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TECHNICAL MEMORANDUM NO. 2
DATE: February 14, 2020
TO: District of Kent
ATTN: Mike Van Laerhoven
FROM: Michael Foster, P.Eng

RE: Final Route Alignment Plans, Summary of Design and Additional Design Requirements

This memorandum was prepared to provide the District with a detailed review of Option 3 Rockwell Drive to Lougheed Highway. An overview of this option was detailed in our Technical Memorandum No. 1. A detailed field review of the route was completed on December 9th and 10th, 2019 by Michael Foster, P.Eng. and Andrew Brabandt, AScT.

The entire route was either driven or walked to review the existing conditions in detail which has resulted in a slight modification to the original route Option 3 but will also dramatically reduce the construction costs.

1 Rockwell Drive to Lougheed Highway

A road access from Rockwell Drive to the Lougheed Highway via the Ruby-Lougheed FSR would follow a combination of existing roads, an old railway grade that would need to be upgraded (Figure 1), and a short section of new construction on Crown Land. The upgraded road section is within the northern extents of the Sasquatch Provincial Park boundary. During the field review, the Mahood Creek crossing was reviewed in detail with two potential road options to tie back into the Lougheed FSR. This is detailed further in Section 1.3 below. The entire route is approximately 21 km from Harrison Hot Springs to the Lougheed Highway.

1.1 Detailed Route Description

Rockwell Drive is an extension of Lillooet Avenue that goes through the downtown area of Harrison Hot Springs. The road leads towards Sasquatch Provincial Park and the Lakeside Campground on Deer Lake. It is approximately 13 km from downtown Harrison Hot Springs. The road is mainly paved with the last few kilometres of Rockwell Drive within the provincial park as a maintained gravel road. The road is fully accessible for all vehicle types including RV's. While driving east towards Deer Lake the originally constructed railway grade continues along the north side of the Lake and junctions off just outside the Lakeside Campground.

The old railway grade was walked from its point of commencement (POC) adjacent to the campground to the Mahood Creek bridge. Overall, the railway grade is in very good shape and the majority of it will only require brushing, tree falling to widen the right-of-way, resurfacing, ditch construction, and replacement/installation of new drainage structures for cross drains and stream crossings. Road grades are gentle and typically ranged from 0-5% along the existing grade with a number of wide areas available for turnout locations. Photos taken along the alignment are attached for reference. An overview of the road location is detailed in Figure 2.

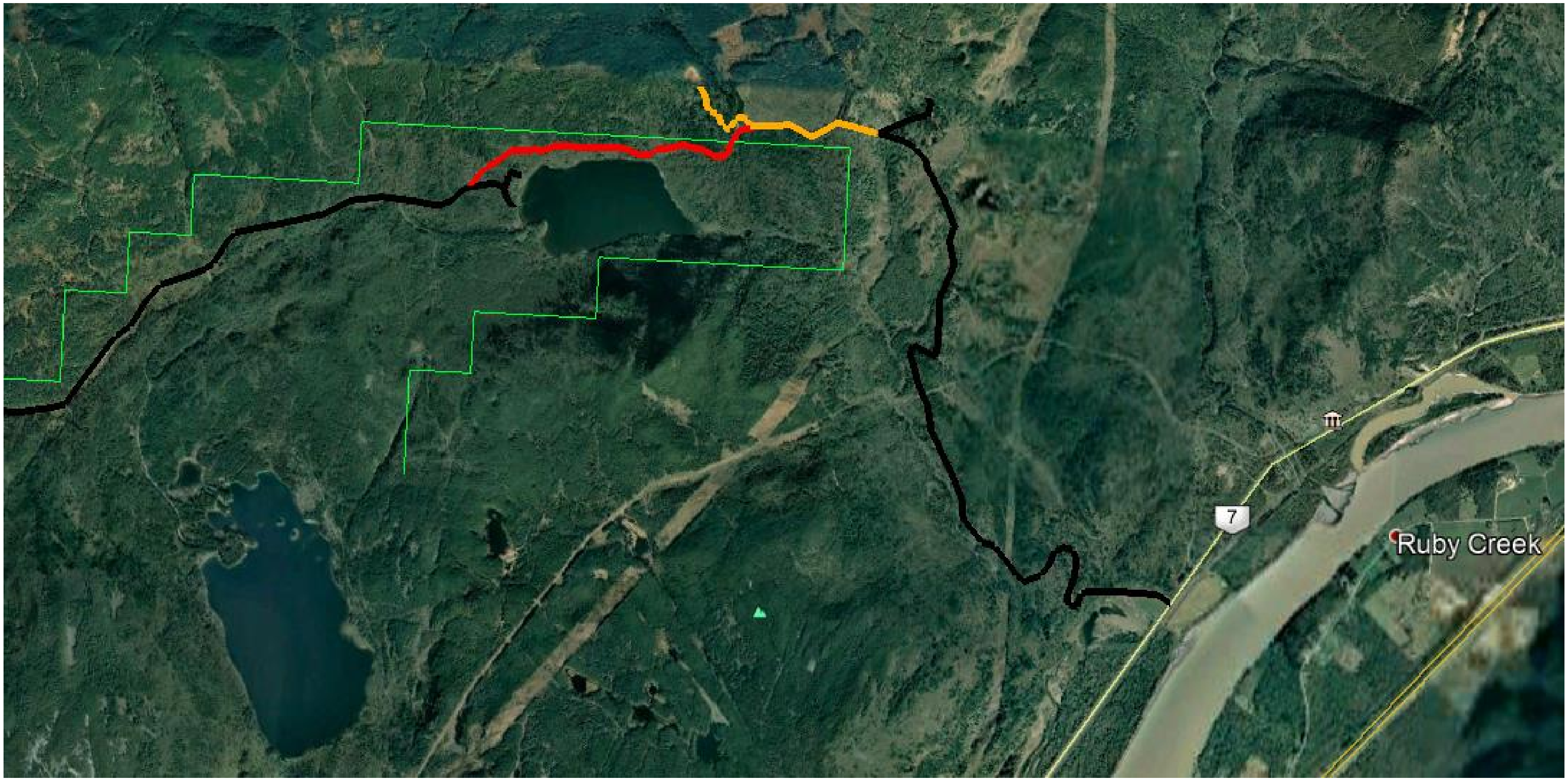

Figure 1. General Overview of Rockwell Drive to Lougheed Highway

Existing Railway Grade	(red line)
Existing Forest Service Road (Unmaintained)	(yellow line)
Existing Maintained Access Roads	(black line)

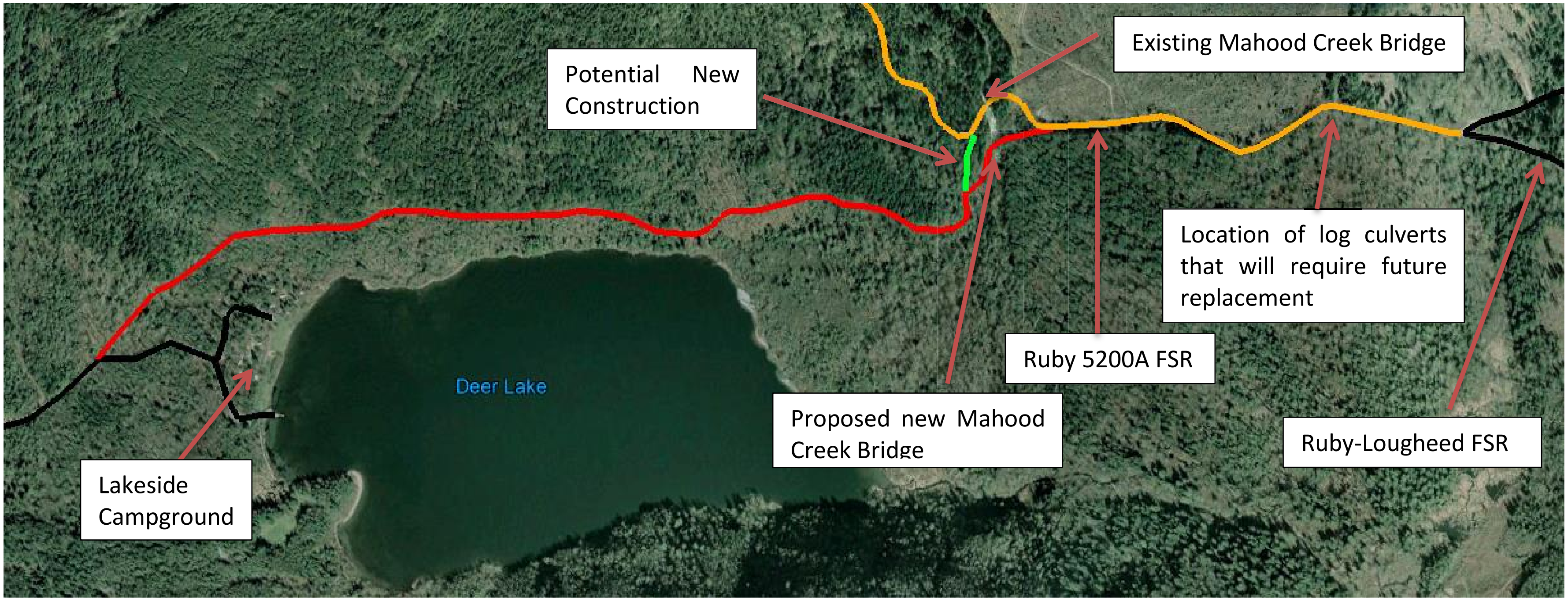

Figure 2. Overview of Road Alignment

Existing Railway Grade

Existing Forest Service Road (Unmaintained)

Potential New Road Connection

Existing Maintained Access Roads

1.2 Difficult Road Sections

While the vast majority of the road reconstruction is simple and straightforward, there are a few road sections that will require additional attention to construct a safe road prism.

1+200 At station 1+200 the existing railway grade narrows significantly at a short section with a very oversteepened road fill (>100%). It is recommended to shift the road into the cutslope for a 20 m long section to maintain a reasonable horizontal alignment. At this location the cutslope is comprised of a gravelly till over fractured bedrock. Blasting is not anticipated to be required. A detailed site survey is required to obtain a volume estimate for construction if a cost estimate is needed and to slope stake the top of cut.

1+250 At station 1+250 the existing railway grade narrows significantly with an oversteepened fill slope below (>100%) and bedrock outcrop above the road. It is recommended to shift the road into the cutslope to achieve a safe road width. Blasting of the bedrock will be required to construct a safe road prism. Rock from blasting could be crushed and used as surfacing material along the reconstruction. A detailed site survey is required to obtain a volume estimate for construction if a cost estimate is needed and to slope stake the top of cut.

1+750 Between stations 1+700 and 1+800, the existing road prism becomes narrow with a bedrock cutslope on the left and the fill slope on the right extending down to Mahood Creek. It is recommended to shift the road into the cutslope slightly to create a safer, wider road surface with the installation of no post barriers above the fill slope. Rock from blasting could be crushed and used as surfacing material along the reconstruction. A detailed site survey is required to obtain a volume estimate for construction if a cost estimate is needed and to slope stake the top of cut.

1.3 New Road Construction

During the field review of the existing railway grade and the originally proposed bridge crossing location on Mahood Creek, a short section of new road construction was found that would allow use of the existing Mahood Creek bridge (BCTS Site ID CK-2493). The new construction section is approximately 120 m long and would offer *significant* cost savings over installing a new bridge over Mahood Creek. However, while the terrain is fairly benign with side slopes averaging 30% for the location, the average grade of 10-14% could be difficult for some passenger vehicles.

Construction of a new bridge crossing on the existing railway grade is possible and would continue with road grades of under 5%, suitable for all types of vehicles. The bridge would most likely be a steel-concrete composite bridge built on concrete spread footings with steel risers. This is a very typical resource style type of structure with Ministry of Forests Standard Drawings[1] available for most of the components.

Both the new road and bridge construction is mainly located on Crown Land with the initial 20 m or so located within Sasquatch Provincial Park so construction authorization for a majority of the road is not anticipated to be an issue.

as . Ta new road option was found that allows for use of the existing BC Timber Sales Bridge crossing (BCTS Site ID CK-2493) as detailed on Figure 2 and avoids having to construct a new bridge crossing. A short section of new road construction will connect the railway grade to the existing FSR above the

[1] https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/resource-roads/engineering-standards-guidelines/bridge-design-construction/manual-standard-drawings

existing Mahood Creek bridge. This new road construction will start within the park boundary but extend through crown land to connect into a spur road of the Ruby-Lougheed FSR.

1.4 Forest Service Road Re-Construction

Once onto the existing Ruby 5200A FSR (see Figure 2 for details) heading east, the existing FSR has not been maintained in recent years since forest harvesting was completed. The road surface is excessively potholed in sections and alder trees crowd the road surface and will require grading and brushing. A number of older log culverts were found that will require future replacement (estimate 5-10 years until required replacement) with large diameter corrugated metal culverts (estimated at 2200 mm CMP).

The Ruby-Lougheed FSR is in excellent condition due to recent BC Hydro and Fortis use of the road system for utility upgrade work. No work is currently required on the existing 5.2 km of road back down to the Lougheed Highway (Highway 7).

1.5 Budget Cost Estimate

As discussed in our Memo #1, reconstruction of the majority of the old railway grade will be fairly routine work for a forestry contractor. Road resurfacing will likely be required. However, there are also a few sections of re-construction that will require additional effort with rock blasting and end hauling of excess material as noted above in Section 1.2. Reconstruction costs for the majority of the railway grade would be estimated at $35,000/km (increased to account for the large diameter culverts required on the stream crossings). The difficult road sections noted above would be estimated at $180,000/km and the new bridge construction estimated at $500,000. Additionally there will be some reconstruction costs to improve the road surface along the Ruby 5200A FSR and these are estimated at $20,000/km. Future replacement of the two wood culverts with large diameter CMP's on the Ruby 5200A FSR is estimated to cost $95,000 for engineering and construction.

This results in a total construction cost for the route of $741,000 although replacement of the structures on the Ruby 5200A can be delayed for a few years.

1.6 Construction Approval and Use of the Road

The main concern with this route is construction approval of the road. The majority of the road for the route is currently within Sasquatch Provincial Park and would require some negotiations to gain approval for construction. BC Parks are protected by the Protected Areas of British Columbia Amendment Act, 2019. Section 7 of the Act allows for the Lieutenant Governor in Council to re-establish or revise the boundaries of any park. A boundary revision to return the road right-of-way to Crown Land would be required to allow construction approval under the Forest Act/Forest and Range Practices Act.

The road would require access restrictions on each end (heavy duty hydraulic gates) to prohibit unauthorized use within the park. Consideration should be made to restricting access for emergencies only although allowing industrial use of the road could help to alleviate logging truck traffic through the streets of Harrison Hot Springs. However, this would then push the traffic adjacent to the Lakeside Campground.

2 Road Design Requirements

The entire road network for the project was either walked on foot or field reviewed via 4x4 vehicle to review for any concerns that would relate to design requirements or user safety issues. Overall, the road location will easily achieve the design specifications noted below in Table 1. At this time, limited field ribboning was completed to not bring the project to the public's attention with all data collected via an R1 GPS that is easily relocatable in the field for additional design work. Also, with timing for construction not known at this time due to the level of political engagement required, any field ribboning would most likely be wiped out by the time construction starts.

The level of design required can be directly connected to the type of construction contract that is awarded for the work. Overall the vast majority of the reconstruction work is straightforward that any typical forest road contractor can easily complete with minor oversight.

There are 2 separate Professional Practice Guidelines published by the ABCFP/EGBC that relate to roads and crossings. These are the Guidelines for Professional Services in the Forest Sector – Crossings V.2 and Forest Roads V.1. Members of the ABCFP and EGBC have professional obligations to provide for user and worker safety and to protect the environment in the conduct of their work. These guidelines are meant to assist in fulfilling these obligations by providing guidance to members who have professional involvement in specific roads and crossings. They are intended to establish standards of practice that members should meet to fulfill professional obligations, including the duty to protect the safety, health, and welfare of the public and the environment.

There are a few different publications that guide the design of gravel/resource style roads in BC. These include the BC Supplement to TAC (2019), the Forest Road Engineering Guidebook (2002) and the Ministry of Forests Engineering Manual (2016). All three documents reference the Manual of Geometric Design Standards for Canadian Roads as the underlying design standard. For the purposes of this project as the road will be mainly used by non-industrial users, it is recommended to use the BC Supplement to TAC Chapter 500 road specifications for a Low Volume Road. Table 1 below summarizes the road design specifications that are recommended to be used for the new road construction section. As the existing access roads are in active use, it is assumed that minimal upgrades are required.

Table 1 - Summary of Recommended Geometric Road Design Specifications

Components	30 km/hr Design Speed
Maximum Road Grade	14%
Vertical Curve	K = 6 for Sag, K = 4 for Crest
Minimum Curve Length	30 m
Minimum Stopping Sight Distance	29-39 m
Minimum Horizontal Curve Radius	35 m
Curve Widening	Minimum 1.0 m inside curve widening for all curves below 60m radius with 10 m long tapers
Minimum Cross Drain Culvert Diameter	600 mm
Minimum cross fall	0.04 m/m without super elevation
Ditch Size	Minimum 0.6m deep with a 0.6m wide base; wider ditches may be specified at culvert inlets
Road Width	Minimum 5 m
Turnout Size	Additional 5 m width, 20 m long with a 7.5 m long taper at each end; intervisible when possible
Load Rating	Minimum BCL-625. If industrial traffic will use the road then specify minimum L-100 to determine corrugation and wall thickness of culverts

3 Additional Work Required

As noted in Section 1.2 there remains some additional field work to complete detailed site surveys of three road sections as well as engineered crossing designs for the bridge over Mahood Creek and on the Ruby 5200A for the future replacement of the log culverts.

Additionally, it's recommended to complete a Terrain Stability Assessment on the three road sections noted in Section 1.2.

Once the road within the park has received government approval to fully proceed it would be worthwhile to meet with the local approving agency to map out all of the submissions required to obtain construction approval.

We trust this will meet with your requirements at this time. Once the District has reviewed and accepted this Technical Memorandum, we propose a review with the District to determine the next steps in completing the Issued For Construction drawings for the Rockwell Drive to Lougheed Highway option. This work would be completed under a separate contract.

Yours Truly,

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2020-03-13

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Attach. Detailed Road Assessment – Plan Views

Photo 1

December 10th, 2019
View from start of
railway grade along
park access road

Photo 2

December 10th, 2019
View of start of
railway grade

Photo 3

December 10th, 2019
View of typical railway grade condition

Photo 4

December 10th, 2019
View of stream crossing #1 at station 0+670

Photo 5

December 10th, 2019
View of stream crossing #2 near station 1+165 and old wood stave culvert to replace.

Photo 6

December 10th, 2019
View of narrow road section near 1+200; will require shifting road into cutslope for 10-15m to create safe road width

Photo 7

December 10th, 2019
View of narrow road section near 1+250; will require blasting into rock face to create safe road width

Photo 8

December 10th, 2019
View of stream crossing #3 near station 1+527.

Photo 9

December 9th, 2019
View of section with narrow road near station 1+700, will require shifting road into cutslope slightly.

Photo 10

December 9th, 2019
View of railway grade near station 1+800, bedrock adjacent to road.

Photo 11

December 9th, 2019
Start of new road construction near station 1+890 and stream crossing #4 (NCD)

Photo 12

December 9th, 2019
View of Provincial Park Boundary sign near station 1+950

Photo 13

December 9th, 2019
View of tie in to existing FSR above Mahood Creek bridge

Photo 14

December 9th, 2019
View of original railway grade crossing location at Mahood Creek

Photo 15

December 9th, 2019
View of original railway grade crossing location at Mahood Creek