarrow, northwestern sedge and showy aster. The bryophyte layer is well developed and is dominated by red-stemmed feathermoss and curly heron’s bill moss. These ecosystems are red-listed (BC CDC, 2006a) and have been identified on midslope positions in the transmission corridor where the gradient is greater than 5%. Conservation status and distribution of this ecosystem will be discussed in the Ecological Communities of Conservation Concern ([section 5.3.3.7](#)).

##### Spruce – Feathermoss – Ragged moss gully (Map code SFg; 09)

Occurs on moist slopes in lower and toe positions often along stream channels. It generally does not occur adjacent to non-forested wetlands and shrub-carrs. The forest canopy is moderately closed, and dominated by hybrid white spruce, with scattered Douglas-fir, lodgepole pine, and aspen. The undergrowth is diverse and distinguished by abundant pinegrass, palmate coltsfoot, and star-flowered false Solomon’s seal. Dominant mosses are feathermoss and ragged mosses (*Brachythecium* spp.). These ecosystems have been identified in gullies and stream channels in the transmission corridor and access road.

### Spruce – Snowberry – Prickly rose gully (Map code SSg; 08)

These gully associations occur on moist to wet, lower and toe slope sites that receive seepage water during most of the growing season. They are often associated with intermittent or permanent streams. The forest canopy is moderately closed and dominated by hybrid white spruce. The undergrowth includes a moderate cover of shrubs, including common snowberry and black twinberry, and several moist- to wet-site forbs such as twinflower, star-flowered false Solomon's-seal, and sweet-scented bedstraw. The moss layer is dominated by red-stemmed feather moss and step moss but, in contrast to drier sites, leafy mosses are also present. These sites are red-listed (BC CDC 2006a), small in area, and act as buffer areas adjacent to small streams. These ecosystems have been identified in gullies in the transmission corridor. Conservation status and distribution of this ecosystem will be discussed in the Ecological Communities of Conservation Concern (section 5.3.3.7).

### Douglas fir – Douglas maple gully (Map code DMg; 05)

These are slightly moist sites occurring on steep east-facing slopes, mostly on the west side of the Fraser River. DM often occurs on the vegetated portions of east facing or cool aspect bouldery talus slopes. The tree cover consists of scattered Douglas-fir with Douglas maple in gaps and close to the conifers. Other vegetation includes scattered clumps of bluebunch wheatgrass, and a low cover of other herbaceous species such as pasture sage, junegrass, pussytoes and Holboell's rockcress. These ecosystems have been identified in small gullies in the transmission corridor.

In the vegetation RSAs, riparian ecosystems are most likely to be influenced by forest sector activities, particularly activities related to road construction. Substantial areas of riparian edge exist at baseline and appear to be primarily related to past forest harvesting activities and associated access.