



# **Alberni Clayoquot Regional District Ring Road Connector – Highway 4 to Franklin River Road Route Study Conceptual Design and Cost Estimate**

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#12-552





## 1.0 EXECUTIVE SUMMARY

R. F. Binnie and Associates Ltd. were asked to do a route study and conceptual design for a road connecting Highway 4 to Franklin River Road. Some work on this route was already done by Island Timberlands in conjunction with the Alberni-Clayoquot Regional District (ACRD) and the City of Port Alberni and several options were roughed in on an orthophoto map provided to Binnie by the ACRD. This study looked at the options presented, determined their feasibility, and developed projects cost estimates for the routes that were deemed feasible by Binnie.

For this study, Binnie analyzed four Options. The first Option which is referred in this report as **Option 1** exits Highway 4 just downhill of the access to the shooting range. A full left turn slot on Highway 4 for a T-intersection and an 80km/h design speed would be required at this point. Binnie felt that this was a better location for an intersection than the one shown in Island Timberlands Option drawings, which showed the intersection at Aspenden Road. Aspenden Road is just west of Coombs Country Candy. An intersection at this point would require the Ring Road to travel east or uphill, more or less parallel to the existing Highway 4 to avoid crossing Roger Creek and its formidable gullies. This in effect would require traffic to backtrack. With the Intersection just west of the access to the shooting range, it is a more direct route to Ship Creek Road. Ring Road would connect with Ship Creek at the current intersection where Cameron Main, Ship Creek Road and the road to Bamfield intersect. This route will require two bridges, both approximately 22 metres in length. The first bridge will cross Stokes Creek, at a point about 800 metres onto Ring Road from Highway 4. The second bridge will cross Roger Creek at about kilometre 2.1 of Ring Road. At this location Roger Creek is not in a deep canyon, and we estimate a bridge about 3 metres above the water elevation with a 10 metre wide channel would suffice. Once across Roger Creek, Ring Road has to gain elevation to attain the height of the plateau, so the alignment follows the contours to gain such elevation. From there it is relatively easy road building following existing logging roads to the Cameron Main. The total length of Option 2 is 10.3 kilometres from Highway 4 to the Cameron Main, Franklin River Road Intersection.

The estimated cost for this Option is \$17.3 million.

**Option 2** - uses the same alignment as Option 1 to kilometre 4.9 then branches off to intersect Franklin River Road about 1 km South of Anderson Road. This option provides a more direct route to Franklin River Road and a shorter distance to the City of Port Alberni's waterfront. While this route is more direct and would save travel time for motorists travelling to Port Alberni, the terrain is very steep and difficult with a very large excavation required to match the grade of Franklin River Road. The total length of Option 2 is 8.3 kilometres.

The estimated cost for this Option is \$20.5 million.

**Option 3** - This is a combination of both Option 1 and 2. Option 1 and Option 2 could be built as standalone projects. Option 3 is an option to build both as a single project and the cost estimate has been developed accordingly.

The estimated cost for this Option is \$27.8 million.



**Option 4** – leaves Highway 4 close to the new Chrysler dealership by Maebelle Road at Dundalk Road. The major difficulty with this option is the crossing of Roger Creek. At this location Roger Creek is in a deep gorge cut through shale. The road profile would have to cut into the gorge from both sides to avoid a lengthy bridge. Our initial investigation showed that at a minimum, a bridge would have to be in the vicinity of 100 metres long. Even with a bridge of this length, the grade on the south side of the creek to get to the plateau would be in the order of 10% which would result in large excavation quantities. We have attached a plan and profile view of the first segment of this option. Currently the cost of bridges, depending on their complexity, is about \$3,500/m<sup>2</sup>. The road width is 10.2 metres for a 100 metres long bridge gives a surface area of 1,020 m<sup>2</sup>. A bridge of this length in this location would cost in the order of \$3.5 Million. Secondly a grade of 10% exiting the bridge is not desirable and at the maximum recommended by TAC guidelines for a 60 km/h design speed and above the recommended 8% for an 80 km/h design speed. To achieve an 8% grade means either lengthening the bridge, or flattening the profile on the south side of the bridge, which would increase excavation quantities adversely. For these reasons, Binnie did not pursue this option any further.

#### **Travel distances and times**

The distance from Highway 4 through Option 1 to the Franklin River Road/Cameron Main junction, then to the intersection with Option 2 is 10.3 kilometres. From this intersection, then heading north on the Franklin River Road past Cox Lake to the intersection with Option 2 is 4.0 kilometres.

The total distance for Option 2 is 8.3 kilometres. The difference is 6.0 kilometres. If Option 1 is only built, a vehicle travelling at 60 km/h, would take 6 minutes longer travelling to Port Alberni. Conversely if only Option 2 is built, the travel time to Port Alberni is minimized, and those travelling to Bamfield would have to travel a further 4 kilometres to get to the junction of Franklin River Road and Cameron Main, or an additional 4 minutes.

#### **Other Considerations:**

The existing Franklin River Road from the Cameron Main Junction to where Franklin River Road intersects with Option 2 may need improvements if additional truck traffic is introduced. It would be quite easy to spend a couple million dollars to strengthen, upgrade, and repair this route. For this reason, it may be best to pursue Option 2. For relatively the same cost, vehicles entering the Franklin River Road would be 4 kilometres closer to Port Alberni if their destination is the waterfront.

#### **Potential Cost Savings:**

It may be possible to save costs if Option 1 and 2 are fully implemented by not paving Option 1 from kilometre 4.9 to the junction with Cameron Main and Franklin River Road. This could potentially save costs in asphalt and road base gravels to the tune of about 2.0 million dollars.

Other savings could potentially be found on Option two by further engineering to try to reduce the volume of excavation required.



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## 2.0 INTRODUCTION

R. F. Binnie and Associates Ltd. were hired by Alberni Clayoquot Regional District (ACRD) to carry out a conceptual design study for a new road into Port Alberni connecting Highway 4 with the Franklin River/Ship Creek Road.

The scope of the work was as follows:

- Use the plans developed by Island Timberlands and the ACRD as a guide to assess viable routes;
- Use the digital mapping provided by Island Timberlands as the basis for the design;
- Determine approximate cost estimates for the Options;
- Provide comments on the feasibility and pros and cons of this route.

The Options examined are as follows:

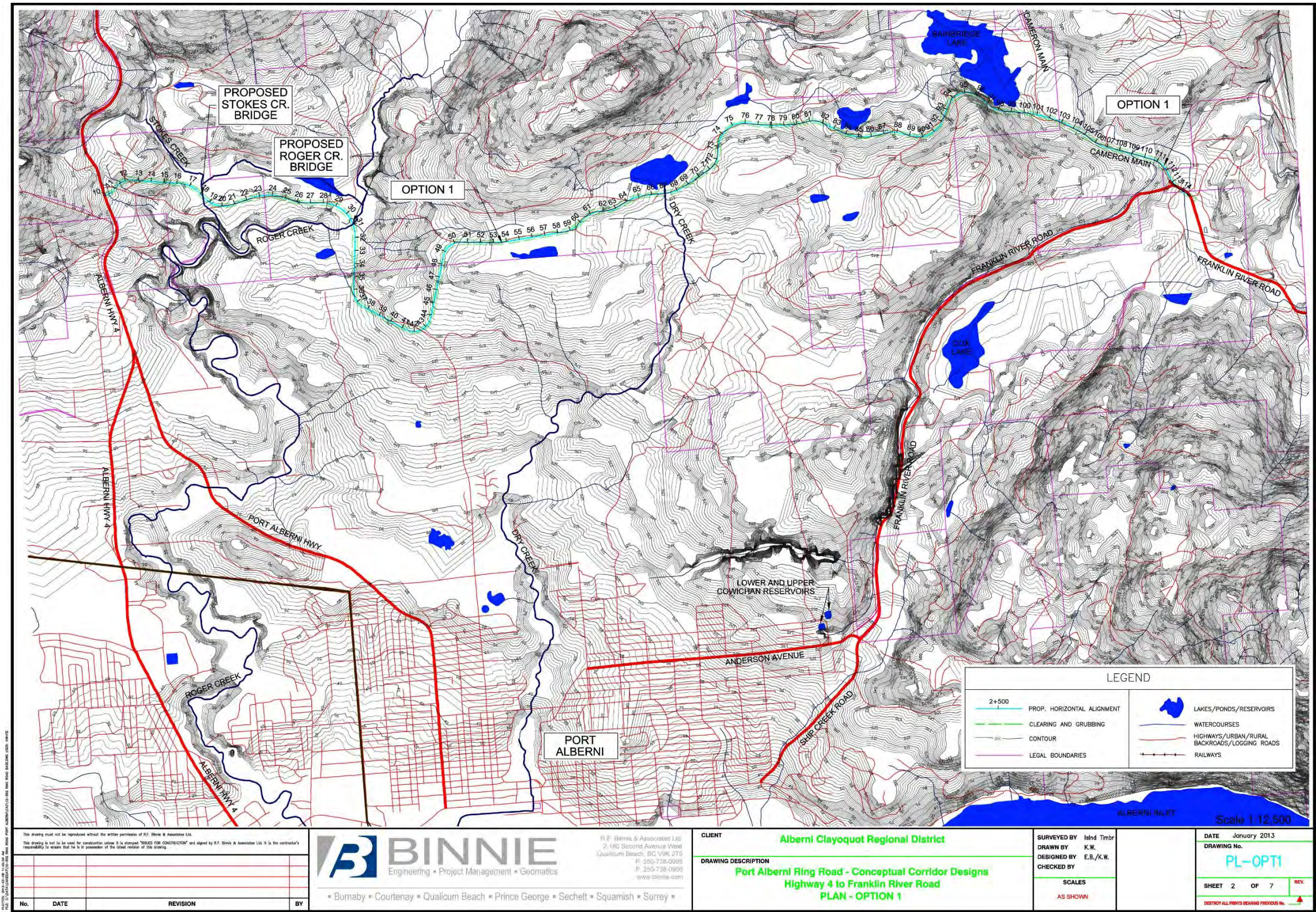
- Option 1 – from Highway 4 to the Cameron Main/Franklin River Road junction;
- Option 2 – Highway 4 to Franklin River Road intersecting Franklin River Road about 1 kilometre south of Anderson Road;
- Option 3 which is a combination of Option 1 and 2.
- Option 4 – From Dundalk Road (near new Chevron Dealership) to Franklin River Road.

Please note, Binnie did not examine the connecting roads to Burde Street, or the extension of Argyle Street from the Concept roads, as this was not part of the scope of the work. The options are there to connect Burde Street if required. Argyle would be more difficult because of recent development at the south end of Argyle.





2.1 FIGURE 2.1 OPTION 1 PLAN





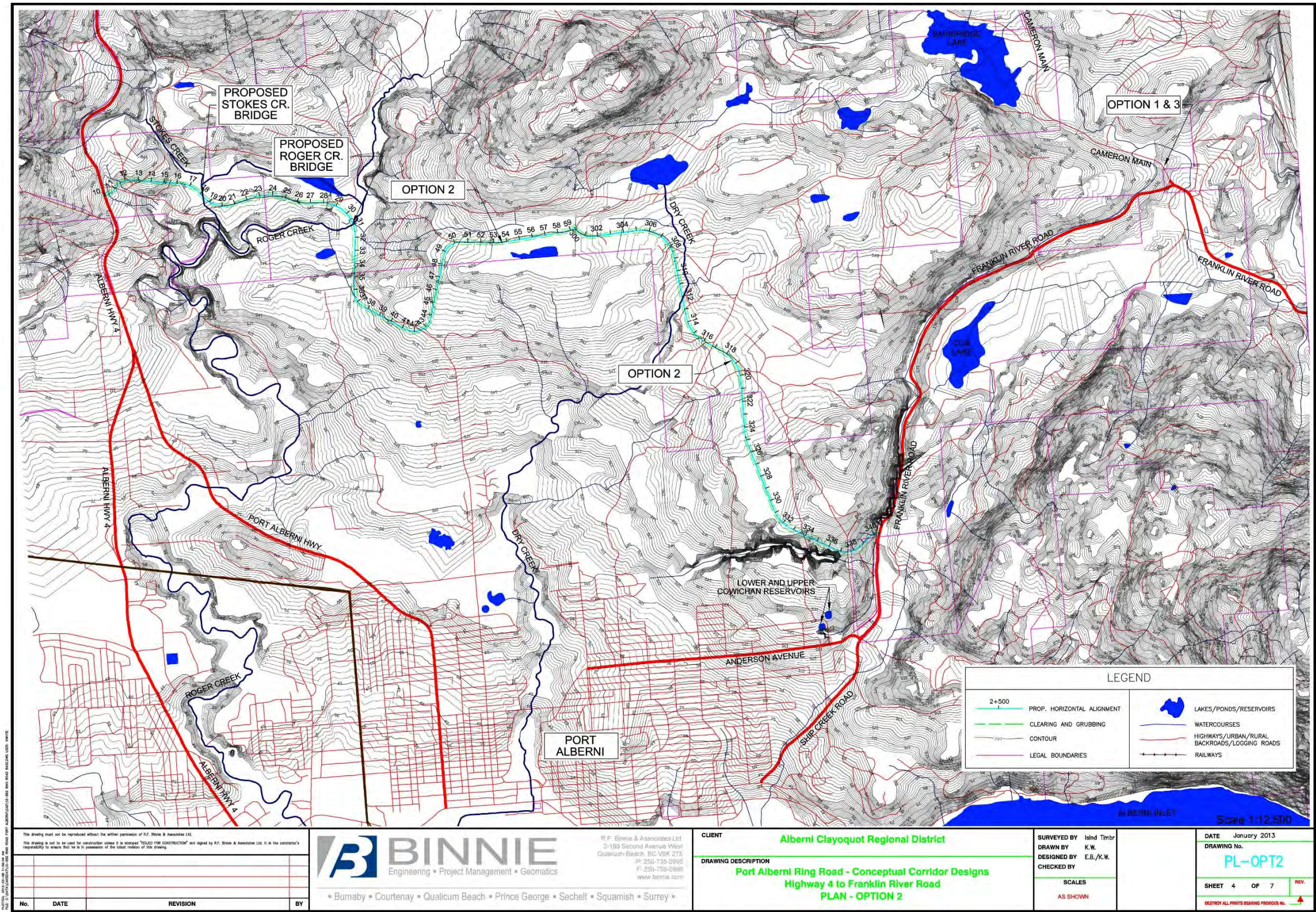


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2.3 FIGURE 2.3 OPTION 2 PLAN

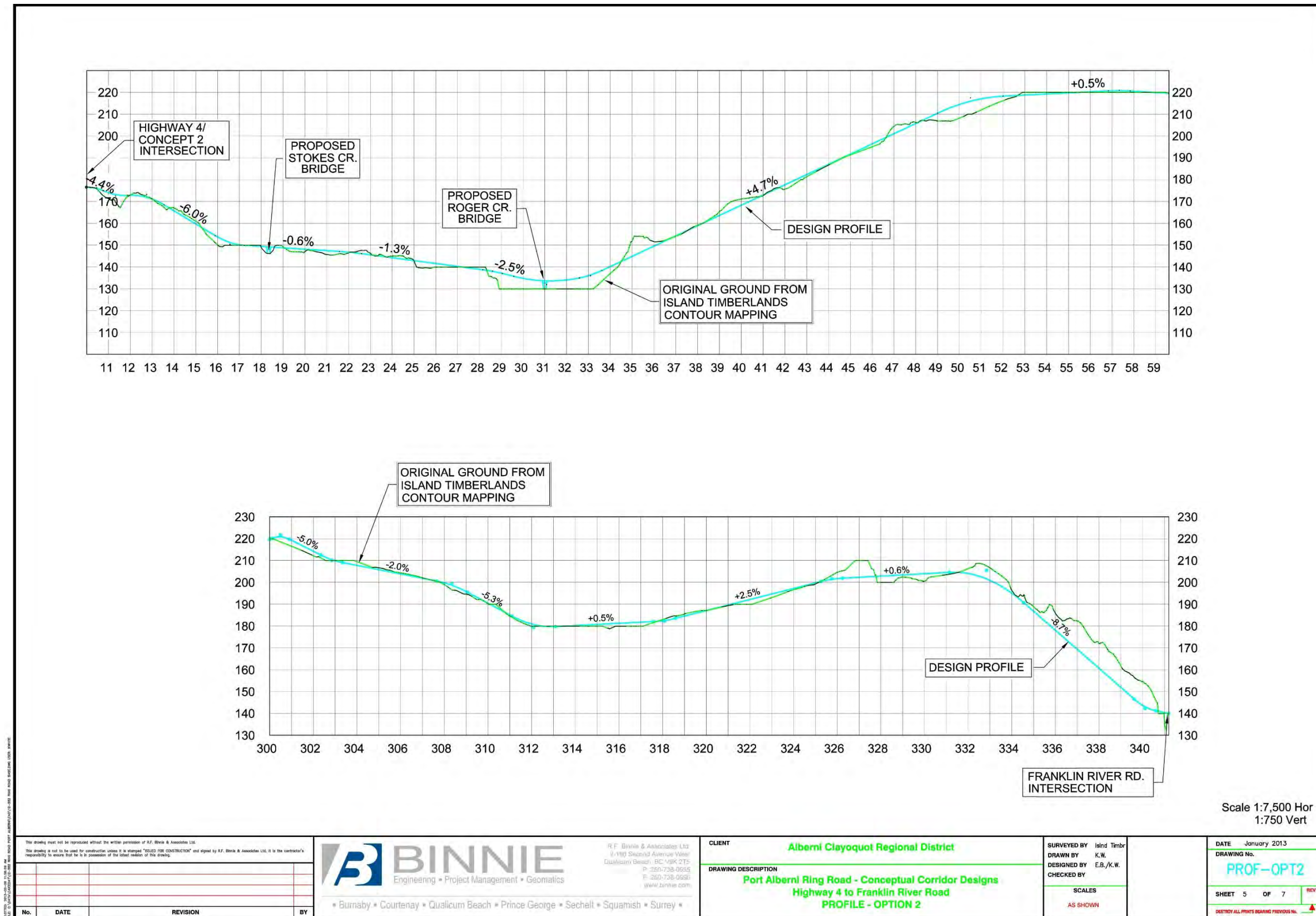






Ring Road Route Study – Highway 4 to Franklin River Road  
Route Study – Conceptual Design and Cost Estimate

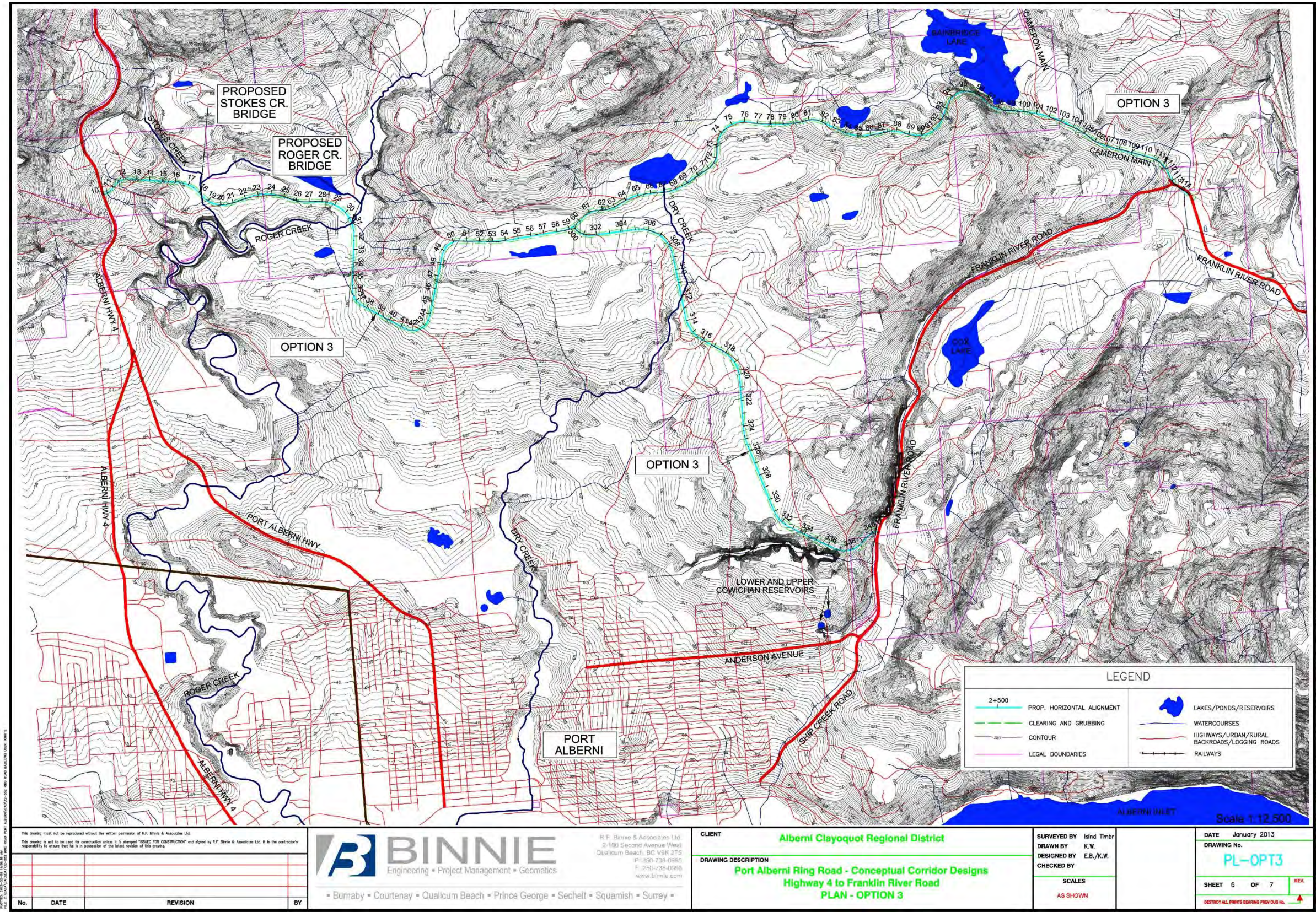
2.4 FIGURE 2.4 OPTION 2 PROFILE







2.5 FIGURE 2.5 OPTION 3 PLAN











## 3.0 DESIGN PARAMETERS

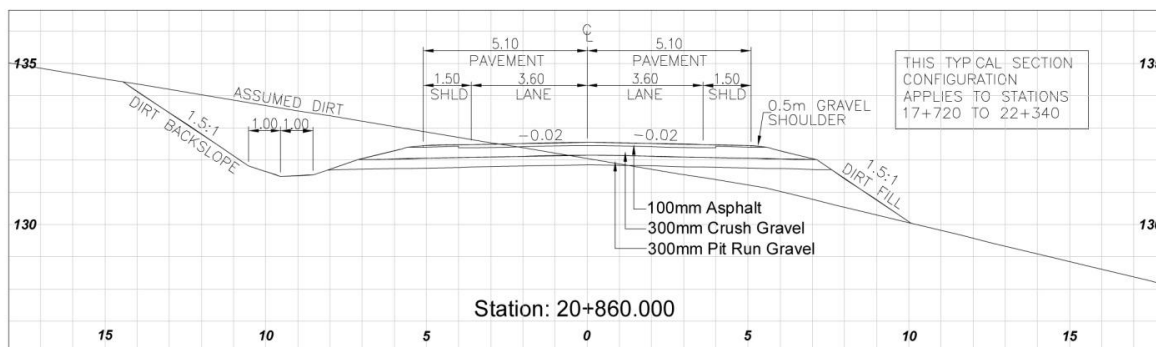
### 3.1 DESIGN

The design parameters for this project were obtained from the B.C. Supplement to TAC Geometric Design Guide for a Rural Conventional Undivided (RCU) Roadway Class. The previous MOT Highway Engineering Design Manual (Green Book) and the TAC Geometric Design Guide for Canadian Roads (TAC) were also drawn upon to provide design parameters for items not found in the B.C. Supplement to TAC Geometric Design Guide.

### 3.2 TYPICAL CROSS-SECTION

The cross-section consists of two 3.6 m lanes with 1.5 m wide paved shoulders and 0.5 m of gravel shoulders. The 1.5 m of paved shoulders is the minimum width required for a shoulder bikeway. Additional cross-section elements are shown in **Figure 3.1** below.

Much of the alignment is inaccessible at this stage of the design so an assumption was made that all the material to be removed for road construction is dirt excavation, not solid rock. Clear zones and recovery zones have not been applied to the cross section elements.



**Figure 3.1: Typical Cross Section Ring Road**

The typical section assumes 1.5:1 cut and fill slopes which would need to be confirmed during future geotechnical investigations. A 2:1 cut and fill slope may be required which would create a larger project footprint and cost. A standard pavement structure consisting of 100mm of asphalt pavement has been assumed but would also need to be confirmed by the geotechnical investigation.

### 3.3 HORIZONTAL ALIGNMENT

A minimum radius of 130m and a maximum super elevation of 6% have been used as per Table 330.01.04 from the B.C. Supplement to TAC Geometric Design Guide which achieves a 60 km/hr design speed. There are a couple short segments where the terrain won't allow a 60km/hr design speed and curve warning signs can be provided at the curves that do not meet the 60km/h design speed. Initially, we looked at trying to achieve an 80km/hr design speed, but because of the nature of the terrain we felt it best to design to 60km/hr to reduce the construction costs. If required an 80 km/hr design speed may be achievable with further engineering work, but for the purposes of this study we adopted a 60km/hr design speed. The exception is that a left hand turn slot on Highway 4 will have to be designed to an 80km/h design speed.





### 3.4 VERTICAL ALIGNMENT

TAC recommends a maximum grade of 10% for a Rural Conventional Undivided (RCU) highway in mountainous terrain for a 60 km/h design speed and 8% for an 80 km/h design speed. The previous MoT Highway Engineering Design Manual recommended a maximum grade of 10% for RCU in mountainous terrain. For this design we have achieved a maximum of 8% on Option 1 and 8.7% on Option 2. The proposed profiles for the various options are shown in Section 2.

### 3.5 INTERSECTION DESIGN

On Highway 4 we recommend that a T-intersection be designed just west of the access to the shooting range. Although the highway is on a grade of about 4%, there is good site distance and appears to be little if any conflict with existing properties or driveway access. A 4% grade through the intersection is also within TAC guidelines. We have determined this location to best suit the new Route to Ring Road. Further west the alignment and site distances are poor. To go directly south from there to Ring Road would not be a viable option because of the large canyon at Roger Creek. From past experience of a recently constructed intersection at Whiskey Creek on Highway 4, we have estimated the cost of the intersection at \$400,000.

### 3.6 STRUCTURAL DESIGN

The new route crosses two creeks requiring bridges. It is not possible to accurately determine the lengths of the bridges due to the inaccuracy of the contour mapping, but we do believe we can comfortably estimate the length of bridge required for both locations. We have assumed a channel width of 10 metres, with the bridges being three metres above the current water elevation. The bridges will require bridge end fills made of gravel at each end of the bridge, protected by 500kg rip-rap. The bridges will be constructed on abutments on the bridge end fills and we estimate the costs of bridges to be about \$3,500.00 per square metre of bridge deck. The structures are fairly simple and we do not anticipate any piers being required for the bridge but further geotechnical investigation would be required to confirm this.



Figure 3.2: View of Roger Creek at possible bridge site.





### **3.7 DRAINAGE DESIGN**

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There are some creeks, which will require large diameter pipes. At Dry Creek, which drains from a swamp at Station 67 of Option 1, and crosses Option 2, we have assumed pipe sizes of 2.0 metres in diameter. For the remaining alignment we have projected culverts at a nominal spacing of 300 metres and nominal size alternating between 1000mm and 600mm along the entire project length to establish the drainage costs.

### **3.8 CONCRETE ROADSIDE BARRIER**

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The only concrete barrier requirements on this project that we have considered are at the approaches to the bridges. The need for additional concrete barriers at high fill locations would be determined as the design progresses.

### **3.9 PROPERTY ISSUES**

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In this report we have made no attempt to determine ownership or status of the land. An allowance of 3% of the construction cost is in the cost estimates for land purchases if necessary.

### **3.10 ENVIRONMENT**

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It is clear that there will be significant environmental issues related to this project. Ring Road crosses Stokes Creek and Roger Creek with bridges, so a detailed environmental investigation would need to be done in the next phase of design. The environmental investigation may indicate the need for larger culvert structures or increased bridge lengths but this will be determined at a later stage. On the west end of the project, the alignment crosses the headwaters of Dry Creek. We have assumed that 2.0 metre diameter culverts will be large enough to manage the flow. A hydrological study will also be required to determine flows in Roger Creek, Stokes Creek, Dry Creek, and other water courses to determine bridge parameters and culvert sizing.

Another issue related to Option 1 is the proximity of the new road to the City's reservoir at Bainbridge Lake. The design has to take into account, storm water management to ensure that contaminated water does not enter any stream that enters into the reservoir.





## 4.0 ALIGNMENT OPTIONS AND CONSTRUCTION COSTS

A guiding principal for Binnie when selecting options was to utilize existing logging road networks as much as possible. This strategy we believe will ultimately reduce costs by minimizing excavation quantities, reducing the amount of clearing and grubbing, maximize opportunities to utilize existing culverts for drainage courses, and utilizes the strength of the existing road as much as possible. The cost savings that may be realized by using the existing logging road networks have not been accounted for in the costing of the various options. This will be developed later when a more detailed survey and mapping exercise is done of the various routes.

The design parameters assume that all culverts, road gravels, asphalt, and rip-rap will be new, however in reality utilization of some of the existing infrastructure, including the Cameron Main from Bainbridge Lake to the junction at Franklin River Road will ultimately save in costs.

The earthwork volumes were determined from the digital mapping provided by Island Timberlands. We believe these are fairly reliable in generating earthworks volumes. In driving the roadways, it appears the excavations will mostly be soil, not bedrock. A geotechnical investigation has not been done and is not part of this Option design.

For clearing and grubbing boundaries, the areas have been determined from the cross sections and we have added 5 metres additional width on either side of the cut or fill slopes to provide room for storing topsoil and to provide width for falling trees.

Option 2 drops from elevation 205 metres to 140 metres in a relatively short distance (800 metres) causing an 8.7% grade and very large excavation quantities. Within the scope of work done, we did not find an alternative route, however with an additional review, and broadened scope, a route may exist which would reduce the volume of excavation and cost for this option. This should be investigated further when doing preliminary design work.





## **COST ESTIMATES**





# **Ring Road Route Study – Highway 4 to Franklin River Road** **Route Study – Conceptual Design and Cost Estimate**

Option 1 Highway 4 to Intersection of Franklin River Road and Cameron Main					
Ring Road - Station 10+00 to 113+00 - 10.3km					
		Quantity	Unit	Price	Extended
<b>Mobilization</b>		1	LS	\$530,000	\$530,000
<b>Traffic Management</b>		1	LS	\$180,000	\$180,000
<b>Quality Management</b>		1	LS	\$360,000	\$360,000
<b>Clearing and Grubbing</b>		36.3	ha	\$12,000	\$435,600
<b>Intersection Construction</b>					
	Highway 4 Lt Turn Slot to Ring Road	1	ea	\$400,000	\$400,000
	Franklin River Road/Cameron Main	1	ea.	\$200,000	\$200,000
<b>Pavement</b>		23,406	tonnes	\$120.00	\$2,808,720
<b>Guardrail</b>		240	ea	\$250.00	\$60,000
<b>Gravel</b>					
	25mm	40,344	m3	\$30.00	\$1,210,320
	SGSB	44,569	m3	\$20.00	\$891,380
	Shoulder	258	m3	\$100.00	\$25,800
<b>Excavation</b>					
	Stripping	54,000	m3	\$7.00	\$378,000
	Type D excavation	239,350	m3	\$10.00	\$2,393,500
<b>Culverts</b>					
	2000dia Creek Crossing	60	m	\$1,000	\$60,000
	600 dia	340	m	\$300.00	\$102,000
	1000 dia	340	m	\$600.00	\$204,000
	Rip-Rap 25Kg	50	m3	\$90.00	\$4,500
<b>Bridges</b>					
	Stokes Creek	204	m2	\$3,500.00	\$714,000
	Roger Creek	204	m2	\$3,500.00	\$714,000
	Rip -Rap 500kg	280	m3	\$300.00	\$84,000
	Bridge End Fill	3,480	m3	\$50.00	\$174,000
				<b>Sub-Total</b>	<b>\$11,929,820</b>
Contingency 16%					\$1,908,771
Detailed Design 7%					\$835,087
Construction Supervision 10%					\$1,192,982
Project Management 4%					\$477,193
Management Reserve 5%					\$596,491
Property Acquisition 3%					\$357,895
<b>Total cost Option 1 – 10.3 kilometres</b>				<b>Total</b>	<b>\$17,298,239</b>
<b>ROUNDED ESTIMATE</b>					<b>\$17,300,000</b>





# **Ring Road Route Study – Highway 4 to Franklin River Road** **Route Study – Conceptual Design and Cost Estimate**

<b>Option 2 From Highway 4 to Franklin River Road approx. 1km South of Anderson Road</b>					
<b>Total length 8.34 km.</b>					
		<b>Quantity</b>	<b>Unit</b>	<b>Price</b>	<b>Extended</b>
<b>Mobilization</b>		1	LS	\$630,000	\$630,000
<b>Traffic Management</b>		1	LS	\$215,000	\$215,000
<b>Quality Management</b>		1	LS	\$430,000	\$430,000
<b>Clearing and Grubbing</b>		32.3	ha	\$12,000	\$387,600
<b>Intersection Construction</b>					
	Highway 4 Left Turn Slot to Ring Road	1	ea	\$400,000	\$400,000
	Franklin River Road	1	ea	\$200,000	\$200,000
<b>Pavement</b>		20,309	tonnes	\$120.00	\$2,437,080
<b>Guardrail</b>		240	ea	\$250.00	\$60,000
<b>Gravel</b>					
	25mm	35,019	m3	\$30.00	\$1,050,570
	SGSB	40,704	m3	\$20.00	\$814,080
	Shoulder	224	m3	\$100.00	\$22,400
<b>Excavation</b>					
	Stripping	48,100	m3	\$7.00	\$336,700
	Type D excavation	513,421	m3	\$10.00	\$5,134,210
<b>Culverts</b>					
	2000dia Creek Crossing	60	m	\$1,000	\$60,000
	600 dia	280	m	\$300.00	\$84,000
	1000 dia	280	m	\$600.00	\$168,000
	Rip Rap - 25kg	84	m3	\$90.00	\$7,560
<b>Bridges</b>					
	Stokes Creek	204	m2	\$3,500.00	\$714,000
	Roger Creek	204	m2	\$3,500.00	\$714,000
	Rip -Rap 500kg	280	m3	\$300.00	\$84,000
	Bridge End Fill	3,480	m3	\$50.00	\$174,000
				<b>Sub-Total</b>	<b>\$14,123,200</b>
	Contingency 16%				\$2,259,712
	Detailed Design 7%				\$988,624
	Construction Supervision 10%				\$1,412,320
	Project Management 4%				\$564,928
	Management Reserve 5%				\$706,160
	Property Acquisition 3%				\$423,696
	<b>Total for Option 2 - 8.34 km.</b>			<b>Total</b>	<b>\$20,478,640</b>
<b>ROUNDED ESTIMATE</b>					<b>\$20,500,000</b>





## Ring Road Route Study – Highway 4 to Franklin River Road Route Study – Conceptual Design and Cost Estimate

Option 3 (Option 1 and 2 combined)					
Total Length 13.74 kilometres					
		Quantity	Unit	Price	Extended
<b>Mobilization</b>		1	LS	\$860,000	\$860,000
<b>Traffic Management</b>		1	LS	\$295,000	\$295,000
<b>Quality Management</b>		1	LS	\$590,000	\$590,000
<b>Clearing and Grubbing</b>		51.7	ha	\$12,000	\$620,400
<b>Intersection</b>					
	Highway 4 Left Turn Slot to Ring Road	1	ea.	\$400,000	\$400,000
	Franklin River Road	1	ea	\$200,000	\$200,000
	Franklin River Road/Cameron Main	1	ea.	\$200,000	\$200,000
<b>Pavement</b>		32,515	tonnes	\$120.00	\$3,901,800
<b>Guardrail</b>		240	ea	\$250.00	\$60,000
<b>Gravel</b>					
	25mm	56,063	m3	\$30.00	\$1,681,890
	SGSB	61,973	m3	\$20.00	\$1,239,460
	Shoulder	359	m3	\$100.00	\$35,900
<b>Excavation</b>					
	Stripping	77,100	m3	\$7.00	\$539,700
	Type D excavation	634,971	m3	\$10.00	\$6,349,710
<b>Culverts</b>					
	2000dia Creek Crossing	80	m	\$1,000	\$80,000
	600 dia.	460	m	\$300.00	\$138,000
	1000 dia	460	m	\$600.00	\$276,000
	25kg rip rap	134	m3	\$90.00	\$12,060
<b>Bridges</b>					
	Stokes Creek	204	m2	\$3,500.00	\$714,000
	Roger Creek	204	m2	\$3,500.00	\$714,000
	Rip -Rap 500kg	280	m3	\$300.00	\$84,000
	Bridge End Fill	3,480	m3	\$50.00	\$174,000
				<b>Sub-Total</b>	<b>\$19,165,920</b>
Contingency 16%					\$3,066,547
Detailed Design 7%					\$1,341,614
Construction Supervision 10%					\$1,916,592
Project Management 4%					\$766,637
Management Reserve 5%					\$958,296
Property Acquisition 3%					\$574,978
<b>Total for Option 3 - 13.74 km.</b>				<b>Total</b>	<b>\$27,790,584</b>
<b>ROUNDED ESTIMATE</b>					<b>\$27,800,000</b>

The above estimates contain contingencies at percentages typically used by the Ministry of Transportation and Infrastructure for projects similar in nature to this one.





### **Quantity Balance**

It is worth noting that with this design there is a rough balance of cuts and embankments for Option 1. For the first 4.94 kilometres there are 117,975 metres of cut and 102,035 metres of embankment. For the next 5.4 kilometres there are 121,550 metres of cut and 124,894 metres of embankment. This will be further refined with the next phase of design.

Option 2 is much different. The balance for the first 4.94 kilometres is as above. For the section from km 4.95 to km 8.3 the excavation quantity is 395,621 cubic metres and embankment is only 11,830 metres, so a large amount of excavation would have to be wasted. We have not considered a waste site for this material.





## 5.0 CONCLUSION

This study shows that there is a route joining Highway 4 to Franklin River Road. There are areas of reasonably steep terrain and two significant water courses to cross requiring bridges, or arch spans. We did achieve a 60km/hr design speed for most of the corridor.

To build Option 1 and 2 would cost approximately 27.8 million dollars. To build just Option 1 from Highway 4 to the Cameron Main intersection with Franklin River Road would cost approximately 17.8 million dollars. Another option is to build just Option 2 that would cost approximately 20.5 million dollars. Option 4 that crosses Roger Creek at the Chevron Dealer on Highway 4, we felt is not a viable option due to the steep grades and cost of crossing Roger Creek.

More detailed work would need to be done to develop all of these Options into viable designs such as but not limited to topographical survey, public consultation, design, geotechnical, environmental review, archaeological investigation, first nation's consultation, and liaison with all stakeholders. Further refinements of the alignments and profiles are required to determine the need for concrete roadside barriers, bridge lengths, and earthworks quantities. To confirm the pavement structure, bridge foundation designs and cut and fill slopes will require an investigation by a geotechnical engineer.

Some of the benefits of the new route are as follows:

- A connection between Highway 4 in the vicinity of the shooting range and Franklin River Road shortens the distance for vehicles heading towards Franklin River and Bamfield.
- The new route would allow large trucks access to the waterfront, via Ship Creek Road, eliminating the need for trucks to travel through the downtown core.  
A new road would allow expansion of the City boundaries as Burde Street could be continued to intersect the Ring Road to allow for expanded development.

## 5.1 NEXT STEPS

The following items are suggested next steps that should be considered to further the design.

- A meeting with the Ministry of Transportation should be held to discuss the location of the left turn slot on Highway 4.
- Once a preferred route is selected, survey data such as LiDAR or low level aerial photography should be obtained and a Preliminary Design should be completed. The Preliminary Design will provide a greater level of design detail and will result in a more accurate construction cost estimate. Geotechnical, environmental and property constraints should also be identified as part of the Preliminary Design.