



Placer Site Revegetation Report

Taku River Tlingit First Nation Placer
Site Revegetation Prescriptions

November 5, 2021

Prepared for:

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PLACER SITE REVEGETATION REPORT

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Abbreviations

BC	British Columbia
BEC	biogeoclimatic ecosystem classification
BWBSdk1	Dry cool Boreal Black and White Spruce
SWBun	Undifferentiated Spruce Willow Birch
TRTFN	Taku River Tlingit First Nation



PLACER SITE REVEGETATION REPORT

Introduction
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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Taku River Tlingit First Nation (TRTFN) to develop revegetation prescriptions for placer mining sites in the TRTFN territory (the Project). The TRTFN territory covers over 40,000 sq/km throughout northwestern BC, Yukon and Alaska. In BC, the majority of placer mining occurs near Atlin, a small community of approximately 400 people. Placer mining is used to extract minerals deposits, namely gold, from stream bed deposits called placers. Placer mining requires the removal of soil and gravel (overburden) and alters the hydrology of the watercourse and topography of the surrounding landforms, resulting in a disturbed landscape.

1.1 PURPOSE AND SCOPE

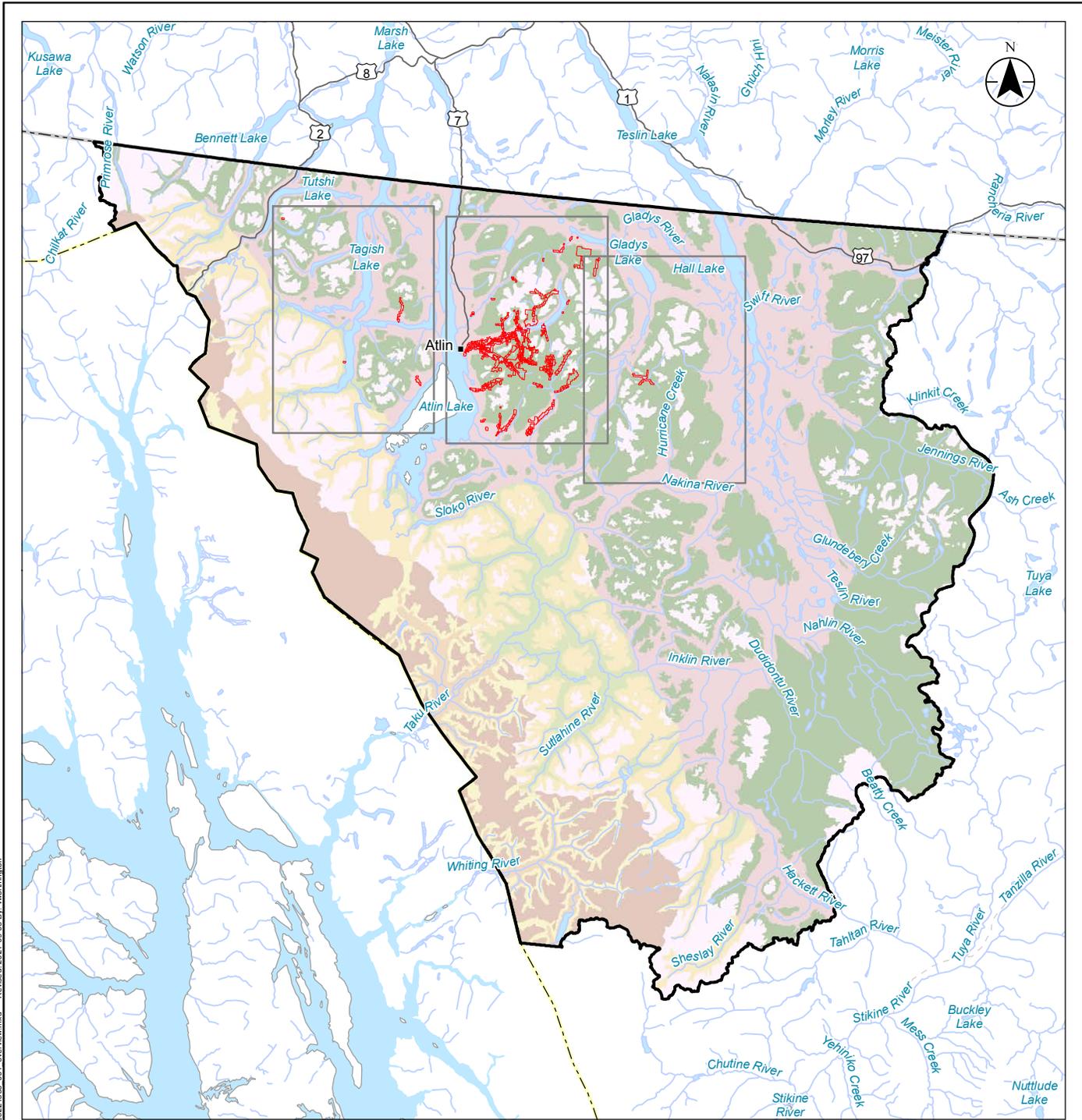
This report describes the revegetation prescriptions for the Project, which includes an information review, cross-sectional diagram of a typical watercourse, revegetation prescriptions, and a reclamation decision matrix. This report and accompanying revegetation fact sheets (Appendix A) will be used to guide the planning and implementation of placer site revegetation within the TRTFN and is not to be used in place of a reclamation plan. The purpose of the revegetation prescriptions is to initiate the re-establishment of functional ecosystems on placer mining sites that support wildlife habitat, particularly for beaver and moose, continuing traditional land use, and recreational activities. The revegetation prescriptions include native species that are intended to establish on disturbed conditions and create a vegetation cover that will also support erosion and sediment control. The revegetation prescriptions in this report only apply to the Atlin area in the northwestern BC portion of the TRTFN territory where placer mining predominantly occurs (Figure 1-1). A detailed map book of the placer mining tenures and biogeoclimatic ecosystem classification (BEC) zones within the TRTFN territory is presented in Appendix B.

1.2 OBJECTIVES

The objectives for the revegetation of placer mining sites in the TRTFN territory include the following:

- Re-establish functional ecosystems with permanent vegetation cover on riparian and upland areas disturbed by placer mining.
- Support wildlife habitat for a diversity of species, with a focus on beaver and moose habitat.
- Provide opportunities for traditional harvesting, gathering, and other activities on the land that enable the continuation of the Tlingit *khustiyxh* (way of life).
- Provide erosion and sediment control.





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- Highway
- - - Resource Road
- Watercourse
- Waterbody
- ▭ Taku River Tlingit First Nation Traditional Territory
- ▭ Placer Tenures
- ▭ Appendix B Figure Index

- BEC Zone**
- Boreal Altai Fescue Alpine
 - Boreal White and Black Spruce
 - Coastal Mountain-heather Alpine
 - Coastal Western Hemlock
 - Engelmann Spruce - Subalpine Fir
 - Mountain Hemlock
 - Sub-Boreal Spruce
 - Spruce - Willow - Birch



Project Location: Taku River Tlingit First Nation Traditional Territory
 Project Number: 123221853
 Prepared by MYOUNG on 20210622
 Requested by HSHORT on 20210603
 Checked by LBORGES on 20210624

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Figure No.
1-1

Placer Mining Tenures and BEC Units in the Taku River Tlingit First Nation Traditional Territory

Notes
 1. Coordinate System: NAD 1983 BC Environment Albers
 2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, TRTFN

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PLACER SITE REVEGETATION REPORT

Relevant Legislation and Guidelines
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1.3 INFORMATION REVIEW

The following sources were reviewed to support the development of revegetation prescriptions for the Project:

- Assessing and Promoting Ecosystem Recovery After Placer Mining in the Atlin Area (Burton and Haig 2016)
- Blue Canyon/At Xá Koogu Resource Management Zone—2017 Vegetation Condition Assessment (Przeczek 2017)
- Wóoshtin Wudidaa Atlin Taku Land Use Plan (Province of BC and TRTFN 2011)
- Atlin Placer Mining Best Management Practices Guidebook (FLNRO and MEM 2014)
- Handbook for Mineral and Coal Exploration in British Columbia (MEMPR and MOE 2009)
- Yukon Revegetation Manual (Matheus and Omtzigt 2011)
- A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region (Banner et al. 1993)
- Final Report: Tulsequah Chief Mine and Access Road Expanded Terrestrial Ecosystem Mapping (Fuller, R. and Forest Information Systems 2002)

2.0 RELEVANT LEGISLATION AND GUIDELINES

Reclamation of placer mine sites is required in accordance with the *Mines Act* and the Health, Safety and Reclamation Code for Mines in British Columbia. Proponents are responsible for complying with federal, provincial, and municipal legislation and associated permit requirements that may be applicable to individual placer mine sites. Laws and regulations applicable to placer mining and revegetation implementation include the following:

- *Mines Act* (RSBC 1996, C.293)
- *Environmental Management Act* (SBC 2003, c.52) and associated Placer Mining Waste Control Regulation (B.C. Reg. 107/89)
- *Water Sustainability Act* (SBC 2014 c.F-15) and associated Water Sustainability Regulation
- *Fisheries Act* (SOR/2019-286)
- *Weed Control Act* (2020)
- *Forest and Range Practices Act* (FRPA) (SBC 2002, c.69)
- *Migratory Birds Convention Act* (MBCA) (S.C. 1994, c.22) and the Migratory Birds Regulations
- *Species at Risk Act*
- *Wildlife Act* (RSBC 1996, C.488)



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Environmental Context

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In addition, best management practices should be implemented to comply with applicable environmental legislation and policies, and to avoid or reduce potential adverse effects of reclamation on land and water use, vegetation, wildlife and wildlife habitat, and fish and fish habitat resources. Industry best practices that should be considered during revegetation implementation include the following:

- *BC Placer Mining Best Management Practices Technical Guide* (BC MEMPR 2019)
- *Atlin Placer Mining Best Management Practices Guidebook* (FLNRO and MEM 2014)
- *Erosion and Sediment Control Best Management Practices* (ESCA BC 2018)
- *BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture* (BC MOECCS 2019)
- *Standards and Best Practices for Instream Works* (BC MWLAP 2004)
- *Measures to Protect Fish and Fish Habitat* (DFO 2019)
- *Pathways of Effects* (DFO 2018)
- *Best Practices for Managing Invasive Plants on Roadsides* (ISCBC 2019)
- *Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia* (BC FLNRO 2013)
- *General nesting periods of migratory birds* (ECCC 2020a)
- *Guidelines to reduce risk to migratory birds* (ECCC 2020b)
- *Best Management Practices for Amphibian and Reptile Salvages in British Columbia* (BC FLNRO 2016)
- *Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia. A Companion Document to Develop with Care* (BC FLNRO 2014)

3.0 ENVIRONMENTAL CONTEXT

The description of existing environmental conditions is based on information from the literature review (Section 1.3) and personal communications with TRTFN staff and members who are knowledgeable of placer site mine conditions within the Atlin area (J.Caldwell and T.Jack, June 3, 2021).

3.1 SOIL

During placer mining operations the overburden is stripped which removes the top layer of organic matter and fertile soil. Most legacy placer sites in the Atlin area did not stockpile or salvage overburden for re-application following mining operations. During the mineral extraction process, fine particle sized soil components (i.e., sand, silt, clay) are typically washed away which results in undeveloped regosol soils (i.e., lacking soil development or horizon formation) in the disturbed landscape. These “soils” are coarse in texture and comprised mostly of gravels and cobbles. Coarse fragment content is often >70% on placer sites, and few placer sites in the Atlin area contain measurable organic soil layers or stockpiled overburden (Burton and Haig 2016). Coarse soils have a reduced capacity to retain water and nutrients, which limits plant growth and nutrient cycling.



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Mine features that typically contain higher proportions of organic matter and fine sediments include overburden waste piles and settling ponds. Disturbed soils are prone to erosion, particularly on sloped sites. Erosion can impede the re-establishment of vegetation and cause damage to watercourses receiving the eroded material. Soils on flat areas subject to traffic, such as roads, may be highly compacted which limits water infiltration, causes soil loss and limits vegetation establishment and growth.

3.2 VEGETATION

The majority of placer mining activities in the Atlin area occur in the Stikine variant of the Dry Cool Boreal White and Black Spruce (BWBSdk1) and the undifferentiated Spruce Willow Birch (SWBun) biogeoclimatic ecosystem classification (BEC) subzones/variants. Disturbed sites left for natural revegetation (i.e., without active restoration) are often devoid of vegetation or contain a community of pioneer species that is dissimilar to undisturbed sites particularly on sites that lack topsoil, have coarse or compacted substrates, are positioned on mid-upper crest slopes, or subject to a harsh climate (Burton and Haig 2016). Vegetation cover is typically higher on sites with more time since disturbance (>30 years old), minimal microsite relief (<28 cm), or on level or lower slopes with loose loamy soils (Burton and Haig 2016).

The biogeoclimatic subzone boundaries in the vicinity of placer mining tenures in the Atlin area are illustrated in Figure 1-1 and discussed in more detail below.

3.2.1 Boreal White and Black Spruce Biogeoclimatic Zone

The Boreal White and Black Spruce (BWBS) zone occurs in forested lowland and montane areas east of the Coast – St. Elias mountain range at elevations between 100 m–1200 m. These areas experience a northern continental climate with long, very cold winters and short warm summers (Banner 1993). Most of the zone has a mean annual temperature below freezing. Tree growth is poor in this zone due to the cold soil temperatures and short growing season resulting from the northern continental climate. The BWBS transitions into the SWB zone at approximately 900-1100 m elevation.

The most common tree species include white spruce (*Picea glauca*), black spruce (*P. mariana*), subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), trembling aspen (*Populus tremuloides*), balsam poplar (*P. balsamifera*), and paper birch (*Betula papyrifera*). Forest fires frequently occur in this zone; sites disturbed by fire are commonly re-colonized by lodgepole pine and scrubs of willow and trembling aspen. Older stands are dominated by white spruce with lesser amounts of subalpine fir and black spruce. The BWBS has less subalpine fir, more continuous and productive forest cover and more pine and deciduous trees than SWB.

The BWBSdk1 variant occurs within mountainous terrain with an elevation range from 500 to 1050 m. The climate is drier than other variants within the BWBS with warmer winters and slightly cooler growing season. The BWBSdk1 experiences characteristics of mountain climates including temperature inversions, chinook winds, local rain shadow, and pronounced aspect differences. On undisturbed sites, non-forested units in the BWBS include wetland units as well as a grassland/scrub unit common on south-facing slopes with coarse-textured soils. Shrub and herb layers are poorly to moderately developed on zonal sites.



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Understory species are characterized by highbush-cranberry (*Viburnum edule*), prickly rose (*Rosa acicularis*), soopolallie (*Shepherdia canadensis*), bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), heart-leaved arnica (*Arnica cordifolia*), and tall bluebells (*Mertensia paniculata*). Other common species include green alder (*Alnus viridis* ssp. *crispa*), Labrador tea (*Rhododendron groenlandicum*), lingonberry (*Vaccinium vitis-idaea*), Altai fescue (*Festuca altaica*), palmate coltsfoot (*Petasites frigidus* var. *palmatus*), bastard toad-flax (*Comandra umbellata* var. *umbellata*), and one-sided wintergreen (*Orthilia secunda*). The moss layer is well developed and dominated by feathermosses.

3.2.2 Spruce Willow Birch Biogeoclimatic Zone

The Spruce Willow Birch (SWB) zone is a subalpine zone found above the BWBS at elevations between 600–900 and 1600 m in the northern half of the Prince Rupert Forest Region (Banner 1993). This zone has an interior continental climate with very long, cold winters and very short cool summers. The zone has an estimated mean annual temperature of around -3° C. On undisturbed sites, lower elevations are forested, primarily by white spruce and subalpine fir with variable amounts of lodgepole pine, aspen and black spruce on valley bottoms and lower slopes. Well-developed shrub layers dominated by grey-leaved willow (*Salix glauca*) and scrub birch (*Betula glandulosa*) with other willow species (*Salix* sp.), shrubby cinquefoil (*Potentilla fruticosa*), and soopolallie are present on typical sites. Species present in the herb layer typically include black crowberry (*Empetrum nigrum*), twinflower, lingonberry, dwarf blueberry (*Vaccinium caespitosum*), Altai fescue, fireweed (*Epilobium angustifolium*), arctic lupine (*Lupinus arcticus*) and tall bluebells (*Mertensia paniculate*). Higher elevations within the zone are non-forested and are covered by deciduous shrubs consisting mainly of scrub birch and multiple willow species including grey-leaved willow, Barclay's willow (*Salix barclayi*), tea-leaved willow (*Salix planifolia*), Baratt's willow (*Salix barrattiana*), and woolly willow (*Salix lanata*). Soil development is typically poor on SWB sites due to recent glaciation and cold climate.

Due to the remoteness of the area, most of the SWB in the vicinity of placer mining in the TRTFN is “undifferentiated”, meaning the variation within the zone is poorly understood. Two subzones may be present including the Moist Cool Spruce-Willow-Birch (SWBmk) subzone and the Moist Cool Scrub Spruce-Willow-Spruce subzone (SWBmk), as described by Fuller (2002). The SWBmk subzone has a canopy dominated by subalpine fir and typical sites have a sparsely developed shrub and herb layer typically consisting of crowberry, bunchberry and twinflower with a well-developed moss layer. Dwarf forms of trembling aspen and common juniper are found on steep, warm aspects. The SWBmks occurs at elevations above the SWBmk subzone and is mainly covered by non-forested shrub, dwarf shrub, dwarf shrub-graminoid and grassland ecosystems. Species common in the SWBmk subzone include scrub birch, willows, dwarf willows (net-veined, Arctic, stoloniferous), crowberry, bog blueberry, dwarf blueberry, Altai fescue, and mountain sagewort.



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4.0 REVEGETATION PRESCRIPTIONS

Revegetation prescriptions were developed for riparian areas (i.e., outside of the bankfull channel) and transition areas disturbed by placer mining activities, including wetland/flooded sites, riparian sites, lower slope, mid-upper slope, and steep slopes for both the BWBSdk1 and SWBun BEC subzones. For each prescription the description, site preparation, management considerations and revegetation and seed mixes are described in detail in Appendix A.

4.1 VEGETATION ZONES

For the purposes of identifying site-appropriate vegetation prescriptions, three generalized vegetation zones were identified, based on a conceptual watercourse in the TRTFN territory. Each vegetation zone has distinct topography, site position, and moisture tendencies. The vegetation zones are depicted on a conceptual cross-section diagram of a typical watercourse provided in Figure 4-1 and are described as follows:

- **Flood or Wet Zone:** includes banks and low-lying areas located immediately adjacent to the watercourse channel. This zone includes wet areas where the water table is at or close to the surface; these areas may be seasonally flooded or continually covered by standing water. The ground is generally flat or has a gently grade slope. Mine features such as roads, settling ponds, and waste piles may be present. Soil moisture is typically greater (i.e., wetter) in this zone compared to the lower slope and mid-upper slope zones. On slopes experiencing surface erosion and slope instability problems, additional treatments may be required to stabilize the slope surface and establish vegetation. Treatments may include installation of bioengineering structures such as live stakes, wattle fences, brush layers, live pole drains or live fascines.
- **Lower Slope:** located above the flood or wet zone and includes the lower portion of the surrounding hillslope surrounding a watercourse which may include flat benches, roads, waste rock piles, or terraces. The slope grades are typically gentle to moderate, though steeply slopes waste rock piles may be present. On slopes experiencing surface erosion and slope instability problems, additional treatments may be required to stabilize the slope surface and establish vegetation. Treatments may include installation of erosion control mats/blankets, or bioengineering structures such as wattle fences or modified brush layers.
- **Mid-Upper Slope:** includes the middle and upper portion of the hillslope and valley walls. This zone typically has steeper slopes though flat benches may be present. Mainly consists of well-drained, water-shedding sites. On slopes experiencing surface erosion and slope instability problems, additional treatments may be required to stabilize the slope surface and establish vegetation. Treatments may include installation of erosion control blankets, or bioengineering structures such as wattle fences or modified brush layers.



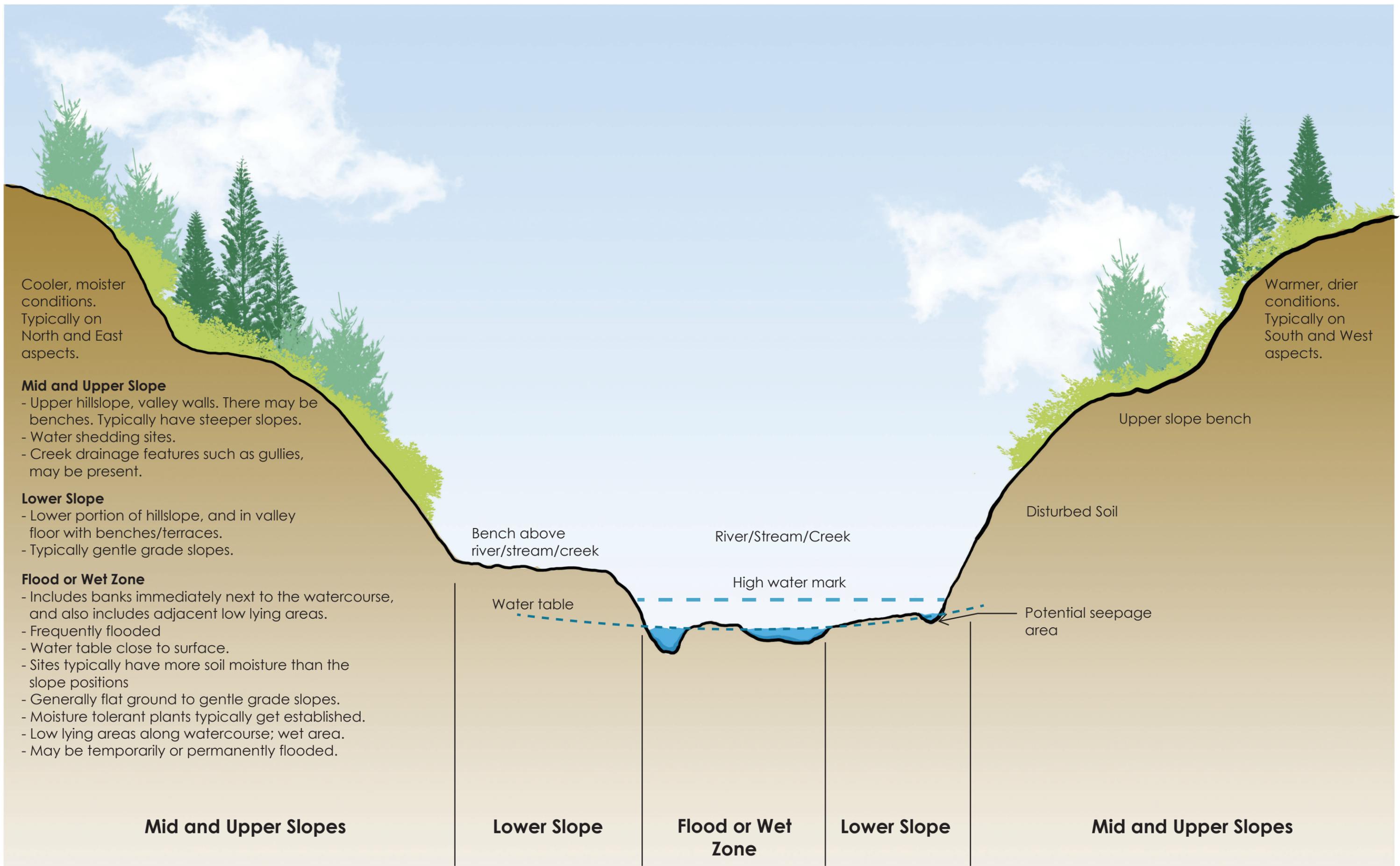


Figure 4-1: Schematic of a Conceptual Watercourse Cross Section in the TRTFN Territory

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4.2 RECLAMATION DECISION MATRIX

The reclamation decision matrix provided in Figure 4-2 and Figure 4-3 provides a query-based pathway to identify the appropriate vegetation prescriptions for each vegetation zone illustrated in the conceptual cross-section presented in (Figure 4-1). Site preparation and vegetation prescriptions are detailed on factsheets provided in Appendix A.



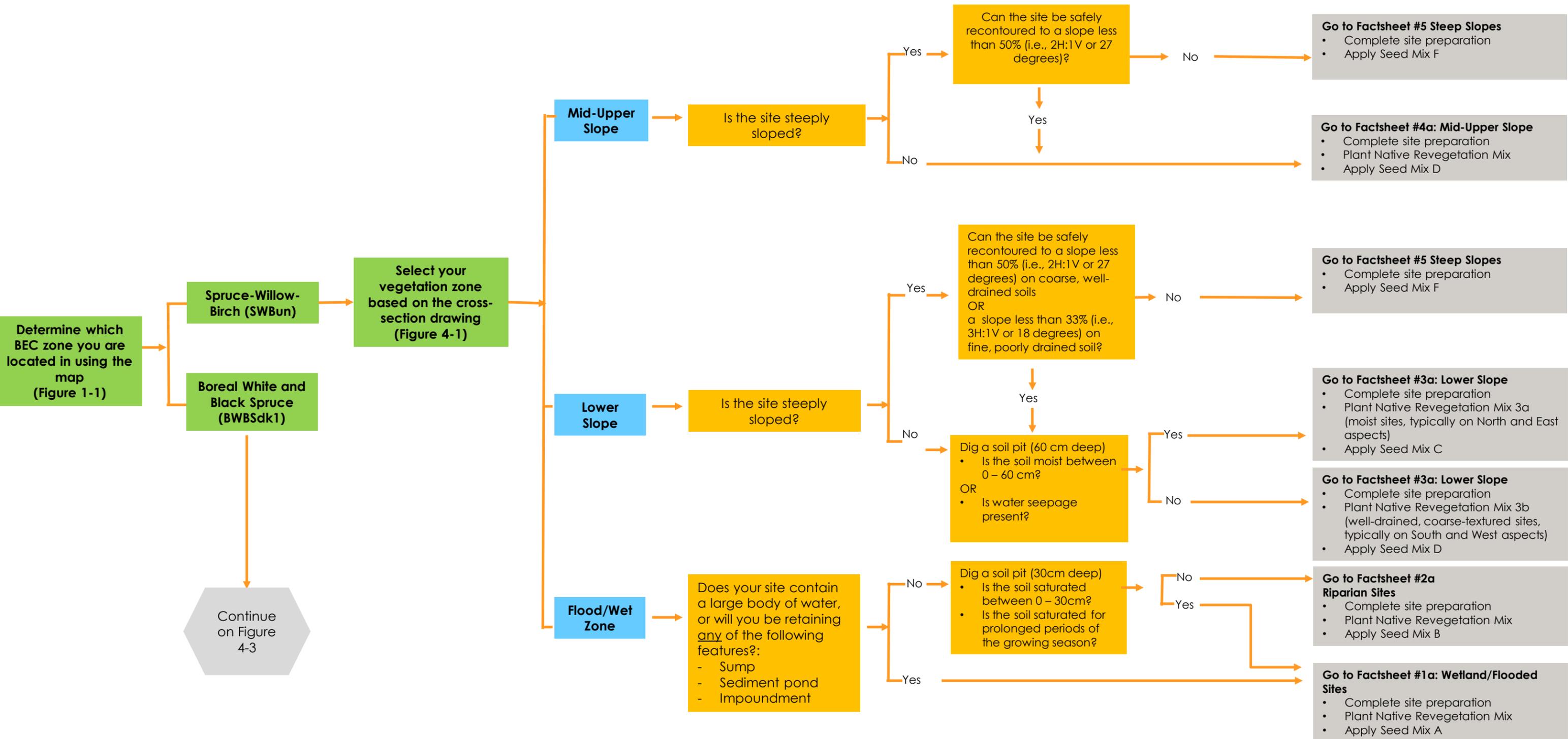


Figure 4-2

Decision Matrix for Selecting and Implementing Placer Site Revegetation Prescriptions in the SWBun Zone

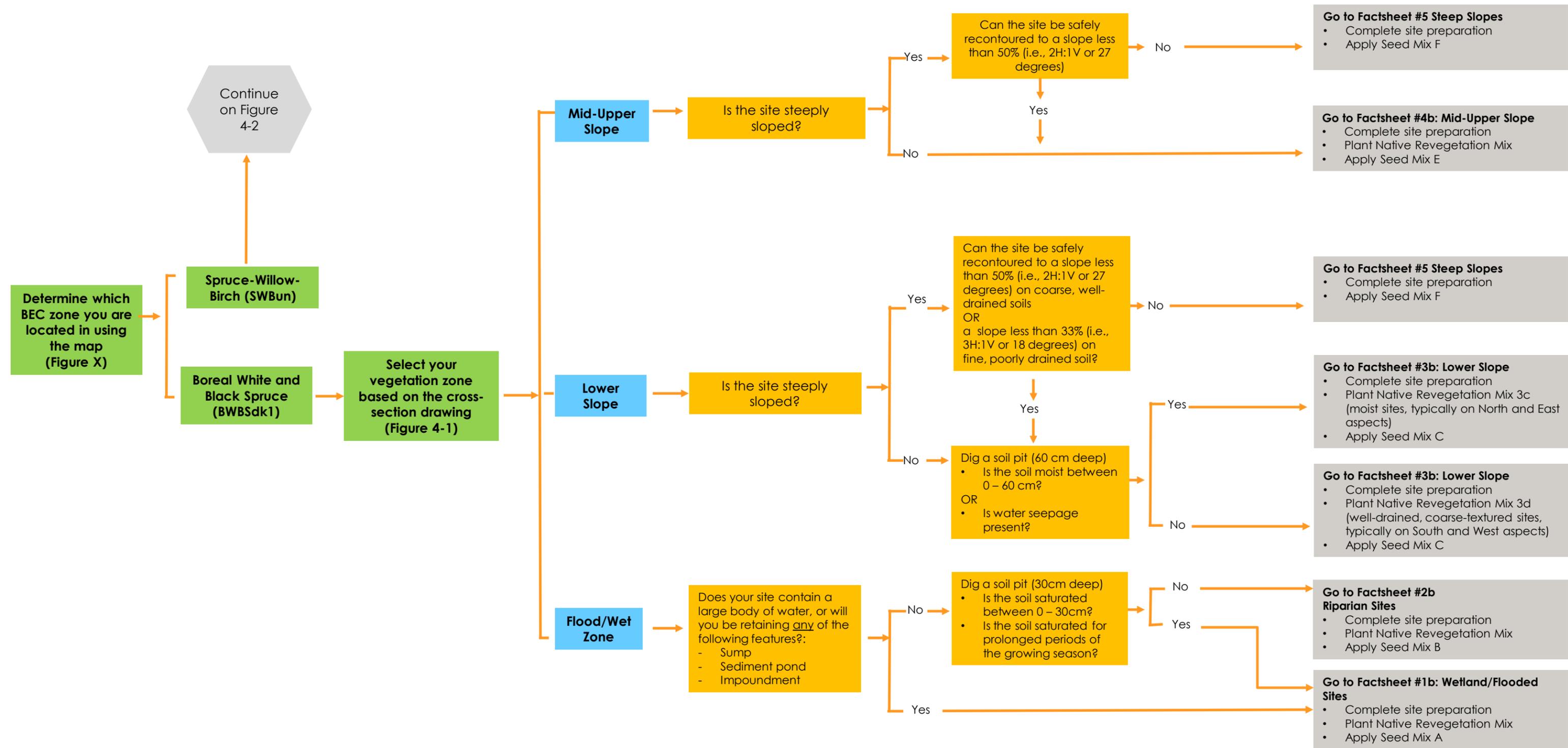


Figure 4-3

Decision Matrix for Selecting and Implementing Placer Site Revegetation Prescriptions in the BWBSdk1 Zone

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4.3 SITE PREPARATION

Site preparation is important to reduce erosion, and improve soil structure and moisture retention. Site preparation techniques for each vegetation prescription are outlined in the revegetation factsheets (Appendix A). Soil that is left rough and loose with some hummocky micro-topography is desired to make slopes more variable, retain organic and fine-grained mineral soil components and create conditions that promote vegetation establishment and growth. Reapplying stockpiled soil (and/or overburden) material following mining operations increases the rate of vegetation establishment and accelerates recovery. If available, coarse woody debris such as logs, stumps, or mulch can be spread to reduce erosion, facilitate plant growth, and add organic material to the soil over time. Supporting revegetation and plant litter accumulation will add organic matter and improve the moisture and nutrient retention of the soil over time.

Proper salvage and stockpiling of overburden is a key management practice to support successful ecosystem recovery (BC MEMPR 2019). If stockpiled soil material is not available to spread on site, it is particularly important to decompact and roughen surface to promote the retention of fine soil materials and improve the structure of the bare mineral soil. In addition, fine sediments can be excavated from settling ponds and spread over coarse-textured soils where overburden is not available. It is recommended to test sediments for elevated levels of metals (e.g., arsenic, copper, mercury, zinc) prior to applying onto reclamation sites.

Sites with a high risk of erosion (e.g., unstable or steep slopes) may require specialized erosion measures such as engineered solutions or bioengineering techniques which are out of the scope of this report. Best practices for slope design vary depending on soil characteristics and slope type. Additional input from professional engineers and/or soil and erosion control specialists may be required when addressing steep gradients or sites with erosion issues or potential.

4.4 RECOMMENDED NATIVE PLANT SPECIES

The selection of plant species for each revegetation prescription considers the post-mining site conditions associated with placer mining operations, the characteristics of the plant species and communities associated with the BEC units present in the area, revegetation objectives, and other background material. Revegetation prescriptions focus on tree, shrub, grass and forb species that are native to the local environment and culturally important in the TRTFN territory and are likely to establish on grounds disturbed by placer mining operations. Plant species and seed mixes for each prescription are provided in Appendix A. A more comprehensive list of candidate species for reclamation is listed in Appendix C, which includes information on the conditions required for each species.



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4.4.1 Native Plant Nurseries and Native Seed Mix Suppliers

Table 4.1 provides a list of suppliers for sourcing revegetation materials. Native plant nurseries can supply rooted seedling stock of native trees, shrubs and forbs recommended for planting on reclamation sites. In addition, native plant nurseries can be contracted for services such as seed collection, seed processing and storage, and growing of seedling stock. Seed suppliers can supply the native grass, legume and forb seed mixes recommended for broadcast application on disturbance sites. Seed suppliers can also provide other revegetation products such as fertilizer, soil amendments like organic mulch pellets, and erosion control products like straw/coir logs and erosion control blankets.

Table 4.1 Native Plant Nurseries and Native Seed Mix Suppliers

Name	Contact Information
Native Plant Nurseries	
Twin Sisters Native Plants Nursery	Mailing address: PO Box 298, Moberly Lake, British Columbia, Canada V0C 1X0 Physical address: 2118 N Highway 29, Moberly Lake, British Columbia, Canada Phone: 250 788 2244 Fax: 250 788 2241 E-mail: nurseryadmin@westmo.org Website: https://twinsistersnursery.com/
Linnaea Nurseries Ltd.	Address: 3666 - 224th Street, Langley, BC V2Z 2G7, Canada Phone: (604) 533-8281 Toll Free: 1-888-327-7705 E-mail: linnaea@telus.net Website: https://linnaeanurseries.com/
NATS Nursery	Address: 24555 32nd Avenue, Langley, BC V2Z 2J5, Canada Phone: 604-530-9300 Fax: 604-530-9500 E-mail: marketing@natsnursery.com Website: https://natsnursery.com/
Woodmere Nursery Ltd.	Address: 13399 HWY #16 East, P.O. Box 195, Telkwa, BC, V0J 2X0 Phone: 250-846-5750 E-mail: manager@woodmere.ca Website: http://www.woodmere.ca/index.html
Boreal Horticultural Services	Address: Box 5021 Bonnyville, Alberta T9N 2G3 Phone: 780-826-1709 E-mail: boreal@mcsnet.ca Website: https://borealhort.com/



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Table 4.1 Native Plant Nurseries and Native Seed Mix Suppliers

Name	Contact Information
Seed Suppliers	
Twin Sisters Native Plants Nursery	See contact information listed above.
Premier Pacific Seeds Ltd.	Address: #203 – 19315 96 Avenue, Surrey, BC V4N 4C4 Phone: 604-881-1323 Toll free: 1-800-433-5153 E-mail: info@premierpacificseeds.com Website: https://premierpacificseeds.ca/
BrettYoung Ltd.	Address: Reclamation specialist- Corey Mandrusiak RR #4, Hwy 60 & Hwy 39, 49469 Rge Rd 263, Calmar, AB, T0C 0V0 Phone: 587-335-8278, 780-985-7308 E-mail (Corey Mandrusiak- reclamation specialist): Corey.Mandrusiak@brettyoung.ca Website: https://www.brettyoung.ca/professional-turf-and-reclamation/seed/native-grasses https://www.brettyoung.ca/professional-turf-and-reclamation/seed/reclamation-information/british-columbia-reclamation
Pickseed	Address: Box 2407, 2156 Mile 2, Alaska Highway, Dawson Creek, BC, V1G 4T9 Phone: 250-782-3040 Fax: 250-782-2252 E-mail: darrell.flatla@dlfpickseed.com Website: https://www.dlfpickseed.ca/native-seed/native-seed-guide
Quality Seeds West	Address: 464 Riverside Road, Abbotsford, BC, Canada, V2S 7M1 Phone: 604-574-7333 Toll free: 1-888-770-7333 E-mail (Bill Awmack- reclamation specialist): bill@qualityseedswest.ca Website: http://www.qualityseedswest.ca/index.html

4.5 INVASIVE SPECIES MANAGEMENT

Invasive species, also referred to as “weeds” or “noxious weeds”, are non-native plants that can easily establish on disturbed soil, spread quickly, and limit the growth of native plant species. Invasive plants that are classified as “noxious” under the British Columbia *Weed Control Act* are required to be controlled by the responsible land manager. Revegetation activities should be completed in accordance with the *Weed Control Act* and the Health, Safety, and Reclamation Code for Mines in British Columbia which provide guidance on which species need to be managed, what type of treatment is appropriate, and for reporting. If invasive species are not controlled, seeded and planted areas may be outcompeted, resulting in bare areas or communities of undesirable species. Table 4.2 outlines general practices that are recommended during revegetation to prevent and reduce the spread of invasive species.



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Table 4.2 Recommended Actions to Prevent Invasive Species on Revegetation Sites

Category	Recommended Actions
Equipment Management	<ul style="list-style-type: none"> • Clean equipment prior to entering the revegetation site to prevent the movement of invasive species. • Avoid parking vehicles, equipment, and machinery in or near areas where invasive species occur. • Inspect and wash the undercarriage of vehicles to remove plant material, seeds, or soil prior to moving vehicles or equipment from an area infested with invasive species to a non-infested area.
Site Preparation	<ul style="list-style-type: none"> • Retain existing native vegetation and reduce ground disturbance where possible. • Monitor the revegetation area for invasive species before and after revegetation. • Remove invasive species (e.g., spraying, mowing, or hand pulling) on the revegetation area consistent with the Health, Safety and Reclamation Code for Mines in British Columbia and the <i>Weed Control Act</i>. • Materials used for reclamation and erosion control (e.g., straw bales, growth medium) should be free of invasive species.
Reporting and Education	<ul style="list-style-type: none"> • Personnel should familiarize themselves with invasive species so they can remove invasive plant material and seeds from clothing and equipment. • Invasive species should be reported to the Northwest Invasive Plant Council (1-866-449-3337 or at http://nwipc.org/) and map their location using the Invasive Alien Plant Program (IAPP 2020).
Native Planting and Seeding	<ul style="list-style-type: none"> • Purchased seed mixes must be free of noxious weeds and meet or exceed grade Canada Certified #1 mixture specifications as defined by the <i>Canada Seed Act</i>; The "Certificate of Seed Analysis" should be reviewed to prevent invasive plants from being introduced to revegetation areas.

The following documents provide further information and guidelines for invasive species management:

- *British Columbia Weed Control Act*. Available at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96487_01
- *Health, Safety and Reclamation Code for Mines in British Columbia*. Available at: <https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/health-safety/health-safety-and-reclamation-code-for-mines-in-british-columbia>
- *Guide to Weeds in British Columbia*: provides information on weed identification, management strategies, and invasive species legislation in British Columbia. Available at: http://bcinvasives.ca/documents/Field_Guide_to_Noxious_Weeds_Final_WEB_09-25-2014.pdf
- *Best Practices for Managing Invasive Plants on Roadsides: A Pocket Guide for British Columbia's Maintenance Contractors*: provides information on weed identification, impacts, and management strategies. Available at: https://www.th.gov.bc.ca/publications/eng_publications/environment/ManagingInvasivePlants.pdf



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- Invasive Species Council of British Columbia *T.I.P.S. Targeted Invasive Plant Solutions*: Provides multiple publications providing species-specific Best Management Practices, and Integrated Pest Management principles. Available at: <http://bcinvasives.ca/resources/tips/>
- The Northwest Invasive Plant Council provides management plans and general invasive plant information for the region, as well as a list of invasive species of priority specific to the Stikine Invasive Plant Management Area. It is available at: <http://nwipc.org/files/public/>

4.6 MAINTENANCE AND MONITORING

A maintenance and monitoring plan should be developed for individual revegetation sites that follows applicable regulatory guidelines for mine sites in BC. Post-planting monitoring will be required to determine if the revegetation objectives have been achieved, identify if any follow-up treatments are necessary, and provide information to improve revegetation efforts in the area over time. Revegetation targets and performance indicators should be developed to evaluate the extent to which the revegetation objectives are being met. Maintenance activities, such as remedial planting, erosion control, and ongoing invasive species management, may be required after the first growing season until sufficient vegetation cover is established.



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APPENDIX A

Revegetation Prescription Fact Sheets

Factsheet 1a Wetland/Flooded Sites – SWBun

Wetland/flooded sites includes wet areas where the water table is at or close to the surface that may be seasonally flooded or continually covered by standing water. Seasonally wet sites include areas located next to a watercourse, in low lying depressions, ditches, or at the base of a slope. Continually wet sites include areas near water bodies such as sediment ponds, or natural wetlands that have standing water or a water table near the surface.

The ground is generally flat or has a gently grade slope. A wetland community of moisture tolerant plants such as willows, grasses, and sedges can be established. Soils are typically poorly drained and may contain higher amounts of fine particles and organic materials compared to other vegetation zones.



Typical Photograph

Site Preparation

- In general, do not decompact wetlands or continually wet sites, and avoid the use of heavy equipment to prevent compaction
- Erosion control materials or bioengineering (e.g., live stakes, wattle fences, brush layers, live pole drains or live fascines) may be required on slopes, banks, or areas with seasonal runoff to prevent erosion
- Sumps, sediment ponds, and impoundments should be drained/removed prior to ground preparation
- On seasonally wet sites (e.g., ditches or water pooling over a compacted site) wait until the site is as dry as possible, then decompact using an excavator, toothed rippers, plows or disk harrows. Deeply till the soil and mix with coarse sediments and organic materials to improve drainage.
- Spread available soil cover material and coarse woody debris
- If soil cover material is limited, prioritize slopes and erosion prone areas

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Stake willow cuttings in areas that will be wet or moist throughout summer
- Plant alder and/or balsam poplar from nursery stock in moist soils (not covered with standing water for prolonged periods)
- Target density for shrubs is 2,000–2,500 stems/ha at 2.4–2.2 m spacing
- Seed at 1,500 seeds/m² (20–50 kg/ha) on bare mineral soil or 750 seeds/m² (10–25 kg/ha) if organic materials are applied
- Alder and tree species should be removed from the prescription if located in the non-forested areas of the SWB

Native Revegetation Mix			Seed Mix A		
Layer	Scientific Name	Common Name	Scientific Name	Common Name	% Weight Composition
Shrub	<i>Alnus tenuifolia</i> or <i>Alnus crispa</i>	mountain alder or green alder	<i>Beckmannia syzigachne</i>	American sloughgrass	20
Shrub	<i>Salix alaxensis</i> *	feltleaf willow	<i>Calamagrostis canadensis</i>	bluejoint	20
Shrub	<i>Salix barclayi</i>	Barclay's willow	<i>Carex rostrata</i> var. <i>utriculata</i> **	beaked sedge	15
Shrub	<i>Salix planifolia</i> *	planeleaf willow	<i>Deschampsia caespitosa</i>	tufted hairgrass	30
Shrub	<i>Salix pulchra</i> *	diamond-leaf willow	<i>Poa Palustris</i>	fowl bluegrass	15

NOTES:
 *Species suitable for staking
 ** Sedge species to be used if available; other native sedge species common to the area may also be used



Factsheet 1b Wetland/Flooded Sites – BWBSdk1

Wetland/flooded sites includes wet areas where the water table is at or close to the surface that may be seasonally flooded or continually covered by standing water. Seasonally wet sites include areas located next to a watercourse, in low lying depressions, ditches, or at the base of a slope. Continually wet sites include areas near water bodies such as sediment ponds, or natural wetlands that have standing water or a water table near the surface.

The ground is generally flat or has a gently grade slope. A wetland community of moisture tolerant plants such as willows, grasses, and sedges can be established. Soils are typically poorly drained and may contain higher amounts of fine particles and organic materials compared to other vegetation zones.



Typical Photograph

Site Preparation

- In general, do not decompact wetlands or continually wet sites, and avoid the use of heavy equipment to prevent compaction
- Erosion control materials or bioengineering (e.g., live stakes, wattle fences, brush layers, live pole drains or live fascines) may be required on slopes, banks, or areas with seasonal runoff to prevent erosion
- Sumps, sediment ponds, and impoundments should be drained/removed prior to ground preparation
- On seasonally wet sites (e.g., ditches or water pooling over a compacted site) wait until the site is as dry as possible, then decompact using an excavator, toothed rippers, plows or disk harrows. Deeply till the soil and mix with coarse sediments and organic materials to improve drainage.
- Spread available soil cover material and coarse woody debris
- If soil cover material is limited, prioritize slopes and erosion prone areas

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Stake willow cuttings in areas that will be wet or moist throughout summer
- Plant alder and/or balsam poplar from nursery stock in moist soils (not covered with standing water for prolonged periods)
- Target density for shrubs is 2,000–2,500 stems/ha at 2.4–2.2 m spacing
- Seed at 1,500 seeds/m² (20–50 kg/ha) on bare mineral soil or 750 seeds/m² (10–25 kg/ha) if organic materials are applied

Native Revegetation Mix

Layer	Scientific Name	Common Name
Tree	<i>Picea mariana</i>	black spruce
Tree	<i>Populus balsamifera</i> *	balsam poplar
Shrub	<i>Alnus tenuifolia</i> or <i>Alnus crispa</i>	mountain alder or green alder
Shrub	<i>Salix alaxensis</i> *	feltleaf willow
Shrub	<i>Salix barclayi</i>	Barclay's willow
Shrub	<i>Salix glauca</i> *	Gray willow
Herb	<i>Equisetum pratense</i>	meadow horsetail
Herb	<i>Equisetum arvense</i>	common horsetail

NOTES:

*Species suitable for live staking

** Sedge species to be used if available; other native sedge species common to the area may also be used

Seed Mix A

Scientific Name	Common Name	% Weight Composition
<i>Beckmannia syzigachne</i>	American sloughgrass	20
<i>Calamagrostis canadensis</i>	bluejoint	20
<i>Carex rostrata</i> var. <i>utriculata</i>	beaked sedge**	15
<i>Deschampsia caespitosa</i>	tufted hairgrass	30
<i>Poa Palustris</i>	fowl bluegrass	15



Factsheet 2a Riparian Sites - SWBun

Riparian sites include banks and low lying-areas located immediately next to the watercourse. The ground is generally flat or has a gently grade slope. Mine features such as roads or waste piles may be present. The soil is typically average to moist. Moisture tolerant plants such as willows, alder, lupine, and grasses can be established.



Typical Photograph

Site Preparation

- Sumps, sediment ponds and impoundments should be drained/removed prior to ground preparation
- Recontour slopes and piles so that they blend in with the natural topography of the surrounding landscape
- Decompact and roughen the upper 30-40 cm of ground using an excavator, toothed rippers, plows, or disk harrows
- Avoid driving equipment over areas that have already been tilled to prevent re-compacting
- Erosion control materials or bioengineering (e.g., live stakes, wattle fences, brush layers, live pole drains or live fascines) may be required on slopes, banks, or areas with seasonal runoff to prevent erosion
- After decompacting, spread available soil cover material and mix into the top layer of soil (10–30 cm) using a harrow
- Spread available coarse woody debris
- If soil cover material is limited, prioritize slopes, erosion prone areas, and areas with poor conditions
- Do not smooth out the soil, leave the surface rough and loose with small depressions for seeds to collect and germinate

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Stake willow cuttings in areas that will be wet or moist throughout summer
- Target density for potted and staked plants is 2,000–2,500 stems/ha at 2.4–2.2 m spacing
- Seed at 1,500 seeds/m² (20–50 kg/ha) on bare mineral soil or 750 seeds/m² (10–25 kg/ha) if organic materials are applied
- Alder and tree species should be removed from the prescription if located in the non-forested areas of the SWB

Native Revegetation Mix

Layer	Scientific Name	Common Name
Shrub	<i>Alnus tenuifolia</i> or <i>Alnus crispa</i>	mountain alder or green alder
Shrub	<i>Betula glandulosa</i> **	scrub birch
Shrub	<i>Salix alaxensis</i> *	feltleaf willow
Shrub	<i>Salix barclayi</i>	Barclay's willow
Shrub	<i>Salix barrattiana</i>	Barratt's willow
Shrub	<i>Salix planifolia</i> *	tea-leaved willow
Shrub	<i>Salix pulchra</i> *	diamond-leaf willow
Herb	<i>Chamaenerion latifolium</i> **	dwarf fireweed
Herb	<i>Lupinus arcticus</i> **	arctic lupine

NOTES:

*Species suitable for live staking

**Only plant if soil organic material is present

**Herbs suitable for planting or seeding (collect seeds and add to seed mix)

Seeding Mix B

Scientific Name	Common Name	% Weight Composition
<i>Beckmannia syzigachne</i>	American sloughgrass	25
<i>Calamagrostis canadensis</i>	bluejoint	20
<i>Deschampsia caespitosa</i>	tufted hairgrass	20
<i>Elymus alaskanus</i>	Alaskan wheatgrass	15



Factsheet 2b Riparian Sites – BWBSdk1

Riparian sites include banks and low lying-areas located immediately next to the watercourse. The ground is generally flat or has a gently grade slope. Mine features such as roads or waste piles may be present. The soil is typically moist but may be free draining if organic materials and fine sediments have been removed. Moisture tolerant plants such as willows, alder, lupine, and grasses can be established.



Typical Drawing/Photograph

Site Preparation

- Sumps, sediment ponds, and impoundments should be drained/removed prior to ground preparation
- Recontour slopes and piles so that they blend in with the natural topography of the surrounding landscape
- Decompact and roughen the upper 30–40 cm of ground using an excavator, toothed rippers, plows or disk harrows
- Avoid driving equipment over areas that have already been tilled to prevent re-compacting
- Erosion control materials or bioengineering (e.g., live stakes, wattle fences, brush layers, live pole drains or live fascines) may be required on slopes, banks or areas with seasonal runoff to prevent erosion
- After decompacting, spread available soil cover material and mix into the top layer of soil (10–30 cm) using a harrow
- Spread available coarse woody debris
- If soil cover material is limited, prioritize slopes, erosion prone areas, and areas with poor conditions
- Do not smooth out the soil, leave the surface rough and loose with small depressions for seeds to collect and germinate

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Stake willow cuttings and/or balsam poplar in areas that will be wet or moist throughout summer
- Target density for potted and staked plants is 2,000–2,500 stems/ha at 2.4–2.2 m spacing
- Seed at 1,500 seeds/m² (20–50 kg/ha) on bare mineral soil or 750 seeds/m² (10–25 kg/ha) if organic materials are applied

Native Revegetation Mix			Seeding Mix B		
Layer	Scientific Name	Common Name	Scientific Name	Common Name	% Weight Composition
Tree	<i>Abies lasiocarpa</i>	subalpine fir			
Tree	<i>Populus balsamifera</i>	balsam poplar	<i>Beckmannia syzigachne</i>	American sloughgrass	25
Tree	<i>Populus tremuloides</i>	trembling aspen	<i>Calamagrostis canadensis</i>	bluejoint	20
Shrub	<i>Alnus tenuifolia</i> or <i>Alnus crispa</i>	mountain alder or green alder	<i>Deschampsia caespitosa</i>	tufted hairgrass	20
Shrub	<i>Salix alaxensis</i> *	feltleaf willow	<i>Festuca altaica</i>	Altai fescue	20
Shrub	<i>Salix barclayi</i>	Barclay's willow	<i>Elymus alaskanus</i>	Alaskan wheatgrass	15
Shrub	<i>Salix planifolia</i> *	planeleaf willow			
Shrub	<i>Salix glauca</i> *	Gray willow			
Herb	<i>Chamaenerion angustifolium</i> (<i>Epilobium angustifolium</i>)**	fireweed			
Herb	<i>Chamaenerion latifolium</i> **	dwarf fireweed			

NOTES:
 *Species suitable for staking
 **Herbs suitable for planting or seeding (collect seeds and add to seed mix)



Factsheet 3a Lower Slope - SWBun

The lower slope prescription applies to the lower portion of the hillslope surrounding a watercourse which may include flat benches, roads, waste rock piles or terraces. The slope grades are typically gentle, though steep slopes may be present.

Site Preparation

- Sumps, sediment ponds, and impoundments should be drained/removed prior to ground preparation
- Recontour slopes and piles so that they blend in with the natural topography of the surrounding landscape
- Decompact and roughen the upper 30-40 cm of ground using an excavator, toothed rippers, plows or disk harrows
- Avoid driving equipment over areas that have already been tilled to prevent re-compacting
- Erosion control materials or bioengineering (e.g., erosion control mats/blankets, wattle fences, modified brush layers) may be required on slopes, banks or areas with seasonal runoff to prevent erosion
- After decompacting, spread available soil cover material and mix into the top layer of soil (10–30 cm) using a harrow
- Spread available coarse woody debris
- If soil cover material is limited, prioritize slopes, erosion prone areas, and areas with poor conditions
- Do not smooth out the soil, leave the surface rough and loose with small depressions for seeds to collect and germinate



Typical Photograph

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Stake willow cuttings in areas that will be wet or moist throughout summer
- Target density for potted and staked plants is 2,000–2,500 stems/ha at 2.4–2.2 m spacing
- Seed at 1,500 seeds/m² (20–50 kg/ha) on bare mineral soil or 750 seeds/m² (10–25 kg/ha) if organic materials are applied
- Alder and tree species should be removed from the prescription if located in the non-forested areas of the SWB

Native Revegetation Mix 3a: Recommended for moist sites, typically on North and East aspects

Layer	Scientific Name	Common Name
Tree	<i>Abies lasiocarpa</i>	subalpine fir
Tree	<i>Picea glauca</i>	white spruce
Shrub	<i>Potentilla fruticosa</i>	shrubby cinquefoil
Shrub	<i>Salix barclayi</i>	Barclay's willow
Shrub	<i>Salix barrattiana</i>	Barratt's willow
Shrub	<i>Salix planifolia</i> *	tea-leaved willow
Herb	<i>Empetrum nigrum</i> **	black crowberry (moss berry)
Herb	<i>Epilobium angustifolium</i> ***	fireweed
Herb	<i>Hedysarum alpinum</i> ***	alpine hedysarum (alpine bear root)
Herb	<i>Lupinus arcticus</i> ***	arctic lupine
Herb	<i>Vaccinium caespitosum</i>	dwarf blueberry

Revegetation Mix 3b: Recommended for well-drained, coarse - textured sites, typically on South and West aspects

Layer	Scientific Name	Common Name
Tree	<i>Pinus contorta</i>	lodgepole pine
Shrub	<i>Shepherdia canadensis</i>	soopolallie
Herb	<i>Achillea millefolium</i>	yarrow
Herb	<i>Arctostaphylos uva-ursi</i>	kinnikinnick
Herb	<i>Artemisia norvegica</i>	mountain sagewort
Herb	<i>Dryas drummondii</i>	yellow mountain-avens
Herb	<i>Dryas integrifolia</i>	mountain avens
Herb	<i>Dryas octopetala</i>	white mountain-avens (eightpetal mountain-avens)
Herb	<i>Empetrum nigrum</i> *	black crowberry (moss berry)
Herb	<i>Vaccinium caespitosum</i>	dwarf blueberry

NOTES:
*only plant on acidic soils where organic matter is present (i.e., thick organic layer, moss present, low pH)

NOTES:

*Species suitable for live staking
**only plant on acidic soils where deep organic matter is present (i.e., thick organic layer, moss present, low pH)
***Herbs suitable for planting or seeding (collect seeds and add to seed mix)

Seeding Mix C: Recommended for moist slopes, typically on North and East aspects

Scientific Name	Common Name	% Weight Composition
Beckmannia syzigachne	American sloughgrass	25
Deschampsia caespitosa	tufted hairgrass	25
Elymus trachycaulis	slender wheatgrass	25
Festuca altaica	Altai fescue	25

Seeding Mix D: Recommended for dry, exposed slopes, typically on South and West aspects

Scientific Name	Common Name	% Weight Composition
Elymus alaskanus (Agropyron alexensis)	Alaska wheatgrass	25
Festuca altaica	Altai fescue	25
Festuca saximontana	Rocky mountain fescue	25
Poa glauca	glaucous bluegrass	25



Factsheet 3b Lower Slope – BWBSdk1

The lower slope prescription applies to the lower portion of the hillslope surrounding a watercourse which may include flat benches, roads, waste rock piles or terraces. The slope grades are typically gentle, though steep slopes may be present.



Typical Photograph:

Site Preparation

- Sumps, sediment ponds, and impoundments should be drained/removed prior to ground preparation
- Recontour slopes and piles so that they blend in with the natural topography of the surrounding landscape
- Decompact and roughen the upper 30–40 cm of ground using an excavator, toothed rippers, plows or disk harrows
- Avoid driving equipment over areas that have already been tilled to prevent re-compacting
- Erosion control materials or bioengineering (e.g., erosion control mats/blankets, wattle fences, modified brush layers) may be required on slopes, banks or areas with seasonal runoff to prevent erosion
- After decompacting, spread available soil cover material and mix into the top layer of soil (10–30 cm) using a harrow
- Spread available coarse woody debris
- If soil cover material is limited, prioritize slopes, erosion prone areas, and areas with poor conditions
- Do not smooth out the soil, leave the surface rough and loose with small depressions for seeds to collect and germinate

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Stake willow cuttings in areas that will be wet or moist throughout summer
- Target density for potted and staked plants is 2,000–2,500 stems/ha at 2.4–2.2 m spacing
- Seed at 1,500 seeds/m² (20–50 kg/ha) on bare mineral soil or 750 seeds/m² (10–25 kg/ha) if organic materials are applied

Native Revegetation Mix 3c: Recommended for moist sites, typically on North and East aspects

Native Revegetation Mix 3d: Recommended for dry sites, typically on South and West aspects

Layer	Scientific Name	Common Name	Layer	Scientific Name	Common Name
Tree	<i>Abies lasiocarpa</i>	subalpine fir	Tree	<i>Pinus contorta</i>	lodgepole pine
Tree	<i>Populus balsamifera</i>	balsam poplar	Tree	<i>Populus tremuloides</i>	trembling aspen
Tree	<i>Picea glauca</i>	white spruce	Shrub	<i>Juniperus communis</i>	common juniper
Tree	<i>Pinus contorta</i>	lodgepole pine	Shrub	<i>Rosa acicularis</i>	prickly rose
Tree	<i>Populus tremuloides</i>	trembling aspen	Shrub	<i>Shepherdia canadensis</i>	soopolallie
Shrub	<i>Salix scouleriana*</i>	Scouler’s willow	Herb	<i>Arctostaphylos uva-ursi**</i>	kinnikinnick
Shrub	<i>Rhododendron groenlandicum</i>	Labrador tea	Herb	<i>Artemisia frigida**</i>	Prarie sagewort
Shrub	<i>Rosa acicularis</i>	prickly rose	Herb	<i>Dryas integrifolia**</i>	mountain avens
Shrub	<i>Viburnum edule</i>	highbush cranberry			
Herb	<i>Chamaenerion angustifolium</i> (<i>Epilobium angustifolium</i>)**	fireweed			

****Herbs suitable for planting or seeding (collect seeds and add to seed mix**

NOTES:
 *Species suitable for staking
 **Herbs suitable for planting or seeding (collect seeds and add to seed mix

Seeding Mix C: Recommended for moist slopes, typically on North and East aspects

Seeding Mix E: Recommended for dry, exposed slopes, typically on South and West aspects

Scientific Name	Common Name	% Weight Composition	Scientific Name	Common Name	% Weight Composition
<i>Beckmannia syzigachne</i>	American sloughgrass	25	<i>Deschampsia caespitosa</i>	tufted hairgrass	25
<i>Deschampsia caespitosa</i>	tufted hairgrass	25	<i>Elymus trachycaulis</i>	slender wheatgrass	25
<i>Elymus trachycaulis</i>	slender wheatgrass	25	<i>Festuca saximontana</i>	Rocky mountain fescue	25
<i>Festuca altaica</i>	Altai fescue	25	<i>Leymus innovatus</i>	fuzzy spiked wildrye	25



Factsheet 4a Mid-Upper Slope – SWBun

The mid-upper slope zone includes the middle and upper portion of the hillslope and valley walls. This zone typically has steeper slopes though flat benches may be present. Consists of well-drained, water-shedding sites.



Typical Drawing/Photograph

Site Preparation

- Sumps, sediment ponds, and impoundments should be drained/removed prior to ground preparation
- Recontour side slopes and piles so that they blend in with the natural topography of the surrounding landscape
- De-compact slopes using teeth mounted on the bucket of an excavator with a long reach, or by using rippers mounted on the back of a tracked vehicle
- De-compact/roughen flat areas by tilling the top 25–40 cm of the surface using a plough, disk harrow, ripping teeth on a tracked vehicle, or hand tools (for small sites)
- Erosion control materials or bioengineering (e.g., erosion control blankets, wattle fences, modified brush layers) may be required on slopes, banks or areas with seasonal runoff to prevent erosion
- Avoid driving equipment over areas that have already been tilled to prevent re-compacting
- After decompacting, spread available soil cover material and mix into the top layer of soil (10–30cm) using a harrow
- Spread available coarse woody debris
- If soil cover material is limited, prioritize slopes, erosion prone areas, and areas with poor conditions
- Do not smooth out the soil, leave the surface rough and loose with small depressions for seeds to collect and germinate

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Target density for potted plants is 2,000–2,500 stems/ha at 2.4–2.2 m spacing
- Seed at 1,500 seeds/m² (20–50 kg/ha) on bare mineral soil or 750 seeds/m² (10–25 kg/ha) if organic materials are applied

Native Revegetation Mix

Layer	Scientific Name	Common Name
Tree	<i>Abies lasiocarpa</i>	subalpine fir
Tree	<i>Picea glauca</i>	white spruce
Shrub	<i>Juniperus communis</i>	common juniper
Shrub	<i>Salix glauca</i>	grey-leaved willow
Shrub	<i>Shepherdia canadensis</i>	soopolallie
Herb	<i>Achillea millefolium*</i>	yarrow
Herb	<i>Artemisia norvegica</i>	mountain sagewort
Herb	<i>Dryas drummondii</i>	yellow mountain-avens
Herb	<i>Dryas integrifolia*</i>	mountain avens
Herb	<i>Dryas octopetala</i>	white mountain-avens (eightpetal mountain-avens)
Herb	<i>Empetrum nigrum</i>	black crowberry

NOTES:

*Herbs suitable for planting or seeding (collect seeds and add to seed mix)

Seeding Mix D

Scientific Name	Common Name	% Weight Composition
<i>Elymus alaskanus</i> (<i>Agropyron alexensis</i>)	Alaska wheatgrass	25
<i>Festuca altaica</i>	Altai fescue	20
<i>Festuca saximontana</i>	Rocky mountain fescue	25
<i>Poa glauca</i>	glaucous bluegrass	15
<i>Trisetum spicatum</i>	spiked trisetum	15



Factsheet 4b Mid-Upper Slope – BWBSdk1

The mid-upper slope zone includes the middle and upper portion of the hillslope and valley walls. This zone typically has steeper slopes though flat benches may be present. Consists of well-drained, water-shedding sites.



Typical Drawing/Photograph

Site Preparation

- Sumps, sediment ponds, and impoundments should be drained/removed prior to ground preparation
- Recontour side slopes and piles so that they blend in with the natural topography of the surrounding landscape
- De-compact slopes using teeth mounted on the bucket of an excavator with a long reach, or by using rippers mounted on the back of a tracked vehicle
- De-compact/roughen flat areas by tilling the top 25–40 cm of the surface using a plough, disk harrow, ripping teeth on a tracked vehicle, or hand tools (for small sites)
- Erosion control materials or bioengineering (e.g., erosion control blankets, wattle fences, modified brush layers) may be required on slopes, banks or areas with seasonal runoff to prevent erosion
- Avoid driving equipment over areas that have already been tilled to prevent re-compacting
- After decompacting, spread available soil cover material and mix into the top layer of soil (10–30cm) using a harrow
- Spread available coarse woody debris
- If soil cover material is limited, prioritize slopes, erosion prone areas, and areas with poor conditions
- Do not smooth out the soil, leave the surface rough and loose with small depressions for seeds to collect and germinate

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Target density for potted plants is 2,000–2,500 stems/ha at 2.4–2.2 m spacing
- Seed at 1,500 seeds/m² (20–50 kg/ha) on bare mineral soil or 750 seeds/m² (10–25 kg/ha) if organic materials are applied

Native Revegetation Mix

Seeding Mix E

Layer	Scientific Name	Common Name	Scientific Name	Common Name	% Weight Composition
Tree	<i>Pinus contorta</i>	lodgepole pine	<i>Deschampsia caespitosa</i>	tufted hairgrass	25
Tree	<i>Populus tremuloides</i>	trembling aspen	<i>Elymus trachycaulis</i>	slender wheatgrass	25
Shrub	<i>Juniperus communis</i>	common juniper	<i>Festuca saximontana</i>	Rocky mountain fescue	25
Shrub	<i>Shepherdia canadensis</i>	soopolallie	<i>Leymus innovatus</i>	fuzzy spiked wildrye	25
Shrub	<i>Salix alaxensis</i> *	feltleaf willow			
Herb	<i>Achillea millefolium</i> **	yarrow			
Herb	<i>Arctostaphylos uva-ursi</i> **	kinnikinnick			
Herb	<i>Artemisia frigida</i> **	Prarie sagewort			
Herb	<i>Dryas integrifolia</i> **	mountain avens			
Herb	<i>Hedysarum boreale</i> **	northern hedysarum (bear root)			
Herb	<i>Oxytropis campestris</i> **	yellow locoweed			

NOTES:

*Species suitable for staking

**Herbs suitable for planting or seeding (collect seeds and add to seed mix)



Factsheet 5 Steep Slopes – SWBun and BWBSdk1

Steep slopes can be challenging to revegetate because they are typically dry, prone to erosion, and lack organic materials. Stabilizing slopes and reducing erosion is important on these sites to promote vegetation growth. A cover of drought tolerant grasses can be established with proper site preparation.



Typical Photograph:

Site Preparation

- For slopes cannot be resloped to a less steep grade, scrape the slope surface using a toothed bucket to help retain seeds
- Erosion control measures such as erosion matting or bioengineering may be required to support seed germination, especially in areas where slopes cannot be prepared using heavy machinery
- Apply available soil cover material prior to track-walking or bucket scraping
- Soil cover materials will help reduce erosion and promote plant growth but are at risk of being washed downslope if not properly incorporated

Management Considerations

- Survey the area for invasive and noxious weeds and complete weed management and removal if needed
- Follow the applicable regulatory requirements for working adjacent to waterbodies

Revegetation and Seed Mixes

- Heavy broadcast is required since seed loss occurs on steep slopes due to runoff and low germination rates.
- Seed at a rate of 3,000 seeds/m² (40–100 kg/ha). The seed rate can be reduced by up to half if a substantial amount of organic materials are applied
- Steep slopes are typically too dry to plant shrubs and herbs however, if the slope is wet or moist (e.g., wet banks), willow cuttings can be staked
- Grass species for wet sites (e.g., slopes next to water bodies or ditches) are listed along the bottom
- Hydroseeding should be considered on steep slopes that are impractical to seed using equipment or too large to seed by hand a rate of 3,000 seeds/m² (40–100 kg/ha)
- Non-native fast growing annual grasses are effective in rapidly establish vegetation cover and could be considered in erosion prone or problematic areas; annual grasses should make up more than 10% of the seed mix

Seed Mix F

Layer	Scientific Name	Common Name	% composition
Grass	<i>Elymus alakanus (Agropyron alexensis)</i>	Alaska wheatgrass	20
Grass	<i>Elymus trachycaulis</i>	slender wheatgrass	20
Grass	<i>Festuca altaica</i>	Altai fescue*	15
Grass	<i>Festuca saximontana</i>	Rocky mountain fescue	20
Grass	<i>Poa glauca</i>	glaucous bluegrass	15
Herb	<i>Chamaenerion angustifolium (Epilobium angustifolium)</i>	fireweed	5
Herb	<i>Chamaenerion latifolium</i>	dwarf fireweed	5
Grass	<i>Deschampsia caespitosa</i>	tufted hairgrass*	-

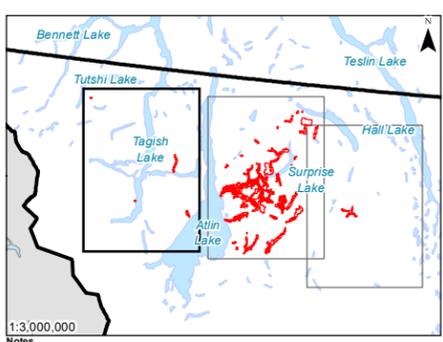
NOTES:

*only seed on moist-wet sites

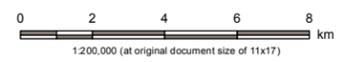


APPENDIX B

**Map book of Placer Mining Tenures and Biogeoclimatic
Zones in the Taku River Tlingit First Nation Territory**



- Trail
- Topographic Contour
- Watercourse
- Waterbody
- Placer Tenures
- BAFAun - Boreal Altai Fescue Alpine Undifferentiated
- ESSFun - Engelmann Spruce - Subalpine Fir Undifferentiated
- ESSFun - Engelmann Spruce - Subalpine Fir Undifferentiated parkland
- SWBuns - Spruce - Willow - Birch Undifferentiated scrub
- SBSun - Sub-Boreal Spruce Undifferentiated
- SWBun - Spruce - Willow - Birch Undifferentiated
- BWBSdk - Boreal White and Black Spruce Dry Cool



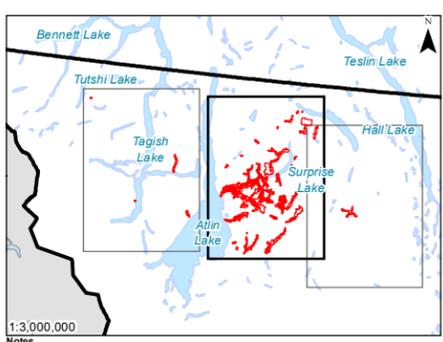
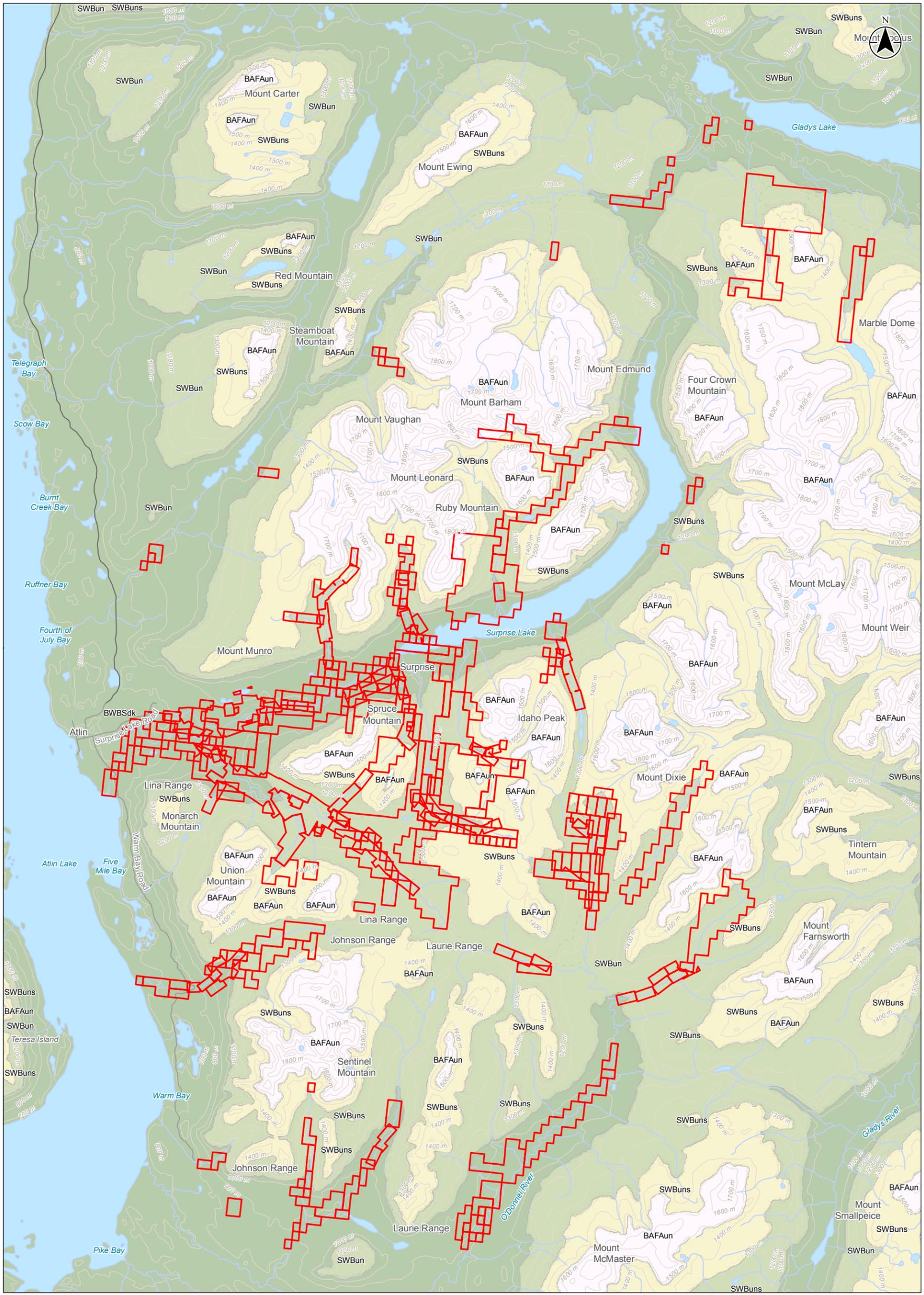
Project Location: Taku River Tlingit First Nation, Traditional Territory
 Project Number: 12321853
 Prepared by: MYOUNG on 20210622
 Requested by: HSHORT on 20210603
 Checked by: LBORGES on 20210624

Client/Project/Report: Taku River Tlingit First Nation, Placer Site Revegetation Report

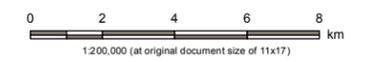
Figure No. **Appendix B**
 Title: **Map book of Placer Mining Tenures and Biogeoclimatic Zones in the Taku River Tlingit First Nation**

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Notes
 1. Coordinate System: NAD 1983 BC Environment Albers
 2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, TRTFN
 Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.



- Highway
- Road
- Local Street
- - - Resource Road
- - - Trail
- Topographic Contour
- Watercourse
- Waterbody
- Placer Tenures
- BAFaun - Boreal Altai Fescue Alpine Undifferentiated
- SWBuns - Spruce - Willow - Birch Undifferentiated scrub
- SWBun - Spruce - Willow - Birch Undifferentiated
- BWBSdk - Boreal White and Black Spruce Dry Cool



Stantec

Project Location: Taku River Tlingit First Nation Traditional Territory
 Project Number: 123221853
 Prepared by: MYOUNG on 20210622
 Requested by: HSHORT on 20210603
 Checked by: LBORGES on 20210624

Client/Project/Report: Taku River Tlingit First Nation Placer Site Revegetation Report

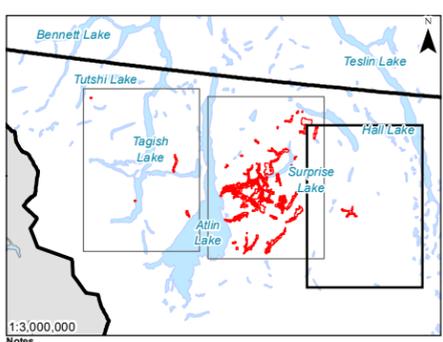
Notes
 1. Coordinate System: NAD 1983 BC Environment Albers
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Figure No. **Appendix B**
 Title **Map book of Placer Mining Tenures and Biogeoclimatic Zones in the Taku River Tlingit First Nation**

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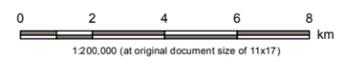


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- Trail
- Topographic Contour
- Watercourse
- Waterbody
- Placer Tenures
- BFAun - Boreal Altai Fescue Alpine Undifferentiated

- SWBuns - Spruce - Willow - Birch Undifferentiated scrub
- SWBun - Spruce - Willow - Birch Undifferentiated
- BWBSdk - Boreal White and Black Spruce Dry Cool



Project Location: Taku River Tlingit First Nation Traditional Territory
 Project Number: 123221853
 Prepared by: MYOUNG on 20210622
 Requested by: HSHORT on 20210603
 Checked by: LBORGES on 20210624

Client/Project/Report:
 Taku River Tlingit First Nation
 Placer Site Revegetation Report

Figure No:
Appendix B

Map book of Placer Mining Tenures and Biogeoclimatic Zones in the Taku River Tlingit First Nation

Notes
 1. Coordinate System: NAD 1983 BC Environment Albers
 2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, TRFN
 Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

APPENDIX C

Candidate Revegetation Species List

PLACER SITE REVEGETATION REPORT

Appendix C Candidate Revegetation Species List
November 5, 2021

Appendix C CANDIDATE REVEGETATION SPECIES LIST

Layer	Scientific Name	Common Name	Site Type	Shade Tolerance	Drought Tolerance	Nitrogen Fixer	Conditions for Recovery/ Comments	Source	Comments
BWBSdk1									
Grass	Beckmannia syzigachne	American sloughgrass	Riparian; Transition				tolerant to a range of pH, wetness, and low nutrients		
Grass	Calamagrostis canadensis	bluejoint	Riparian; Transition; Mesic Upland	shade-tolerant to shade-intolerant	(Y)	N	seed (rhizomes); may increase in pioneer and early seral stages	Blue Canyon; Yukon Reveg	Tolerant to slightly acidic soils, low nutrients, permafrost and wetness. Tall bunch grass with aggressive rhizomatous growth and extensive cover production. Early spring and late summer growth. However, due to its aggressive spreading by rhizomes it can become the dominant species in a stand and choke-out other species, including woody plants. Therefore, consider limiting it to 10–20% of the seed mix, unless a pure stand of reedgrass is desired (Yukon Reveg Manual)
Grass	Carex rostrata var. utriculata	beaked sedge							Sedge species to be used if available; other native sedge species common to the area may also be used
Grass	Deschampsia caespitosa	tufted hairgrass	Riparian, Transition, Mesic Upland		N	N	-	Yukon Reveg Manual; Atlin Ecosystem Recovery	Tolerant to extremely acidic soils, heavy metals, low nutrients, permafrost and wetness. Bunch forming, strong competitive ability and can form extensive cover. Not drought tolerant. (Yukon Reveg Manual). Recommended for low slope, low-mid elevation sites, wet sites, right-of-ways, and high elevation sites
Grass	Elymus alaskanus (Agropyron alexensis)	Alaska wheatgrass	Mesic Upland; Dry Upland		Y	N	-	Atlin Ecosystem Recovery Report; Yukon Reveg Manual	Tolerant to alkaline soils, drought and low nutrients; also has considerable tolerance to permafrost and moderate tolerance to saline soils and high elevations. Bunch forming with strong competitive ability. Recommended for Steep slopes, low-high elevation by Yukon Reveg Manual. Not documented in Tulsequah TEM.
Grass	Elymus trachycaulis	slender wheatgrass	Dry Upland; Mesic Upland	shade intolerant	Y	N	-	Yukon Reveg Manual; Tulsequah; Blue Canyon; Atlink Ecosystem Recovery	Tolerant to broad range of pH, dry ground and low nutrients. High tolerance to saline soil. Performs poorly on permafrost and high elevations sites. Forms loose bunches and is short-lived, but exhibits rapid emergence. low slope low-mid elevations, steep slopes, right-of-ways (Yukon Reveg manual)
Grass	Festuca altaica	Altai fescue	Upland Dry; Upland Mesic; Transition; Riparian		Y	N	-	LMH 26; Blue Canyon; Yukon Reveg; Tulsequah	Tolerant to low nutrients, drought, high elevation and permafrost. Medium size bunchgrass with low seed yield, but spreads rhizomatously to form extensive cover as plants mature. Widespread, grows in open woods, alpine grasslands, tundra, at all elevations. Recommended for wide variety of sites by Yukon reveg manual.
Grass	Festuca saximontana	Rocky mountain fescue	Dry Upland; Mesic Upland	shade intolerant	Y	N	-	Yukon Reveg Manual: Tulsequah	Tolerant to dry alkaline soils, low nutrients, permafrost and high elevations. Bunch grass with rapid emergence in early spring. Do not use on wet or acidic sites. Recommended for low slope low-mid elevations, steep slopes, right-of-ways, high elevation sites (Yukon Reveg Manual)
Grass	Leymus innovatus	fuzzy spiked wildrye							
Grass	Poa glauca	glaucous bluegrass	Mesic Upland; Dry Upland		(Y)	N	-	Yukon Reveg Manual;	Tolerant to broad range of pH, drought, low nutrients, permafrost and high elevations. Forms low growing bunches with a high root-shoot ratio, spreads aggressively through rhizomes, rapid emergence in early spring. Recommended for low slope low-mid elevation, steep slopes, right-of-ways, high elevation (Yukon Reveg manual)
Grass	Poa Palustris	fowl bluegrass	Riparian; Transition		N				Tolerant to acidic soils, low nutrients and wetness. Shallow-rooted, generally short-lived and not aggressive.



PLACER SITE REVEGETATION REPORT

Appendix C Candidate Revegetation Species List
November 5, 2021

Layer	Scientific Name	Common Name	Site Type	Shade Tolerance	Drought Tolerance	Nitrogen Fixer	Conditions for Recovery/ Comments	Source	Comments
Herb	<i>Arctostaphylos uva-ursi</i>	kinnikinnick	Dry Upland	shade-intolerant (to low shade tolerance)		N	resprouts, or from rhizomes following disturbance; seeds	LMH 26	
Herb	<i>Artemisia frigida</i>	Prarie sagewort							
Herb	<i>Chamaenerion angustifolium</i> (Epilobium angustifolium)	fireweed	Riparian; Transition; Mesic Upland	shade-intolerant to very shade-intolerant	Y	N	good colonizing herb according to Yukon Reveg Manual	LMH 26; Blue Canyon	
Herb	<i>Chamaenerion latifolium</i>	dwarf fireweed							Only plant if soil organic material is present
Herb	<i>Cornus canadensis</i>	bunchberry	Mesic Upland, Dry Upland, Transition, Riparian	shade-tolerant		N	-	LMH 26	Not sure about practicality. Climax species.
Herb	<i>Dryas integrifolia</i>	mountain avens	Dry Upland	shade intolerant	Y	Y	good colonizing herb according to Yukon Reveg Manual	Atlin Ecosystem Recovery Report	Tolerant to alkaline soils, drought, low nutrients. Matt-forming, low stature forb that grows in very poor soils and calciferous disturbed areas at all elevations, including scree slopes and gravel. Recommended for (high elevation and steep slopes) by Yukon reveg manual.
Herb	<i>Equisetum arvense</i>	common horsetail	Riparian	shade-tolerant to shade-intolerant		N	-	LMH 26	Not sure about practicality to seed
Herb	<i>Equisetum pratense</i>	meadow horsetail	Riparian	-		N	-	based on common horsetail; LMH 26	Not sure about practicality to seed
Herb	<i>Hedysarum boreale</i>	northern hedysarum (bear root)	Riparian; Transition; Mesic Upland		Y	Y	good colonizing herb according to Yukon Reveg Manual	Yukon Reveg Manual; Atlin Ecosystem Recovery	Seeds require scarification or stratification. Assume similar to <i>H. alpinum</i> .
Herb	<i>Leymus innovatus</i>	fuzzy spiked wildrye	Dry Upland		Y	N	-	LMH 26; Brett Young Catalog	Errect bunch rhizome grass. Acidic to neutral soil, Fine to coarse textured soil
Herb	<i>Linnea borealis</i>	twinflower	Mesic Upland, Dry Upland, Transition, Riparian			N	-	LMH 26	Not sure about practicality. Climax species.
Herb	<i>Oxytropis campestris</i>	yellow locoweed	Riparian; Transition; Mesic Upland			Y	good colonizing herb according to Yukon Reveg Manual	Yukon Reveg Manual	Seeds require scarification or stratification
Herb	<i>Petasites frigidus var palmatus</i>	palmate coltsfoot	Transition	shade-tolerant to shade-intolerant		N	-	LMH 26	Not sure about practicality to seed
Shrub	<i>Alnus tenuifolia</i>	mountain alder	Riparian, Flooded Wet Zone	moderately shade-tolerant; mineral soils		Y	sprouts from root crowns (stumps) and roots, and seed; mineral soil	LMH 26	
Shrub	<i>Rhododendron groenlandicum</i>	Labrador tea	Transition (organic phase); Mesic to Submesic Upland	shade-intolerant to moderately shade-tolerant		N	natural recovery on undisturbed soils; seeds (possibly rhizomes)	LMH 26	Would need organics to be successful
Shrub	<i>Rosa acicularis</i>	prickly rose	Mesic Upland, Dry Upland, Transition, Riparian	shade-tolerant to shade-intolerant		N	natural regeneration from seed and rhizomes; pioneer to mature seral; dispersal by animals	LMH 26	Good candidate to consider for experimental propagation and planting by Yukon reveg manual. But minor component of communities.
Shrub	<i>Salix alaxensis</i>	feltleaf willow	Riparian; Transition; Mesic Upland		Y				Suitable for live staking
Shrub	<i>Salix barclayi</i>	Barclay's willow	Riparian; Transition						



PLACER SITE REVEGETATION REPORT

Appendix C Candidate Revegetation Species List
November 5, 2021

Layer	Scientific Name	Common Name	Site Type	Shade Tolerance	Drought Tolerance	Nitrogen Fixer	Conditions for Recovery/ Comments	Source	Comments
Shrub	Salix planifolia	planeleaf willow	Riparian; Transition						Suitable for live staking
Shrub	Salix scouleriana	Scouler's willow	Riparian; Transition						Suitable for live staking
Shrub	Salix glauca	Gray willow	Riparian; Transition						Suitable for live staking
Shrub	Rhododendron groenlandicum	Labrador tea	Mesic Upland, Dry Upland, Transition, Riparian						
Shrub	Rosa acicularis	prickly rose	Mesic Upland, Dry Upland, Transition, Riparian						
Shrub	Shepherdia canadensis	soopolallie	Mesic Upland, Dry Upland (south slopes; coarse textured benches)	shade-tolerant to shade-intolerant; pioneer to late seral	Y	Y	natural regeneration by seed; animal dispersal	LMH 26	Good candidate to consider for experimental propagation and planting by Yukon reveg manual. But minor component of communities.
Shrub	Vaccinium membranaceum	black huckleberry	Dry Upland	shade-tolerant to shade-intolerant	Y	N	natural recovery possible on undisturbed soil	LMH 26	
Shrub	Viburnum edule	highbush cranberry	Dry Upland, Mesic Upland, Riparian	shade-tolerant to shade-intolerant. Persists in pioneer seral stage		N	-	LMH 26	
Tree	Abies lasiocarpa	subalpine fir	(Mesic Upland), (Transition)	shade-tolerant to shade-intolerant	Y	N	short dispersal distance (<100 m); all substrates	LMH 26	
Tree	Picea glauca	white spruce	Riparian, Transition, Mesic Upland, (Dry Upland), Slopes	moderately shade-tolerant to very shade intolerant		N	natural regeneration from seed; dispersion up to 300 m; exposed mineral soil	LMH 26	
Tree	Picea mariana	black spruce	Transition (organic phase)	shade-tolerant to moderately shade-tolerant		N	natural regeneration from seed; dispersal up to 100 m but cones generally opened by fire; organic soils	LMH 26	
Tree	Pinus contorta	lodgepole pine	Mesic Upland, Dry Upland, (Transition)	moderately shade-tolerant to very shade intolerant	Y	N	natural regeneration from seed (prolific producer); dispersal <100m, but largely dependent on wildfire to open cones	LMH 26	
Tree	Populus balsamifera	balsam poplar	Riparian	shade intolerant	N	N	-	Yukon Reveg manual	Lowland wet sites – Only use in wet/moist locations; easily established through staking of live/dormant cuttings (Yukon Reveg Manual)
Tree	Populus tremuloides	trembling aspen	Mesic Upland, Dry Upland, (Transition)	shade-intolerant to very shade-intolerant		N	natural regeneration from seed, vegetatively (roots)	LMH 26	



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Layer	Scientific Name	Common Name	Site Type	Shade Tolerance	Drought Tolerance	Nitrogen Fixer	Conditions for Recovery/ Comments	Source	Comments
SWBun									
Grass	Beckmannia syzigachne	American sloughgrass	Riparian; Transition				tolerant to a range of pH, wetness, and low nutrients		
Grass	Calamagrostis canadensis	bluejoint	Riparian; Transition; Mesic Upland	shade-tolerant to shade-intolerant	(Y)	N	seed (rhizomes); may increase in pioneer and early seral stages	Blue Canyon; Yukon Reveg	Tolerant to slightly acidic soils, low nutrients, permafrost and wetness. Tall bunch grass with aggressive rhizomatous growth and extensive cover production. Early spring and late summer growth. However, due to its aggressive spreading by rhizomes it can become the dominant species in a stand and choke-out other species, including woody plants. Therefore, consider limiting it to 10–20% of the seed mix, unless a pure stand of reedgrass is desired (Yukon Reveg Manual)
Grass	Carex rostrata var. utriculata	beaked sedge							Sedge species to be used if available; other native sedge species common to the area may also be used
Grass	Deschampsia caespitosa	tufted hairgrass			N	N	-	Yukon Reveg Manual; Atlin Ecosystem Recovery	Tolerant to extremely acidic soils, heavy metals, low nutrients, permafrost and wetness. Bunch forming, strong competitive ability and can form extensive cover. Not drought tolerant. (Yukon Reveg Manual). Recommended for low slope, low-mid elevation sites, wet sites, right-of-ways, and high elevation sites
Grass	Elymus alaskanus (Agropyron alexensis)	Alaska wheatgrass	Mesic Upland; Dry Upland		Y	N	-	Atlin Ecosystem Recovery Report; Yukon Reveg Manual	Tolerant to alkaline soils, drought and low nutrients; also has considerable tolerance to permafrost and moderate tolerance to saline soils and high elevations. Bunch forming with strong competitive ability. Recommended for Steep slopes, low-high elevation by Yukon Reveg Manual. Not documented in Tulsequah TEM.
Grass	Elymus trachycaulis	slender wheatgrass	Dry Upland; Mesic Upland	shade intolerant	Y	N	-	Yukon Reveg Manual; Tulsequah; Blue Canyon; Atlink Ecosystem Recovery	Tolerant to broad range of pH, dry ground and low nutrients. High tolerance to saline soil. Performs poorly on permafrost and high elevations sites. Forms loose bunches and is short-lived, but exhibits rapid emergence. low slope low-mid elevations, steep slopes, right-of-ways (Yukon Reveg manual)
Grass	Festuca altaica	Altai fescue	Upland Dry; Upland Mesic; Transition; Riparian		Y	N	-	LMH 26; Blue Canyon; Yukon Reveg; Tulsequah	Tolerant to low nutrients, drought, high elevation and permafrost. Medium size bunchgrass with low seed yield, but spreads rhizomatously to form extensive cover as plants mature. Widespread, grows in open woods, alpine grasslands, tundra, at all elevations. Recommended for wide variety of sites by Yukon reveg manual.
Grass	Festuca saximontana	Rocky mountain fescue	Dry Upland; Mesic Upland	shade intolerant	Y	N	-	Yukon Reveg Manual	Tolerant to dry alkaline soils, low nutrients, permafrost and high elevations. Bunch grass with rapid emergence in early spring. Do not use on wet or acidic sites. Recommended for low slope low-mid elevations, steep slopes, right-of-ways, high elevation sites (Yukon Reveg Manual)
Grass	Leymus innovatus	fuzzy spiked wildrye							
Grass	Poa alpina	alpine bluegrass	Transition; Upland Mesic	shade-tolerant	(Y)	N	-	Blue Canyon; Yukon Reveg; Atlin Ecosystem Recovery Report	Tolerant to low nutrients and permafrost. Rhizomatous and high root-shoot ratio, strong competitive ability. Recommended by Yukon reveg manual for high elevation
Grass	Poa glauca	glaucous bluegrass	Mesic Upland; Dry Upland		(Y)	N	-	Yukon Reveg Manual;	Tolerant to broad range of pH, drought, low nutrients, permafrost and high elevations. Forms low growing bunches with a high root-shoot ratio, spreads aggressively through rhizomes, rapid emergence in early spring. Recommended for low slope low-mid elevation, steep slopes, right-of-ways, high elevation (Yukon Reveg manual)
Grass	Poa Palustris	fowl bluegrass	Riparian; Transition		N				"Tolerant to acidic soils, low nutrients and wetness. Shallow-rooted, generally short-lived



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Layer	Scientific Name	Common Name	Site Type	Shade Tolerance	Drought Tolerance	Nitrogen Fixer	Conditions for Recovery/ Comments	Source	Comments
Grass	<i>Trisetum spicatum</i>	spiked trisetum	Mesic Upland; Dry Upland (high elevation)	shade-intolerant	(Y)	N	-	Atlin Ecosystem Recovery Report; Yukon Reveg Manual	Tolerant to mildly acidic to mildly alkaline soils, drought, low nutrients, permafrost and high elevations. Short bunchgrass, good colonizer with vigorous seedlings that provide good initial cover
Herb	<i>Achillea millefolium</i>	yarrow	Mesic Upland		Y	N	often associated with disturbance; pioneer	Yukon Reveg Manual	Tolerant to alkaline soils, drought, low nutrients. A slender, colonizing forb with white flower heads that bloom late in summer. Mostly found in areas with well-drained but poorly developed soil. Produces tiny seeds in abundance (Yukon Reveg Manual) Recommended for low slope, low-mid elevation sites, road right-of-ways.
Herb	<i>Artemisia norvegica</i>	mountain sagewort	Upland Dry	shade-intolerant	Y	N	good colonizing herb according to Yukon Reveg Manual	Yukon Reveg; Tulsequah	Tolerant to drought, low nutrients. Medium stature forb or short shrub. Wormwood species grow in a diversity of open/disturbed areas from riverbanks and grasslands to steep slopes and alpine/Arctic tundra. Mostly adapted to dry soils. Recommended for low-mid elevation, steep slopes, right-of-ways, and high elevation sites (Yukon Reveg Manual) Mountain sagewort documented in Tulsequah.
Herb	<i>Chamaenerion angustifolium</i> (Epilobium angustifolium)	fireweed	Riparian; Transition; Mesic Upland	shade-intolerant to very shade-intolerant	Y	N	good colonizing herb according to Yukon Reveg Manual	LMH 26; Blue Canyon	
Herb	<i>Chamaenerion latifolium</i>	dwarf fireweed							Only plant if soil organic material is present
Herb	<i>Dryas drummondii</i>	yellow mountain-avens	Dry Upland	shade intolerant	Y	Y	likely similar to <i>Dryas integrifolia</i>	Atlin Ecosystem Recovery Report	
Herb	<i>Dryas integrifolia</i>	mountain avens	Dry Upland	shade intolerant	Y	Y	good colonizing herb according to Yukon Reveg Manual	Atlin Ecosystem Recovery Report	Tolerant to alkaline soils, drought, low nutrients. Matt-forming, low stature forb that grows in very poor soils and calciferous disturbed areas at all elevations, including scree slopes and gravel. Recommended for (high elevation and steep slopes) by Yukon reveg manual.
Herb	<i>Dryas octopetala</i>	white mountain-avens (eightpetal mountain-avens)	Dry Upland	shade intolerant	Y	Y	likely similar to <i>Dryas integrifolia</i>		upper elevation SWB, though not documented in any of our sources
Herb	<i>Empetrum nigrum</i>	black crowberry	Mesic Upland; Dry Upland; Transition;	shade-intolerant	Y	N	-	LMH 26; Tulsequah	Identified as culturally important species (moss berry). Xeric-submesic unit in Tulsequah TEM with crowberry dominant – BI – Crowberry – Lichen
Herb	<i>Hedysarum alpinum</i>	alpine hedysarum (alpine bear root)	Riparian; Transition; Mesic Upland		Y	Y	good colonizing herb according to Yukon Reveg Manual	Yukon Reveg Manual; Atlin Ecosystem Recovery	Tolerant to alkaline soils, drought and low nutrients. A nitrogen-fixing forb that provides a colourful flowering bloom. Grows in a variety of alkaline sediments in disturbed areas at low to high elevation, ranging from roadsides and riverbanks to open forest. Recommended for low-mid elevation sites, (Yukon Reveg Manual). Seeds require scarification or stratification.
Herb	<i>Hedysarum boreale</i>	northern hedysarum (bear root)	Riparian; Transition; Mesic Upland		Y	Y	good colonizing herb according to Yukon Reveg Manual	Yukon Reveg Manual; Atlin Ecosystem Recovery	Seeds require scarification or stratification. Assume similar to <i>H. alpinum</i> .
Herb	<i>Linnea borealis</i>	twinflor	Riparian; Transition			N	-	LMH 26	
Herb	<i>Lupinus arcticus</i>	arctic lupine	Riparian, Transition	shade-intolerant	N	Y	good colonizing herb according to Yukon Reveg Manual	LMH 26; Yukon Reveg Manual	Tolerant to low nutrients, permafrost, limited drought. A low-growing, nitrogen-fixing forb that provides a colourful flowering bloom. Grows mostly on moist soils in disturbed areas ranging from lowland riverbanks to alpine and tundra. Identified as culturally important species.
Herb	<i>Mertensia paniculata</i>	tall bluebells	Riparian; Transition; Mesic Upland	shade-tolerant	N	N	-	LMH 26	
Herb	<i>Oxytropis campestris</i>	yellow locoweed	Riparian; Transition; Mesic Upland			Y	good colonizing herb according to Yukon Reveg Manual	Yukon Reveg Manual	Seeds require scarification or stratification



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Herb	<i>Salix nivalis</i>	dwarf willow	Dry Upland			N	-	Tulsequah	upper elevations; avoid propagation by cuttings according to Yukon revegetation manual
Herb	<i>Salix reticulata</i>	net-veined willow	Dry Upland			N	-	Tulsequah	upper elevations; avoid propagation by cuttings according to Yukon revegetation manual
Herb	<i>Vaccinium caespitosum</i>	dwarf blueberry	Dry Upland; Mesic Upland; Transition	shade-tolerant to shade-intolerant		N	-	LMH 26; Tulsequah	
Herb	<i>Vaccinium vitis-idaea</i>	lingonberry	Dry Upland; Mesic Upland; Transition	-		N	-	LMH 26; Tulsequah	
Shrub	<i>Alnus tenuifolia</i> or <i>Alnus crispa</i>	mountain alder or green alder	Riparian; Transition; Mesic Upland, flooded wet zone		N	Y	-	Yukon reveg manual; Tulsequah	Only plant seedlings grown in a nursery from locally-collected seed. Tolerant to slightly acidic soils and low nutrients. Use on moist/wet sites that are not alkaline according to Yukon Reveg Manual.
Shrub	<i>Betula glandulosa</i>	scrub birch	Riparian; Transition	shade-intolerant	N	N	vegetatively, resprouts from crown or rhizomes following top disturbance	LMH 26	low to upper elevations. Avoid propagation by cuttings according to Yukon revegetation manual. Only plant seedlings grown in a nursery from locally-collected seed. Tolerant to acid soils. Use on moist sites with good organic content according to Yukon Reveg Manual.
Shrub	<i>Potentilla fruticosa</i>	shrubby cinquefoil	Riparian; Transition; Mesic Upland			N	-	LMH 26; Tulsequah	Good candidate to consider for experimental propagation and planting by Yukon reveg manual. But minor component of communities.
Shrub	<i>Salix alaxensis</i>	feltleaf willow	Riparian; (Transition)		N	N	-	Yukon reveg manual	Only use in wet locations and only use the species listed. Willow is the main plant used for staking of live/dormant cuttings and for bioengineered structures. Suitable for live staking
Shrub	<i>Salix barclayi</i>	Barclay's willow	Riparian; Transition			N	-	LMH 26; Tulsequah	upper elevations; avoid propagation by cuttings according to Yukon revegetation manual. Not suitable for staking
Shrub	<i>Salix barrattiana</i>	Barratt's willow	Mesic Upland; Transition; Riparian			N	-	LMH 26; Tulsequah	upper elevations; avoid propagation by cuttings according to Yukon revegetation manual
Shrub	<i>Salix glauca</i>	grey-leaved willow	Dry Upland			N	-	LMH 26; Tulsequah	low to upper elevations; avoid propagation by cuttings according to Yukon revegetation manual. Not suitable for staking
Shrub	<i>Salix planifolia</i>	tea-leaved willow	Mesic Upland; Transition; Riparian		N	N	-	LMH 26; Tulsequah	upper elevations, suitable for live staking
Shrub	<i>Salix pulchra</i>	diamond-leaf willow	Riparian; (Transition)	shade-intolerant		N	natural recovery on undisturbed soils	based on typical recovery of willow sp and open habitat; Yukon Reveg Manual	Only use in wet locations and only use the species listed. Willow is the main plant used for staking of live/dormant cuttings and for bioengineered structures. Suitable for live staking
Shrub	<i>Shepherdia canadensis</i>	soopolallie	Mesic Upland; Dry Upland	shade-tolerant to shade-intolerant; pioneer to late seral	Y	Y	natural regeneration by seed; animal dispersal	LMH 26; Atlin ecosystem recovery	Good candidate to consider for experimental propagation and planting by Yukon reveg manual. But minor component of communities.
Tree	<i>Abies balsamifera</i>	subalpine fir	Dry Upland	shade-tolerant to shade-intolerant		N	short dispersal distance (<100 m); all substrates	LMH 26; Tulsequah	low elevations; major component in several units in Tulsequah TEM
Tree	<i>Picea glauca</i>	white spruce	Transition, Mesic Upland, Dry Upland, Riparian (low elevation)	moderately shade-tolerant to very shade intolerant		N	natural regeneration from seed; dispersion up to 300 m; exposed mineral soil	LMH 26; Tulsequah	low elevations; minor component in Tulsequah TEM



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Layer	Scientific Name	Common Name	Site Type	Shade Tolerance	Drought Tolerance	Nitrogen Fixer	Conditions for Recovery/ Comments	Source	Comments
Tree	Pinus contorta	lodgepole pine	Dry Upland; Mesic Upland (low elevation)	moderately shade-tolerant to very shade intolerant		N	natural regeneration from seed (prolific producer); dispersal <100 m, but largely dependent on wildfire to open cones	LMH 26; Tulsequah	low elevations on lower slopes. Dominant in PI – Crowberry – Lichen from Tulsequah TEM.
Tree	Populus tremuloides	trembling aspen	Dry Upland (south slopes)	shade-intolerant to very shade-intolerant		N	natural regeneration from seed, vegetatively (roots)	LMH 26	consider use on sites with warm soils/ south facing slopes in lower elevations of SWB zone

