Detailed Terrain Stability Field Review

Proposed Construction of the extension of Laird Creek Mainline, and Spurs A and B in the Laird Creek Area

for

Cooper Creek Cedar Ltd.

W. Halleran P. Geo, L.Eng.

APEX GEOSCIENCE CONSULTANTS LTD.

13/02/2020

Contents

1. Summary

If the recommendations contained within this report are implemented, road construction will not significantly increase the low likelihood of landslide initiation. The proposed roads pose a low risk to water quality at the intakes along Laird Creek.

2. Introduction

Apex Geoscience Consultants was requested to complete a detailed terrain stability assessment (DTSFA) and a Specific Risk Analysis of the proposed extension of Laird Mainline and Spurs A and B (CP 404) in the Laird Creek Watershed by Mr. Bill Kestell RPF of Cooper Creek Cedar Ltd.

Mr. Kestell requested the review because portion of the proposed roads cross or are upslope of terrain mapped as Class V (unstable) and Class IV (Potentially unstable) (Greg Utzig P.Ag. 1997) as shown in Figure #1. This area is of heightened concern due to a May 2011 debris slide below the existing Laird Mainline.

There are existing landslide hazards and risks in the Laird Creek Watershed, this assessment/analysis objective is to determine the incremental increase to the hazards and risks posed by the proposed road and spurs.

3. Methods, Limitations and Reliability

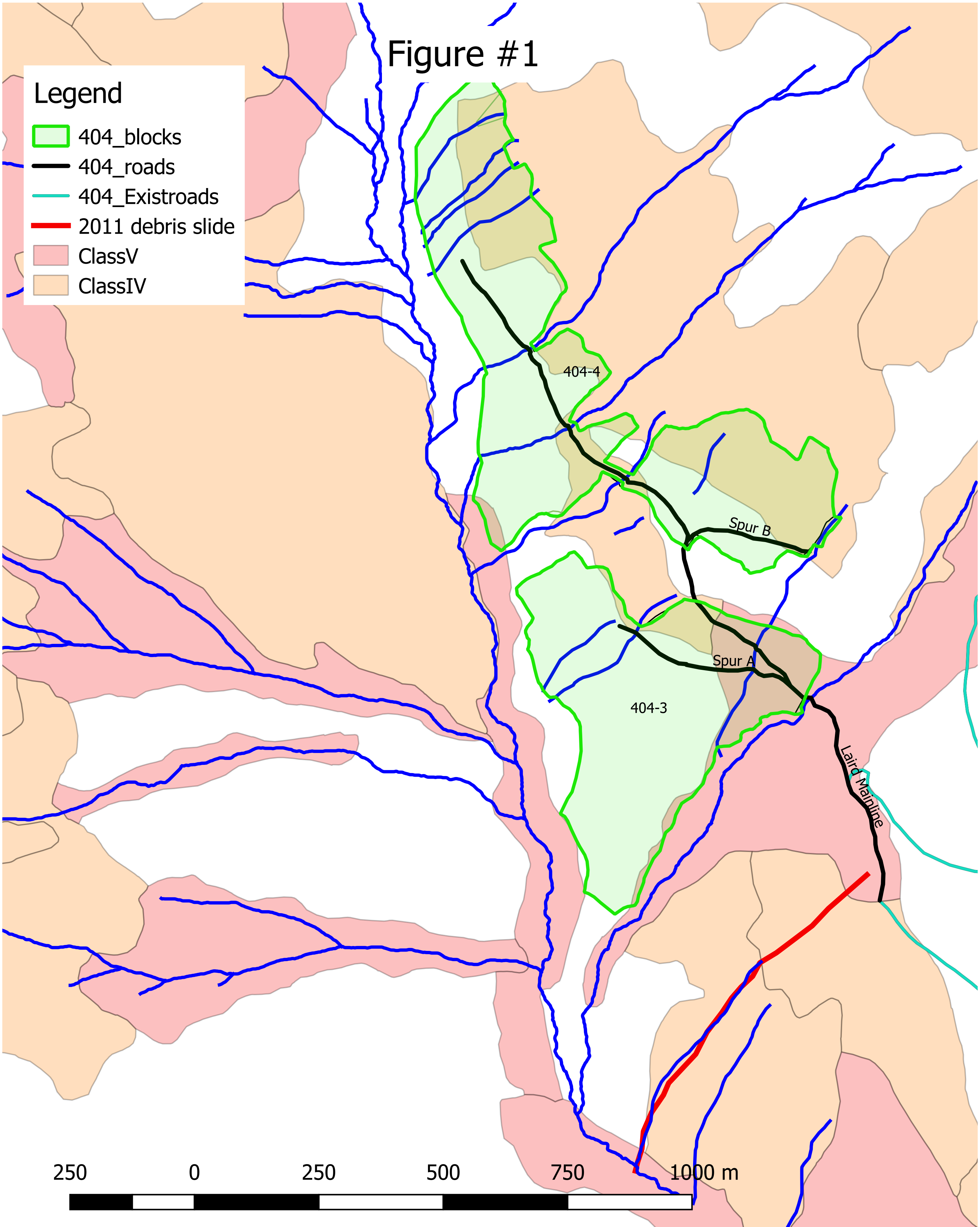
Google earth imagery; Bing maps satellite imagery; historical air photos; and previous reports were reviewed prior to the field assessment.

CCC supplied Lidar DEM files; and development and hill shade maps with the proposed development, previous development and terrain stability polygons marked on it. A Samsung android tablet with the Avenza maps program with the imported hill shade map was used for navigation and note taking.

Mr. Bill Kestell RPF. conducted a field visits of the road, blocks, and adjacent slopes (areas of possible concern) with W. Halleran of Apex in late 2019 and early 2020.

The field assessment was completed by W. Halleran P. Geo L. Eng. on June 17th, 18th, 23rd, and 25th, the weather was warm and dry. Inferences are made from observations

Figure #1


Legend
404_blocks
404_roads
404_Existroads
2011 debris slide
ClassV
ClassIV
404-4
Spur B
Spur A
404-3
Laird Mainline
250
0
250
500
750
1000 m

of materials in soil pits, road cuts, and tree churns within and adjacent to the proposed roads during the field review.

The terrain stability assessment made in this report is based on generally accepted practice described in “Guidelines for Terrain Stability Assessments in the Forest Sector-October 2010” published by APEG of BC. The risk assessment presented in this report is based the conventions outlined in Land Management Handbook 56 “Landslide Risk Case Studies in Forest Development Planning and Operations”.

Previous reports reviewed include: Hydrological Assessment of the Laird Creek Study Area by Henderson Environmental Consulting Ltd. (2004); Forest Harvesting and Road Building in the Laird Creek Watershed by Forest Practices Board Complaint Investigation 040598 (2005); May 2011 Laird Creek landslide Event Geotechnical Assessment by Sitkum Consulting Ltd. (2011); May 22 Technical memorandum regarding the May 2011 Laird Creek Landslide summarising the April 2012 field review (2012); Laird Creek landslide Complaint Investigation 111006 by the Forests Practices Board (2013); Various Bioremediation reports and assessments by Pierre Raymond of Terra Erosion in collaboration with W. Halleran of Apex Geoscience Consultants Ltd. (2012-2013); Laird Creek Hydrogeomorphic Assessment by Apex Geoscience Consultants Ltd (2018).

A Specific Risk analysis was conducted on those portions of the roads and blocks that have a greater than low likelihood of landslide initiation and pose a potential hazard to the elements considered for risk. This review assumes road good construction standards are met. Even if all standards are met there is still a possibility of landslides. Terrain assessment can reduce the likelihood of landslides, not eliminate it.

3.2 Likelihood of Landslide Determination

In this report the annual likelihood (Pa) of an event occurring is estimated by considering the age of the event (in this case, landslide). Slide reports, previous assessments and field observations are used to determine the age, cause, distribution, type, size, and materials of both natural and development related landslides. In the absence of other information; for purposes of this report, the age of the landslide is assumed to be equal to the return period of the conditions/climatic event that triggered the slide, i.e. a 500-yr. old event is associated with a 1 in 500-year return period (Pa). This results in a higher estimate of the annual likelihood of an event occurring than is present.

For the natural terrain stability, field evidence for events that occurred less than 20 years ago, (Pa >0.05) will be obvious and likely appear relatively fresh (i.e. exposed mineral soil, broken and/or scarred timber, etc.). These areas are deemed to have a very high annual likelihood of landslides.

Field evidence for events that occurred between 20 and 100 years ago, (Pa = 0.05-0.01) should be obvious (i.e. change in vegetation, sharp slide scarps, scarred trees, buried soil horizons, absence of developed soil profile in the scar and scarp, etc.). These areas are deemed to have a high annual likelihood of landslides.

Field evidence associated with events that occurred between 100 and 500 years ago, (Pa=0.01-0.002) are usually more subdued (muted slide scars, multiple and/or thicker buried soil horizons, less developed soil profile within the scar compared to the adjacent slope, lack of burnt snags within the slide path if present on the adjacent slope). These areas are deemed to have a moderate annual likelihood of landslides.

Unless very large, field evidence for events associated with greater than 500-year-old events (Pa < 0.002) can be hard to notice (muted slide scars, old gullies, may have deep thick buried soils horizons). These areas are thought to have a low annual likelihood of landslides.

Debris slide paths are most likely U-shaped swales, debris slides can transition to debris flows if the slide enters a gully or is otherwise channelized. Along lower gradient reaches and/or in unconfined sections, debris deposition often occurs as levees or debris lobes. Trimlines (scoured side slopes), scarred trees adjacent to the channel, and buried soil horizons on levees or deposition sites can indicate the age and frequency of events.

Observations of how previous development has influenced terrain stability, experience and professional judgment are used to determine how the proposed development will influence terrain stability.

The following formula is used to estimate the likelihood of an event occurring during the lifetime of a specific structure/element (long-term likelihood).

$Px=1-[1-(Pa)]^x$

Where Pa is the annual probability, x is the lifespan of the "structure" and Px is the probability during the lifetime of the structure.

For this report, the likelihood of an event occurring during the lifetime of the structure (Px) is defined as:

Greater than 50% is deemed Very High likelihood; from 50% to 20 % is a High likelihood; from 20% to 5% is a Moderate likelihood; less than 5% is a Low likelihood of landslide initiation.

3.3 Hazard Determination

For this report, a hazard is defined as a source for potential harm in terms of water quality or water intake infrastructure. An event is deemed to be a hazard if it can materially adversely affect the element(s) assessed for risk (specific hazardous event –P (H)). For this report, the hazard is a function of the likelihood of a landslide and the likelihood that the slide can reach Laird Creek (P(HA)-Hazardous slide or Landslide Hazard) (Table 3.3.1). Runout distance of the future slides was based on field evidence of the runout characteristics of past slides

The elements considered in this analysis is water quality at the intakes on Laird Creek and the intake infrastructures.

Table 3.3.1 Matrix for determining Hazardous slide, P (HA).

		Likelihood that the Landslide and or Sediment Delivery Will Reach or Otherwise Affect Laird Creek given that the Landslide/Soil Erosion Occurs			
		High	**Moderate**	**Low**	**Negligible**
Likelihood of Occurrence of Landslide	**Very High**	Very High	Very High	High	(Low)
	High	Very High	High	Moderate	Low
	Moderate	High	Moderate	Low	Very Low
	Low	Moderate	Low	Very Low	Very Low

3.4 Specific Risk Analysis Methodology

The risk analysis presented in this report is qualitative and is based on information gathered during this project and reviews of previous reports.

The elements assessed for risk for this project is water intakes/water quality at the licensed intakes (PODs) shown on figure #2.

For this report, the risk is defined as hazard (P(HA)) x consequence. Hazard has been defined in section 3.3, and consequence is the possible effect of the event. The vulnerability of the elements is not well defined. For this analysis, water intakes are assumed to be within the stream channels and "once debris and sediment enter Laird Creek, the 15% (avg) gradient of the channel through the middle and lower reaches allows for the rapid transport of fine sediment (sand and gravel) down to the intakes above Beggs Road."[1].

Table 3.4.1: Water quality and water supply infrastructure

Consequence	***Effect***
High	Long-term or permanent deterioration of water quantity/ quality. Complete destruction of water intake structures.
Moderate	Short-term deterioration of water quality quantity, repairable damage to water intake structures.
Low	Short-term (less then 1 week) deterioration of water quality/quantity, "damage" to water intake structures repairable during regular maintenance.

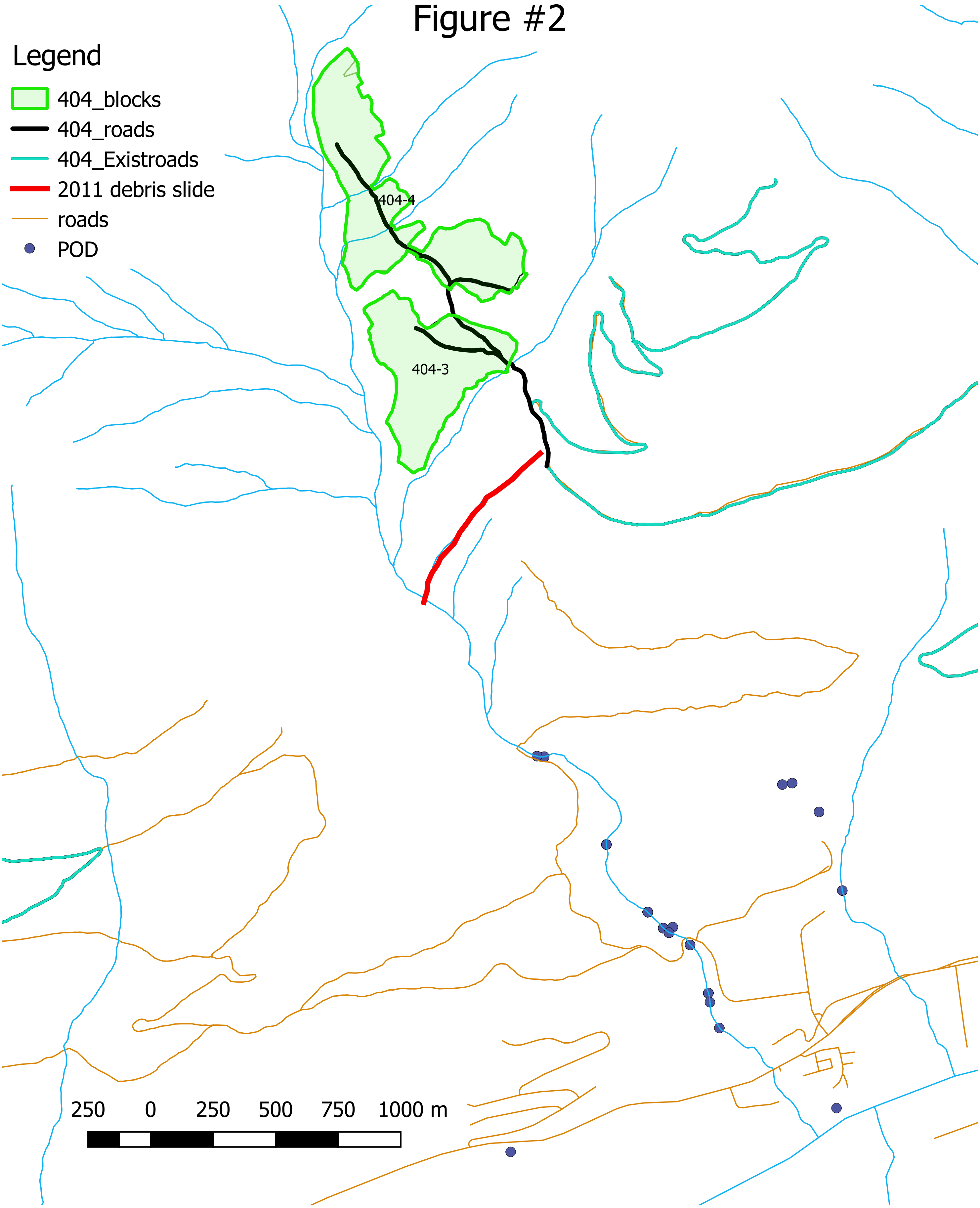
Specific Risk is the product of the hazard and the consequence as shown in table 3.4.2

Table 3.4.2 Matrix for determining risk for water resources.

		Consequence		
		High	**Moderate**	**Low**
Hazard	**Very High**	Very High	Very High	High
	High	Very High	High	Moderate
	Moderate	High	Moderate	Low
	Low	Moderate	Low	Very Low
	Very Low	Low	Very Low	Very Low

[1] Laird Creek Hydrogeomorphic Assessment 2018.

Figure #2


Legend
404_blocks
404_roads
404_Existroads
2011 debris slide
roads
POD
404-4
404-3
250 0 250 500 750 1000 m

4. Observations and Interpretations:

Laird Main extension is 1,979.33 meters long, for ease of discussion and for the purposes of this report, the road has been divided into 13 sections of similar terrain as shown on Figure #3; and tabulated in the Road Table and overview map in Appendix I. Observation sites are shown on the figure Apex Road Stations and tabulated in Appendix II.

For the most part the roads are located on stable ground, maintaining downslope terrain stability with slope drainage control, is the most critical management objective. Culverts were well located by the road survey crew, it was noted that some culverts marked in the field were not noted in the notes, these were noted by Apex. A few additional culverts were marked in the field by Apex, and areas of follow up inspection (after construction) were noted. The overall culvert plan shown on proposed culvert map in Appendix III.

Laird Mainline:

Section #1 (Hubs 1-7): The first 254 meters is along the recontoured segment of the Laird Mainline. This portion of the road was recontoured as part of the response to the 2011 debris slide that occurred 40 meters downslope of the southern end of this section (figure #4). A slide

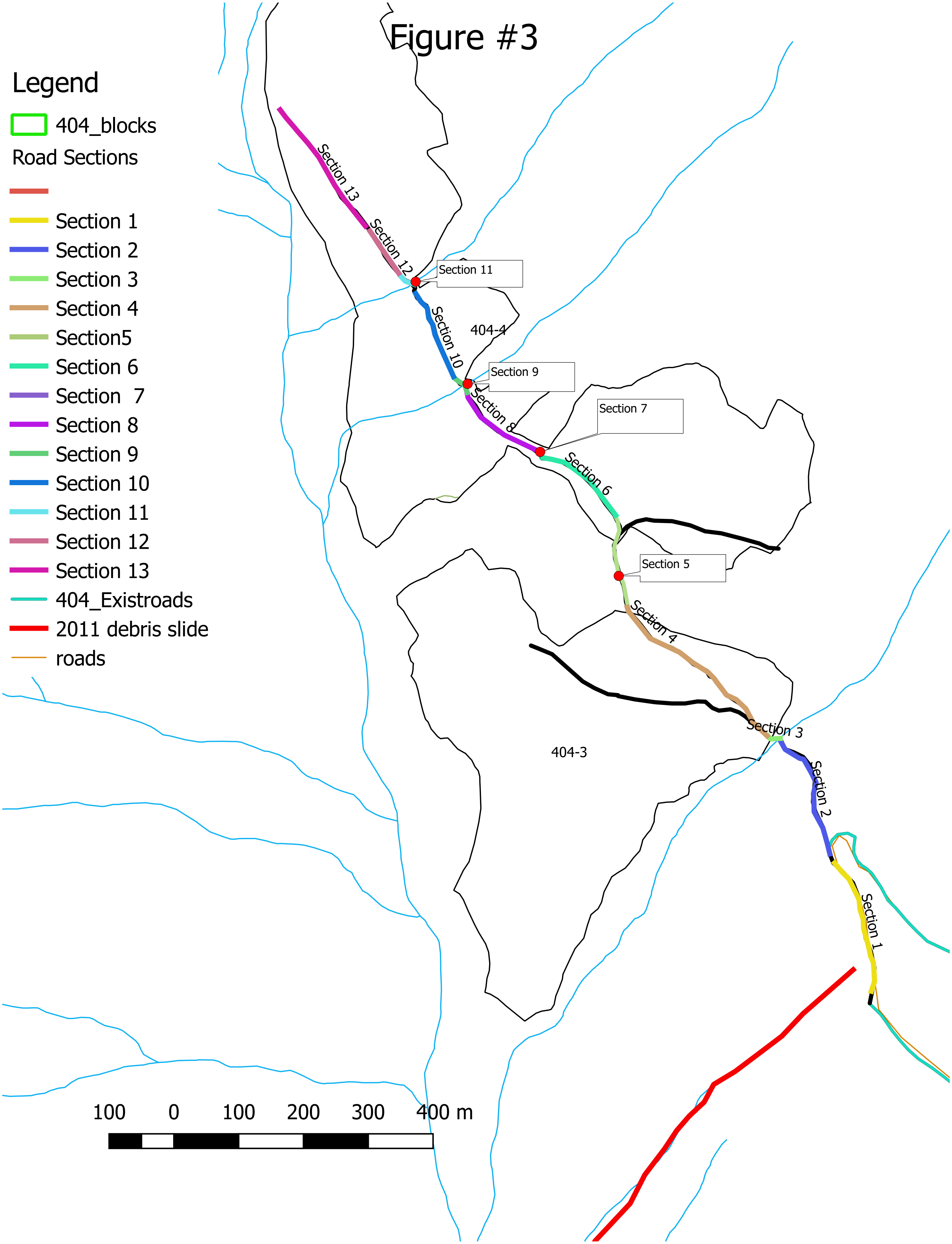


Figure #3
Legend
404_blocks
Road Sections
Section 1
Section 2
Section 3
Section 4
Section5
Section 6
Section 7
Section 8
Section 9
Section 10
Section 11
Section 12
Section 13
404_Existroads
2011 debris slide
roads
Section 13
Section 12
Section 11
Section 10
404-4
Section 9
Section 8
Section 7
Section 6
Section 5
Section 4
404-3
Section 3
Section 2
Section 1
100 0 100 200 300 400 m

investigation (Sitkum 2011) into the 2011 debris slide stated that major trigger of the slide was water diverted out of an adjacent watershed catchment into the catchment upslope of the slide. The combined flow was directed down the six stacked road lifts and discharged onto the slide scarp. After additional drainage works were completed on the road network (prior to the recontouring), the volume of discharge from this culvert onto the scarp was reduced by 80%. Since 2011 no additional slides have occurred below the cross-ditches, suggesting that the drainage control measures are adequate to maintain downslope stability.

The recontoured road traverses and switches through a “swaled” ancient slump scarp. Currently there are cross-ditches at all swale locations, the cutslope has sloughed to 30 to 60% at swale locations. Cross-drain culverts locations are marked at all the cross-ditch locations (Figure 4).

Section #2 (Hubs 7-18): The proposed road crosses a 55 to 65% gradient slope with a small flat just before a deeply incised creek. The slope is underlain by moderately well graded sandy angular gravel. Approximately 100 meters downslope of the south end of section #2 there is an ancient complex of large debris slide headscarps feeding into a debris flow gully. Small recent slides have initiated within the large scarp complex. The most recent slide (slide #1- figure #5) appears to be < 50 yrs. old, the debris slide entered a small side gully and transitioned into a debris flow. Most of the debris was deposited just upstream of the confluence with the major gully. Further downstream, fine sediment (sand and small pebbles) was deposited about 10cm deep within the major gully. There also appears to be a trim line about 2m elevation above the bottom of the main gully suggesting other events have occurred within the main gully. Inspection of the gully about 200m downstream shows no evidence of debris flow deposits or scour, indicating that historically debris floods terminated upstream within the gully.

Just before the road stream crossing (Section #3) there is a recent (~15 yrs old) shallow small debris slide (Slide #2), on an 80% gradient slope underlain by loose sandy gravel. The debris slide made it to the gully below. The proposed road at this location is set back from the slope break on a small flat.

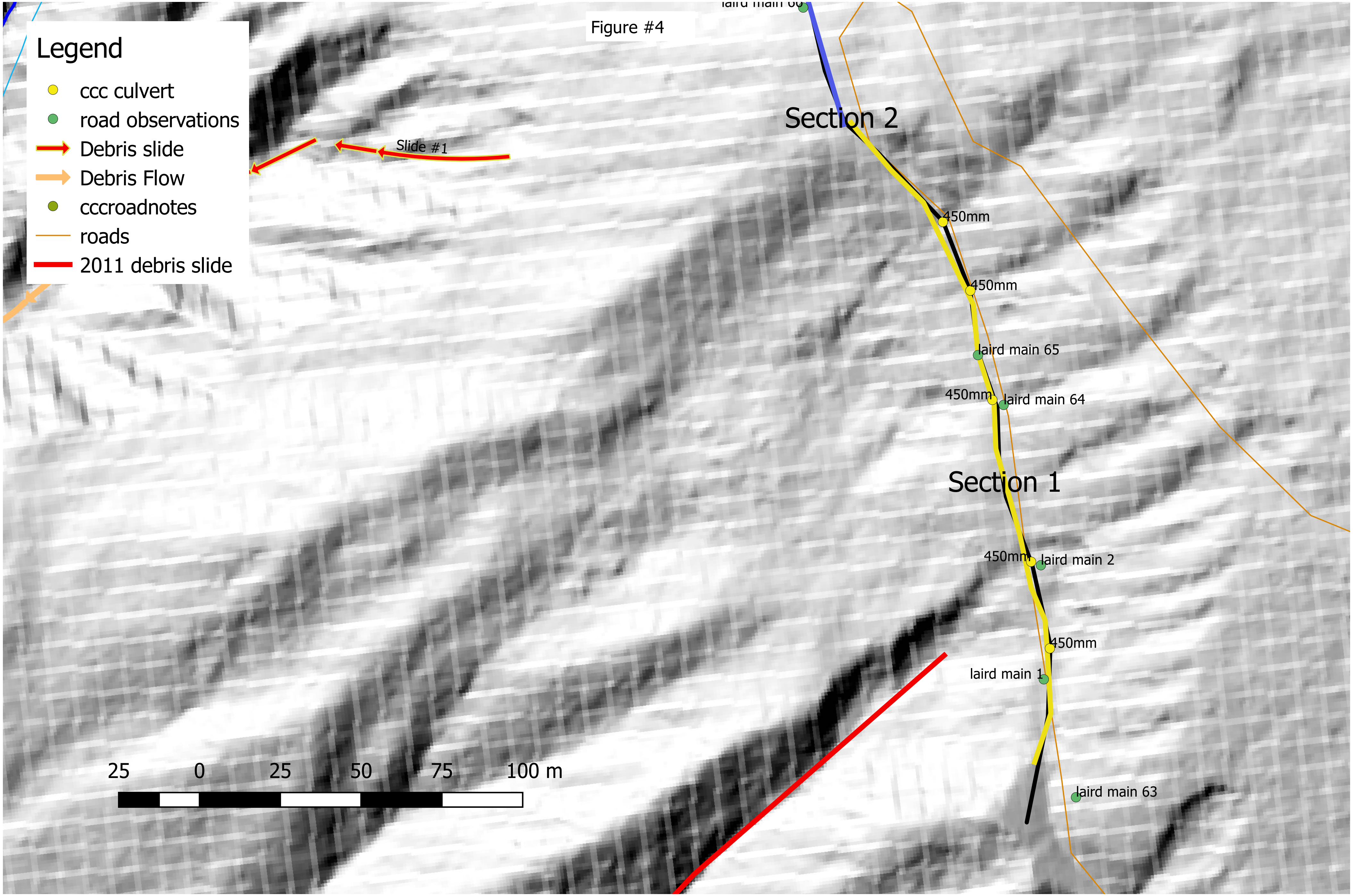


Figure #4
Legend
ccc culvert
road observations
Debris slide
Debris Flow
cccroadnotes
roads
2011 debris slide
Slide #1
Section 2
450mm
450mm
laird main 65
450mm
laird main 64
Section 1
450mm
laird main 2
450mm
laird main 1
laird main 63
25
0
25
50
75
100 m

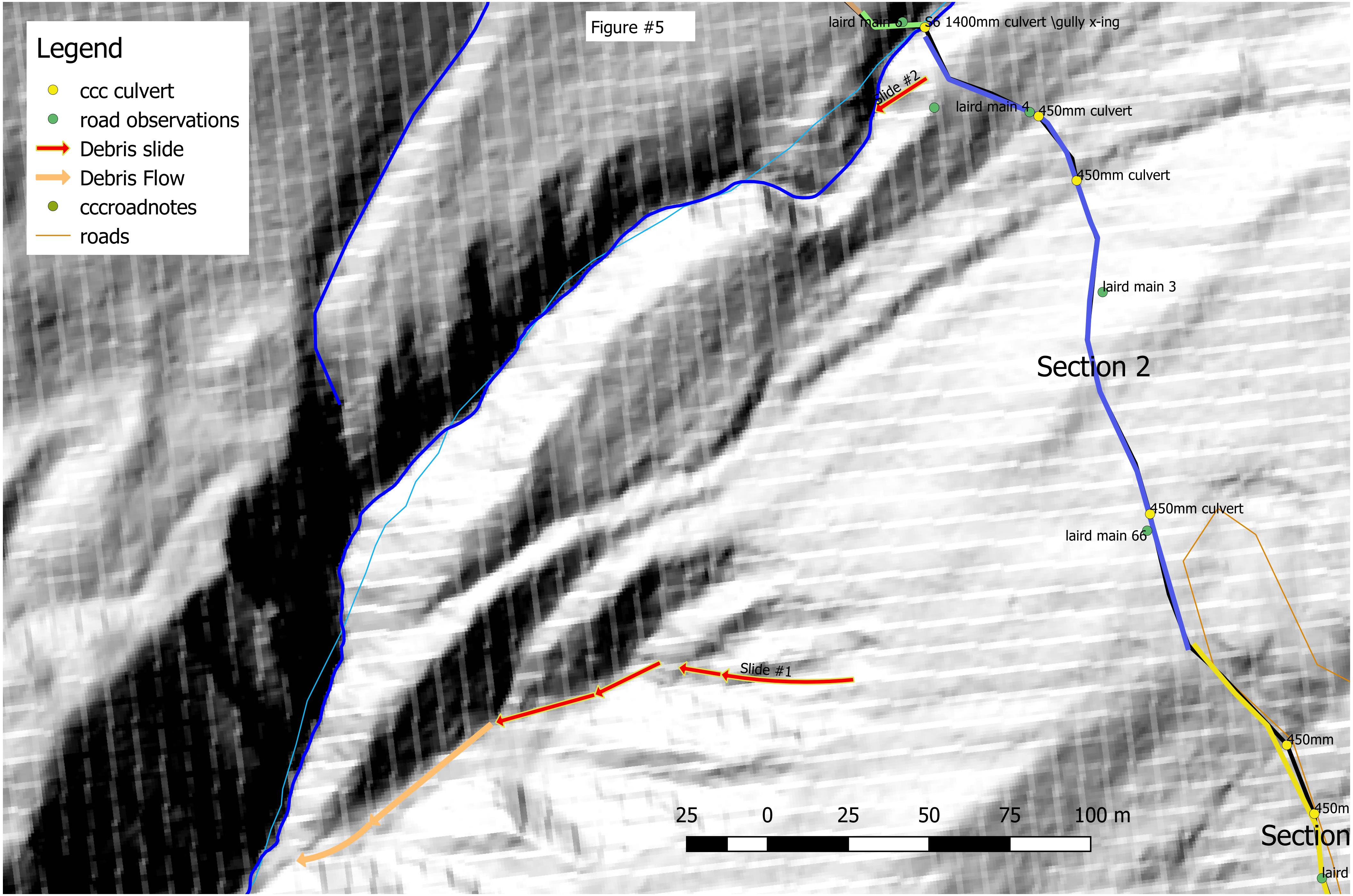


Figure #5
Legend
ccc culvert
road observations
Debris slide
Debris Flow
cccroadnotes
roads
laird main 6
S6 1400mm culvert \gully x-ing
Slide #2
laird main 4
450mm culvert
450mm culvert
laird main 3
Section 2
450mm culvert
laird main 66
Slide #1
450mm
450m
Section
laird
25 0 25 50 75 100 m

Section #3 (Hub 10): The gully at the road crossing is 5m deep, the first 3m is sandy gravel with a slope gradient of 80%, the bottom 2m is vertical rock. Upstream of the crossing, this stream is known to host debris flows triggered by slumping and sloughing sideslopes. The debris is deposited along a low gradient section upstream of the crossing. There is no evidence of debris flows/floods at the crossing location.

Section #4 (Hubs 22-36): This section of the road angles up a 50% gradient slope underlain by loose sandy boulder gravel towards a large wet bench (Section #5).

Section #5 (Hubs 36-42, 65-67): This section of the proposed road is on a low gradient wet bench (receiving site) with a shallow depth to the water table. There is a small, slightly entrenched stream that crosses the flat (Station Laird Main 16), a 1000mm culvert flag was marked there during road layout but was not noted in the road notes. The southern portion of this section is just upslope of a complex headscarp of large ancient debris slide/slumps (Figure #6) and smaller more recent debris slides. Springs occur at the base of the scarps ~ 8m below the slope break. A shallow slide off the steep scarp (slide #3) is estimated to have occurred about 25 yrs ago, the slide transitioned to a small debris flow where the springs coalesce into a small stream confined by steep sideslopes. The flow appears to terminate where the stream becomes unconfined just upslope of Spur A.

Section #6 (Hub 67-74): This section of the proposed road crossed ancient debris cones/fans underlain by loose sandy gravel. The slope gradient is 50% or less.

Section #7 (Hubs 74-77): The road crosses a debris flow/avalanche gully confined by 4m boulder sideslopes. The channel is 2m wide floored in boulders. The trimline, scarred trees and rotten wood in partial levees, suggest the last major event was ~ 50 yrs ago.

Section #8 (77-83): The 55 to 70% gradient slope (the eastern half is just upslope of a broad bench) is underlain by well graded angular gravel.

At the northern end, the road crosses an old slide/slough (70% slope) underlain by weathered granite, feldspar crystals comprise most to the coarse fragments.

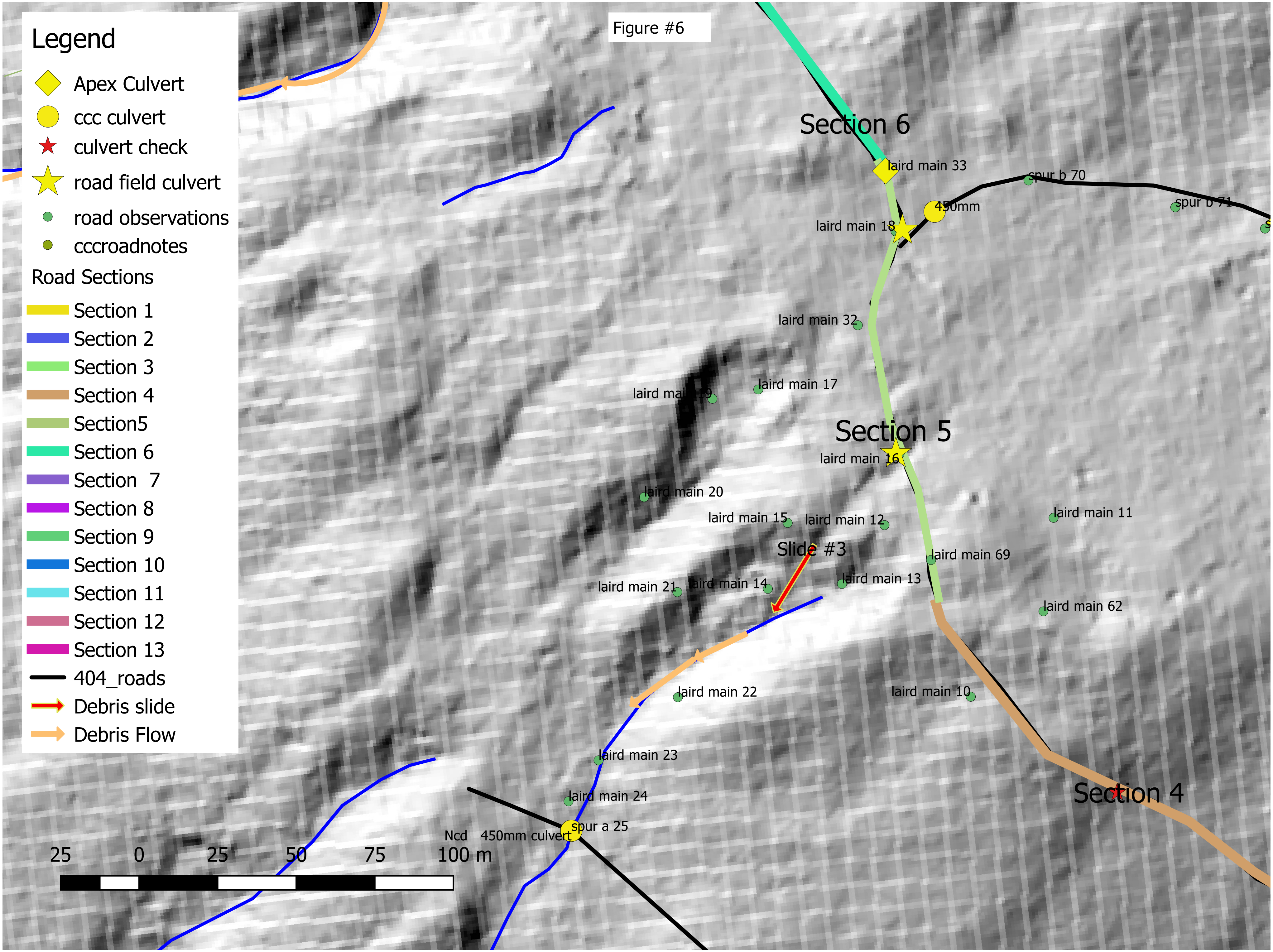


Figure #6
Legend
Apex Culvert
ccc culvert
culvert check
road field culvert
road observations
cccroadnotes
Road Sections
Section 1
Section 2
Section 3
Section 4
Section5
Section 6
Section 7
Section 8
Section 9
Section 10
Section 11
Section 12
Section 13
404_roads
Debris slide
Debris Flow
Section 6
laird main 33
spur b 70
450mm
spur b 71
laird main 18
laird main 32
laird main 17
Section 5
laird main 16
laird main 20
laird main 15
laird main 12
laird main 11
Slide #3
laird main 69
laird main 21
laird main 14
laird main 13
laird main 62
laird main 22
laird main 10
laird main 23
laird main 24
Section 4
spur a 25
Ncd
450mm culvert
25 0 25 50 75 100 m

Section #9 (Hubs 83-88): The road crosses a 5m deep 2m wide gully with large boulders on east side, rock on the west side. The stream channel gradient is 75% flowing through mossy boulders, there is no evidence of recent debris flows.

Photo 1 Looking downstream at crossing.

Section #10 (Hubs 88-98): The proposed road crosses a 55 to 70% gullied/swaled slope underlain by well graded angular gravel to well graded sandy rounded gravel. The bottom of the swales/gullies are moist (devils club) the interfluves are dry.

Section #11(Hubs 98-101): The road crosses a 4 to 5 m deep 3m wide rock “canyon”. The channel at the crossing location is a small rock bench, with a water fall downstream and a cascade upstream, the overall gradient upstream is 70%.

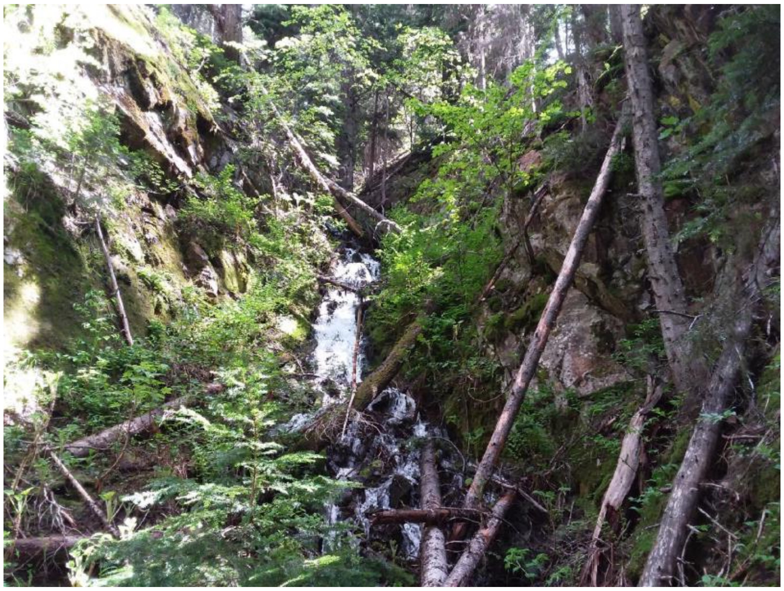


Photo 2, Stream crossing at canyon looking upstream.

<u>Section #12 (Hubs 101-106)</u>: This section of road is on a 70% gradient slope with shallow soils over rock.

Photo 3 Typical terrain along Section 12

<u>Section #13 (Hubs 106-113)</u>: This section of the road crosses a 30 to 50% gradient slope of swaled and gullied boulder gravel.

Photo 4 Typical soils Section 13

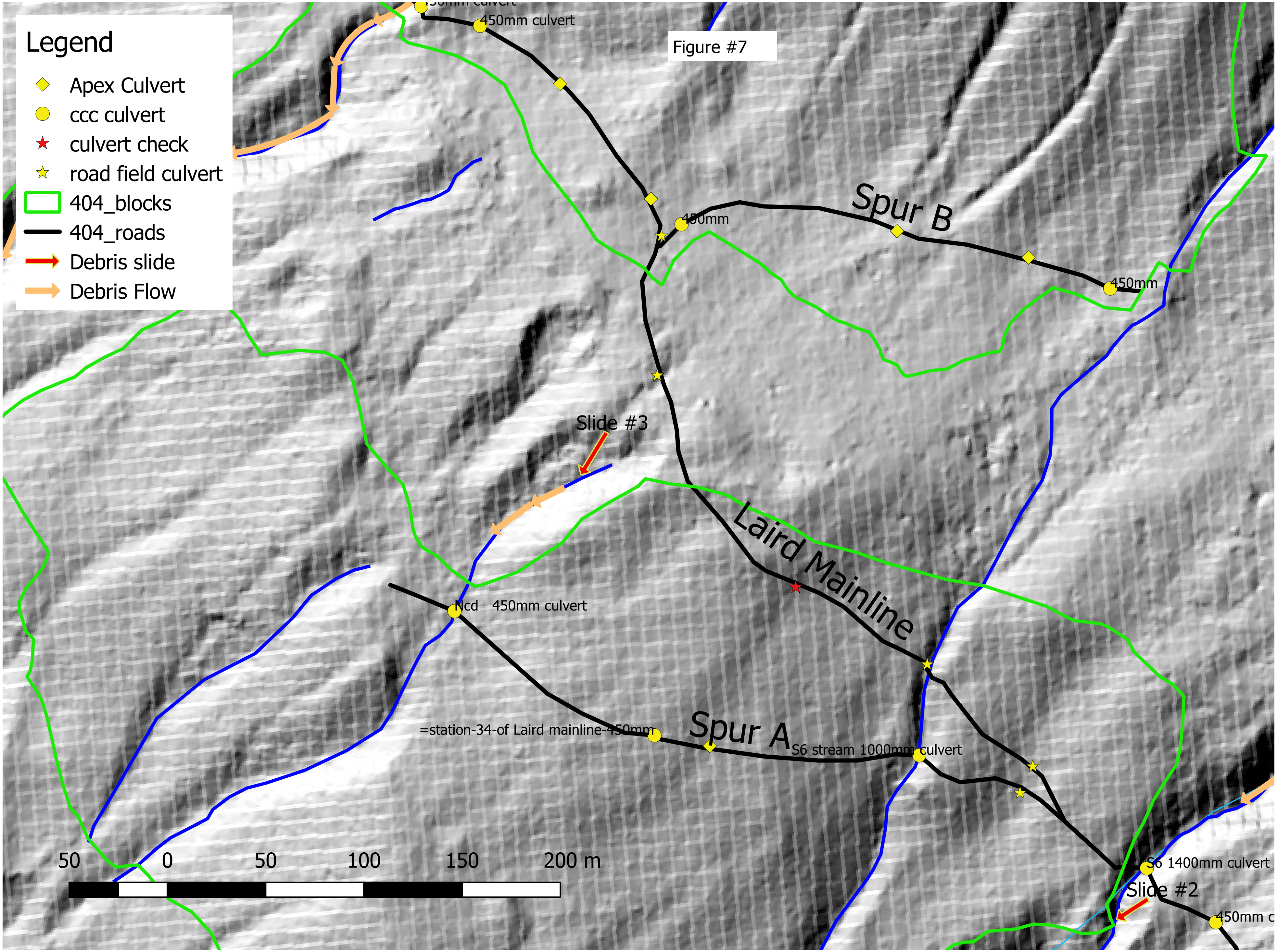
Spur A:

Spur A is located downslope of Proposed Laird Main (Figure #7), the slope (30 to 55%) is underlain by sandy gravel to boulder gravel. Just past the junction point of departure from Laird Main, the Spur crosses a creek confined by 2 to 3 m high 60% boulder sideslopes. There is no evidence of debris flows through here, there are old burnt stump in bottom. The channel gradient is 45%, with small woody debris and mossy cobbles.

Near the termination of the spur, the proposed road crosses an old debris deposit, currently the small stream is caught in a small swale that conveys it across the deposit. The channel gradient is 30%, upslope of the Spur the channel hosted a small debris flow (25yrs slide #2) that terminated prior to Spur A.

Spur B:

Spur B leaves the proposed Laird Main extension on the wet flat, the spur then traverses Colluvial cones the base of two draws. The slope gradient does not exceed 45%. It is likely that water flows sub-surface through the cones (Figure #7).



Legend
Apex Culvert
ccc culvert
culvert check
road field culvert
404_blocks
404_roads
Debris slide
Debris Flow
Figure #7
450mm culvert
450mm
Spur B
450mm
Slide #3
Laird Mainline
Ncd 450mm culvert
=station-34-of Laird mainline-450mm
Spur A
S6 stream 1000mm culvert
S6 1400mm culvert
Slide #2
50 0 50 100 150 200 m

5. Implications, Recommendation and Risk Analysis

For the most part the proposed road and spurs are located on stable terrain. Drainage control along the proposed road and spurs is the primary management objective. Proposed culvert locations are shown on the figure 8 Proposed Culverts in Appendix III. There are Twenty-nine 450 mm culverts, three 1000mm culverts, two 1200 mm culverts and one 1400 mm culvert.

Culvert Table

Road	Hub	size
Laird Main	2	450 mm
Laird Main	3	450 mm
Laird Main	4	450 mm
Laird Main	5	450 mm
Laird Main	6	450 mm
Laird Main	9	450 mm
Laird Main	14	450 mm
Laird Main	16	450 mm
Laird Main	20	1200 mm
Laird Main	26	450 mm
Laird Main	30	1000 mm
Laird Main	33	450 mm
Laird Main	39	1000 mm
Laird Main	65	450 mm
Laird Main	65.5	450 mm
Laird Main	70	450 mm
Laird Main	72	450 mm
Laird Main	75	450 mm

Road	Hub	size
Laird Main	78	450 mm
Laird Main	81	450 mm
Laird Main	85	1200 mm
Laird Main	94	450 mm
Laird Main	96	450 mm
Laird Main	99	1400 mm
Laird Main	105	450 mm
Laird Main	108	450 mm
Laird Main	111	450 mm
Spur A	2	450 mm
Spur A	28	1000 mm
Spur A	33	450 mm
Spur A	34,1	450 mm
Spur B	2	450 mm
Spur B	6	450 mm
Spur B	9	450 mm
Spur B	11	450 mm

Laird Mainline:

Section #1: This section of the road will be reconstruction of a recontoured road upslope of the 2011 debris slide. The material is moderately dense silty gravel (GM). The cutslope should not exceed 1.1:1, the fillslope should be 1.3:1 with a 3% inslope. Where the slope exceeds 65% the fill should be keyed into the slope, or the toe should be supported by rock (D50 =0.5m). The rock, keyed in, can be 1:1. The cutslope above the inlets of the culverts should be buttressed with rock (D50= 0.35) to avoid sloughing of the cut. The culvert discharge should not flow onto the fillslope, use rock for erosion protection or extend the outlet to discharge onto forest floor.

The road layout crew have proposed 450mm culverts at all cross-ditch locations, which correspond to natural swales, this is sufficient to maintain the current slope drainage patterns. Reconstruction of this section of road will not significantly increase the low likelihood of landslide initiation. If a slide did occur it is highly likely that it would reach Laird Creek.

Table Matrix for determining Hazardous slide, P (HA).

		Likelihood that the Landslide and or Sediment Delivery Will Reach or Otherwise Affect Laird Creek given that the Landslide/Soil Erosion Occurs			
		High	**Moderate**	**Low**	**Negligible**
Likelihood of Occurrence of Landslide	**Very High**	Very High	Very High	High	(Low)
	High	Very High	High	Moderate	Low
	Moderate	High	Moderate	Low	Very Low
	Low	Moderate	Low	Very Low	Very Low

A slide along here poses a Moderate Hazard. Road construction will not significantly increase the Hazard.

The 2011 debris slide became channelized and transitioned into a debris flow which entered Laird Creek. A debris flood was triggered in Laird Creek for about 200 meters downstream. Fine debris was transported a further 450m downstream. Water users reported elevated turbidity and sand/silt deposition.

The consequence of the slide was short term deterioration of water quality and cleaning of some intake structures. (Sitkum 2011) Turbidity also occurred in 2012 (Sitkum 2012), bioremediation of the slide in 2012 appears to have significantly reduced sediment delivery into Laird Creek (Terra Erosion Control 2013, Apex 2013). Laird creek, prior to the slide, experienced 2 to 6 weeks of elevated turbidity every freshet (Sitkum 2013).

Table 5.1 Water quality and water supply infrastructure

Consequence	*Effect*
High	Long-term or permanent deterioration of water quantity/ quality. Complete destruction of water intake structures.
Moderate	Short-term deterioration of water quality quantity, repairable damage to water intake structures.
Low	Short-term (less then 1 week) deterioration of water quality/quantity, “damage” to water intake structures repairable during regular maintenance.

The consequence of the slide is deemed low.

Specific Risk is the product of the hazard and the consequence as shown in table 5.2.

Table 5.2 Matrix for determining risk for water resources.

		Consequence		
		High	**Moderate**	**Low**
Hazard	**Very High**	Very High	Very High	High
	High	Very High	High	Moderate
	Moderate	High	Moderate	Low
	Low	Moderate	Low	Very Low
	Very Low	Low	Very Low	Very Low

There is a low risk to water Quality and infrastructure.

Section #2: The material is loose, moderately well graded, sandy angular gravel on 55% or less slope gradient upslope of unstable terrain. The major concern along here is drainage control, the road layout crew culvert locations are well situated to maintain natural drainage patterns. Construction of this section of road will not increase the downslope likelihood of landslide initiation. There is a small recent debris slide at the north end of this section just before the stream crossing. The slide is small, the crown of the slide should be scaled back to about 70 to 75% ~ 2m below the top of the scarp, the scarp can be reached by the excavator during road construction.

Approximately 100 m downslope of the southern portion of this segment is a 50 yr. old debris slide/flow (slide #1) The debris flow terminated within the gully system upslope of Laird Creek. It is likely that fine sediment did reach Liard Creek.

There is a low likelihood of a road related landslide.

Table 5.3 Matrix for determining Hazardous slide, P (HA).

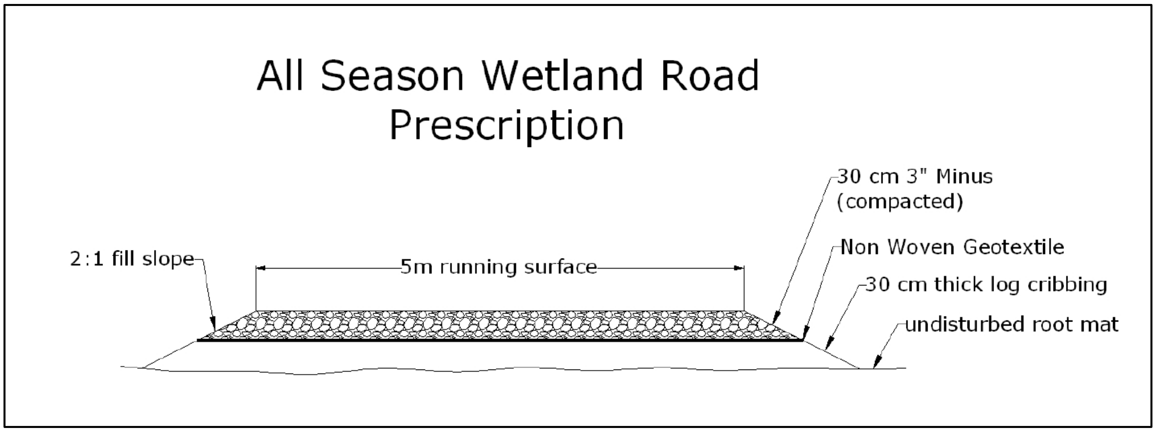
		Likelihood that the Landslide and or Sediment Delivery Will Reach or Otherwise Affect Laird Creek given that the Landslide/Soil Erosion Occurs			
		High	**Moderate**	**Low**	**Negligible**
Likelihood of Occurrence of Landslide	**Very High**	Very High	Very High	High	(Low)
	High	Very High	High	Moderate	Low
	Moderate	High	Moderate	Low	Very Low
	Low	Moderate	Low	Very Low	Very Low

A slide along this section of road poses a low hazard.

Section #3: This stream crossing is designed by SNT. (See Appendix IV). There is a low likelihood of landslide initiation at the crossing as designed.

Section #4: Make sure water is not diverted down this section of road from section #5. Currently there are three culverts proposed along this section.

Section #5: The objective along this section of road is to maintain natural slope drainage. The water table is near surface, overlanding the road through this section with culverts located at road Hub 39. Additional culverts may be required if the road inhibits free flowing water.



There is a low likelihood of landslide initiation along the road alignment.
There is a recent debris slide that transitioned to a small debris flow 30 meters downslope of this portion of the road. The flow terminated on an ancient debris cone just upslope of Spur A, there is no evidence of debris flows reaching Laird creek over the last few rotations. There is a low likelihood that a debris flow will reach Laird Creek. Construction of the road as recommended will not significantly increase the high likelihood of landslide initiation downslope of the road.

Table 5.4 Matrix for determining Hazardous slide, P (HA).

		Likelihood that the Landslide and or Sediment Delivery Will Reach or Otherwise Affect Laird Creek given that the Landslide/Soil Erosion Occurs			
		High	**Moderate**	**Low**	**Negligible**
Likelihood of Occurrence of Landslide	**Very High**	Very High	Very High	High	(Low)
	High	Very High	High	Moderate	Low
	Moderate	High	Moderate	Low	Very Low
	Low	Moderate	Low	Very Low	Very Low

A slide is deemed a Moderate Hazard with Low Consequences, the Risk is Low.

Table 5.5 Matrix for determining risk for water resources.

		Consequence		
		High	**Moderate**	**Low**
Hazard	**Very High**	Very High	Very High	High
	High	Very High	High	Moderate
	Moderate	High	Moderate	Low
	Low	Moderate	Low	Very Low
	Very Low	Low	Very Low	Very Low

Road construction will not significantly increase the Risk.

Section #6: There are good potential borrow sites and spoil sites along this section of road. Road construction will not significantly increase the low likelihood of landslide initiation.

Section #7: Crossing of a debris flow/Avalanche gully with annual probability of (Pa) 2%, fill (1.3:1) through the gully using the available boulders (D90 0.75m). Swale the road through the gully to allow debris/avalanche to pass over. Currently there is a small discontinuous stream channel, upgrade the proposed 450 mm culvert to 600 mm. There is a low likelihood of landslide initiation along the road alignment.

Section #8: The bench below the road along the eastern portion (Hub 78) is a good spoil site. The cutslope should be 1.2:1 (0.5:1 in rock), the fill slope will be stable at 1.3:1. Key the fill into the slope to avoid sliver fills on the 70% slope gradient swale Near the western end (Hub 80). Make sure the culvert discharges onto forest floor not the fillslope. Road construction will not significantly increase the low likelihood of landslide initiation.

Section #9: Fill (1.3:1) through gully utilise boulders and rock excavated along road to armour the fill on upstream side (D90=50cm). Fullbench the gully egress, use material to fill behind.

Construction of the crossing will not significantly increase the low likelihood of landslide initiation.

Section #10: Culvert the gullies and swales, the cutslope should be 1.25:1/ the fillslope 1.3:1 in the sandy gravel, if rock is encountered the cut can be 0.25:1 and the stacked blocky fill 1:1. There is a low likelihood of landslide initiation.

Section #11: This canyon crossing is designed by SNT.

Section #12: Key in fill, place blocky fill with hoe at 1:1, cut in rock 0.25:1.

Section #13: Conventional road construction will not significantly increase the low likelihood of landslide initiation.

Spurs A and B:

Provided the proposed culverts are installed, there are no terrain stability concerns for Spurs A and B.

Respectfully Submitted,
Apex Geoscience Consultants Ltd.

Will Halleran

Digitally signed by Will Halleran
DN: cn=Will Halleran, o=Apex Geoscience Cons., ou=Geotech, email=apexgeo@shaw.ca, c=CA
Date: 2020.08.17 11:45:53 -07'00'

Will Halleran P.Geo. Eng. L.

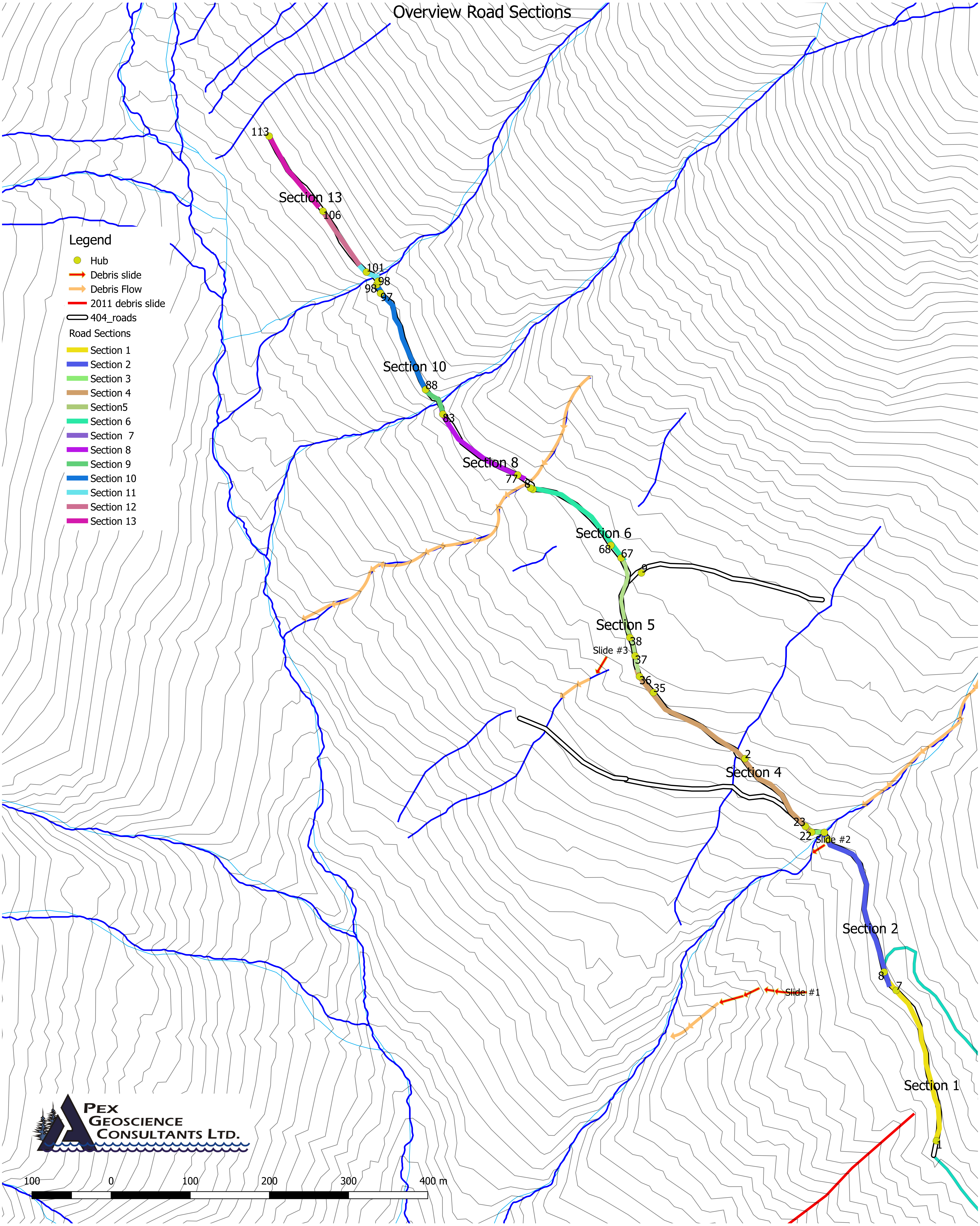
Appendix I Road Table and Overview Map

Section	Sites	Road Hubs	Slope	material	Prob landslide	Cut/fill	Notes	Residual Prob
#1	Laird Main 1 and 2. 63-65	1-7	60%	Mod compact silty sandy Gravel (GM)	Low	1.2:1/1.3:1	Previously recontoured road (see SNT), 2011 debris slide below this section, several swales, cut sloughed to 35% below swale (flowing water), key fill into slope. SNT design Appendix IV Culvert swales and armour (0.5m) cut at inlet	Low
#2	Laird Main 3-5 (Laird main 66)	7-18	55%	Loose moderately well graded sandy angular gravel	Low	1.25:1	Lots of boulders, upslope of slides scarps. (404-3 27 -36) Just before creek crossing recent small slide into creek. Approach to creek is "flat", approach and crossing designed by SNT.	Low
#3	Laird 6	10					Stream Crossing SNT design	
#4	Laird Main 7 -10	22-36	50%	Loose boulder gravel	Low			Low
	Laird Main 10	36					At station 10 the proposed road crosses an ancient scarp up onto "wet flats". Ensure water is not diverted down road.	
#5	Laird 69, 16-18, 32-33	36-42; 65-67	25%	Silty, sandy boulder gravel.	*Low		Overland over wet ground to avoid concentration of drainage onto slide scarps. See Prescription in report.	*Low Currently high likelihood below

Section	Sites	Road Hubs	Slope	material	Prob landslide	Cut/fill	Notes	Residual Prob
	Laird 16	39					Stream, moderately well entrenched, install culvert (road flagged 1000mm)	
#6	Laird Main 33-37, 78,	67-74	50%	Sandy gravel	Low			Low
	Laird Main 33-34	67-70			Low		Crosses an ancient sandy gravel fan/cone, good borrow site and material for overland subgrade.	Low
#7	37	74-77					Debris flow gully, road culvert, transport zone,	
#8	Laird Main 39-43. 76	77-83	55-70	Well graded angular gravel	Low	1.2:1 /1.3:1		Low
	41-	80	70		Low		Swale, pilot below to key in fill, Culvert	Low
#9	Laird Main 43-45, 75	83-88	90%		Low	1.3:1	5m wide crossing 5m high. Fill through gully, Fill (1.3:1) through gully utilise boulders and rock excavated along road to armour the fill on upstream side (D90=50cm). Fullbench the gully egress, use material to fill behind*.	Low
	Laird Main 45	88	80%	Shallow to rock		0.25:1 cut in rock, 1:1 stacked fill.	*full bench out, or key in fill stack at 1:1, use excess to fill in gully.	

Section	Sites	Road Hubs	Slope	material	Prob landslide	Cut/fill	Notes	Residual Prob
#10	Laird 45-49	88-98	55-70	Well graded angular gravel to sandy rounded gravel	Low	1.2:1 /1.3:1	Swales/gullies to edge of canyon, culvert swales.	Low
	49	98					Edge of canyon	
#11	Laird Main 49-51	98-101		rock	Low	0.5:1/1.2:1	Full bench approaches, fill through (SNT)	Low
#12	Laird Main 51-53	101-106	70	Shallow to rock	Low	0.25:1/1:1	key in fill. place with hoe, 1:1, cut in rock 0.25:1.	Low
#13	Laird Main 53-57	106-113	30 - 55	Boulder Gravel.	Low		Swaled and gullied	Low

Overview Road Sections



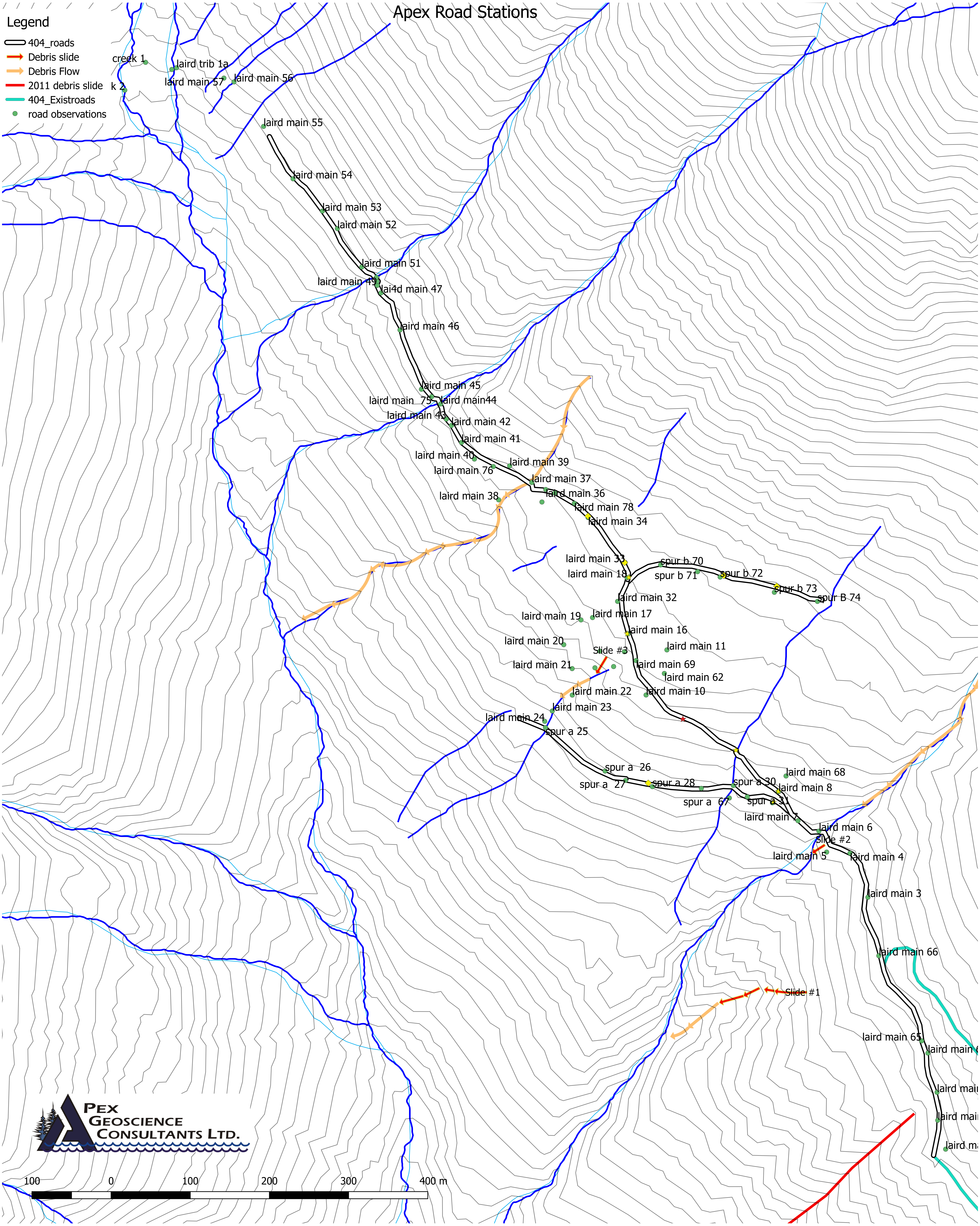
Appendix II Tabulated Field Notes and Map.

Title	Description
	Section #1
laird main 1	sandy silty mod dense, cut slumped to 60%.
laird main 2	sloughed to 35%, water out of cut, small swale to side, remnant cutslope just back at 90%, slope 60%, fully recontoured forward.
laird main 63	cutslope and fill along here stable at 75 to 80%, silty sandy coarse gravel. for recontoured road keep this angle.
laird main 64	to here recontoured to 40% on 60% slope, here old debris slide 2m deep draw, 60% slope, bench below, 60% recontour.
laird main 65	cut sloughed onto recontoured road, two sharp swales forward.
laird main 66	65% fill 55% slope below, use 80% cut and fill, pilot below.
	Section #2
laird main 3	65% slope, sand 25%, silt 15%, mod well graded angular gravel mostly small, loose, deep Bm. one large boulder or outcrop, to 75%. coarse fragment increases towards creek. to here, about sta. 15 on steeper slope, design, here on ancient debris deposition zone.
laird main 4	looks like ancient slide deposit, deep silty Bm with angle fragments, 55%.
laird main 5	recent slide scarp, loose sandy gravel, -80%/ flat. 5 yrs. old shallow, main about 10 to 15yrs, 20m down to creek check creek. remove scarp, scale to 75% 2.5m down.
	Section #3
laird main 6	last 2m rock, 3m 80% gravel, rock step creek, 1400 mm culvert. may be use arch.
	Section #4
laird main 7	evidence of surface flow, 50% slope.
laird main 8	road culvert marked
laird main 10	3m scarp, ancient, road heads onto it, stable here.
	Section #5
laird main 69	make sure water is not diverted to here, check this section for intercepted ground water back to stable scarp.
laird main 12	road on crown of large scarp, wet flats upslope would partially discharge here, even sub surface, slightly stepped, aspen and birch upslope, mostly cedar on slope, just below road +35/-65%, large churns, sharp scarp. Sand 25%, silt 15%, boulder gravel 60%.
laird main 16	road on wet flats, 20m from break, small stream in swale across flats here, soil in scarp is wet, slide likely occurred due to increased pore pressure at bottom of scarp, this stream flows in swale over slope break into slide scar, no tension cracks, slide likely occurred after fire about 20 to 15 yrs. ago (1999?). road 1000 culvert marked.
laird main 17	80% stepped scarps down, to 30% head, springs at base of scarp on head about 8m down, along slope, slide scar is unforested, very wet lots of ferns, maple and alder and birch. likely occurred due to high pore pressure 8m down. ha4d to tell age due to w3athered soil and water.45% slope, confined on north by steep 6m scarp
laird main 18	flats, jct, road culvert no evidence of stream ,, large tree churns silty sandy gravel, deep Bm, tree churns 2m deep no water in bottom, overland with permeable? road unlikely to intercept ground water, will clearcut increase drainage, say slide 1in150. see note 32. ay want to continue overland to here, permeable subgrade.
laird main 32	pool of water 1m below surface in large complex tree churn, slight depression, so aquitard or elevated water table, churn about 6m to west of road center line, flat and wet here. small ridge on west side, may be breached above scarps. just ahead station 41 culvert marked.
laird main 33	low point, before small rise (fan?), blue culvert. just before sta. 67.

Title	Description
	Section #6
laird main 34	crossed gravel fan other side here, no obvious stream , old graded sediment lobe, 20cm of sand grades to fine gravel, good Bm, charcoal on top, but could be from tree fall, sediment may correlate to last fire or one before, deposition from erosion, culvert blue. boulders upslope.19m sou5h of sta. 71, road starts toward toe of slope, fern zone ahead.
laird main 35	middle of fern zone, wet, 10m across road culvert here, likely seeps from toe, +55/-35%.
laird main 78	rd. sta. 71, good spoil site, can use to build road up. to at least 68, looks a little wetter ahead. can use for overlanding past jct and on to, just before 39.
laird main 36	ancient boulder debris piles, 45%, step below is toe of, a pile.
	Section #7
laird main 37	debris flow gully, sides boulders as is bottom, no vets in bottom, possible trim line 2m up 50% gradient, 4m sides slopes 90%, 2m wide base. possible debris below, check it out.
laird main 38	sharp corner, trim line rises to top, large vets on top. 30cm diameter cedar scarred about 15cm in, soil profiles hard to get as all soil is dark, bottom of gully has thick forest floor, seems some old rotten logs parallel to gully near bottom, large 40cm grand fir not scarred, checked debris levee on other side dark as d over angular gravel, two scarred cedars (smaller) partially killed, no obvious flagging, might be snow avalanche, age 60 yrs.? regardless it is transport not initiation. incised into large cone or flats here, road is okay.
	Section #8
laird main 39	near toe of coarse angular gravel 60% slope flats just below.
laird main 76	good spoil site. here north to road station 77
laird main 40	crossing boulder nose, 55%. looks like further down it may get steeper. dry Doug fir forest. sand 20%, silt 10%, well graded angular gravel 70%.
laird main 41	just onto 60%. still angular gravel, small stream, and swale just ahead. sta. 80. just upslope is a break to more gentle terrain, head scarp, could be close to rock here.
laird main 42	in broad swale, at culvert 70% slope, old slide, lots of windfall from wind down gully ahead, tree churns rip up weathered rock, feldspar frags, through here from sta. 81 to 82, pilot below, I can hear a stream ahead.
laird main 43	sta. 82 to 83 is on 55% slope, slight rise to gully side slope, gully side slope 90%, 5m high, 60% boulders, use boulders to fill through.
	Section 9
laird main 75	90% slope, rock, fb, use to fill back
laird main44	last 2m likely rock exposed 3m up, 30% stream gradient, partially flows under mossy floor, 2m flat. Old wood in bottom, no evidence of recent debris flows. below road 75% channel gradient, rock lip, rusty rock.
laird main 45	coming out of gully, rock to sta. 88, slope,80%, likely need to drill, quartz rich intrusive rusty, full bench out, or key in fill stack at 1:1, use excess to fill in gully. then onto 55% slope, coarse angular gravel, likely close to rock. sand 25%, silt 5%, well graded angular gravel 70%.
	Section 10
laird main 46	to here (sta. 92) slopes up to 65%, here -50%+70%, draw ahead. ahead side slope of dry swale 65% swale to bottom broad v shaped. then a rounded ridge to next swale, can hear water in that one.
laird main 47	no channel but devils club, boulders, and rock exposed, head scarp just upslope, ancient, between was rounded sandy gravel, slope 55%, side slope here 2m high 60%.
laird main 48	70%, silt 10%, sand 20% angular cf 70%, small canyon ahead likely small bluff below, multibench. or fb
	Section 11
laird main 49	sta. 98, edge of canyon, slope to creek 100% 3m between vert rock, fb in, use rock to fill.

Title	Description
laird main 50	stream channel, 70% gradient, small bench here, waterfall below, cascade up, 3m fill. steep out. full bench the approaches, use to fill.
	Section 12
laird main 51	out of canyon, 70% slope, shallow to rock, key in fill. place with hoe, 1:1, cut in rock 0.25:1.
laird main 52	to here 70 to 80% slope, shallow to rock, scattered outcrops, competent rock, intrusive. key in fill, place with hoe, 0.5m
laird main 53	sta. 106, 55%, blocky material, very large blocks, or outcrops as well. photo just ahead,
	Section 13
laird main 54	past shallow dry swale, 55% slope, sandy boulder, sand 15%, mostly boulders or blocks. colluvial apron.
laird main 55	50% slope, wetter, still coarse, sand up to 25% silt 15%, still lots of la4ge coarse, irregular terrain, old deposition along the apron, here small bench before creek, cannot see if it continues.
laird main 56	stream, 30% gradient, confined on old cone, 50% slope.
laird main 57	deep draws in boulder debris, encroach on trib, stream in west one.
laird main 62	ancient failed slump
laird main 68	ancient slumps, average slope grade 50%, 2 to 3m high rounded 65% scarps, stepped, sandy boulder gravel.
laird main 77	spoil site t
	Spur A
laird main 9	road culvert marked.
spur a 26	to here 45%, boulder ground.
spur a 27	No surface evidence of water, boulder slope, 45%, 10m up from -55%.
spur a 67	Rock side slope, canyon
spur a 25	onto spur at base of sediment fan (ancient), stream caught in small swale here, 30% gradient, no trim no scarring.
spur a 28	sta. 33, subtle broad swale, I would put the culvert here. blue, aspen and cedar.
spur a 29	from sta. 31 looks like ancient debris deposits, may have water in places. 45%.
spur a 30	creek, huge boulder below, ancient sloughs likely before stream was incised by 2m high 60% on north 3m high 60% south, no evidence of debris flows through here, old burnt stump in bottom. 45%, swd and mossy, road to north may require additional culvert.
spur a 31	large boulder ridge.
	Spur B
spur b 70	on wet flats, just below 3m high 45% toe of ancient debris cone, then onto finer fan from toe.
spur b 71	crossed sandy wash off debris cones, here just onto gravelly boulder fan/cone, good Bm, ancient. 25%.
spur b 72	just on start what appear to be boulder cobble levees or debris lobes, sta. 7, may want to put a culvert in here somewhere, check after pilot. 25 %, good bm. in between levees sand deposits, good bm. yes culvert, couple of sharp swales just upslope.
spur b 73	sta. 9, just off large cone from about 7 to 9, small rise ahead, check this zone for water, likely just below in cone. may want one here.
spur B 74	pot marked here, culvert just back, landing, likely center, from 9 to here along toe of 45% slope just back from wet flats, may intercept. check after. creek ahead, start of coarse debris deposits, ancient, or at least very old. this is the end of the road, go up boundary.

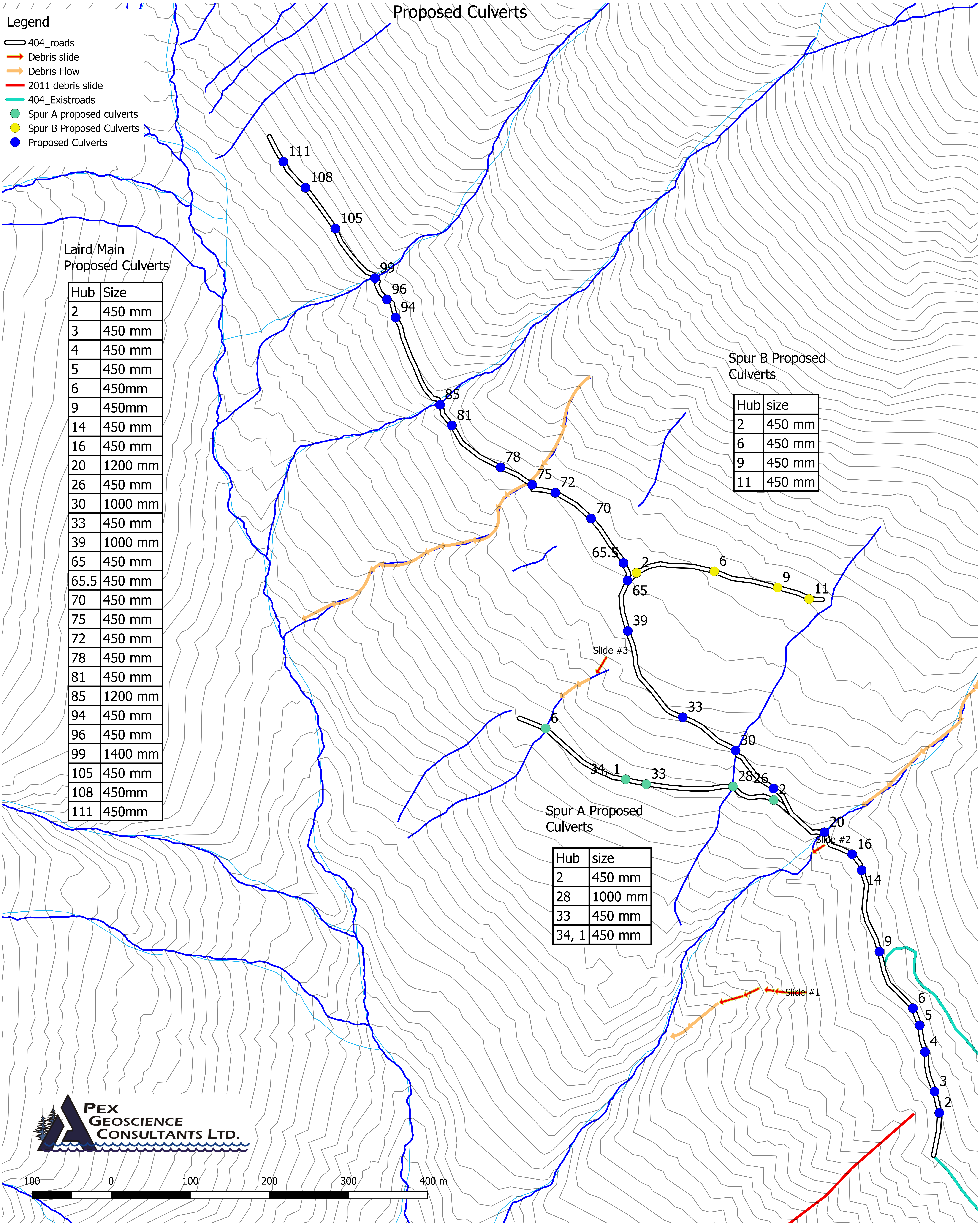
Title	Description
	Terrain below Section #5 and above spur A
laird main 13	strong spring out of base of scarp, brushy not treed.
laird main 14	stream now, 25-year-old scars on cedars on side slope, +70%/-55%, trim line narrows.
laird main 15	trees churn off scarp exposes boulders at top, older slide to north.
laird main 19	springs and muck at toe of scarp, lots of water.
laird main 20	after short 50% step, stream o confined, no obvious scarred trees possible slumps on side slope, 40% gradient now.
laird main 21	silty gravelly sand razor back between draws
laird main 22	lots of rotten wood, muck and coarse sand, hard to get pit, very wet, deadfall mostly birch sugg3sts no slide for at ,east 80 yrs., perhaps last fire, no real trim or tree scarring.45% gradient very wet.
laird main 23	coarse sand deposits, levee, 35%, unconfined to north. deposits are dark, some mixed organics, guess last fire.
laird main 24	sediment deposit, coarse sand, 30%, unconfined, wet, charcoal on top, predates last fire, smaller levee mentioned before postdates, unconfined down on 40% slope.



Apex Road Stations
Legend
404_roads
Debris slide
Debris Flow
2011 debris slide
404_Existroads
road observations
creek 1
k 2
laird trib 1a
laird main 57
laird main 56
laird main 55
laird main 54
laird main 53
laird main 52
laird main 51
laird main 49
lai4d main 47
laird main 46
laird main 45
laird main 75
laird main44
laird main 43
laird main 42
laird main 41
laird main 40
laird main 39
laird main 76
laird main 37
laird main 38
laird main 36
laird main 78
laird main 34
laird main 33
laird main 18
spur b 70
spur b 71
spur b 72
spur b 73
spur B 74
laird main 32
laird main 19
laird main 17
laird main 16
laird main 20
laird main 11
Slide #3
laird main 69
laird main 21
laird main 62
laird main 22
laird main 10
laird main 23
laird main 24
spur a 25
spur a 26
spur a 27
spur a 28
laird main 68
spur a 30
laird main 8
spur a 67
spur a 31
laird main 7
laird main 6
Slide #2
laird main 5
laird main 4
laird main 3
laird main 66
Slide #1
laird main 65
Pex Geoscience Consultants Ltd.
100
0
100
200
300
400 m

Appendix III Culvert Plan

Proposed Culverts



Laird Main Proposed Culverts

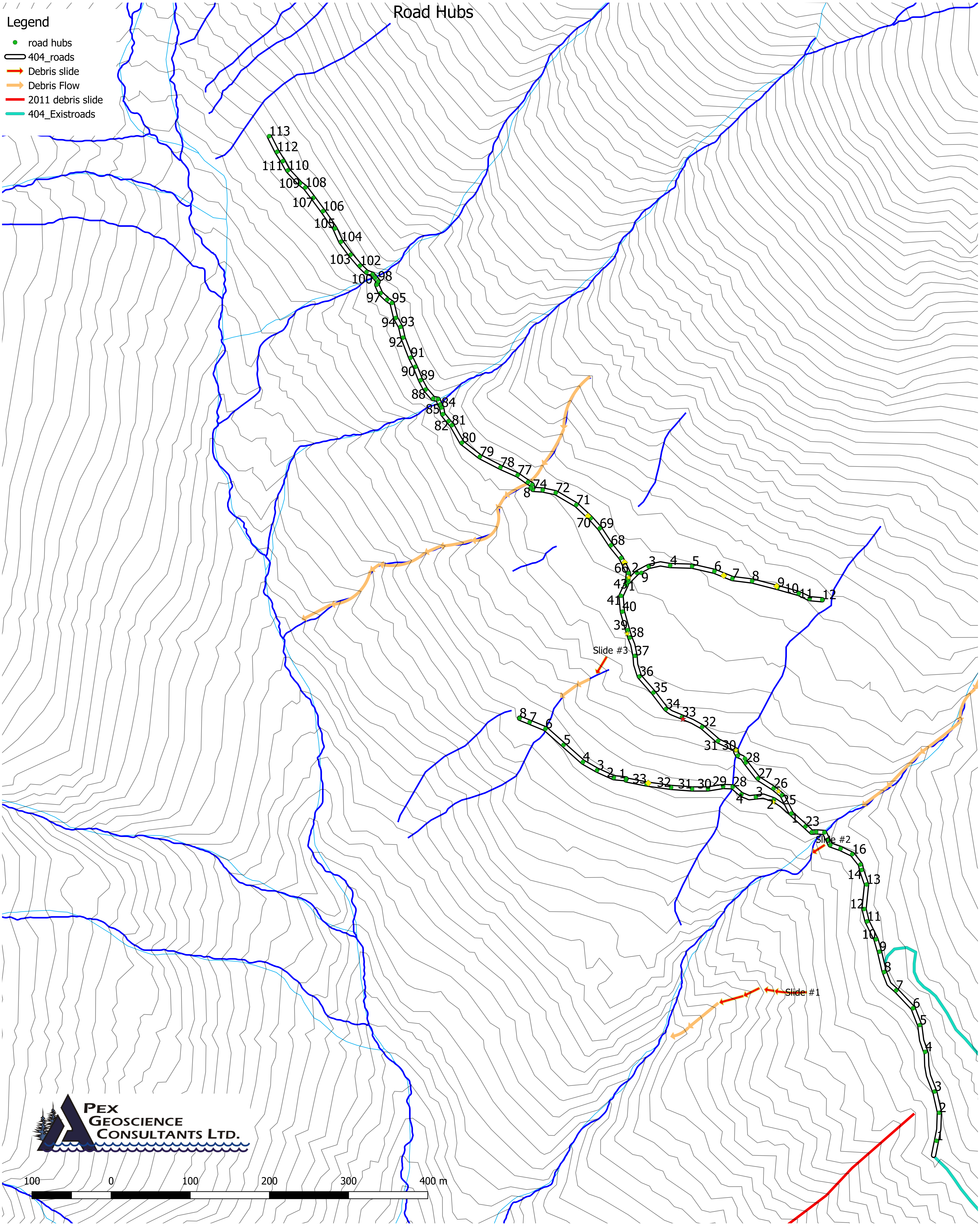
Hub	Size
2	450 mm
3	450 mm
4	450 mm
5	450 mm
6	450mm
9	450mm
14	450 mm
16	450 mm
20	1200 mm
26	450 mm
30	1000 mm
33	450 mm
39	1000 mm
65	450 mm
65.5	450 mm
70	450 mm
75	450 mm
72	450 mm
78	450 mm
81	450 mm
85	1200 mm
94	450 mm
96	450 mm
99	1400 mm
105	450 mm
108	450mm
111	450mm

Spur B Proposed Culverts

Hub	size
2	450 mm
6	450 mm
9	450 mm
11	450 mm

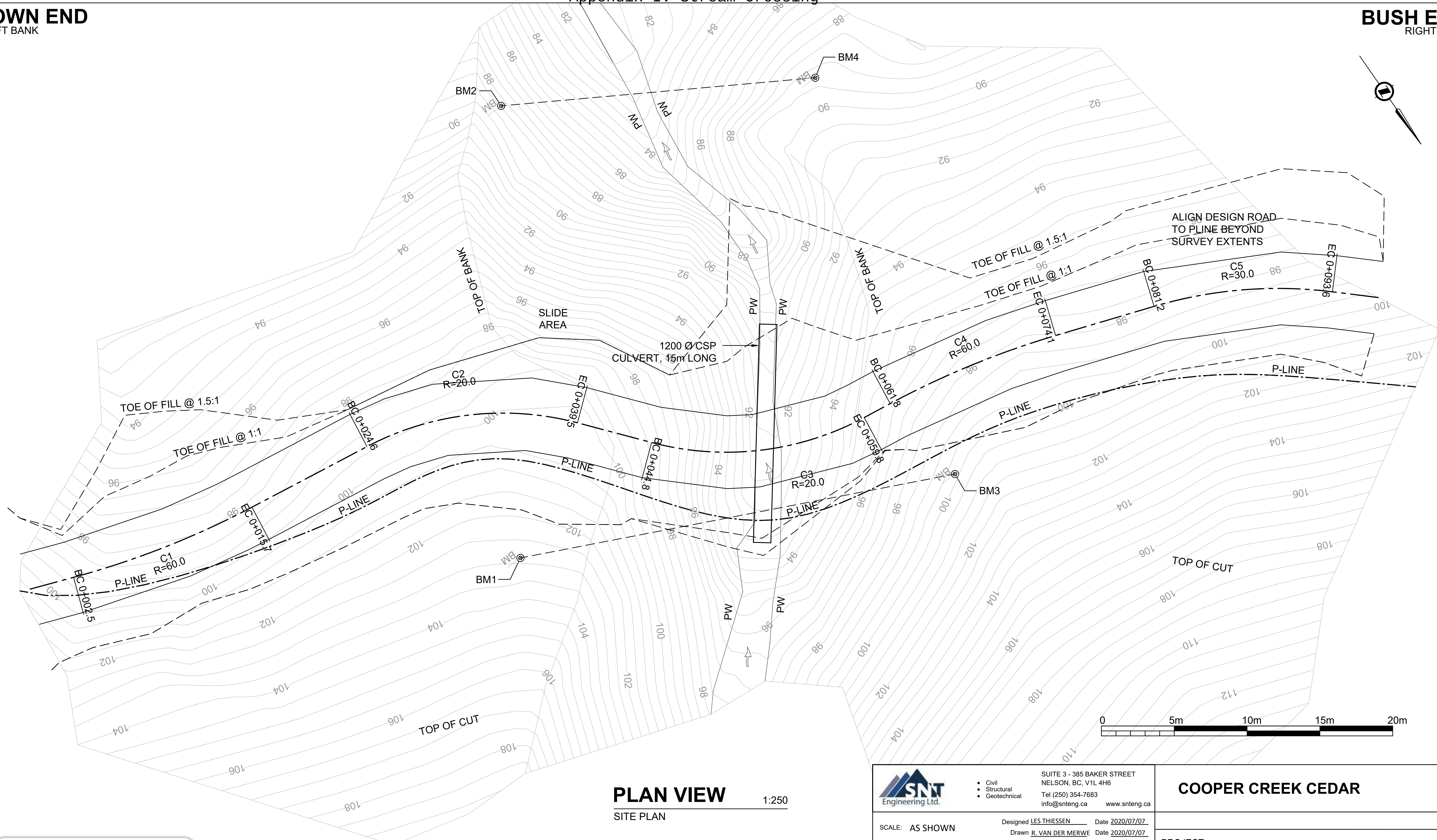
Spur A Proposed Culverts

Hub	size
2	450 mm
28	1000 mm
33	450 mm
34, 1	450 mm


Road Hubs
Legend
road hubs
404_roads
Debris slide
Debris Flow
2011 debris slide
404_Existroads
Slide #1
Slide #2
Slide #3
PEX GEOSCIENCE CONSULTANTS LTD.
100 0 100 200 300 400 m

TOWN END
LEFT BANK

BUSH END
RIGHT BANK



PLAN VIEW

1:250

SITE PLAN

PRELIMINARY NOT FOR CONSTRUCTION

Road in plan view based on 5m road width. Additional widening may be required for tracking.

SNT Engineering Ltd.

- Civil
- Structural
- Geotechnical

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COOPER CREEK CEDAR

SCALE: AS SHOWN

Designed LES THIESSEN Date 2020/07/07
Drawn R. VAN DER MERWE Date 2020/07/07

PROJECT: LIARD CREEK TRIBUTARY CP404 CULVERT

DRAWING TITLE: SITE PLAN AND PROFILE

Rev	Date	DESCRIPTION	Init
0	2020/07/07	ISSUED FOR APPROVAL	RV

REVISIONS

ORIGINAL SIGNED and SEALED BY: --

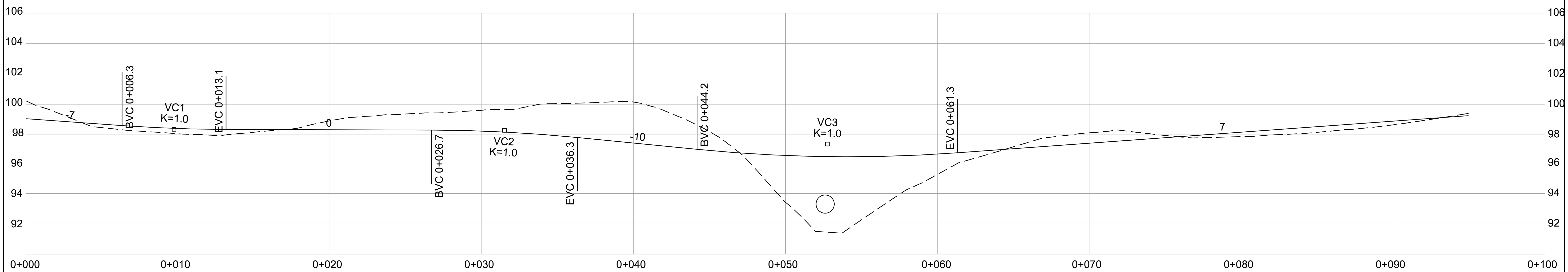
APPROVED BY: --

DESIGN ENGINEER: LES THIESSEN P. ENG

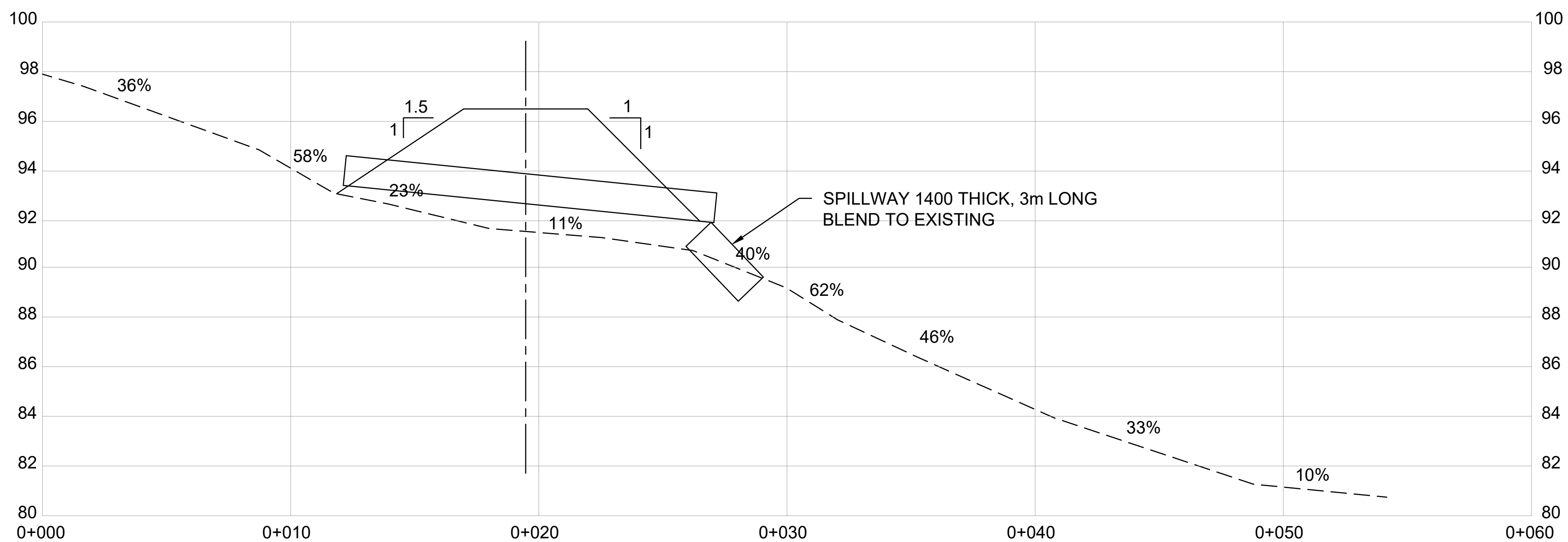
SNT PROJECT No. CCC-20-03

DRAWING No. CCC-20-03-102 | 0

CANCEL PRINTS BEARING PREVIOUS LETTER



ROAD PROFILE 1:250



CREEK PROFILE 1:250

PRELIMINARY NOT FOR CONSTRUCTION

SNT Engineering Ltd.

- Civil
- Structural
- Geotechnical

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SCALE: AS SHOWN

Designed LES THIESSEN Date 2020/07/07
Drawn R. VAN DER MERWE Date 2020/07/07

Rev	Date	DESCRIPTION	Init
0	2020/07/07	ISSUED FOR APPROVAL	RV

REVISIONS

COOPER CREEK CEDAR

PROJECT: LIARD CREEK TRIBUTARY CP404 CULVERT

DRAWING TITLE: GENERAL ARRANGEMENT

ORIGINAL SIGNED and SEALED BY: --

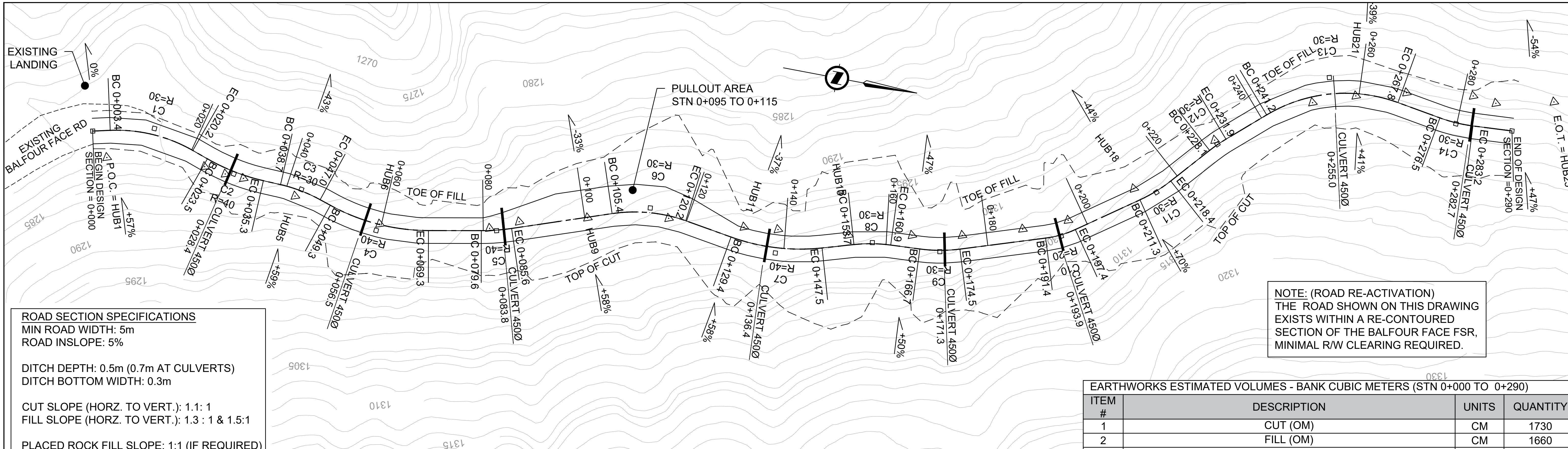
APPROVED BY: --

DESIGN ENGINEER: LES THIESSEN P. ENG

SNT PROJECT No. CCC-20-03

DRAWING No. CCC-20-03-103 | 0

CANCEL PRINTS BEARING PREVIOUS LETTER



NOTE: (ROAD RE-ACTIVATION)
THE ROAD SHOWN ON THIS DRAWING EXISTS WITHIN A RE-CONTOURED SECTION OF THE BALFOUR FACE FSR, MINIMAL R/W CLEARING REQUIRED.

ROAD SECTION SPECIFICATIONS
MIN ROAD WIDTH: 5m
ROAD INSLOPE: 5%

DITCH DEPTH: 0.5m (0.7m AT CULVERTS)
DITCH BOTTOM WIDTH: 0.3m

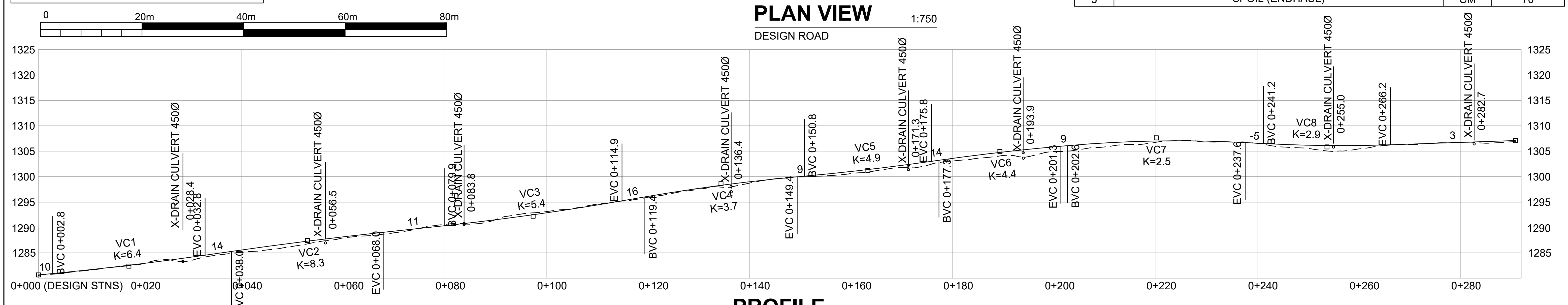
CUT SLOPE (HORZ. TO VERT.): 1.1: 1
FILL SLOPE (HORZ. TO VERT.): 1.3 : 1 & 1.5:1

PLACED ROCK FILL SLOPE: 1:1 (IF REQUIRED)

EARTHWORKS ESTIMATED VOLUMES - BANK CUBIC METERS (STN 0+000 TO 0+290)

ITEM #	DESCRIPTION	UNITS	QUANTITY
1	CUT (OM)	CM	1730
2	FILL (OM)	CM	1660
3	SPOIL (ENDHAUL)	CM	70

PLAN VIEW 1:750
DESIGN ROAD



PROFILE 1:750 H 1:750 V
DESIGN ROAD ℄

DESIGN NOTES:

1. TOTAL STATION ROAD SURVEY COMPLETED BY SNT ENGINEERING JULY 2020. LIDAR DATA PROVIDED BY COOPER CREEK CEDAR LTD. GEOTECHNICAL ASSESSMENT (JULY 2020) OF ROAD CORRIDOR (INTERPRETATION OF SOILS AND DRAINAGE, AND RECOMMENDED CONSTRUCTION METHODS PROVIDED BY APEX GEOTECHNICAL LTD.
2. OTHER MATERIAL (OM) INCLUDES THE COMBINED EXCAVATED VOLUME OF HARDPAN, GRANULAR AND FINE SOILS. OM VOLUME DOES NOT INCLUDE STRIPPING
3. ALL FILLS SHALL BE CONSTRUCTED WITH OPTIMUM MATERIAL, AS SPECIFIED, EITHER ROCK OR FREE-DRAINING COMPETENT MATERIAL. LOCAL CUT MATERIAL IS ASSUMED TO BE SUITABLE FOR SUBGRADE FILLS (INCLUDING ROCK) UNLESS OTHERWISE NOTED. GENERAL ROCK FILLS ARE PRESCRIBED IN SOME VENEER SECTIONS, AND KEYED OR PLACED ROCK FILLS THROUGH SOME GULLY CROSSINGS TO STABILIZE AND LIMIT FILL SLOPE LENGTHS.
4. IF REQUIRED, SPOIL LOCATIONS AND CAPACITIES SHOULD BE CONFIRMED BY THE ROAD CONSTRUCTION SUPERVISOR. SPOIL SHOULD NOT IMPEDE NATURAL OR PRESCRIBED DRAINAGE. UTILIZE KEYED ROCK FILLS AND COMPACT BETWEEN LIFTS WHERE REQUIRED TO MAXIMIZE SPOIL CAPACITY AND STABILITY.
5. FINAL CROSS-DRAIN CULVERT REQUIREMENTS TO BE CONFIRMED BY THE ROAD SUPERVISOR OR A QUALIFIED REGISTERED PROFESSIONAL DURING PRELIMINARY CONSTRUCTION.
6. ALL CULVERT INLETS AND OUTLETS ARE TO BE ARMOURED WITH EROSION PROTECTION (~1 M3 OF ROCK EACH).

PRELIMINARY NOT FOR CONSTRUCTION

SNT Engineering Ltd.
• Civil • Structural • Geotechnical
SUITE 3 - 385 BAKER STREET
NELSON, BC, V1L 4H6
Tel (250) 354-7683
info@snteng.ca www.snteng.ca

COOPER CREEK CEDAR

SCALE: AS SHOWN
Designed LES THIESSEN Date 2020/08/13
Drawn R. VAN DER MERWE Date 2020/08/13

PROJECT: CP404 LAIRD CREEK ACCESS ROAD

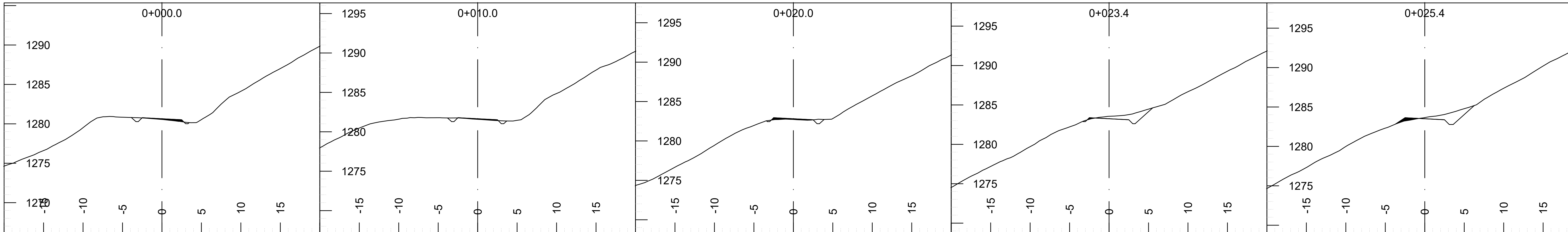
DRAWING TITLE: ROAD PLAN AND PROFILE

Rev	Date	DESCRIPTION	Init
1	2020/08/14	ISSUED FOR APPROVAL - CUTSLOPES REVISED	MD
0	2020/08/13	ISSUED FOR APPROVAL	RV

REVISIONS

ORIGINAL SIGNED and SEALED BY: --
APPROVED BY: --
DESIGN ENGINEER: LES THIESSEN P. ENG
SNT PROJECT No. CCC-20-03
DRAWING No. CCC-20-03-101 | 1

CANCEL PRINTS BEARING PREVIOUS LETTER



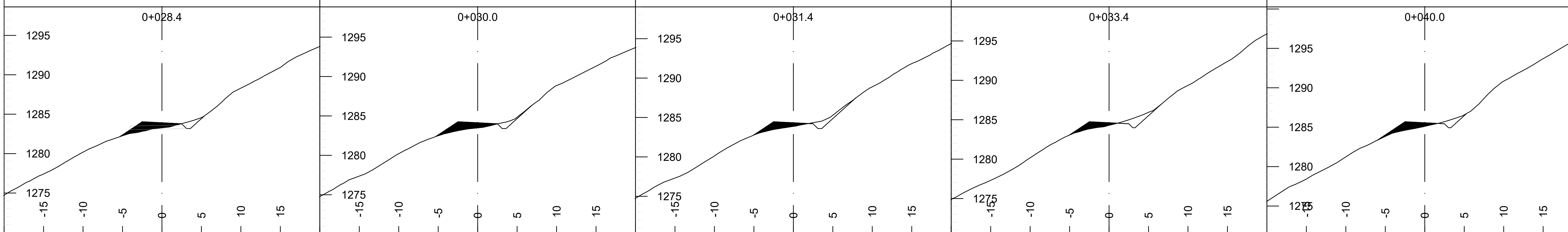
L-Stn :	0+000.0	L-Ssl:	-10	Stk L X:	-3.9
H. Offset:	0.0	L-Ssr:	36	Stk L Y:	0.2
Cut Dp:	-0.1	P-Stk L:	3.9	Stk R X:	3.5
Grd.Nxt.:	10	P-Stk R:	3.5	Stk R Y:	-0.5

L-Stn :	0+010.0	L-Ssl:	0	Stk L X:	-3.8
H. Offset:	0.0	L-Ssr:	33	Stk L Y:	0.1
Cut Dp:	-0.1	P-Stk L:	3.8	Stk R X:	3.7
Grd.Nxt.:	11	P-Stk R:	3.7	Stk R Y:	-0.3

L-Stn :	0+020.0	L-Ssl:	-33	Stk L X:	-3.4
H. Offset:	0.0	L-Ssr:	30	Stk L Y:	-0.3
Cut Dp:	-0.1	P-Stk L:	3.4	Stk R X:	3.9
Grd.Nxt.:	12	P-Stk R:	3.9	Stk R Y:	-0.1

L-Stn :	0+023.4	L-Ssl:	-39	Stk L X:	-3.3
H. Offset:	0.0	L-Ssr:	31	Stk L Y:	-0.3
Cut Dp:	0.3	P-Stk L:	3.4	Stk R X:	5.5
Grd.Nxt.:	13	P-Stk R:	5.7	Stk R Y:	1.4

L-Stn :	0+025.4	L-Ssl:	-37	Stk L X:	-3.7
H. Offset:	0.0	L-Ssr:	37	Stk L Y:	-0.7
Cut Dp:	0.1	P-Stk L:	3.8	Stk R X:	6.3
Grd.Nxt.:	13	P-Stk R:	6.5	Stk R Y:	1.7



L-Stn :	0+028.4	L-Ssl:	-31	Stk L X:	-5.4
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Grd.Nxt.:	14	P-Stk R:	5.4	Stk R Y:	0.9

L-Stn :	0+030.0	L-Ssl:	-33	Stk L X:	-5.3
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Cut Dp:	-0.7	P-Stk L:	5.6	Stk R X:	6.9
Grd.Nxt.:	14	P-Stk R:	7.3	Stk R Y:	2.2

L-Stn :	0+031.4	L-Ssl:	-37	Stk L X:	-5.1
H. Offset:	0.0	L-Ssr:	50	Stk L Y:	-1.6
Cut Dp:	-0.5	P-Stk L:	5.3	Stk R X:	7.9
Grd.Nxt.:	14	P-Stk R:	8.5	Stk R Y:	3.2

L-Stn :	0+033.4	L-Ssl:	-41	Stk L X:	-5.1
H. Offset:	0.0	L-Ssr:	51	Stk L Y:	-1.6
Cut Dp:	-0.3	P-Stk L:	5.3	Stk R X:	6.6
Grd.Nxt.:	14	P-Stk R:	7.0	Stk R Y:	2.3

L-Stn :	0+040.0	L-Ssl:	-39	Stk L X:	-6.0
H. Offset:	0.0	L-Ssr:	57	Stk L Y:	-2.2
Cut Dp:	-0.5	P-Stk L:	6.4	Stk R X:	5.3
Grd.Nxt.:	14	P-Stk R:	5.4	Stk R Y:	1.2

ROAD SECTION SPECIFICATIONS
MIN ROAD WIDTH: 5m
ROAD INSLOPE: 5%

DITCH DEPTH: 0.5m (0.7m AT CULVERTS)
DITCH BOTTOM WIDTH: 0.3m

CUT SLOPE (HORZ. TO VERT.): 1.1: 1
FILL SLOPE (HORZ. TO VERT.): 1.3 : 1 & 1.5:1

PLACED ROCK FILL SLOPE: 1:1 (IF REQUIRED)

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COOPER CREEK CEDAR

SCALE: 1:500
Designed LES THIESSEN Date 2020/08/13
Drawn R. VAN DER MERWE Date 2020/08/13

Rev	Date	DESCRIPTION	Init
1	2020/08/14	ISSUED FOR APPROVAL - CUTSLOPES REVISED	MD
0	2020/08/13	ISSUED FOR APPROVAL	RV

REVISIONS

PROJECT: CP404 LAIRD CREEK ACCESS ROAD

DRAWING TITLE: X-SECTIONS SHEET 1 OF 7

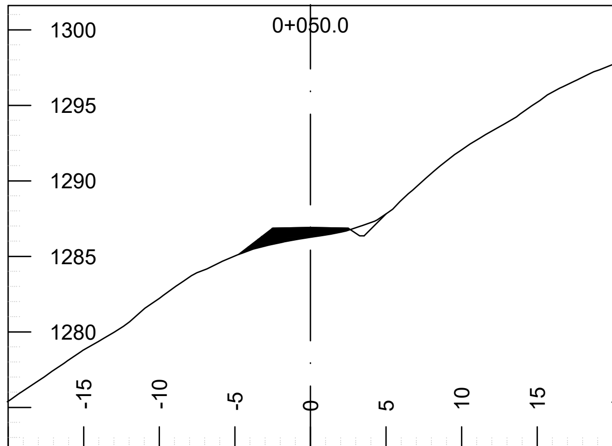
ORIGINAL SIGNED and SEALED BY: --
APPROVED BY: --

DESIGN ENGINEER
LES THIESSEN P. ENG

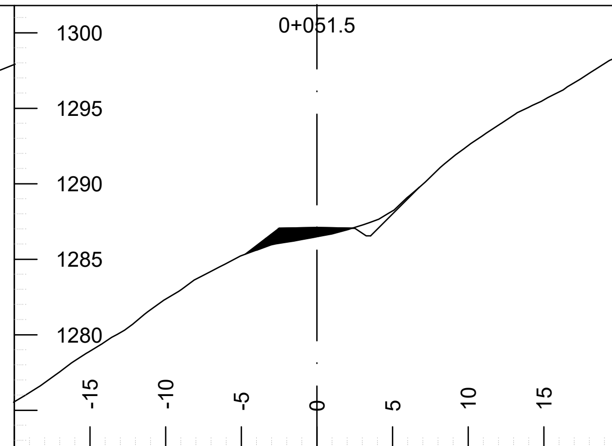
SNT PROJECT No.
CCC-20-03

DRAWING No.
CCC-20-03-102 | 1

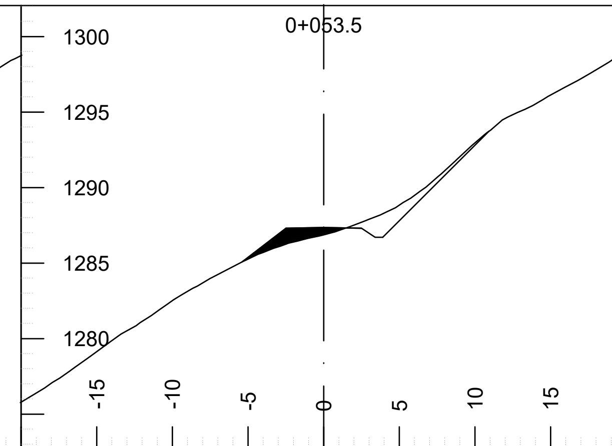
CANCEL PRINTS BEARING PREVIOUS LETTER



L-Stn :	0+050.0	L-Ssl:	-40	Stk L X:	-4.8
H. Offset:	0.0	L-Ssr:	58	Stk L Y:	-1.8
Cut Dp:	-0.6	P-Stk L:	5.1	Stk R X:	5.0
Grd.Nxt.:	13	P-Stk R:	5.1	Stk R Y:	0.9



L-Stn :	0+051.5	L-Ssl:	-41	Stk L X:	-4.7
H. Offset:	0.0	L-Ssr:	60	Stk L Y:	-1.8
Cut Dp:	-0.6	P-Stk L:	5.0	Stk R X:	6.8
Grd.Nxt.:	13	P-Stk R:	7.3	Stk R Y:	2.7



L-Stn :	0+053.5	L-Ssl:	-44	Stk L X:	-5.4
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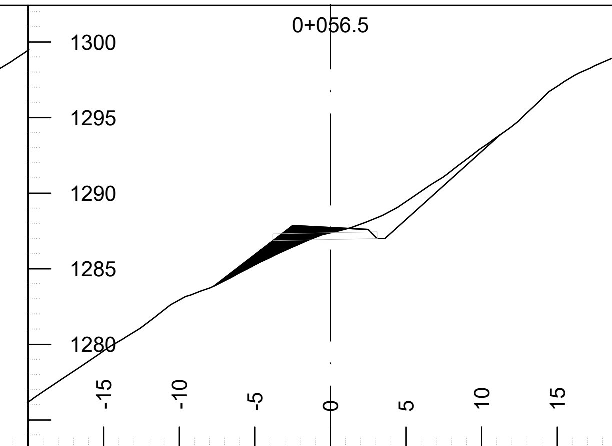
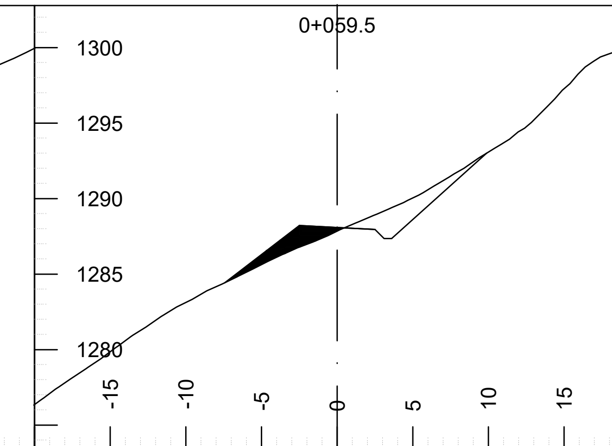
Grd.Nxt.:	13	P-Stk R:	12.6	Stk R Y:	6.4



L-Stn :	0+056.5	L-Ssl:	-44	Stk L X:	-7.7
H. Offset:	0.0	L-Ssr:	56	Stk L Y:	-3.9
Cut Dp:	-0.4	P-Stk L:	8.6	Stk R X:	11.2
Grd.Nxt.:	12	P-Stk R:	12.8	Stk R Y:	6.1



L-Stn :	0+059.5	L-Ssl:	-47	Stk L X:	-7.4
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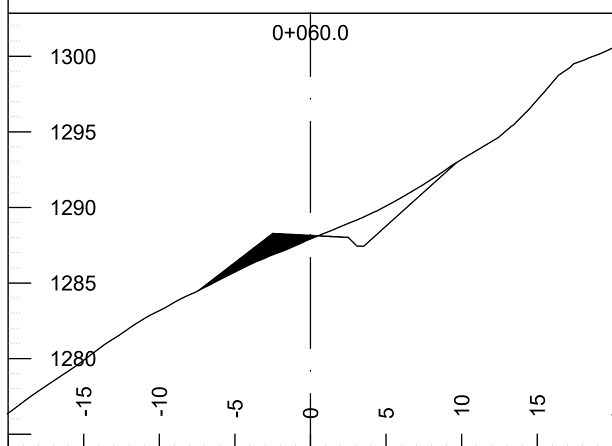
Grd.Nxt.:	12	P-Stk R:	11.0	Stk R Y:	4.9



L-Stn :	0+060.0	L-Ssl:	-47	Stk L X:	-7.4
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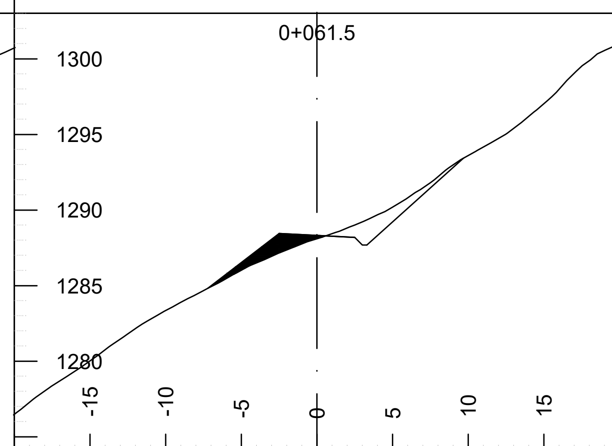
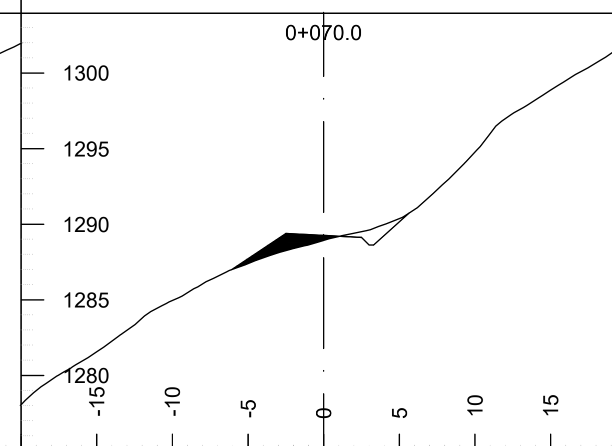
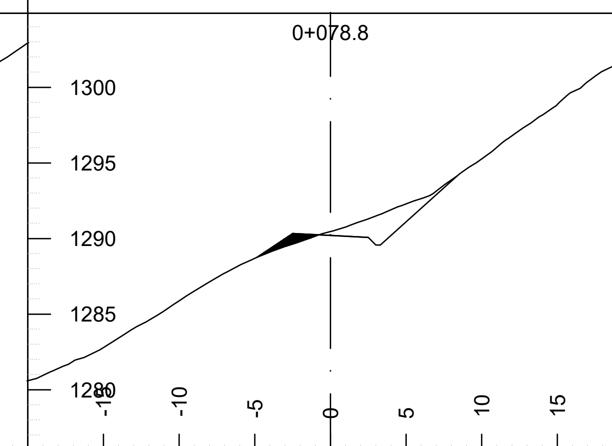
Cut Dp:	-0.2	P-Stk L:	8.3	Stk R X:	9.7
Grd.Nxt.:	12	P-Stk R:	10.8	Stk R Y:	4.8



L-Stn :	0+061.5	L-Ssl:	-47	Stk L X:	-7.2
H. Offset:	0.0	L-Ssr:	55	Stk L Y:	-3.5
Cut Dp:	-0.2	P-Stk L:	8.0	Stk R X:	9.7
Grd.Nxt.:	12	P-Stk R:	11.0	Stk R Y:	5.1



L-Stn :	0+070.0	L-Ssl:	-40	Stk L X:	-6.1
H. Offset:	0.0	L-Ssr:	58	Stk L Y:	-2.3
Cut Dp:	-0.3	P-Stk L:	6.5	Stk R X:	5.7
Grd.Nxt.:	11	P-Stk R:	5.8	Stk R Y:	1.5



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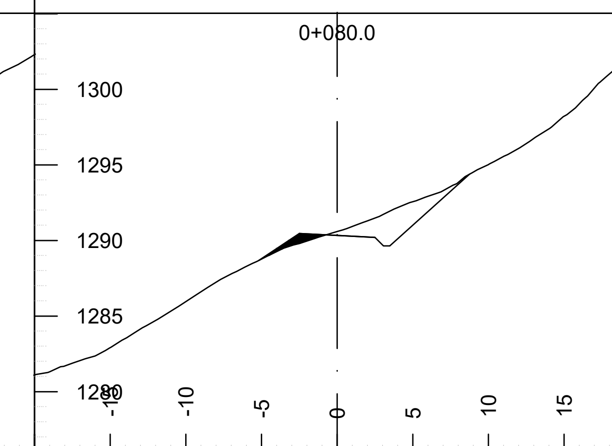
Grd.Nxt.:	11	P-Stk R:	9.3	Stk R Y:	3.9



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Grd.Nxt.:	11	P-Stk R:	9.7	Stk R Y:	4.1

ROAD SECTION SPECIFICATIONS
MIN ROAD WIDTH: 5m
ROAD INSLOPE: 5%

DITCH DEPTH: 0.5m (0.7m AT CULVERTS)
DITCH BOTTOM WIDTH: 0.3m

CUT SLOPE (HORZ. TO VERT.): 1.1: 1
FILL SLOPE (HORZ. TO VERT.): 1.3 : 1 & 1.5:1

PLACED ROCK FILL SLOPE: 1:1 (IF REQUIRED)

PRELIMINARY NOT FOR CONSTRUCTION

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COOPER CREEK CEDAR

SCALE: 1:500

Designed LES THIESSEN Date 2020/08/13
Drawn R. VAN DER MERWE Date 2020/08/13

Rev	Date	DESCRIPTION	Init
1	2020/08/14	ISSUED FOR APPROVAL - CUTSLOPES REVISED	MD
0	2020/08/13	ISSUED FOR APPROVAL	RV

REVISIONS

PROJECT: CP404 LAIRD CREEK ACCESS ROAD

DRAWING TITLE: X-SECTIONS SHEET 2 OF 7

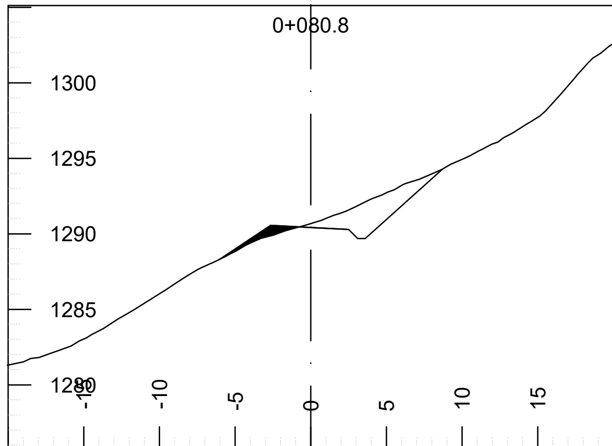
ORIGINAL SIGNED and SEALED BY: --
APPROVED BY: --

DESIGN ENGINEER
LES THIESSEN P. ENG

SNT PROJECT No.
CCC-20-03

DRAWING No.
CCC-20-03-103 | 1

CANCEL PRINTS BEARING PREVIOUS LETTER



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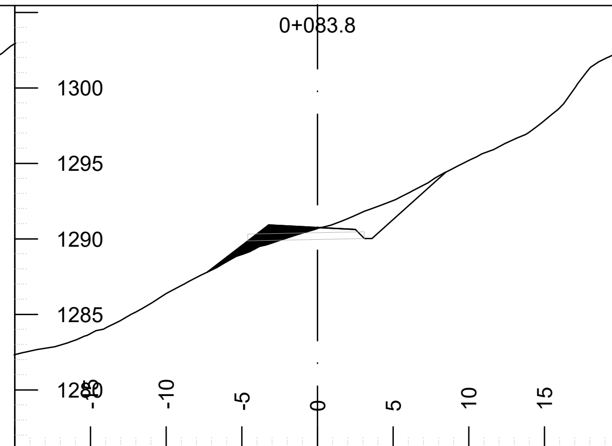

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H. Offset:	0.0	L-Ssr:	45	Stk L Y:	-3.0
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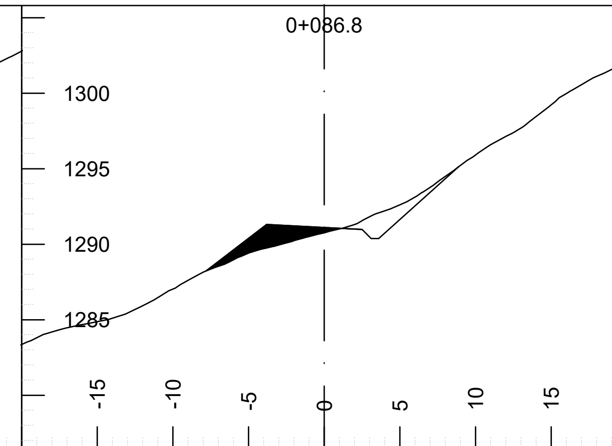

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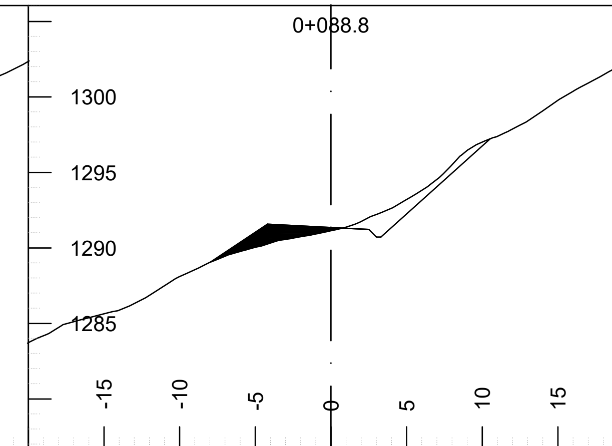
Grd.Nxt.:	12	P-Stk R:	9.7	Stk R Y:	4.0



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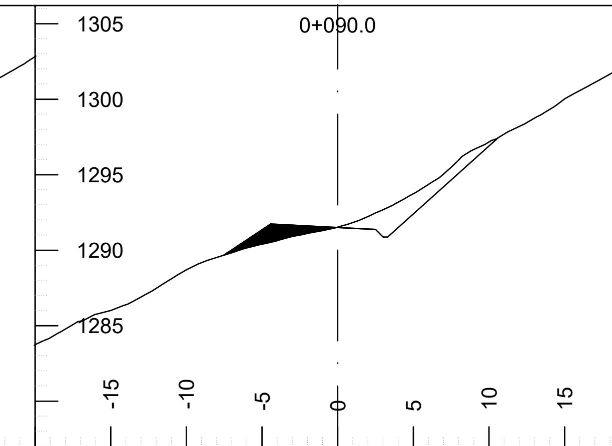
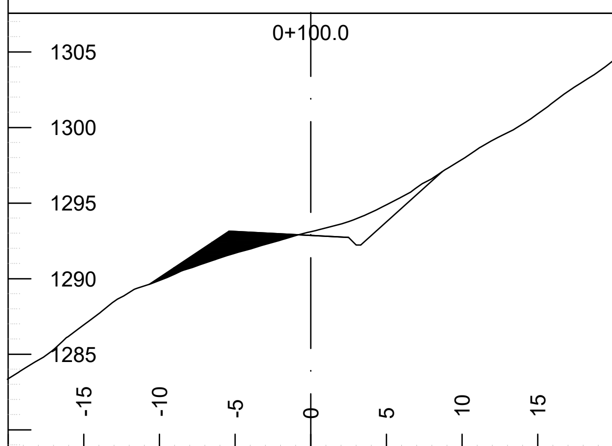
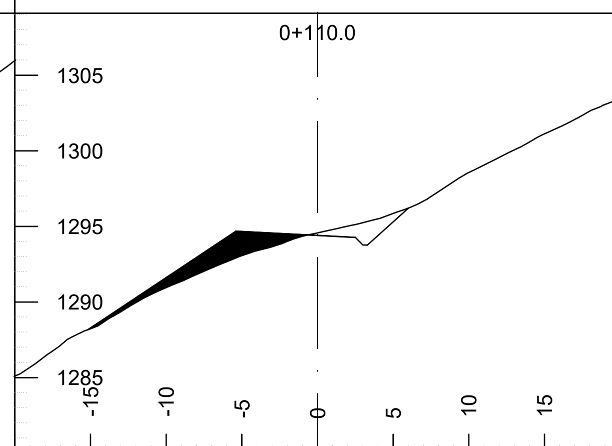
Grd.Nxt.:	12	P-Stk R:	12.1	Stk R Y:	5.9



L-Stn :	0+090.0	L-Ssl:	-28	Stk L X:	-7.5
H. Offset:	0.0	L-Ssr:	56	Stk L Y:	-1.8
Cut Dp:	0.0	P-Stk L:	7.8	Stk R X:	10.6
Grd.Nxt.:	13	P-Stk R:	12.1	Stk R Y:	5.9



L-Stn :	0+100.0	L-Ssl:	-32	Stk L X:	-10.7
H. Offset:	0.0	L-Ssr:	48	Stk L Y:	-3.2
Cut Dp:	0.2	P-Stk L:	11.2	Stk R X:	8.7
Grd.Nxt.:	14	P-Stk R:	9.7	Stk R Y:	4.2



L-Stn :	0+110.0	L-Ssl:	-36	Stk L X:	-15.2
H. Offset:	0.0	L-Ssr:	40	Stk L Y:	-6.2
Cut Dp:	0.2	P-Stk L:	16.4	Stk R X:	6.0
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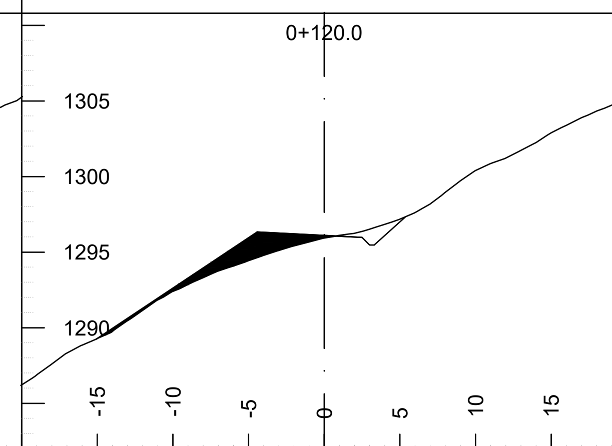
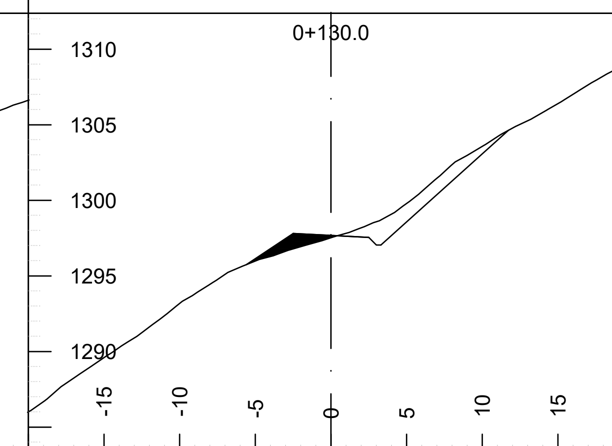
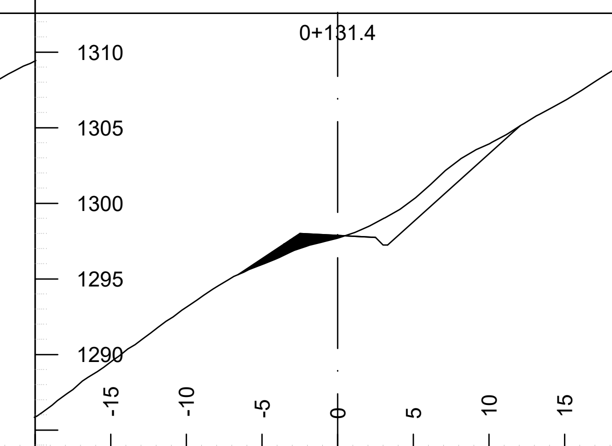


L-Stn :	0+120.0	L-Ssl:	-35	Stk L X:	-15.1
H. Offset:	0.0	L-Ssr:	45	Stk L Y:	-6.9
Cut Dp:	-0.2	P-Stk L:	16.6	Stk R X:	5.4
Grd.Nxt.:	17	P-Stk R:	5.5	Stk R Y:	1.2



L-Stn :	0+130.0	L-Ssl:	-43	Stk L X:	-5.6
H. Offset:	0.0	L-Ssr:	60	Stk L Y:	-1.9
Cut Dp:	-0.2	P-Stk L:	5.9	Stk R X:	11.7
Grd.Nxt.:	14	P-Stk R:	13.6	Stk R Y:	7.0



L-Stn :	0+131.4	L-Ssl:	-46	Stk L X:	-6.6
H. Offset:	0.0	L-Ssr:	62	Stk L Y:	-2.6
Cut Dp:	-0.2	P-Stk L:	7.1	Stk R X:	12.1
Grd.Nxt.:	14	P-Stk R:	14.1	Stk R Y:	7.3

ROAD SECTION SPECIFICATIONS
MIN ROAD WIDTH: 5m
ROAD INSLOPE: 5%

DITCH DEPTH: 0.5m (0.7m AT CULVERTS)
DITCH BOTTOM WIDTH: 0.3m

CUT SLOPE (HORZ. TO VERT.): 1.1: 1
FILL SLOPE (HORZ. TO VERT.): 1.3 : 1 & 1.5:1

PLACED ROCK FILL SLOPE: 1:1 (IF REQUIRED)

PRELIMINARY NOT FOR CONSTRUCTION

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COOPER CREEK CEDAR

SCALE: 1:500
Designed LES THIESSEN Date 2020/08/13
Drawn R. VAN DER MERWE Date 2020/08/13

Rev	Date	DESCRIPTION	Init
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0	2020/08/13	ISSUED FOR APPROVAL	RV

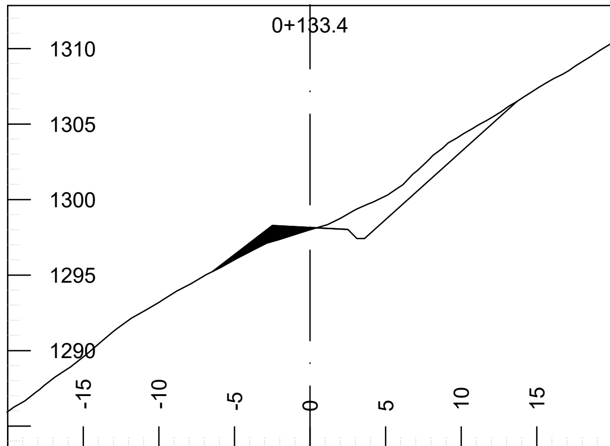
REVISIONS

PROJECT: CP404 LAIRD CREEK ACCESS ROAD

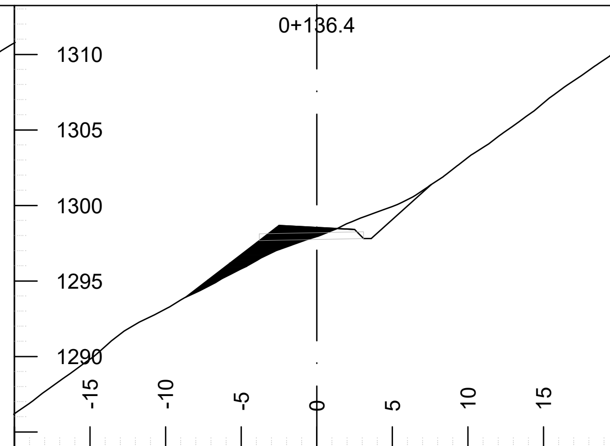
DRAWING TITLE: X-SECTIONS SHEET 3 OF 7

ORIGINAL SIGNED and SEALED BY: --
APPROVED BY: --
DESIGN ENGINEER: LES THIESSEN P. ENG
SNT PROJECT No.: CCC-20-03
DRAWING No.: CCC-20-03-104 | 1

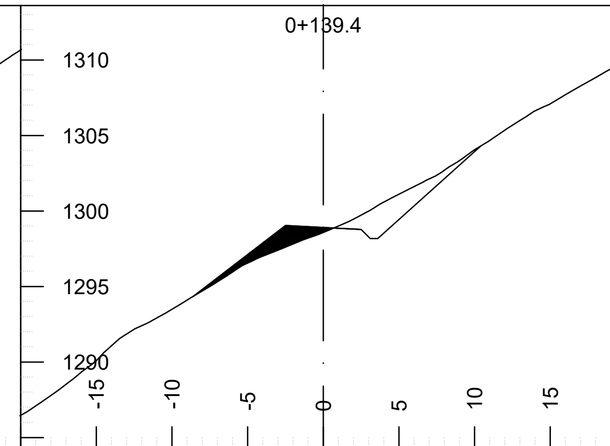
CANCEL PRINTS BEARING PREVIOUS LETTER



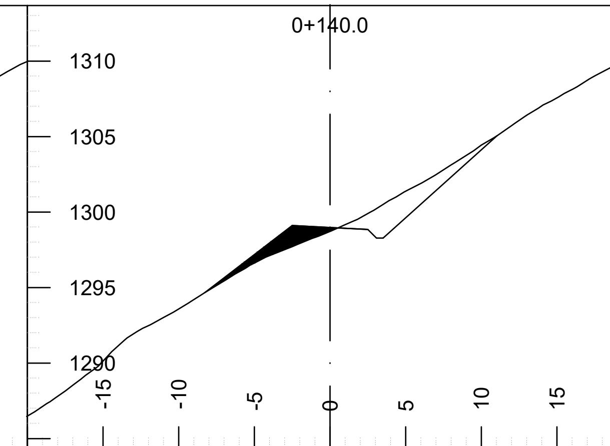
L-Stn :	0+133.4	L-Ssl:	-48	Stk L X:	-6.5
H. Offset:	0.0	L-Ssr:	63	Stk L Y:	-2.9
Cut Dp:	-0.2	P-Stk L:	7.1	Stk R X:	13.7
Grd.Nxt.:	13	P-Stk R:	16.0	Stk R Y:	8.4



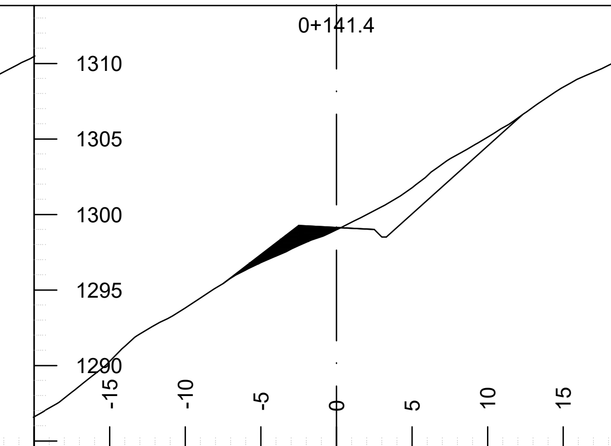
L-Stn :	0+136.4	L-Ssl:	-48	Stk L X:	-8.7
H. Offset:	0.0	L-Ssr:	52	Stk L Y:	-4.6
Cut Dp:	-0.6	P-Stk L:	9.8	Stk R X:	7.6
Grd.Nxt.:	13	P-Stk R:	8.1	Stk R Y:	2.8



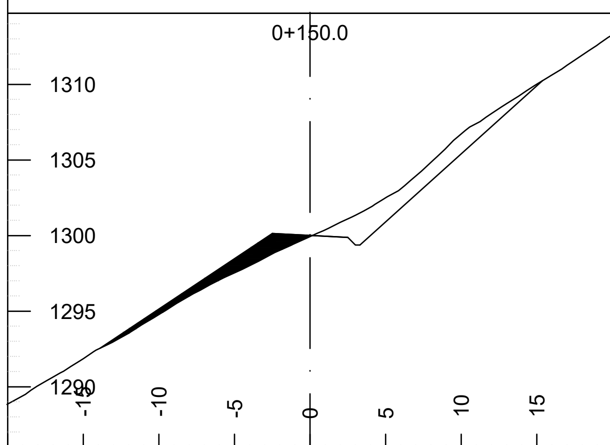
L-Stn :	0+139.4	L-Ssl:	-51	Stk L X:	-8.6
H. Offset:	0.0	L-Ssr:	55	Stk L Y:	-4.6
Cut Dp:	-0.3	P-Stk L:	9.7	Stk R X:	10.4
Grd.Nxt.:	12	P-Stk R:	11.7	Stk R Y:	5.4



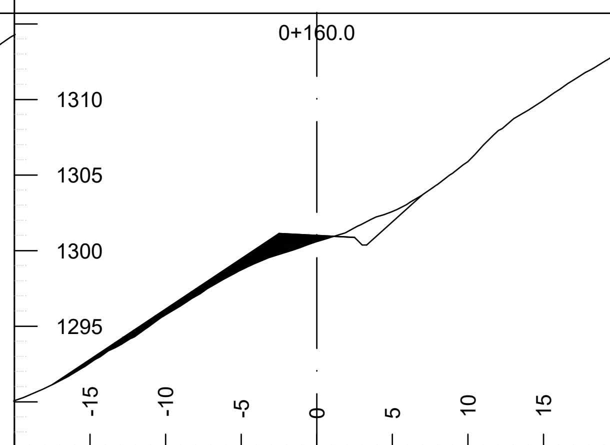
L-Stn :	0+140.0	L-Ssl:	-52	Stk L X:	-8.3
H. Offset:	0.0	L-Ssr:	57	Stk L Y:	-4.3
Cut Dp:	-0.3	P-Stk L:	9.3	Stk R X:	11.0
Grd.Nxt.:	12	P-Stk R:	12.6	Stk R Y:	6.1



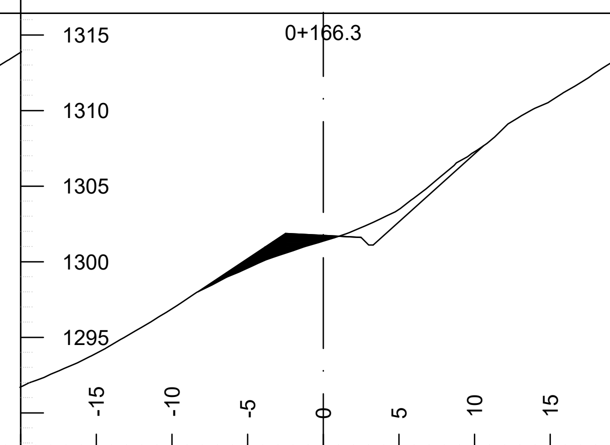
L-Stn :	0+141.4	L-Ssl:	-52	Stk L X:	-7.5
H. Offset:	0.0	L-Ssr:	61	Stk L Y:	-3.7
Cut Dp:	-0.2	P-Stk L:	8.3	Stk R X:	12.3
Grd.Nxt.:	11	P-Stk R:	14.4	Stk R Y:	7.5



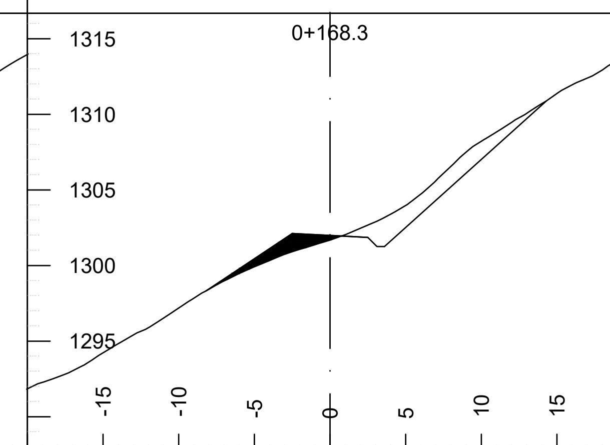
L-Stn :	0+150.0	L-Ssl:	-52	Stk L X:	-13.9
H. Offset:	0.0	L-Ssr:	68	Stk L Y:	-7.5
Cut Dp:	-0.1	P-Stk L:	15.8	Stk R X:	15.4
Grd.Nxt.:	9	P-Stk R:	18.5	Stk R Y:	10.2



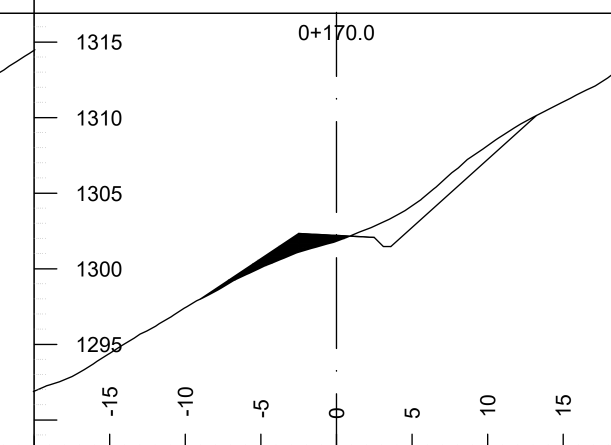
L-Stn :	0+160.0	L-Ssl:	-48	Stk L X:	-17.5
H. Offset:	0.0	L-Ssr:	53	Stk L Y:	-9.9
Cut Dp:	-0.4	P-Stk L:	20.1	Stk R X:	6.9
Grd.Nxt.:	11	P-Stk R:	7.4	Stk R Y:	2.6



L-Stn :	0+166.3	L-Ssl:	-45	Stk L X:	-8.3
H. Offset:	0.0	L-Ssr:	59	Stk L Y:	-3.7
Cut Dp:	-0.4	P-Stk L:	9.1	Stk R X:	10.6
Grd.Nxt.:	12	P-Stk R:	12.1	Stk R Y:	5.9



L-Stn :	0+168.3	L-Ssl:	-45	Stk L X:	-8.2
H. Offset:	0.0	L-Ssr:	65	Stk L Y:	-3.7
Cut Dp:	-0.3	P-Stk L:	9.0	Stk R X:	14.3
Grd.Nxt.:	13	P-Stk R:	16.8	Stk R Y:	8.9



L-Stn :	0+170.0	L-Ssl:	-44	Stk L X:	-9.0
H. Offset:	0.0	L-Ssr:	63	Stk L Y:	-4.2
Cut Dp:	-0.4	P-Stk L:	10.0	Stk R X:	13.2
Grd.Nxt.:	13	P-Stk R:	15.4	Stk R Y:	7.9

ROAD SECTION SPECIFICATIONS
MIN ROAD WIDTH: 5m
ROAD INSLOPE: 5%

DITCH DEPTH: 0.5m (0.7m AT CULVERTS)
DITCH BOTTOM WIDTH: 0.3m

CUT SLOPE (HORZ. TO VERT.): 1.1: 1
FILL SLOPE (HORZ. TO VERT.): 1.3 : 1 & 1.5:1

PLACED ROCK FILL SLOPE: 1:1 (IF REQUIRED)

PRELIMINARY NOT FOR CONSTRUCTION

SNT Engineering Ltd.
- Civil
- Structural
- Geotechnical

SUITE 3 - 385 BAKER STREET
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COOPER CREEK CEDAR

SCALE: 1:500

Designed LES THIESSEN Date 2020/08/13
Drawn R. VAN DER MERWE Date 2020/08/13

Rev	Date	DESCRIPTION	Init
1	2020/08/14	ISSUED FOR APPROVAL - CUTSLOPES REVISED	MD
0	2020/08/13	ISSUED FOR APPROVAL	RV

REVISIONS

PROJECT: CP404 LAIRD CREEK ACCESS ROAD

DRAWING TITLE: X-SECTIONS SHEET 4 OF 7

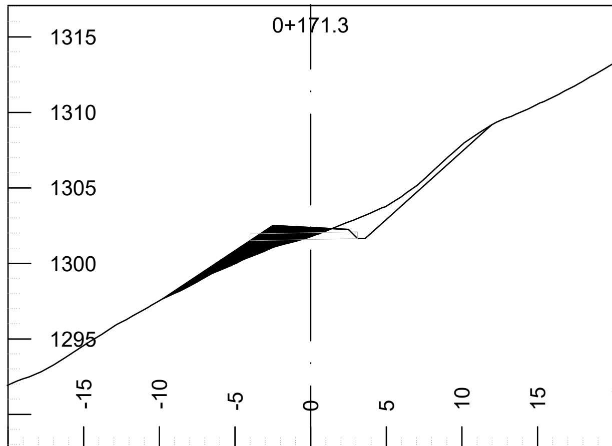
ORIGINAL SIGNED and SEALED BY: --
APPROVED BY: --

DESIGN ENGINEER
LES THIESSEN P. ENG

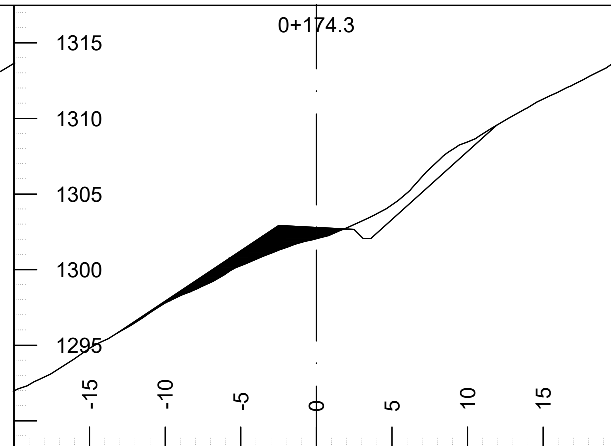
SNT PROJECT No. CCC-20-03

DRAWING No. CCC-20-03-105 | 1

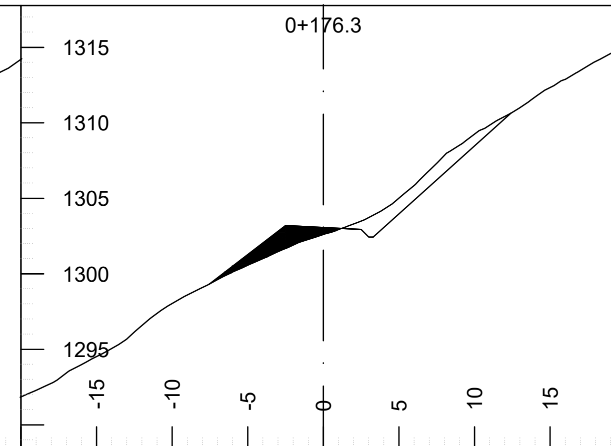
CANCEL PRINTS BEARING PREVIOUS LETTER



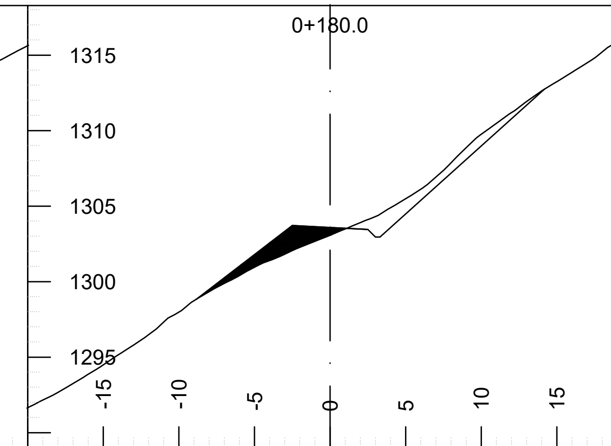
L-Stn :	0+171.3	L-Ssl:	-42	Stk L X:	-9.8
H. Offset:	0.0	L-Ssr:	61	Stk L Y:	-4.7
Cut Dp:	-0.6	P-Stk L:	10.8	Stk R X:	12.0
Grd.Nxt.:	13	P-Stk R:	13.8	Stk R Y:	6.8



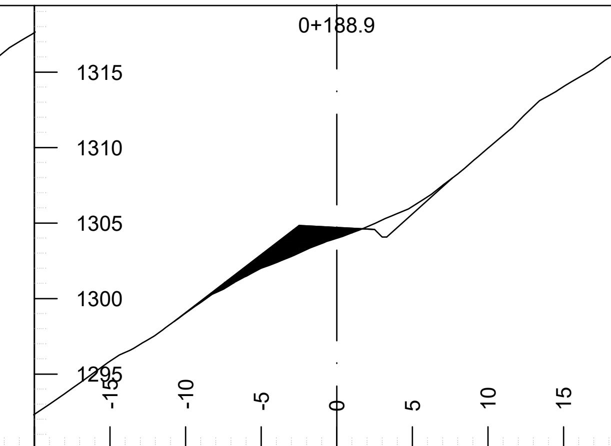
L-Stn :	0+174.3	L-Ssl:	-43	Stk L X:	-13.2
H. Offset:	0.0	L-Ssr:	64	Stk L Y:	-7.0
Cut Dp:	-0.7	P-Stk L:	14.9	Stk R X:	11.9
Grd.Nxt.:	14	P-Stk R:	13.7	Stk R Y:	6.8



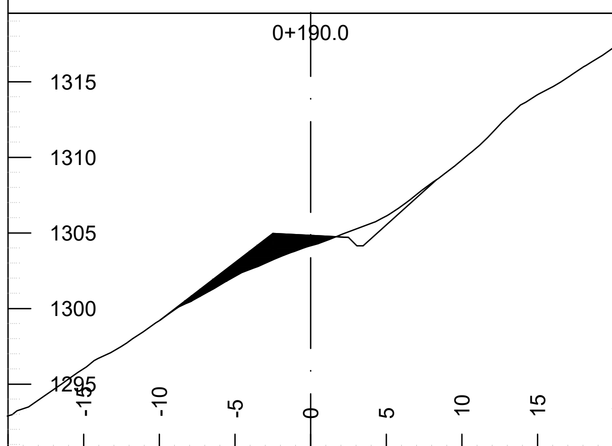
L-Stn :	0+176.3	L-Ssl:	-46	Stk L X:	-7.5
H. Offset:	0.0	L-Ssr:	66	Stk L Y:	-3.8
Cut Dp:	-0.5	P-Stk L:	8.4	Stk R X:	12.4
Grd.Nxt.:	14	P-Stk R:	14.6	Stk R Y:	7.6



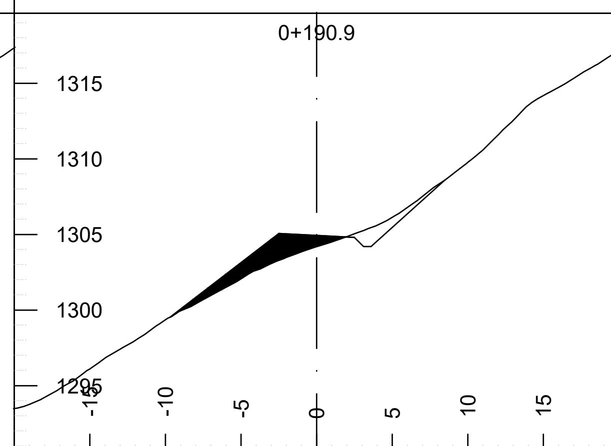
L-Stn :	0+180.0	L-Ssl:	-51	Stk L X:	-8.9
H. Offset:	0.0	L-Ssr:	67	Stk L Y:	-4.8
Cut Dp:	-0.5	P-Stk L:	10.1	Stk R X:	14.2
Grd.Nxt.:	14	P-Stk R:	16.9	Stk R Y:	9.2



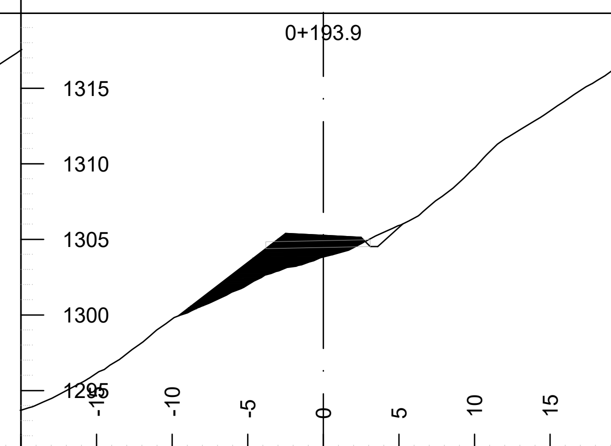
L-Stn :	0+188.9	L-Ssl:	-50	Stk L X:	-10.7
H. Offset:	0.0	L-Ssr:	60	Stk L Y:	-6.2
Cut Dp:	-0.7	P-Stk L:	12.4	Stk R X:	7.6
Grd.Nxt.:	12	P-Stk R:	8.3	Stk R Y:	3.3



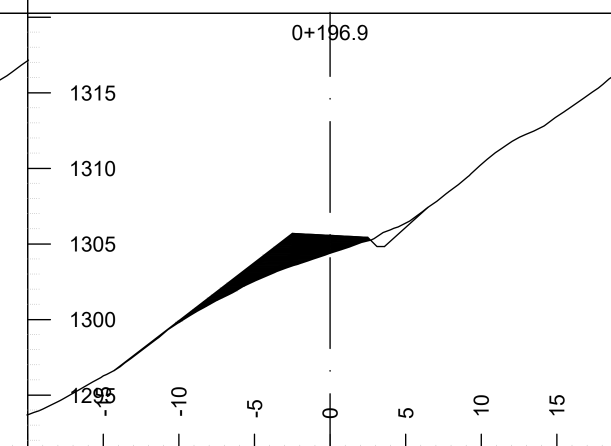
L-Stn :	0+190.0	L-Ssl:	-50	Stk L X:	-10.0
H. Offset:	0.0	L-Ssr:	57	Stk L Y:	-5.6
Cut Dp:	-0.7	P-Stk L:	11.4	Stk R X:	8.3
Grd.Nxt.:	11	P-Stk R:	9.1	Stk R Y:	3.7



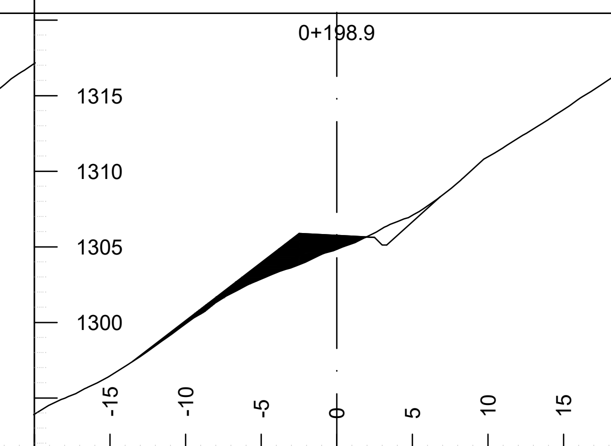
L-Stn :	0+190.9	L-Ssl:	-48	Stk L X:	-9.7
H. Offset:	0.0	L-Ssr:	56	Stk L Y:	-5.4
Cut Dp:	-0.7	P-Stk L:	11.1	Stk R X:	8.5
Grd.Nxt.:	11	P-Stk R:	9.2	Stk R Y:	3.7



L-Stn :	0+193.9	L-Ssl:	-41	Stk L X:	-9.6
H. Offset:	0.0	L-Ssr:	59	Stk L Y:	-5.3
Cut Dp:	-1.4	P-Stk L:	11.0	Stk R X:	5.3
Grd.Nxt.:	10	P-Stk R:	5.3	Stk R Y:	0.8



L-Stn :	0+196.9	L-Ssl:	-46	Stk L X:	-14.3
H. Offset:	0.0	L-Ssr:	59	Stk L Y:	-8.9
Cut Dp:	-1.2	P-Stk L:	16.9	Stk R X:	6.5
Grd.Nxt.:	10	P-Stk R:	6.7	Stk R Y:	1.9



L-Stn :	0+198.9	L-Ssl:	-49	Stk L X:	-13.5
H. Offset:	0.0	L-Ssr:	61	Stk L Y:	-8.3
Cut Dp:	-0.9	P-Stk L:	15.9	Stk R X:	6.9
Grd.Nxt.:	9	P-Stk R:	7.3	Stk R Y:	2.6

ROAD SECTION SPECIFICATIONS
MIN ROAD WIDTH: 5m
ROAD INSLOPE: 5%

DITCH DEPTH: 0.5m (0.7m AT CULVERTS)
DITCH BOTTOM WIDTH: 0.3m

CUT SLOPE (HORZ. TO VERT.): 1.1: 1
FILL SLOPE (HORZ. TO VERT.): 1.3 : 1 & 1.5:1

PLACED ROCK FILL SLOPE: 1:1 (IF REQUIRED)

PRELIMINARY NOT FOR CONSTRUCTION

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- Geotechnical

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COOPER CREEK CEDAR

SCALE: 1:500

Designed LES THIESSEN Date 2020/08/13
Drawn R. VAN DER MERWE Date 2020/08/13

Rev	Date	DESCRIPTION	Init
1	2020/08/14	ISSUED FOR APPROVAL - CUTSLOPES REVISED	MD
0	2020/08/13	ISSUED FOR APPROVAL	RV

REVISIONS

PROJECT: CP404 LAIRD CREEK ACCESS ROAD

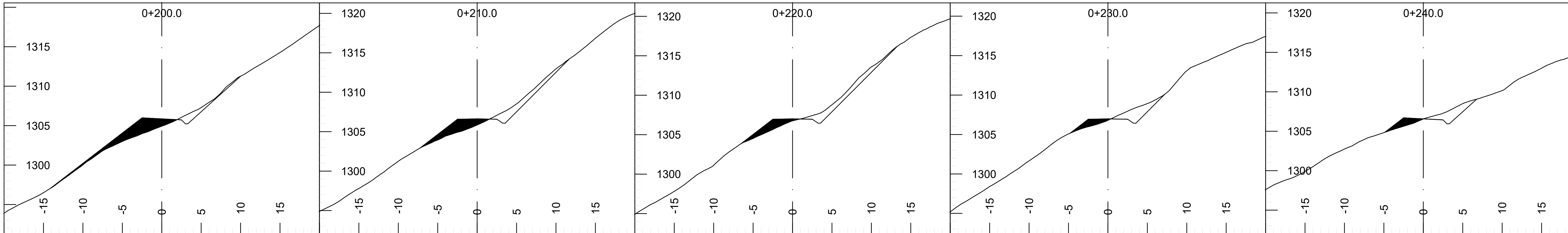
DRAWING TITLE: X-SECTIONS SHEET 5 OF 7

ORIGINAL SIGNED and SEALED BY: --
APPROVED BY: --

DESIGN ENGINEER
LES THIESSEN P. ENG

SNT PROJECT No. CCC-20-03
DRAWING No. CCC-20-03-106 | 1

CANCEL PRINTS BEARING PREVIOUS LETTER



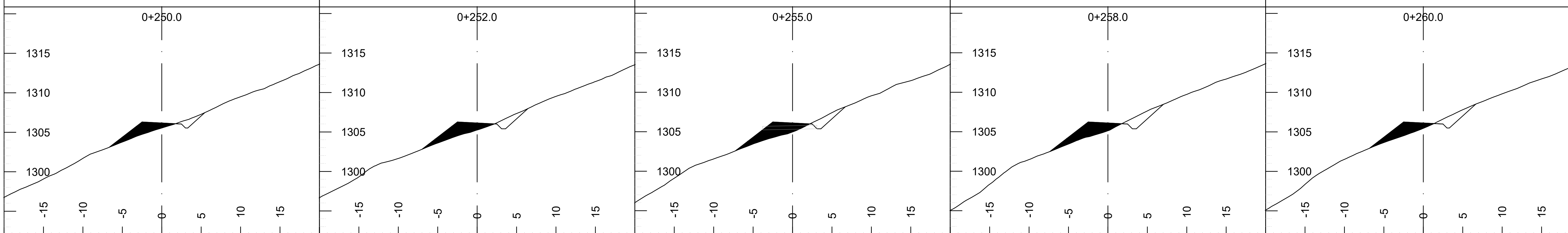
L-Stn :	0+200.0	L-Ssl:	-49	Stk L X:	-14.2
H. Offset:	0.0	L-Ssr:	63	Stk L Y:	-8.8
Cut Dp:	-0.9	P-Stk L:	16.7	Stk R X:	10.0
Grd.Nxt.:	9	P-Stk R:	11.4	Stk R Y:	5.4

L-Stn :	0+210.0	L-Ssl:	-46	Stk L X:	-7.3
H. Offset:	0.0	L-Ssr:	71	Stk L Y:	-3.7
Cut Dp:	-0.8	P-Stk L:	8.2	Stk R X:	11.7
Grd.Nxt.:	6	P-Stk R:	13.9	Stk R Y:	7.6

L-Stn :	0+220.0	L-Ssl:	-56	Stk L X:	-6.5
H. Offset:	0.0	L-Ssr:	68	Stk L Y:	-3.2
Cut Dp:	-0.3	P-Stk L:	7.3	Stk R X:	13.3
Grd.Nxt.:	2	P-Stk R:	16.2	Stk R Y:	9.2

L-Stn :	0+230.0	L-Ssl:	-51	Stk L X:	-4.8
H. Offset:	0.0	L-Ssr:	63	Stk L Y:	-1.8
Cut Dp:	-0.2	P-Stk L:	5.2	Stk R X:	7.2
Grd.Nxt.:	-2	P-Stk R:	7.9	Stk R Y:	3.1

L-Stn :	0+240.0	L-Ssl:	-38	Stk L X:	-4.9
H. Offset:	0.0	L-Ssr:	36	Stk L Y:	-1.7
Cut Dp:	0.0	P-Stk L:	5.2	Stk R X:	6.8
Grd.Nxt.:	-5	P-Stk R:	7.2	Stk R Y:	2.5



L-Stn :	0+250.0	L-Ssl:	-38	Stk L X:	-6.7
H. Offset:	0.0	L-Ssr:	40	Stk L Y:	-3.1
Cut Dp:	-0.6	P-Stk L:	7.3	Stk R X:	5.5
Grd.Nxt.:	-2	P-Stk R:	5.6	Stk R Y:	1.3

L-Stn :	0+252.0	L-Ssl:	-36	Stk L X:	-7.0
H. Offset:	0.0	L-Ssr:	43	Stk L Y:	-3.3
Cut Dp:	-0.9	P-Stk L:	7.8	Stk R X:	6.5
Grd.Nxt.:	-2	P-Stk R:	6.7	Stk R Y:	1.8

L-Stn :	0+255.0	L-Ssl:	-34	Stk L X:	-7.3
H. Offset:	0.0	L-Ssr:	46	Stk L Y:	-3.5
Cut Dp:	-1.1	P-Stk L:	8.1	Stk R X:	6.7
Grd.Nxt.:	-1	P-Stk R:	7.0	Stk R Y:	2.0

L-Stn :	0+258.0	L-Ssl:	-36	Stk L X:	-7.4
H. Offset:	0.0	L-Ssr:	46	Stk L Y:	-3.6
Cut Dp:	-1.0	P-Stk L:	8.2	Stk R X:	7.0
Grd.Nxt.:	1	P-Stk R:	7.4	Stk R Y:	2.4

L-Stn :	0+260.0	L-Ssl:	-39	Stk L X:	-6.8
H. Offset:	0.0	L-Ssr:	44	Stk L Y:	-3.2
Cut Dp:	-0.7	P-Stk L:	7.5	Stk R X:	6.7
Grd.Nxt.:	1	P-Stk R:	7.1	Stk R Y:	2.4

ROAD SECTION SPECIFICATIONS
MIN ROAD WIDTH: 5m
ROAD INSLOPE: 5%

DITCH DEPTH: 0.5m (0.7m AT CULVERTS)
DITCH BOTTOM WIDTH: 0.3m

CUT SLOPE (HORZ. TO VERT.): 1.1: 1
FILL SLOPE (HORZ. TO VERT.): 1.3 : 1 & 1.5:1

PLACED ROCK FILL SLOPE: 1:1 (IF REQUIRED)

PRELIMINARY NOT FOR CONSTRUCTION

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COOPER CREEK CEDAR

SCALE: 1:500
Designed LES THIESSEN Date 2020/08/13
Drawn R. VAN DER MERWE Date 2020/08/13

Rev	Date	DESCRIPTION	Init
1	2020/08/14	ISSUED FOR APPROVAL - CUTSLOPES REVISED	MD
0	2020/08/13	ISSUED FOR APPROVAL	RV

REVISIONS

PROJECT: CP404 LAIRD CREEK ACCESS ROAD

DRAWING TITLE: X-SECTIONS SHEET 6 OF 7

ORIGINAL SIGNED and SEALED BY: --
APPROVED BY: --
DESIGN ENGINEER: LES THIESSEN P. ENG
SNT PROJECT No.: CCC-20-03
DRAWING No.: CCC-20-03-107 | 1

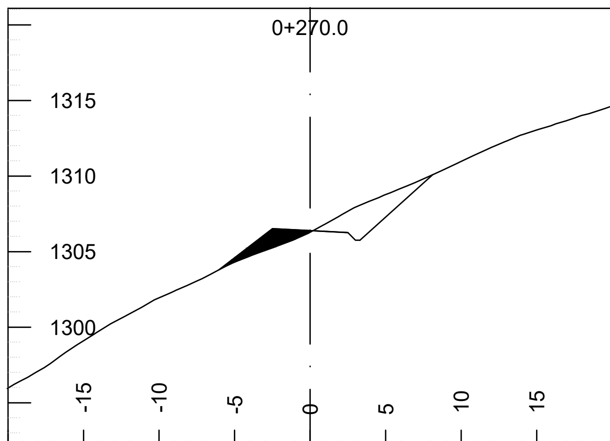
CANCEL PRINTS BEARING PREVIOUS LETTER

ROAD SECTION SPECIFICATIONS
MIN ROAD WIDTH: 5m
ROAD INSLOPE: 5%

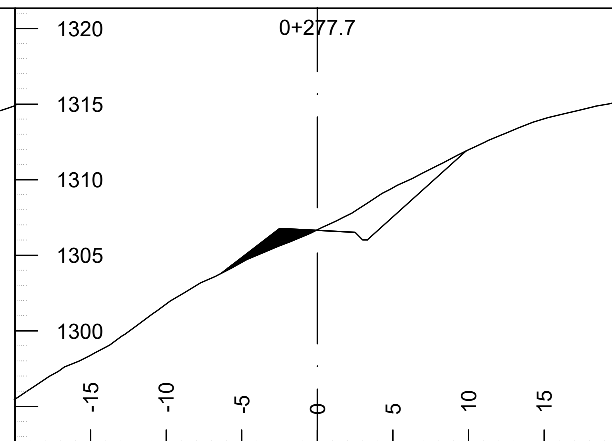
DITCH DEPTH: 0.5m (0.7m AT CULVERTS)
DITCH BOTTOM WIDTH: 0.3m

CUT SLOPE (HORZ. TO VERT.): 1.1: 1
FILL SLOPE (HORZ. TO VERT.): 1.3 : 1 & 1.5:1

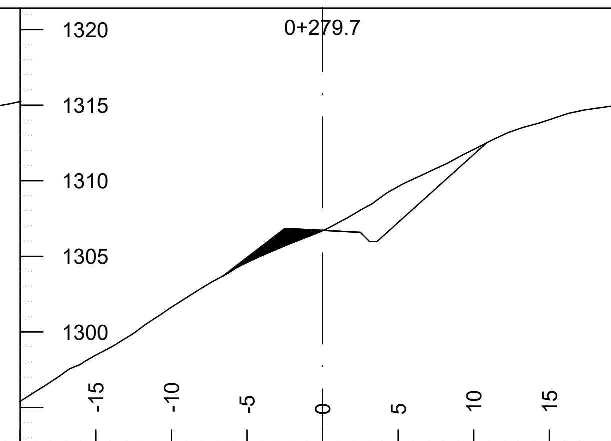
PLACED ROCK FILL SLOPE: 1:1 (IF REQUIRED)



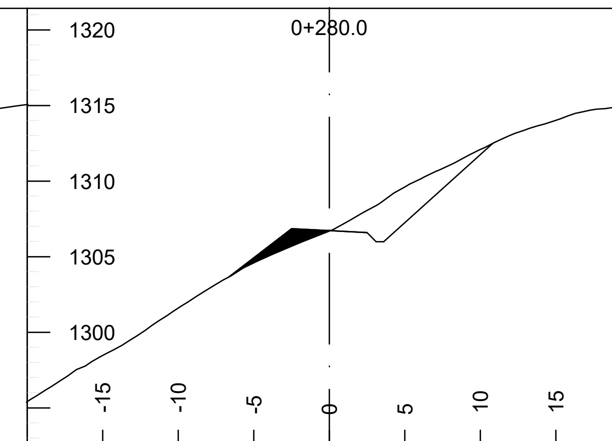
L-Stn :	0+270.0	L-Ssl:	-43	Stk L X:	-6.0
H. Offset:	0.0	L-Ssr:	47	Stk L Y:	-2.6
Cut Dp:	-0.1	P-Stk L:	6.6	Stk R X:	8.1
Grd.Nxt.:	3	P-Stk R:	8.9	Stk R Y:	3.7



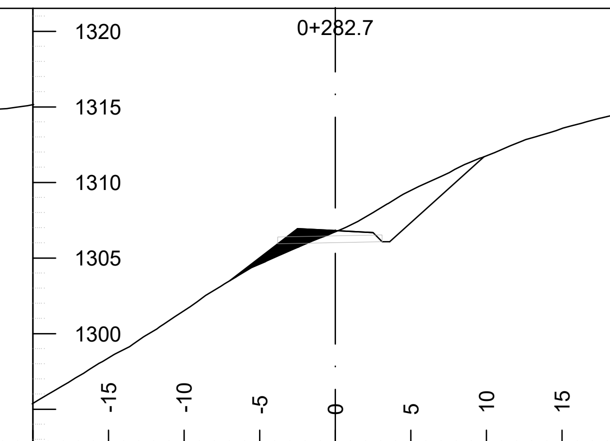
L-Stn :	0+277.7	L-Ssl:	-49	Stk L X:	-6.4
H. Offset:	0.0	L-Ssr:	53	Stk L Y:	-2.9
Cut Dp:	0.0	P-Stk L:	7.0	Stk R X:	9.8
Grd.Nxt.:	3	P-Stk R:	11.1	Stk R Y:	5.2



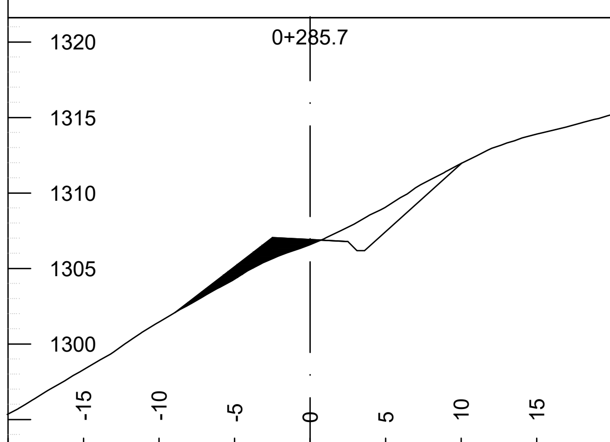
L-Stn :	0+279.7	L-Ssl:	-51	Stk L X:	-6.6
H. Offset:	0.0	L-Ssr:	54	Stk L Y:	-3.0
Cut Dp:	0.0	P-Stk L:	7.3	Stk R X:	10.8
Grd.Nxt.:	3	P-Stk R:	12.3	Stk R Y:	5.8



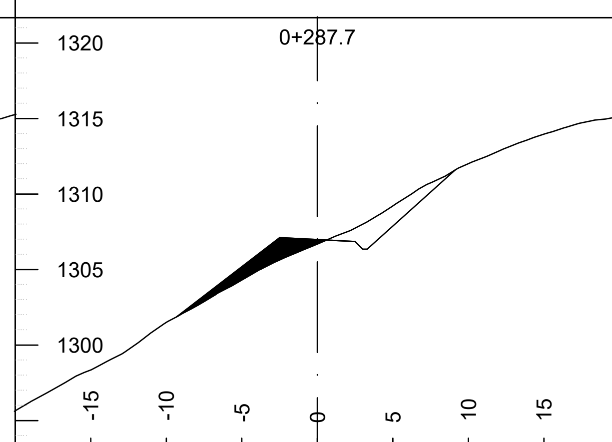
L-Stn :	0+280.0	L-Ssl:	-51	Stk L X:	-6.7
H. Offset:	0.0	L-Ssr:	54	Stk L Y:	-3.1
Cut Dp:	0.0	P-Stk L:	7.4	Stk R X:	10.8
Grd.Nxt.:	3	P-Stk R:	12.3	Stk R Y:	5.8



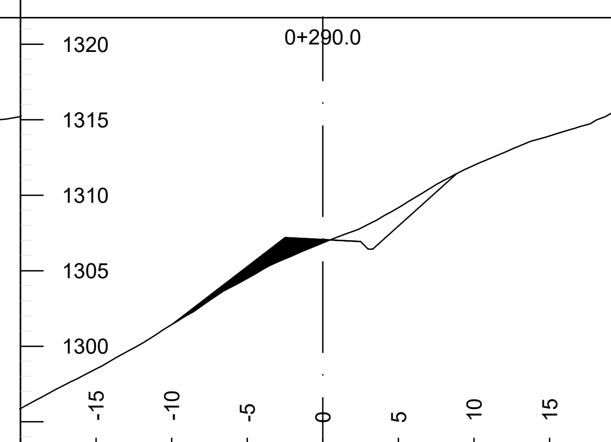
L-Stn :	0+282.7	L-Ssl:	-52	Stk L X:	-7.0
H. Offset:	0.0	L-Ssr:	50	Stk L Y:	-3.3
Cut Dp:	-0.1	P-Stk L:	7.7	Stk R X:	9.8
Grd.Nxt.:	3	P-Stk R:	11.0	Stk R Y:	4.9



L-Stn :	0+285.7	L-Ssl:	-51	Stk L X:	-9.0
H. Offset:	0.0	L-Ssr:	54	Stk L Y:	-4.8
Cut Dp:	-0.3	P-Stk L:	10.2	Stk R X:	10.0
Grd.Nxt.:	3	P-Stk R:	11.2	Stk R Y:	5.1



L-Stn :	0+287.7	L-Ssl:	-52	Stk L X:	-9.3
H. Offset:	0.0	L-Ssr:	53	Stk L Y:	-5.1
Cut Dp:	-0.3	P-Stk L:	10.6	Stk R X:	9.1
Grd.Nxt.:	3	P-Stk R:	10.2	Stk R Y:	4.6



L-Stn :	0+290.0	L-Ssl:	-54	Stk L X:	-9.9
H. Offset:	0.0	L-Ssr:	51	Stk L Y:	-5.6
Cut Dp:	-0.2	P-Stk L:	11.4	Stk R X:	8.9
Grd.Nxt.:	3	P-Stk R:	9.9	Stk R Y:	4.4

X-SECTIONS 1:500
DESIGN ROAD

PRELIMINARY NOT FOR CONSTRUCTION

SNT Engineering Ltd.
• Civil
• Structural
• Geotechnical
SUITE 3 - 385 BAKER STREET
NELSON, BC, V1L 4H6
Tel (250) 354-7683
info@snteng.ca www.snteng.ca

COOPER CREEK CEDAR

SCALE: AS SHOWN
Designed LES THIESSEN Date 2020/08/13
Drawn R. VAN DER MERWE Date 2020/08/13

PROJECT: CP404 LAIRD CREEK ACCESS ROAD

DRAWING TITLE: X-SECTIONS SHEET 7 OF 7 & MASSHAUL GRAPH

Rev	Date	DESCRIPTION	Init
1	2020/08/14	ISSUED FOR APPROVAL - CUTSLOPES REVISED	MD
0	2020/08/13	ISSUED FOR APPROVAL	RV

REVISIONS

ORIGINAL SIGNED and SEALED BY: --
APPROVED BY: --
DESIGN ENGINEER: LES THIESSEN P. ENG
SNT PROJECT No.: CCC-20-03
DRAWING No.: CCC-20-03-108 | 1

CANCEL PRINTS BEARING PREVIOUS LETTER