



Development Permit

DP2314E (Crottey)

Date: June 24, 2024

Issued pursuant to Section 490 and 491 of the *Local Government Act*

1. This Development Permit is issued to Ruth Pilla, Lisa Crottey and Michael Crottey of Qualicum Beach, BC as the registered owner (hereinafter called the “Permittee”) and shall only apply to those lands within the Regional District of Central Kootenay, in the Province of British Columbia legally described as LOT B DISTRICT LOT 12075 KOOTENAY DISTRICT PLAN NEP78423 (PID 026-329-981) as shown on the attached Schedules 1 and 2, forming part of this Permit, referred to hereafter as the “said lands”.
2. This Development Permit is issued subject to compliance with all of the bylaws of the Regional District of Central Kootenay applicable thereto, except as specifically varied or supplemented by this Permit.
3. This Development Permit shall not have the effect of varying the use or density of land as specified in the applicable Zoning Bylaw of the Regional District of Central Kootenay, nor a Floodplain Specification under Section 524 of the *Local Government Act*.
4. The said lands have been designated ‘Suburban Residential (RS)’ and are located within a Development Permit Area pursuant to the *Electoral Area ‘E’ Rural Official Community Plan Bylaw No. 2260, 2013* as amended.
5. The Permittee has applied to the Regional District of Central Kootenay to undertake the construction of a raised deck with four posts and footings and native planting below the front edge of the proposed raised deck, and to use land and buildings situated on the said lands for this purpose. Pursuant to this Development Permit and subject to the terms and conditions herein contained, as well as all other applicable Regional District Bylaws, the Regional District of Central Kootenay hereby authorizes the use of the said lands for the above landscape works.
6. The Permittee is required to obtain approval in writing from the Regional District of Central Kootenay prior to the construction any new buildings, external additions to existing buildings or for any deviation from the development authorized under Section 5 of this Development Permit. Furthermore, the Permittee is hereby advised of the following requirements:
 - 6.1 The Regional District of Central Kootenay Building Department requires that the Permittee obtain a demolition permit and/or building permit prior to the removal of any existing buildings and structures, the renovation, expansion or alteration of any existing building and the construction of any new building.
 - 6.2 Development is authorized in accordance with the terms described in “1434 Highway 31, Queens Bay, BC Riparian Assessment” prepared by Masse Environmental Ltd., dated June 21, 2024 hereinafter referred to as “The Report” and attached to this permit as Schedule 3. Compliance with all terms, conditions, guidelines and recommendations is required.
 - 6.3 Environmental Monitoring – In accordance with the recommendations in Section 7 of The Report:
 - 6.4.1 QEP to provide guidance during revegetation, as required.

- 6.4.2 QEP will conduct a post site visit once revegetation is complete to assess compliance and completion of the project and submit an environmental summary report to the RDCK.
7. As a condition of the issuance of this Permit, the Regional District shall hold an irrevocable Letter of Credit submitted by the Permittee in the amount of \$3,968.75 to ensure the landscaping and restoration requirements as set forth in Section 6 are completed and in accordance with the following provisions:
- 7.1 A condition of the posting of the Letter of Credit is that should the Permittee fail to carry out the works and services as herein above stated, according to terms and conditions of this permit within the time provided, the Regional District may use the Letter of Credit to complete these works or services by servants, agents or contractors, and any surplus shall be paid over to the Permittee. If the amount of funds is insufficient to cover the actual cost of completing the works, then the Permittee shall pay such deficiency to the Regional District immediately upon receipt of the Regional District's bill for same.
- 7.2 The Permittee shall complete the landscaping works required by this Permit prior to June 24, 2026. Within this time period the required landscaping must be inspected and approved by the Regional District.
- 7.3 If the landscaping is not approved within this time period, the Regional District has the option of continuing to renew the Letter of Credit until the required landscaping is completed or has the option of drawing from the Letter of Credit to complete the required landscaping. In this event, the Regional District or its agents have the irrevocable right to enter into the property to undertake the required landscaping for which the Letter of Credit was submitted.
- 7.4 If the landscaping is approved within this time period without the Regional District having to draw the on the Letter of Credit, 90% of the original amount of the Letter of Credit shall be returned to the Permittee.
- 7.5 A hold back of 10% of the original amount of the Letter of Credit shall be retained until a final inspection is undertaken within 12 months of the date of the original inspection and approval was given to the landscaping. If the landscaping receives approval at final inspection, the 10% hold back will be returned to the Permittee. If after the final inspection, approval of the landscaping is not given, the Regional District has the option of continuing to renew the Letter of Credit until the required landscaping is approved or has the option of drawing on the Letter of Credit the funds to complete the required landscaping. In this event, the Regional District or its agents have the irrevocable right to enter onto the property to undertake the required landscaping for which the Letter of Credit was submitted.
8. The said lands shall be developed strictly in accordance with the terms and conditions of this Development Permit and the requirements of all applicable Regional District Bylaws as well as any plans and specifications which may, from time to time, be attached to this Permit shall form a part thereof.
9. In accordance with the Local Government Act, if the development authorized by this Development Permit is not commenced within two years of the date of this Permit, this Permit shall lapse.
10. In accordance with the Local Government Act, 'Notice' shall be filed in the Land Title Office that the said lands are subject to this Development Permit.
11. The terms of this Development Permit including subsequent amendments, are binding on all persons who acquire an interest in the said lands associated with this Permit.

12. It is understood and agreed that the Regional District has made no representations, covenants, warranties, guarantees, promises, or agreement (verbal or otherwise) with the Permittee other than those in this Development Permit. It is solely the responsibility of the Permittee to ensure that the requirements of all other applicable government agencies are satisfied.
13. This Development Permit does not constitute a building permit.
14. This Development Permit shall come into force and effect 14 days after the date of issuance unless a Waiver of Appeal is received from the Permittee at which time the Development Permit shall be deemed to be issued upon receipt of the Waiver of Appeal. OR If a Notice of Appeal is received the Development Permit shall be suspended until such time as the Board of the Regional District of Central Kootenay has decided the Appeal.

S Sudan

Sangita Sudan, General Manager of Development and Community Sustainability Services

July 15, 2024

Date of Approval (date of review and approval)

August 16, 2024

Date of Issuance (pending receipt of securities)

Schedule 1: Subject Property



Schedule 3: *"1434 Highway 31, Queens Bay, BC Riparian Assessment"* prepared by Masse Environmental Ltd., dated June 24, 2024



1434 Hwy 31, Queens Bay, BC
Riparian Assessment



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Revised June 21, 2024

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Project Number 2022-1013

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1 INTRODUCTION

Masse Environmental Consultants Ltd. was retained by Deborah Weiland (Contractor, Weiland Construction) on behalf of the property owners, Lisa and Mike Crottey, to conduct a riparian assessment to accompany an application for a Watercourse Development Permit (WDP) for their waterfront property located at 1434 Highway 31, Queens Bay, BC (PID 026-329-981, Lot B, Plan NEP78423, DL 12075, Kootenay Land District (KLD)). The development permit is required for proposed demolition and replacement of an existing residential structure, its associated septic facilities, and the associated water intake line. The Owner is also seeking a site-specific floodplain exemption in order to redevelop the property. The requested relaxation of the 15 m floodplain setback to 12.36 m is being requested to accommodate the proposed raised deck (including post supports and footings) which is attached to the proposed residence located outside the 15 m setback.

A site visit was completed on May 25, 2023, by Fiona Lau B.Tech., A.Sc.T. and Jennifer Ross, M.Sc., P.Chem. to conduct a riparian assessment on the property. The riparian assessment evaluates the existing conditions of the property and riparian areas, identifies habitat values, assesses potential environmental impacts, and recommends measures to mitigate or compensate for the alteration of the riparian area to maintain environmental values. It is based on the following regulatory framework and best management practices documents:

- RDCK Electoral Area 'E' Rural Official Community Plan Bylaw No. 2260, 2013
- RDCK Floodplain Management Bylaw No. 2080, 2009
- British Columbia *Riparian Areas Protection Regulation* B.C. Reg. 178/2019.
- Kootenay Lake Shoreline Management Guidelines
- British Columbia *Water Sustainability Act*
- British Columbia *Wildlife Act*
- Federal *Fisheries Act*
- Federal *Migratory Birds Convention Act*
- Develop with Care. Environmental Guidelines for Urban and Rural Land Development in B.C.
- Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia
- A Resource for Kootenay Lake Living – RDCK Kootenay Lake Development Permit Area Resource
- On the Living Edge: Your Handbook for Waterfront Living
- British Columbia FireSmart Homeowners Manual and Landscaping Guide
- A Homeowner's Guide to Stormwater Management
- Riparian Factsheet No. 6 – Riparian Plant Acquisition and Planting

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This report has been prepared by Jennifer Ross, M.Sc., P. Chem. and reviewed by Fiona Lau B.Tech., A.Sc.T.

I, Fiona Lau, hereby certify that:

- a) I am a Qualified Environmental Professional (QEP), as defined in Section 21 of the *Riparian Areas Protection Regulation* made under the *Riparian Areas Protection Act*;
- b) I am qualified to carry out this part of the assessment of the development proposal made by the developer Weiland Construction which is described in Section 2.3 of this Assessment Report;
- c) I have carried out my assessment of the development proposal, and my assessment is set out in this Assessment Report; and
- d) In carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the *Riparian Areas Protection Regulation*.

2 PROJECT OVERVIEW

2.1 Site Location

The subject property is located in Queens Bay on Kootenay Lake, within Area E of the RDCK, approximately 30 km northeast of the City of Nelson, BC (see Appendix 1 for Site Location Map). The property is 0.094 acres in size and has 13.57 m of frontage along Kootenay Lake per the legal survey for Plan NEP78423 completed in 2005 by Ward Engineering and Land Surveying Ltd. (Ward Engineering). The subject property is bordered by private properties to the north and south, by Highway 31 to the immediate west and additional private properties further west, and by Kootenay Lake to the east.

The project area is within the Interior Cedar-Hemlock dry warm variant 1 (ICHdw1) biogeoclimatic subzone, which occurs at valley bottom elevations around most of Kootenay Lake (MacKillop and Ehman 2016). The ICHdw1 subzone is characterized by moist, warm springs, hot and dry summers and mild, dry winters with moderately shallow snowpack. Winter rain-on-snow events are frequent and snow-free areas are common, particularly on warm-aspect sites. The ICHdw1 is a highly productive biogeoclimatic unit. Common species on drier sites include: baldhip rose (*Rosa gymnocarpa*), birch-leaved spirea (*Spiraea betulifolia*), Douglas maple (*Acer glabrum*), falsebox (*Paxistima myrsinites*), interior Douglas fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), Oregon grape (*Mahonia spp.*), paper birch (*Betula papyrifera*), ponderosa pine (*Pinus ponderosa*), soopolallie (*Shepherdia canadensis*), Western larch (*Larix occidentalis*), and Western red cedar (*Thuja plicata*) (MacKillop and Ehman 2016).

2.2 Existing Site Conditions

The property is situated with an east-facing aspect sloping moderately towards Kootenay Lake. From Highway 31, the MOTI Right-of-Way (ROW) embankment slopes steeply (approximate 1:1 grade) down to

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the property. The slope then becomes more moderate (~20 %) within the property and slightly beyond the natural boundary of Kootenay Lake before steepening again to 27 % into Kootenay Lake.

Along the south side of the property, there is a small, one-storey cabin (9.5 m x 4.3 m) with a large, raised deck (7.4 m x ~4.75 m including the exterior staircase) that was constructed in the 1940's (Photo 1, Cover Photo). The wood cabin currently sits on concrete block footings and is set back 12.7 m (measured from the most eastern deck supports) from the surveyed present natural boundary. A wooden walk-out deck was constructed at the north side of the cabin (7.1 m x 1.8 m) and this connects to the wooden staircase (~9 m x 1 m) leading up the highway embankment (Photo 2) and to a small set of concrete stairs. The area under the existing cabin is being used for storage.

North of the cabin is a concrete slab patio (6.1 m x 3.6 m) (Photo 3) set back 14 m from the present natural boundary. A wooden shed (3.65 m x 3 m) (Photo 4) and a wooden outhouse (1.4 m x 1.4 m) (Photo 5) are set back >15 m from the present natural boundary of Kootenay Lake. In addition to the outhouse, the cabin is serviced with a grey water pit and an above-ground seasonal water intake line. The intake line is equipped with a submersible pump.

Evidence of historical tree removal on the property included five large Douglas fir stumps (Photo 6) and one birch stump. Only the double Douglas fir stump located under the existing deck was cleared within the 15 m WDP area (Photo 7).



Photo 1. View of existing cabin and raised deck.



Photo 2. View of highway embankment staircase.

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Photo 3. View of concrete slab patio.



Photo 4. View of wooden shed.



Photo 5. View of outhouse.



Photo 6. View of two large Douglas fir stumps previously removed from the property.



Photo 7. View of Douglas fir stump within 15 m setback under raised deck.

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The foreshore of Kootenay Lake within Queens Bay has been significantly impacted by the construction of single-family residences, marine rails, water intakes, and landscaping activities including the removal of riparian vegetation and relocation of boulders (Photo 8, Photo 9). The subject property has been less impacted than the properties to the north and south due to the modest development, minimal encroachment into the 15 m setback from the natural boundary, and the retention of three mature (but topped to 10 ft) Douglas fir trees and one mature saskatoon bush within the 15 m WDP area along the northern and southern property boundaries. The beach area of the subject property has been relatively undisturbed and consists of uniform gravel with some re-growth of grasses and invasive weed species.



Photo 8. View of neighbouring properties to the south.



Photo 9. View of neighbouring properties to the north.

During the site visit, the visible high-water mark (HWM) of Kootenay Lake was confirmed at approximately the present natural boundary line as shown on the legal survey for Plan NEP78423 completed in 2005 by Ward Engineering. This HWM is located at an elevation of ~533.4 m based on the Flood Assessment Review completed by Crowsnest Engineering on May 7, 2023. The surveyed present natural boundary⁴ will be used as the HWM from which riparian setbacks will be referenced against.

2.3 Proposed Development

A preliminary plan for the new residence, parking pad, and retaining walls has been prepared by WSA Engineering Ltd. This plan is accompanied by a sewerage design brief also prepared by WSA Engineering. Both have been included in Appendix 2.

⁴ "Natural Boundary" means the visible high water mark of any lake, river, stream or other body of water is where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the body of water a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself."

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The proposed development within the 15 m WDP area of Kootenay Lake includes:

- A raised deck with four posts and footings (33 m²) structurally attached to the residence.
 - The deck and its supports will encroach into the 15 m setback up to 12.36 m from the natural boundary. Construction materials used below the 536.5 m elevation will consist of flood tolerant materials such as concrete footings and piers to support wood above the flood level.
- Installation of native cuttings and seeding with native riparian grasses and forbs on the lake-side of the proposed septic area and below the front edge of the proposed raised deck.

The raised deck attached to the proposed residence will encroach into the 15 m setback from Kootenay Lake by up to 3.58 m (southern corner). A Site-Specific Floodplain Exemption and a relaxation of the WDP permit area setback are required for this construction. The deck will be elevated off the ground by ~3.91 m.

2.4 Services

Domestic water for the house will be extracted from Kootenay Lake. A water service line will be installed to the new home approximately at the mid/north section of the property along the alignment of the existing line. This line will be entrenched into the beach substrate to a depth sufficient to prevent freezing during the winter months.

The septic plan includes Type 3 septic system (1,000 L/day flow) with a 12 m² dispersal field located within the 30 m setback, and outside of 15 m setback, in accordance with the Sewerage System Standard Practice Manual Version 3 (HPBMOH 2014).

3 REGULATORY OVERVIEW

To determine whether the 15 m WDP setback from the HWM of Kootenay Lake aligns with the *Riparian Areas Protection Regulation (RAPR)* criteria, a detailed assessment of the subject property was conducted to calculate the Streamside Protection and Enhancement Area (SPEA) setbacks. Results for the Zones of Sensitivity (ZOS) and SPEA are presented in Table 1 and Appendix 3.

As per the RAPR, the large woody debris (LWD) and litter ZOS were plotted 15 m inland from the HWM of Kootenay Lake with the shade ZOS plotted 0 m from the HWM from Kootenay Lake. The SPEA setback is determined based on the ZOS with the greatest width. Therefore, within the subject property the SPEA from the HWM of Kootenay Lake is 15 m.

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Table 1. Results of detailed RAPR assessment for Kootenay Lake.

Feature Type	SPVT ¹	Zones of Sensitivity			SPEA ³
		LWD ²	Litter fall	Shade	
Kootenay Lake	TR	15 m	15 m	0 m	15 m

¹ SPVT: site potential vegetation type (TR-tree)

² LWD- large woody debris

³ SPEA- streamside protection and enhancement area

3.1 Kootenay Lake Shoreline Management Guidelines

The Kootenay Lake Foreshore Inventory Mapping (FIM) (KLP 2023) and the Kootenay Lake Shoreline Management Guidelines documents (Schleppe and Cormano 2013, KLP 2020) were used to help determine site-specific risks for riparian habitat, Ktunaxa Nation cultural values, and archaeological resources along the shoreline. The property is within FIM segment 46 and the FIM indicates that the foreshore is located within an area with high juvenile rearing potential. Table 2 provides the environmental and archaeological risk results identified in the FIM along the shoreline of the property.

Table 2. Environmental and archaeological risk results.

Aquatic Habitat Index Rating	Aquatic Sensitivity	Archaeological Risk	Enhanced Engagement Required
Moderate	Yes	Moderate to High	Yes

The subject parcel was flagged with moderate to high archaeological risk; however, further assessment of archaeological risk is beyond the scope of this report. For further information please consult the Kootenay Lake Shoreline Guidance Document (KLP 2020). Archaeological Chance Find Procedures are provided in Appendix 4.

4 ENVIRONMENTAL RESOURCES

4.1 Fish and Aquatic Habitat

Kootenay Lake borders the subject property along the east boundary. It is a long, narrow, and deep lake with a surface area of approximately 400 km². Kootenay Lake's main inflows include the Lower Duncan River to the north and the Kootenay River to the south. It drains through the West Arm into the Kootenay River. Kootenay Lake typically experiences one seasonal water level increase annually, which occurs in the late spring and early summer months (late May through July). Lake levels can vary by up to 4 m throughout the year, affecting the extent of exposed shoreline.

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The foreshore of the property consists of a sloped beach (20-27 % gradient) with uniform rounded gravel substrate (Photo 10). A few pieces of large woody debris were present (Photo 11) and served as the only source of cover habitat for fish. There was no overhanging vegetation along this section of foreshore and the only boulders observed were placed above the present natural boundary. No aquatic vegetation was observed at the time of the site assessment, though it is likely that some amount of aquatic vegetation exists further out into the lake in deeper water.



Photo 10. View of beach looking east from the residence.



Photo 11. View of beach substrate and small amount of large woody debris.

Kootenay Lake supports a variety of fish species, including several species of regional interest, such as Burbot (*Lota lota*), Bull Trout (*Salvelinus confluentus*), Kokanee (*Oncorhynchus nerka*), Rainbow Trout (*Oncorhynchus mykiss*), Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*), and White Sturgeon (*Acipenser transmontanus*).

No known white sturgeon spawning or kokanee shore spawning has been reported in this area (DFO 2014, KLP 2020). Kootenay Lake FIM ranks this section of shoreline as high juvenile rearing potential, however potential along the actual property is likely lower based on the sparse cover available to fish.

Mussels were not observed along the foreshore; however, a complete mussel survey was not conducted as part of the riparian assessment.

4.2 Vegetation

The riparian assessment area of Kootenay Lake (i.e., within 30 m of the shoreline) contained both mature native species, and low-growing herbaceous species, including grasses (Cover Photo, Photo 10). Several invasive species have colonized the cleared areas of the property.

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Native riparian vegetation (Photos 12-16) included one common snowberry (*Symphoricarpos albus*) bush, three topped mature Douglas fir trees and several regenerating seedlings, three mature Douglas maple clusters, one immature elderberry (*Sambucus sp.*) shrub, one young paper birch tree, one mature saskatoon (*Amelanchier alnifolia*) bush, a patch of thimbleberry (*Rubus parviflorus*), and several mature Western redcedars (~6 trees). Native herbaceous vegetation was dominated by a patch of aster (*Symphotrichum spp.*) and dandelions (*Taraxacum officinale*). A single yellow salsify plant was identified onsite (Photo 17). This weed has been identified as a priority species for eradication within the Central Kootenay Region by the Central Kootenay Invasive Species Society (CKISS).



Photo 12. View riparian vegetation looking northeast from existing raised deck.



Photo 13. View riparian vegetation looking east from existing raised deck.



Photo 14. Riparian vegetation south of staircase (highway embankment and edge of 30 m riparian area).



Photo 15. Riparian vegetation north of staircase (highway embankment and edge of 30 m riparian area).

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Photo 16. Orthophoto provided by Crownest Engineering. Property boundaries estimated.



Photo 17. Invasive yellow salsify plant.

Table 3 provides a list of riparian vegetation species encountered on the property during the riparian assessment.

Table 3. Plant Species at the Property

Common Name	Scientific Name	Common Name	Scientific Name
Trees		Herbaceous (cont.)	
interior Douglas fir	<i>Pseudotsuga menziesii</i>	false Solomon's seal	<i>Smilacina racemosa</i>
paper birch	<i>Betula papyrifera</i>	forget-me-not	<i>Myosotis sp.</i>
Western redcedar	<i>Thuja plicata</i>	grasses	
Shrubs		miner's lettuce	<i>Claytonia perfoliata</i>
common snowberry	<i>Symphoricarpos albus</i>	red clover	<i>Trifolium pratense</i>
Douglas maple	<i>Acer glabrum</i>	Invasive Species	
elderberry	<i>Sambucus sp.</i>	cleavers	<i>Galium aparine</i>
saskatoon	<i>Amelanchier alnifolia</i>	knapweed	<i>Centaurea sp.</i>
thimbleberry	<i>Rubus parviflorus</i>	peavine	<i>Lathyrus sp.</i>
Herbaceous		orange hawkweed	<i>Pilosella aurantiaca</i>
aster	<i>Symphyotrichum spp.</i>	oxeye daisy	<i>Leucanthemum vulgare</i>
black medic	<i>Medicago lupulina</i>	wall lettuce	<i>Mycelis muralis</i>
bracken fern	<i>Pteridium aquilinum</i>	yellow hawkweed	<i>Hieracium spp.</i>
dandelion	<i>Taraxacum officinale</i>	yellow salsify	<i>Tragopogon dubius</i>

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4.3 Wildlife

Mature riparian vegetation within 30 m of Kootenay Lake is limited to approximately one dozen trees and a saskatoon bush. All of the trees are all located along the property lines, including those at the base of the highway embankment (Photo 16). This provides minimal habitat for wildlife.

4.3.1 Reptiles and Amphibians

Garter snakes (*Thamnophis* spp.), Northern alligator lizard (*Elgaria coerulea*), Northern pacific treefrog (*Pseudacris regilla*), Norther rubber boa (*Charina bottae*), and Western skink (*Plestiodon skiltonianus*) have all been recorded within 5 km of the subject property (BC 2023), but no specific habitat features with high reptile or amphibian value were observed on the property.

4.3.2 Birds

The subject property and the adjacent vegetation along the highway ROW provides some habitat for songbirds, piciformes (woodpeckers, sapsuckers, flickers, etc.), and raptors. No nests were observed during the riparian assessment, but some feeding excavations were noted in one of the Douglas fir stumps onsite (Photo 18), and a Northern flicker (*Colaptes auratus*) was heard calling from a distance. The mature Western redcedar trees provide perching habitat for raptors (Photo 19) and saskatoon bushes provide berries to entice songbirds. During the riparian assessment Canada Goose (*Branta canadensis*) poop was observed along the foreshore of Kootenay Lake confirming their use of the property.

Birds recorded within 5 km of the subject property include barred owl (*Strix varia*), bald eagle (*Haliaeetus leucocephalus*), great blue heron (*Ardea herodias herodias*) and trumpeter swan (*Cygnus buccinator*) (BC 2023, iNaturalist 2023). Many more species are expected to frequent the area transiently.



Photo 18. Piciforme feeding excavations in Douglas fir stump.



Photo 19. Mature Western redcedar perch trees.

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4.3.3 Mammals

The property provides minimal habitat for mammals other than red squirrel (*Tamiasciurus hudsonicus*), small rodents, and bats due to the cumulative effects of development (residences and Highway 31) along this section of Kootenay Lake. However, it does provide a potential movement corridor along the shoreline for ungulates, bears, and small carnivores such as American marten (*Martes americana*) and raccoon (*Procyon lotor*).

4.4 Species at Risk

BC Conservation Data Center (CDC) occurrence data and critical habitat for Federally listed species at risk were queried within iMap BC (BC 2023), using a 10 km buffer around the center point of the subject property. The query results are presented in Table 4. Seven species at risk and/or critical habitat for species at risk were identified within this buffer. The potential occurrence on the property was assessed as likely, possible, unlikely, or very unlikely, according to known species habitat affinities, the habitat profile of the property, and the proximity to mapped occurrences.

Table 4. Species at risk with potential occurrence based on iMap BC 10 km radius query.

Common Name (Scientific Name)	Likelihood of Occurrence on Subject Property	Comment	BC Conservation Status ¹	COSEWIC ² / SARA ²
Caribou (Southern Mountain Population) (<i>Rangifer Tarandus pop. 1</i>)	Very unlikely	Historically inhabited the Southern Selkirk Mountains, with mapped critical habitat within 10 km of the subject property and including the subject property. This population has been extirpated (Habitat ID: 20946, 21013, 21278, 21281, 21288, 211289, 21302, 21395).	Red	E/T
Coeur d'Alene Salamander (<i>Plethodon idahoensis</i>)	Unlikely	CDC occurrence mapped ~8.9 km east of the subject property near McGregor Lake on Pilot Peninsula of Kootenay Lake (Shape ID: 986, Occurrence ID: 4964). Typically inhabits seepage sites and streamside talus.	Blue	SC
Painted Turtle (Intermountain – Rocky Mountain Population) (<i>Chrysemys picta pop.2</i>)	Unlikely	CDC occurrence mapped ~9 km northeast of the subject property in Fraser Lake on the east shore of Kootenay Lake (Shape ID: 96554, Occurrence ID: 12181). Inhabits wetlands.	Blue	SC
Western Skink (<i>Plestiodon skiltonianus</i>)	Possible	CDC occurrences mapped as close as ~6.25 km from the subject property near Coffee Creek. Known to occur around Kootenay Lake (Shape IDs: 29881, 29876, Occurrence IDs: 6929, 6928) but habitat is generally associated with rocks.	Blue	SC

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Common Name (Scientific Name)	Likelihood of Occurrence on Subject Property	Comment	BC Conservation Status ¹	COSEWIC ² / SARA ²
Whitebark Pine (<i>Pinus albicaulis</i>)	Very unlikely	CDC occurrences and critical habitat mapped as close as ~3 km from the subject property in all directions (Shape IDs: 136828, 136831, Occurrence IDs: 17117, 17120, Habitat IDs: 94378, 94413, 94467, 95003, 95028, 95044, 95093, 95241, 95253, 95291, 95306, 96716, 133647, 133669). Sub-alpine species.	Blue	E
White Sturgeon (Upper Kootenay River Population) (<i>Acipenser transmontanus pop. 1</i>)	Possible	Found in the mainstem of Kootenay Lake, known to use the Creston Delta, Duncan Delta, and Crawford Bay (Shape ID: 1370, Occurrence ID: 4745).	Red	E
Wild licorice (<i>Glycyrrhiza lepidota</i>)	Possible	CDC historical occurrence mapped within the subject property but growth tends to be in moist habitats (Shape ID: 79277, Occurrence ID: 10659).	Blue	NS

¹Red = Species that is at risk of being lost (extirpated, endangered, or threatened) within British Columbia. Blue = Species considered to be of special concern within British Columbia. ²(E) Endangered = Facing imminent extirpation or extinction. (T) Threatened = Likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction. (SC) Special concern = May become a threatened or an endangered species because of a combination of biological characteristics and identified threats. (NS) No Status. Information sources: British Columbia Conservation Data Centre.

Many bats species are blue-listed in BC (e.g.: little brown myotis (*Myotis lucifugus*)). The little brown myotis is also listed as 'endangered' under the *Species At Risk Act*. The little brown myotis is expected to have a 'possible' occurrence rating on the subject property based on masked species polygons mapped in the area. Bat roosting habitat includes tall, live or dead trees with crevices, peeling bark, or cavities (MoE 2016).

4.5 Archeological and Heritage Resources

Kootenay Lake is part of the traditional territory of the Ktunaxa, Sinixt, and Syilx (Okanagan) First Nations and archaeological evidence is documented at multiple shoreline sites. A review of archaeological resources on this property is outside the scope of this report. Archaeological Chance Find Procedures are provided in Appendix 4 for guidance on which protocols to follow in the event of a chance archaeological find, to ensure that archaeological sites are documented and protected as required for compliance with the *BC Heritage Conservation Act*.

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5 IMPACT ASSESSMENT

The proposed works were assessed based on current site conditions and proposed development activities within the SPEA (15 m from the present natural boundary). Potential impacts include:

- Habitat modification of a ~33 m² area of potential riparian vegetation from the proposed construction of a raised deck;
- Habitat modification of a ~15 m² area of potential riparian vegetation from the proposed construction of the water intake line;
- Temporary disturbance to wildlife and riparian habitat; and
- Potential spread of invasive vegetation.

The proposed development is sited partially within the existing footprint of the current cabin and does not involve removing any of the established trees or shrubs within the SPEA, which has already been modified and currently supports only three topped Douglas fir trees, one saskatoon bush, and low-value grasses, herbs, and invasive species. To help mitigate for the encroachment of the raised deck into the SPEA, native riparian shrub cuttings will be installed on the lake side of the proposed septic area and below the front edge of the proposed raised deck. The SPEA will also be seeded with native riparian grasses and forbs (Appendix 5). This planting provides enhanced habitat complexity within the SPEA by increasing the area of riparian vegetation onsite and preventing negative impacts associated with invasive plants (which will be removed from the property).

Provided that the recommended mitigation planting and the measures to protect the SPEA (detailed below) are implemented and followed, the negative impacts associated with the proposed development and future use of the property will be minimized. Though the proposed development will contribute to the overall cumulative effects of development along the Kootenay Lake foreshore, the riparian habitat quality and function within the property is expected to be enhanced through the addition of native riparian vegetation and the removal of invasive plant species. Enhanced values include:

- Addition of habitat for songbirds, small mammals, and reptiles such as garter snakes.
- Addition of root matrices that stabilize soils and minimize erosion.

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6 MEASURES TO PROTECT THE INTEGRITY OF THE SPEA

This section provides measures to protect the integrity of the SPEA as described in RAPR, as well as recommended best management practices for development and future use of the property.

6.1 Scheduling of Environmentally Sensitive Activities

Demolition and excavation activities, the construction of the foundation and all footings/supports, and the installation of the new water intake line should be completed during the low water period for Kootenay Lake (September through early April) in order to minimize the risk associated with the release of deleterious materials into Kootenay Lake. Other mitigation considerations associated with deleterious materials are discussed in Sections 6.7, 6.11 and 6.12.

Clearing of vegetation should be scheduled outside of the regional nesting period for migratory birds, which extends from early-April to mid-August (ECCC 2023). If this timeline cannot be accommodated and vegetation has to be removed during, or close to, this period of highest risk to nesting birds, a nesting survey should be conducted by an appropriately qualified environmental professional to ensure that there are no active nests that would be impacted.

It is an offence to kill, injure, or disturb nesting birds and the habitat of migratory birds, species at risk, and certain raptors at any time of the year.

6.2 Danger Trees

A certified danger tree assessor was not retained as a part of this assessment, but no hazard tree indicators were observed during the riparian assessment.

Refer to Section 6.5 for measures to protect trees so that they do not become future danger trees as a result of development.

6.3 Windthrow

Assessment of windthrow risk is beyond the scope of this report, and any such assessment should be led by a Registered Professional Forester (RPF).

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6.4 Slope Stability

A geotechnical field review of the subject property was conducted by Crowsnest Engineering. The review concluded that the proposed new residential structure was satisfactory with respect to geotechnical slope stability considerations (Crowsnest Engineering 2023a).

6.5 Protection of Trees and Vegetation in the SPEA

All mature trees and shrubs located within the SPEA will be protected from the proposed development activities. The mature trees and shrubs include three topped Douglas fir trees and a saskatoon bush. The retention of this vegetation is important in order to maintain the existing wildlife values, habitat complexity, and shoreline stability around the property.

The following mitigation measures will be implemented to protect the above noted SPEA trees and shrubs and any other mature trees/shrubs that are not necessary to remove for the proposed development:

- Erect a physical barrier to protect the existing trees/shrubs. This barrier should provide for the majority of the root system.
- Excavation or ground disturbance will be avoided within the root zone of these trees/shrubs. Roots of a mature tree typically extend from 1-3 times the height of a tree from the tree's trunk (far beyond the drip line) and are typically located within the upper 0.30 – 0.40 m of soil (MFLNRORD 2019).
- Avoid any change in the grade, ground level, or ground surface characteristics around these trees/shrubs. This includes compaction of the soils due to parking underneath the vegetation and the construction of a large retaining wall immediately adjacent to an established tree.
- Ensure that the trees/shrubs are not damaged during construction, damage includes broken branches, torn bark, or wounds to the trunk. If limbs are damaged, cut or prune the damaged limb with a clean cut near the base of the limb.
- Avoid changes to the natural drainage of the property.
- Avoid the introduction and establishment of invasive weed species. The best way to do this is to know where imported soils are coming from and to ensure they are weed-free. Know the common invasive species in the area (CKISS 2023) and removed them if they begin to establish before they go to seed.
- Avoid the introduction of pollutants that could contaminate the soil next to the trees/shrubs (e.g., fuels and oils leaking from construction vehicles). Refer to Section 6.11 for mitigation measures recommended for fuel and equipment.
- Do not permit any future clearing of vegetation once the proposed development activities have been completed.

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6.6 Encroachment

The proposed development will encroach into the SPEA up to 10 m from the present natural boundary of Kootenay Lake in order to construct the proposed residence and associated septic facilities. Temporary encroachment up to the present natural boundary will be required for the installation of the new water intake line.

To delineate development boundaries and protect existing riparian habitat during demolition and construction of the new residence and the associated septic facilities, a sediment fence will be installed along the 7.5 m setback line (Section 6.7) and physical barriers will be erected to protect the existing riparian vegetation (Section 6.5). No encroachment mitigation is proposed for the installation of the new water intake line as this should be of short duration and installation should occur during the low water period for Kootenay Lake.

Further development beyond that proposed in this report is strongly discouraged and any future development with the 15 m WDP area (including landscaping) will require a new WDP approval.

6.7 Sediment and Erosion Control

In order to prevent erosion of the property and to prevent sediment from entering Kootenay Lake, soil disturbance will be minimized as much as possible and exposed soils will be re-vegetated as soon as possible.

The following mitigation measures should be implemented to reduce the risk of sediment input to Kootenay Lake:

- The water line installation will be scheduled during the lower water period for Kootenay Lake (September through early-April). To the extent possible, all other works construction works within the SPEA should also be conducted within this timing window.
- A sediment fence will be installed along the 7.5 m setback line of Kootenay Lake during construction of the new residence and associated septic facilities. Sediment fencing should be properly keyed into the substrate to a minimum depth of 6".
- If groundwater or surface water is observed coming into the disturbed construction site, it will be conveyed around the development area and away from any exposed soil.
- During construction, activities should be suspended during periods of heavy rain if there is any risk that continued work could result in sediment delivery to Kootenay Lake. Where required, additional mitigation measures, such as sediment fencing, ditching, check dams, or covering soils

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may be required to manage turbid wastewater generated by construction or heavy rain events. Turbid wastewater will not be permitted to enter Kootenay Lake.

- During the installation of the water intake line visual monitoring of suspended sediment and turbidity in Kootenay Lake should be conducted. If suspended sediment is generated to the extent that it is migrating away from the property (>30 m), works will be modified to reduce the amount of sediment generated and/or erosion and sediment control measures, such as a sediment curtain, will be installed to contain the sediment.
- Soils or excavated lake substrate will be safely stockpiled in a manner that eliminates the possibility of erosion and sediment transport. Stockpiles will be located as far away from Kootenay Lake as possible.
- Disturbed soils will be revegetated as soon as possible after construction.

6.8 Stormwater Management

The proposed development will result in an increase in the total impervious area of the property. The following mitigation measures will help decrease stormwater impacts:

- Pervious materials (e.g., gravel) for use on driveways, parking areas, and pathways. This minimizes stormwater runoff from impervious materials (e.g., asphalt and concrete), which must be managed using natural hydrologic pathways. Storm water will not be permitted to discharge directly to Kootenay Lake.
- A roof rainwater collection system and a similar system for the deck will be designed to direct rainwater into a suitable landscape feature that can absorb and utilize the runoff. Roof and deck runoff will not be permitted to discharge directly to Kootenay Lake.
- Stormwater discharges must adhere to the *Water Sustainability Act* or any other applicable legislation.

6.9 Floodplain Concerns

A small portion of the proposed development is located within the 15 m floodplain setback of Kootenay Lake. A flood assessment was completed by Crowsnest Engineering to support a Site-Specific Floodplain Setback Exemption Application for the proposed development (Crowsnest Engineering 2023b). The proposal provided recommendations for the construction of the foundations and footings for the proposed development and indicated that “the proposed developments would be adequately protected against flooding hazards with return periods of up to 200 years, provided that the recommendation outlined in the report are implemented.”

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6.10 Protection of Fish Wildlife Habitat

To minimize disturbance to fish, wildlife, and their habitat, the following measures will be implemented:

- Adhere to sediment, stormwater, equipment, fuel, and concrete management best practices outlined in this report to ensure that there is no release of deleterious materials into Kootenay Lake.
- The best timing for the proposed development is September to early-April when Kootenay Lake water levels are low and prior to the period of highest risk to nesting birds in this region (Section 6.1).
- To minimize impacts to fish, the Interim Code of Practice for end-of-pipe fish protection screens for small water intakes in freshwater (DFO 2020) should be followed during the replacement of the water intake line. This includes minimizing the diameter of the water intake line, ensuring that a fish screen is placed at the intake, and installing the water line along a path that minimizes the amount of current and future vegetation disturbance.
- Follow the Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (MoE 2013) if any active raptor nests are discovered within 100 m of the subject property. Active raptor nests are legally protected at all times of the year and some inactive nests (ex: Bald Eagle nests) are similarly protected.
- Follow the Best Management Practices for Bats in British Columbia (MoE 2016) if bats are known to be roosting within 100 m of the subject property and if noise in excess of 150 dB is expected.
- Avoid any modifications to the beach substrate and preserve the remaining woody debris along the foreshore, which provides some cover habitat to juvenile fish.
- Ensure that any power equipment used is well-maintained and leak free.

6.11 Management of Equipment and Fuel/Lubricant Materials

Deleterious substances degrade water quality and affect fish and fish habitat. A spill prevention and emergency response plan should be developed by Weiland Construction to minimize the likelihood and impact of a spill of a deleterious substance, such as fuels, oils, and lubricants contained in equipment or vehicles used for construction.

At a minimum, this plan should:

- Ensure that all construction machinery arrives at the property in a clean condition (preferably steam-cleaned), free of fluid leaks, excess oil or grease, mud, and sediment.
- Retain a heavy equipment contractor that can supply equipment using biodegradable hydraulic oil and greases.

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- Ensure that each piece of heavy equipment is equipped with its own spill response kit that is appropriate to the types and quantities of fluids stored within. The contents of each kit must be replaced immediately after use.
- Ensure that all equipment operators are familiar with the use of spill kits and their contents.
- Ensure that leaking equipment is removed from the worksite and repaired offsite.
- Create a designated area to park, store, and re-fuel all equipment that is as far away from Kootenay Lake as possible and apply secondary containment (e.g. spill trays) to detect, capture, and contain any potential spills or leaks. It is recommended that the shoulder of Highway 31 be used for this purpose.
- If a spill occurs immediately abate and contained the spill. Report the spill according to the *Spill Reporting Regulation* and then clean up. Any contaminated material will be removed from the subject property and disposed of, along with any contaminated soils, in compliance with the RDCK Resource Recovery Plan and associated bylaws (RDCK 2023).

6.12 Concrete Management

Fresh concrete and concrete laden water is caustic (causing elevated water pH) and toxic to aquatic organisms.

To minimize impacts to Kootenay Lake, the following measures will be implemented:

- No concrete, or wastewater that has been in contact with fresh concrete will be disposed of onsite.
- Concrete delivery trucks will either be equipped with a wash water recycling system to capture all wash water used to clean the truck, or a wash water containment bin large enough to capture and contain all wash water will be made available for truck washing.
- Tool washing will occur in a designated wash basin.
- Wash basins should be set aside so that solid material has time to settle and harden. Contents should be disposed of in compliance with Appendix 14.6 of the Standards and Best Practices for Instream Works, (MWLAP 2004).

6.13 Invasive Plant Management

Construction activities can potentially increase the prevalence of invasive plant species which can out-compete native riparian vegetation, causing damage to habitat and ecosystem function. The following mitigation measures are recommended to reduce the establishment and proliferation of invasive plant species on site:

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- All equipment should be thoroughly washed and inspected before entering the project site to prevent the import of new invasive plant seeds and root fragments.
- The amount of soil disturbance should be minimized and exposed soils should be re-vegetated immediately following construction.
- Remove yellow salsify from the property (Photo 17). This is best accomplished by excavating the plant and the entire tap root. Double bag and dispose of the plant as general household waste. Yellow salsify spreads by seed. Remove the flowering head before seeds develop.
- Other priority invasive species such as cleavers, hawkweeds, knapweeds, and oxeye daisy will be removed from the SPEA as part of the mitigation plan.
- Following development, manage new invasive weeds on the property according to guidance from the CKISS to prevent establishment and spread (CKISS 2023).

7 RESTORATION PLAN

The Shoreline Management Guidelines for Kootenay Lake outlines general principles for shoreline development in order to achieve a “No Net Loss” of habitats present. The principle is achieved by applying the following priority sequence of mitigation options: 1. *Avoidance* of environmental impacts; 2. *Minimization* of unavoidable impacts; 3. *On-site restoration* of unavoidable impacts; and 4. *Compensation* for residual impacts (KLP 2020).

Minimization and on-site restoration measures have been incorporated into the development plan by retaining the existing high-value riparian vegetation within the SPEA and through onsite riparian planting.

On-site restoration measures include installing native riparian shrub cuttings on the lake side of the proposed septic area and below the front edge of the proposed raised deck, removal of the priority invasive species currently colonizing the central area of the property, and . The seeding the SPEA with native riparian grasses and forbs to re-colonize the areas formerly impacted by invasive species. Refer to Appendix 5 for the proposed revegetation schematic.

The riparian revegetation plan is as follows:

- Native willow (*Salix sp.*) and/or red-osier dogwood (*Cornus sericea*) cuttings (at least 24 cuttings) will be installed in six clumps of four cuttings each. Clumps may be sited anywhere within the 15-meter SPEA setback at the Owner’s/landscaper’s discretion.
- Cuttings will be sourced locally and installed late in the fall or early in the spring, when plants are dormant. Cuttings will be soaked in water for 7-10 days prior to planting.

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- Cuttings will be installed according to the *Instructions for Harvesting, Transporting, and Storing Live Cuttings for Vegetating and Stabilizing Streambanks* (Appendix 6). We recommend that this work is completed by a qualified person that is experienced with collecting and planting cuttings to help ensure the best results.
- Organic soils that are disturbed within the 15 m setback will be de-compacted.
- The native riparian seed mixture provided in Table 5 will be used to seed the SPEA. Seeding will be completed in the late-fall or early-spring.
- During the hot summer months, the Owner's will water the newly installed plants and grasses until they are established.

Table 5. Recommended Riparian Seed Mix blend (Applied at a rate of 25 kg/ha)

Native Riparian Blend #1	% by weight	% by Species
Slender wheatgrass	25.0%	18.0 %
Streambank wheat grass	25.0%	18.0 %
Fringed brome grass	24.7%	9.0 %
Northern wheat grass	20.0 %	14.0%
Sheep fescue	3.0 %	10.0%
Tufted hairgrass	1%	11.0%
Fowl bluegrass	1%	9.0%
Yarrow	0.3%	3.0%

The plant and grass species selected in the riparian revegetation plan occur naturally around Kootenay Lake, are flood and drought tolerant and require little to no maintenance. There is no risk of erosion potential as, the planting will occur in the natural substrate. This proposed planting will:

- help mitigate for the construction impacts (including those related to the installation of a new septic system and water line) and for the encroachment of the raised deck into the riparian area,
- enhance the ecological values of the site by providing enhanced habitat complexity within the riparian area; and,
- add root matrices that stabilize soils and minimize erosion.

The following ongoing maintenance strategy is recommended:

- Remove the invasive plants by hand prior to going to seed during the first two growing seasons.
- Assess plant survivorship one year after planting. If more than 50 % of the shrubs are lost after at least one growing season and one dormant season, replacement planting will be required.

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7.1 Environmental Monitoring

Environmental support is recommended during the development activities and during restoration to ensure that measures to protect the SPEA and the recommendations for mitigation planting are implemented and followed.

The anticipated effort for environmental monitoring (completed by a QEP) and professional guidance on this project includes the following:

- Conduct a site visit prior to construction to:
 - Inspect the installation of the sediment fencing and physical barriers to protect the existing SPEA trees/shrubs.
 - Review other mitigation measures outlined in this report.
 - Ensure that obligations regarding the exercise of due diligence for the protection of environmental values are understood and implemented.
- Execute and/or provide guidance during the restoration activities. If site restoration is conducted by another party, conduct a site visit following completion of the restoration activities.
- Prepare an environmental summary report for the entire project upon completion. This will be submitted to the RDCK for closure.
- Complete effectiveness monitoring of the planted area for two growing seasons and provide recommendations for ongoing maintenance and/or replanting, if required. The following indicators of success of riparian plantings will be documented:
 - Plant composition includes only native plant species.
 - After two full growing seasons, survival of at least 50% of plants will indicate that the revegetation plan has been successful.

8 CONCLUSION

Overall, the measures to protect the SPEA will help mitigate the environmental impacts caused by the proposed development. Temporary disturbance to wildlife may occur throughout the development, but any wildlife present are likely accustomed to similar levels of background disturbance given the location, and the duration of works will be short enough such that the resulting disturbance is not anticipated to be of a level that is detrimental to these species. The risk of potential spread of invasive species is expected to be effectively mitigated through the measures outlined for invasive plant management and the restoration plan. The proposed development will modify ~48 m² (33 m² deck + 15 m² water intake) of potential riparian vegetation. The proposed revegetation and invasive plant removal along the foreshore will help mitigate some of the riparian loss caused by the proposed development and provide some additional habitat complexity along the foreshore.

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Provided that the recommended mitigation planting and the measures to protect the SPEA are implemented and followed, the negative impacts associated with the proposed development and future use of the property will be minimized.

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9 CLOSURE

This report has been prepared by a Qualified Environmental Professional (QEP) who has not acted for, or as an agent(s) of the RDCK and was at the expense of the property owner.

I, Fiona Lau, certify that I am qualified to carry out this assessment; and that the assessment methods under the Regulation have been followed; and that, in my professional opinion:

- (i) if the development is implemented as proposed, or
- (ii) if the streamside protection and enhancement areas identified in the report are protected from the development, and
- (iii) if the developer implements the measures identified in the report to protect the integrity of those areas from the effects of the development,

then there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area.

Sincerely,



Fiona Lau, BTech., ASCT
fiona@masseenvironmental.com



Jennifer Ross, M.Sc., P.Chem.
Masse Environmental Consultants

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10 REFERENCES

[BC] Province of British Columbia. 2014. *Water Sustainability Act*. SBC 2014, Chapter 15, This Act is current to March 29, 2023. Victoria, British Columbia, Canada.

[BC]. 2019. *Riparian Areas Protection Regulation*. B.C. Reg. 178/2019, Last amended February 5, 2021 by B.C. Reg. 11/2021. Victoria, British Columbia, Canada.

[BC]. 2023. iMap BC Mapping Application. Available online at:

<https://www2.gov.bc.ca/gov/content/data/geographic-data-services/web-based-mapping/imapbc>

British Columbia FireSmart. N.D. FireSmart BC Homeowner's Manual. Available online at:

https://firesmartbc.ca/wp-content/uploads/2021/04/05.31.22.FireSmartBC_HomeownersManual_Printable.pdf

British Columbia FireSmart. N.D. FireSmart BC Landscaping Guide. Available online at:

https://firesmartbc.ca/wp-content/uploads/2021/04/FireSmartBC_LandscapingGuide_Web_v2.pdf

[CKISS] Central Kootenay Invasive Species Society. 2023. CKISS Invasive Plant Priority List 2023. Available online at: <https://ckiss.ca/species/invasive-plant-priority-lists/>

Crowsnest Engineering. 2023a. Geotechnical Field Review. Project No.: WEIL-2022-002. Completed by Nicholas Ellis, P. Eng. January 24, 2023.

Crowsnest Engineering. 2023b. Flood Assessment Review. Project No.: WEIL-2022-002. Completed by Nicholas Ellis, P. Eng. May 7, 2023.

[DFO] Fisheries and Oceans Canada. 2014. Recovery Strategy for White Sturgeon (*Acipenser transmontanus*) in Canada [Final]. Ein Species at Risk Act Recovery Strategy Series. Ottawa: Fisheries and Oceans Canada. 252 pp.

[DFO] Fisheries and Oceans Canada. 2020. Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater. Available online at:

<https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html>

1434 Hwy 31, Queens Bay – Riparian Assessment

[ECCC] Environment and Climate Change Canada. 2023. General Nesting Periods of Migratory Birds. Available online at: <https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html>

Gov BC . 2022. Requirements and Best Management Practices for Making Changes In and About a Stream in British Columbia, V. 2022.01. Government of British Columbia.

iNaturalist Network. 2023. iNaturalist Interactive Mapping. Available online at: <https://www.inaturalist.org/observations>

Kipp, S. and Callaway, C. 2002. On the Living Edge. Your Handbook for Waterfront Living.

[KLP] Kootenay Lake Partnership. 2020. Shoreline Guidance Document – Kootenay Lake. Originally prepared by Ktunaxa Nation Council, Regional District of Central Kootenay, Ministry of Forests, Lands, and Natural Resource Operations, Ecoscape Environmental Consultants Ltd., Tipi Mountain Eco-Cultural Services Ltd. The Firelight Group Ltd., Wayne Choquette.

[KLP]. 2023. Kootenay Lake Shoreline Inventory Mapping Interactive Map. Available online at: <http://kootenaylakepartnership.com/>

Mackillop, D. and Ehman, A. 2016. A Field Guide to Site Classification and Identification for Southeast British Columbia: the South-Central Columbia Mountains. Province of B.C., Victoria, B.C. Land Management Handbook 70.

McKenzie, E. and Hill, T. 2023. Conservation, Restoration and Stewardship of Low Elevation Brushland (Gb), Grassland (Gg) and Dry Forest Ecosystems in the West Kootenay Region – Background Information Document. Prepared for the Okanagan Nation Alliance and the Fish & Wildlife Compensation Program (FWCP) Section of the Ministry of Forests, Lands, Natural Resource Operations & Rural Development, Nelson, BC. February 28, 2023. 69 pp.

Metro Vancouver. N.D. A Homeowner’s Guide to Stormwater Management. Available Online at: <http://www.metrovancouver.org/services/liquid-waste/LiquidWastePublications/HomeownersGuideStormwaterManagement.pdf>

[MFLNRORD] BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2019. Riparian Areas Protection Regulation Technical Assessment Manual. V 1.1. November 2019.

1434 Hwy 31, Queens Bay – Riparian Assessment

[MoA] BC Ministry of Agriculture. 2012. Riparian Factsheet No. 6. Riparian Plant Acquisition and Planting. Order No. 810.210-6.

[MoE] BC Ministry of Environment. 2013. Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (2013). Province of British Columbia. Victoria, British Columbia, Canada.

[MoE] BC Ministry of Environment. 2014. Develop with Care 2014. Environmental Guidelines for Urban and Rural Land Development in British Columbia. Province of British Columbia. Victoria, British Columbia, Canada.

[MoE] BC Ministry of Environment. 2016. Best Management Practices and Guidelines for Bats in British Columbia. Province of British Columbia. Victoria, British Columbia, Canada.

[MWLAP] BC Ministry of Water, Land and Air Protection. 2004. Standards and Best Practices for Instream Works. Province of British Columbia. Victoria, British Columbia, Canada.

[RDCK] Regional District of Central Kootenay. 2009. Floodplain Management Bylaw No. 2080, 2009. Last updated December 2019.

[RDCK]. 2013. Electoral Area 'E' Rural Official Community Plan Bylaw No. 2260, 2013. Last updated October 2021.

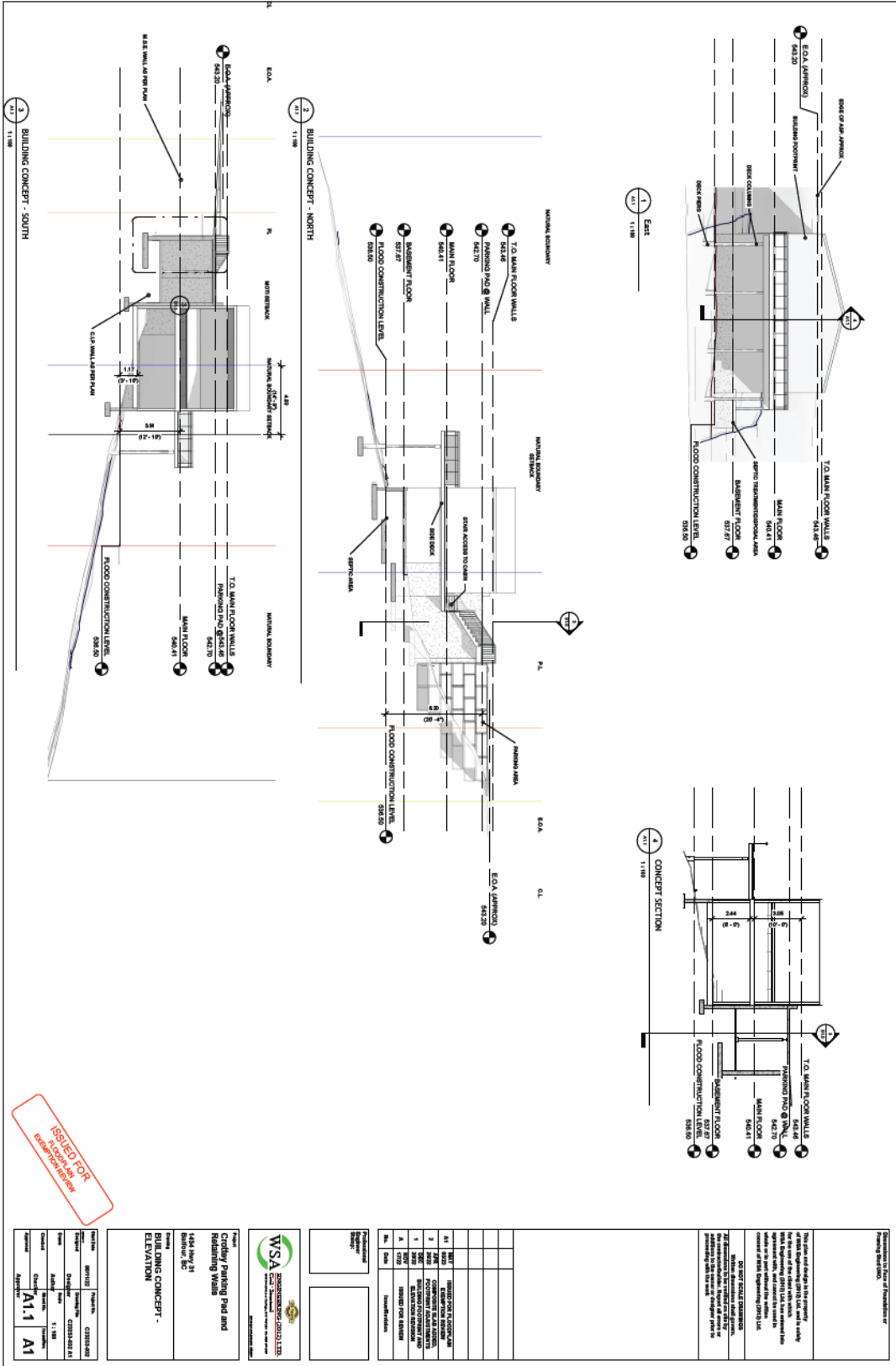
[RDCK]. 2023. Resource Recovery Facilities Regulatory Bylaw No. 2891, 2023.

[RDCK]. N.D. A Resource for Kootenay Lake Living. Available online at:
https://www.rdck.ca/assets/Services/Land~Use~and~Planning/Documents/2021-04-20-KLDPA_Resource-V5.pdf

Schleppe, J. and Cormano, A. 2013. Kootenay Lake Foreshore Inventory, Mapping and Aquatic Habitat Index. Ecoscape Environmental Consultants Ltd. Project File: 12-952. July 2013. Prepared for: Kootenay Lake Partnership & Fisheries and Oceans Canada.

APPENDIX 1. SITE LOCATION MAP

APPENDIX 2. PROPOSED DEVELOPMENT PLANS



APPENDIX 3. RIPARIAN ASSESSMENT SHOWING SPEA SETBACKS



Queen's Bay - Riparian Assessment Setbacks

- Property Boundary (PID 026-329-981)
- Present Natural Boundary
- Kootenay Lake Setbacks
 - Shade ZOS (30 m)
 - Litterfall and LWD ZOS (15 m)
 - SPEA and WDP Area (15 m)



Map Date: 2023/06/26
Projection: NAD83 UTM Zone 11
1434 Highway 31, Queens Bay, BC
Map Scale: 1: 250
Orthoimage Date: October 26, 2022
Fortis BC Lake Level: 531.45 m

0 5 10 m

APPENDIX 4. ARCHAEOLOGICAL CHANGE FIND PROCEDURE



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www.ktunaxa.org

Chance Find Procedures for Archaeological Material

This document provides information on how a developer and/or their contractor(s) can manage for potential archaeological material discoveries while undertaking construction and/or maintenance activities. This document can provide assistance to in-field contractors in the identification of archaeological remains and the procedures to follow if a discovery is made. The discovery of human remains initiates a different course of action and is outlined separately.

Under the provincial *Heritage Conservation Act (HCA)*, archaeological sites that pre-date 1846 are automatically protected whether on public or private land. Protected sites may not be damaged, altered or moved in any way without a Section 12 or 14 Permit as issued through the *HCA*. It is illegal to collect or remove any heritage object from an archaeological site unless authorized to do so under permit.

1. Activities occurring outside of known Archaeological Sites:

When archaeological material is encountered outside of known archaeological site areas work in the vicinity must stop immediately no matter what type of material or feature has been identified. Alteration to an archaeological site can only occur under a Section 12 (Site Alteration Permit) or Section 14 (Heritage Inspection Permit) *Heritage Conservation Act* permit. Such permit applications should be prepared by a professional archaeologist.

If archaeological material is discovered during the course of construction activities:

- 1.1 **Stop Work:** Halt all work in the area of the discovery and safely secure the area. Contact the project manager or site foreman.
- 1.2 **Contact an Archaeologist:** An archaeologist should be contacted as soon as possible. For a list of qualified archaeologists in the area, the proponent is directed to the BC Association of Professional Consulting Archaeologists website: www.bcapa.ca. The proponent may also wish to contact the Ktunaxa Nation Council's Archaeology Technician Nathalie Allard for direction (1-250-426-9549; nallard@ktunaxa.org).
- 1.3 **Archaeologist provides guidance:** The archaeologist will direct the proponent on the next courses of action, which will include notifying the Archaeology

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Tobacco Plains

Branch and First Nations with interest in the area.

2. Activities Occurring within Known Archaeological Site Boundaries:

Land altering activity within a previously recorded archaeological site must be conducted under a Section 12 HCA Site Alteration Permit (SAP), in some cases with an onsite archaeological monitor. It is common for additional archaeological material and features to be encountered during activities occurring within previously recorded archaeological sites. Minor finds (lithic flakes, diffuse charcoal or fire altered rock) may not require work to stop, however significant finds require a level of assessment by a professional archaeologist, and it is up to the onsite project manager to determine the level of significance based on criteria presented below.

2.1 Significant Cultural Finds that Require a Professional Archaeologist (described in detail in Section 4)

- Intact archaeological features, which can include but are not limited to hearths, cultural depressions (e.g. cache pits, house depressions) and rock alignments or forms (e.g. tipi rings, cairns, blinds)
- Significant archaeological materials, which include but are not limited to, the presence of formed lithic tools (e.g. projectile point, microblade core, scraper), a dense concentration of lithic waste flakes, or artistic items
- Human Remains (described in detail in Section 3)

2.2 Archaeological Site Management Options

- 2.2.1 Site Avoidance:** If the boundaries of a site have been delineated, redesign the proposed development to avoid impacting the site. Avoidance is normally the fastest and most cost effective option for managing archaeological sites. Site avoidance could also be achieved through minimizing ground disturbance by looking for alternative constructive methods.
- 2.2.2 Mitigation:** If it is not feasible to avoid the site through project redesign, it is necessary to conduct systematic data collection and analysis within the site prior to its loss. This could include surface collection and/or excavation. This work can be time-consuming and therefore expensive to conduct.
- 2.2.3 Protection:** It may be possible to protect all or portions of the site which will be impacted through installation of barriers during the development period and possibly for a longer period of time. Methods for barrier construction could include fencing around site boundaries or applying

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geotextile to the ground surface and capping it with fill. The exact method used would be site-specific.

3. Chance Find Procedures for Identified Human Remains

Procedures in the event of the discovery of human remains during construction are covered in depth by an Archaeology Branch Policy Statement, found on their website at www.for.gov.bc.ca/archaeology, and are summarized below.

- 3.1 Stop all construction activities immediately in the area of found or suspected human remains and contact the RCMP and/or Office of the Coroner.
- 3.2 The coroner must determine whether the remains are of contemporary forensic concern or archaeological/aboriginal.
- 3.3 If the remains are found to be of aboriginal ancestry then the next step involves the relevant First Nations collaboratively determining the appropriate treatment of those remains.

The key to respectfully dealing with ancient aboriginal remains is to involve the appropriate First Nations as early as possible in the process. However this must be done in a manner that does not interfere with the coroner's office ability to conduct their business in the manner that they see fit.

4. Site Identification Guide

The following are characteristics typical to site types found within the Ktunaxa Traditional Territory.

4.1 Artifact Scatters

Lithic (stone) scatters from the production and maintenance of stone tools are the most common type of archaeological site found in the region. Other materials that may be represented in artifact scatters are Fire Broken Rock (FBR), bone, antler and tooth.

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Lithics: What to look for

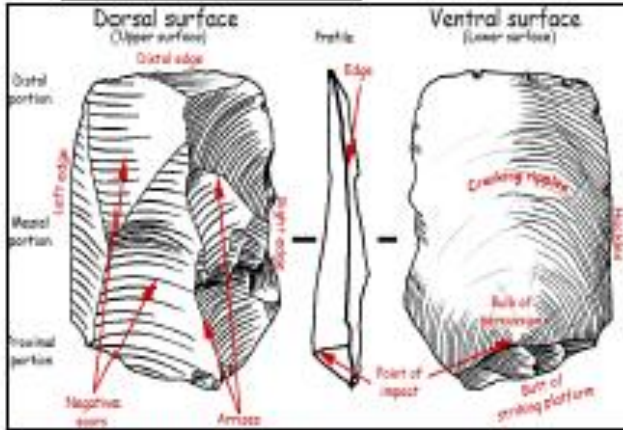


Image 1: Basic flake morphology



Image 2: Examples of lithic flakes



Image 3: Example of lithic scatter found on ground surface



Image 4: Example of formed lithic artifacts

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Image 5: Ground stone artifacts

Bone, Tooth and Antler Artifacts: What to Look For

- Obvious shaping
- Incising
- Unnatural holes



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Image 6: Bone and Antler artifacts

4.2 Fire Broken Rock and Hearths

Fire-broken rock (FBR) results from the use of fire during cooking, heating and processing activities. FBR is often associated with other features including hearths and cultural depressions, but can also be thinly scattered in concentrations away from the features with which they were first associated.

When looking for FBR, note concentrations of roughly fractured rock from rapid heating and cooling, rock showing signs of burning or oxidation and/or reddening or blackening of surrounding matrix.



Image 7: Example of FBR; note the zig/zag pattern of breakage common to FBR. A hearth feature is evidence of a fire pit or other fireplace feature of any period. Hearths were used for cooking, heating, and processing of some stone, wood, faunal, and floral resources and may be either lined with a wide range of materials like stone or left unlined. Occasionally site formation processes (e.g., farming or excavation) deform or disperse hearth features, making them difficult to identify without careful study.

Hearths: What to look for

- FBR
- reddening or blackening of the associated soil/sediment
- charcoal
- layering of FBR and charcoal, and
- depressions in the earth associated with FBR, reddened or blackened matrix and charcoal.

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Image 8: Example of a hearth uncovered along the wall of an excavation unit

4.3 Cultural Depressions

Any depression seen on the ground surface that appears to have been excavated by man can be a cultural depression and have archaeological significance. These "pits" were dug for a variety of reasons such as for food storage, cooking or as a base for a dwelling. They can range in size from 1m across to 7-10m across, and are usually found associated with other artifacts such as FBR and lithic scatters.

To identify a cultural depression, look for:

- Subtle to deep scours on the ground surface that are circular to rectilinear in shape
- A raised rim along the edge of a depression
- Depressions associated with artifacts and FBR
- Depressions associated with fire reddening and blackening of the matrix

Palisades

Pajaro

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Image 9: Example of a large cultural depression in a natural setting

4.6 Rock Alignments

There are several types of rock alignments that occur within the culture area, which include tipi rings, medicine wheels, cairns and blinds. When attempting to identify rock alignments, look for a group of rocks that look purposefully placed as in a circle, pile or line; isolated groups of rock that do not seem to belong to that landscape; and/or rocks which form a pattern.



Image 10: Example of a Cairn or piling of rocks



Image 11: Example of a tipi ring in a natural setting

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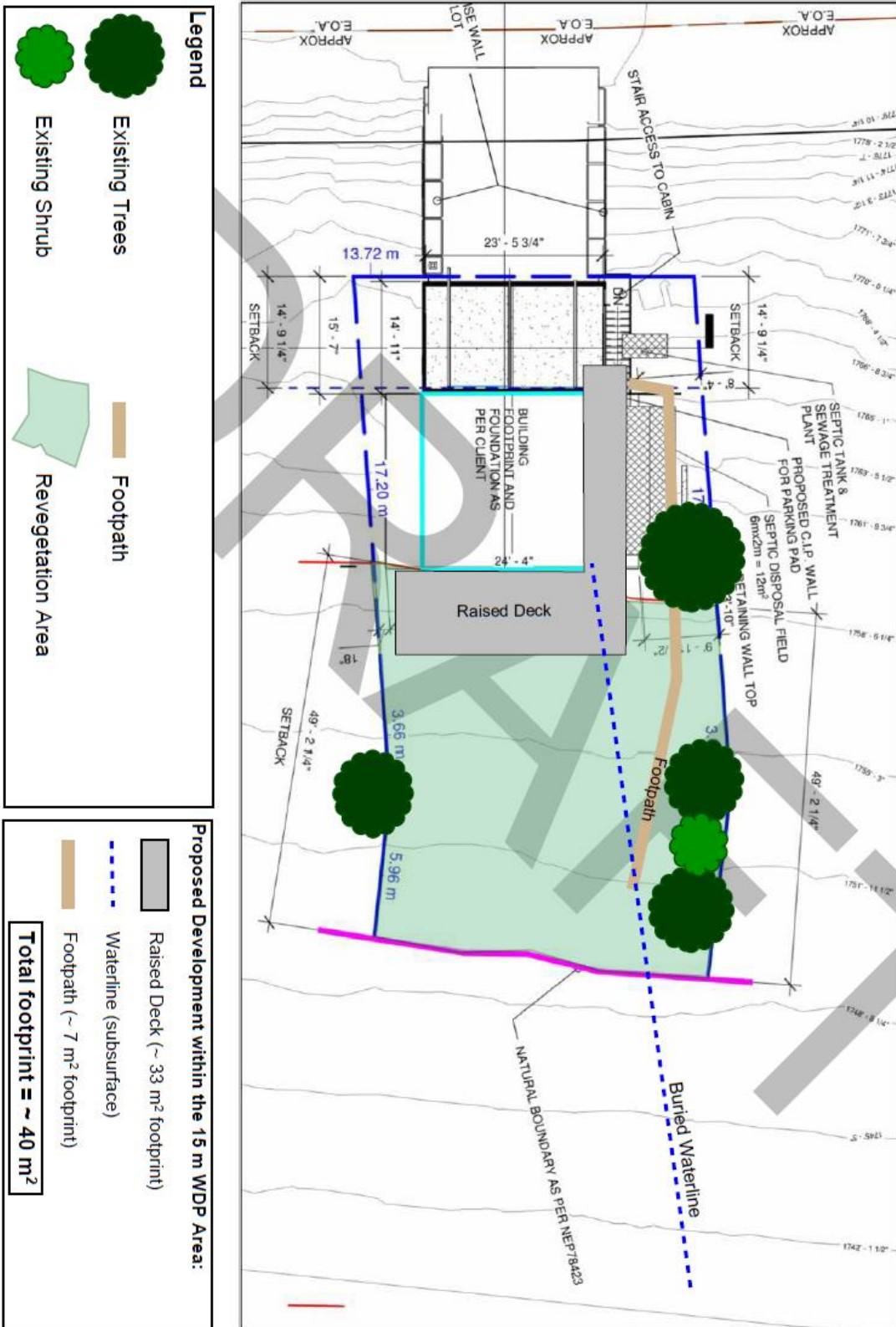
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APPENDIX 5. REVEGETATION SCHEMATIC

Revegetation Plan Schematic

(drawing taken from Crowsnest Engineering Flood Assessment Review)



Legend

- Existing Trees
- Existing Shrub
- Footpath
- Revegetation Area

Proposed Development within the 15 m WDP Area:

- Raised Deck (~ 33 m² footprint)
- Waterline (subsurface)
- Footpath (~ 7 m² footprint)

Total footprint = ~ 40 m²

APPENDIX 6. CUTTING INSTALLATION INSTRUCTIONS

Instructions for Harvesting, Transporting, and Storing Live Cuttings

for

Vegetating and Stabilizing Streambanks

Phil Balch

October 2008



INTRODUCTION

Live cuttings are leafless stem cuttings of woody plant species. These cuttings can be planted in various configurations to achieve certain vegetative and stabilization goals. The planting method(s) will be specified in the project or planting design. These methods may include: live siltation, brush layering, branch packing, brush mattress, live stakes, live poles, vegetated geogrids, live crib-walls, joint planting, live fascines, and many others.

Willow and cottonwood cuttings are commonly used for riparian rehabilitation because they are easily established from cuttings. Although this document is primarily intended for willow species, the occasional inclusion of cottonwoods, sycamores, or other species as cuttings is acceptable. For additional species suitability, see the USDA, NRCS, publication National Engineering Handbook (NEH) Part 650, Chapter 16: Streambank and Shoreline Protection.



Cuttings can be obtained from commercial nurseries or cut from native stands located near project sites. When buying cuttings from commercial sources, the source and species shall be compatible with the planting area, i.e. native to the area and suitable for the local climate.

CUTTINGS FROM NATIVE STANDS

Native willow stands located near the project site are the best source of cuttings. On large stream systems, native willow stands are normally found on point bars directly across the river from project areas. Native stands of willow and cottonwood may have insect and disease infestations which can stress the plants. Extremely dry years or long periods of drought may also cause plant stress. This stress may reduce plant energy reserves resulting in decreased plant survival. When planning the number of cuttings to harvest, take stress indicators into account and harvest extra plants if needed.



Permission to harvest from the landowner, private or public, must be obtained prior to harvesting live cuttings.

CUTTINGS

Establishment success is significantly increased if cuttings are taken from live willows during the dormant season. This is the period between the fall leaf drop and the plant leaf budding in the spring.

See "Storage" section for procedures when harvesting well before the projected planting date.

Cutting Diameter

Cuttings shall be 1/2 inch diameter or larger depending upon the species. Ideal trees for cuttings should be from 3/4 inch to 3 inches in base diameter. Larger diameter cuttings have more energy and stored reserves than smaller diameter cuttings, but are often more difficult to place into the ground. Cuttings from 2 to 3 inches in diameter typically have the highest survival rates.

Cuttings as large as 8 inches can be used as poles instead of live stakes. Live poles provide more resistance to higher velocity flows and create roughness which reduces water velocity. However, larger diameter cuttings require longer cutting lengths and should be planted deeper in the soil. Deciding factors for selecting the cutting diameter are: stand density, size of the selected native species, and the selected planting method. When planting, cuttings should be large enough that they will not bend or break while being driven during installation. Smaller diameter cuttings, or limbs removed from larger cuttings are more suitable for brush mattresses, brush layering, branch packing, live fascines, or vegetated geo-grids.

Cutting Length

Cuttings shall have at least two leaf nodes, or bud scars, above the ground as illustrated on page 6. Cutting length is largely determined by the depth to the mid-summer vadose zone, or the area of moist soil at the lower bank. For ease of handling and transportation, cuttings should be harvested and stored at full length and then cut into shorter lengths prior to planting. Plantings should be placed on the lower portion of the streambank slope. Cuttings shall be long enough so the stem base reaches into the vadose zone. This zone extends slightly above the water surface elevation in most situations (See illustration on page 6).

- Several inches of the bottom of each cutting should be in the vadose zone.
- Each cutting should have a minimum of 2-4 buds above the ground.
- Observe the 2/3 or 3/4 rule: 2/3 to 3/4 of the cutting length should be placed below the soil surface.

Harvest of Cuttings

Once cutting size, source location is determined — and landowner permission obtained — the actual cutting process can begin. Lopping shears, pruning shears, a small wood saw, brush cutters, or a chain saw are appropriate tools for harvesting cuttings. Desired cutting size will determine the appropriate tool(s).

- Make clean cuts. Ensure all equipment is sharp.
- Use live wood at least 1 year old or older. Do not use very old or dry wood.
- Larger wood is difficult to root. The best wood is 2-5 years old with smooth bark which is not deeply furrowed.
- Avoid current year's growth. It lacks the stored energy reserves necessary to consistently sprout when planted.
- When harvesting from native stands, make sure the stand will not be denuded or destroyed by your cutting activity, most willow species will sprout and grow from base of harvested plant.
- Trim off all side branches so only the main stem remains.
- The side branches can be used in live fascines, branch packing, brush layering, etc.
- Harvested plant material shall be $\frac{3}{4}$ inch to 3 inches in diameter at the base and 6 to 12 feet tall.
- A processing alternative, when cutting limbs into live stakes, is to cut the top of cutting with a horizontal cut and bottom of cutting with a 45 degree cut, (See illustration on page 6). This allows quick recognition of the cutting top (see Caring for Harvested Cuttings).
- Care should be taken to select plant materials that are free of physical damage, disease, and insect damage.



Caring for Harvested Cuttings

One of the most important steps in this process is the identification of **TOP** of cutting. If cuttings are planted upside down, mortality will occur. Leaf scars are the most reliable indicator to identify the cutting top. Buds emerging from leaf scar always point up. Another key is the stem. Usually, the smaller diameter end is the top of cutting; however this is not always obvious.

Transportation and Storage

After being harvested, the cuttings should be tied into bundles small enough to be easily carried by 1 or 2 people. Each bundle may contain 25 – 50 trees, depending on their size. Placing the same number of cuttings in each bundle makes it easier to count the number of harvested cuttings.

During harvesting, transportation, and storage, willow bundles should be kept moist and protected from sunlight and wind by covering or wrapping the bundles with wet burlap or a reflective moisture barrier to protect cuttings from becoming desiccated.

To minimize storage time, harvest cuttings in early spring within two to three weeks of the planned planting date. If this is not possible, cuttings can be harvested in late fall or winter and stored in a large cooler at 34-38°F until immediately prior to planting. Cuttings can be stored for several months in this manner. If cuttings are kept in a cooler, root cellar, garage, or shop floor, make sure the storage area is dark, moist, and cool at all times. Maintain a storage temperature slightly above freezing. Cuttings may be wrapped in a black tarp or plastic to be kept dark, if stored in an out building. Cuttings should be checked periodically for signs of frost damage and/or to insure that mold is not forming.



Pre-plant Soaking of Cuttings

Soaking plant material, prior to planting, significantly increases the survival rate. Prior to planting, all cuttings should be soaked for a minimum of 36 hours, regardless whether they are stored or harvested for immediate planting. Research shows that soaking the cuttings for 7 to 10 days can double the survival rate. Cuttings should be removed from water prior to root emergence from the bark. This normally takes 7 to 10 days. Soaking initiates the root growth processes within the inner layer of bark in willows and cottonwoods.



Only the bottom 1/3 of the cuttings needs to be soaked. However, soaking the entire cutting is not detrimental. Soaking can be accomplished in any container that will hold enough water to the required depth. Cuttings can also be soaked in streams, ponds, lakes, or other bodies of water. Avoid soaking cuttings in areas that are susceptible to flooding or where beavers are present.

PLANTING LIVE CUTTINGS

Spacing Considerations

Plant the cuttings about 3-4 feet apart for all live cuttings. This spacing is suitable for both within and between rows. Normally, only the lower slope should be planted with willows. Live cuttings should be

planted on the first and/or second row above the edge of water. The first row is normally planted approximately 4 feet from the waters edge at low flow. Subsequent rows should be planted an additional 3 - 4 feet up slope from the previous row. Each row should be planted on an off-set pattern from the previous row (See attached design details on pages 6 and 7).

When to Plant

Cuttings should be planted in early spring after frost has left the soil, but no later than June 1. Avoid planting cuttings or rooted stock in summer because of heat stress and a shortened growing period.

Planting Methods and Planting Cuttings

One or two-person posthole power augers, hand soil augers, planting bars, shovels, soil probes, or simply pushing or driving the cutting into moist soil are appropriate tools to plant cuttings. When planting, keep several things in mind:

- Push the cutting into the soil when possible.
- If the soil is too firm to push the cutting into the soil, the cutting can be driven into the soil using a hammer. A 2-3 pound “dead blow hammer”, or shot filled mallet, works well to drive cuttings. This type of hammer reduces the chance of splitting the cutting or stake.
- If a cutting is split while driving, trim the cutting to below the split to prevent desiccation and plant mortality.
- It is essential to have firm contact between the cutting and soil. Avoid creating air pockets around the cutting that can prevent roots from developing. Holding on to the cutting with one hand while driving reduces air pocket formation.
- Avoid damaging buds when inserting the cutting into the hole or when driving the cutting.
- If the soil is too compacted to drive the cutting, a hole can be formed by driving a rebar or other metal rod into the soil first and then placing the cutting into the hole. The hole diameter shall be smaller than the cutting diameter to prevent air pocket formation.
- Holes can be created with any of the tools mentioned at the start of this section.
- The planting depth will determine the planting method. Deeper holes will be made easier by using a power auger.
- If the hole dug is larger than the cutting, additional soil will be required to form a good soil to stem contact. Preference should be given to local topsoil to encourage mycorrhizal formation and/or nodule formation by nitrogen-fixing organisms. Do not backfill with clay.
- Carefully tamp the soil around the cutting firmly several times as you fill any drilled or augered hole.
- “Water In” the back-filled soil around large cutting holes to settle soil and provide good soil to cutting contact.



MANAGEMENT AND MAINTENANCE

Proper management is necessary to maintain healthy, competitive plants that perform the desired function. This is as important as the initial planting to ensure rehabilitation of the riparian area. Some maintenance is expected on-site for several years after planting. For the first few years after planting, vegetation should be evaluated and monitored annually, or after any flood event. Some replanting may be needed in succeeding years in order to insure the establishment of a functioning riparian corridor.

Monitoring of the site is necessary to detect any in-stream dead organic material (i.e. old logs, dead root masses, branches, etc.). In-channel organic material may cause erosive cross currents that can erode a planted streambank. If this condition develops, the organic material should be removed or repositioned. Any trimming of cuttings should be done in the dormant season so growth will not be slowed during the growing season. During the establishment period, leave standing dead branches within the plantings to reduce stream flow velocities, thus protecting the established plantings.

REFERENCES

Bratton, T.L. 1998. Tree Planting Guide. Kansas State University.

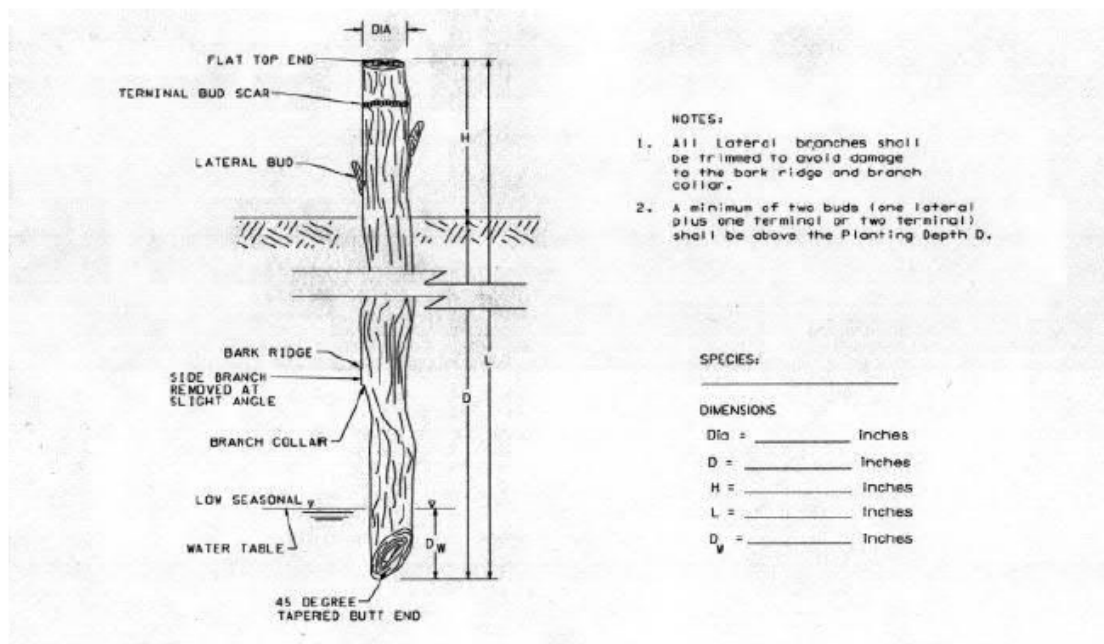
McCullah, John. Environmentally-Sensitive Streambank Stabilization. CD-ROM. Redding, CA. 2005. Salix Applied Earthcare.

Schaff, S.D., S.R. Pezeshki, and F.D. Shields, Jr. 2002. Effects of Preplanting Soaking on Growth and Survival of Black Willow Cuttings. *Restoration Ecology* 10:267-274.

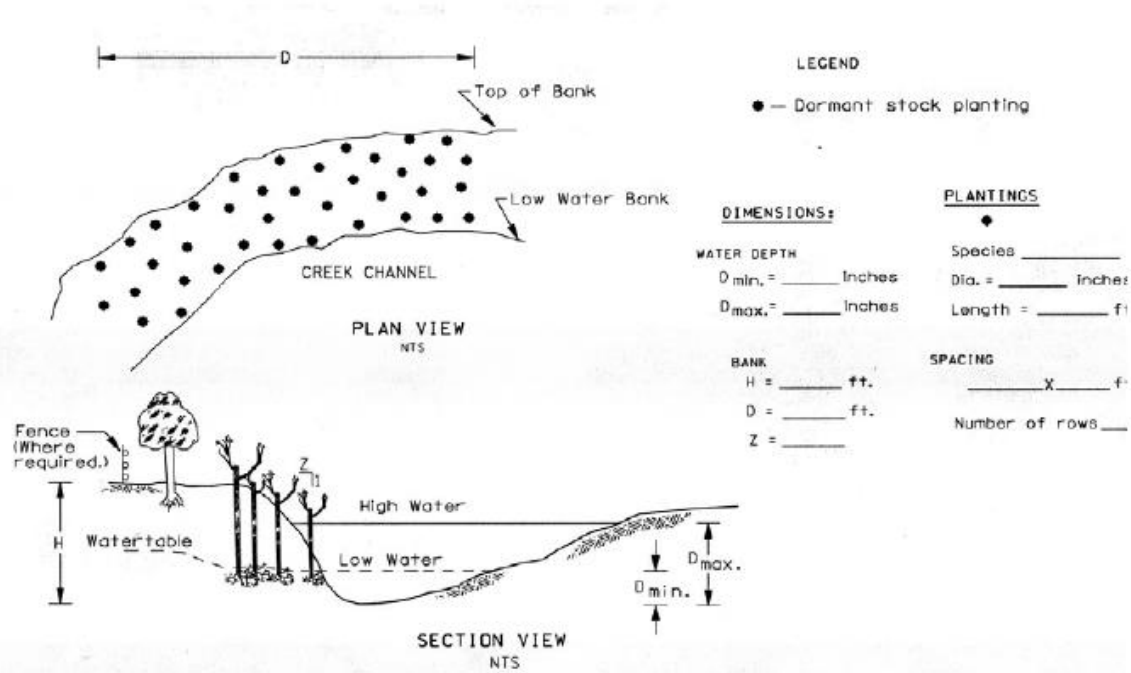
USDA, NRCS. 1995. Collecting Willow, Poplar and Redosier Dogwood Hardwood Cuttings for Riparian Site Plantings. Wayne Crowder. Plant Materials Technical Note – 29. Spokane, Washington.

USDA, NRCS. Part 650. Engineering Field Handbook, Chapter 16. Streambank and Shoreline Protection. 1996. 62 pp.

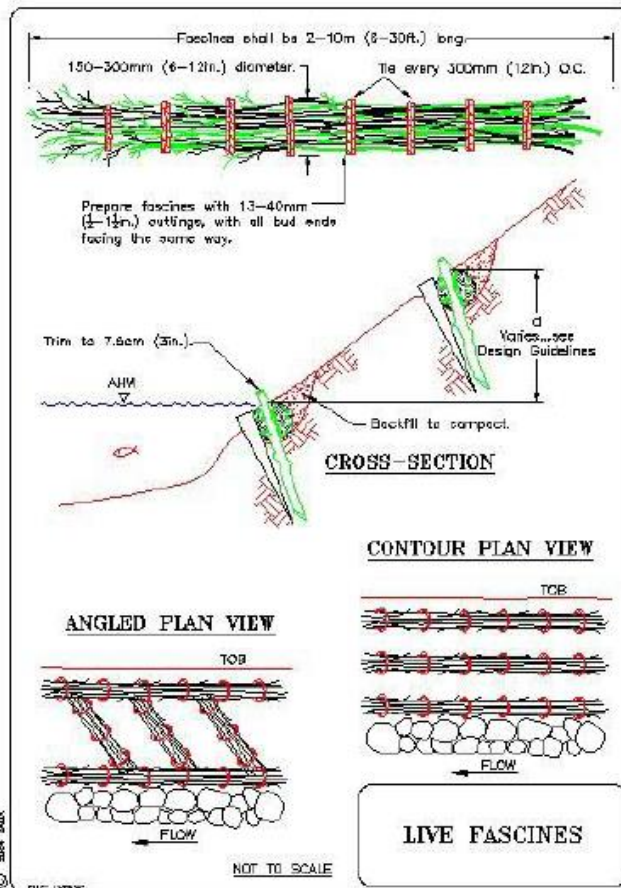
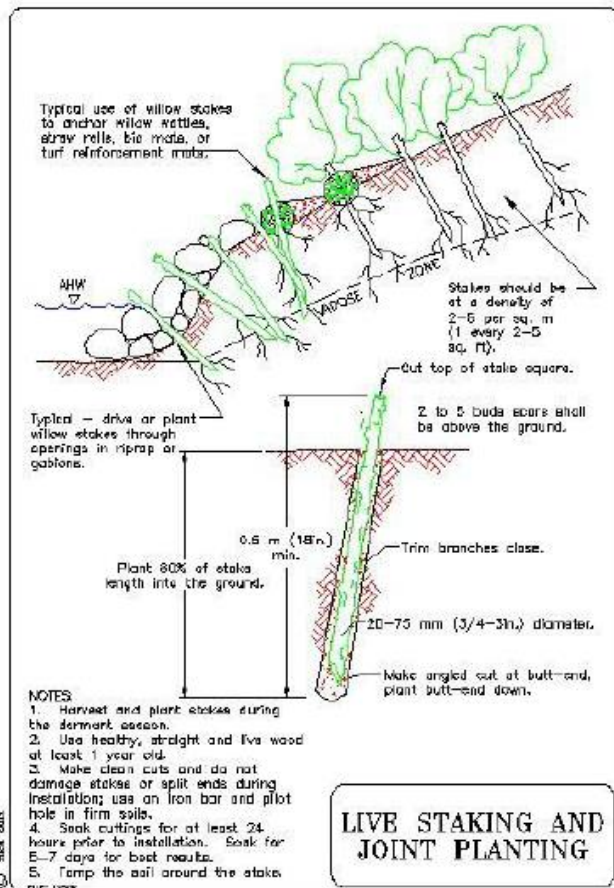
USDA, NRCS. 1998. The Practical Streambank Bioengineering Guide. Bentrup, Gary and J. Chris Hoag. Interagency Riparian / Wetland Plant Development Project. 150 pp.



Source – USDA – Soil Conservation Service



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