



REGIONAL DISTRICT OF CENTRAL KOOTENAY
DEVELOPMENT PERMIT
DP19013D (Ramirez)

Date: November 24, 2020

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

1. This Development Permit is issued to Arnoldo Antonio Ramirez Mora and Maria Del Pilar Ramirez-Portela of Rossland, BC as the registered owners (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 4, District Lot 7386, Kootenay District, Plan 10684 (PID 011-805-391) 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 ‘Watercourse Development Permit Area’ and are located within a Development Permit Area pursuant to Electoral Area ‘D’ Comprehensive Land Use Bylaw No. 2435, 2016.
5. The Permittee has applied to the Regional District of Central Kootenay to construct a single-family dwelling built on the original, pre-existing foundation and to use land and buildings situated on the said lands for residential purposes. 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 related construction works for the single family dwelling, construction of a gravel pathway from the house to the east property edge with circular gravel pad, and vegetation clearing and land works for the installation of electrical utilities and a water line.
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 Development is authorized in accordance with the terms described in the report titled, “Riparian Assessment Report: 5336 Amundsen Road, Kaslo” prepared by Keefer Ecological Services Ltd. dated November 2, 2020, attached to this permit as Schedule 3, including:
 - i. The 30 m WDPA shall be marked with flagging or snow fencing to protect from further encroachment during construction. No machines shall operate below the top of bank.

- ii. A SPEA of 10 m shall be retained and marked permanently with wooden stakes or similar, and no additional vegetation removal or construction is permitted in this area with the exemption of works required to enact the Remediation Plan included in Schedule 3;
 - iii. All activities in the Communication Plan included in Schedule 3 must be undertaken;
 - iv. All activities in the Remediation Plan included in Schedule 3 must be undertaken;
 - v. New and known species of invasive plants found colonizing disturbed areas shall be removed by hand and disposed of; and,
 - vi. No works are authorized on the foreshore.
- 6.2 A building permit shall be required prior to any construction involving land in this location at which time the Permittee shall be required to address sewage disposal issues to the satisfaction of the Interior Health Authority and Regional District of Central Kootenay Senior Building Official.
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 **\$1912.00** to ensure the landscaping 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 **November 24, 2022**. Within this time period the required landscaping must be inspected and approved by the Regional District.
 - 7.3 The Permittee shall obtain a one site assessment per growing season by a qualified person for two growing seasons to ensure the monitoring requirements outlined in Schedule 3 are followed.
 - 7.4 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.
 - 7.5 If the landscaping is approved within this time period without the Regional District having to draw on the Letter of Credit, 90% of the original amount of the Letter of Credit shall be returned to the Permittee.
 - 7.6 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.

ssudan

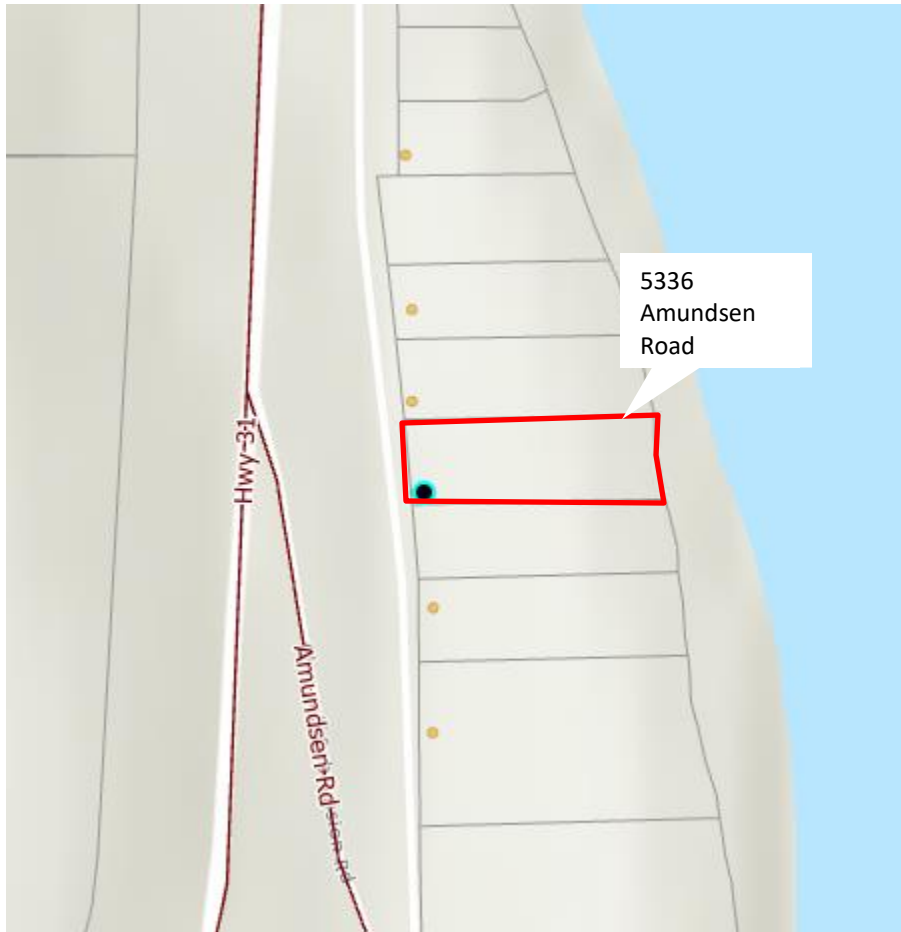
Sangita Sudan, General Manager of Development Services

November 24, 2020

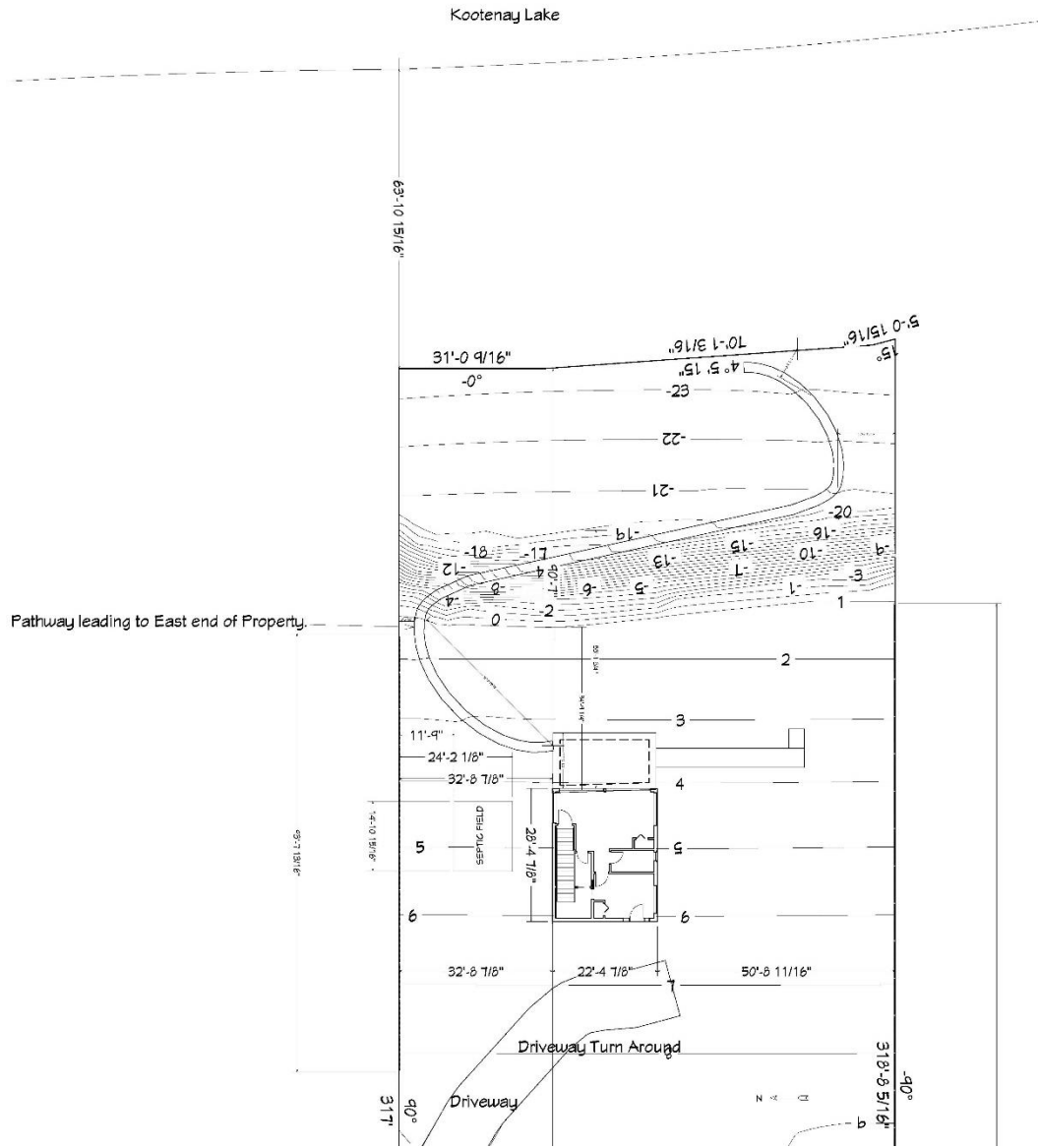
Date of Approval (date of review and approval)

Date of Issuance (pending receipt of securities)

Schedule 1: Subject Property



Schedule 2: Site Plan



Schedule 3: Qualified Environmental Professional's Report

Riparian Assessment Report

5336 Amundsen Road, Kaslo

Jessica Lowey, MSc, PAg

Michael Keefer, MSc, PAg

Virginia Hermanson, MSc

11/2/2020



Keefer Ecological Services Ltd.

3816 Highland Road

Cranbrook, BC V1C 6X7

(250) 489-4140

www.keefereco.com

Executive Summary

The assessed property is located at 5336 Amundsen Road, Mirror Lake (Kaslo); on the west shore of Kootenay Lake. This report has been prepared for the Regional District of Central Kootenay (RDCK) as a pre-condition of the issuance of a building permit. This report is included as part of a Development Permit, as required under section 920 of the Local Government Act, and will be filed on the title of the assessed property. The report has been prepared for and at the expense of the owner of the assessed property. The authoring Qualified Environmental Practitioner (QEP) has not acted for or as an agent of the RDCK.

The assessment followed the Simple Assessment methodology as described in the Riparian Areas Protection Regulation (BC Reg. 178/2019). The SPEA width for this Simple Assessment is 10 m, given the width of the ravine (the east and west shores of Kootenay Lake). It is important to note that access upstream and downstream of the assessed property was not possible as all adjacent lands are privately owned; as a result, the assessment relied heavily upon the use of orthophotographs coupled with on-site observations. However, estimating distances from the roadside and observing neighbouring properties from the assessment property resulted in the conclusion that at every 40 m interval, the first permanent structure appeared to be less than 10 m from the TOB. On all observed properties, the TOB was greater than 30 meters from the HWM.

To remediate impacts to the SPEA on the assessed property, communication and remediation plans have been prescribed. Monitoring will also be implemented to ensure that remediation goals are being achieved in the next two growing seasons.

Table of Contents

Executive Summary.....	i
Property Description.....	4
Existing and Planned Development.....	4
Riparian Area Assessment.....	5
1. Methodology.....	5
1.1. Determining Vegetation Category.....	5
1.2. Determining Fish Bearing Status.....	7
1.3. Determining Stream Permanence.....	7
1.4. Calculating SPEA Width.....	7
2. Fisheries Resource Values.....	7
Determination of SPEA Width.....	8
Discussion of Existing and Potential Impacts.....	11
Proposed Remediation Measures.....	12
3. Communication Plan.....	12
4. Remediation Plan.....	13
Monitoring.....	23

List of Tables

Table 1. Kootenay Lake shoreline habitat assessment summary (Kootenay Lake Partnership, 2020).	8
Table 2. Site-specific determination of SPEA width.....	8
Table 3. Summary of remediation and revegetation plan.....	22

List of Figures

Figure 1. Assessment area derived from a preliminary desktop exercise (pre-field) using air photo interpretation.....	6
Figure 2. Determining SPEA widths for the Simple Assessment.....	7
Figure 3. Overview map of the assessed property following the in-field inspection.	10
Figure 4. Detailed map of the assessed property with revegetation zones identified.....	14
Figure 5. Evidence of natural revegetation occurring in Zone 3.....	15

Figure 6. Vegetative reference conditions at the high-water mark on adjacent property to the south of the assessed property..... 16

Figure 7. Young Scotch broom plant pulled during site survey, likely from pit-run fill material..... 17

Figure 8. Zone 2 tree negatively affected by fine gravel substrate. 18

Figure 9. CWD to be used for slope stability in Zone 3, with residual debris used in Zone 6 and Zone 2.. 19

Figure 10. Natural ingress of blackcap raspberry (*Rubus leucodermis*) and thimbleberry (*Rubus parviflorus*) in Zone 3. 19

Figure 11. Example of moss divot to be transplanted in the cut-bank along the Zone 4/5 boundary, and throughout Zone 5. 20

Figure 12. CWD from Zone 3 to be situated on Zone 6 hill prior to topsoil placement. 21

Figure 13. Slope of Zone 6 to be improved with CWD anchoring, slope texturing, and possible soil bioengineering using willow. 21

Property Description

The assessed property is approximately 0.3 hectares (ha) and is located at 5336 Amundsen Road, Mirror Lake (Kaslo); on the west shore of Kootenay Lake. The legal description for the assessed property is Lot 4 Plan NEP10684 District Lot 7386 Land District 26 (Kootenay). The Parcel Identification number (PID) is 011-805-391. The current owners of the assessed property are Arnolito Ramirez and Pilar Portela, who purchased the property in June 2019.

Existing and Planned Development

The proposed development is for the construction of a new single-family residential dwelling and associated landscaped features (e.g., pathway, firepit, beach area) on a steep, east-facing lot on the west shore of Kootenay Lake (watershed code 340). The average slope from the lake shore to the first significant slope break, or top of bank (TOB), is greater than 3:1 (~60%), at which point the slope lessens to less than 3:1 (~12%).

The existing parcel contains a single-family dwelling. The new dwelling is built on the original, pre-existing foundation. There is a septic tank immediately north of the dwelling; it is located approximately in line with the TOB. Brush clearing and tree removal has occurred in the northwest corner of the property in accordance with the Fire Smart program, as communicated by the developer. On the east side (lake side) of the property, a pre-existing wooden staircase was removed and replaced by a newly constructed gravel pathway to access the shoreline. This feature is entirely located within 30 meters (m) of the high-water mark (HWM). The pathway was predominantly created with materials from the property (e.g., rocks). The pathway ends approximately 7 m from the HWM. At approximately 12 m from the HWM, along the pathway, a circular gravel pad and temporary fire pit has been constructed. There is an electrical box located 14 meters from the HWM, southeast of the dwelling and along the gravel pathway. The pre-existing electric box has been repaired to meet the current electrical code. The main water supply line (intake) for the dwelling is located underground and extends from the lake to the dwelling. Both the aforementioned electrical and water services for the dwelling are located in a trench beneath the gravel pathway, as was required by electrical and building codes.

The shoreline of the assessed property and adjacent properties were observed to have modified shoreline rocks in such a way as to create small, U-shaped wave protection areas perpendicular to the lakeshore.

Construction commenced in November 2019, and is currently ongoing. The proposed end date is November 2020.

Riparian Area Assessment

1. Methodology

The assessment followed the Simple Assessment methodology as described in the Riparian Areas Protection Regulation (BC Reg. 178/2019). The Simple Assessment establishes Streamside Protection and Enhancement Area (SPEA) widths based on certain stream characteristics – fish-bearing status, nature of stream flows, and the status of streamside vegetation. These widths have been established for the protection of fish habitat while taking into consideration existing development (i.e., permanent structures).

1.1. Determining Vegetation Category

The vegetation category is assessed within a 30 m wide area starting from the middle of the assessed property and going 200 m both upstream and downstream along the bank where the development will occur. Within the 30 m and 200 m assessment boundaries, the distance from the TOB to the first permanent structure was estimated at 40 m intervals (Figure 1). An air photo was used to undertake this measurement prior to inspecting the site in person. An air photo of sufficient resolution was not available and permission to complete ground transects along neighbouring properties was not obtained. For this assessment, distances from permanent structures to the TOB were estimated from the assessed property or along the public access road (Amundsen Road).



Figure 1. Assessment area derived from a preliminary desktop exercise (pre-field) using air photo interpretation.

1.2. Determining Fish Bearing Status

Fish bearing streams are ones in which fish are present or potentially present if introduced obstructions could be made passable. Using publicly available information on the waterbody, the fish bearing status of Kootenay Lake was confirmed. The following sources of information were consulted:

- iMapBC Fresh Water Atlas
- BC Habitat Wizard
- Kootenay Lake Shoreline Inventory Mapping

1.3. Determining Stream Permanence

Stream flow permanence is a factor only in determining a SPEA on non-fish-bearing streams.

1.4. Calculating SPEA Width

Using the three aforementioned characteristics, SPEA width is determined using Figure 2. **It is important to note that for ravines greater than 60 m wide, the SPEA is 10 m beyond the TOB.** The Riparian Areas Protection Regulation (BC Reg. 178/2019) defines the top of ravine bank as the first significant break in ravine slope (greater than 3:1) where the break occurs such that the grade beyond the break is flatter than 3:1 for a minimum of 15 m measured perpendicularly from the break, and the break does not include a bench within the ravine that could be developed.

Vegetation Category	Existing or potential streamside vegetation conditions	Streamside Protection and Enhancement Area Width*		
		Fish bearing	Non-Fish bearing	
			Permanent	Non Permanent
1	Continuous areas ≥ 30 m or discontinuous but occasionally > 30 m to 50 m	30 m		Minimum 15 m Maximum 30m Refer to Figure 2-2
2	Narrow but continuous areas = 15 m or discontinuous but occasionally > 15 m to 30 m	Minimum 15 Maximum 30 Refer to Figure 2-2	15 m	
3	Very narrow but continuous areas up to 5 m or discontinuous but occasionally > 5 m to 15 m	15 m	Minimum 5m Maximum 15 m Refer to Figure 2-3	

Figure 2. Determining SPEA widths for the Simple Assessment.

2. Fisheries Resource Values

Kootenay Lake is a fish bearing waterbody that is managed for angler use. Kootenay Lake supports many different fish species, both native and invasive. Species present include longnose dace, torrent sculpin, rainbow trout, kokanee, slimy sculpin, brook trout, mountain whitefish, redbside shiner, peamouth chub, northern pikeminnow, bull trout, white sturgeon, pygmy whitefish, yellow perch, burbot, westslope cutthroat trout, longnose sucker, leopard dace, largescale sucker, prickly sculpin, bridgelip sucker, lake whitefish, dolly varden, carp, pumpkinseed, and largemouth bass. Known key fish habitat present in Kootenay Lake includes spawning, rearing, living and foraging, and migration corridors.

The shoreline at the assessed property is gravelly. There was no woody debris observed along the shoreline below the HWM. This observation is consistent with adjacent properties. Above the HWM (~5 m) some woody debris piles were observed and were noted to be a result of the construction activities at the site. There were no pools, turbulent water features (e.g., riffles, cascades), boulders, undercut banks or in-stream vegetation observed along the shoreline of the assessed property or adjacent properties. The Kootenay Lake Shoreline Guidance Document (Kootenay Lake Partnership, 2020) assessed the same segment of shoreline as having no evidence or low potential for aquatic habitat for the species listed in Table 1, with the exception of juvenile rearing habitat.

Table 1. Kootenay Lake shoreline habitat assessment summary (Kootenay Lake Partnership, 2020).

Habitat Assessed	Habitat Potential	Habitat Assessed	Habitat Potential
White sturgeon spawning	No	Red- or Blue-listed species	No
Bats	No	Fish staging	No
Raptors	No	Fish migration	No
Heron	No	Salmon spawning	No
Nests	No	Juvenile rearing	High
Amphibians	No	Kokanee spawning	No

The riparian area vegetation of the assessed property and adjacent properties is predominantly conifer forest (with some deciduous species) which extends to the HWM but does not overhang the waterbody. Much of the riparian area vegetation on the assessed property and neighbouring properties has been modified through clearing activities.

Determination of SPEA Width

The SPEA width for this Simple Assessment is 10 m (Table 2), given the width of the ravine (the east and west shores of Kootenay Lake). It is important to note that access upstream and downstream of the assessed property was not possible as all adjacent lands are privately owned; as a result, the assessment relied heavily upon the use of orthophotographs coupled with on-site observations.

Table 2. Site-specific determination of SPEA width (assessed property highlighted).

Segment Assessed	Distance to First Permanent Structure
1	< 10 m
2	< 10 m
3	< 10 m
4	< 10 m
5	< 10 m
6	3 m

Segment Assessed	Distance to First Permanent Structure
7	< 10 m
8	< 10 m
9	< 10 m
10	< 10 m
11	< 10 m
12	< 10 m
Total	< 10 m

As per the Assessment Methods, the vegetation category was assessed within a 30 m area starting from the middle of the property and going 200 m both upstream and downstream on the bank. Every 40 m, beginning at the midpoint of the lot, the distance from the TOB to the first permanent structure was measured to determine the SPEA width. As noted, the full assessment could not be conducted in the field due to access limitations on private property, with the exception of the assessed property. Furthermore, current aerial imagery with sufficient resolution was not available to measure from the TOB to the first permanent structure due to dense tree cover along the TOB. However, estimating distances from the roadside and observing neighbouring properties from the assessment property resulted in the conclusion that at every 40 m interval, the first permanent structure appeared to be less than 10 m from the TOB. On all observed properties, the TOB was greater than 30 meters from the HWM.

As for the assessed property, the TOB ran diagonally through the parcel (from south to north), with approximately 7 m to the first permanent structure (concrete foundation) on the south side of the property and 0 m from the TOB to the first permanent structure (concrete foundation and septic tank) on the north side (Figure 3). Other permanent structures within 30 m of the TOB included a telephone pole (approximately 25 m from TOB). The average slope from the TOB to the first permanent structure was less than 12 degrees. The average slope from the TOB to the bottom of the bank was approximately 65 degrees.



Figure 3. Overview map of the assessed property following the in-field inspection.

Disturbances within 30 m of the high-water mark include:

- Electrical box (~14 m)
- End of the gravel pathway leading down from the house (~7 m)
- Gravel pad for sitting area (~12 m)
- A portion of the gravel pathway leading to/from the house

Vegetation within the riparian area includes:

- Douglas fir
- Western red cedar
- paper birch
- Douglas maple
- red osier dogwood
- cottonwood
- green alder
- willow species
- spotted knapweed (invasive; provincially noxious)
- aster species
- oxeye daisy
- rose species

Discussion of Existing and Potential Impacts

Prior to purchasing the assessed property in 2019, the property was littered with waste. In an attempt to clean up the property prior to initiating construction of a new dwelling on the existing foundation, the current owners caused limited soil disturbance above and below the TOB. As a result of necessary upgrades to electrical and water services for the property, services were buried between the lake shore and the dwelling at the TOB, causing further disturbance to the riparian area (ground disturbance and vegetation clearing). These services currently lie beneath the constructed gravel pathway.

The riparian area vegetation observed in the area is predominantly conifer forest (with some deciduous species) which extends to the HWM but does not overhang the waterbody. Much of the riparian area vegetation on the assessed property and neighbouring properties has been modified through clearing activities. The shoreline of the assessed property and adjacent properties were observed to have modified shoreline rocks in such a way as to create small, U-shaped wave protection areas perpendicular to the lakeshore. This disturbance occurred prior to the purchase of the property by the current owners.

The aquatic habitat type most likely to occur along this segment of the shoreline is juvenile rearing habitat which has high value and sensitivity (Kootenay Lake Partnership, 2020). Rearing habitat are areas outside of primary spawning habitats where juvenile fish feed, seek shelter and grow (Cooney et al, 2003). These habitats are commonly characterized by the presence of pools, large woody debris, boulder cover, and overhead cover (Johnston & Slaney, 1996); none of which were observed along the segment of shoreline for the assessed property. Vegetation clearing can also impact the aquatic habitat by potentially increasing the erosion and sedimentation potential along the shoreline. Impacts to the terrestrial environment as a result of vegetation clearing may also include the loss of bird, amphibian, reptile and small mammal habitat.

Evidence of impacts to aquatic and terrestrial habitats exist predominantly in the form of vegetation clearing (current) and the alteration of the gravel substrate of the shoreline (historic); however, no evidence of ongoing impacts (e.g., erosion or sedimentation concerns) was observed, although the potential exists until the riparian area is revegetated.

Proposed Remediation Measures

3. Communication Plan

Personnel participating in revegetation efforts, subsequent construction, and follow-up monitoring, should be made aware of remediation and conservation priorities at the assessed property. This is particularly relevant for work happening in the SPEA, with consideration for the potential juvenile rearing habitat adjacent the assessed property (Kootenay Lake Partnership, 2020). Machine operators should be advised to avoid working below the TOB, however if necessary, operators should take precautions to avoid impacting bank stability and to work above the high-water mark. If bank stability becomes an issue during restoration activities, silt fencing should be installed as a short-term solution to avoid sediment loading in Kootenay Lake.

In addition, cleaning procedures should be implemented for all incoming equipment, including footwear, to avoid the introduction of both terrestrial and marine invasive plant species. This is particularly important during the revegetation process before grasses have established as recently disturbed soils are highly vulnerable to invasion. Personnel working on the assessed property should receive the tools required to identify potential invasive species for treatment. In particular, Scotch broom (*Cytisus scoparius*), spotted knapweed (*Centaurea stoebe*), and bull thistle (*Cirsium vulgare*) have been observed on site and should be controlled. Lastly, training on live stake and seedling maintenance and watering will be provided to the property owners following revegetation to aid in reaching survivorship targets.

4. Remediation Plan

The overall goal of the remediation plan for the assessed property is the establishment of native species, and the development of a more heterogeneous structural landscape to provide important terrestrial-riparian habitat components. In addition, the establishment of well rooted vegetation should mitigate erosion and reduce sedimentation potential in the SPEA. An overview of the proposed revegetation zones on the assessed property is provided in Figure 4.

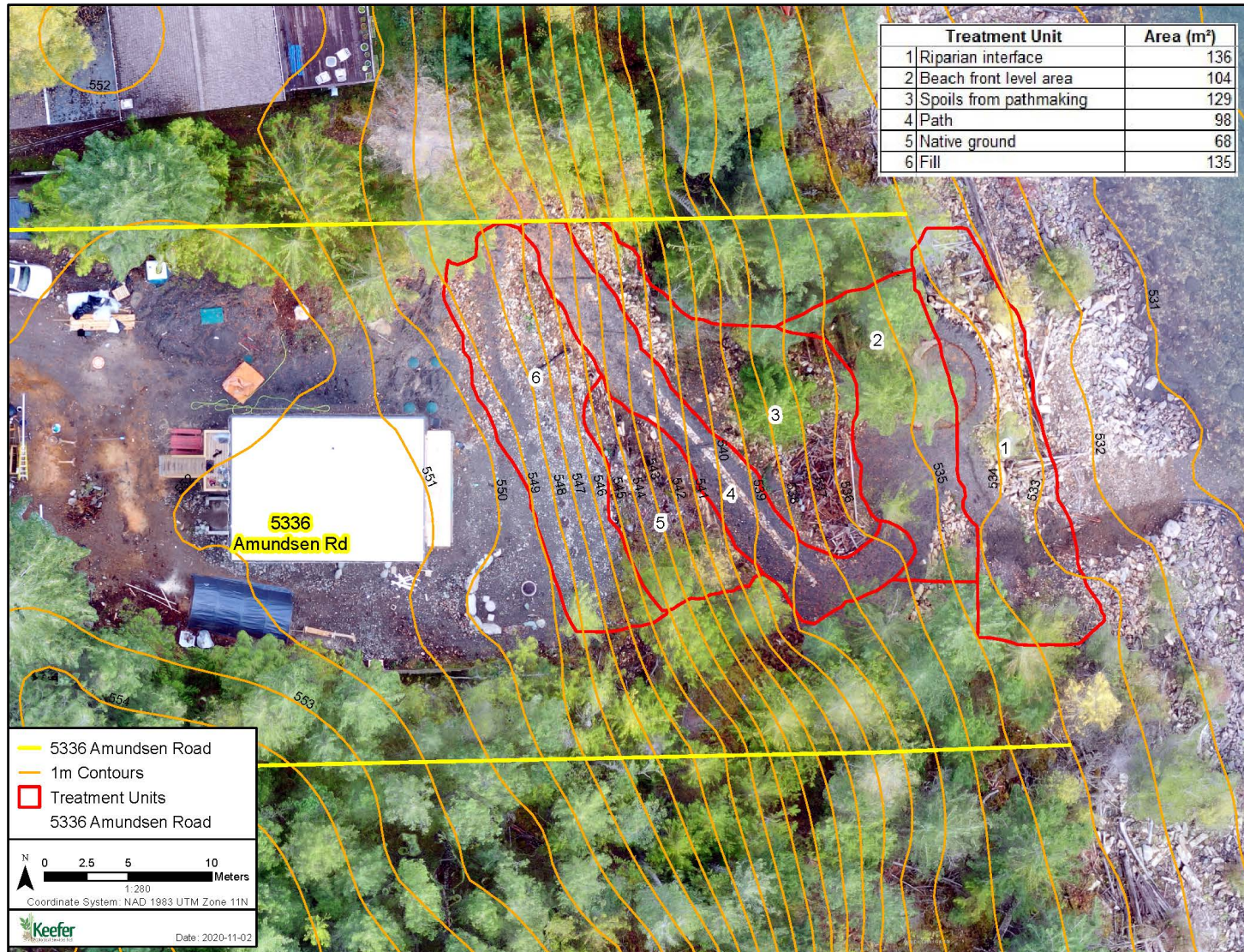


Figure 4. Detailed map of the assessed property with revegetation zones identified.

A site survey completed by Michael Keefer of Keefer Ecological Services Ltd. on September 28, 2020, indicated that extensive natural revegetation should be expected on the site (Figure 5). In order to accelerate the restoration process, the following revegetation plan is recommended. It should be noted that the site will be deliberately over-planted to account for expected mortality of juveniles, and over-seeded to account for dispersal and failed germination of native grass seeds.



Figure 5. Evidence of natural revegetation occurring in Zone 3.

Figure 6 illustrates a reference condition at the high-water mark on the adjacent property to the south, including established flood-resistant vegetation as well as mixed size and quality of rock and wood litter, including coarse wood debris (CWD).



Figure 6. Vegetative reference conditions at the high-water mark on adjacent property to the south of the assessed property.

Surveying of the site revealed the presence of the following invasive plant species, all of which are characteristic of disturbed sites: Scotch broom, spotted knapweed, and bull thistle. Figure 7 shows a pulled Scotch broom plant from the site survey, which suggests the pit-run infill material was likely contaminated with Scotch broom seeds. This species is of particular concern as seeds can remain viable in the seed bank for many years (Bossard, 1993). In addition, both Scotch broom and spotted knapweed are allelopathic, meaning they can have direct negative effects on adjacent plants. The presence of these three species will be controlled as part of site management activities to ensure restoration goals are achieved.



Figure 7. Young Scotch broom plant pulled during site survey, likely from pit-run fill material.

The riparian interface (Zone 1, Figure 4) is composed of coarse rock fragments with pockets of finer rock material. Cottonwood (*Populus balsamifera*), red osier dogwood (*Cornus sericea*), and willow (*Salix sp.*) live stakes, in addition to five mountain alder (*Alnus tenuifolia*) juveniles should be planted at 1.5 m spacing throughout the Zone, as dictated by acceptable substrate. The exact species mix for the live stakes will be determined based on availability and should not affect the restoration outcomes. The prescribed grass seed mix contains 52% bluebunch wheatgrass (*Pseudoroegneria spicata*), 25% Idaho fescue (*Festuca idahoensis*), and 23% prairie junegrass (*Koeleria macrantha*). Zone 1 should be lightly seeded, with a density of 500 pure live seed grass seeds per square metre, which accounts for potential seed loss due to runoff. Lastly, the portion of the concrete pad extending into Zone 1 will be removed.

Moving upslope towards the TOB, Zone 2 (Figure 4) will be planted with two Douglas fir (*Pseudotsuga menziesii*) and three paper birch (*Betula papyrifera*) juveniles. The prominent Douglas fir tree in Zone 2 (Figure 8) was observed to be negatively impacted by the fine gravel substrate layer surrounding its stem. The fine material will be removed until the natural ground level is uncovered immediately around this tree in order to reduce this unnecessary stress. The existing gravel pad will be reduced in size and the site naturalized through revegetation efforts.



Figure 8. Zone 2 tree negatively affected by fine gravel substrate.

In Zone 3, moving further upslope towards the TOB (Figure 4), coarse woody debris (CWD; Figure 9) should be anchored into the slope to provide stability, with additional CWD being used similarly in Zone 6 and placed throughout Zone 2. Natural regeneration of numerous species including wild rose (*Rosa* sp.), is already occurring in Zone 3 (Figure 10), which will be supplemented with two chokecherry (*Prunus virginiana*) juveniles, and two Douglas fir juveniles. All of Zone 3 should be lightly seeded with the prescribed grass mix (500 seeds/m²).



Figure 9. CWD to be used for slope stability in Zone 3, with residual debris used in Zone 6 and Zone 2.



Figure 10. Natural ingress of blackcap raspberry (*Rubus leucodermis*) and thimbleberry (*Rubus parviflorus*) in Zone 3.

The walking path that runs through Zone 4 (Figure 4) needs to be narrowed to approximately one metre width. Moss divots (Figure 11) from on-site should be transplanted to shady patches of the uphill cut slope along the boundary between Zones 4 and 5. In addition, red osier dogwood should be planted along the cut slope to support slope stability. On the fill side of the path five kinnikinnick (*Arctostaphylos uva-ursi*) plugs should be planted in the sunny top 15 metres of the fill. Zone 5 (Figure 4) consists primarily of a rockface. Only light grass seeding (500 seeds per square metre) and transplantation of moss divots (Figure 11) will occur as dictated by available substrate.



Figure 11. Example of moss divot to be transplanted in the cut-bank along the Zone 4/5 boundary, and throughout Zone 5.

The overarching objective for Zone 6 (Figure 4) is to maintain vegetation compliance with FireSmart BC guidelines. As such, this zone will be revegetated primarily with shrubs, with the exception of three western larch (*Larix occidentalis*) seedlings. Shrub species selection is targeted towards attracting pollinators and consists of eight Saskatoon berry (*Amelanchier alnifolia*), two ocean spray (*Holodiscus discolor*), and two mock orange (*Philadelphus lewisii*) shrubs. As the site was levelled using pit-run gravel, the soil is likely highly xeric and topsoil will need to be applied throughout the Zone to support shrub and tree establishment. Prior to application of topsoil, CWD from Zone 3 (Figure 12) should be placed on the hill (Figure 13) to improve slope stability and help reduce erosion potential. Topsoil should be applied to a depth of 15 cm across the zone, with a depression in the pit-run established around each

plant such that the topsoil depth will be 30 cm. Light grass seeding should also be completed throughout Zone 6 following topsoil application. Adding a modified brush layer as well as willow staking may be organized by a sub-contractor at a later date.



Figure 12. CWD from Zone 3 to be situated on Zone 6 hill prior to topsoil placement.



Figure 13. Slope of Zone 6 to be improved with CWD anchoring, slope texturing, and possible soil bioengineering using willow.

To support successful establishment of vegetation, all live stakes of cottonwood, dogwood, and willow should be planted in fall 2020. The remaining shrubs and juvenile trees should be planted as container stock in spring 2021. In addition, we recommend delaying topsoil placement until spring 2021 in order to avoid erosion potential due to snowmelt. A summary table of all prescribed remediation activities can be found below (Table 3).

Table 3. Summary of remediation and revegetation plan.

ZONE	ACTION	DETAILS
1	Plant live stakes	Plant cottonwood, dogwood, and willow live stakes at 1.5m spacing in fall 2020. Approximately 70 cuttings, exact species mix TBD.
1	Plant container stock	Plant 5 mountain alder in spring 2021.
1	Light grass seeding	Seed prescribed grass mix using approximately 500 seeds per square metre.
1	Remove concrete pad	Section of concrete pad in the riparian interface zone needs to be removed.
2	Plant container stock	Plant 2 Douglas fir and 3 paper birch in spring 2021.
2	Uncover natural ground around prominent tree	Remove fine gravel substrate from around stem of prominent tree (Figure 8).
2	Place CWD throughout	Excess CWD from Zone 3 should be distributed randomly throughout Zone 2.
2	Potential further modifications	Pending confirmation of private land boundary.
3	Anchor CWD in slope	Place CWD from this zone into slope to provide increased stability.
3	Plant container stock	Plant 2 chokecherry and 2 Douglas fir in spring 2021.
3	Light grass seeding	Seed prescribed grass mix using approximately 500 seeds per square metre.
4	Narrow walking path	Manually narrow walking path to one metre width.
4	Plant live stakes	Plant dogwood live cuttings on cut slope in fall 2020.
4	Plant container stock	Plant 5 kinnikinnick in the sunny top 15m of the fill side of the path in spring 2021.
4/5	Transplant moss divots	Transplant moss divots from onsite to shady patches of the up-hill cut slope along the Zone 4/5 boundary.
5	Light grass seeding	Seed prescribed grass mix using approximately 500 seeds per square metre.
5	Transplant moss divots	Transplant moss divots from onsite to available substrate patches.
6	Anchor CWD in slope	Place CWD from Zone 3 into slope prior to application of topsoil to provide increased stability.
6	Plant container stock	Plant 3 larch, 8 saskatoon berry, 2 ocean spray, and 2 mock orange in Spring 2021.

6	Apply topsoil	Apply 15 cm depth of topsoil throughout zone, with depressions created around each plant prior to application such that topsoil depth will be 30 cm around plants. Apply in Spring 2021.
6	Light grass seeding	Seed prescribed grass mix using approximately 500 seeds per square metre.
6	Potential further modifications	Addition of a modified brush layer and willow staking may be organized at a later date.

Monitoring

Monitoring of the site is recommended to take place for two growing seasons following completion of the revegetation plan. It should consist of one site assessment per growing season by a qualified person. The targeted survivorship rates are as follows and are based on observations of adjacent intact vegetation:

- 50% survival of live stakes in year 1, 25% survival in year 2.
- 50% survival of Douglas fir and western larch.
- 75% survival of Saskatoon.
- 40% grass cover in the lightly seeded zones (1, 3, 5, 6).

Monitoring for Scotch broom, spotted knapweed, and bull thistle will also take place. The absence of Scotch broom and spotted knapweed in years 1 and 2 is a priority as they can negatively affect the establishment of the targeted native plant species. Species identification support and removal processes will be provided to the property owners as per the communication plan.