



MEMO

To: [REDACTED]
Owner's Engineer, Lead Advisor,
Site C Road and Bridge Infrastructure Project Team

Feb 21, 2012

cc.:

From: [REDACTED]
Owner's Engineer, Highway Design Advisor,
Site C Road and Bridge Infrastructure Project Team

**Re: Response to Public Consultation Comments and Suggestions Regarding
Upper Bench Options for Highway 29**

We've been asked to look at concepts utilizing the upper bench for the relocation of segments of Highway 29. These concepts have arisen from the Stage 2 consultation and subsequent discussions with landowners and the public, and were originally addressed in a letter by Urban Systems dated June 22, 2010.

Conclusion:

We find as a result of our evaluation that there is no basis for further investigation and consideration of options that utilize the upper bench at Bear Flat, Halfway River, or via existing roads west of Highway 97 to the north.

Background:

These options are evaluated herein at a conceptual level to corroborate the Urban Systems memo and to provide closure w.r.t. the question of further investigation. The cost estimates shown are only for the purpose of comparing alternatives on a relative and conceptual basis, and not for project cost estimating.

The numbering of the four alternatives below corresponds to the numbering in the Urban Systems letter.

1: Bear Flat – Alternative Alignment at Top of Bench Along Transmission Line

The attached sketch shows a conceptual route along the bench above Bear Flat. Similar to the alignment in the Urban Systems report, the route would generally follow the transmission line, but would divert around larger gullies where possible.

- o In addition to being longer than the proposed option, the alternative route faces the additional challenge of crossing the Cache Creek valley at a much higher elevation.
- o This would either require a very large bridge on the order of 1km long and 120m high, or a smaller (but still very large) structure might be possible by routing the highway down into the Cache Creek valley. Routing the highway down into the valley may not be possible with geometry maintaining the 90 km/h design speed, and would entail very large earthworks on slopes which have been characterized as unstable silt.

Handwritten initials, possibly "EO", in the bottom left corner.

- o The following table summarizes a conceptual cost comparison for the bridge options and shows the very large cost differential between the two options. Excluding the bridge crossings, the upper bench option would still cost on the order of 40% more due to the length of new highway needed and the requirement to provide access to the properties on Bear Flat.

Option	1	2
Description	Base Case: Highway relocation along the south side of Bear Flat	Alternative alignment along the transmission line on the upper bench
Length of New Highway (km)	9	11.5
Length of Upgraded Secondary Road to Maintain Access to Landowners (km)	0	5
Cost of New Highway	[REDACTED]	
Cost of Bridges		
Subtotal		
Cost of Upgraded Secondary		
Subtotal New + Upgrade		
Total		

Note: Doesn't include contingency, project management, engineering, property, operations and maintenance

Note: The cost for the Option 2 structure is based on 1km long by 14m wide > (from [REDACTED] June 2010 "Highway 29 Relocations – Plateau Option"; additional width as required for most economical cable stay structure)

Assumed Unit Costs:

Avg Cost of New Highway/KM	[REDACTED]
Avg Cost of New Secondary Road	[REDACTED]

Conclusion: Based on the above, the upper bench option does not warrant further investigation because the additional cost cannot be justified.

2: Halfway River – Alternative Alignment at Top of Bench

The attached sketch shows two conceptual alternatives for upper bench routes at Halfway River.

Also shown are the three options carried over from Stage 2, Options A, B, and C. A recent multiple account evaluation has identified Option B as the preferred option generally due to lowest cost and property impacts.

Upper Bench Option 1 has the challenges of an even larger structure than required for the upper bench option at Bear Flat as well as a new sidehill cut up to the upper bench through difficult topography and poor geotechnical conditions. A costing exercise similar to the Bear Flat option would yield similar results.

Upper Bench Option 2, reviewed in the Urban Systems memo, is an extension of Stage 2 Option A, but adds approximately 2 kilometres of additional new highway on a sidehill cut through difficult topography and poor geotechnical conditions, for no appreciable benefit.

Conclusion: Further investigation of these upper bench options at Halfway River is not warranted since there is no basis for incurring the extra cost.

3 & 4: Alternative Alignments Utilizing Existing Roads off Highway 97 North of Highway 29

The attached sketch shows conceptual routes along existing roads from "Mile 68" and "Mile 95" on Highway 97. These options are evaluated herein at a conceptual level to corroborate the Urban Systems report and determine if further investigation is warranted.

- o The routes shown are not continuous and will require non-existent connections and river crossings.
- o It can be expected that significant portions of existing road alignments will not have road geometry meeting design speed (highway) requirements.
- o Even in areas where existing road geometry may be adequate for the proposed design speed, it is expected that substantial reconstruction of the road base, river crossings, and drainage works will be required to meet the highway design criteria, including roadside clear zone.
- o Geotechnical information for the alternative routes is not provided but it is expected that substantial hauls for granular materials for road base and paving will be required from limited sources in the region.
- o It is expected that all-season access to inhabited areas along the existing Highway 29 will need to be provided and/or maintained.
- o The table below provides a concept cost comparison between the base case (Highway 29 relocations and bridges) and alternative routes.
- o The alternatives are substantially more expensive than the base case based on new highway construction alone. The provision of access to the isolated areas of Highway 29, and consideration of user costs further increase the cost differentials. Consideration of maintenance costs would also increase the cost differentials. Consideration of property costs would not affect the fundamental result of this evaluation. The comparison is not sensitive to unit costs; similar results are derived using a range of unit costs.
- o Significant increases in travel time between Hudson's Hope and Fort St. John, and points in between, will result.

	1	2	3	4
Highway Route from Hwy97/29 Junction to Hudson's Hope (refer to sketch)	M-N-P	A-B-C-D	A-B-C-E-H-J-P	A-G-F-H-J-P
Upgraded Secondary Road Segments to Maintain Access to Landowners		G,F,L,H,J,K	K,G,L	L,K
Distance from Hwy97/29 Junction to Hudson's Hope (km)	72	198	212	118
Length of New Highway (km)	28	133	143	91
No. of Major Bridges	1	0	1	1
No. of Large Bridges	3	2	0	0
No. of Small Bridges	1	2	4	4
Length of Upgraded Secondary Road to Maintain Access to Landowners	0	122	73	40
Cost of New Highway				
Cost of Bridges				
Subtotal New Highway & Bridges				
Cost of Upgraded Secondary				
Subtotal New + Upgrade				
User Cost (annual)				
User Cost (20 Years)				
Total New + Upgrade + User Cost				

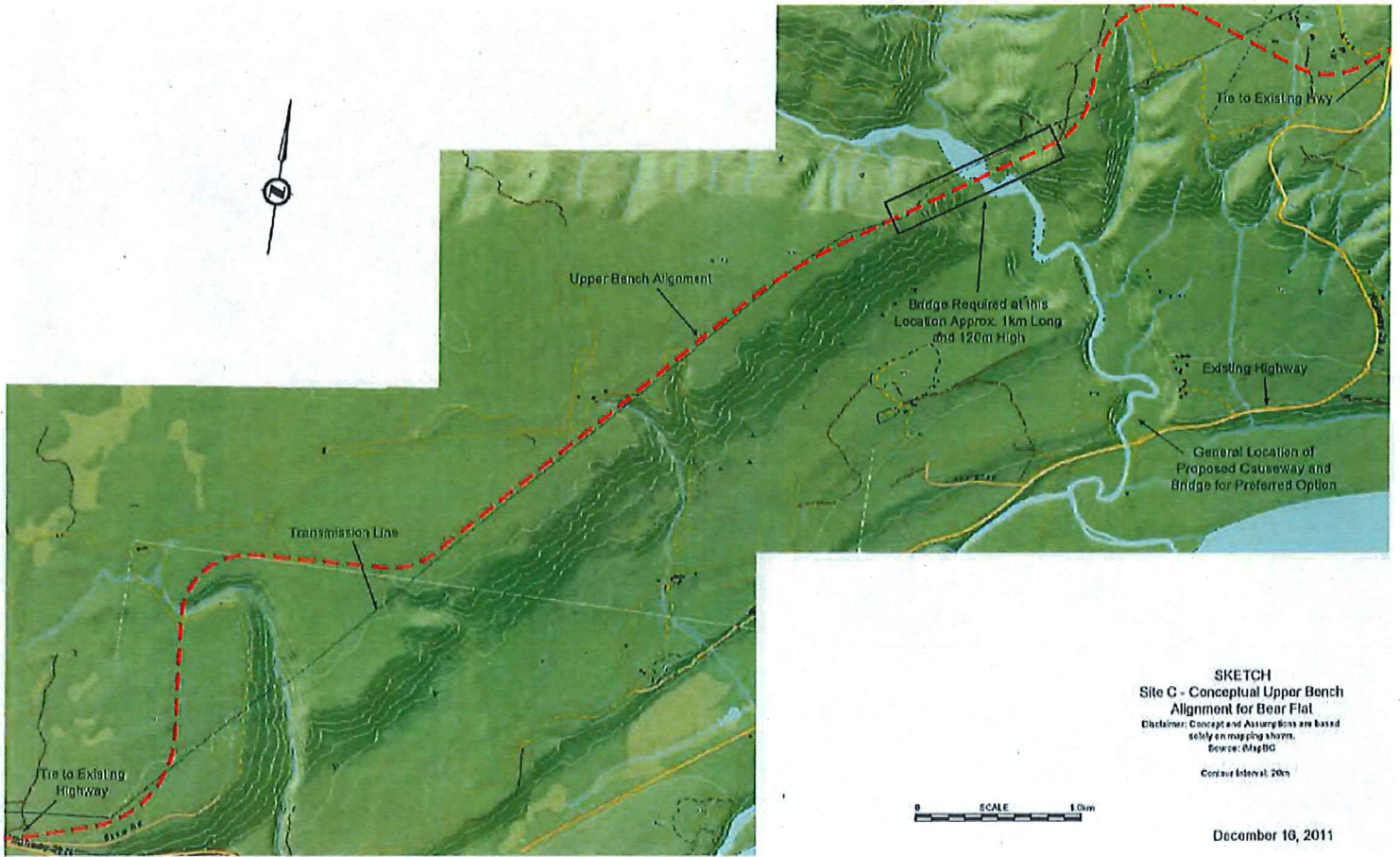
Note: doesn't include O&M and property

Assumed Unit Costs:

AADT	
User Cost/KM	
Avg Cost of New Highway/KM	
Avg Cost of Upgraded Secondary	
Cost of Major Bridge	
Cost of Large Bridge	
Cost of Small Bridge	

Conclusion: Within the objectives of the Site C project, there is no justification to further explore the relocation of the Fort St. John to Hudson's Hope connection via these alternative routes. These alternatives will be substantially more costly, effect a larger environmental footprint, and impose significant costs and time on existing road users.

End of Memo – Three sketches attached.

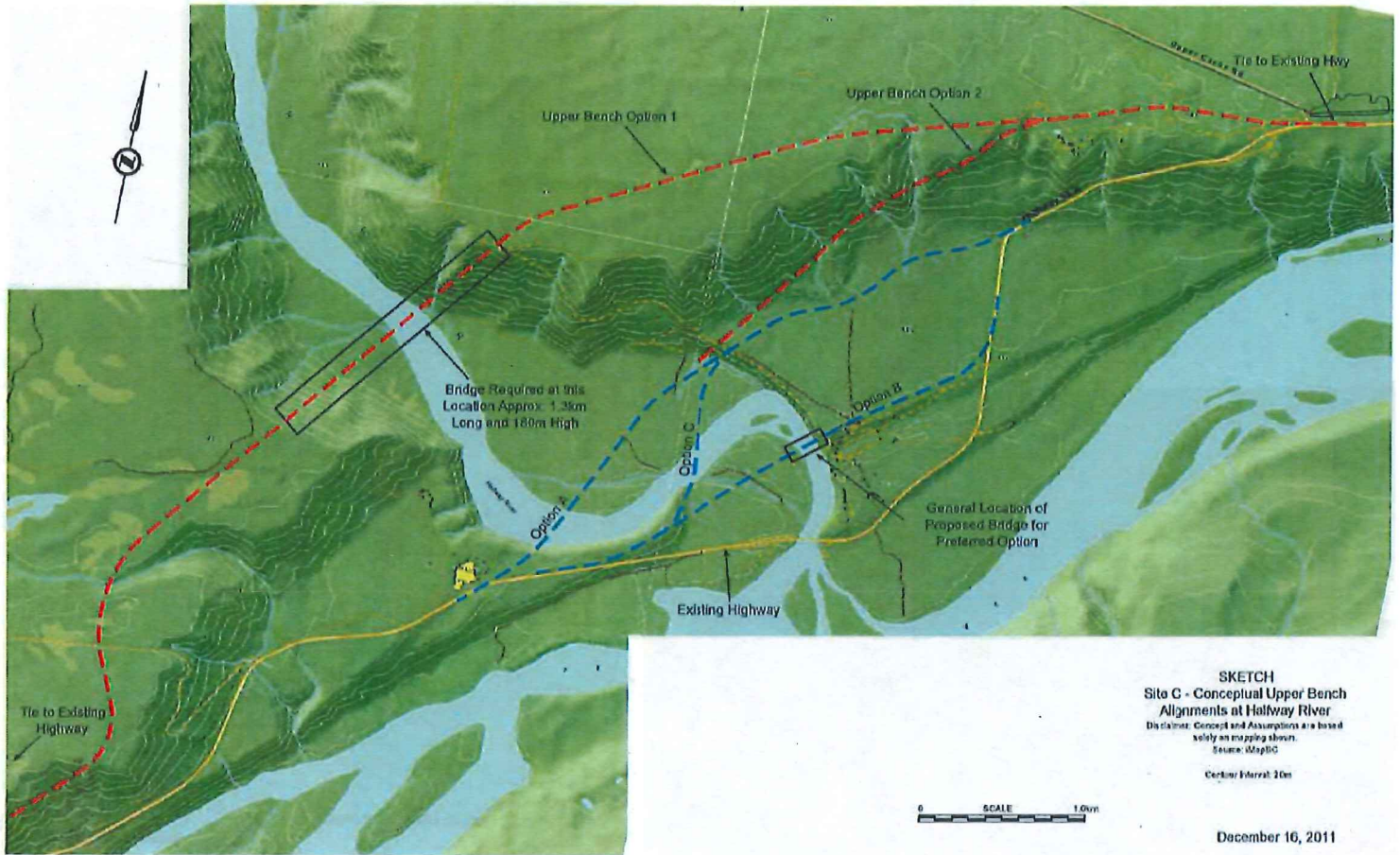


SKETCH
Site C - Conceptual Upper Bench
Alignment for Bear Flat

Disclaimer: Concept and Assumptions are based
 solely on mapping shown.
 Source: MapBC

Contour Interval: 20m

December 10, 2011



SKETCH
Site C - Conceptual Upper Bench
Alignments at Hallway River
 Disclaimer: Concept and Assumptions are based
 solely on mapping shown.
 Source: May/10
 Contour Interval: 20m

December 16, 2011

