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Project No.: 0272097

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Via email: Maureen.Kelly@gov.bc.ca

Re: Peers Creek Frontage Road Geotechnical Assessment and Recommendations

1.0 INTRODUCTION

The British Columbia Ministry of Transportation and Infrastructure (MoTI) is proceeding with the remediation of Peers Creek Frontage Road (PCFR), located about 13 km east of Hope, British Columbia (BC). Flooding on the Coquihalla River in November and December 2021 caused extensive erosion and damage to infrastructure throughout the river valley, including washouts of PCFR and Highway 5 (located adjacent to PCFR). PCFR washout occurred during two separate flood events:

- November 15 to 16, 2021: the Coquihalla River eroded through PCFR and removed a small section of Highway 5. The river also avulsed along a portion of PCFR.
- November 28 to December 2, 2021: the Coquihalla River eroded further into Highway 5 upstream of the avulsion. The river also avulsed along the original November avulsion path, but continued further south, reentering the mainstem of the Coquihalla River near the Peers Creek Bridge. Area shown in Photograph 1 and 2 attached.

During the response phase, MoTI constructed embankment repairs and a riprap revetment along Highway 5 in the former location of PCFR along a 150 m section, as shown in Photographs 3 to 5 attached. The riprap revetment constructed during the response phase turns east at the downstream end (i.e., perpendicular to Highway 5) to reduce the potential for additional avulsions along the former PCFR alignment during the spring freshet.

MoTI has retained BGC to provide geotechnical engineering services for the final reinstatement work. BGC has also been retained to complete the hydrotechnical assessment and hydrotechnical design for the revetment remediation. MoTI has retained McElhanney Consulting Ltd. (McElhanney) to complete the road design and act as the project management consultant.

The design for final reinstatement of PCFR is currently at the 50% design phase dated October 14, 2022 and provided to BGC on October 25, 2022, including the drawings in Appendix A. BGC understands that Kiewit Corporation (Kiewit) intends to complete interim repairs

of PCFR to provide construction access for the Trans Mountain Expansion Project in advanced on the final reinstatement being completed by MoTI. Based on an email with MoTI (Maureen Kelly) on October 24, 2022, BGC understands that Kiewit will be assuming engineer of record responsibilities for the design and construction of the interim geotechnical work.

1.1. Scope of Work

The general scope of services for this work was provided in BGC proposal entitled “Work Plan and Cost Estimate for Hydrotechnical and Geotechnical Engineering Services for the Peers Creek Frontage Road, near Hope, BC and dated July 26, 2022 (revised). The geotechnical work scope outlined as part of the larger scope included:

1. A site visit to evaluate the existing conditions.
2. Geotechnical recommendations for the PCFR reinstatement work.

All work was completed under the existing As and When Geotechnical Engineering and Design Services contract (Contract No. 861CS1183) between BGC and MoTI, dated September 16, 2021.

2.0 SITE RECONNAISSANCE

A field reconnaissance was carried out by BGC on October 18, 2022 along PCFR within the proposed reinstatement with the purpose of making observations on the current site conditions and work completed as part of the response phase. Observations and commentary are summarized below in Table 2-1 as they specifically relate to the area of the preliminary proposed alignment. BGC also reviewed photographs collected by others during the washout and during the response phase of work for the discussion in Table 2-1.

Table 2-1. Observations along PCFR within the proposed embankment alignment. Alignment chainage as provided by McElhanney’s 50% design in Appendix A.

Approx. Project Alignment Chainage (from)	Approx. Project Alignment Chainage (to)	BGC site observations (Includes comparison between photos by others during the response, where possible)
100+00 (south limits of PCFR)	101+20	• Photographs provided by others from early March 2022 showed rockfill placement with a dozer and apparent compaction with a smooth drum roller. No documentation of the rockfill placement was provided to BGC. • BGC observed rockfill on the exposed slopes that ranged in sizes up to 600 mm (intermediate rock dimension). • A localized area of settlement was observed immediately west of the rockfill toe measuring 5.6 m in diameter. • An 800 mm diameter CSP culvert appeared to have been installed on March 14 and 15, 2022, based on photographs provided by others. No documentation of the culvert backfill was provided. • Areas shown in Photographs 2, 5, 14 to 18.

Approx. Project Alignment Chainage (from)	Approx. Project Alignment Chainage (to)	BGC site observations (Includes comparison between photos by others during the response, where possible)
101+20	103+30	• BGC observed that some rockfill was placed to create a level surface along this section during the response phase. Rockfill placement appeared thickest (up to approximately 1 m thick) on the east shoulder of the temporary access. The toe of the rockfill was against native sandy soils and piled wood debris. • Existing Highway 5 embankment slopes have riprap of various size up to about 600 mm (intermediate dimension) exposed. • Areas shown in photographs 2, 12, and 13.
103+30	103+70	• Photographs provided by others from the initial response showed fill was placed to which allowed a connection with Highway 5. No photographs or construction records of materials and construction methods were provided. Material outside of the travelled path appears to have been placed without compaction. • Areas shown in photographs 11 and 12, labelled as ramp to Highway 5.
103+70	104+70	• BGC observed that the section appeared to be on existing fluvial channel materials or reworked fluvial materials with little to no material added as part of the response phase. The material consisted of sand, gravel and cobbles. • Areas shown in photographs 6, 10, and 11.
104+70	105+20	• Photographs provided by others from the initial response appeared to show this area near level with the elevation of Highway 5 and was constructed early in the response work to cut off water flowing into the evulsion channel. No photographs or construction records documentation of materials and construction methods used were provided. The upper 300 mm is high fines (silt and clay) material that has grass. • Area shown in photograph 9.
105+20	106+60	• BGC observed a 150 m disconnect between the existing pavement at the north end of PCFR and the temporary access road near station 105+20. • BGC observed riprap rock ranging from about 2.5 m to 0.5 m (intermediate axis measured) within the revetment. Larger riprap pieces were observed near the toe imbedded into the river channel substrate. • The large diameter riprap appears to have been placed directly against the Highway 5 embankment that was repaired as part of the response work. • Areas shown in photographs 3, 4, and 8.

Approx. Project Alignment Chainage (from)	Approx. Project Alignment Chainage (to)	BGC site observations (Includes comparison between photos by others during the response, where possible)
106+60	107+88 (North limit of PCRF)	• BGC observed the existing pavement in this section was generally in good condition. An apparent localized 1.5 m diameter depression in the pavement was observed. This depression could be evidence of internal embankment erosion and settlement of the existing pavement structure. • Vegetation (grasses) on the shoulder and within the ditch and embankment slopes of Highway 5. • Area shown in Photograph 9.

Note:

1. Alignment chainage has been rounded to the nearest 10 m, unless actual boundary chainage has been shown on the 50% design drawings.

3.0 GEOTECHNICAL DESKTOP REVIEW

Surficial Geology

A limited desktop review of the geology surrounding the site was completed by BGC for this project using available information. The surficial geology was interpreted from work completed by BGC for other clients that overlap with the project limits. The work by BGC for others (BGC, August 2014) described the area in vicinity of the PCFR as fluvial plain (Fp) or active floodplain (FAp) subject to channel changes from the Coquihalla River. Based on visual observations and review of photographs within the project limits the washout under Peers creek exposed sand, gravel and cobble mixture with some boulders, as shown in Photographs 2 and 3 attached.

Historical Subsurface Data

The MoTI provided historical borehole records that were part of the New Coquihalla Highway Project that appear to have been drilled in 1983, logs are provided in Appendix B. Two boreholes, BH #83-2 (termination depth 15.5m) and BH #83-3 (termination depth 30.6 m), are located about 250 m from the south end of the project limits. The soils were described by others as: very dense GRAVEL sandy to SAND gravelly with cobbles and inferred boulders. Split spoon values record indicated high blow counts between 50 and 100 for the majority of the boreholes.

A search of the BC Groundwater Wells and Aquifers online database indicates two water supply wells near PCFR. Well Tag Number 70643 is registered at 69101 Othello Road which is located west and upslope of the PCFR site. The lithology records by others indicate silty gravel and cobbles between 3.6 m and 8.5 m, and gravels between 8.5 m and 12.1 m.

4.0 ENGINEERING ASSESSMENT

4.1. Seismic Hazard

For the purposes of assessing stability of the earth embankments during a seismic event, the Peers Creek Project will follow the Canadian Highway Bridge Design Code, CHBDC (CSA, 2019, Section 6-19) where possible, which refers to the seismic hazard provisions of the current National Building Code of Canada (NBCC) (CCBFC, 2020). The classification for seismic site response considers the average properties of the top 30 m of the soil profile. In the absence of shear wave velocity data, seismic site classification was determined from average Standard Penetration Test (SPT) blow counts measured during the historical nearby borehole drilled to 30 m, as provided in Appendix B. Using this information, the site has been estimated as Class D (stiff soil) for the purposes of this project.

BGC was asked by MoTI to provide the PGA (Peak Ground Acceleration) values from both the 2015 and 2020 Building Codes that will be considered for assessment of the embankment stability. The values given below are for a ground motion with a return period of 1 in 475 years.

- PGA from 2015 NBCC (Site Class D) – 0.098 g
- PGA from 2020 NBCC (Site Class D) – 0.126 g.

4.2. Embankment Stability Assessment

Slope stability analyses were performed using the two-dimensional limit equilibrium method in Slope/W (GEO-SLOPE, 2021), a commercially available limit equilibrium stability analysis software program. The Morgenstern-Price method of analysis was used, which considers both force and moment equilibrium. Unless otherwise noted, an optimized failure surface and minimum factor of safety (FoS) calculated by the software is reported herein. The optimized failure surface allows for incrementally altering portions (from one defined geometric shape) of slip surfaces and thereby refining the critical slip surface geometry and FoS.

In determination of the global stability of embankment design criteria, the following was considered for the understanding and consequence. A low degree of understanding was applied given the assessment has relied on available historical boreholes provided by MoTI for a site 150 m south. Groundwater conditions were estimated based on the fluctuations of the Coquihalla River. A low consequence was applied given that PCRF runs directly adjacent to Highway 5 and alternate route access is possible and currently being used. At this time BGC understands, PCFR provides access to one resident and various pipeline operators (with an alternate access currently being used).

One cross section was analyzed at the location shown in Appendix D, Figure D-1. The cross section was taken from the 50% design prepared by McElhanney at section 104+20. This section was selected as it is outside of the main Coquihalla River channel and will not have riprap rock on the slopes or riprap keyed in below the toe of the slopes. Riprap rock on the slopes is estimated to provide increased stability of the embankment slopes.

Subsurface soil conditions were based on available observations from the site reconnaissance and historical geotechnical borehole data (as discussed above in Section 3.0) from a nearby site. Groundwater conditions were estimated based on the approximate flow conditions of the Coquihalla River and is subject to change upon finalization BGC's hydrotechnical analysis for the project. The material parameters used for the slope stability analyses are summarized in Table 4-1 and estimated based on BGC's experience with similar materials.

Table 4-1. Soil parameters for slope stability analyses.

Soil Layer	Unit Weight (kN/m^3)	Effective Cohesion (kPa)	Friction Angle (degrees)
Earth Embankment (Imported Sand and Gravel)[1]	20	0	36
Fluvial (Gravel, sand and cobbles) Foundation Soils)	20	0	35
Riprap (if applicable)	24	0	55

Note:

1. Assumes the Earth Embankment material is consistent with a sand and gravel with less than 5% fines.

The following cases were analyzed for the section at 104+20:

1. Case 1: Steady State conditions with water level of near the toe of the proposed embankment, approximately elevation 217.4 m representing a river level elevation near the toe of the embankment (permanent).
2. Case 2: Flood conditions for the assumed 200-year return period have been estimated at this time to be approximately elevation 219 m (temporary condition). Scour and loss of embankment material has not been considered at this time and shall be addressed by the Hydrotechnical Engineer where required.
3. Case 3: A rapid draw down case has been assessed with a dropping river level from 218.0 m (westbound ditch elevation) to 217.4 m elevation (approximate toe of the embankment slope as a temporary condition. Given the relatively free draining nature of anticipated foundation soils (fluvial unit), the relatively small embankment heights (less than 3 m), and the proposed embankment fills consisting of sand and gravel with less than 5% fines, a rapid drawdown condition within the embankment is unlikely to occur.
4. Case 4: Seismic case considering "other geotechnical systems" shall have at least 50% of the travelling lanes (one lane for PCFR) available following ground motions with a return period of at least 475-years, as outlined in Section 6.14.2.3 in Bridge Standards and Procedures Manual Volume 1 MoTI's Supplement to CSA S6:19 Canadian Highway Bridge Design Code (CHBDC Supplement) (MoTI, July 2022). The seismic case analysis considers a horizontal seismic load of 50% of the PGA based on 475-year return period for PGA from 2020 NBCC which corresponds to 0.063 g.

Other considerations for the slope stability analyses are as follows:

1. The current preliminary interim design as shown in Appendix A has no structures or culverts (no culverts greater than 3 m) and therefore the culvert structures are not treated as such.

2. In all cases the entry surface was restricted to be no closer than 0.5 m from the road shoulder. BGC assumes that more than this amount of loss to the shoulder could adversely impact normal traffic operations.
3. A typical live load surcharge to simulate parked traffic in each of the two travelling lanes was considered and has been represented by a 12 kPa 6 m wide strip load across the travelling lanes.

MoTI Technical Circular Geotechnical Design Criteria T-04/17 provides direction for soil slope and embankment design. Based on Table 6.2b of MoTI's Supplement to CHBDC S6-19 (MoTI, July 2022), the required minimum FoS for global stability of embankments with a low degree of understanding and low consequence factor is 1.45 for permanent conditions (Case 1 and Case 3) and 1.24 for temporary conditions (Case 2) and 1.10 for seismic conditions using a pseudo static analysis (Case 4). These FoS targets were considered to be suitable by the MoTI as per phone communication between Ian Polos (BGC) and Maureen Kelly (MoTI) on October 17, 2022. The required factor of safety of 1.10 for pseudo static condition was provided in Technical Circular T-04/17 dated March 22, 2017.

The results of the stability analyses are presented in Table 4-2 below.

Table 4-2. Results of stability analyses for the critical sections.

Case Description	Factor of Safety	Appendix D Reference
Section 5+80		
Case 1: Earth Embankment Slopes, 2.0H:1V (steady state)	1.63	**D-2**
Case 2: Earth Embankment Slopes, 2.0H:1V (flood)	1.67	**D-3**
Case 3: Earth Embankment Slopes, 2.0H:1V (rapid draw down)	1.35	**D-4**
Case 4: Earth Embankment Slopes, 2.0H:1V (seismic)	1.38	**D-5**

The earth embankment slopes of PCFR (Section 104+20) were able to meet the required factor of safety using 2H:1V slopes for the proposed embankment heights assessed up to 3 m as given in the typical section. Given the analysis results, the proposed 2H:1V are considered suitable for all slopes for PCFR as presented in the 50% design.

4.3. Pavement Assessment

BGC understands that PCFR is used by a single resident to access their property north of the reinstatement work and for construction access for pipeline operators. BGC is not aware of any future development that would lead to increased traffic. It is understood the future use will continue to be used for access by vehicle traffic for a single resident and by infrequent use by Trans Mountain operations. No traffic data or pavement records were available that would allow for a complete or accurate assessment for a new pavement structure.

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1. General

All construction for the proposed project is to conform to the BC Ministry of Transportation Standard Specifications for Highway Construction Volume 1 and Volume 2 (MoTI, November 1, 2020). The following site-specific geotechnical considerations and reference to sections within the Standard Specifications are provided for the PCFR reinstatement project.

5.2. Subgrade Preparation

All clearing and grubbing should be completed in accordance with the MoTI Standard Specifications Section 200, where it may be required.

BGC recommends subgrade preparation and stripping depth as summarized in Table 5-1. Unless otherwise specified stripping under the embankment structure should be down to native fluvial sand, gravel and cobbles including the removal of wood debris that maybe encountered. Once suitable subgrade is exposed, the recommended subgrade for earth embankment material should be compacted to the equivalent to at least 95% Standard Proctor Maximum Dry Density (SPMDD) (ASTM, 2021) where possible. The prepared subgrade surface should be reviewed by the Geotechnical Engineer of Record or Ministry Representative and, if possible, tested (proof-roll testing) to identify soft spots prior to the placement of new embankment fill. If soft or otherwise unsuitable areas are found, they should be sub-excavated and backfilled with suitable earth embankment fill or rockfill.

Table 5-1. Recommended subgrade preparation and stripping estimates along PCFR within the project limits. Alignment chainage as provided by McElhanney's 50% design attached in Appendix A.

Approx. Project Alignment Chainage (from)	Approx. Project Alignment Chainage (to)	Recommended Stripping Depth (mm)	Commentary (Anticipated subgrade preparation)
100+00 (south limits of PCFR)	101+20	0 to 300	• The transition from the existing rockfill embankment to earth fill embankment shall transition with at least 0.5 m thick layer of finer rockfill before placement of earth embankment fill. • Widening of the existing east embankment toe will require removal of existing wood debris down to native fluvial (sand and gravel and cobbles). • Unless otherwise directed by MoTI and in the absence or construction records the existing 800 mm CSP culvert installed during the response phase shall be re-installed and backfilled according to MoTI standards.

Approx. Project Alignment Chainage (from)	Approx. Project Alignment Chainage (to)	Recommended Stripping Depth (mm)	Commentary (Anticipated subgrade preparation)
101+20	103+30	150 to 500	• Widening of the current east embankment toe will require removal of existing piled wood debris down to native fluvial (sand and gravel and cobbles). • The transition from the existing rockfill on the Highway 5 slopes shall transitions with at least 0.5 m thick layer of finer rockfill before placement of earth embankment fill.
103+30	103+70	500 to 3000	• Excavate uncontrolled fill down to native fluvial (sand and gravel and cobbles) within the embankment extents.
103+70	104+70	None	• Existing subgrade appears consistent with native fluvial sand, gravel, cobble subgrade. No additional subgrade preparation anticipated.
104+70	105+20	500 to 3000	• Excavate uncontrolled fill down to native fluvial (sand and gravel and cobbles) within the embankment extents. • The upper 300 mm of high fines material with organics (grass) shall be stripped. This material is not suitable for re-use as part of the earth embankment.
105+20	106+60	3000	• Remove existing large riprap placed during the initial response phase down to native fluvial (sand and gravel and cobbles). • It is anticipated riprap can be reused in the revetment design pending approval from the hydrotechnical engineer.
106+60	107+88 (North limit of PCRF)	100	• Excavate existing asphalt pavement (less than 100 mm) prior to excavation for the pavement structure subgrade and/or prior to the placement of additional embankment fill material. • The area around the localized depression in the pavement shall be reviewed following pavement removal for the presence of voids.

Note:

1. Alignment chainage has been rounded to the nearest 10 m, unless actual boundary chainage has been shown on the 50% design drawings.

5.3. Permanent Embankments Fill Slopes

BGC recommends that the permanent embankment fill slopes be no steeper than 2H:1V (Horizontal:Vertical) for up to 5 m high embankment slopes provided the embankment fill materials can achieve a friction angle of 36 degrees or greater.

It is recommended that earth embankment fill consist of a well-graded granular (sand and gravel) material with less than 5% fines for earth embankment construction. All wood debris, organic material and particles larger than 150 mm shall be removed within the earth embankment fill. Achieving adequate compaction within a soil matrix is unlikely when there are particles sizes greater than 150 mm. It is recommended that within the upper 500 mm of subgrade the maximum particle size not exceed 100 mm.

It is understood that the project may also consider using rock fill material for embankment construction if it is more readily available. Rockfill is described by MoTI as material containing more than 15% by volume of rock larger than 150 mm. Rock Embankments shall be constructed in layers equal in thickness to the largest size of material but not exceeding 0.7 m. If the rockfill embankment is overlain with earth fill embankment or by subbase or base course materials the top 0.5 m of the rock fill shall be sealed with small rock particles.

The proposed gradation of the rockfill to be used and the 0.5 m transition material used to earth embankment should be reviewed by Geotechnical Engineer or Ministry Representative prior to placement.

Embankment fills in contact with the riprap revetment or rockfill slopes shall be checked by hydrotechnical engineering for filter compatibility between the two materials and appropriate transition shall be recommended. A granular filter rock or geotextile or combination of both will need to be considered to transition between the design riprap armoring rock and earth embankment fills. Given the size of rip rap proposed, Class 2,000 kg, a 150 mm thick layer of gravel bedding is recommended to cover the non-woven geotextile to limit damage and tearing.

All earthworks should be done in accordance with Section 201 Roadway and Drainage, particularly Section 201.37 Earth Embankments (MoTI, November 1, 2020) with specified lift thickness and density as specified in Table 5-2.

Table 5-2. A Lift thickness and required density by depth below pavement subgrade, summarized in Table 201 A Section 201.37 (MoTI, November 1, 2020).

Depth Below Pavement Subgrade (mm)	Minimum Thickness (mm)	Minimum Density (% SPMDD)
0 to 300	100	100
300 to 500	100	95
Below 500	200	95

Note:

1. SPMDD refers to Standard Proctor Maximum Dry Density obtained by ASTM D698.

It is recommended that final embankment slopes, where riprap is not specified, are dressed with topsoil to a nominal thickness of 0.15 m followed by hydroseed (or approved equivalent) or with an approved erosion control mats (or similar equivalent) that will promote vegetation to mitigate against erosion channels from forming on the embankment slopes as a result of surface run-off from the road surface. Sand and gravel material on the embankments slope can be prone to

erosion and small erosion channels may occur. Surface water runoff from the roadway should be controlled to limit surface erosion of the embankment slopes.

5.4. Culverts (Under 3 m)

BGC understands that there may be multiple culverts crossing PCFR conveying flow from Highway 5 and adjacent road ditches and shown in the 50% design. Unless otherwise directed by MoTI, the existing 800 mm CSP at about 100+30 installed as part of the response (without as-built records) shall be reinstalled and backfilled according to MoTI specifications and slope (as design designed by others).

Based on the 50% design, the culverts will not be greater than 3 m in diameter and will therefore not be considered as a structure by MoTI in accordance with the Canadian Highway Bridge Design Code (CSA-S6-19). The culvert bedding should follow the Subsections 303.21.05 (Bedding), 303.21.07 (Embedment) and 303.21.08 (Backfilling) from the Standard Specification (MoTI, November 1, 2020) as they relate to the geotechnical aspects.

All other culvert recommendations should be specified by the Highway Design Engineer of Record.

5.5. Pavement Structure

In absence of available traffic data, BGC recommends that the pavement structure follow MOTI's Technical Circular T-01/15 *"Pavement Structure Design Guide"* (MoTI, January 26, 2015) Type C structure pavement structure throughout the limits of construction for new pavement placement which is given below in Table 5-3.

Table 5-3. New pavement structure recommendations.

Materials	Minimum Thickness (mm)
Hot Mix Asphalt Pavement (AP) – Single Lift	75
Crushed Base Course (CBC) – 25 mm CBC	225
Select Granular Sub-base (SGSB)	150[1]

Note:

1. The minimum SGSB layer thickness is provided for an assumed subgrade consisting of coarse-grained soils (gravel and/or sand soils).

5.5.1. Asphalt Materials

The asphalt layers should be in accordance with Section 502 (MoTI, November 1, 2020). According to the Technical Circular T-01/15 (MoTI, January 26, 2015), an asphalt cement binder grade of 80-100A (PG 64-22) is typical for the South Coast Region and should be used. A tack coat should be used between asphalt lifts, all vertical faces and at all tie-ins to existing locations.

It is recommended that the asphalt be placed in one 75 mm lift consisting of 16 mm Class 1 Medium Mix as Specified in Section 502, Table 502-D Asphalt Mix Aggregate Gradation Limits (MoTI, November 1, 2020).

It is recommended that asphalt lift achieve a minimum of 97% Marshall Density in accordance with the Sub-section 502.52 (MoTI, November 1, 2020).

5.5.2. Granular Base and Sub-Bases

The material, placement and compaction of the crushed base course and select granular sub-base layers should be in accordance with Section 202 Standard Specifications (MoTI, November 1, 2020). BGC recommends that a target density of 100% SPMDD be achieved for both the CBC and SGSB materials.

5.5.3. Pavement Drainage

New Asphalt pavements should be constructed to provide positive cross-lateral drainage at the top of the pavement subgrade. The top of the pavement subgrade should be sloped at a minimum of 2% crossfall, while the pavement surface should be constructed with a minimum 2% crossfall.

5.5.4. Asphalt Transitions

Special considerations maybe required between the existing road and the new asphalt such that smooth and well bonded transitions are made. All longitudinal and transverse joints in the new asphalt surface should be staggered between asphalt lifts. The staggering of the longitudinal joints should be accomplished by offsetting the pavement edge by a minimum of 150 mm.

At the paving limits, the transverse tie-in of the existing pavement surface shall be milled to a depth equal to the existing asphalt thickness up 50 mm so that the new asphalt material can be placed flush with the top of the existing pavement surface. At all longitudinal tie-ins to existing pavements, the top lift of asphalt must extend a minimum of 5 m in length beyond the transverse joint of the bottom lift.

6.0 FIELD REVIEWS

Interim Work (by Others)

As discussed in the introduction section, BGC understands that Kiewit Corporation (Kiewit) intends to complete interim repairs of PCFR to provide construction access for the Trans Mountain Expansion Project in advance on the final reinstatement being completed by MoTI. Based on an email with MoTI (Maureen Kelly) on October 24, 2022, BGC understands that Kiewit will be assuming Engineer of Record responsibilities for the design and construction of the interim geotechnical work. The quality control documentation shall be collected by the contractor or the contractor's consultant along the quality assurance oversight by MoTI. This documentation shall be shared with the geotechnical EOR of the final reinstatement works.

Final Reinstatement

In BGC's proposal (July 26, 2022), BGC proposed to offer geotechnical support during construction, and a scope and cost estimate for that effort would be developed once the final

reinstatement design has been completed. Assuming full time monitoring by the Ministry Representative, allowance for a BGC Field review frequency of about 10% should be considered, as per the Engineering of Record and Field Review guidelines provided in Technical Circular T-06/09.

Assuming full time monitoring by the Ministry Representative, allowance for a BGC Field review frequency of about 10%, as per the Engineering of Record and Field Review guidelines provided in Technical Circular T-06/09.

7.0 CLOSURE

BGC Engineering Inc. (BGC) prepared this document for the account of BC Ministry of Transportation and Infrastructure. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of document preparation. Any use which a third party makes of this document or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

Yours sincerely,

BGC ENGINEERING INC.
per:

Ian Polos, P.Eng.
Geotechnical Engineer

Reviewed by:

Martin Devonald, M.Sc., P.Eng.
Principal Geotechnical/Geological Engineer

EGBC Permit To Practice: 1000944

ES/MD/rm/th

Attachment(s): Appendix A – 50% Design Drawing Package (October 14, 2022)
Appendix B – Historical Borehole Logs
Appendix C – Select Site Photographs
Appendix D – Stability Results

REFERENCES

BGC Engineering Inc. (2014, August). Terrain Map RK 1023 to 1047. Prepared for TransMountain.

BGC Engineering Inc. (2022, July 26). *Work Plan and Cost Estimate for Hydrotechnical and Geotechnical Engineering Services Peers Creek Frontage Road, near Hope, BC*. Prepared for the Ministry of Transportation and Infrastructure.

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British Columbia Ministry of Transportation and Infrastructure (MoTI). (2022 July). Bridge Standards and Procedures Manual Volume Supplement to CHBDC S6:19. Adopted July 2022.

Canadian Commission on Building and Fire Codes (CCBFC). (2020). National Building Code of Canada.

GEO-SLOPE International. (2021). Slope/w Slope Stability Software, Version 11.0. Calgary, AB, Canada

APPENDIX A
50% DESIGN DRAWING PACKAGE (OCTOBER 14, 2022)

BRITISH COLUMBIA

Ministry of Transportation and Infrastructure

PROJECT No. 14092-0000

PEERS CREEK FRONTAGE RD

WASHOUT RECOVERY

I. PILKINGTON, CHIEF ENGINEER

50% DETAILED DESIGN

2022-10-14

DRAWING INDEX

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

PROJECT No. 14092-0000

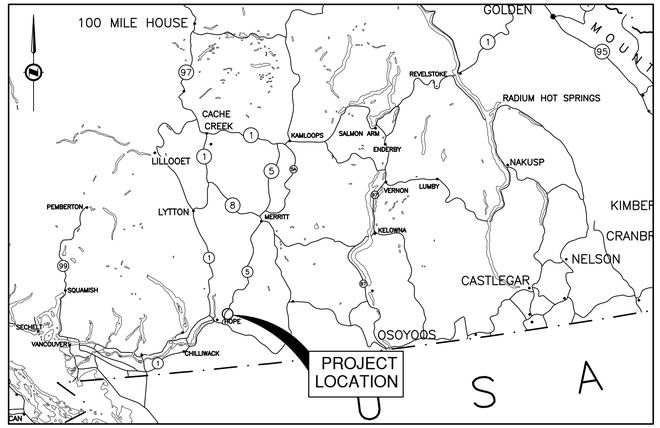
PEERS CREEK FRONTAGE RD

WASHOUT RECOVERY

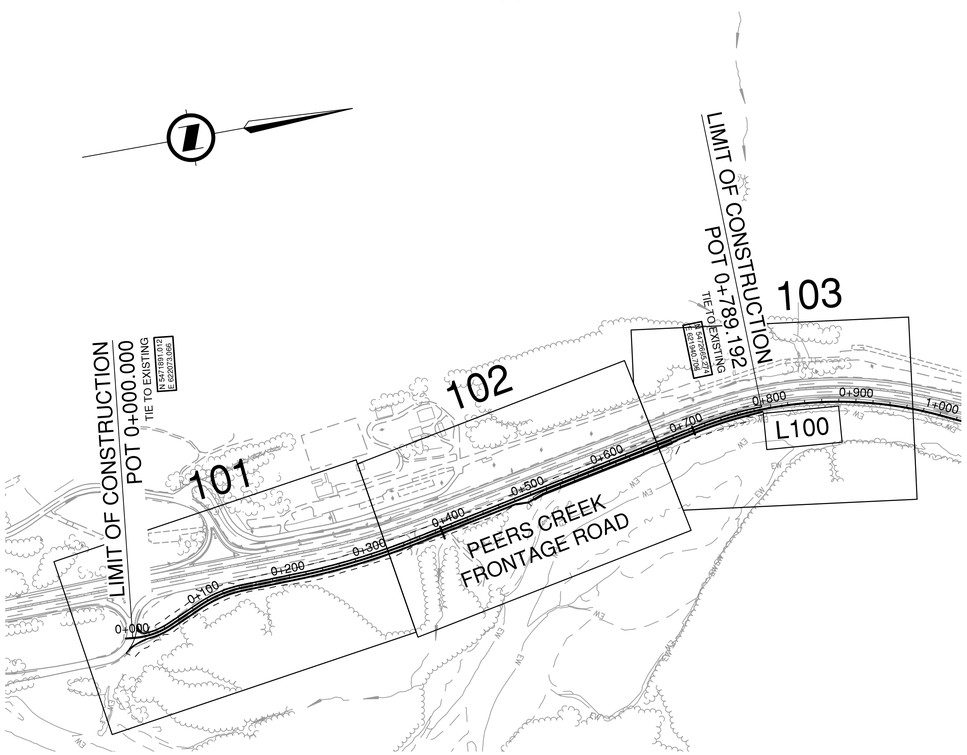
L100

L100 STA. P.O.T. 0+00.000 - STA. P.O.T. 0+789.192

0.790 km



LOCATION MAP
N.T.S.



KEY PLAN
N.T.S.

FOR DISCUSSION ONLY

PERMIT TO PRACTICE

McElhanney Ltd.
PERMIT NUMBER: 1003299

Engineers and Geoscientists of British Columbia

APPROVED SEAL

McElhanney
Suite 200
858 Beatty Street
Vancouver BC
Canada V6B 1C1
Tel 604 683 8521

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SCALE

CAD FILENAME R1-1032-001
PLOT DATE 10/13/2022

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

KEY PLAN AND INDEX

PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY
L100 - STA. 0+00.000 TO 0+789.192

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-001	A

PLOT DATE: 2022/10/13 \\corp\TAL\COLO\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\000_CoverKeyPlanLegend\R1-1032-001.dwg

LEGEND

EXISTING SYMBOLS

SURVEY

- SPOT ELEVATION
- BENCHMARK
- REFERENCE POINT
- DETAIL HUB
- OLD IRON PIN
- CONCRETE POST MONUMENT
- CONTROL MONUMENT
- ROCK POST MONUMENT
- STANDARD BRASS CAP MONUMENT
- LEAD PLUG
- TEST HOLE
- TEST PIT
- WOODEN POST
- ALUMINUM POST
- ANGLE IRON POST
- WITNESS POST
- DOMINION IRON POST
- NON-STD. ROUND IRON POST
- NON-STD. SQUARE IRON POST

AERIAL UTILITIES

- POWER GUY POLE
- TELEPHONE GUY POLE
- POWER / TELEPHONE GUY POLE
- DEADMAN
- ANCHOR GUY WIRE
- HIGH TENSION POLE
- HIGH TENSION TOWER
- POWER POLE
- TELEPHONE POLE
- POWER / TELEPHONE POLE
- POWER POLE WITH TRANSFORMER
- POWER / TELEPHONE WITH TRANSFORMER
- PEDESTAL (TELUS)
- TELEPHONE BOOTH

DETAIL

- GATE POST
- GUARD POST
- FLAG POLE
- DELINEATOR POST
- MAILBOX
- TREE
- WELL
- COMMERCIAL SIGN
- SWAMP
- POST MOUNTED DELINEATOR (YELLOW)
- POST MOUNTED DELINEATOR (WHITE)

DRAINAGE & UTILITIES

- MANHOLE
- POWER MANHOLE
- SANITARY SEWER MANHOLE
- STORM SEWER MANHOLE
- TELEPHONE MANHOLE
- UNKNOWN MANHOLE
- VAULT MANHOLE
- WATER MANHOLE
- MH/CB DRYWELL
- CATCH BASIN
- CATCH BASIN MANHOLE
- ASPHALT SPILLWAY
- DRAINAGE GRATE
- CULVERT
- CULVERT INLET
- CULVERT OUTLET
- CULVERT KINK
- RIPRAP

ROAD SIGNS

- ONE-POST SIGN
- TWO-POST SIGN
- BREAKAWAY STEEL
- STD. DAVIT POLE - TYPE 3
- STD. COMBINATION POLE - TYPE 1
- HEAVY DUTY DAVIT POLE - TYPE 6
- H.D. COMBINATION POLE - TYPE 7
- HEAVY POLE - TYPE H
- H. COMBINATION POLE - TYPE H
- CANTILEVER STRUCTURE
- SIGN BRIDGE STRUCTURE
- SIGN - MOUNTED ON STRUCTURE

EXISTING LINE TYPES

FEATURES

- CONCRETE ROADSIDE BARRIER
- BROKEN WHITE LINE RURAL
- SOLID WHITE LINE
- SOLID YELLOW LINE
- DOUBLE YELLOW LINE
- CENTRELINE
- ROAD SHOULDER
- PAVEMENT EDGE
- ASPHALT CURB
- GRAVEL ROAD
- SIDEWALK
- FENCE
- GUARD RAIL ROAD SIDE BARRIER
- GARDEN, LAWNS, VEGETATION
- HEDGE, BUSH LINE & TREE LINE
- RETAINING WALL
- CN TRACK BED

TOPOGRAPHY

- BOTTOM OF SLOPE
- TOP OF BANK
- CONTOURS MAJOR
- CONTOURS MINOR

BOUNDARIES

- EASEMENT
- GAZETTE
- PARCEL, LEGAL SUBDIVISIONS
- QUARTER SECTION LINE
- SECTION LINE & DISTRICT LOT
- RIGHT OF WAY
- JURISDICTION BOUNDARY

HYDROLOGY

- EDGE OF WATER
- DITCH CENTER/CREEK CENTER / DRAINAGE
- EDGE OF DITCH

PROPOSED SYMBOLS

AERIAL UTILITIES

- POWER GUY POLE
- TELEPHONE GUY POLE
- POWER / TELEPHONE GUY POLE
- ANCHOR GUY WIRE
- HIGH TENSION POLE
- HIGH TENSION TOWER
- POWER POLE
- TELEPHONE POLE
- POWER / TELEPHONE POLE
- POWER POLE WITH TRANSFORMER
- POWER / TELEPHONE WITH TRANSFORMER
- PEDESTAL (TELUS)
- TELEPHONE BOOTH

DETAIL

- GATE POST
- GUARD POST
- FLAG POLE
- DELINEATOR POST
- POST MOUNTED DELINEATOR (YELLOW)
- POST MOUNTED DELINEATOR (WHITE)
- TOP MOUNTED BI-DIRECTIONAL REFLECTOR
- TOP OR SIDE MOUNTED MONO-DIRECTIONAL YELLOW REFLECTOR
- TOP OR SIDE MOUNTED MONO-DIRECTIONAL WHITE REFLECTOR
- SPOT ELEVATION

DRAINAGE & UTILITIES

- MANHOLE
- POWER MANHOLE
- SANITARY SEWER MANHOLE
- STORM SEWER MANHOLE
- TELEPHONE MANHOLE
- UNKNOWN MANHOLE
- VAULT MANHOLE
- WATER MANHOLE
- MH/CB DRYWELL
- CATCH BASIN (SINGLE)
- CATCH BASIN (TWIN)
- LAWN BASIN
- ISOLATION / WEIR STRUCTURE / DITCH BLOCK
- RIPRAP SPILLWAY C/W DRAINAGE BARRIER
- CLEANOUT
- STORM WATER TREATMENT DEVICE
- CULVERT INLET / OUTLET
- CULVERT HEADWALL C/W TRASH RACK
- RIPRAP PAD / SPLASH PAD

PROPOSED LINE TYPES

FEATURES

- ALIGNMENT CONTROL LINE
- SECONDARY ALIGNMENT
- PAVEMENT EDGE
- GRAVEL SHOULDER
- ASPHALT CURB
- CONCRETE ROADSIDE BARRIER
- SOLID WHITE LINE
- SOLID YELLOW LINE
- BROKEN WHITE LINE
- RUMBLE STRIP
- ROAD TOES
- SAWCUT LINE
- CLEARING & GRUBBING
- BERM - TOE
- BERM - TOP
- INDEX CONTOUR
- INTERMEDIATE CONTOUR

BOUNDARIES

- LICENSE TO CONSTRUCT

UTILITIES

- DITCH
- EDGE OF DITCH
- CULVERT

FOR DISCUSSION ONLY

PERMIT TO PRACTICE

McElhanney Ltd.

PERMIT NUMBER: 1003299

Engineers and Geoscientists of British Columbia

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BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SCALE

CAD FILENAME R1-1032-002

PLOT DATE 10/13/2022

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

LEGEND

PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY

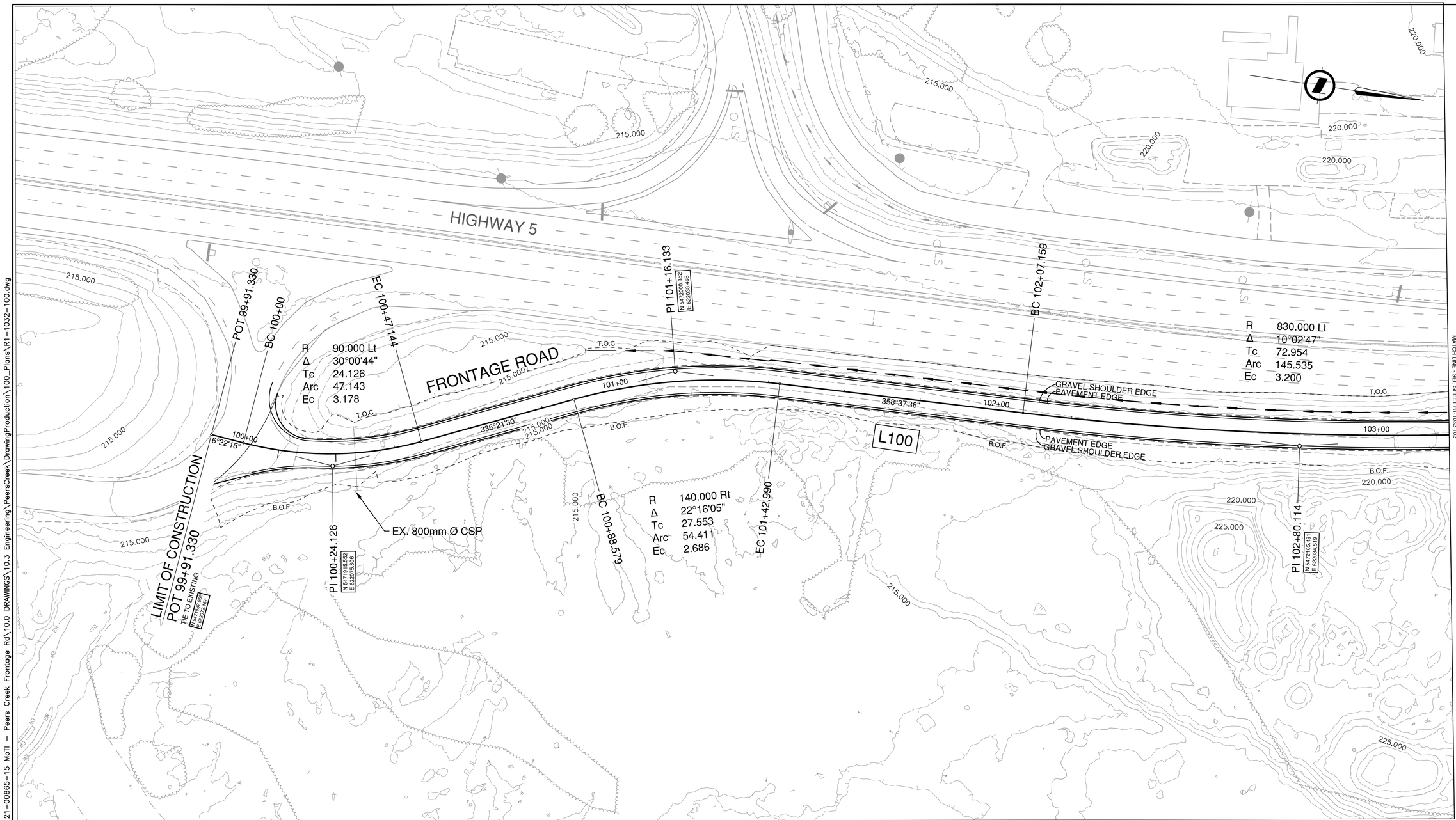
STA. 0+00.000 TO 0+789.192

N. GUARAN
ENGINEER OF RECORD
DATE 2022-08-08

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-002	A

PLOT DATE: 2022/10/13 \\corp\TAL\COLO\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\000_CoverKeyPlanLegend\R1-1032-002.dwg

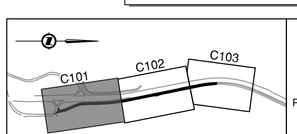


PLOT DATE: 2022/10/14 \\corp\TAL\colo\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\100_Plans\R1-1032-100.dwg

REFERENCE DRAWINGS

FOR PROFILE SEE DWG. R1-1032-201
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR GEOMETRICS AND LANING SEE DWG. R1-1032-401
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005

FOR DISCUSSION ONLY



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McElhanney Ltd.
PERMIT NUMBER: 1003299

Engineers and Geoscientists of British Columbia

APPROVED SEAL

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

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BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SCALE 0 5 1:500 25m

CAD FILENAME R1-1032-100
PLOT DATE 10/14/2022

PLAN

PEERS CREEK FRONTAGE RD WASHOUT RECOVERY

STA. 100+00.000 TO 103+20.000

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
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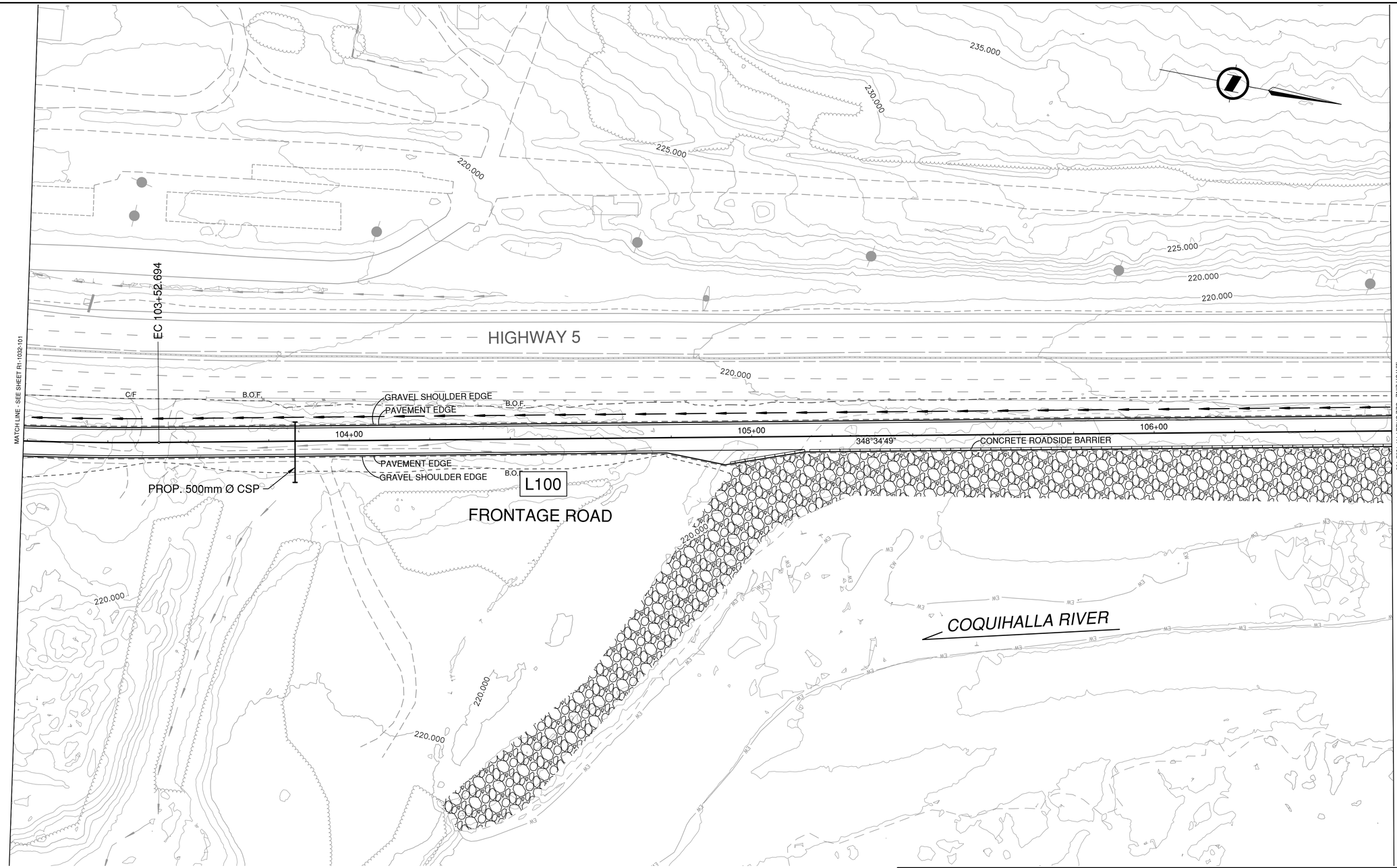
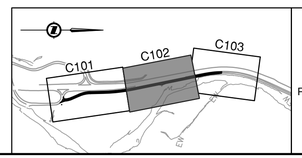


FOR DISCUSSION ONLY

REFERENCE DRAWINGS

FOR PROFILE SEE DWG. R1-1032-202
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR GEOMETRICS AND LANING SEE DWG. R1-1032-402
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005



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SCALE 0 5 1:500 25m

CAD FILENAME R1-1032-100
PLOT DATE 10/14/2022

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

PLAN

PEERS CREEK FRONTAGE RD WASHOUT RECOVERY

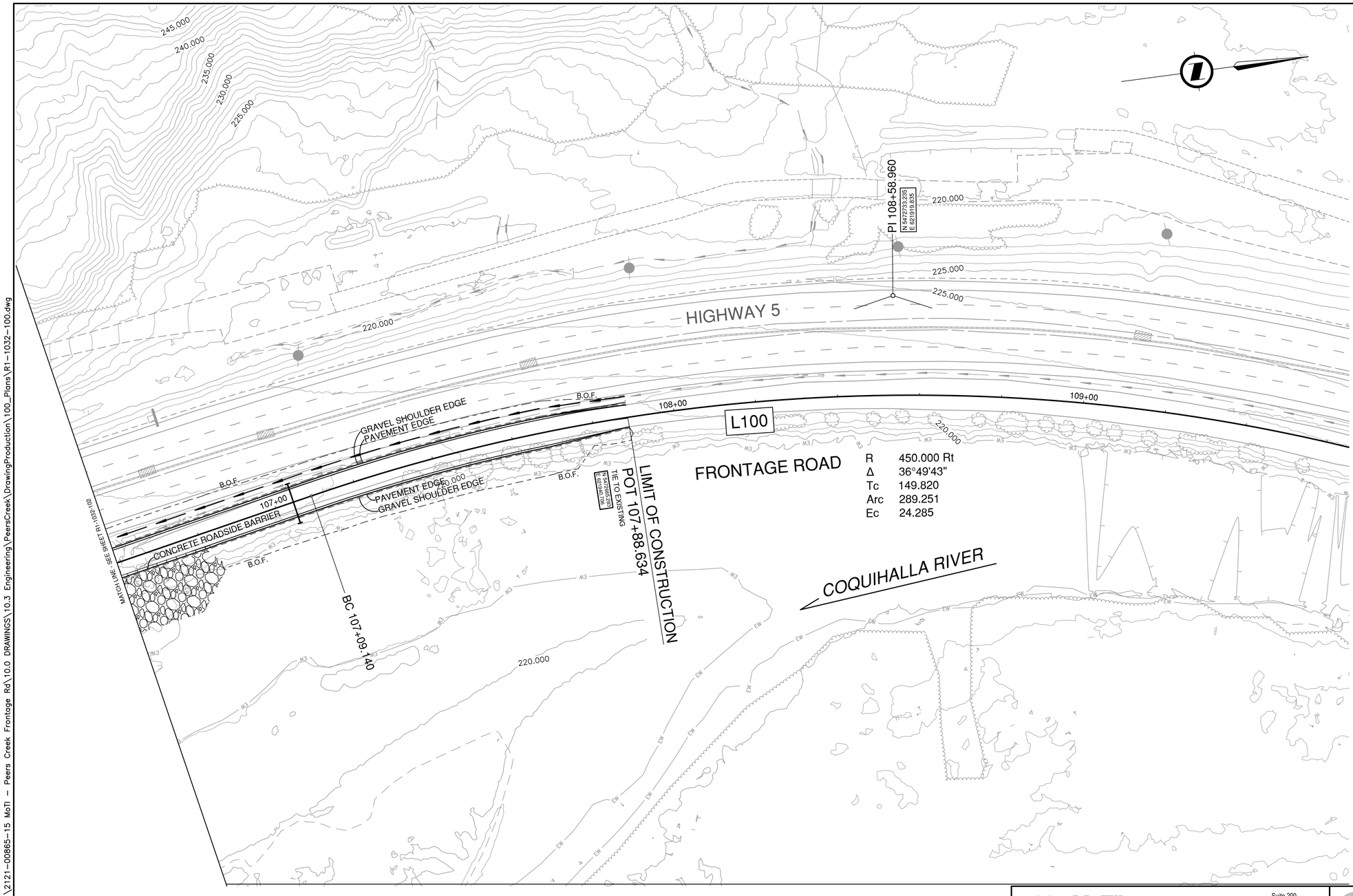
STA. 103+20.000 TO 106+60.000

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-102	A

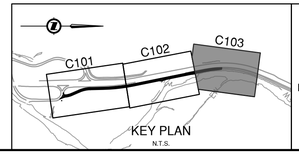
PLOT DATE: 2022/10/14 \\corp\TAL\colo\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\100_Plans\R1-1032-100.dwg



FOR DISCUSSION ONLY

REFERENCE DRAWINGS

FOR PROFILE SEE DWG. R1-1032-203
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR GEOMETRICS AND LANING SEE DWG. R1-1032-403
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005



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McElhanney Ltd.

PERMIT NUMBER: 1003299

Engineers and Geoscientists of British Columbia

APPROVED SEAL

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858 Beatty Street
Vancouver BC
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SCALE 0 5 1:500 25m

CAD FILENAME R1-1032-100

PLOT DATE 10/14/2022

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

PLAN

PEERS CREEK FRONTAGE RD WASHOUT RECOVERY

STA. 106+60.000 TO 107+88.634

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
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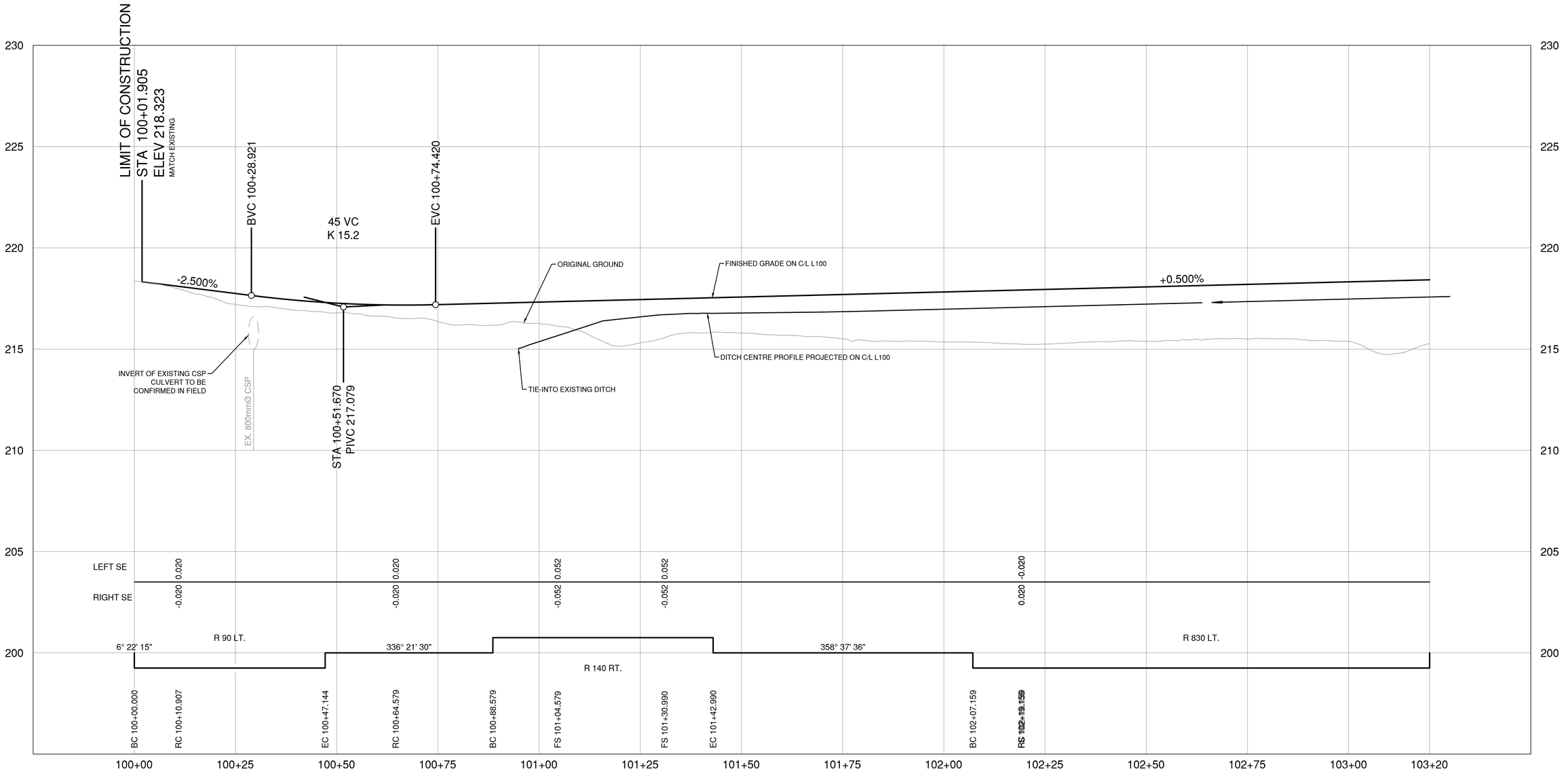

FOR DISCUSSION ONLY

REFERENCE DRAWINGS

FOR PLAN SEE DWG. R1-1032-101
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR GEOMETRICS AND LANING SEE DWG. R1-1032-401
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005

PERMIT TO PRACTICE

McElhanney Ltd.
PERMIT NUMBER: 1003299

Engineers and Geoscientists of British Columbia

APPROVED SEAL

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858 Beatty Street
Vancouver BC
Canada V6B 1C1
Tel 604 683 8521

SCALE 0 5 1:500 25m

CAD FILENAME R1-1032-200
PLOT DATE 2022-10-14

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

PROFILE

PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY

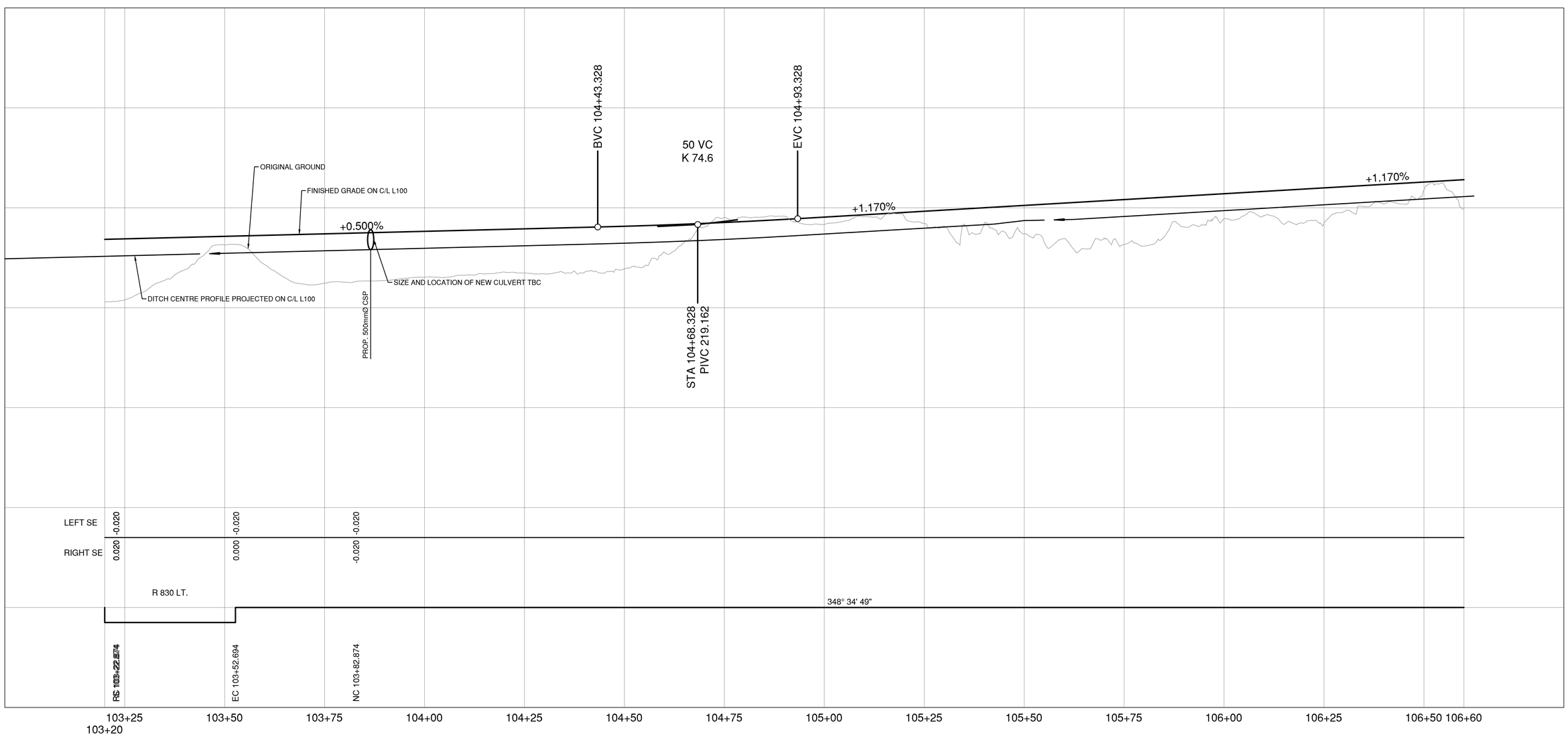
STA. 0+00.000 TO 3+20.000

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-201	A

PLOT DATE: 2022/10/14 X:\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\200_Profiles\R1-1032-200.dwg



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REFERENCE DRAWINGS

FOR PLAN SEE DWG. R1-1032-102
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR GEOMETRICS AND LANING SEE DWG. R1-1032-402
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005

FOR DISCUSSION ONLY

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McElhanney Ltd.
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Engineers and Geoscientists of British Columbia

APPROVED SEAL

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A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

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858 Beatty Street
Vancouver BC
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SCALE 0 5 1:500 25m
CAD FILENAME R1-1032-200
PLOT DATE 10/14/2022

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

PROFILE

PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY
STA. 3+20.000 TO 6+60.000

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
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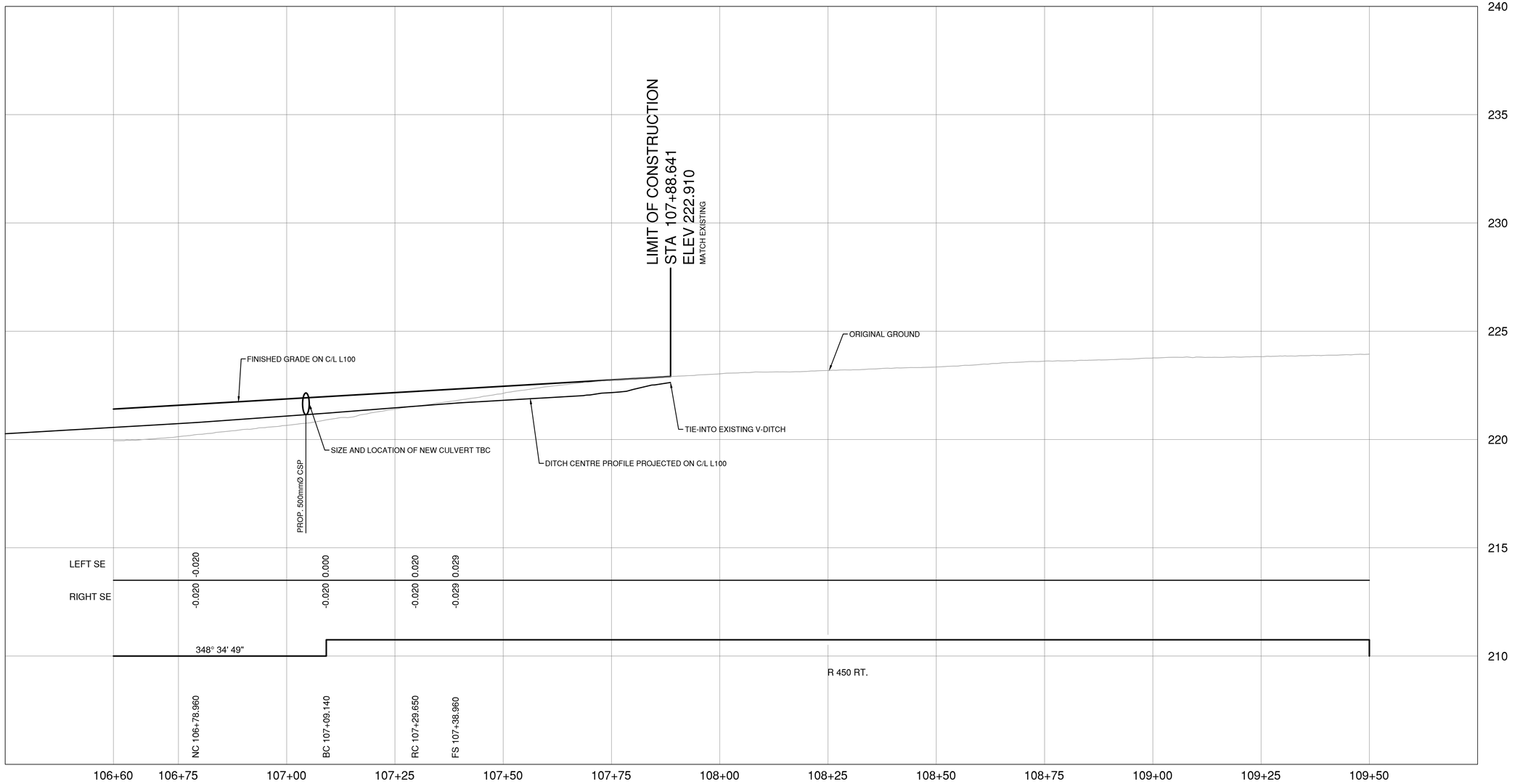

PLOT DATE: 2022/10/14 \\corp\TAL\colo\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\200_Profiles\R1-1032-200.dwg

REFERENCE DRAWINGS

FOR PLAN SEE DWG. R1-1032-103
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR GEOMETRICS AND LANING SEE DWG. R1-1032-403
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005

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PERMIT NUMBER: 1003299
Engineers and Geoscientists of British Columbia

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858 Beatty Street
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Canada V6B 1C1
Tel 604 683 8521

SCALE 0 5 1:500 25m
CAD FILENAME R1-1032-200
PLOT DATE 10/14/2022

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

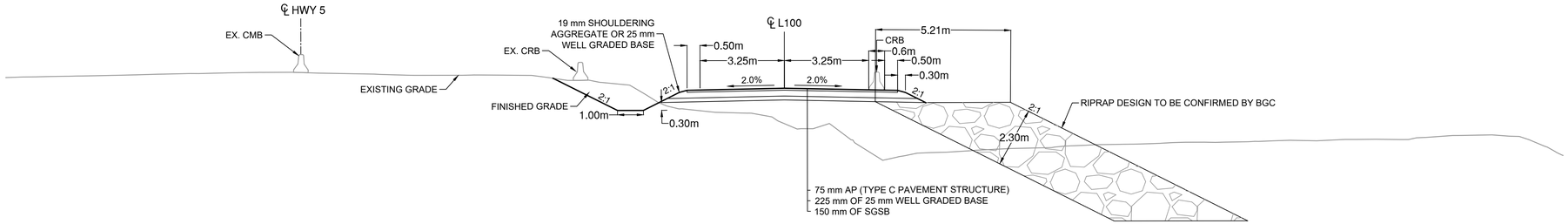
PROFILE

PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY
STA. 6+60.000 TO 10+00.000

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

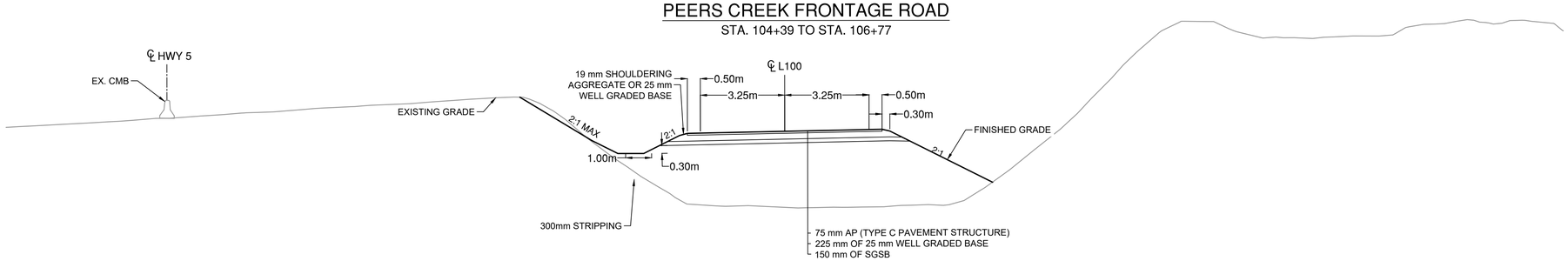
DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-15

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-203	A



PEERS CREEK FRONTAGE ROAD

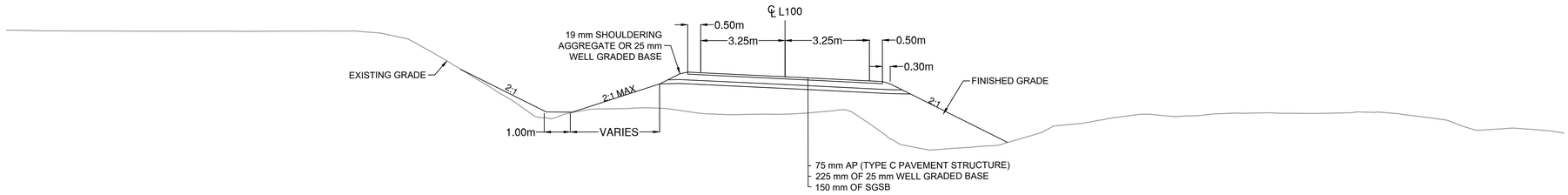
STA. 104+39 TO STA. 106+77



PEERS CREEK FRONTAGE ROAD

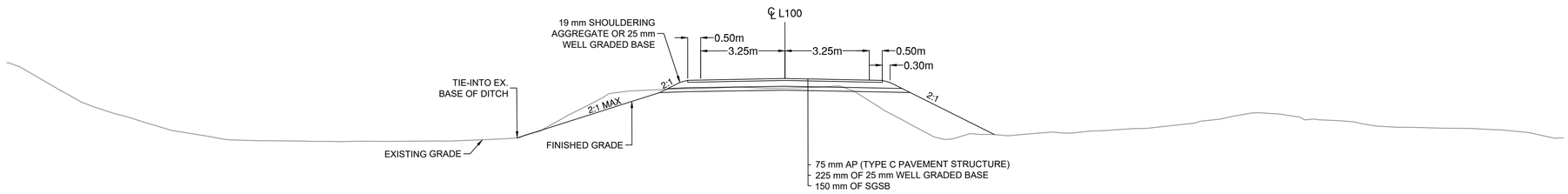
STA. 101+40 TO STA. 104+79

STA. 106+85 TO STA. 107+68



PEERS CREEK FRONTAGE ROAD

STA. 100+94 TO STA. 101+39



PEERS CREEK FRONTAGE ROAD

STA. 100+19 TO STA. 100+94

REFERENCE DRAWINGS

FOR PROFILE SEE DWG. R1-1032-101, R1-1032-102, AND R1-1032-103
FOR GEOMETRICS AND LANING SEE DWG. R1-1032-401, R1-1032-402, AND R1-1032-403

FOR DISCUSSION ONLY

PERMIT TO PRACTICE

McElhanney Ltd.

PERMIT NUMBER: 1003299

Engineers and Geoscientists of British Columbia

APPROVED SEAL

McElhanney
Suite 200
858 Beatty Street
Vancouver BC
Canada V6B 1C1
Tel 604 683 8521

SCALE 0 1 1:100 5m

CAD FILENAME R1-1032-300

PLOT DATE 10/14/2022

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

TYPICAL SECTIONS

PEERS CREEK FRONTAGE RD

WASHOUT RECOVERY

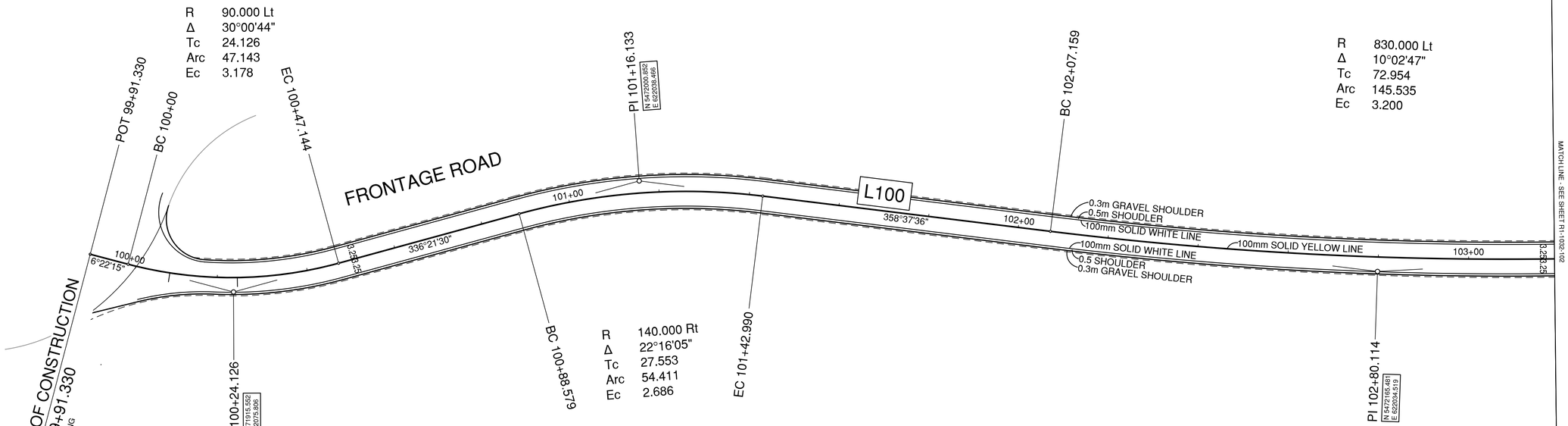
L100 - STA. 0+00.000 TO 0+789.192

N. GUARAN
ENGINEER OF RECORD
DATE 2022-08-15

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-301	A

PLOT DATE: 2022/10/14 \\corp\TAL\colo\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\300_TypicalSections\R1-1032-300.dwg

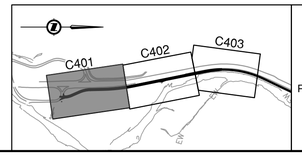


ALIGNMENT	CLASSIFICATION	DESIGN SPEED
L100	LVR	50 km/h

REFERENCE DRAWINGS

FOR PLAN SEE DWG. R1-1032-101
FOR PROFILE SEE DWG. R1-1032-201
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005

FOR DISCUSSION ONLY



PERMIT TO PRACTICE

McElhanney Ltd.
PERMIT NUMBER: 1003299

Engineers and Geoscientists of British Columbia

APPROVED SEAL

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

McElhanney
Suite 200
858 Beatty Street
Vancouver BC
Canada V6B 1C1
Tel 604 683 8521

SCALE 0 5 1:500 25m

CAD FILENAME R1-1032-400
PLOT DATE 10/14/2022

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

GEOMETRICS AND LANING

PEERS CREEK FRONTAGE RD WASHOUT RECOVERY

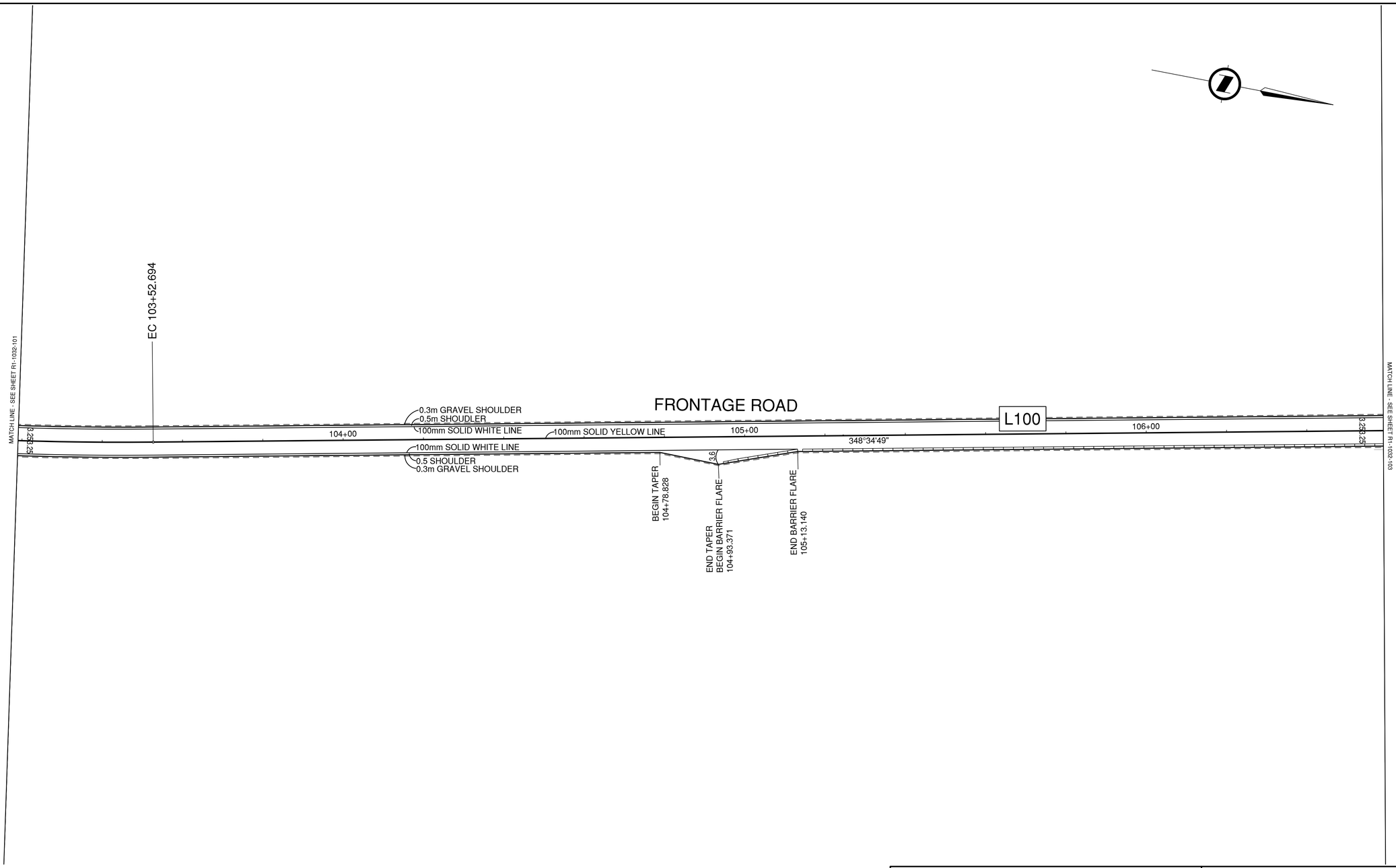
STA. 0+00.000 TO 3+20.000

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-401	A

PLOT DATE: 2022/10/14 \\corp\TAL\colo\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\400_GeometricsLaning\R1-1032-400.dwg



ALIGNMENT	CLASSIFICATION	DESIGN SPEED
L100	LVR	50 km/h

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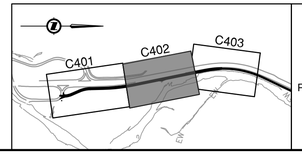
FOR PROFILE SEE DWG. R1-1032-202
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005

FOR DISCUSSION ONLY



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Vancouver BC
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Tel 604 683 8521

SCALE 0 5 1:500 25m

CAD FILENAME R1-1032-400

PLOT DATE 10/14/2022

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	N. GUARAN

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

GEOMETRICS AND LANING

PEERS CREEK FRONTAGE RD WASHOUT RECOVERY

STA. 3+20.000 TO 6+60.000

N. GUARAN
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DATE 2022-10-14

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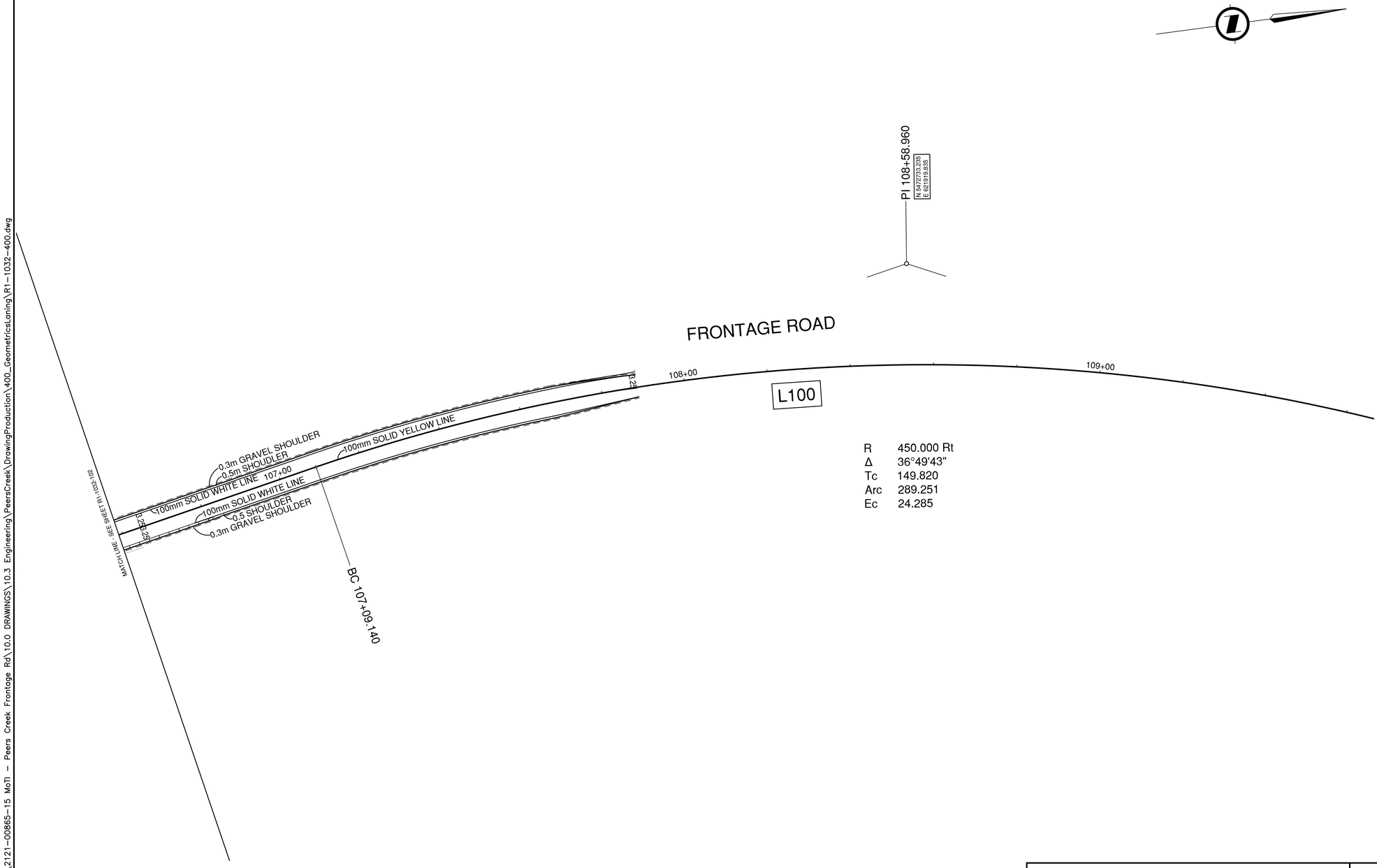
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-402	A

PLOT DATE: 2022/10/14 \\corp\TAL\colo\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\400_GeometricsLaning\R1-1032-400.dwg



ALIGNMENT	CLASSIFICATION	DESIGN SPEED
L100	LVR	50 km/h

REFERENCE DRAWINGS

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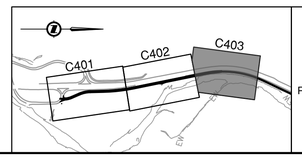
FOR PROFILE SEE DWG. R1-1032-203
FOR TYPICAL SECTIONS SEE DWG. R1-1032-301
FOR CROSS SECTIONS SEE DWG. R1-1032-1001 TO 1005

FOR DISCUSSION ONLY



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Engineers and Geoscientists of British Columbia

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Vancouver BC
Canada V6B 1C1
Tel 604 683 8521

SCALE 0 5 1:500 25m

CAD FILENAME R1-1032-400
PLOT DATE 10/14/2022

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

GEOMETRICS AND LANING

PEERS CREEK FRONTAGE RD WASHOUT RECOVERY

STA. 6+60.000 TO 10+00.000

N. GUARAN
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DATE 2022-10-14

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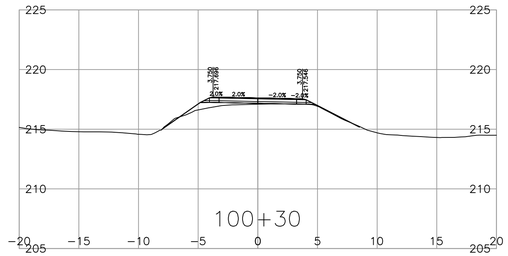
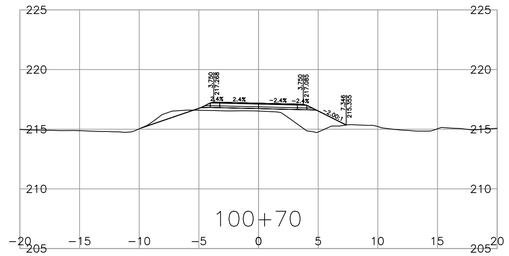
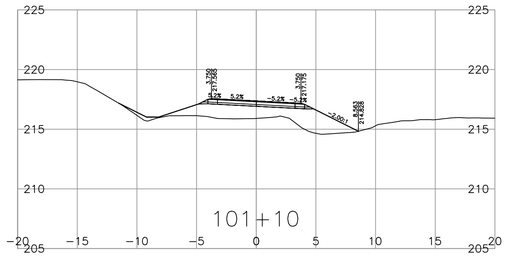
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

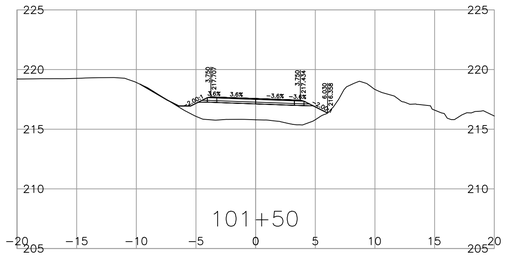
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-403	A

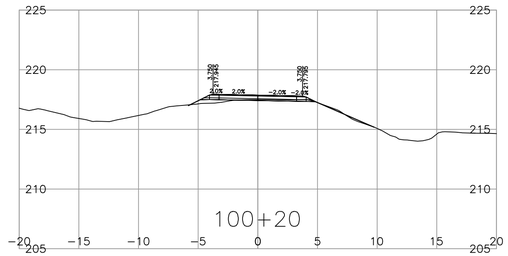
PLOT DATE: 2022/10/14 \\corp\TAL\colo\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\400_GeometricsLaning\R1-1032-400.dwg

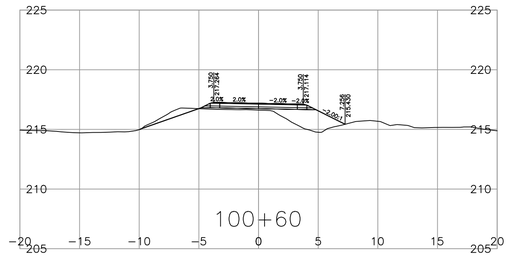


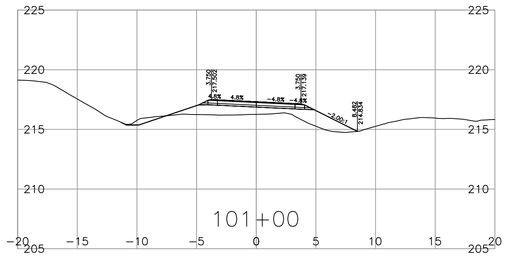


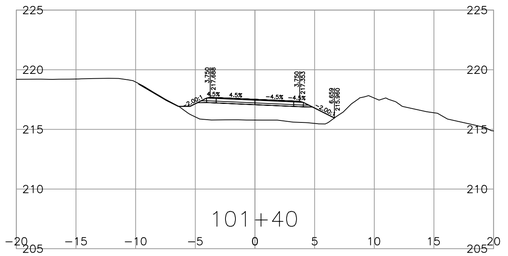


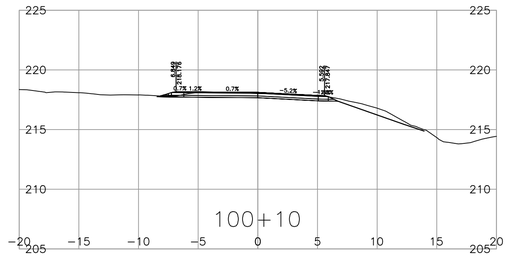


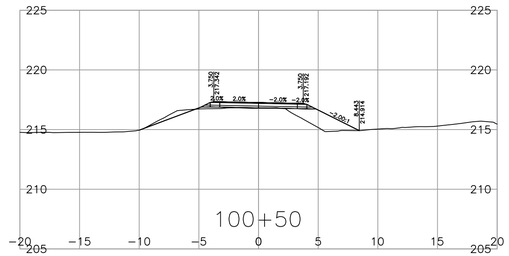


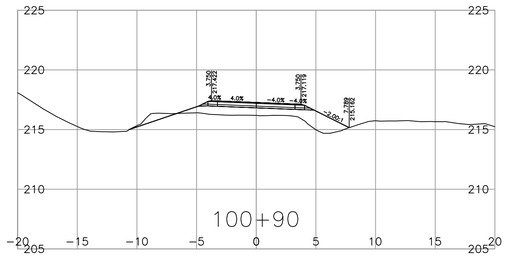


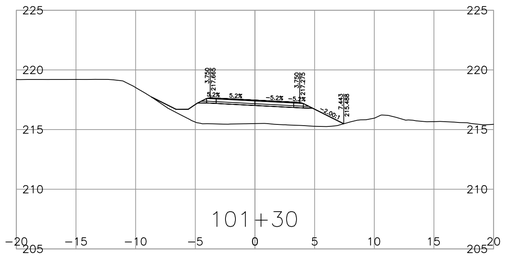


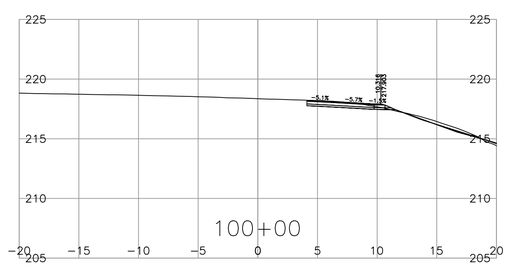


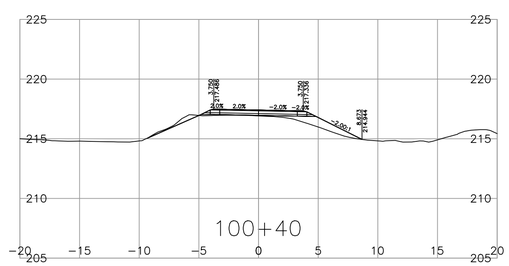


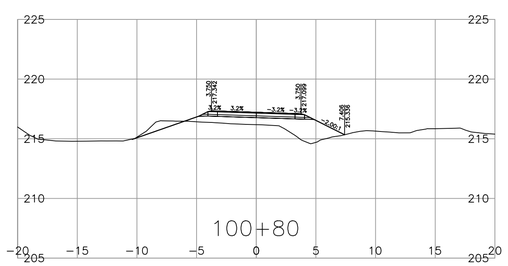


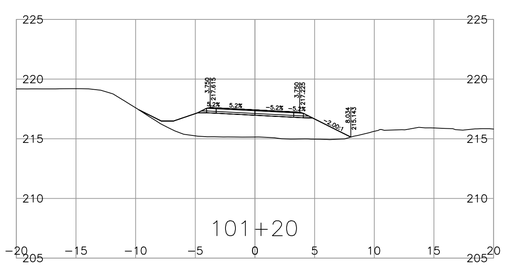












PLOT DATE: 2022/10/14 X:\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\1000_DesignSections\R1-1032-1000.dwg

SCALE 0 2 1:250 12m

CAD FILENAME R1-1032-1000

PLOT DATE 2022-10-14

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

N. GUARAN
ENGINEER OF RECORD
DATE 2022-10-14

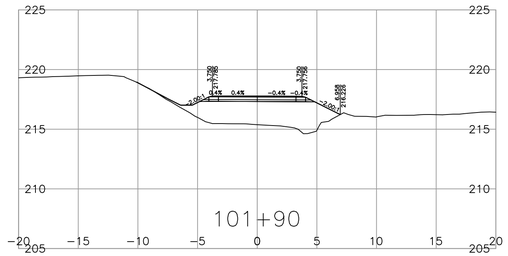
DESIGNED K. YANG DATE 2022-10-14
QUALITY CONTROL N. GUARAN DATE 2022-10-14
QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

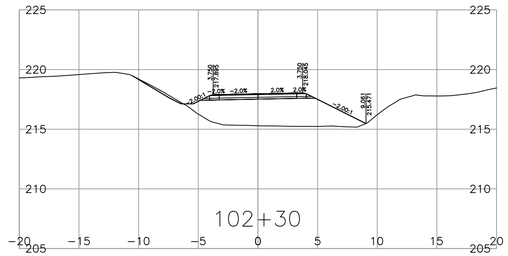
CROSS SECTIONS

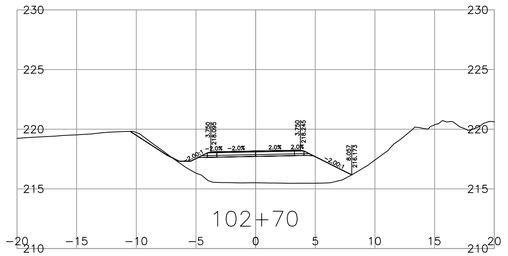
PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY

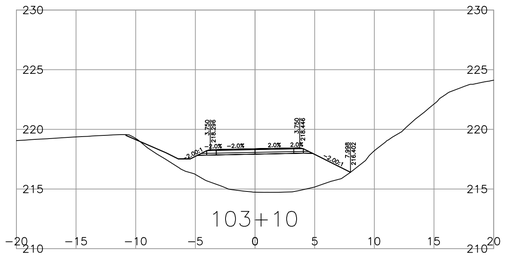
STA. 100+00 TO 0+101+50

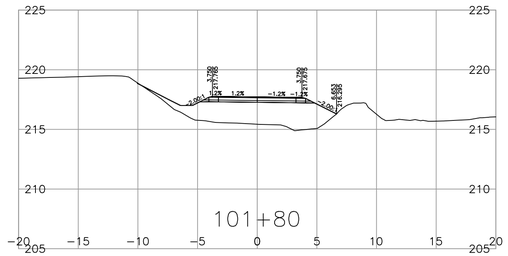
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-1001	A

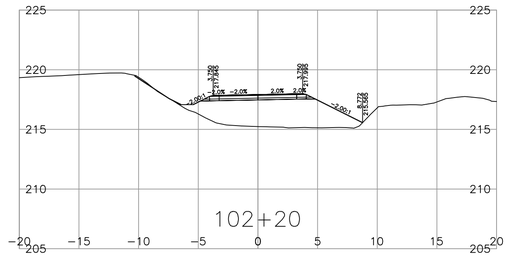


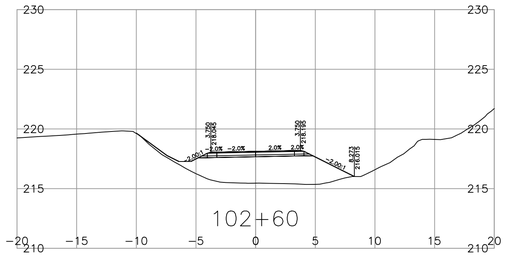


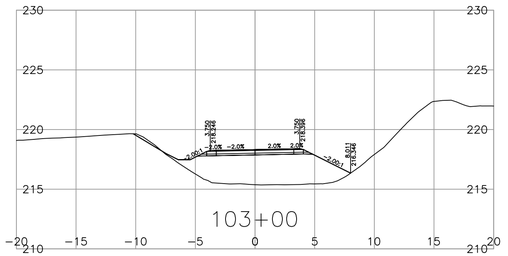


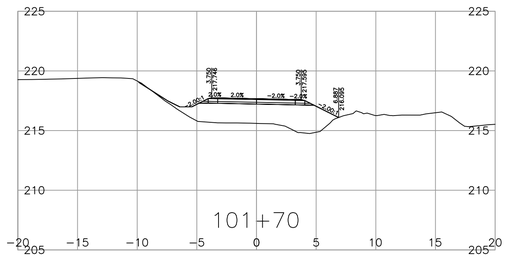


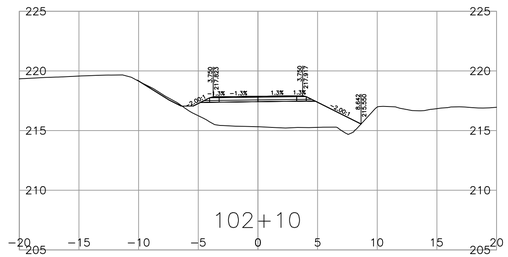


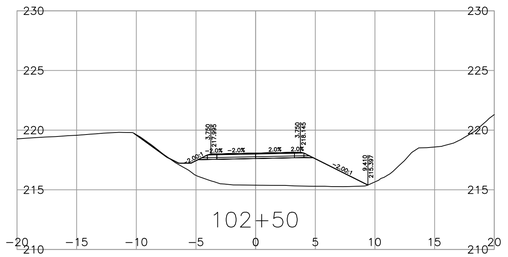


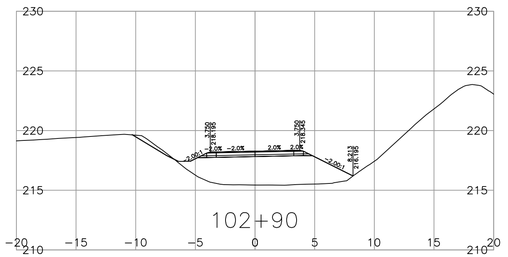


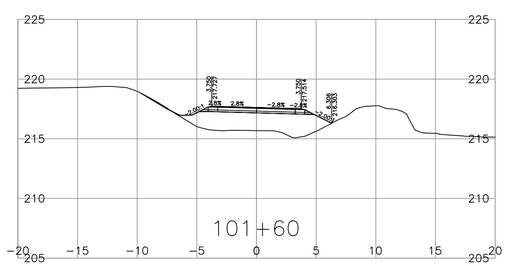


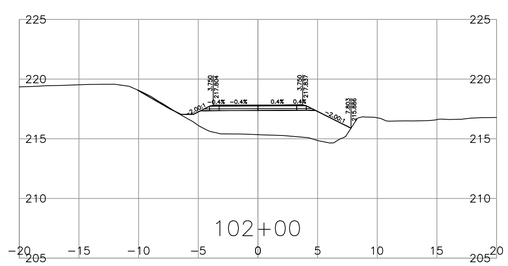


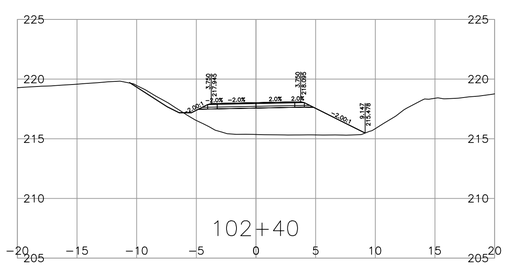


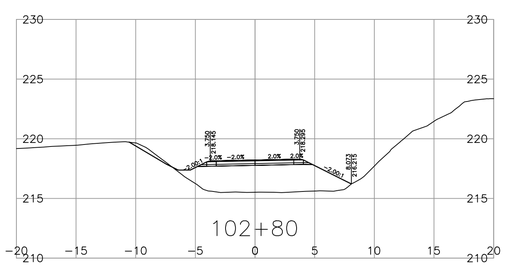












SCALE 0 2 1:250 12m

CAD FILENAME R1-1032-1000

PLOT DATE 2022-10-14

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	

BRITISH COLUMBIA

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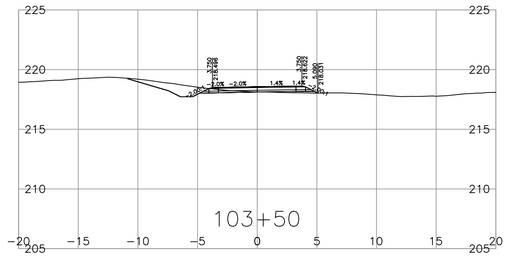
CROSS SECTIONS

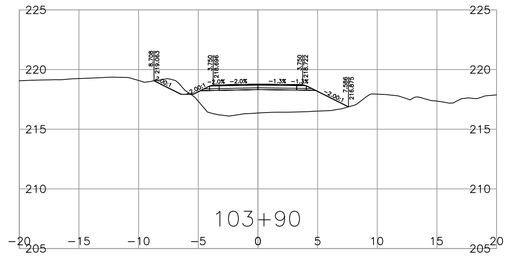
PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY

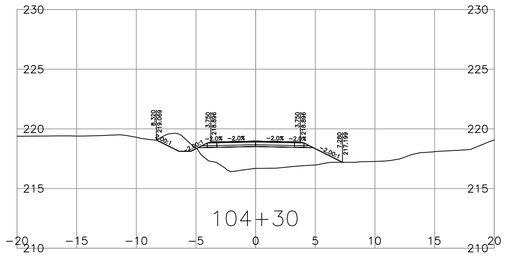
STA. 101+60 TO 103+10

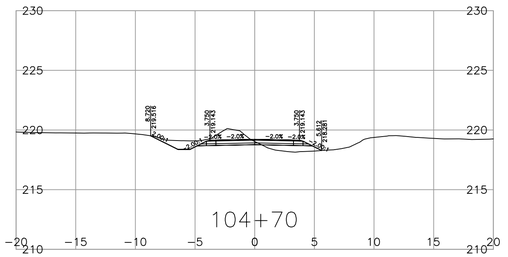
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-1002	A

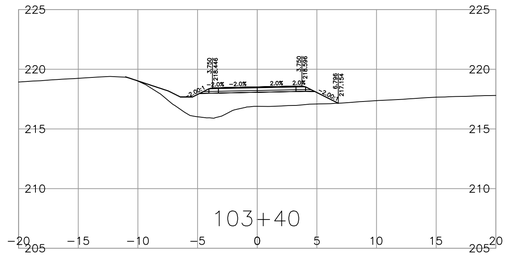
PLOT DATE: 2022/10/14 X:\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\1000_DesignSections\R1-1032-1000.dwg

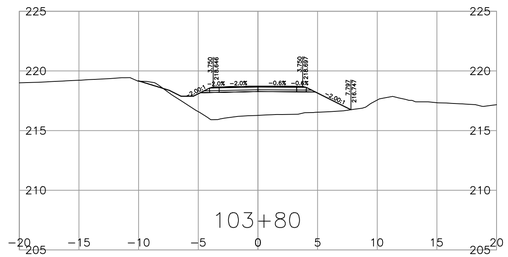


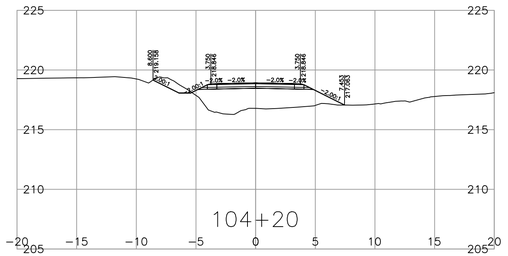


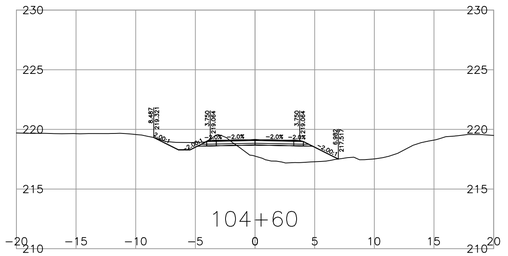


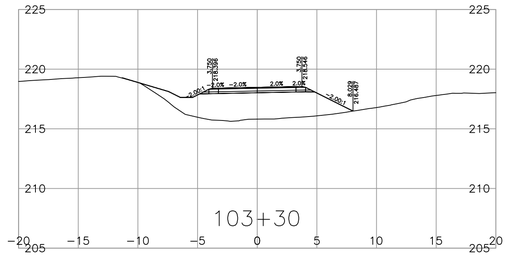


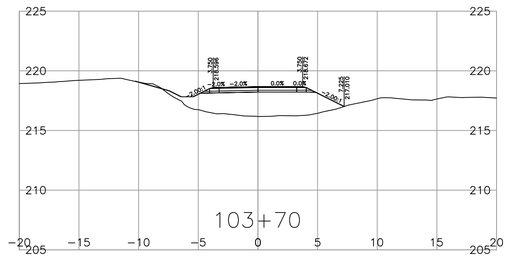


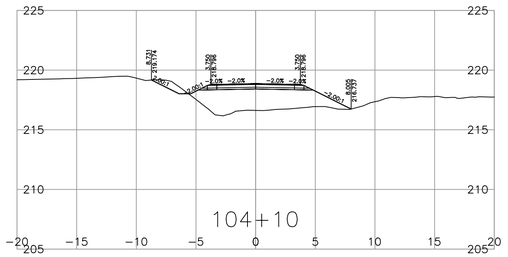


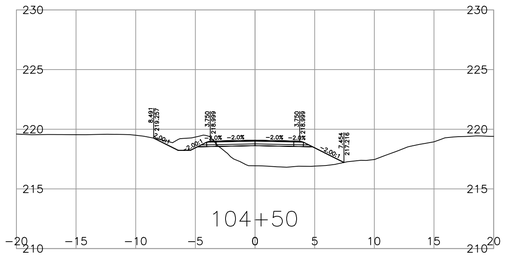


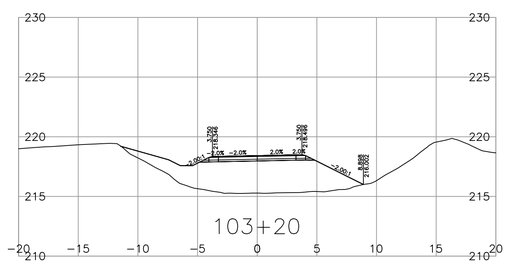


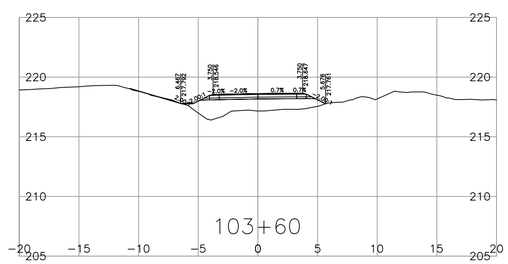


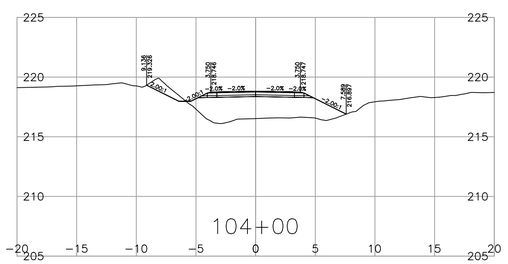


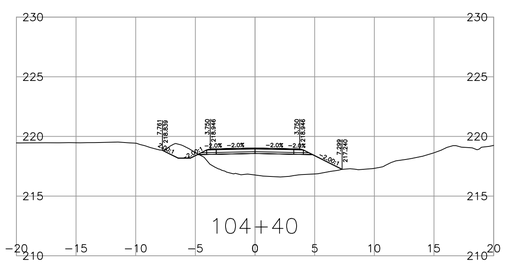












SCALE 0 2 1:250 12m

CAD FILENAME R1-1032-1000

PLOT DATE 2022-10-14

REV	DATE	REVISIONS	NAME
A	2022-10-14	50% DETAILED DESIGN	

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QUALITY ASSURANCE R. BEDARD DATE 2022-10-14
DRAWN K. MADRIGAL DATE 2022-10-14

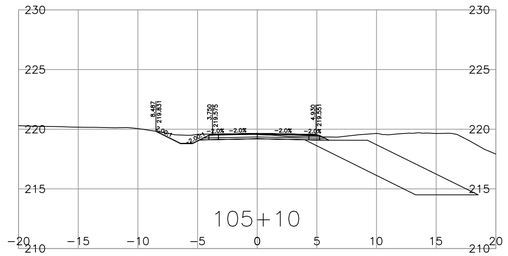
CROSS SECTIONS

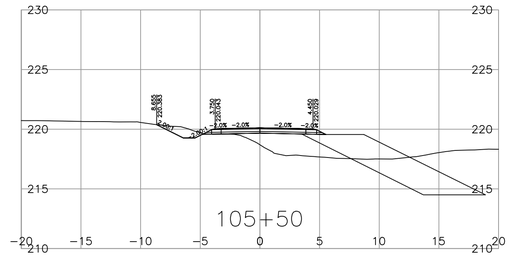
PEERS CREEK FRONTAGE RD

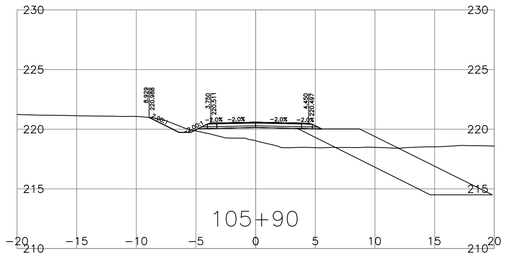
STA. 103+20 TO 104+70

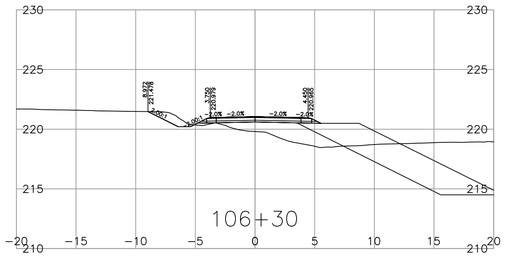
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-1003	A

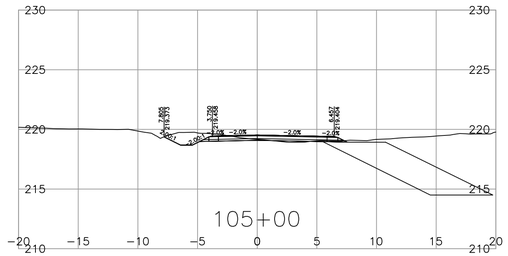
PLOT DATE: 2022/10/14 X:\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\1000_DesignSections\R1-1032-1000.dwg

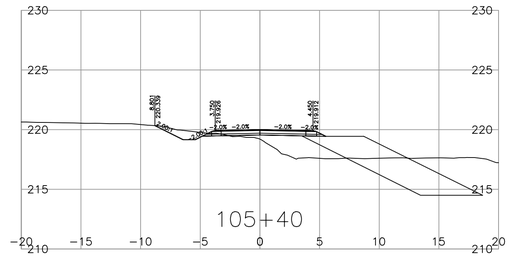


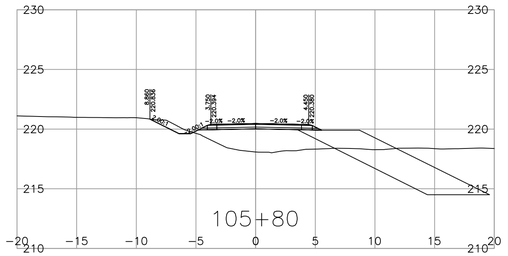


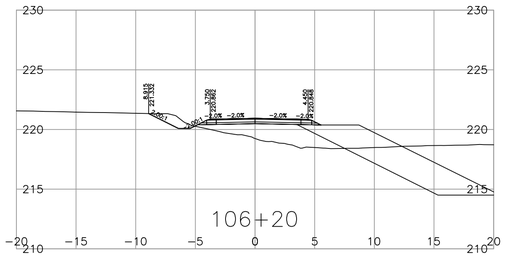


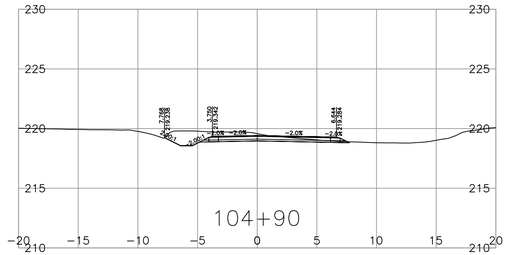


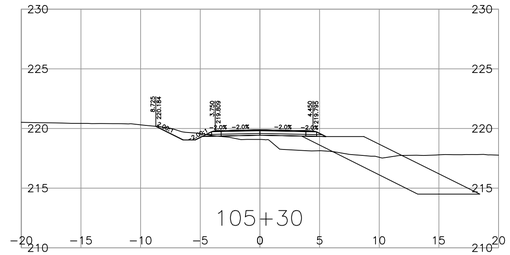


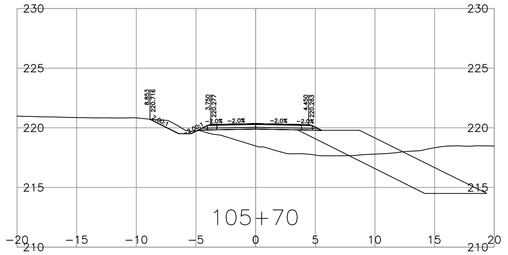


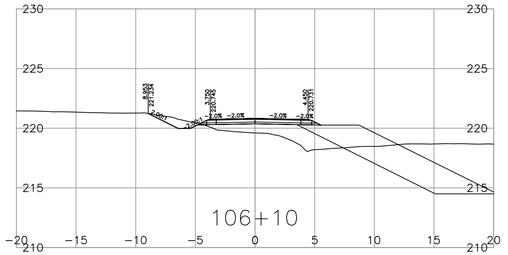


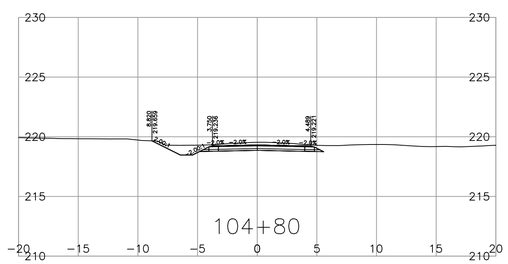


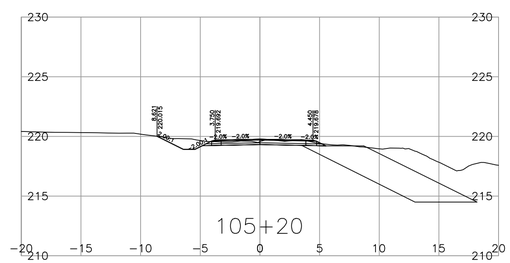


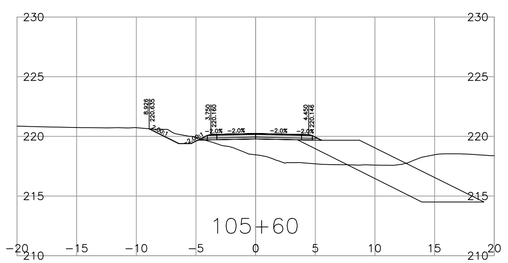


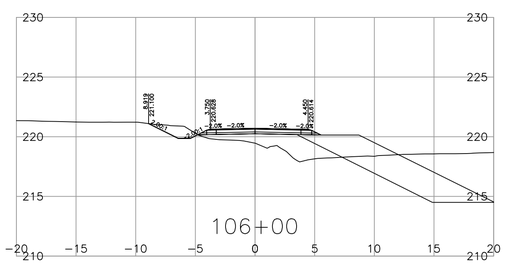












SCALE 0 2 1:250 12m

CAD FILENAME R1-1032-1000

PLOT DATE 2022-10-14

REV	DATE	REVISIONS	NAME
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BRITISH COLUMBIA

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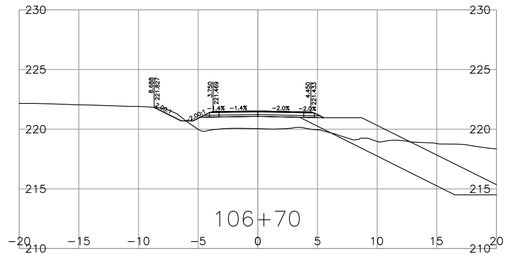
CROSS SECTIONS

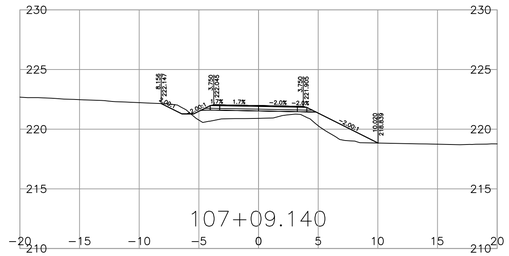
PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY

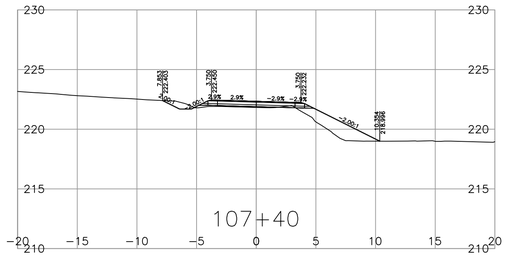
STA. 104+80 TO 106+30

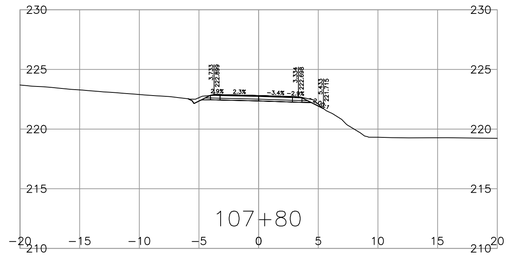
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-1004	A

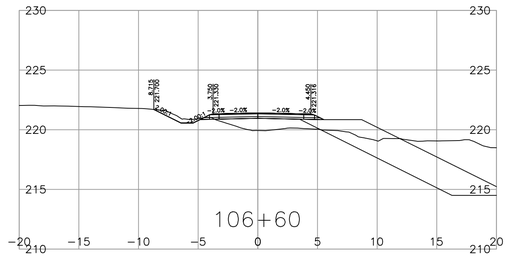
PLOT DATE: 2022/10/14 X:\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\1000_DesignSections\R1-1032-1000.dwg

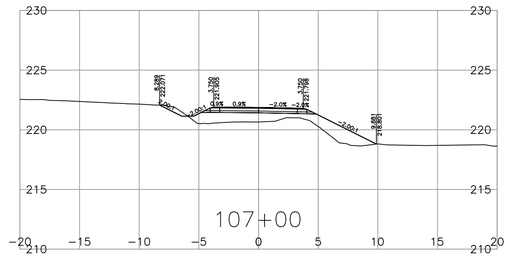


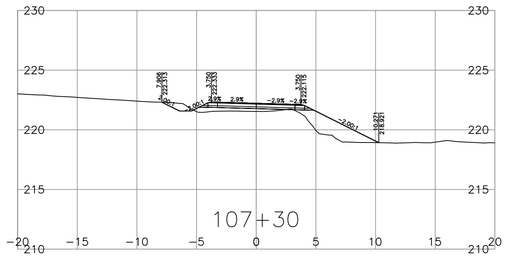


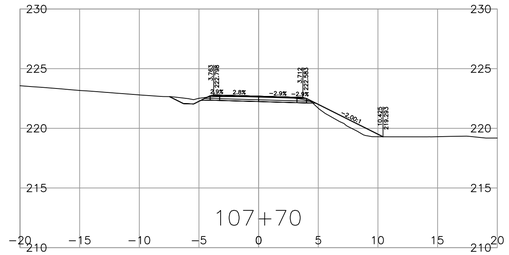


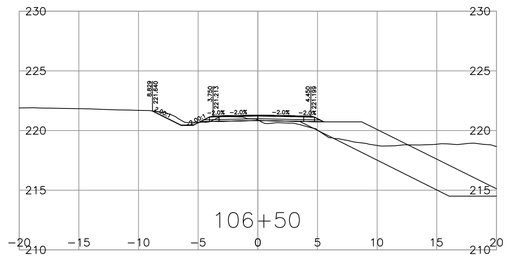


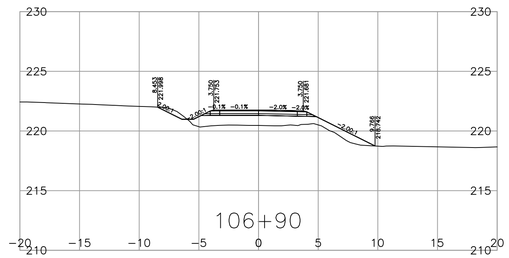


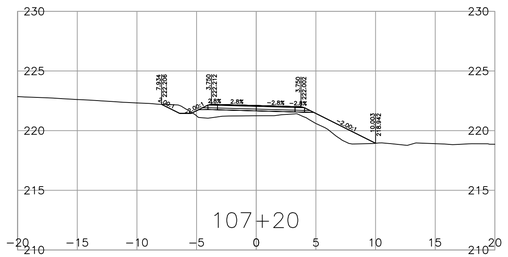


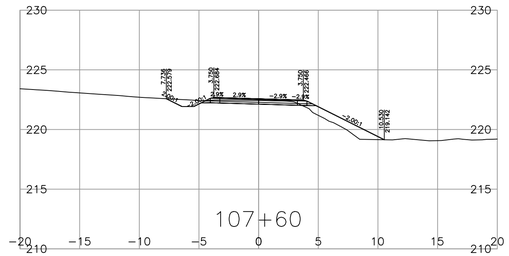


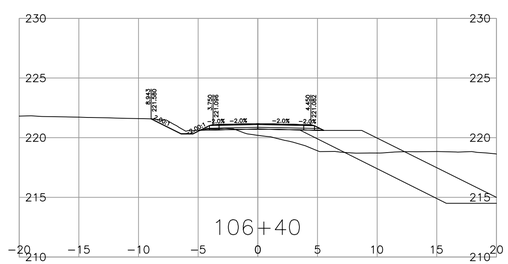


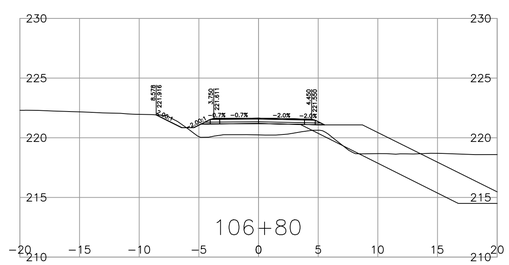


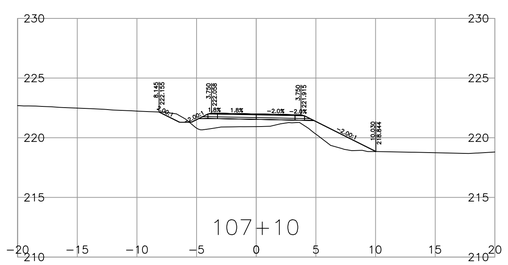


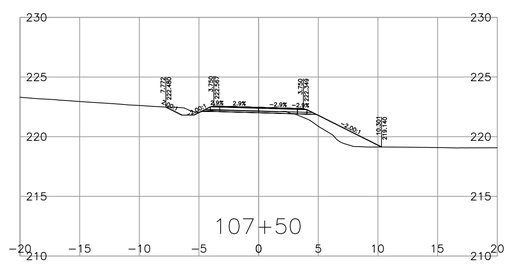












SCALE 0 2 1:250 12m

CAD FILENAME R1-1032-1000

PLOT DATE 2022-10-14

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CROSS SECTIONS

PEERS CREEK FRONTAGE RD
WASHOUT RECOVERY

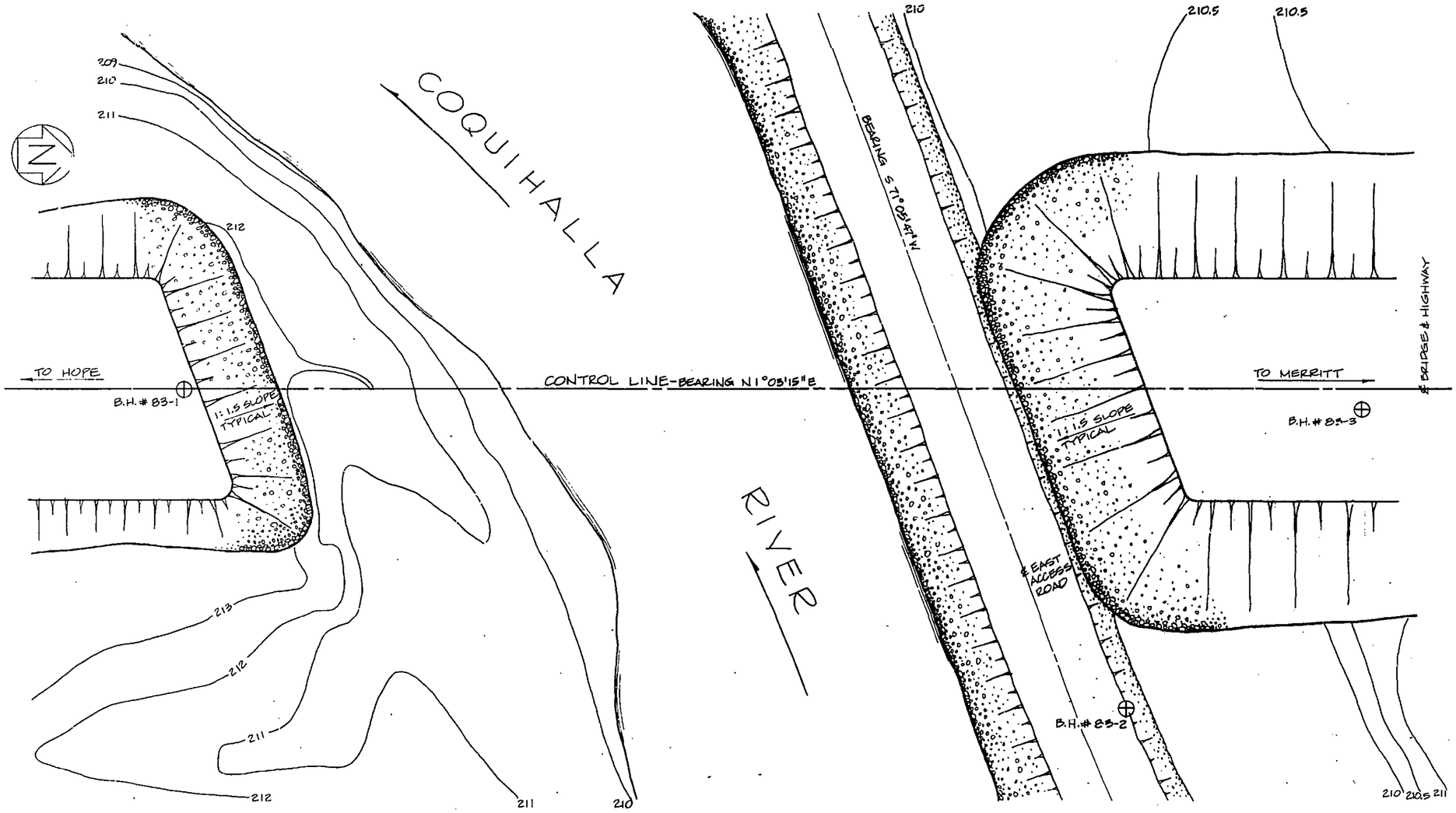
STA. 106+40 TO 107+80

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00865-15	14092-0000	1	R1-1032-1005	A

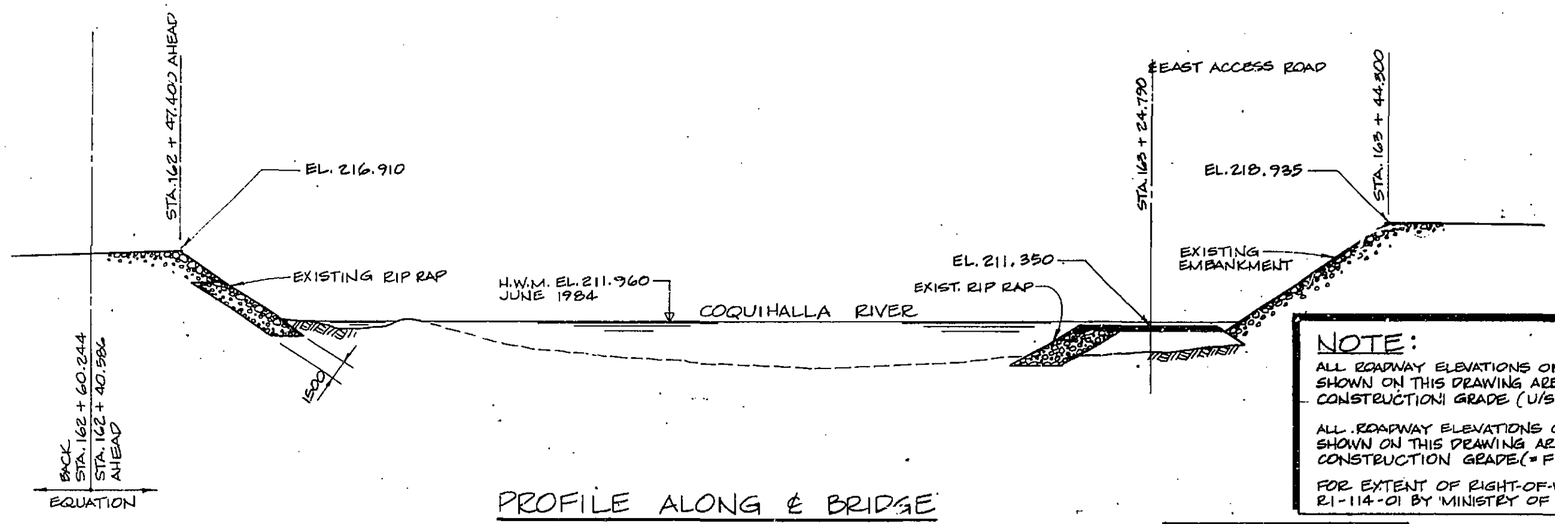
PLOT DATE: 2022/10/14 X:\2121\2121-00865-15 MoTI - Peers Creek Frontage Rd\10.0 DRAWINGS\10.3 Engineering\PeersCreek\DrawingProduction\1000_DesignSections\R1-1032-1000.dwg

APPENDIX B
HISTORICAL BOREHOLE LOGS

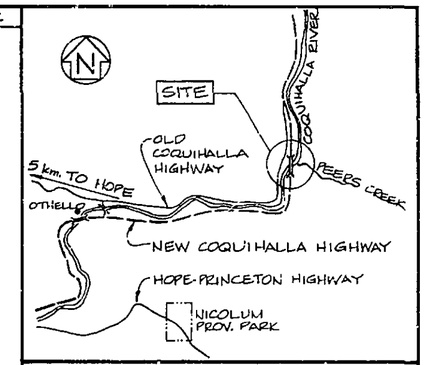
4742



PLAN

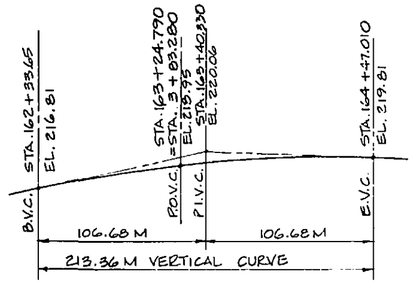


PROFILE ALONG ℄ BRIDGE



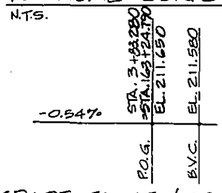
KEY PLAN

SCALE: 1 0 1 2 KILOMETRES



VERTICAL CURVE AT ℄ BRIDGE

N.T.S.



GRADE EL. AT ℄ ACCESS ROAD

N.T.S.

LIST OF DRAWINGS.

DWG. NO.	TITLE.
R1-114-01	REFERENCE DRAWING (FOR RIGHT-OF-WAY)
2692-1	SITE PLAN
2692-2	TEST HOLE LOGS
2692-3	GENERAL ARRANGEMENT- SHEET # 1
2692-4	GENERAL ARRANGEMENT- SHEET # 2
2692-5	NORTH ABUTMENT
2692-6	SOUTH ABUTMENT
2692-7	NORTH PIER
2692-8	SOUTH PIER
2692-9	POST-TENSIONED STRINGERS
2692-10	PRESTRESSED STRINGERS
2692-11	BRIDGE DECK, DECK DRAINS
2692-12	BEARINGS, CROSS FRAMES
2692-13	DIAPHRAGMS
2692-14	DECK JOINTS & MISC. DETAILS
2784-1	STANDARD BRIDGE PARAPET
2784-2	STANDARD BRIDGE PARAPET TRANSITION
2785-1	STANDARD BRIDGE PARAPET STP.EL RAILING

NOTE:

ALL ROADWAY ELEVATIONS ON THE RIGHT-OF-WAY SHOWN ON THIS DRAWING ARE 305mm. BELOW CONSTRUCTION GRADE (U/S ASPHALT)

ALL ROADWAY ELEVATIONS ON THE ACCESS ROAD SHOWN ON THIS DRAWING ARE 305mm. BELOW CONSTRUCTION GRADE (= FINISHED GRADE)

FOR EXTENT OF RIGHT-OF-WAY SEE DWG. NO. R1-114-01 BY MINISTRY OF HIGHWAYS.

CW MM CHOUKALOS WOODBURN MCKENZIE MARANDA LTD. CONSULTING ENGINEERS

D			
C			
B			
A	AS BUILT- NO CHANGE		OCT.'86
	REVISIONS		

GOVERNMENT OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
BRIDGE ENGINEERING BRANCH

CHILLIWACK DISTRICT
COQUIHALLA HIGHWAY
PEERS BRIDGE.
SITE PLAN

PREPARED UNDER THE DIRECTION OF CONSULTING ENGINEER	DATE	SCALE: 1:250 U/N		NEG. No.	282451
		DRAWN	AUG.'84	CHECKED	T.C. NOV'84
APPROVED FOR USE IN CONSTRUCTION DIRECTOR OF BRIDGE ENGINEERING	DATE 85.01.02	EXAMINED AND ACCEPTED EXECUTIVE DIRECTOR OF ENGINEERING		DATE	DRAWING No. 2692-1

CANCEL PRINTS BEARING EARLIER LETTER

BOREHOLE No. 83-1

Location STA. 162+68(BK) - 162+48.3 (AHD.) Elevation 214.74m
Driller D. ROBERTS Method DIAMOND DRILL Dates 83-09-01.

Depth (m)	Sample Type	Blowcount	Recovery (m)	Shear Strength (kPa)	Gradation % Fines	Sand	Gravel	Index Properties W_L	W_p	W	Classification	Description	Other Tests
1	S	54	.30		5	40	55					about 15% larger than 0.05 m ø in field according to driller	
2													
3	S	100"	0									very dense GRAVEL, boulders, sandy, brown, saturated	
4													
5	S	96	.20		5	35	60				GP + SB + LB		
6	S	100"	.30		5	35	60						
7		100"	.15			20	80						
8												about 60% larger than 0.1m ø in fluid according to driller in field.	
9	S	100"	.15			20	80						
10												10.4m	
11		100"	.08			15	85						
12		100"	.20		20	15	65				GM	very dense GRAVEL, silty and sandy, light brown saturated	
13													
14		100"	.13		25	15	60				GM		
15		100"	.10		5	30	65						
16												15.9m	
17													
18	S	100"	.18		15	65	20				SM - SP	very dense SAND, gravelly, some silt, light brown, saturated.	
19													
20													
21		100"	.18		5	65	30						
22													

BOREHOLE No. 83-2

Location STA. 163+42 (AHD.) 38m RT. Elevation 210.94
Driller E. BUDZKO Method DIAMOND DRILL Dates 83-8-17.

Depth (m)	Sample Type	Blowcount	Recovery (m)	Shear Strength (kPa)	Gradation % Fines	Sand	Gravel	Index Properties W_L	W_p	W	Classification	Description	Other Tests
1	S	100"	.18		5	50	45				GP LB	very dense GRAVEL, with boulders to .36 m ø, grey brown saturated.	
2													
3	S	100"	.20		5	25	70						
4												3.7m	
5	S	51	.36		10	35	55				GP GM + LB	very dense GRAVEL, large boulders, grey-brown, saturated	
6											LB	6.1m	
7	S	65	.41		5	40	55				GP + SB	very dense GRAVEL, sandy, boulders up to 0.25m ø, grey-brown, sat.	
8	S	73	.56		5	40	55					8.2m	
9	S	100"	.43		5	40	55				SP + SB	very dense SAND, gravelly, some rocks to 0.1m ø grey-brown, saturated.	
10													
11	S	90	.25			90	10					11.3m	
12	S	100"	.28			35	65				GP + SB	very dense GRAVEL, sandy, rocks to 0.15m ø grey-brown, saturated.	
13													
14	S	88	.36		5	35	60						
15		100"	.28		5	35	60					15.54m END OF HOLE	

BOREHOLE No. 83-3 CONT'D.

Location Elevation
Driller Method Dates

Depth (m)	Sample Type	Blowcount	Recovery (m)	Shear Strength (kPa)	Gradation % Fines	Sand	Gravel	Index Properties W_L	W_p	W	Classification	Description	Other Tests
24													
25		100"	.20		10	85	25				GP GM	very dense GRAVEL, sandy, grey-brown saturated.	
26													
27													
28		100"	.10		5	40	55						
29													
30		100"	.15			40	60					30.6m END OF HOLE	

BOREHOLE No. 83-1 CONT'D.

Location Elevation
Driller Method Dates

Depth (m)	Sample Type	Blowcount	Recovery (m)	Shear Strength (kPa)	Gradation % Fines	Sand	Gravel	Index Properties W_L	W_p	W	Classification	Description	Other Tests
24											SM - SP		
	S	90	.46		5	60	35						
												24.7m END OF HOLE	

BOREHOLE No. 83-3

Location STA. 163+66 (AHD.) 1.8m RT. Elevation 210.92.
Driller E. BUDZKO Method DIAMOND DRILL Dates 83-08-17.

Depth (m)	Sample Type	Blowcount	Recovery (m)	Shear Strength (kPa)	Gradation % Fines	Sand	Gravel	Index Properties W_L	W_p	W	Classification	Description	Other Tests
											SP	SAND	
1												0.6m	
2	S	100"	.20		5	25	70				GP SB + LB	LB very dense GRAVEL, sandy rocks up to 0.25m ø, grey brown, saturated	
3	S	88	.13			30	70						
4												4.0m	
5	S	57	.31			55	45						
6	S	38	.38			75	25				SP + SB	dense SAND, gravelly, rocks up to 0.1m ø grey-brown, saturated	
7	S	37	.46			65	35						
8													
9												silty	
10	S	64	.48		10	55	35					9.0m	
11	S	100"	.28		5	15	80				GP SB	very dense GRAVEL, some rocks, grey-brown	
12	S	93	.51		5	85	10					11.3m	
13													
14	S	100"	.37		15	50	25				SP SM + SB	very dense SAND, gravelly and silty, grey-brown, saturated.	
15	S	100"	.43		20	65	15						
16													
17												17.1m	
18		100"	.15			20	80				GP SB	very dense GRAVEL, boulders to 0.15m ø, grey brown, sat.	
19												18.6m	
20													
21											SM	very dense SAND, gravelly and sandy grey-brown, saturated.	
22	S	100"	.36		15	70	15						

BOREHOLE No.

Location Elevation
Driller Method Dates

Depth (m)	Sample Type	Blowcount	Recovery (m)	Shear Strength (kPa)	Gradation % Fines	Sand	Gravel	Index Properties W_L	W_p	W	Classification	Description	Other Tests

SOIL CLASSIFICATION

MAJOR DIVISIONS		SYMBOL	SOIL TYPE
COARSE GRAINED SOILS	GRAVEL & GRAVELLY SOILS	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES. LITTLE OR NO FINES
		GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES. LITTLE OR NO FINES
		GM*	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		GC*	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND & SANDY SOILS	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SM*	SILTY SANDS SAND-SILT MIXTURES
		SC*	CLAYEY SANDS SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS L.L. < 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS L.L. > 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
ORGANIC SOILS		Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS
TOPSOIL		TS	TOPSOIL WITH ROOTS, ETC.
COBBLES		SB	ROCK FRAGMENTS AND COBBLES, PARTICLE SIZE 75 mm TO 300 mm DIAMETER
BOULDERS		LB	BOULDERS, PARTICLE SIZE OVER 300 mm IN DIAMETER

* GM_1: GC_1: SM_1: SC_1: 12 - 20%
GM_2: GC_2: SM_2: SC_2: 20 - 30%
GM_3: GC_3: SM_3: SC_3: 30 - 40%
GM_4: GC_4: SM_4: SC_4: 40 - 50%
passing No. 200 sieve

NOTE:
TEST HOLES WERE DRILLED PRIOR TO CONSTRUCTION OF ACCESS ROAD AND COQUIHALLA HIGHWAY RIGHT-OF-WAY.

SAMPLE TYPE	SHEAR STRENGTH	TESTS
A - Auger	U - Unconfined Compression	M - Mechanical Analysis
C - Core	L_v - Lab Vane	$\overline{O}\overline{R}S$ - Triaxial Compression
D - Denison	F_v - Field Vane	C - Consolidation
P - Pitcher Sampler	R - Remoulded	D S - Direct Shear
S - Split Spoon		W_L W_p - Liquid Plastic Limits
T - Shelby Tube		W - Moisture Content
W - Wash		

Blowcount - Standard Penetration Test (A S T M 1586)

PREPARED BY:
GEOTECHNICAL & MATERIALS BRANCH

DRAWING NO.

INDEX	NEG NO	SHT NO
P	91,759	1 of 1

REVISIONS

Date	Description	Initial

GOVERNMENT OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
BRIDGE ENGINEERING BRANCH

PEERS CREEK BRIDGE
TEST HOLE LOGS
COQUIHALLA.

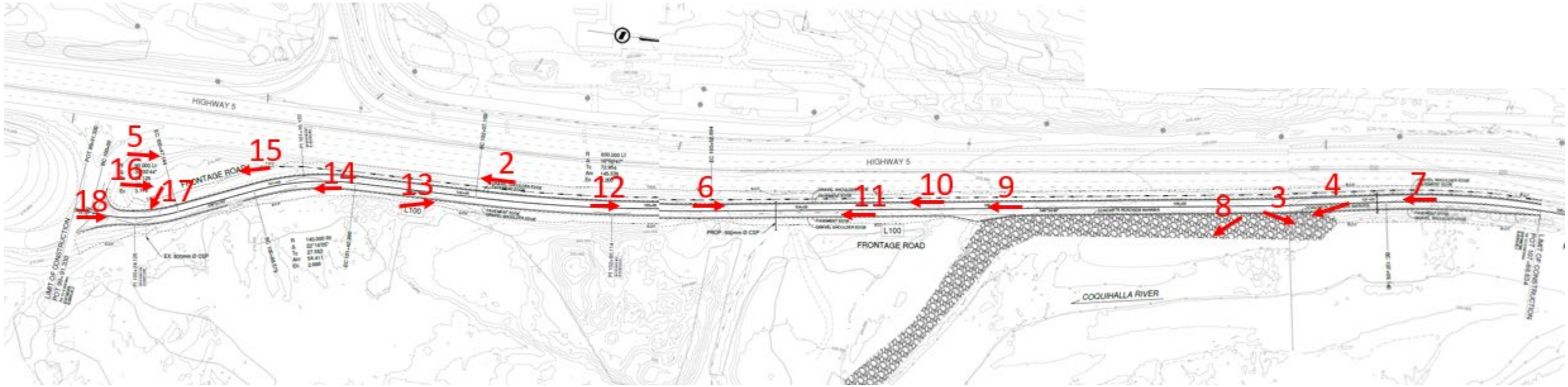
PEERS CREEK, COQUIHALLA

PREPARED UNDER THE DIRECTION OF	DATE	SCALE:	NEG No 282452
GEOTECHNICAL ENGINEER	84.9.11	DRAWN KFR 84.9.10	CHECKED 84.9.11
APPROVED FOR USE IN CONSTRUCTION: DIRECTOR OF BRIDGE ENGINEERING	DATE 85.01.02	EXAMINED AND ACCEPTED: EXECUTIVE DIRECTOR OF ENGINEERING	DATE 1985 12 20

DRAWING No. 2692-2

CANCEL PRINTS BEARING EARLIER LETTER

APPENDIX C
SELECT SITE PHOTOGRAPHS



Photograph location plan showing the location of the ground shot photos with the arrow indicating the direction of the photo. Plan view from Appendix A (50 % Design Drawing Package October 14, 2022).

Photograph 1. **Aerial view looking south (downstream) with the red dashed line showing the washout of the Peer's Creek Frontage Road (PCFR) which run adjacent to eastbound Highway 5 (Photograph provided by MoTI taken on December 2, 2021).**

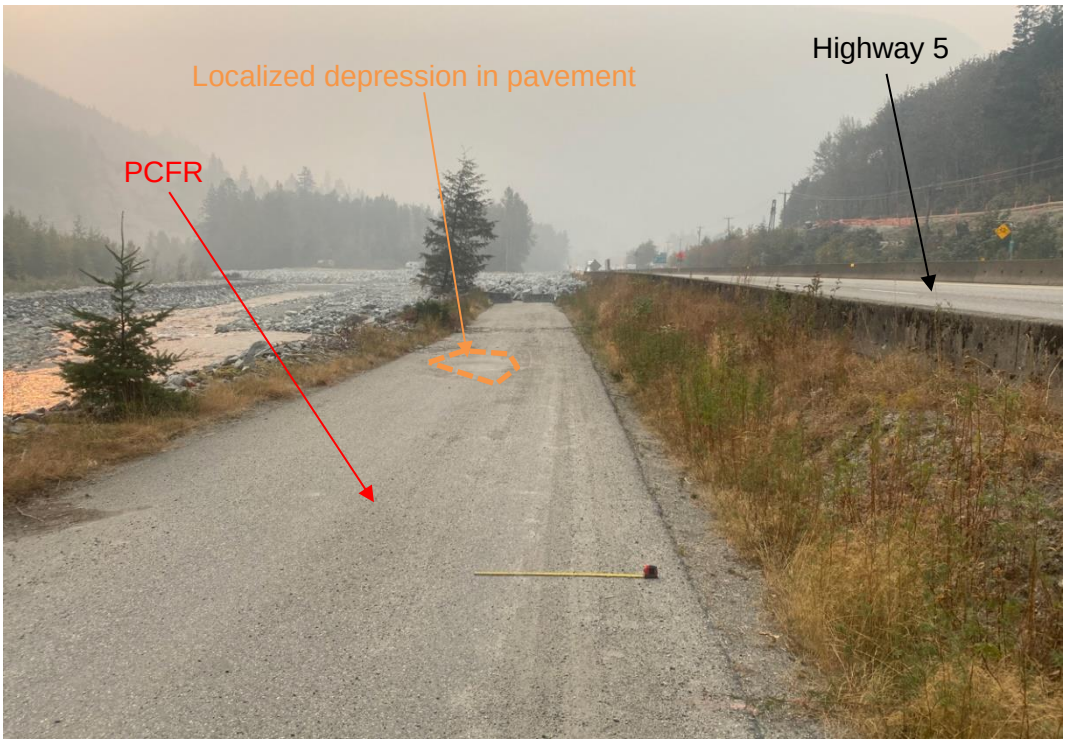
Photograph 2. **View looking south (downstream) with the red dashed line showing the washout of PCFR which runs adjacent to eastbound Highway 5 (Photograph provided by MoTI taken on December 11, 2021).**

Photograph 3. **View looking northeast (upstream) with the red dashed line showing the washout of the PCFR which runs adjacent to eastbound Highway 5 (Photograph provided by MoTI taken on February 27, 2022).**

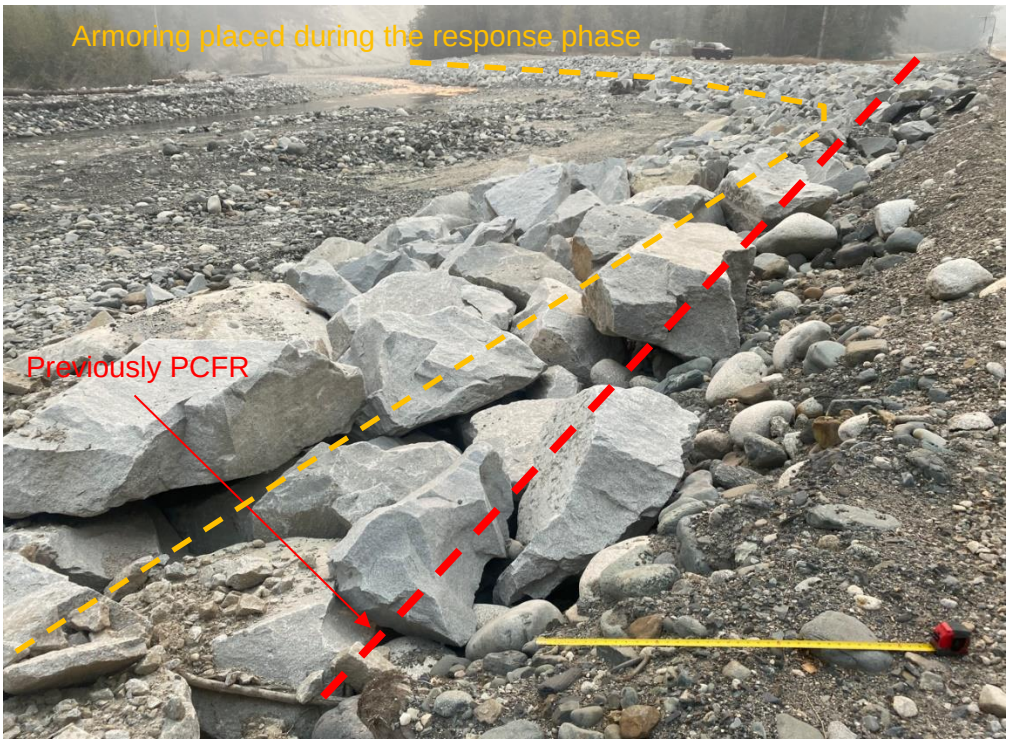
Photograph 4. **View looking south (downstream) with the red dashed line showing the washout of the PCFR which runs adjacent to eastbound Highway 5 (Photograph provided by MoTI taken on March 9, 2022).**

Photograph 5. **View looking northeast (upstream) showing rockfill placement along the previous PCFR alignment which runs adjacent to eastbound Highway 5 (Photograph provided by MoTI taken on March 2, 2022).**

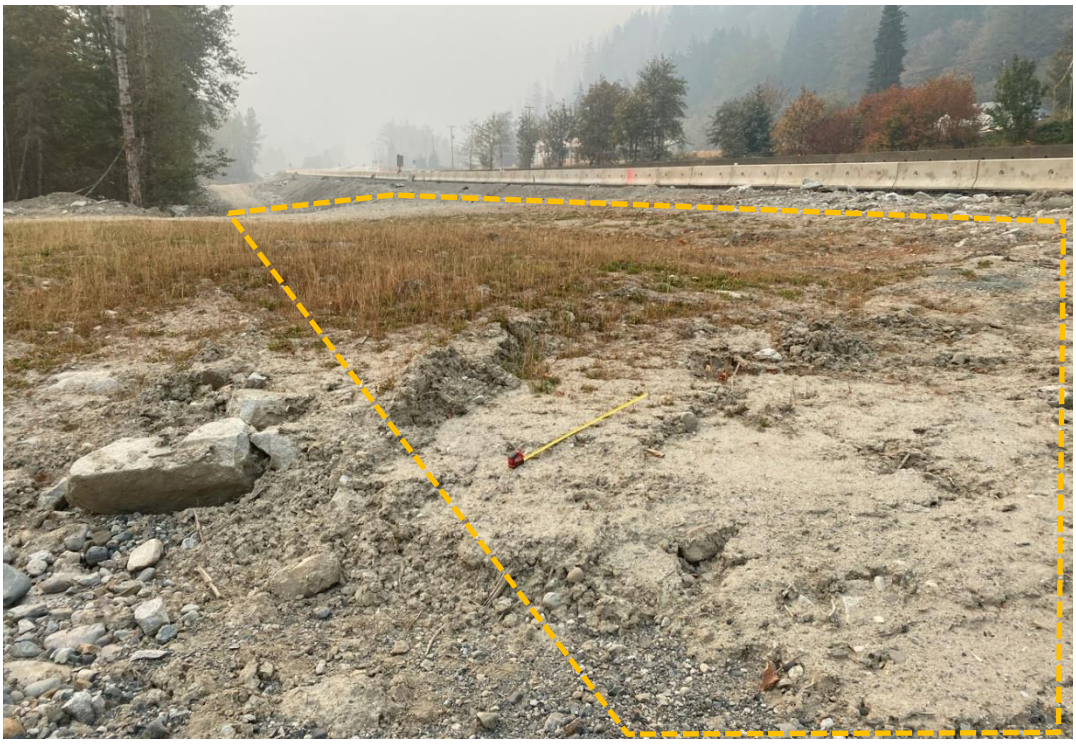
Photograph 6. **View looking north (upstream) with the red dashed line showing the washout of the PCFR, which runs adjacent to eastbound Highway 5 (Photograph provided by MoTI taken on March 9, 2022).**



Photograph 7. **View looking south (downstream) along the existing PCFR at the north end project limits with the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**



Photograph 8. **View looking southeast (downstream) at riprap placed during the initial response work (in yellow) with the approximate alignment of the PCFR prior to the washout in the red dashed line. The measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**

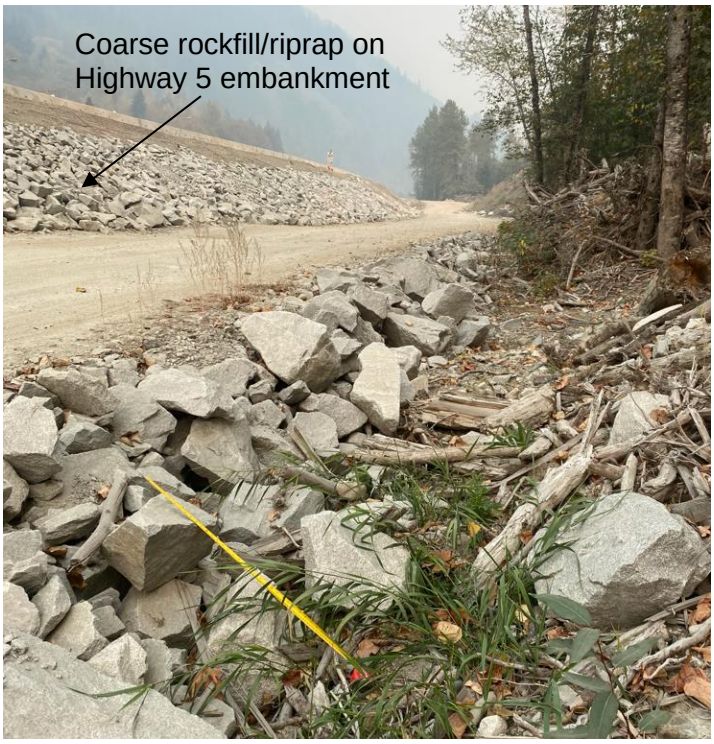


Photograph 9. **View looking southwest (downstream) showing embankment fill (in orange) during the initial response work with the measuring tape extended to 1 m in the photo. Apparent topsoil layer was placed on the embankment fill and seeded (Photograph by BGC taken on October 18, 2022).**

Photograph 10. **View looking south (downstream) at embankment fill placed during the initial response work with the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**

Photograph 11. **View looking south (downstream) along the previous PCFR alignment, the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**

Photograph 12. **View looking north (upstream) along the previous PCFR alignment at the fill placed early in the response phase of work, the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**



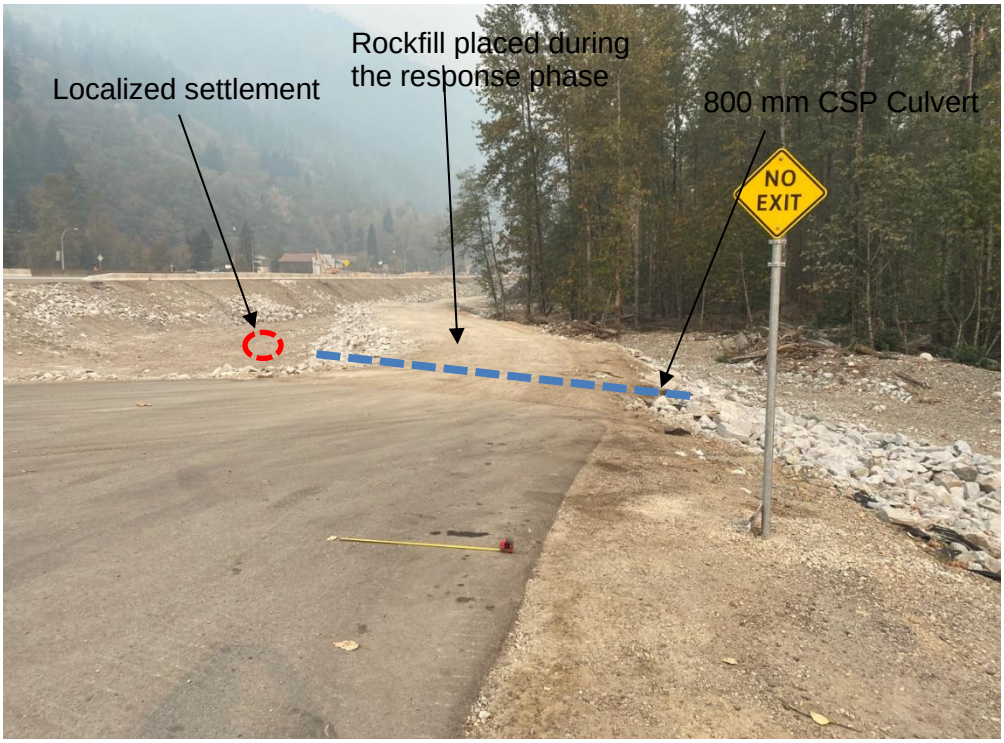
Photograph 13. **View looking northwest (upstream) along the previous PCFR alignment the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**

Photograph 14. **View looking south (downstream) along the previous PCFR alignment, the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**

Photograph 15. **View looking southeast (downstream) where the previous PCFR alignment with rockfill placed during the response work, the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**

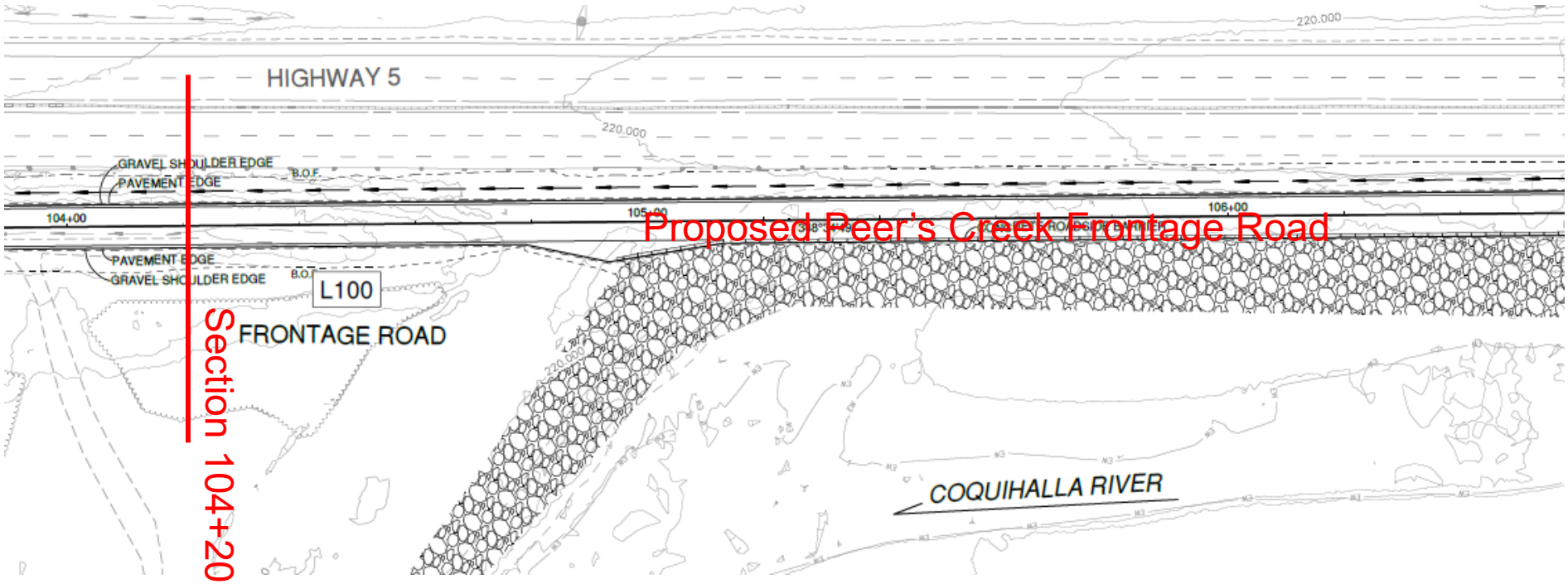
Photograph 16. **View looking northwest (upstream) at a localized settlement area (as outlined in red) near the previous PCFR alignment the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**

Photograph 17. **View looking east at rockfill placed following the initial response work with an 800 mm diameter CSP culvert, the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**



Photograph 18. **View looking northwest (upstream) at rockfill placed during the response phase at the south project limits, the measuring tape extended to 1 m in the photo (Photograph by BGC taken on October 18, 2022).**

APPENDIX D
STABILITY RESULTS



NOTES

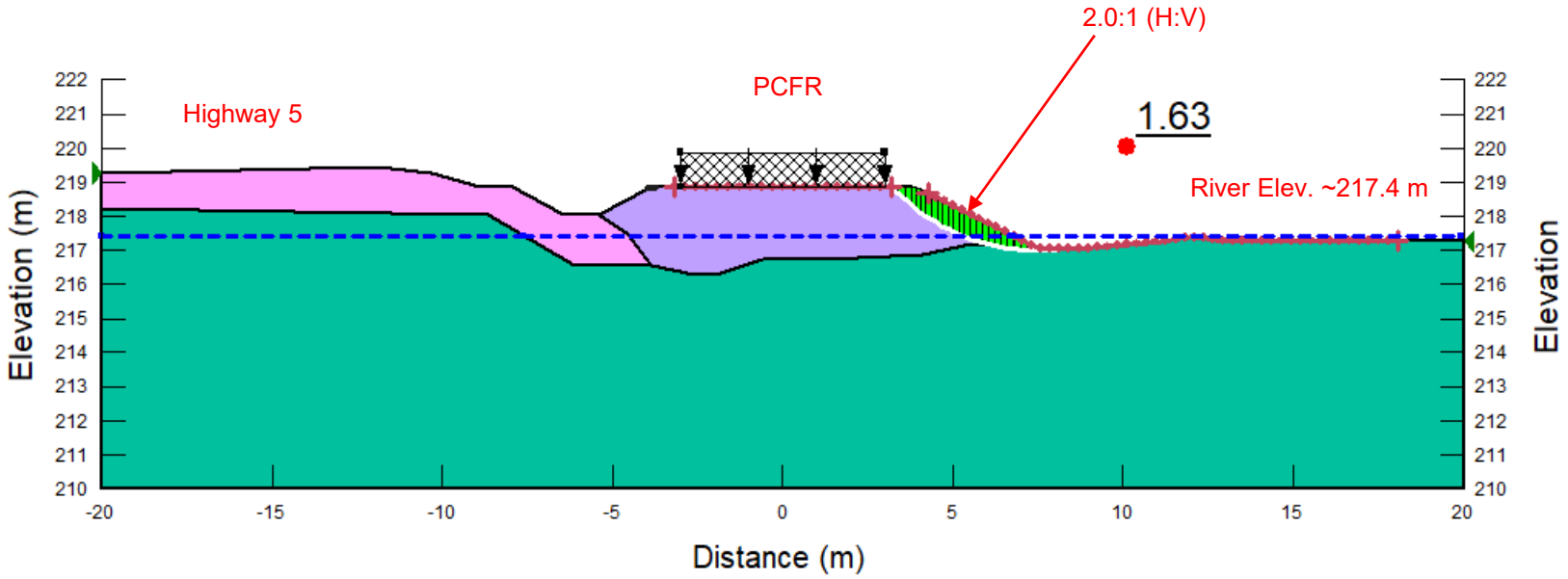
1. THIS FIGURE SHOULD BE READ IN CONJUNCTION WITH BGC'S LETTER REPORT TITLED PEERS CREEK FRONTAGE ROAD GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS AND DATED APRIL 2023.
2. ROAD AND EMBANKMENT DESIGNED BY MCELHANNEY. DRAWINGS AND REFERENCE SECTIONS PROVIDED IN APPENDIX A OF THIS REPORT.

PREPARED BY: IKP	FIGURE TITLE: INTERPRETED CRITICAL SECTIONS ALONG PEERS CREEK FRONTAGE ROAD (~104+20)		
CHECKED BY: MD	CLIENT: BRITISH COLUMBUA MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		
APPROVED BY: IKP	SCALE: NTS	PROJECT NO: 0272097	FIGURE NO: D-1

0 5 10 mm in ANSI A sized paper

BGC ENGINEERING INC.

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	EARTH EMBANKMENT (EXISTING)	20	0	36	1
	EARTH EMBANKMENT (NEW)	20	0	36	1
	FLUVIAL	20	0	35	1



NOTES

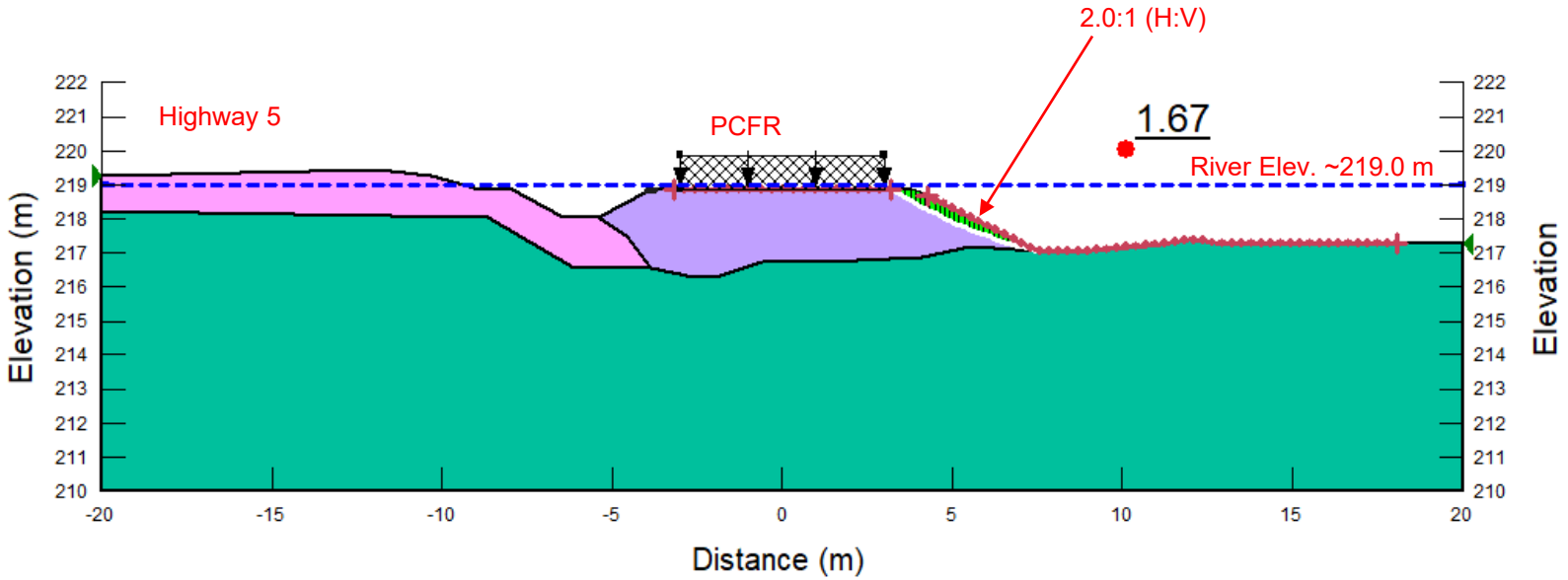
1. THIS FIGURE SHOULD BE READ IN CONJUNCTION WITH BGC'S LETTER REPORT TITLED PEERS CREEK FRONTAGE ROAD GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS AND DATED APRIL 2023.
2. ROAD AND EMBANKMENT DESIGNED BY MCELHANNEY. DRAWINGS AND REFERENCE SECTIONS PROVIDED IN APPENDIX A OF THIS REPORT.
3. THE SECTION SHOWS THE CONCEPTUAL GEOLOGICAL INTERPRETATION BASED ON SITE OBSERVATIONS AND BOUNDARIES BETWEEN MATERIAL UNITS SHOULD BE CONSIDERED APPROXIMATE.
4. THE ENTRY SURFACE WAS RESTRICTED TO BE NO CLOSER THAN ABOUT 0.5 M FROM THE ROAD SHOULDER.

PREPARED BY: IKP	FIGURE TITLE: CASE 1 - PEERS CREEK FRONTAGE ROAD (~104+20) 2.0:1 (H:V) EMBANKMENT SLOPES, STATIC STEADY STATE STABILITY ANALYSIS RESULT		
CHECKED BY: MD	CLIENT: BRITISH COLUMBUA MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		
APPROVED BY: IKP	SCALE: NTS	PROJECT NO: 0272097	FIGURE NO: D-2

0 5 10 mm in ANSI A sized paper

BGC ENGINEERING INC.

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	EARTH EMBANKMENT (EXISTING)	20	0	36	1
	EARTH EMBANKMENT (NEW)	20	0	36	1
	FLUVIAL	20	0	35	1



NOTES

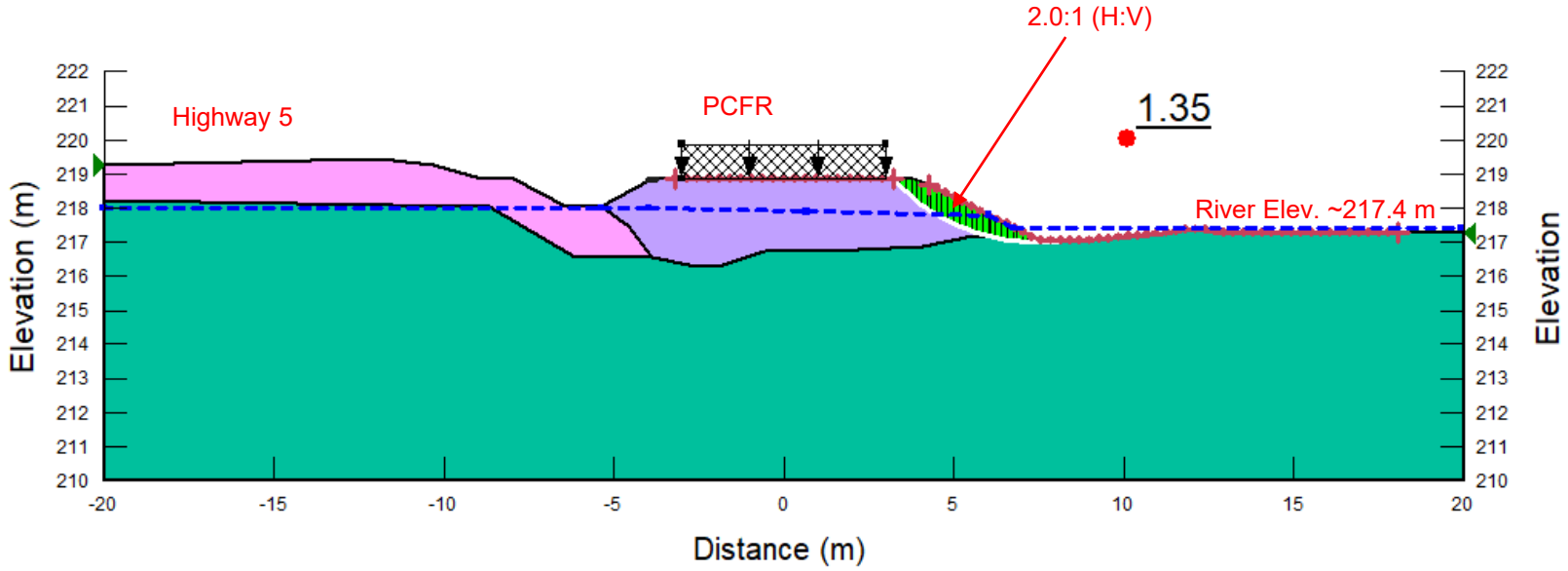
1. THIS FIGURE SHOULD BE READ IN CONJUNCTION WITH BGC'S LETTER REPORT TITLED PEERS CREEK FRONTAGE ROAD GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS AND DATED APRIL 2023.
2. ROAD AND EMBANKMENT DESIGNED BY MCELHANNEY. DRAWINGS AND REFERENCE SECTIONS PROVIDED IN APPENDIX A OF THIS REPORT.
3. THE SECTION SHOWS THE CONCEPTUAL GEOLOGICAL INTERPRETATION BASED ON SITE OBSERVATIONS AND BOUNDARIES BETWEEN MATERIAL UNITS SHOULD BE CONSIDERED APPROXIMATE.
4. THE ENTRY SURFACE WAS RESTRICTED TO BE NO CLOSER THAN ABOUT 0.5 M FROM THE ROAD SHOULDER.

PREPARED BY: IKP	FIGURE TITLE: CASE 2 - PEERS CREEK FRONTAGE ROAD (~104+20) 2.0:1 (H:V) EMBANKMENT SLOPES, FLOOD CONDITION ANALYSIS RESULT		
CHECKED BY: MD	CLIENT: BRITISH COLUMBUA MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		
APPROVED BY: IKP	SCALE: NTS	PROJECT NO: 0272097	FIGURE NO: D-3

0 5 10 mm in ANSI A sized paper

BGC ENGINEERING INC.

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	EARTH EMBANKMENT (EXISTING)	20	0	36	1
	EARTH EMBANKMENT (NEW)	20	0	36	1
	FLUVIAL	20	0	35	1



NOTES

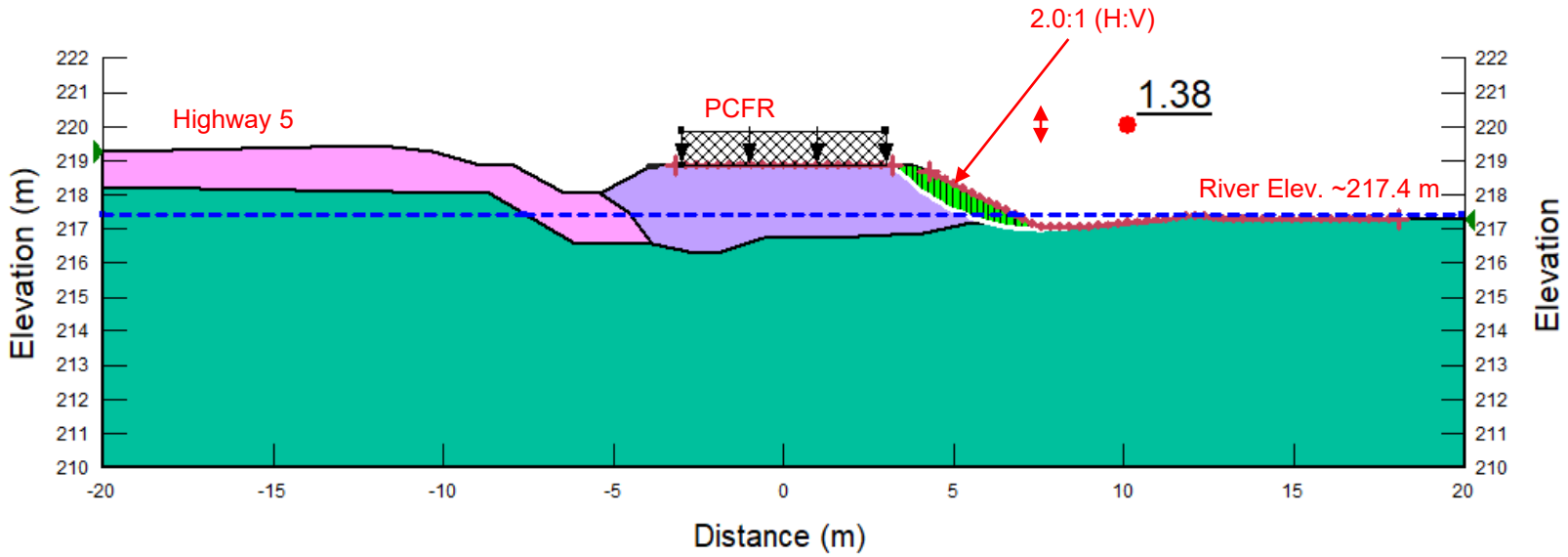
1. THIS FIGURE SHOULD BE READ IN CONJUNCTION WITH BGC'S LETTER REPORT TITLED PEERS CREEK FRONTAGE ROAD GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS AND DATED APRIL 2023.
2. ROAD AND EMBANKMENT DESIGNED BY MCELHANNEY. DRAWINGS AND REFERENCE SECTIONS PROVIDED IN APPENDIX A OF THIS REPORT.
3. THE SECTION SHOWS THE CONCEPTUAL GEOLOGICAL INTERPRETATION BASED ON SITE OBSERVATIONS AND BOUNDARIES BETWEEN MATERIAL UNITS SHOULD BE CONSIDERED APPROXIMATE.
4. THE ENTRY SURFACE WAS RESTRICTED TO BE NO CLOSER THAN ABOUT 0.5 M FROM THE ROAD.

PREPARED BY: IKP	FIGURE TITLE: CASE 4 - PEERS CREEK FRONTAGE ROAD (~104+20) 2.0:1 (H:V) EMBANKMENT SLOPES, RAPID DRAW DOWN CONDITION STABILITY ANALYSIS RESULT		
CHECKED BY: MD	CLIENT: BRITISH COLUMBUA MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		
APPROVED BY: IKP	SCALE: NTS	PROJECT NO: 0272097	FIGURE NO: D-4

0 5 10 mm in ANSI A sized paper

BGC ENGINEERING INC.

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	EARTH EMBANKMENT (EXISTING)	20	0	36	1
	EARTH EMBANKMENT (NEW)	20	0	36	1
	FLUVIAL	20	0	35	1



NOTES

1. THIS FIGURE SHOULD BE READ IN CONJUNCTION WITH BGC'S LETTER REPORT TITLED PEERS CREEK FRONTAGE ROAD GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS AND DATED APRIL 2023.
2. ROAD AND EMBANKMENT DESIGNED BY MCELHANNEY. DRAWINGS AND REFERENCE SECTIONS PROVIDED IN APPENDIX A OF THIS REPORT.
3. THE SECTION SHOWS THE CONCEPTUAL GEOLOGICAL INTERPRETATION BASED ON SITE OBSERVATIONS AND BOUNDARIES BETWEEN MATERIAL UNITS SHOULD BE CONSIDERED APPROXIMATE.
4. THE ENTRY SURFACE WAS RESTRICTED TO BE NO CLOSER THAN ABOUT 0.5 M FROM THE ROAD.
5. THE PSEUDO STATIC ANALYSIS (PSA) ABOVE IS SHOWN FOR HORIZONTAL PGA (PEAK GROUND ACCELERATION) OF 0.063 G BASED ON A 50% OF THE 475-YEAR RETURN PERIOD.

PREPARED BY:	FIGURE TITLE:		
IKP	CASE 4 - PEERS CREEK FRONTAGE ROAD (~104+20) 2.0:1 (H:V) EMBANKMENT SLOPES, SEISMIC CONDITION STABILITY ANALYSIS RESULT		
CHECKED BY:	CLIENT:		
MD	BRITISH COLUMBUA MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE		
APPROVED BY:	SCALE:	PROJECT NO:	FIGURE NO:
IKP	NTS	0272097	D-5

0 5 10 mm in ANSI A sized paper

BGC ENGINEERING INC.