

Change Approval Application Number: 100403050 (Changes In and About a Stream)

DATE: March 15, 2023

TO: FrontCounter BC

FROM: Chloe Slomowitz

Re: Supplementary Information to Support Change Approval Application Number 100403050 for Kenyon Creek and Flume Creek Culvert and Bank Stabilization Works

The Ministry of Transportation and Infrastructure (MOTI) retained PGL Environmental Consultants (PGL) to prepare regulatory approval applications for the MOTI's permanent culvert and stream bank stabilization works at three roadway stream crossing sites within the Sunshine Coast Regional District (SCRD). The first stream crossing site is where Kenyon Creek crosses under Redroofs Road, the second is where Flume Creek crosses under Margaret Road, and the third is where Flume Creek crosses Beach Avenue. Refer to Table A below for a summary of road names, stream names, and site location details. An overview map of the three sites is attached to the Change Approval application (refer to Appendix 1 – Site Location Crossing Culverts SCRCD).

Table A: Road Names (Site Names), Stream Names, Municipality within the SCRCD, and Site Coordinates

Road Name (Site Name)	Stream Name	Location within SCRCD	Site Coordinates
Redroofs Road	Kenyon Creek	Sechelt, BC	Lat: 49.4803320
			Long: -123.8554920
Margaret Road	Flume Creek	Robert's Creek, BC	Lat: 49.4314860
			Long: -123.6693050
Beach Avenue	Flume Creek	Robert's Creek, BC	Lat: 49.4314860
			Long: -123.6693050

1.0 BACKGROUND

Widespread flooding from an atmospheric rain event in November 2021 led to culvert capacity exceedances, washouts, and significant erosion at several road-crossing culverts throughout the SCRCD. The Redroofs Road, Margaret Road, and Beach Avenue sites all required emergency repair works shortly following the flooding event to restore the roadways to working order. The emergency repair works (described in the subsection below) were intended to be temporary measures to promptly restore road functionality until the site-specific permanent design plan for each site's culvert replacement and bank stabilization works were established. This Change Approval application is to seek regulatory approval for the permanent design scopes of work required at the three sites (Redroofs Road, Margaret Road, and Beach Avenue [the Project]). The Project will be completed as part of the provincial Disaster Financial Assistance Arrangements (DFAA) work underway across southern BC in response to the Fall 2021 floods. DFAA requires the Project design to mirror pre-disturbance conditions.

1.1 Redrooffs Road Background

At the Kenyon Creek crossing under Redrooffs Road, the November 2021 heavy rainfall events resulted in the existing 900mm circular concrete culvert being plugged by debris, and high flow volumes that overtopped the road (refer to Appendix 2 – Kenyon Site Photographs). To alleviate the flooding and restore the road to a functional state, temporary emergency works were conducted until a permanent design solution could be established. Emergency works were conducted during the rainfall events, and consisted of:

- Installing five temporary culverts:
 - One 900mm-diameter, circular, corrugated steel pipe (CSP) culvert;
 - Three 600mm-diameter, circular, corrugated, dual-walled, high-density polyethylene (HDPE) culverts; and
 - One 400mm-diameter, circular, corrugated, dual-walled HDPE culverts.
- Placing riprap along both sides of the roadway embankment to provide erosion protection.

In August 2022, the MOTI and PGL submitted a Notification of Authorized Changes in and About a Stream (Tracking Number 100393058) for interim culvert debris removal works prior to the permanent works. The interim works were focused solely on alleviating the water pooling at the culvert inlet caused by the blockage. The Ministry of Forests (MOF) reviewed the application, issued a MOTI/PGL a Terms and Conditions Letter on August 25, 2022, and the MOTI conducted the interim debris removal works in September 2022.

1.2 Margaret Road Background

At the Flume Creek crossing under Margaret Road, the November 2021 heavy rainfall events led to flow capacity exceedances, roadway washout, and culvert barrel exposure of the existing 1.6m-diameter, circular CSP. Emergency works were conducted after the flooding to restore functionality to the site. Three temporary 800mm-diameter CSP culverts were installed in a triangular formation, riprap was placed at the inlets and outlets of the culverts, Margaret Road was rebuilt, and a residential driveway crossing the roadside ditch along the east side of Margaret Road was rebuilt with a new 0.6m-diameter CSP culvert (refer to Appendix 3 – Flume Creek Site Photographs).

1.3 Beach Avenue Background

At the Flume Creek crossing under Beach Avenue, the November 2021 heavy rainfall events led to flow capacity exceedances, roadway washout, and culvert barrel exposure of the existing 1.6m-diameter, circular CSP. Emergency works were conducted after the flooding to restore functionality to the site. Four 800mm-diameter circular CSP culverts were installed side-by-side, and riprap was placed at the inlets and outlets to provide erosion protection. One of the temporary culverts was significantly longer than the others (refer to Appendix 3 – Flume Creek Site Photographs). It is noted that no previous approvals were sought for these works, as they were completed on an emergency basis.

2.0 PROJECT DESCRIPTION

The MOTI has retained Urban Systems Ltd. (Urban Systems) to develop permanent design solutions for each of the sites. The permanent designs aim to address outstanding safety, stability, and capacity concerns after the atmospheric river event. The designs factor in projected climate change and extreme weather (peak-flow) scenarios based on available 2100 climate change models. The culvert slopes will match each creek's natural stream grade. The goal is to prevent embankment sloughing, culvert failure, and sedimentation from impacting the fish and fish habitat in Kenyon and Flume Creeks. Additionally, the new box culverts with fish baffles will provide improved fish passage under Redrooffs Road, Margaret Road, and Beach Avenue.

The project will follow guidelines and Best Management Practices (BMPs) outlined in the following:

1. *MOTI's Erosion and Sediment Control Manual* (Version 1.0, November 2022) [Appendix 4];
2. *MOTI's Sunshine Coast Construction Environmental Management Plan (CEMP)* [Appendix 5]; and
3. *Requirements and Best Management Practices for Making Changes In and About a Stream in British Columbia* (January 2022) [Appendix 6].

A Qualified Environmental Professional (QEP) will be onsite conducting environmental monitoring for the duration of instream Project works and sensitive works, such as concrete use. The QEP will monitor turbidity/water quality and erosion and sediment control measures. Fish and amphibian salvage (if required) will be conducted prior to instream works.

The QEP will monitor the Project for compliance with the referenced guidance documents. Works will be conducted in the dry, as much as possible, and during low-flow conditions and limited precipitation. Works will be conducted in isolation of flow following Fisheries and Oceans Canada's (DFO's) interim code of practice for temporary cofferdams and diversion channels and end-of-pipe fish protection screens for small water intakes in freshwater. The onsite QEP is responsible for obtaining the required permits to conduct fish and amphibian salvage works for the Project.

2.1 Redrooffs Road Scope of Work

The permanent Redrooffs Road design includes the following scope of work:

- Removing the five temporary culverts installed under emergency works during the flooding event;
- Installing two, 35m-long, concrete, square box culverts side-by-side (two-barrel culvert crossing) – one 2.4m width x 2.4m height, the other 2.1m width x 2.1m height complete with fish baffles design (refer to appended civil engineering drawings);
- Installing one, 13m-long, 0.90m-diameter HDPE culvert;
- Installing 50kg Class (550mm thickness) riprap aprons (armoring) at the culvert inlets and outlets (6m length riprap armoring at inlets, and 12m-long armoring at outlets) on top of 150mm-thickness, medium-weight, non-woven geotextile fabric (keyed into ground); and
- Regrading embankments and repaving Redrooffs Road according to finalized civil engineering drawings.
- Removal of trees determined likely to fail, as described in the Arborist Summary Report (Appendix 15)
- Seeding and/or planting any disturbed vegetated areas from construction works and restoration areas, as prescribed in Section 4.0.

2.2 Margaret Road Scope of Work

The proposed permanent design scope of work at Margaret Road includes:

- Removing accumulated debris and gravel/sand substrate that may have accumulated at the culvert inlets/outlets during the atmospheric river event;
- Removing the three temporary CSP culverts at Margaret Road, which were installed under emergency works;
- Installing two side-by-side (double-barrel) concrete box culverts (both culverts 12.5m-long, one barrel 2.7m wide and 1.5m high, the other barrel 2.1m wide and 1.2m high), complete with a concrete headwall, and fish baffles (spacing of fish baffles is TBD);
- Clearing and grubbing (minor vegetation removal) at culvert inlets/outlets and along the road edges to accommodate the riprap armoring and road/driveway rebuilding;
- Stripping surface material and installing non-woven geotextile fabric to be covered by 450mm-thick class 25kg riprap armoring at the inlet and outlet (67m² of riprap at the inlet, and 95m² at the outlet);
- Excavating, stripping, rebuilding, grading, and paving an approximately 90m-long section of Margaret Road; and
- Minor regrading of a residential driveway off Margaret Road.
- Seeding and/or planting any disturbed vegetated areas from construction works and restoration areas, as prescribed in Section 4.0.

2.3 Beach Avenue Scope of Work

The proposed permanent design scope of work at Beach Avenue includes:

- Removing accumulated debris and gravel/sand substrate that may have accumulated at the culvert inlets/outlets during the atmospheric river event;
- Removing the four temporary CSP culverts, which were installed under emergency works;
- Installing two side-by-side (double-barrel) concrete box culverts (both 13m long, one barrel 2.1m wide and 1.2m wide, the second barrel with a width of 2.7m and height of 1.5m), complete with a concrete headwall, and fish baffles (spacing of fish baffles is TBD);
- Clearing and grubbing (minor vegetation removal) at culvert inlets/outlets and along the road edges to accommodate the riprap armouring and road rebuilding;
- Stripping surface material and installing non-woven geotextile fabric to be covered by 450mm-thick class 25kg riprap armouring at the inlet and outlet; and
- Excavating, stripping, rebuilding, grading, and paving an approximately 60m-long section of Beach Avenue.
- Seeding and/or planting any disturbed vegetated areas from construction works, as prescribed in Section 4.0.

2.4 Timing Windows

The MOTI and the contractors will aim to conduct instream activities within the combined least-risk work window for Pacific Salmon and Coastal Cutthroat Trout (August 1–September 15).

It is anticipated that works may extend past the reduced-risk timing window, based on the MOTI's requirement to conduct extensive instream works on multiple sites on the Sunshine Coast that are a priority for bank stability and public safety. The works will not extend past October 31 to protect amphibian and trout species potentially present at the site. Conducting instream works past September 15 extends past the Pacific salmon reduced-risk window, which is recommended to prevent interference during the spawning season. Additional mitigation measures to reduce the potential impacts of the works on spawning Pacific salmon should be implemented. This includes completing the initial diversion of the stream prior to the end of the reduced-risk work window and increasing environmental monitoring to the minimum of daily inspections.

For Kenyon Creek the existing culvert and waterfall are a barrier to upstream fish passage, it is unexpected that Pacific salmon spawn upstream of the works. The work zone will be isolated when conducting works outside of the reduced-risk timing window; therefore, if salmon are present downstream of the Site, they will not require access to the work zone or relocation upstream of the Site.

Within Flume Creek at Beach Avenue and Margaret Road, there are no current fish barriers, and it is expected that Pacific salmon spawn upstream of the works. The work zone will be isolated, and therefore, the migration of spawning Pacific salmon may be blocked. If spawning Pacific salmon are observed downstream of the Site, the environmental monitor will relocate fish upstream of the culvert. Details of the relocation plan will be submitted in the fish salvage permit applications.

It is also noted that if the watercourse is dry, work may take place in the dry stream channel outside of the reduced-risk instream work window, provided other species (birds and amphibians) have also been considered and risks have been mitigated. Works away from streams and riparian habitat, including the proposed road works, can occur outside of the reduced-risk timing window.

3.0 PROJECT FOOTPRINT

The breakdown of the riparian and aquatic footprint from the proposed Project is shown in Appendix 16 –Proposed Impacts Figures and Appendix 9 – Habitat Balance Sheet. Please see a detailed description of the impacts below.

3.1.1 Riparian Habitat

Temporary disturbance to the riparian habitat from clearing and grubbing is 2,028m² (Redroofs Road: 699m²; Margaret Road: 746m²; Beach Avenue: 583m²). The area of disturbance includes riparian areas that will be grubbed but will not have permanent structures placed within them (i.e., culvert headwall/riprap/road) and can be reseeded/vegetated upon completion of the works with native species as described in Section 4.0.

The Project anticipates some permanent loss of riparian habitat to accommodate the placement of riprap required to effectively stabilize the bank and to account for the larger culvert footprint extending above the high-water mark (HWM). There will be a net loss of 40m² of riparian area (Redroofs Road: 10m²; Margaret Road: 9m²; Beach Avenue: 21m²). The riparian area is defined as functional riparian habitat (i.e., does not include the area within permanent structures such as roads and riprap) above the HWM up to 30m beyond the top of bank. It is noted that a total of 22m² associated with the footprint of the proposed road works at Beach Avenue within the washed-out area from the floods was not accounted for in the permanent impacts. The rationale is that this area was observed to be disturbed and unvegetated, and is presumably within the existing footprint of the previous road (which cannot be confirmed as it was washed out at the time of the survey).

The project will also include 104m² of restoration to riparian areas (Redroofs Road: 79m²; Margaret Road: 25m²) that have been disturbed or are covered by fill material. It is noted that disturbed areas suitable for restoration were not observed along Beach Avenue. With the consideration of the riparian restoration areas, there will be no net loss of riparian habitat. The additional 64m² of riparian restoration areas beyond the footprint required to offset the permanent riparian impacts will be created with the intention of offsetting permanent instream impacts as described below.

3.1.2 Instream Habitat

Temporary disturbance to the instream habitat from machine access and potential clearing and grubbing is 523m² (Redroofs Road: 236m²; Margaret Road: 155m²; Beach Avenue: 132 m²). The area of disturbance will not have permanent structures placed within them (i.e., culvert headwall/riprap) and will naturalize to previous conditions post-construction. As these impacts are considered temporary, they are not included in the overall impact calculation described in Appendix 9- Habitat Balance Sheet.

The Project anticipates some permanent loss of instream habitat to accommodate the placement of riprap required to effectively stabilize the channel, to account for the larger culvert footprint below the HWM. There will be instream impacts to 228m² (Redroofs Road: 75m²; Margaret Road: 83m²; Beach Avenue: 70m²) of aquatic area. The Project also includes the enhancement of 170m² (Redroofs Road: 58m²; Margaret Road: 72m²; Beach Avenue: 40m²) of instream habitat by placing spawning gravels along the bottom of the stream bed. Including the enhancement area, the Project will result in a net impact of 58m² to instream habitat. The area of instream impact will be offset with 64m² of riparian restoration area, as described in Section 3.1.1.

4.0 RESTORATION PLANTING REQUIREMENTS AND POST-CONSTRUCTION MONITORING

A detailed Restoration Planting Plan will be required prior to construction that provides details of the number of each plant species and the areas where they should be planted. At this time, a list of plant species proposed for any restoration planting areas within the site is shown in Table B.

Table B: Proposed Planting List for Restoration Planting Areas

Common Name ¹	Scientific Name
Trees	
Douglas-fir	<i>Pseudotsuga menziesii</i>

¹ Plant species were chosen based on the CWHxm1 biogeoclimatic ecosystem classification zone suitability or based on the presence observed during PGL's Site visit as indicated with "**".

Western hemlock	<i>Tsuga heterophylla</i>
Western redcedar	<i>Thuja plicata</i>
Bigleaf maple *	<i>Acer macrophyllum</i>
Red alder*	<i>Alnus rubra</i>
Grand fir*	<i>Abies grandis</i>
Shrubs	
Salal	<i>Gaultheria shallon</i>
Dull Oregon-grape	<i>Mahonia nervosa</i>
Red huckleberry	<i>Vaccinium parvifolium</i>
Baldhip rose	<i>Rosa gymnocarpa</i>
Ocean spray	<i>Holodiscus discolor</i>
Sword fern	<i>Polystichum munitum</i>
Lady fern*	<i>Athyrium filix-femina</i>
Deer fern*	<i>Struthiopteris spicant</i>
Salmonberry*	<i>Rubus spectabilis</i>
Beaked hazelnut*	<i>Corylus cornuta</i>
Goat's beard*	<i>Aruncus dioicus</i>

Seed composition that will be spread within disturbed areas and restoration planting areas will follow the Standard Specifications for Highway Construction, Section 757 – Revegetation Seeding (MOTI, 2020)²

Any areas requiring planting or that have been disturbed from the works adjacent to Kenyon Creek or Flume Creek will be seeded with the Riparian Area Mix that consists of:

- Slender wheatgrass 40%
- Perennial rye 25%
- Kentucky bluegrass 15%
- Timothy 10%
- Redtop 5%
- Junegrass 5%

Following construction and plant restoration works, the MOTI will implement a one-year, post-construction monitoring program that includes monitoring the sites for:

- Structural stability;
- Fish passage and water flow;
- Planting and/or seed growth success; and
- Fish habitat use.

5.0 SITE DESCRIPTIONS

The following site descriptions are based on PGL’s observations while conducting site visits in May 2022. The subsections below provide detailed site descriptions. In addition to the descriptions, PGL has completed two Environmental Overview Assessments; one for the Redroofs Road site at Kenyon Creek, and the second for the

² Standard Specifications for Highway Construction, Section 757 – Revegetation Seeding. Ministry of Transportation and Infrastructure. 2020. Available at: [2020 Standard Specifications for Highway Construction Volume 1 of 2 \(gov.bc.ca\)](https://www2.gov.bc.ca/gov/content/transport/infrastructure/roads/highway-construction/specifications/2020-standard-specifications-for-highway-construction-volume-1-of-2)

Margaret Road and Beach Avenue sites along Flume Creek. The Environmental Overview Assessment reports have been appended to this Change Approval Application as Appendix 10 and Appendix 11, respectively.

5.1 Redroofs Road (Kenyon Creek)

5.1.1 Site Overview

Kenyon Creek is fed by the tributaries surrounding Trout Lake to the north and outlets to Sergeant Bay. A waterfall over bedrock feeds the main channel before it passes underneath Redroofs Road and outlets into the Pacific Ocean. The top of the waterfall is approximately 8m high and is composed of exposed bedrock and angular boulders. Steep ravine banks surround the north, northwest, and northeast sides of the Project footprint, preventing any drainage other than directly south.

Canopy cover is approximately 40–60% in the Project area, and the dominant tree species include western redcedar, Douglas-fir, red alder, and western hemlock. Common understorey vegetation within the riparian area includes salmonberry, salal, western skunk cabbage, lady fern, bracken fern, sword fern, fringecup, thimbleberry, and red huckleberry.

5.1.2 Fish and Fish Habitat

The existing 700m concrete culvert is undersized, and at nearly 6.5% slope under Redroofs Road, creates a barrier to upstream fish movement in Kenyon Creek. Non-anadromous salmonids have been observed above the barrier, though these records are dated and unreliable (BC MOE, 2022). Fish occurrences within Kenyon Creek that have been documented include steelhead (*Oncorhynchus mykiss*), stickleback (*Gasterosteus* sp.), and cutthroat trout (*Oncorhynchus clarkii*) (BC MOE, 2022). The lower reaches of Kenyon Creek are fish accessible from Sergeant Bay up to Redroofs Road. Cobbles, boulders, and large woody debris (LWD) provide optimal fish habitat downstream of Redroofs Road, in addition to dense canopy cover (>60%). Fish habitat below Redroofs Road is considered suitable year-round and likely supports resident or anadromous fish species. During survey work in the fall of 2022, engineering crews observed fish within the Project footprint downstream of Redroofs Road; however, the species of fish was not confirmed.

5.1.3 Species at Risk and Critical Habitat

Within 2km of the Site, there are no occurrence records of federally-listed Species at Risk (SAR); however, there is Critical Habitat for Western painted turtle Pacific coast population (*Chrysemys picta bellii*), (BC Conservation Data Centre, 2022) [refer to Appendix 12 – Critical Habitat for WPT Habitat Wizard]. The turtle occurs in the Fraser Valley, Sunshine Coast, Texada Island, and southern Vancouver Island. The Pacific coast population (*bellii* sub-species) is provincially Red-listed and is Threatened under the *Species At Risk Act* (SARA) and by Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Western painted turtle prefer slow-moving watercourses, shallow ponds and lakes, oxbows, marshes, and sloughs with muddy substrates and emergent vegetation. They require emergent logs, rocks, or vegetation for basking and well-drained, bare, sand, or gravel banks and shorelines for nesting (COSEWIC, 2016). There is the possibility that western painted turtle can disperse into the forested area within the Project works area; however, suitable habitat does not occur within or immediately adjacent to the proposed Project works area. Proposed works are not anticipated to interact with or negatively affect western painted turtle.

At the provincial SAR classification level, two Blue-listed species are known to occur within Kenyon Creek and/or its riparian habitat – Northern Red-legged Frog (*Rana aurora*) and Coastal Cutthroat Trout.

5.2 Margaret Road and Beach Avenue Site Overview (Flume Creek)

Margaret Road is a north-south, low-volume road, about 850m long and 5.5m wide, surrounded by forested areas. The road connects with Beach Avenue at its south end, and provides access to approximately 12 residential lots in addition to a summer camp (Camp Douglas).

Flume Creek flows across Margaret Road from east to west. The stream channel has a typical width of 3m and depth of about 1m, both upstream and downstream of the culvert. Stream morphology follows a riffle-pool sequence, substrates consisted of cobble in riffles and small round gravel and sands in the pools, and banks are low (approximately 0.75m) and quite undercut. The site is very disturbed where emergency works occurred. The canopy cover was approximately 40% and was dominated by western redcedar, bigleaf maple, red alder, and Douglas-fir, with subdominant grand fir. Understorey species include lady fern, sword fern, deer fern, salmonberry, goat's beard, skunk cabbage, salal, red huckleberry, three-leaved foamflower, and costal hedge nettle. LWD was sparse both upstream and downstream of the culvert.

Beach Avenue is approximately 3km long, running parallel to Highway 101 and providing access to several residential properties along the south coast. The road is about 5.5m wide at the Flume Creek crossing.

Flume Creek flows south across Beach Avenue. The channel was measured to be about 4m wide and 0.5m deep upstream of the Beach Avenue culvert, and 3m wide and 1m deep downstream. Upstream of Beach Avenue the creek featured low banks and cleared properties on the northeast side. Substrates consisted of small cobble, gravels, and sand with 30% embeddedness. The canopy cover was approximately 20% and was dominated by western redcedar, bigleaf maple, red alder, and Douglas-fir, with subdominant grand fir. The understorey contained sword fern, lady fern, salmonberry, ocean spray, beaked hazelnut, common horsetail, western skunk cabbage, salal, sedges, and periwinkle. LWD was sparse both upstream and downstream of the culvert.

5.2.1 Flume Creek Fish and Fish Habitat (Margaret Road and Beach Avenue Sites)

Fish habitat at the sites is considered suitable year-round. There are no barriers to fish passage from the mouth of Flume Creek all the way upstream through both the Margaret Road and Beach Avenue sites. Fish occurrences within Flume Creek have been documented on the publicly available provincial database, Habitat Wizard. These include chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), and cutthroat trout (*Oncorhynchus clarkii*). A 1m waterfall at the mouth of Flume Creek may restrict fish migration and any cutthroat trout present are likely to be resident (non-anadromous) fish.

5.2.2 Flume Creek Species at Risk and Critical Habitat (Margaret Road and Beach Avenue Sites)

There are no known occurrence records of federally-listed aquatic Species at Risk (SAR) or SAR critical habitat directly upstream or downstream of the Margaret Road or Beach Avenue crossings (BC Conservation Data Centre, 2022). There are no records of invasive aquatic species present in Flume Creek. The provincial database (Habitat Wizard) indicates that coastal cutthroat trout are present within Flume Creek. Data does not exist classifying the cutthroat trout sub-species; however, given the location of the observations, it is assumed that the cutthroat trout that are present are the provincially blue-listed coastal cutthroat trout (*Oncorhynchus clarkii clarkii*).

6.0 POTENTIAL EFFECTS OF THE PROPOSED PROJECT

The Project aims to alter the size, shape, and type of culverts at the sites; therefore, there may be minor alterations to fish habitat. Overall, the natural watercourse path, volume of flow, and grade will be maintained at the stream crossings. A culvert crossing and some riprap were already existing at each of the sites prior to the atmospheric river event of November 2021.

The Project will increase the riprap armouring of the road embankments and within the stream channels at the culvert inlets/outlets, resulting in some riparian and instream impacts. Impacts from the Project have been reduced by restoring disturbed riparian areas with native seed/plants and enhancing instream habitat with spawning gravels. The quantity of permanent impacts has been outlined in the appended Impact Figures (Appendix 16) and are accounted for within the appended Habitat Balance sheets (Appendix 9). The Project anticipates no net loss of instream and riparian areas.

6.1 Pathways of Effects

Project works were assessed for the potential to cause harmful alteration, disruption, or destruction of fish habitat following DFO's Pathways of Effects.

Potential residual effects from "Organic Debris Management" such as changes in habitat structure and cover are expected to be low. Most of the LWD and vegetation removal required to accommodate the Project works has already been disturbed during emergency works or the flooding event. Replanting to mitigate vegetation removal will occur post-construction. The overall footprint for the Project is changing minimally from existing conditions to accommodate additional riprap stabilization (armouring).

Residual changes to nutrients are not anticipated, nor are changes in water temperature, change in food supply, or changes in dissolved oxygen.

Potential residual effects from "Placement of Material or Structures in Water" may occur; however, the Site had culverts and riprap prior to the flooding events, and this permanent design (the Project) does not result in land use changes. Therefore, we do not anticipate this Project resulting in the onset of any new residual effects associated with culvert and riprap placement within Kenyon Creek and Flume Creek.

Potential negative residual effects from "Fish Passage Issues" are not expected, as the Project will be conducted during the instream least-risk work window for the species anticipated at the sites. Flow around the sites will be maintained; however, fish passage will be temporarily prevented so the work area can be adequately isolated. In contrast, the replacement of the CSP culverts with concrete box culverts and fish baffles will improve fish passage within the watercourses in the long term, resulting in a net positive impact at the sites.

Potential residual effects from "Use of Industrial Equipment" may occur. The removal of the existing culverts, debris, and fill materials has the potential to cause a temporary increase in suspended solids and turbidity downstream. This can be avoided and mitigated as described in the fish and fish habitat protection measures listed below. Heavy machinery will operate from above the top of bank, except where necessary to remove debris.

7.0 FISH AND FISH HABITAT PROTECTION MEASURES AND BEST MANAGEMENT PRACTICES FOR INSTREAM WORKS

The Project will follow the list of fish and fish habitat protection measures and BMPs listed below for instream works to avoid contravention of the *Fisheries Act*.

Fish will be protected by:

- Having the MOTI and Contractors aim to conduct instream activities within the combined least-risk work window for Pacific Salmon (August 1–September 15);
- Conducting works below the HWM during periods of low flow, and working in the dry;

- Limiting the duration of below-HWM works, undertakings, and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (e.g., spawning, rearing, feeding, migrating);
- Once instream works have begun, pursuing them to completion as quickly as possible;
- Employing fish exclusion netting (upstream and downstream) and/or cofferdams to isolate the work site, and ensuring a QEP conducts fish salvage of the isolated work zone prior to undertaking activities;
- Maintaining fish passage and appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish; and
- Having a QEP onsite for the duration of Project works to conduct turbidity monitoring, search for presence of fish or other aquatic species around the work area, inspect exclusion netting, and monitor the instream works for fish or other aquatic species requiring capture and relocating outside of the excluded work zone.

The riparian zone will be protected by:

- Limiting access to shorelines and banks or areas adjacent to water bodies; and
- Maintaining riparian vegetation where possible (minor grubbing works may be required to accommodate road rebuilding/regrading).
- Following recommendations for tree removal and protection as prescribed in the Arborist Summary Report (Appendix 15)

Fish habitat will be protected from sedimentation by:

- Installing effective erosion and sediment control measures to stabilize all erodible and exposed areas (as per the MOTI's Erosion and Sediment Control Manual, see attached);
- Having the Environmental Monitor (EM) regularly inspect the erosion and sediment control measures during all phases of the Project;
- Keeping the erosion and sediment control measures in place until all disturbed ground has been permanently stabilized;
- Installing a settling basin and/or filtration system for water flowing onto the site and water being pumped or diverted from the site, including:
 - Holding back runoff water until suspended sediment has resettled in the settling basin and runoff water is clear;
 - Dewatering gradually to prevent sediment resuspension and bank destabilization;
 - Disposing of and stabilizing all excavated material above the HWM or top of bank of nearby waterbodies, and ensuring sediment re-entry to the watercourse is prevented; and
 - Where possible, utilizing a vacuum truck for sediment removal instead of an excavator.
- Heeding weather advisories and scheduling work to avoid wet, windy, and rainy periods that may result in high flow volumes and/or increase erosion and sedimentation;
- The EM will regularly monitor the watercourse for signs of sedimentation (turbidity monitoring) during all phases of the work, undertaking, or activity, and taking corrective action if required;
- Stopping work and containing sediment-laden water to prevent dispersal; and
- Having heavy equipment operate from the paved roadway above the top of bank.

Fish and fish habitat will be protected from deleterious substances (including suspended sediment) by:

- Avoiding depositing any deleterious substances in the watercourse;
- Isolating concrete works from water flow and precipitation for a minimum of 48 hours after pouring to ensure concrete is cured prior to water contact;
- Having the QEP monitor concrete works, including water quality sampling downstream of concrete works;
- Providing easily accessible concrete mitigation measures such as CO₂ with bubbling hose and silt curtains during concrete works;
- Following the Emergency Spill Response Plan provided in the CEMP (see attached);

- Following the MOTI's Erosion and Sediment Control Manual for guidance measures to avoid sediment entering the stream;
- Ensuring an emergency spill kit is onsite during all phases of the works, undertakings, and activities;
- Maintaining all machinery onsite in a clean condition and free of fluid leaks to prevent any deleterious substances from entering the water;
- Washing, refueling, and servicing machinery, and storing fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water; and
- Disposing of all waste materials (including construction, demolition, excavation, commercial logging) above the HWM of nearby waterbodies to prevent entry.

Additional measures for culvert maintenance will include:

- Limiting the removal of accumulated material and debris (e.g., branches, stumps, other woody materials, garbage, etc.) to the area within the culvert and immediately upstream and downstream of the culvert); and
- Removing accumulated materials and debris slowly to allow clean water to pass, to prevent downstream flooding and to reduce the amount of sediment-laden water going downstream.

8.0 LANDOWNER APPROVALS AND INDIGENOUS CONSULTATION

Restoration activities require extension of works outside of the MOTI right-of-way. The MOTI is currently consulting with affected property owners and expect to forward landowner approvals to the MOF in Spring 2023.

Table C: Affected Properties and Proposed Requirements

Location	PID	Requirement
Kenyon Creek		
	031-056-903 (Shoranick)	<ul style="list-style-type: none"> • Statutory Right of Way • Temporary License for Construction Access
Flume Creek		
	013-058-134 (Camp Douglas)	<ul style="list-style-type: none"> • Temporary License for Construction Access • Property Acquisition (partial)
	013-058-142 (Camp Douglas)	<ul style="list-style-type: none"> • Property Acquisition (partial)
	013-058-223 (Camp Douglas)	<ul style="list-style-type: none"> • Temporary License for Construction Access
	031-806-643 (York)	<ul style="list-style-type: none"> • Temporary License for Construction Access

Indigenous consultation undertaken by the MOTI is summarized in the Record of Consultation (Appendix 13).

9.0 QEP SIGN-OFF FORM

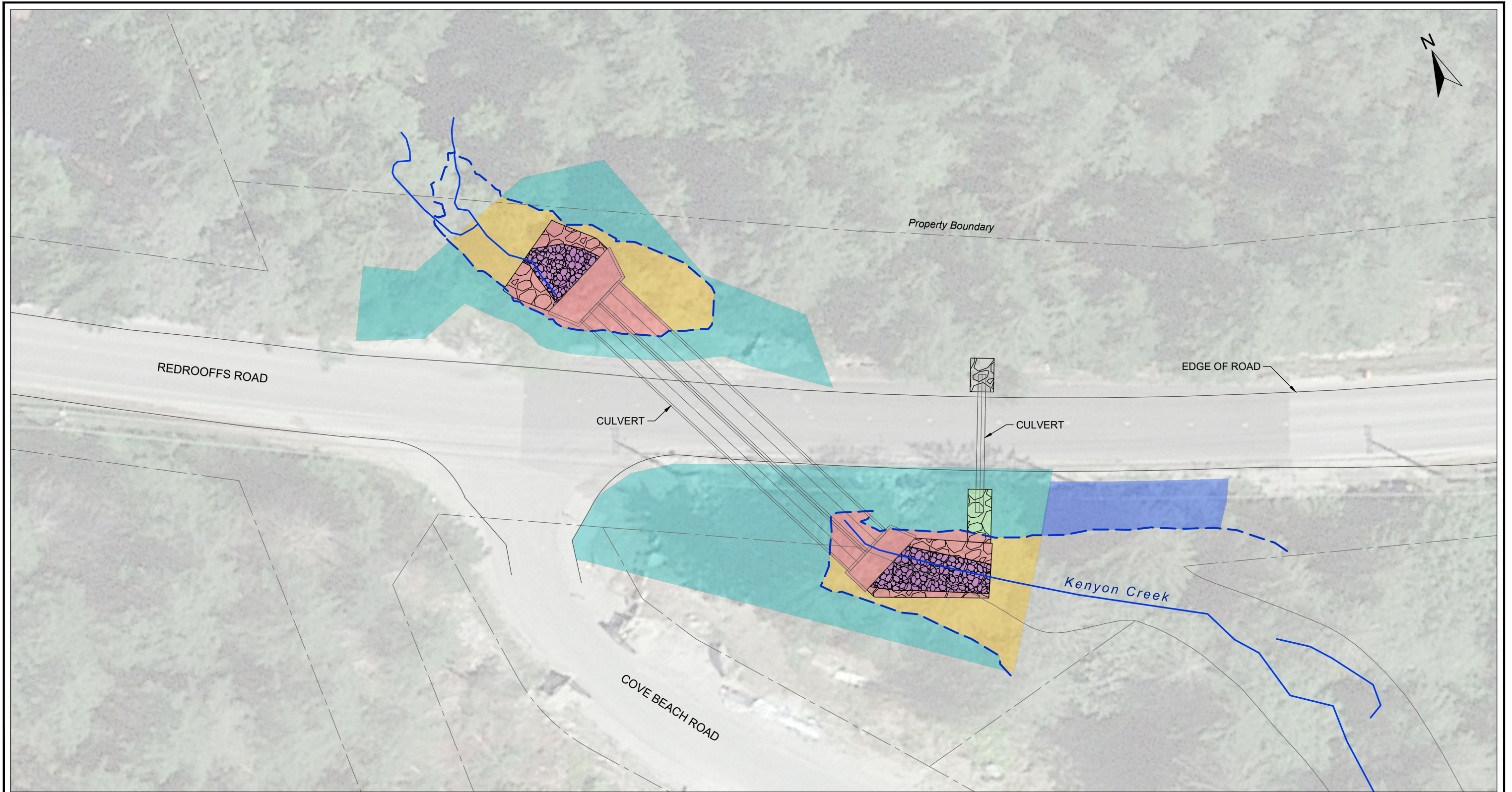
PGL has completed a Key Aquatic Habitat Questions for Qualified Environmental Professionals (QEP Sign-Off Form) for the South Coast Region to accompany this Change Approval application (refer to Appendix 14).

10.0 CLOSING

We trust this memo meets your needs. Should you have any further questions or require clarification, please contact Chloe Slomowitz or Stewart Brown at 604-719-1429 and 604-895-7612, respectively.

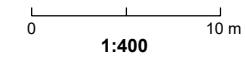
Appendix 1

Site Location Crossing Culverts SCR D



- Retained and Enhanced Instream Area (58 m²)
- Permanent Instream Disturbance (75 m²)
- Temporary Instream Disturbance (236 m²)
- Permanent Riparian Disturbance (10 m²)
- Temporary Riparian Disturbance (699 m²)
- Riparian Restoration Area (79 m²)

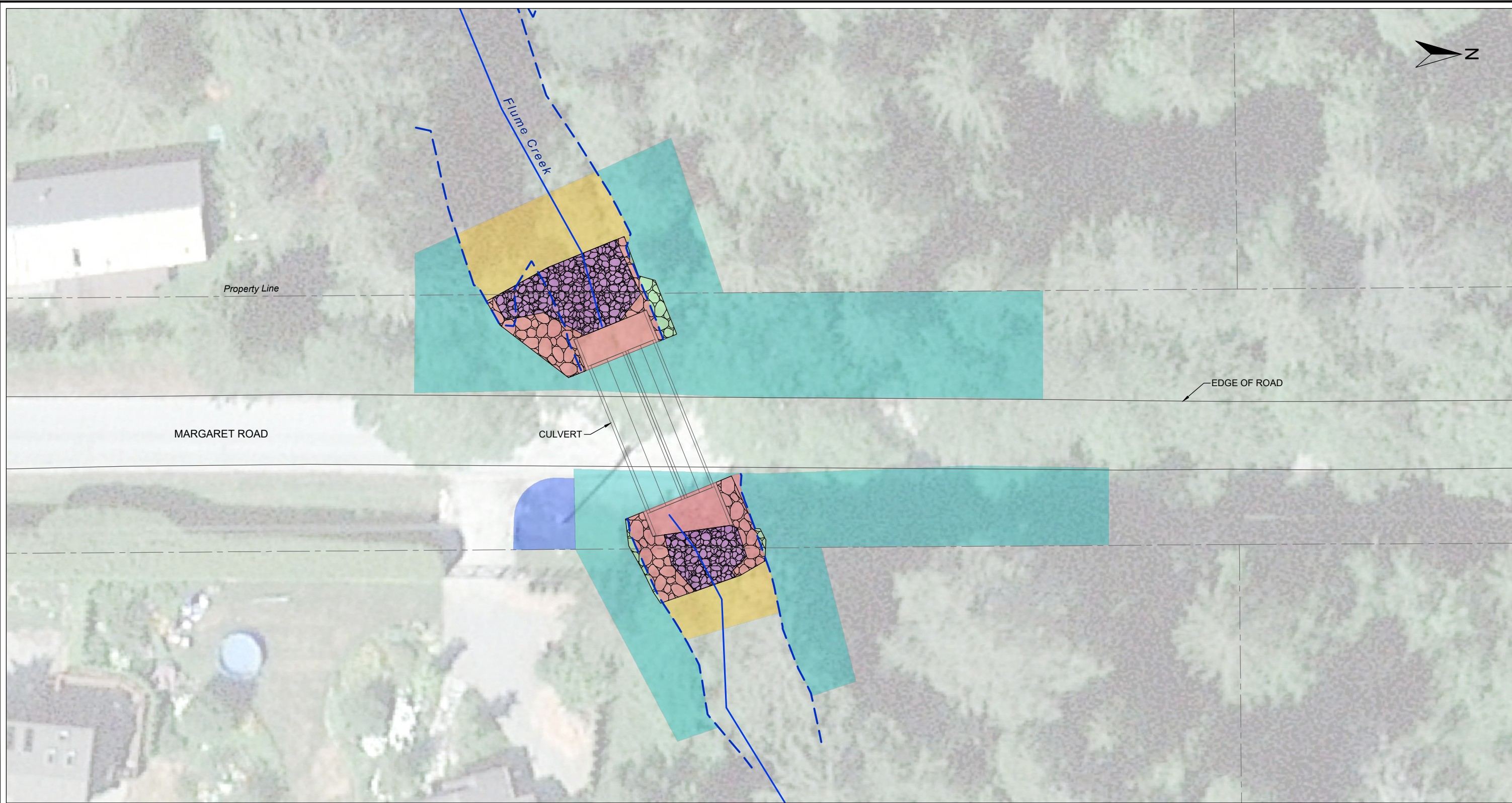
- Riprap
- Cobbles
- High Water Mark
- Creek Centre Line



Referenced from Ministry of Transportation and Infrastructure Drawing; Kenyon Creek DFAA Flood Damage (February 2023). 2021 base image from Sunshine Coast Regional District, 2023. Features are approximate and are presented for discussion purposes only. WGS 1984 UTM Zone 10N.

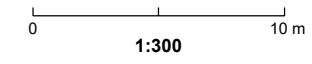
KENYON CREEK			
Kenyon Creek at Redrooffs Road, Sunshine Coast Regional District, BC			
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE			
	File No.: 0346-65.01	Dwg.: 0010	Figure
	Date: MAR 2023	Drawn By: TCM	1

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- Retained and Enhanced Instream Area (72 m²)
- Permanent Instream Disturbance (83 m²)
- Temporary Instream Disturbance (155 m²)
- Permanent Riparian Disturbance (9 m²)
- Temporary Riparian Disturbance (746 m²)
- Riparian Restoration Area (25 m²)

- Riprap
- Cobbles
- High Water Mark
- Creek Centre Line



Referenced from Ministry of Transportation and Infrastructure Drawing; Flume Creek DFAA Flood Damage (March 2023). 2021 base image from Sunshine Coast Regional District, 2023. Features are approximate and are presented for discussion purposes only. WGS 1984 UTM Zone 10N.

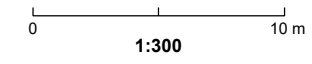
FLUME CREEK			
Flume Creek at Margaret Road, Sunshine Coast Regional District, BC			
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE			
	File No.:	Dwg.:	Figure
	Date:	Drawn By:	
	0346-65.01	0020	2
	MAR 2023	TCM	

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- Retained and Enhanced Instream Area (40 m²)
- Permanent Instream Disturbance (70 m²)
- Temporary Instream Disturbance (132 m²)
- Permanent Riparian Disturbance (21 m²)
- Permanent Riparian Disturbance on Washed Out Areas (22 m²)
- Temporary Riparian Disturbance (583 m²)

- Riprap
- Cobbles
- High Water Mark
- Creek Centre Line



Referenced from Ministry of Transportation and Infrastructure Drawing; Flume Creek DFAA Flood Damage (March 2023). 2021 base image from Sunshine Coast Regional District, 2023. Features are approximate and are presented for discussion purposes only. WGS 1984 UTM Zone 10N.

FLUME CREEK			
Flume Creek at Beach Avenue, Sunshine Coast Regional District, BC			
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE			
	File No.:	Dwg.:	Figure
	Date:	Drawn By:	
	0346-65.01	0030	3
	MAR 2023	TCM	

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Appendix 2
Kenyon Site Photographs

Appendix 3
Flume Creek Site Photographs

Appendix 4

MOTI's Erosion and Sediment Control Manual (Version 1.0, November 2022)

Appendix 5

MOTI's Sunshine Coast Construction Environmental Management Plan (CEMP)

Appendix 6

Requirements and Best Management Practices for Making Changes In and about a Stream in British Columbia (January 2022)

Appendix 7

Urban Systems Engineering Drawings – Kenyon Creek

Appendix 8
Urban Systems Engineering Drawings – Flume Creek

Appendix 9
Habitat Balance Sheet

HABITAT BALANCE

PREPARED BY: PGL Environmental Consultants; Chloe Slomowitz, R.P.Bio., & Katharine Scotton, R.P.Bio.					DATED: 28-Feb,2023			APPROVAL:		
Stream (Please indicate each stream channel and/or reach of the stream)	Description of Works (Please describe type of works for indicated stream)	Stream Channel			Instream Impacts			Riparian Impacts		
		Length (m)	Width (m)	Riparian Setback (m)	Loss (m2)	Gain (m2)	Net (Loss-Gain) (m2)	Loss (m2)	Gain (m2)	Net (Loss-Gain) (m2)
Flume Creek under Margaret Road	Instream- rip-rap and culvert headwall placement	-	-	30	-83.00	0.00	-83.00	0.00	0.00	0.00
Flume Creek under Margaret Road	Instream-retained and enhanced instream area with fisheries gravels	-	-	30	0.00	72.00	72.00	0.00	0.00	0.00
Flume Creek under Margaret Road	Riparian-temporary disturbance (clearing and grubbing) of riparian area that will be reseeded and/or planted	-	-	30	0.00	0.00	0.00	-746.00	746.00	0.00
Flume Creek under Margaret Road	Riparian-permanent impacts to riparian areas from rip-rap or culvert placement	-	-	30	0.00	0.00	0.00	-9.00	0.00	-9.00
Flume Creek under Margaret Road	Riparian-riparian restoration areas			30	0.00	0.00	0.00	0.00	25.00	25.00
Flume Creek under Beach Ave	Instream- rip-rap and culvert headwall placement	-	-	30	-70.00	0.00	-70.00	0.00	0.00	0.00
Flume Creek under Beach Ave	Instream-retained and enhanced instream area with fisheries gravels	-	-	30	0.00	40.00	40.00	0.00	0.00	0.00
Flume Creek under Beach Ave	Riparian-temporary disturbance (clearing and grubbing) of riparian area that will be reseeded and/or planted	-	-	30	0.00	0.00	0.00	-583.00	583.00	0.00
Flume Creek under Beach Ave	Riparian-permanent impacts to riparian areas from rip-rap or culvert placement	-	-	30	0.00	0.00	0.00	-21.00	0.00	-21.00
Kenyon Creek	Instream- rip-rap and culvert headwall placement	-	-	30	-75.00	0.00	-75.00	0.00	0.00	0.00
Kenyon Creek	Instream-retained and enhanced instream area with fisheries gravels	-	-	30	0.00	58.00	58.00	0.00	0.00	0.00
Kenyon Creek	Riparian-temporary disturbance (clearing and grubbing) of riparian area that will be reseeded and/or planted	-	-	30	0.00	0.00	0.00	-699.00	699.00	0.00
Kenyon Creek	Riparian-permanent impacts to riparian areas from rip-rap or culvert placement	-	-	30	0.00	0.00	0.00	-10.00	0.00	-10.00
Kenyon Creek	Riparian-riparian restoration areas			30	0.00	0.00	0.00	0.00	79.00	79.00
IMPACT TOTAL					-228.00	170.00	-58.00	-2068.00	2132.00	64.00
PROJECT NET LOSS/GAIN					INSTREAM:			RIPARIAN:		
							-58.00			64.00
Comments:										
See Section 3.0 in the Supplementary Information Report regarding details of the Habitat Balance.										

Appendix 10

Environmental Overview Assessment – Kenyon Creek

Appendix 11

Environmental Overview Assessment – Flume Creek

Appendix 12

Critical Habitat for WPT HabitatWizard

Appendix 13
Record of Consultation

Appendix 14
QEP Sign-Off Form