

February 27, 2019

0037-075/02

Via email: rbouma@ladysmith.ca

Town of Ladysmith Engineering & Public Works Department
330 Sixth Ave, Box 220
Ladysmith, BC
V9G 1A2

Attn: Ryan Bouma, P.Eng. - Senior Engineering Technologist

**Re: 4th Avenue Culvert Replacement at Rocky Creek, Ladysmith, BC
2019 Culvert Option Review (Revised)**

Dear Ryan:

This letter summarizes a culvert option review for the re-construction of the 4th Avenue crossing over Rocky Creek in Ladysmith, BC. This report is a follow-up to our previous submittal of April 2018 and is subsequent to last year's detailed bridge design and tender (RFP 2018 IS-05).

BACKGROUND

- The initial study was triggered by a heavy rainfall event that occurred in January of 2018 and resulted in settlement of the sidewalk on the South side of 4th Avenue, as well as partial sloughing of the upstream bank. Upon later investigation, it was discovered that the existing 3.0m dia. steel culvert was experiencing partial failure in the form of separation of the southernmost (inlet) section of the culvert from the rest of the structure resulting in both settlement and water ingress into the overlying soils. It was noted that a wooden debris jam was blocking entry to the culvert, causing the water level to rise at the inlet. The natural stream width upstream of the culvert is in the order of 8-10m and the current culvert width of 3m significantly restricts the width of flow under 4th Avenue.
- A Conceptual Options Review of crossing options and probable costs was completed by Herold Engineering in April 2018. The study determined that a bridge would provide the best technical solution in terms of hydraulic opening and ability to pass debris (i.e. lower risk of log-jams than a culvert option). It was also determined that a bridge would likely be more expensive than the culvert options, but was feasible to construct within a shorter environmental window for allowable in-stream works. At that time, the Town opted to proceed with the bridge option based on the options analysis
- During the detailed design phase, two significant project constraints were discovered:
 1. It was determined that the FortisBC gas line under the existing road could not be capped off for bridge construction, since it is 150mm dia. and acts as a main feed for the Town's gas supply. The tender documents addressed this by

including the temporary re-routing of the gas main in the contract scope, done through contractor and FortisBC forces.

2. It was determined that there was a depression at the existing culvert inlet which likely affected culvert hydraulics and enhanced scour at the creek bed. It was determined that in order to re-create a uniform grade on the creek-bed, to enhance environmental characteristics and improve hydraulic performance, the area within the existing culvert would have to be raised by approximately 1m.
- The bridge option was tendered in August 2018 with a closing date of August 23, 2018. The timing of this tender was not ideal due to the in-stream works having to be complete by September 15, 2018.
 - During the bridge tender, there was feedback from bidders that it would not be feasible to keep the road open while constructing a bridge. To address this, the Town offered to open up a detour from the west end of Fourth Avenue to establish a detour route via the Comox Logging Truck Road and Christie Road for the duration of construction.
 - While the lowest bridge tender came in under the project budget, it was deemed non-compliant due to a clerical error on the tender form. The Town subsequently cancelled the tender and proceeded with temporary stabilization of the upstream bank at the existing culvert to allow for further studies of available options for a long-term solution.

The temporary stabilization measures included:

- Removing the existing damaged culvert section
 - Installing a 3.3m dia. CSP section at the culvert inlet
 - Realigning the FortisBC gas main
 - Excavating the embankment around the culvert and reinstating the slope with lock block and riprap placed under geotechnical engineering review
 - Topping high-risk trees near the culvert inlet.
 - Installing 2 x 0.9m dia. overflow culverts.
 - Installing a gate valve on the east approach to isolate the watermain crossing.
 - Installing concrete roadside barriers and temporary fencing for pedestrian and vehicle safety.
- In advance of the temporary stabilization measures, the Town purchased a lot on Churchill Road for the purpose of a secondary, emergency, access which worked well during the temporary measures as it allowed for a full closure of 4th Avenue at the creek crossing.

CULVERT OPTIONS REVIEWED

The focus of the technical review for this part of the project was on culvert options. All Options took into consideration the project constraints which included minimal separation to buried sanitary sewer and watermain; and increasing creek width at crossing to enhance environmental characteristics.

The Options are follows:

1. **A Precast Concrete Box Culvert**

This option was reviewed but discounted because they're generally available only in narrower sections (4.25m x 4.25m max. opening) and would have to be used in pairs to accommodate the volume of water anticipated at this site. Pairs of culverts present a significant risk of debris collection.

2. **A Cast-in-place Box Culvert**

This option was considered as well, since this system could be constructed to the width required. This system would however approach the cost of a bridge and provide slightly lower technical performance in terms of hydraulic opening. Significant amounts of cast-in-place concrete work within the creek, while feasible, is not preferable from the perspective of mitigating environmental risks. For these reasons, a cast-in-place box culvert was not studied further.

3. **Various Steel Arch Culverts**

Steel Arch Culverts were reviewed and determined to be feasible, since the upstream crossing at Davidson Road uses this type of structure and is anecdotally performing satisfactorily. Considerations with this type of structure include:

- Depending on the local site conditions, longevity of steel culverts can be an issue. However, new provisions in the bridge code require a target design life of 100 years for corrosion through the steel. Suppliers are addressing this requirement with the use of polymer coatings and other methods of extending the corrosion resistance of these systems.
- Steel culverts are generally shaped in a circular or parabolic arch. This generally means that the opening available for the passage of debris narrows as the water level rises. This is the opposite case for bridges, which generally provide a wider opening at higher water levels.
- At the 4th Avenue site, the requirement to raise the streambed combined with the elevation of the sanitary line above, means that much of the otherwise available hydraulic opening is lost (see attached sketches).
- Since the site has a history of scour to the existing upstream embankment, it is recommended that cast-in-place headwalls be employed. The upstream culvert at Davidson Road uses both upstream and downstream headwalls and a culvert at 4th Avenue should employ the same system.

COST ESTIMATES

- From last year's Tender (RFP IS-05), bridge costs are known to be in the order of \$960,000 to \$1,200,000, plus GST, assuming that a detour is provided by the Town.

Traffic control in the bridge tender ranged from \$16,000 to \$23,000 and related to operation and maintenance of the Comox Logging Road / Christie Road detour. A copy of the tender comparison is attached for reference.

Base Price	\$1,200,000
Reduction – Traffic Control	\$20,000
Total	\$1,180,000

- An estimate from our cost consultant indicates that a Steel Arch culvert and cast-in-place headwalls would be in the order of \$555,000, plus GST, with exclusions of traffic control and additional riprap placement (see attached costing report). This estimate includes a 20% contingency which should be carried for budgeting.

Base Price	\$555,000
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RECOMMENDATION

Based on our review, we have determined that a **Steel Arch Culvert** is feasible at the 4th Avenue site and can be sized to allow the required volume of water calculated for a Q200 event. We have determined that corrosion design can be done to the current bridge code CSA S6-14 to address longevity. The cost comparison indicates that the steel culvert option would be less expensive than a bridge option; however, it should be noted that a culvert option would present a higher risk of debris accumulation (log-jams) than a bridge option. Maintenance budgets for the culvert option should therefore take this into consideration, should the Town choose to go with a culvert.

The measures taken in September 2018 to mitigate future damage to the creek crossing were sufficient to allow for an improved tender timeline that can take advantage of the environmental window for allowable in-stream works. The addition of the Churchill Road detour option will allow for simplified and expedited construction with significantly decreased detour delays.

If you have any questions, please contact the undersigned.

Yours truly,

HEROLD ENGINEERING LIMITED



Steve Scott, P.Eng.

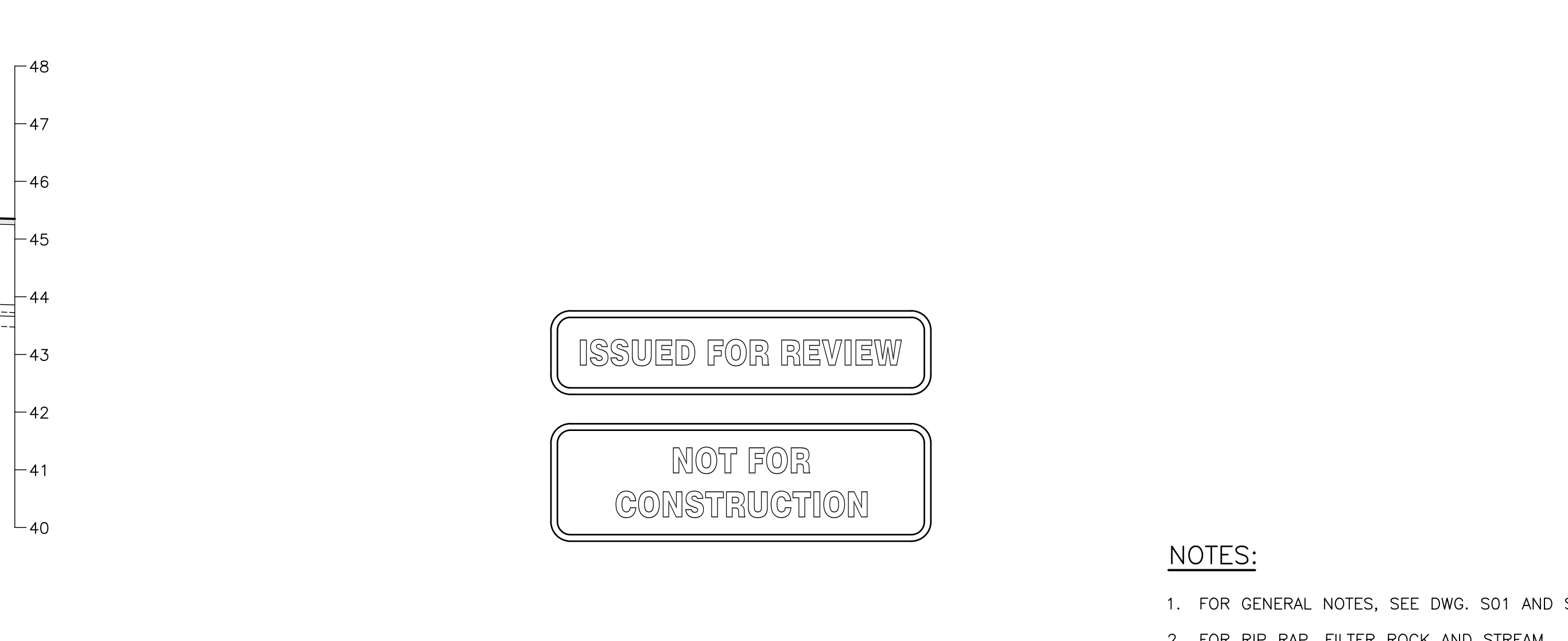
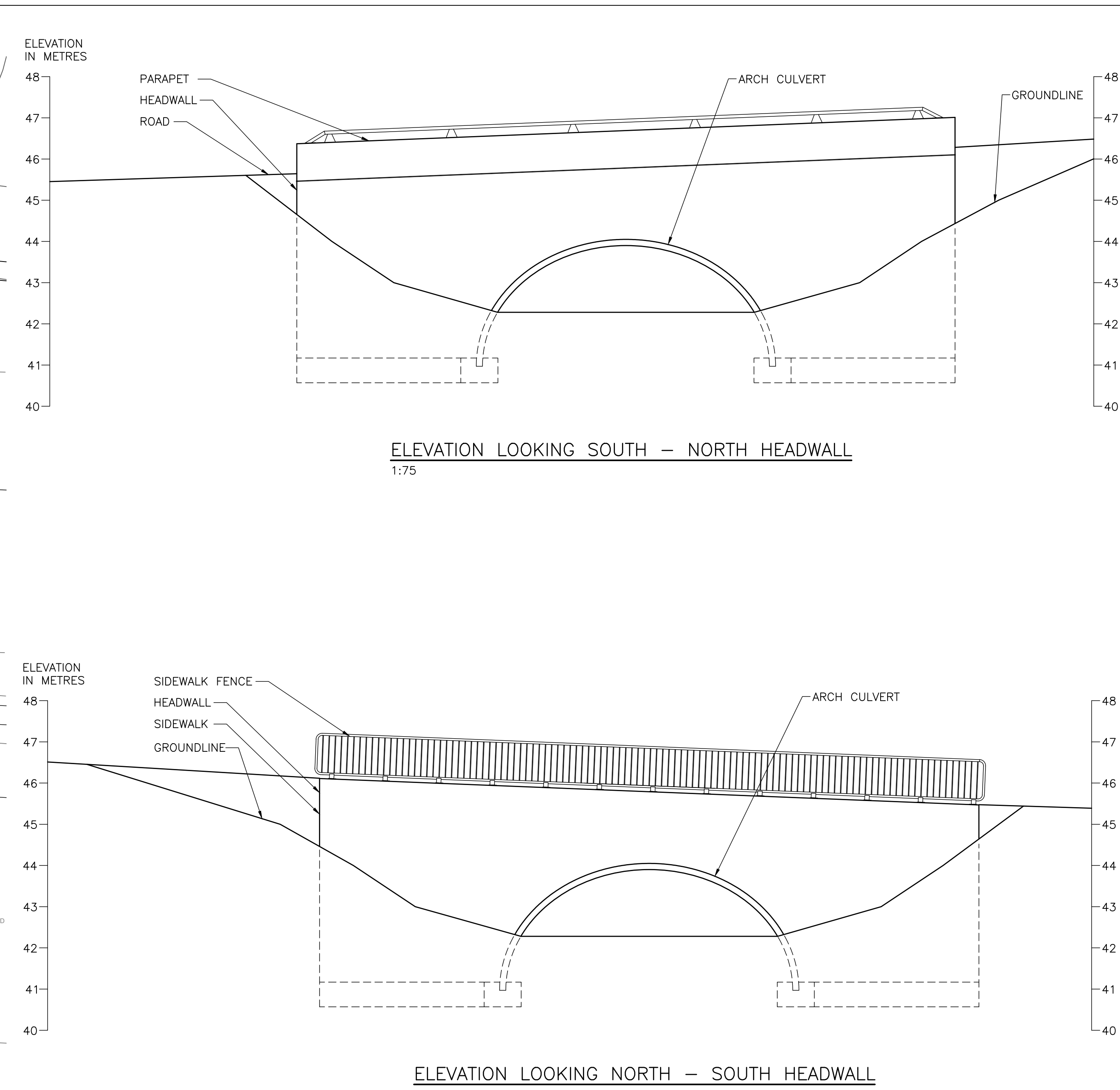


Patrick Ryan, P.Eng., Principal

Attachments:

Appendix A 0037-075 S15, S16, & Sk5
Appendix B RFP IS-05 Cost Comparison
Appendix C Richter7 Engineering Cost Estimate

Appendix A



NOT FOR
CONSTRUCTION

HEL PROJECT No. 0037-075	CLIENT DWG. No. N/A
SCALE AS SHOWN	PERMIT No. N/A
HEL DRAWING No. S15	REVISION A

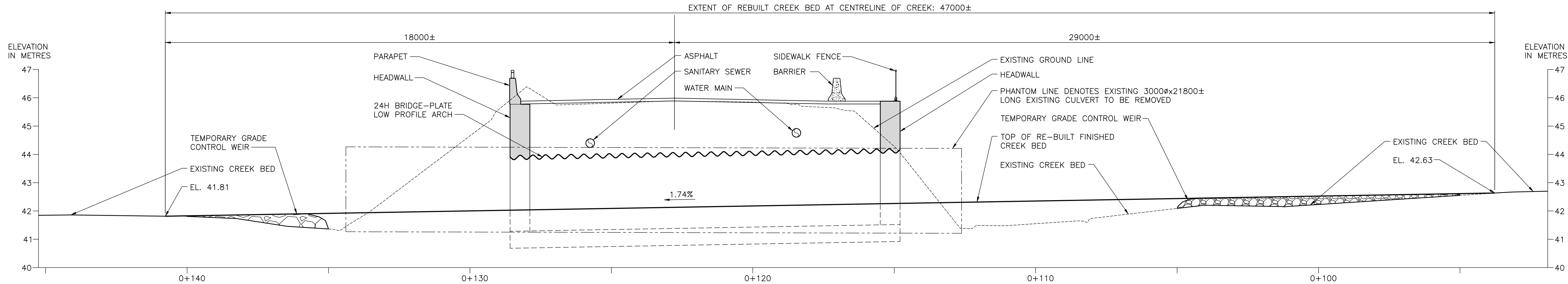
ISSUES								
No.	DATE mm/yy	ISSUED FOR	No.	DATE mm/yy	ISSUED FOR	No.	DATE mm/yy	ISSUED FOR
A	2019.01.14	CLIENT REVIEW						
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DRAFTED JJMC
DRAFTING REVIEW
DESIGNED SPS/SJS
DESIGN REVIEW



4TH AVENUE CROSSING
AT ROCKY CREEK
410 ESPLANADE LADYSMITH BC V9G 1A2
TOWN OF LADYSMITH

HEL PROJECT No. 0037-075	CLIENT DWG. No. N/A
SCALE AS SHOWN	PERMIT No. N/A
HEL DRAWING No. S15	REVISION A




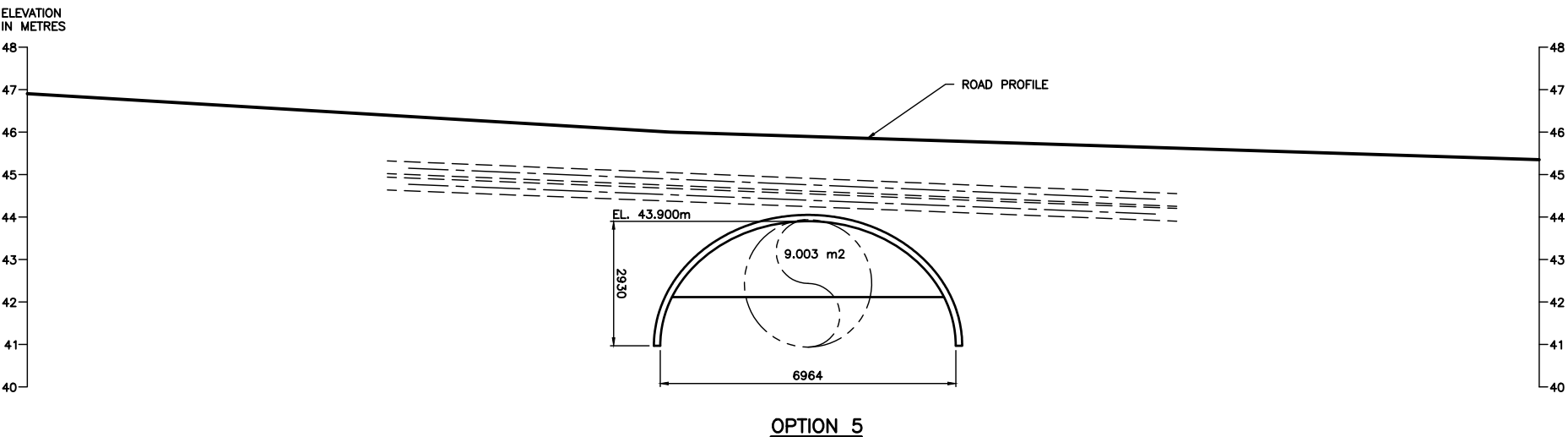
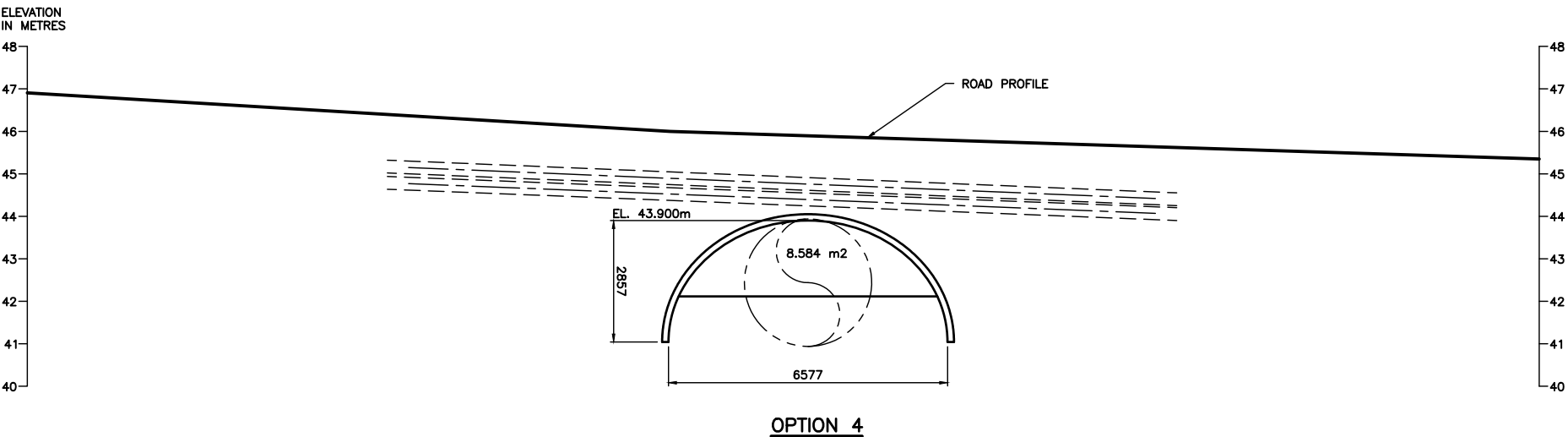
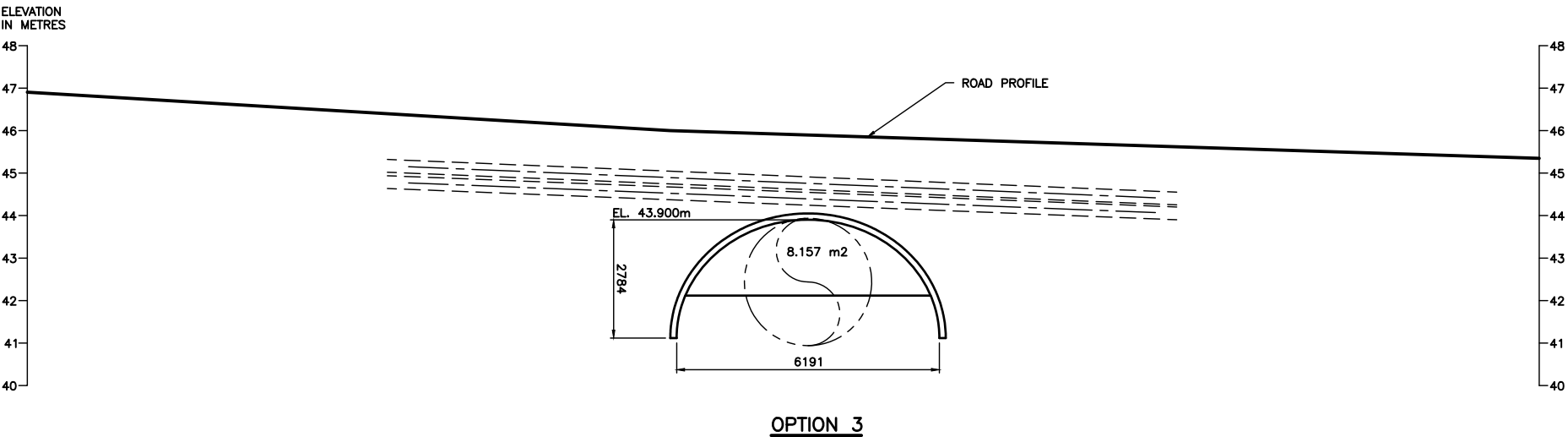
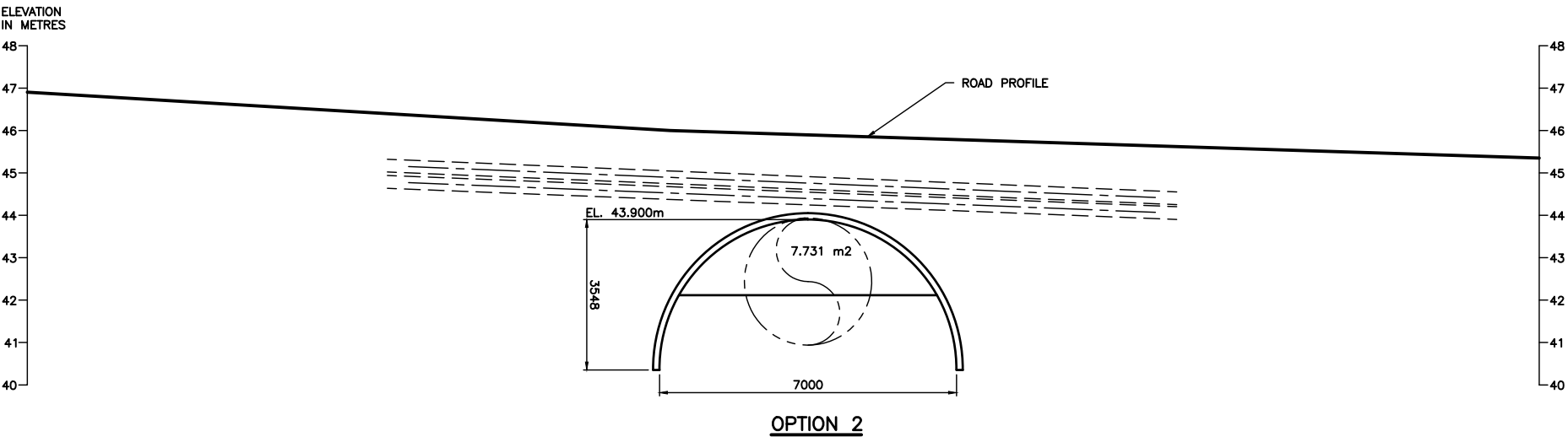
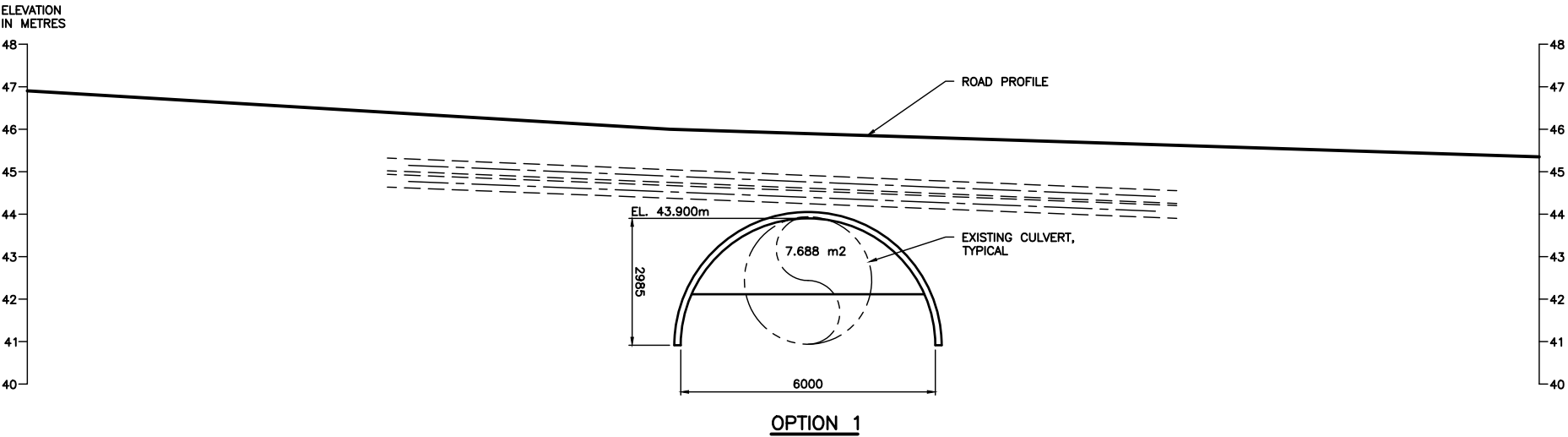
PROFILE LOOKING EAST, CENTRELINE OF CREEK
1:75

ISSUED FOR REVIEW

NOT FOR CONSTRUCTION

- NOTES:
- FOR GENERAL NOTES, SEE DWG. S01 AND S02.
 - FOR RIP RAP, FILTER ROCK AND STREAM REBUILDING DESIGN CRITERIA AND NOTES, SEE DWG. S05.

ISSUES						SUB CONSULTANT	DRAFTED JJMC	 <div>HEROLD ENGINEERING</div> <div>3701 Shenton Rd, Nanaimo, BC V9T 2H1 Tel: 250-751-8558 Fax: 250-751-8559 Email: mail@heroldengineering.com</div>	ENGINEERS SEAL	CULVERT OPTION - GENERAL ARRANGEMENT	4TH AVENUE CROSSING AT ROCKY CREEK 410 ESPLANADE LADYSMITH BC V9G 1A2 TOWN OF LADYSMITH	HEL PROJECT No. 0037-075	CLIENT DWG. No. N/A
No.	DATE	ISSUED FOR	No.	DATE	ISSUED FOR	DRAFTING REVIEW	DESIGNED SPS/SJS		PERMIT No. N/A	SCALE AS SHOWN	HEL DRAWING No. S16	REVISION A	
A	2019.01.14	CLIENT REVIEW				DESIGN REVIEW							
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Appendix B

**TENDER FORM COMPARISON,
UNIT PRICE CONTRACT**

TF4-1

4th Avenue Crossing at Rocky Creek
0037-075/05 Tender Comparison

				Heavy Metal Marine		Windley Contracting		Copcan Civil	
Item	Description	Est.Qty.	Units	Unit Price	Total	Unit Price	Total	Unit Price	Total
Section 1 General Requirements									
1.1	Location of Existing Underground Utilities	1	LS	2,421.79	2,421.79	1,974.00	1,974.00	20,000.00	20,000.00
1.2	Erosion and Sediment Control, Creek Bypass	1	LS	4,981.80	4,981.80	68,020.00	68,020.00	33,800.00	33,800.00
1.3	Traffic Control and Detour								
.1)	Option B (Provisional)	1	LS	19,082.75	19,082.75	15,358.00	15,358.00	22,800.00	22,800.00
1.4	Project Layout	1	LS	7,896.32	7,896.32	10,249.00	10,249.00	7,100.00	7,100.00
1.5	Tree Removal, Clearing and Grubbing	1	LS	16,151.71	16,151.71	12,239.00	12,239.00	17,500.00	17,500.00
1.6	Utility Pole Support (Provisional)	1	LS	3,948.15	3,948.15	2,320.00	2,320.00	1,030.00	1,030.00
1.7	Gas Main Relocation Structure	1	LS	7,132.37	7,132.37	22,197.00	22,197.00	16,000.00	16,000.00
1.8	Envrionmental Restoration	1	LS	8,227.06	8,227.06	9,287.00	9,287.00	4,870.00	4,870.00
Total Section 1					69,841.95		141,644.00		123,100.00
Section 2 Site Works and Rough Grading									
2.1	Common Excavation and Disposal Offsite (incl. Culvert)	1	LS	22,372.89	22,372.89	39,135.00	39,135.00	48,500.00	48,500.00
2.2	Overexcavation and Placement of Granular Fill (Provisional)	100	m ³	48.59	4,859.00	52.50	5,250.00	101.00	10,100.00
2.3	Riprap and Streambed Reconstruction								
.1)	East Bank	290	m ³	110.89	32,158.10	79.00	22,910.00	110.00	31,900.00
.2)	West Bank	195	m ³	110.89	21,623.55	75.50	14,722.50	110.00	21,450.00
.3)	Streambed Reconstruction	150	m ³	110.89	16,633.50	55.00	8,250.00	109.00	16,350.00

**TENDER FORM COMPARISON,
UNIT PRICE CONTRACT**

TF4-2

Item	Description	Est.Qty.	Units	Unit Price	Total	Unit Price	Total	Unit Price	Total
Total Section 2					97,647.04		90,267.50		128,300.00
Section 3 Trench Excavation and Backfill									
3.1	Overexcavation and Placement of Granular Material (Provisional)	60	m ³	48.59	2,915.40	59.00	3,540.00	115.00	6,900.00
Total Section 3					2,915.40		3,540.00		6,900.00
Section 4 Water Distribution System									
4.1	Watermain Piping								
.1)	200mm dia. PVC DR18 C900	26	m	424.12	11,027.12	136.00	3,536.00	248.00	6,448.00
.2)	250mm dia. HDPE DR11	21	m	649.00	13,629.00	128.00	2,688.00	458.00	9,618.00
4.2	Water Main Fittings								
	BENDS								
.1)	200mm 45 DEG. GATE VALVES	4	no.	1,179.07	4,716.28	434.00	1,736.00	650.00	2,600.00
.2)	200mm HxH	1	no.	4,857.48	4,857.48	1,954.00	1,954.00	2,020.00	2,020.00
.3)	200mm FxH REDUCERS	1	no.	2,946.97	2,946.97	1,753.00	1,753.00	1,970.00	1,970.00
.4)	250F x 200F COUPLINGS	2	no.	1,584.96	3,169.92	636.00	1,272.00	641.00	1,282.00
.5)	Flexend Double Ball	2	no.	11,261.02	22,522.04	8,597.00	17,194.00	9,790.00	19,580.00
.6)	Hymax Coupler	2	no.	1,382.74	2,765.48	406.00	812.00	564.00	1,128.00
.7)	HxF Adaptor	2	no.	1,196.90	2,393.80	380.00	760.00	430.00	860.00
.8)	HDPE Flange Adaptor	2	no.	1,058.63	2,117.26	1,032.00	2,064.00	561.00	1,122.00
4.3	Connection to Existing Main Piping								
.1)	200mm dia. PVC	2	no.	639.58	1,279.16	834.00	1,668.00	124.00	248.00
4.4	Bridge Crossing Casing Pipe								
.1)	300mm dia. Steel Sch. 10S SS (Casing Pipe)	19	m	967.26	18,377.94	1,634.00	31,046.00	1,140.00	21,660.00

**TENDER FORM COMPARISON,
UNIT PRICE CONTRACT**

TF4-3

Item	Description	Est.Qty.	Units	Unit Price	Total	Unit Price	Total	Unit Price	Total
Total Section 4					89,802.45		66,483.00		68,536.00
Section 5 Sanitary Sewer System									
5.1	Sanitary Sewer Piping								
.1)	250mm dia. HDPE DR21	62	m	375.85	23,302.70	185.00	11,470.00	264.00	16,368.00
5.2	Connection to Existing Manhole	2	no.	4,796.14	9,592.28	1,653.00	3,306.00	2,940.00	5,880.00
5.3	Bridge Crossing Casing Pipe								
.1)	300mm dia. Steel Sch. 10S SS (Casing Pipe)	19	m	967.26	18,377.94	1,634.00	31,046.00	1,140.00	21,660.00
5.4	Bypass Pumping	1	LS	31,401.00	31,401.00	63,158.00	63,158.00	71,200.00	71,200.00
Total Section 5					82,673.92		108,980.00		115,108.00
Section 6 Storm Sewer System									
6.1	Storm Sewer Piping								
.1)	150mm dia. PVC SDR35 & Reconnect to Exist. Lead	7	m	300.02	2,100.14	270.00	1,890.00	97.00	679.00
.2)	250mm dia. PVC SDR35	6	m	396.00	2,376.00	304.00	1,824.00	145.00	870.00
6.2	Catch basins								
.1)	Town of Ladysmith Type 1	3	no.	2,643.53	7,930.59	1,410.00	4,230.00	1,890.00	5,670.00
6.3	Removal of Existing Structures								
.1)	Catch basin & Capping Lead	1	no.	1,491.78	1,491.78	177.00	177.00	126.00	126.00
Total Section 6					13,898.51		8,121.00		7,345.00
Section 7 Curbs and Sidewalk									
7.1	Curbs								

**TENDER FORM COMPARISON,
UNIT PRICE CONTRACT**

TF4-4

Item	Description	Est.Qty.	Units	Unit Price	Total	Unit Price	Total	Unit Price	Total
.1)	Non-mountable Curb & Gutter	18	m	196.36	3,534.48	179.00	3,222.00	184.00	3,312.00
.2)	Flat Panel Curb	19	m	196.09	3,725.71	180.00	3,420.00	183.00	3,477.00
7.2	Sidewalks								
.1)	100mm Sidewalk	78	m ²	96.20	7,503.60	89.00	6,942.00	93.50	7,293.00
7.3	Cutting and Removal of Existing Sidewalk	103	m ²	23.77	2,448.31	9.00	927.00	15.00	1,545.00
7.4	Cutting and Removal of Existing Curb	20	m	16.89	337.80	13.50	270.00	25.00	500.00
7.5	Concrete Roadside Barriers								
.1)	Parapet Transition Barriers (2 each side)	4	no.	330.18	1,320.72	501.00	2,004.00	465.00	1,860.00
.2)	CMB-E	4	no.	660.36	2,641.44	493.00	1,972.00	458.00	1,832.00
.3)	CTB-2H	3	no.	603.60	1,810.80	448.00	1,344.00	415.00	1,245.00
.4)	CRB-E/H	5	no.	538.75	2,693.75	387.00	1,935.00	359.00	1,795.00
.5)	CTB-1H	3	no.	603.60	1,810.80	448.00	1,344.00	415.00	1,245.00
.6)	CBN-H	3	no.	383.10	1,149.30	241.00	723.00	224.00	672.00
Total Section 7					28,976.71		24,103.00		24,776.00
Section 8 Streets									
8.1	Common Excavation	163	m ³	72.67	11,845.21	37.00	6,031.00	34.60	5,639.80
8.2	Overexcavation and Replacement of Granular Material (Provisional)	40	m ³	37.78	1,511.20	60.00	2,400.00	101.00	4,040.00
8.3	Granular Fill	100	m ³	113.78	11,378.00	38.00	3,800.00	45.40	4,540.00
8.4	Subgrade Preparation	685	m ²	6.84	4,685.40	2.50	1,712.50	1.00	685.00
8.5	Subbase (250mm)	779	m ²	34.76	27,078.04	11.00	8,569.00	13.50	10,516.50
8.6	Base Course (100mm)	708	m ²	51.56	36,504.48	12.00	8,496.00	6.00	4,248.00

**TENDER FORM COMPARISON,
UNIT PRICE CONTRACT**

TF4-5

Item	Description	Est.Qty.	Units	Unit Price	Total	Unit Price	Total	Unit Price	Total
8.7	Pavement Markings	1	LS	1,113.11	1,113.11	786.00	786.00	1,140.00	1,140.00
8.8	Traffic Signs								
.1)	New - Barrier Mounted	4	no.	473.48	1,893.92	364.00	1,456.00	174.00	696.00
.2)	Remove, Store and Replace	1	no.	683.15	683.15	208.00	208.00	198.00	198.00
8.9	Landscaping Allowance (100mm topsoil, Hydroseeding)	274	m ²	15.31	4,194.94	20.00	5,480.00	17.00	4,658.00
8.10	Bridge End Fill	350	m ³			43.00	15,050.00	44.30	15,505.00
Total Section 8					100,887.45		53,988.50		51,866.30
Section 9 Asphalt Concrete Paving									
9.1	Cutting of Existing Asphalt Pavement	18	m	23.90	430.20	10.50	189.00	86.90	1,564.20
9.2	Removal of Existing Pavement	464	m ²	3.20	1,484.80	2.25	1,044.00	3.15	1,461.60
9.3	Lap Joint (Provisional)	18	m	47.38	852.84	38.00	684.00	43.00	774.00
9.4	Asphaltic Concrete								
.1)	75mm Thickness (Approaches)	382	m ²	64.42	24,608.44	59.00	22,538.00	62.70	23,951.40
.2)	100mm Thickness (Bridge)	183	m ²	81.42	14,899.86	80.00	14,640.00	79.50	14,548.50
9.5	Adjustment of Utilities								
.1)	Manholes, adjustment of Frame & Lid	1	no.	639.57	639.57	231.00	231.00	174.00	174.00
.2)	Valves, adjustment of Frame & Lid	1	no.	590.38	590.38	125.00	125.00	174.00	174.00
Total Section 9					43,506.09		39,451.00		42,647.70
Section 10 Bridge									
10.1	Bridge Scope of Work								

**TENDER FORM COMPARISON,
UNIT PRICE CONTRACT**

TF4-6

Item	Description	Est.Qty.	Units	Unit Price	Total	Unit Price	Total	Unit Price	Total
.1)	Bridge incl. Foundations, Structure,	1	LS	425,646.56	425,646.56	730,869.00	730,869.00	628,000.00	628,000.00
.2)	Additional pile length (>3m beyond anticipated)	1	m	1,105.24	1,105.24	2,303.00	2,303.00	1,150.00	1,150.00
Total Section 10					426,751.80		733,172.00		629,150.00
SUMMARY									
Section 1	General Requirements				69,841.95		141,644.00		123,100.00
Section 2	Site Works and Rough Grading				97,647.04		90,267.50		128,300.00
Section 3	Trench Excavation and Backfill				2,915.40		3,540.00		6,900.00
Section 4	Water Distribution System				89,802.45		66,483.00		68,536.00
Section 5	Sanitary Sewer System				82,673.92		108,980.00		115,108.00
Section 6	Storm Sewer System				13,898.51		8,121.00		7,345.00
Section 7	Curbs and Sidewalk				28,976.71		24,103.00		24,776.00
Section 8	Streets				100,887.45		53,988.50		51,866.30
Section 9	Asphalt Concrete Paving				43,506.09		39,451.00		42,647.70
Section 10	Bridge				426,751.80		733,172.00		629,150.00
TOTAL ALL SECTIONS					956,901.32		1,269,750.00		1,197,729.00
GST (5%)					47,845.07		63,487.50		59,886.45
TOTAL WITH GST					1,004,746.39		1,333,237.50		1,257,615.45

Appendix C



Richter7 Engineering Ltd.

February 6, 2019

Herold Engineering Limited
3701 Shenton Road
Nanaimo, B.C.
V9T 6H1

Attention Patrick Ryan, P.Eng. Associate

Re: Ladysmith Culvert Replacement
Engineer's Cost Estimate—[REVISION 1](#)

Hi Patrick,

As requested in your email of Jan 12 2019, I submit the following cost estimate of the culvert replacement based on the information forwarded.

Culvert Replacement Estimate: \$555,000.00 plus GST.

This Estimate **includes a 20% contingency** which I feel reflects the drawing detail level available right now.

For analysis of this estimate by yourself and the Town of Ladysmith I have included contractor style summary sheets of indirect and direct costs. The above estimate is the sum of these costs plus 20%. See Pages 1 and 2 attached.

Some inclusions of note in the estimate are the following:

- Environmental Monitoring Allowance
- Compaction Testing Allowance
- Concrete Testing Allowance
- Stream diversion utilizing the existing temporary overflow culverts
- Removal of existing no-post barriers and trucking FOB to Town of Ladysmith yard.
- Excavation costs assumes offsite haul and full import Pit Run backfill, with $\frac{3}{4}$ minus road base crush bedding 1 meter thick around culvert.
- Option 4 - 24H Armtec Multiplate Arch c/w full Strata Cat coating both sides. Based on Armtec budget price of \$70,000.00. (which includes 2 days of technical assistance added)

Exclusions of note are:

- Any traffic control for the detour other than temporary wood road closure barriers at the site.
- Rip Rap price based on re-utilizing existing Rip Rap as much as possible
- [Line painting](#)



Richter7 Engineering Ltd.

Regards,

Richter7 Engineering Ltd.

A handwritten signature in black ink that reads "Glen Knappett". The signature is written in a cursive style with a large, stylized "G" and a long, sweeping underline.

Glen Knappett P.Eng.

RICHTER7 ENGINEERING LTD.					
Rocky Creek Culvert Estimate					
Page 2					
Feb-06 2019 REV 1					
DIRECT COSTS					
Item No.	Item Description	Qty	Unit	Unit Rate	Total
5	REMOVE No Post BARRIERS	1	LS	1500	1500
10	CLEARING	1	LS	2500	2500
15	CUT & REMOVE ASPHALT	250	M2	4	1000
16	BYPASS PUMPING	1	LS	30000	30000
17	TEMPORARY GAS RELOCATION STRUCT	1	LS	16000	16000
20	BULK EXC& HAUL OFF	1200	M3	15	18000
25	DEMO OLD CULVERT	1	LS	2000	2000
30	DEWATERING&DIVERSION	1	LS	3000	3000
35	STREAM EXC&STOCKPILE	100	M3	6.5	650
40	FTG EXC	15	M3	15	225
45	CULVERT FTG CONC	18	M3	750	13500
50	HEADWALL FTG CONC	38	M3	750	28500
55	CULVERT SUPPLY FOBSITE	1	LS	70000	70000
60	CULVERT INSTALL L&R	150	M2	125	18750
65	HEADWALL WALL CONC	50	M3	1050	52500
70	3/4 INCH CRUSH B/FILL	200	M3	35	7000
75	3 INCH SGSB BACKFILL	1070	M3	30	32100
76	ENVIRONMENTAL RESTORATION	1	LS	8000	8000
80	B/FILL STREAM EXC (REPROFILE)	100	M3	65	6500
81	RIP RAP S&I	420	M2	20	8400
85	200 WATERMAIN	38	LM	350	13300
86	CB'S AND STORM SYSTEM	3	EA	2500	7500
90	250 SANITARY SEWER	61	LM	200	12200
91	1.65m x 150 mm CONC SIDEWALK	45	M2	125	5625
95	3/4 INCH ROAD BASE	400	M2	15	6000
100	C.I.P PARAPET	7	M3	1200	8400
105	75 MM ASPHALT PAVING	400	M2	65	26000
110	APPROACH BARRIER	15	LM	150	2250
120	GALV PARAPET RAILING	17	LM	100	1700
125	GALV SIDEWALK FENCE	17	LM	500	8500
130	SIGNAGE	1	LS	800	800
TOTAL DIRECT COSTS				TOTAL	\$ 412,400.00

RICHTER7 ENGINEERING LTD.

Rocky Creek Culvert Estimate

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INDIRECT COSTS

Item	Qty	Unit	Unit Rate	Allowance	Total
Supervision	2	mth	9600		19200
Tele /toilet	2	mth	450		900
Tool trailer	2	mth	1000		2000
Mob/demob	3	ea	250		750
P/U trucks &F	1.5	mth	2000		3000
Roll tests	2	ea	125		250
Traffic control	1	LS		500	500
Video Pipes	1	ea	350	350	350
Test&Chlor	1	ea	350	350	350
bonds & Ins	500	thous	10		5000
layout	1	LS		2500	2500
compaction test	1	LS		2500	2500
concrete test	3	ea	250		750
Locate utilities	1	LS		500	500
ENVIRO MON	1.5	mth	5000		7500
SUBTOTAL INDIRECT COSTS					46050
10% MARKUP					4605
TOTAL INDIRECT COSTS					\$ 50,655.00

RICHTER7 ENGINEERING LTD.					
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Feb-06 2019 REV 1					
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