



Basic Impact Analysis (BIA)

Illecillewaet Curve Safety Improvements

Glacier National Park, BC

March 2016



Parks
Canada

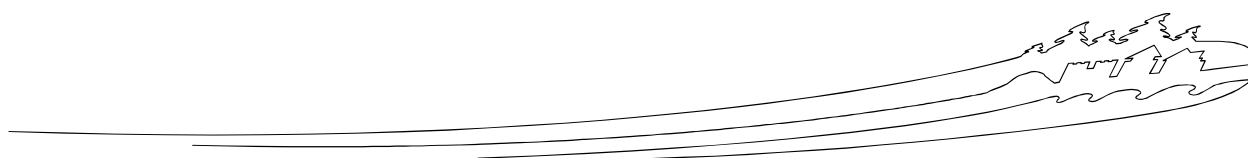
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Appendix 1: Environmental Impact Analysis Tools: Effects Identification Matrix

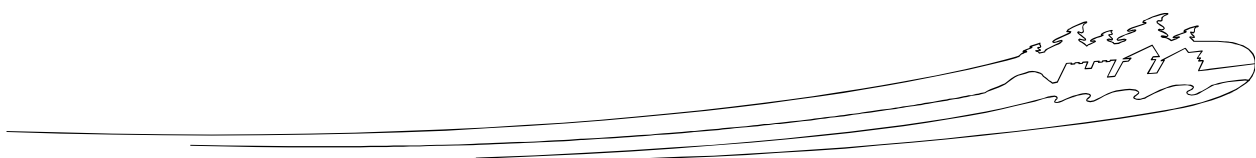
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Appendix 5: Wildlife Species of Management Concern Potentially Found Within 1 Kilometre of Illecillewaet Curve

Appendix 6: Archaeological Overview Assessment, Trans Canada Widening Project, Illecillewaet Curve, Glacier National Park





Parks Canada Basic Impact Analysis

1. PROJECT TITLE & LOCATION

Illecillewaet Curve Safety Improvements, in Glacier National Park, British Columbia. The Project is located along the TCH between KM 21.0 and KM 29.1.

2. PROPONENT INFORMATION

Parks Canada Agency: Ryan Syme, P.Eng., Engineer II – Highway Engineering Services

BIA Author: Tetra Tech EBA Inc.

3. PROPOSED PROJECT DATES

Planned commencement: 2016-03-01

Planned completion: 2017-10-30

4. INTERNAL PROJECT FILE

5. PROJECT DESCRIPTION

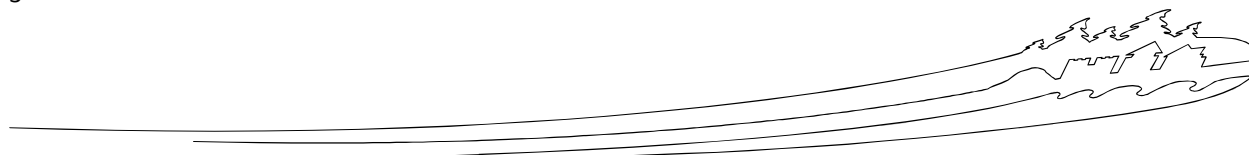
Project Objective

The proposed project is located along the Trans-Canada Highway (TCH) from the west portal of Single Bench snowshed (TCH km 20.0¹), through Rogers Pass, over the Illecillewaet River (referred to as Illecillewaet curve) and ending west of the Canadian Pacific Railway (CP) access road intersection (TCH km 29.1) (Figure 1). The entire project is within Glacier National Park (GNP). The project includes various components relating to highway widening and access improvements designed to improve network performance, road-user safety and visitor experience.

Project Rationale

This section of the TCH is a congested area with known major safety issues related to passing. In particular, the westbound/southbound traffic demonstrates high-risk passing behaviour at the Illecillewaet curve, which has resulted in multiple fatalities in recent years. The lane widening on the TCH westbound side on the approach and departure to the Illecillewaet curve will significantly improve passing opportunity throughout the entire area and therefore improve road user safety and network performance and visitor experience. It achieves this through the inclusion of passing opportunities in the westbound direction as traffic approach the Illecillewaet curve, thus extending the opportunity into areas with more favourable geometry.

¹ Highway kilometre references start from 0 at the Glacier National Park east gate and increase westward.





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To further improve safety and network performance, a number of access amendments have been included. The median crossing access to Illecillewaet campground and Asulkan Trailhead parking lot will be closed thus requiring the addition of a turnaround facility at approximately TCH km 28.0, across from the CP access road, to allow westbound visitors to access both facilities safely. Additionally the Hermit Trailhead parking lot will be set back from the TCH providing the visitors a separation from high speed highway traffic.

During periods of TCH closures for avalanche control or other operational requirements, the existing vehicle ponding capacity will be increased through the inclusion of an additional storage area on the westbound side of the TCH at approximately km 23.40. This ponding area will extend into and connect with the existing parking facilities located in the vicinity of the Rogers Pass Discovery Centre. By extending the ponding capacity, the network performance and visitor safety will be improved through ease of access and reduced waiting times during times of closure.

Project Components

The project will consist of several upgrades to the TCH in the vicinity of Rogers Pass and Illecillewaet curve (see the design drawings in Appendix 3).

Highway Widening (Shown on All Drawing Sheets)

The highway will be widened to accommodate an additional westbound lane through most of the project area. No work is proposed for the Illecillewaet curve itself, which is already two lanes in each direction. The widening will occur mainly on the westbound side but some widening will occur on the eastbound side to minimize cuts into the adjacent steep embankments. Where construction occurs all culverts will either be replaced or rehabilitated to address current TCH and culvert standards for aquatic connectivity and fish bearing streams. An 80 m long downslope retaining wall will be required on the north side of the TCH, beginning at km 27+120.

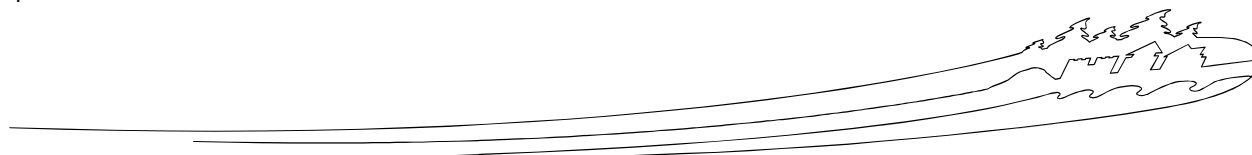
The additional westbound lane will allow faster-moving vehicles to safely pass slower-moving vehicles prior to approaching and after departing the Illecillewaet curve.

Access Consolidation for Hermit Trailhead and Explosives Magazine (Drawing Sheet 003)

The entrances to these two areas will be consolidated to one entrance and joined by a new frontage road. A new parking area will be developed for the trailhead and potentially allows for addition of new visitor amenities. The addition of the frontage road will require a new box or open arch culvert over a tributary to Connaught Creek (which crosses the TCH at km 21.06). The new consolidated entrance will allow for safer vehicle entry and exit for visitors to the trailhead.

Traffic Ponding Area (Drawing Sheet 005)

A new westbound traffic ponding area will be created north of the Rogers Pass Discover Centre. This area will be used to hold westbound traffic when the TCH is closed during avalanche control activities. The new traffic ponding area will allow for more efficient and safer traffic control in winter. The MRG FU will be consulted on the precise location and design of this ponding area.





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Consolidation and Formalization of Access at Discovery Centre Area (Drawing Sheets 005 and 006)

Access to the Discovery Centre will be consolidated at the central intersection across from the Parks compound. Westbound deceleration and acceleration lanes will be added. The current access to the summit area south of the former gas station will be gated to prevent vehicles from accessing the TCH at that location. These changes will improve traffic flow and improve road safety.

Formalization of Access at Monument Area (Drawing Sheet 008)

Westbound deceleration and acceleration lanes will be added to provide for safer entry and exit to the monument area. Across the TCH from the monument area, the Summit truck parking area and NRC Gulley Trailhead gravel pullout or layby will be improved with deceleration and acceleration lanes and a proper t-intersection to provide safer pullout of eastbound traffic visiting the monument area and for eastbound traffic from Illecillewaet Campground and Asulkan Trailhead to turn around and travel west.

Closure of Median Access to/from Illecillewaet Campground and Asulkan Trailhead (Drawing Sheet 012)

There are currently two gaps in the median on Illecillewaet curve that allow vehicles to cross oncoming traffic when entering Illecillewaet Campground and Asulkan Trailhead from the east and similarly when exiting these areas and travelling west. The median gaps will be closed to force exiting vehicles to turn right to more safely join eastbound traffic when exiting. Vehicles looking to exit to the west will be required to turn around at either the monument area or the Discovery Centre area. Westbound vehicles looking to enter the Illecillewaet Campground and Asulkan Trailhead will be required to continue further west to a new turnaround at the CP access road (described below).

West Turnaround (Drawing Sheet 014)

A new turnaround will be created at the CP access road. This will allow westbound vehicles to turn around to access the Illecillewaet Campground and Asulkan Trailhead.

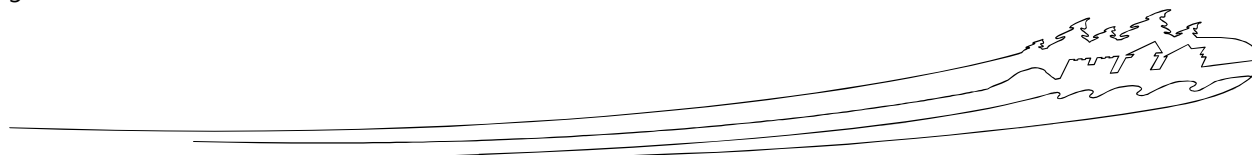
Project Construction Phases and Activities

The project will be conducted over two years, beginning in March 2016 and ending in October 2017. Civil construction work in the first year (2016) will be focused on the area south and west of the summit monument. Civil construction work in the second year (2017) will be focused on the area at and north and east of the summit monument. Clearing and grubbing for the 2017 work areas will be completed at the end of the 2016 construction season (end of August and later) in order to allow for further archaeological assessment in select areas prior to construction and to avoid clearing in the bird breeding season in spring/summer 2017.

The 2016 construction tender will be awarded by the end of May and the contractor may begin mobilization as early as June 1. Clearing and grubbing may begin soon after June 1 but only once permission has been given by the MRG FU Superintendent, archaeological work has been completed and pre-clearing nest surveys have been conducted. The 2016 construction will be completed by October 31.

Project work will include:

- Establishment of site office, staging and laydown areas,
- Asphalt removal,
- Vegetation clearing and grubbing (approximately 18 ha),
- Stripping and placement of topsoil,





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- Earthworks (road embankment/ditching),
- Rock blasting,
- Ditching,
- Culvert installation, extension and rehabilitation, including replacement of the existing culvert at Connaught Creek with an open-bottomed culvert,
- Construction of retaining wall,
- Relocation and re-configuration of avalanche control gun positions,
- Construction of base course and paving,
- Signage installation,
- Guardrail/barrier installation,
- Intersection treatments,
- Pavement marking,
- Utility relocation (electrical/ communications), and
- Re-seeding to restore vegetation in temporary disturbance areas.

Staging and laydown areas will be located at the Rogers Pass maintenance compound and on part of the gravel layby across from the monument.

Two avalanche control gun positions (GPs) will require relocation: Goddard GP at km 25+940 (Drawing Sheet 11) and CP GP at km 25+960 (Drawing Sheet 14). The new relocated GPs will be constructed and calibrated while the old ones are still operational. The process to relocate the GPs will be as follows:

- The military will take measurements for new GPs in winter 2016.
- The new GPs will be constructed in summer 2016 while leaving the old GPs in place.
- The military will configure targets from the new GPs in winter 2016-2017.
- The old GPs will be removed in summer 2017.

During construction, at least single-lane traffic will be maintained at all times. Access to all facilities will be maintained during construction.

Operations Phase

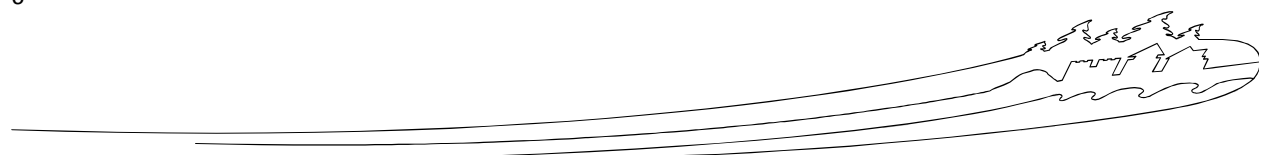
After all phases of construction are complete, the project area will continue to operate as a highway, consistent with the pre-project condition. Operations and maintenance activities will generally remain unchanged and include:

- Pavement surface management,
- Ditch, culvert and drainage management,
- Snow and ice control, and
- Roadside vegetation management.

6. VALUED COMPONENTS LIKELY TO BE AFFECTED

This section includes the following information:

- Valued Components Selection Methods,





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- Existing Conditions, and
- Valued Components (VCs).

Valued Components Selection Methods

The Canadian Environmental Assessment Agency defines Valued Ecosystem Components² as “the environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance”. The tool provided in Appendix 1 was used to identify the broad VC categories that are present in or near the project area and may potentially interact with the project. The VC categories include:

- Air and Noise,
- Soil & Landforms,
- Water (surface water, groundwater, fish [including species at risk] and fish habitat),
- Flora (including species at risk),
- Fauna (including species at risk),
- Cultural Resources, and
- Visitor Experience.

Specific VCs were selected using the following steps³:

Step 1: Identify Candidate Valued Components

Step 2: Evaluate Candidate Valued Components

Step 3: Select Appropriate Valued Components

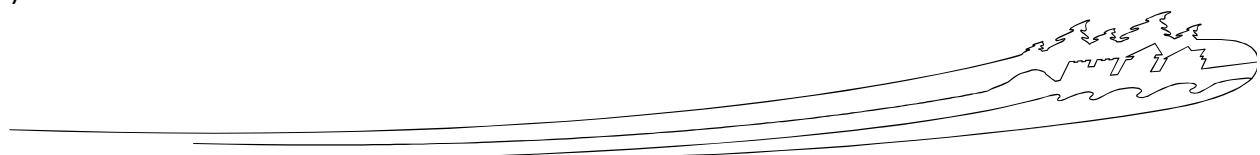
Candidate VCs were identified based on discussion with the Mount Revelstoke and Glacier National Parks (MRG) Field Unit and supported by field reconnaissance and review of existing data and reports. The criteria used to evaluate candidate VCs included the following:

- Component is present in the vicinity of the project area and has potential to interact with the project; and
- Legally binding government requirement to protect the component (e.g., species listed under the *Species At Risk Act* [SARA]); or
- Component is of special management concern (e.g., provincial Red and Blue-listed species), or
- Component is particularly sensitive or vulnerable to disturbance; or
- Component is a particular concern to the public or government (e.g., iconic wildlife species like grizzly bear or recreation opportunities or viewscapes).

The final selection of VCs was refined from the candidate VCs by considering:

² Though CEAA refers to VECs, in this document, the term Valued Components or VCs will be used.

³ The VC selection process used in this assessment is adapted from the British Columbia Environmental Office VC selection framework, as describe in EAO (2013).





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- Can the potential effects of the project on the VC be measured and monitored? Is the candidate VC better represented by another VC?
- Can the potential effects on the candidate VC be effectively considered within the assessment of another VC?
- Is information about the candidate VC needed to support the assessment of potential effects on another VC? Specifically, this refers to an intermediate VC where the effects pathway leads to another VC that may be more relevant.

Existing Conditions

Air and Noise

Anthropogenic impacts to air quality in GNP are mainly a result of vehicle traffic along the TCH, including heavy-duty and light-duty diesel and gasoline vehicles; additional impacts may be incurred from the resulting road dust. Railway emissions also have an effect on air quality in GNP. Overall, the concentration of emissions is located along the highway corridor [Province of British Columbia 2015 - Air Emissions (1 km Grid)]. The landscape, climate, and abundance of vegetation likely help mitigate the effects of emissions on air quality in the vicinity. Existing noise is primarily related to vehicle traffic and routine maintenance of the roadway and park facilities.

Air Quality was identified as a candidate VC because dust and emissions may affect human health and visitor experience and deposition of dust may affect vegetation. Air Quality was considered to be an intermediate component and is assessed under the Vegetation, Visitor Experience and Human Health VCs. Noise was identified as a candidate VC because the project will generate noise which has the potential to affect wildlife and visitors. Noise was considered to be an intermediate component and is assessed under the Wildlife and Visitor Experience VCs.

Soil and Landforms

The geologic bedrock in the project area consists of upper proterozoic coarse clastic sedimentary rocks (Province of British Columbia 2015). Well-drained Podzolics and well-developed Brunisolics are the most common soil parent materials in GNP due to the moist climate and coniferous forests; however, these are typically found at lower elevations (Alberta Institute of Pedology 1984).

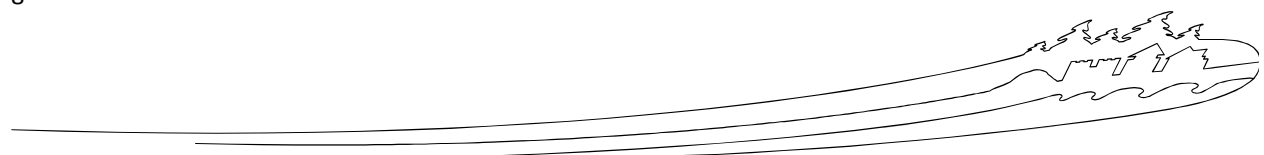
There has been extensive site contamination around the works yard from historical operation, including coal slag in some areas (MRG 2012).

Soil Quality was identified as a candidate VC because of the risk of spills and existing contamination that may be disturbed by the project. It was carried forward as a VC in the effects assessment.

Soil Compaction was identified as a candidate VC as it may affect vegetation. It was considered to be an intermediate component and is assessed under the Vegetation VC.

Soil Erosion and Sedimentation was identified as a candidate VC but because it is primarily related to water, it was considered an intermediate component and is assessed under Fish and Fish Habitat.

Landforms was identified as a candidate VC as there will be rock blasting, but since it is primarily related to view and aesthetics, it is assessed under Visitor Experience.





Water

The project area is located across two drainages: the Illecillewaet River drainage south and west of the Rogers Pass summit monument and Connaught Creek, flowing to the Beaver River, north and east of the summit monument.

The Illecillewaet River is fed primarily by the Illecillewaet Glacier. The drainage basin is approximately 1,200 km² (Province of British Columbia 2000). Flowing southwest, it crosses the TCH within the project area at km 26+600 and then runs parallel to the TCH continuing westward. Base mapping indicates several tributaries draining to the Illecillewaet River with two crossing the TCH at km 24+600 and km 25+700.

Connaught Creek crosses the highway from west to east at about km 22+300 north of the Discovery Centre then continues north and eastward, eventually joining with the Beaver River. Base mapping indicates four tributaries draining to Connaught Creek with three crossing the TCH. Rogers Creek, one of the four tributaries, drains the area north of the summit monument on the east side of the TCH and passes behind the Parks compound. The channel is undefined in some areas. Two tributaries are near the Hermit Trailhead: one crosses at km 21+240 very close to the existing trailhead; the second at km 21+060.

Fish species documented in the Illecillewaet River and headwaters include Bull Trout (*Salvelinus confluentus*), Cutthroat Trout (*Oncorhynchus clarki*), Rainbow Trout (*Oncorhynchus mykiss*), Mountain Whitefish (*Prosopium williamsoni*) and Eastern Brook Trout (*Salvelinus fontinalis*); of these species, only Bull Trout has been identified as occurring near the project in the Illecillewaet drainage (Parks Canada internal document 2014).

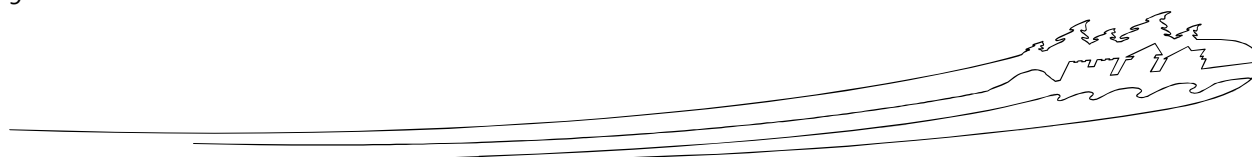
The Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) is regularly occurring in GNP according to the Parks Canada Biotics Web Explorer (Parks Canada 2013). The BC population of Westslope Cutthroat Trout is listed as 'Special Concern' under Schedule 1 of SARA (Government of Canada 2002). The only known population of this species within GNP resides in Schuss Lake and thus will not be encountered by the project (S. Boyle, pers. comm. 2015).

Fish species documented in the Beaver River include Bull Trout, Cutthroat Trout, Eastern Brook Trout, Mountain Whitefish, and Rainbow Trout (Parks Canada internal document 2014). Fish species documented in Connaught Creek include Bull Trout and Mountain Whitefish (Parks Canada internal document 2014). Bull Trout is known to occur in Rogers Creek adjacent to the Rogers Pass Maintenance Compound.

Many of the culverts along the highway are in poor conditions and are currently barriers to fish passage. Culvert replacement and rehabilitation will occur as part of this project and will improve fish passage in addition to improving aquatic connectivity.

The Illecillewaet and Beaver Rivers, as well as their tributaries, provide a source of water, food, and nutrients to fish and fish habitat, and therefore are subject to the Federal *Fisheries Act*. Given that the Project crosses fish-bearing watercourses, there is the potential for impacts to fish species and aquatic environments.

Benthic invertebrates are important indicators of freshwater ecosystem health. Baseline data for benthic invertebrate community assemblages is available for GNP through the Canadian Aquatic Biomonitoring Network (CABIN). The benthic macroinvertebrate community in Connaught Creek was sampled in 2013 and was determined to have high ecological integrity and thus may be used to compare the effects of future disturbances (Scrimgeour and Larson 2015).





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Fish was identified as a candidate VC and was carried forward as a VC in the effects assessment.

Fish Habitat was identified as a candidate VC and was carried forward as a VC in the effects assessment.

Benthic Invertebrates was identified as a candidate VC as they are important indicators of freshwater ecosystem health. Further evaluation of benthic invertebrates was not considered necessary in the context of the proposed project because measures to protect Water Quality, Fish and Fish Habitat would also protect Benthic Invertebrates. It was not carried forward as a VC in the effects assessment.

Flora

British Columbia's Biogeoclimatic Ecosystem Classification (BEC) is a land classification system that groups similar ecosystems based on climate, geology/soils and vegetation. BEC Zones are the highest level of classification and represent areas of broad macroclimate. The Zones are generally named after the dominant tree species with a descriptor of the general climate (subzone).

The project area lies within the Engelmann Spruce – Subalpine Fir Very Wet Cold (ESSFvc) subzone. The vegetation within the ESSF Zone is typically dominated by Engelmann spruce (*Picea engelmannii*) in mature stands with subalpine fir (*Abies lasiocarpa*) in the understorey. At higher elevations, subalpine fir sometimes dominates the stands. Whitebark pine (*Pinus albicaulis*), and alpine larch (*Larix lyallii*) occupy drier areas, usually at higher elevations, in the ESSF Zone. Characteristic shrubs include white-flowered rhododendron (*Rhododendron albiflorum*), black huckleberry (*Gaylussacia baccata*), grouseberry (*Vaccinium scoparium*), and false azalea (*Menziesia ferruginea*) (B.C. Ministry of Forests 1998a).

The vegetation adjacent to the TCH and the roadside clear zone is predominantly a mix of forest and shrubby avalanche paths. The forests are dominated by Engelmann spruce and subalpine fir. The avalanche paths are dominated by Scouler's willow (*Salix scouleriana*) and Sitka alder (*Alnus viridis* ssp. *sinuata*) and stunted spruce and fir. Areas directly adjacent to the road and shoulder are dominated by grasses, forbs and shrubs.

A list of vegetation elements of management concern (VEMC) that may occur in or near the project area was developed. VEMC was considered any plant that met one or more of the following criteria:

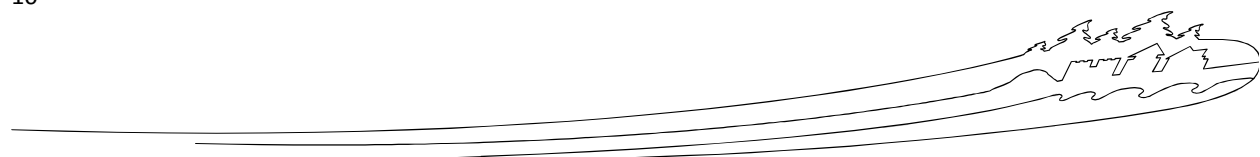
- Listed on the Red or Blue List (BC Ministry of Environment 2015),
- Assessed as Special Concern, Threatened, or Endangered by the Committee on the Status of Endangered Species in Canada (COSEWIC; Government of Canada 2015a), or
- Listed as Special Concern, Threatened, or Endangered in the SARA (Government of Canada 2002).

The list of VEMC was developed based on the following sources:

- The Parks Canada Biotics Web Explorer for SARA-listed species regularly occurring in GNP (Parks Canada 2013),
- BC Conservation Data Centre Internet Mapping tool for documented species within 5 km the Project (BC Conservation Data Centre 2015), and
- BC Species and Ecosystems Explorer for species occurring in both the ESSF BEC and Columbia-Shuswap Regional District (BC Conservation Data Centre 2015).

A total of 42 VEMC were identified as having potential to occur near the project area, of which 10 species have been documented as occurring within 5 km of the project (Figure 2; Appendix 4):

- Western St. John's wort (*Hypericum scouleri* ssp. *nortoniae*) – Blue List,





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- Crested Wood Fern (*Dryopteris cristata*) – Blue List,
- Sutherland’s Larkspur (*Delphinium sutherlandii*) – Blue List,
- *Tayloria splachnoides* (no common name) – Red List,
- Elliptic Spike-rush (*Eleocharis elliptica*) – Blue List,
- Smooth Willowherb (*Epilobium glaberrimum* ssp. *fastigiatum*) - Blue List,
- Least Moonwort (*Botrychium simplex* var. *compositum*) – Blue List,
- Trelease’s Hybrid Willowherb (*Epilobium x treleasianum*) – Blue List,
- Slender Spike-rush (*Eleocharis nitida*) – Blue List, and
- Whitebark Pine – Blue List; Endangered under SARA and COSEWIC.

The closest record to the TCH is Western St. John’s wort near km 23.50 (Figure 2). Western St John’s wort is a vascular plant that occurs in alpine, tundra, grassland, shrub, rock and sparsely vegetated rock habitats. This species is designated as ‘sensitive’ in British Columbia and is on the Blue List (Appendix 4). The precise location of the occurrence is not known but the record description indicates it is in a wetland east of the TCH and suggests that it is not directly adjacent to the existing roadway.

One of the 42 VEMC is listed by either COSEWIC or SARA (Table 1).

Table 1: Federally Plant Listed Species with Potential for Presence Near the Project

English Name	Scientific Name	COSEWIC Status ¹	SARA Schedule ²	Potential for Presence near Project
Whitebark Pine	<i>Pinus albicaulis</i>	Endangered	Endangered Schedule 1	Low - confirmed in vicinity of project but none appear in or adjacent to project footprint from site visits.

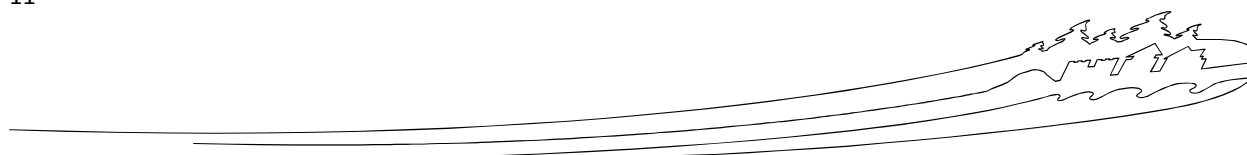
¹COSEWIC – Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2015a).

²SARA - *Species At Risk Act* (Government of Canada 2002). Schedule 1 is the official list of wildlife species at risk.

Whitebark Pine typically inhabits high mountain forests, occupying a narrow elevation zone from timberline, where it may occur as krummholz, to mixed, closed subalpine forest. It can be found at elevations from 1,950 - 2,250 m (COSEWIC 2010). Given the Project’s location and general ecology, the potential for Whitebark Pine to occur within the project footprint was considered low.

A site visit was conducted by a Tetra Tech EBA vegetation ecologist on June 15, 2015. Whitebark Pine was detected approximately 400 m from the TCH on higher elevation slopes but none within or adjacent to the project footprint.

A second site visit was conducted by Tetra Tech EBA on August 17, 2015 to identify potential to support VEMC. Overall the risk of encountering VEMC was considered low through most of the project area. A wet zone at the base of the avalanche chute east of the TCH between the summit monument area and the Parks compound (km 23.10 and 23.98) was considered moderate potential to support VEMC. A plant species inventory was conducted at one location within this area and no VEMC were identified.





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Vegetation was identified as a candidate VC as the project will result in loss of natural vegetation. It was carried forward as a candidate VC.

Listed Plant Species was identified as a candidate VC and was carried forward as a VC in the effects assessment.

Fauna

The ESSF Zone offers a variety of habitats and supports a range of wildlife species, though the wildlife assemblage is strongly influenced by wet, cool summers and long, cold, snowy winters. Areas disturbed by avalanches and fires often have regenerating shrubby berry crops, and dense herbaceous vegetation, which tend to attract Grizzly Bears, Black Bears, and Moose during the spring and summer months. Other ungulates such as Caribou (*Rangifer tarandus caribou*), Mountain Goat (*Oreamnos americanus*), Elk (*Cervus elaphus*), and Mule Deer (*Odocoileus hemionus*) may be found in some areas; Caribou and Mountain Goat tend to overwinter in these areas as well. Other mammals including American Marten (*Martes americana*), Fisher (*Martes pennanti*), and Wolverine (*Gulo gulo*), as well as seed-eating birds such as Red Crossbill (*Loxia curvirostra*), White-winged Crossbill (*Loxia leucoptera*), Pine Siskin (*Carduelis pinus*), and Clark's Nutcracker (*Nucifraga columbiana*) can be found in coniferous forests within the ESSF Zone (B.C. Ministry of Forests 1998).

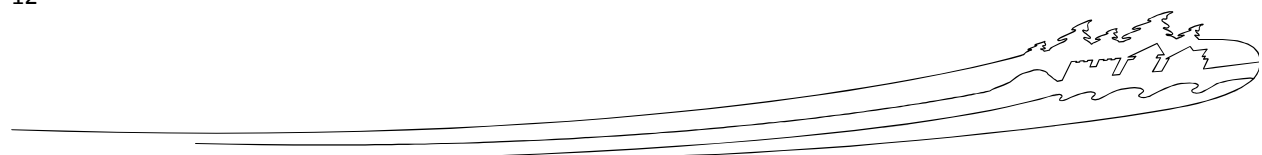
A list of wildlife species of management concern (SOMC) that may occur in or near the project area was developed. SOMC was considered any fauna that met one or more of the following criteria:

- Have federal restricted activity dates or setback distances (Environment Canada 2011),
- Assigned to Red or Blue lists by the BC Conservation Data Centre (2015), where Red lists include indigenous species or subspecies that are candidates for extirpated, endangered or threatened status and blue lists include indigenous species or subspecies considered to be of special concern,
- Assessed as Special Concern, Threatened, or Endangered by the Committee on the Status of Endangered Species in Canada (COSEWIC; Government of Canada 2015a), and
- Listed as Special Concern, Threatened, or Endangered, or under the SARA (Government of Canada 2002).

The list of SOMC was developed based on the following sources:

- The Parks Canada Biotics Web Explorer for species regularly occurring SARA-listed species in GNP (Parks Canada 2013),
- BC Conservation Data Centre Internet Mapping tool for documented species within 5 km the Project (BC Conservation Data Centre 2015),
- Known range maps for species of management concern (SOMC) that may occur within 1 km of the Project (Ridgely et al., 2007; International Union for Conservation of Nature, 2014), and
- Personal communication with PCA staff.

Results of the background search indicate that a total of 20 species of management concern have been found or can potentially be found near the Project Area, including 2 amphibians, 11 birds, and 9 mammals (Appendix 5). Of these species, 11 are listed under COSEWIC as Special Concern, Threatened, or Endangered; and 10 are listed under SARA as Special Concern, Threatened, or Endangered (Appendix 5). Woodland Caribou was identified as occurring within 5 km of the project to the northwest (Figure 2).





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Table 2: Federally Listed Wildlife Species with Potential for Presence Near the Project

Common Name	Scientific Name	COSEWIC Status ¹	SARA Status ²	Potential for Presence near Project
Coeur d'Alene Salamander	<i>Plethodon idahoensis</i>	Special Concern	Special Concern Schedule 1	Moderate – Suitable habitat, and regularly occurring in GNP
Western Toad	<i>Anaxyrus boreas</i>	Special Concern	Special Concern Schedule 1	High – Known to breed in Rogers Pass
Barn Swallow	<i>Hirundo rustica</i>	Threatened	-	High – Known to occur at Rogers Pass and on the underside of bridges in GNP
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Threatened	Threatened Schedule 1	Moderate – Potentially suitable edge habitat and regularly occurring in GNP
Little Brown Myotis	<i>Myotis lucifugus</i>	Endangered	Endangered Schedule 1	Moderate – Potential foraging habitat and regularly occurring in GNP
Northern Long-eared Myotis	<i>Myotis septentrionalis</i>	Endangered	Endangered Schedule 1	Moderate – Potential for maternal colonies in large diameter trees and regularly occurring in GNP
Woodland Caribou - Southern Mountain population	<i>Rangifer tarandus</i> pop. 1	Endangered	Threatened Schedule 1	Moderate – Mapped critical habitat and known occurrences several kilometers from Project
Wolverine	<i>Gulo</i>	Special Concern	-	Moderate – Large home ranges and documented presence in vicinity
Grizzly Bear	<i>Ursus arctos</i>	Special Concern	-	High – Known to occur
Mountain Goat	<i>Oreamnos americanus</i>	-	-	Moderate – Regularly occurring in GNP and potential to be encountered crossing highway.
Seed-eating Birds	-	-	-	High – Known to occur along TCH.

¹COSEWIC – Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2015a).

²SARA - *Species At Risk Act* (Government of Canada 2002). Schedule 1 is the official list of wildlife species at risk.





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Coeur d'Alene Salamander

Coeur d'Alene Salamanders require moist, shady habitat which could include rockwalls with flowing seepages or streams, waterfall splash zones, caves, streams with exposed bedrock, avalanche paths and moist talus. They also require wet, rocky crevices to avoid freezing (Government of Canada 2015c). This species is most likely to be found below 1,365 m in elevation which is within the range of the project. Suitable seepages or streams may be present. This species is regularly occurring in GNP and thus there is a moderate risk of encountering the species. There is a rock cut that may provide suitable habitat for Coeur d'Alene Salamander, located between km 24+000 and km 24+200, just north of the Illecillewaet curve.

This species was carried forward as a VC in the effects assessment.

Western Toad

Western Toads are known to occur at all elevations within GNP (PCA 2012). This species spends a majority of their time in terrestrial habitats including forested areas, moist shrub-lands, meadows and avalanche slopes (Government of Canada 2015d). They use a wide variety of aquatic habitats for breeding, including wetlands and temporary pools. The species has been documented as breeding in Rogers Pass (MacHutchon 2007).

Wetland surveys in GNP⁴ have found Western Toad in two locations near the project area:

- Rogers Pass Sewage Lagoon: In the riparian area adjacent to the lagoon, 175 m from the TCH, and
- Vent Shaft Wetland: Wetland Located approximately 850m south of the actual vent shaft and 110 m east of the TCH.

This species was carried forward as a VC in the effects assessment.

Barn Swallow

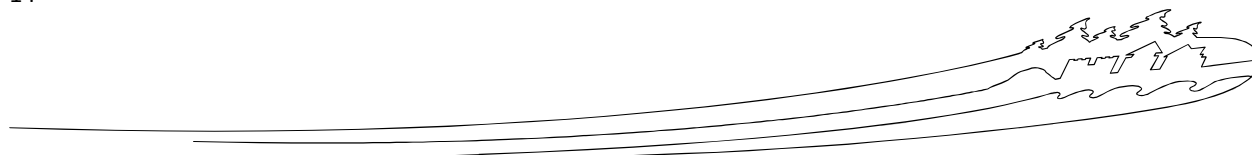
Barn Swallows historically nested mostly in caves, holes, crevices and ledges in cliff faces, though since European settlement, they have shifted largely to nesting in and on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts (COSEWIC 2011). Barn Swallows prefer various types of open habitats for foraging, including grassy fields, pastures, agricultural crops, lake and river shorelines, cleared rights-of-way, and wetlands. Barn Swallow colonies are present at the Rogers Pass maintenance compound and under some bridges in GNP. Barn Swallows may be found foraging adjacent to the highway.

This species was carried forward as a VC in the effects assessment.

Olive-sided Flycatcher

Olive-sided Flycatcher inhabit forests with open areas containing or surrounded by tall trees, often in association with water. Open areas may include human-made openings and thus edges beside the existing highway right-of-way may offer suitable habitat for the Olive-sided Flycatcher. This species is regularly occurring in GNP and reported in annual songbird monitoring in Mount Revelstoke and Glacier National

⁴ Data provided by MRG Field Unit December 17, 2015.





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Parks (Gillies 2013). There is a federally recommended setback of up to 300 m for active nests (Gregoire 2013). This species was carried forward as a VC in the effects assessment.

Bats

Little Brown Myotis and Northern Long-eared Myotis) are present in GNP but detailed data on their distributions are not available. A bat survey at Nakimu Caves, a cave system approximately 4 km east of the project at its closest location, confirmed presence of Little Brown Myotis and likely presence of Northern Long-eared Myotis (Kingbird Biological Consultants Ltd. 2014). It is unknown if suitable hibernation locations exist in the vicinity of the project, but forest edge areas surrounding the project may provide suitable foraging and breeding habitat. Both species are regularly occurring in GNP and thus the risk of encountering is moderate. GNP is home to several other species of bats and these will be carried forward as one VC: bats.

Woodland Caribou

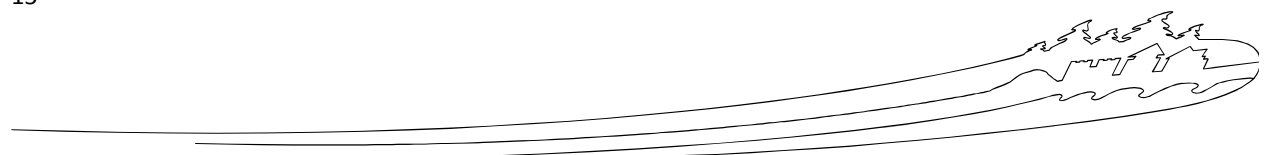
Woodland Caribou that are found within GNP are of the Southern Mountain Population. This population tends to migrate vertically but not over large distances. The Caribou are adapted to living with deep snow, using packed snow to reach tree lichens – one of their primary winter food sources. There are two herds of the Southern Mountain Population known to occur within GNP – the Columbia South herd and the Duncan herd;

Mountain caribou is a SARA species listed as threatened, that is sensitive to long term disturbance. Caribou are considered part of the climax biota because of their dependence on late successional forests and associated lichen forage. Caribou use old-growth and mature coniferous stands across their range. Caribou in the Columbia Mountains primarily inhabit Engelmann spruce-subalpine fir and western red cedar-western hemlock forests >4,000 feet (1,200 m) in elevation with mixed stands of old growth Engelmann spruce-subalpine fir (*Picea engelmannii*-*Abies lasiocarpa*) preferred in late winter.

The Columbia South caribou herd utilizes Glacier National Park as part of their home range, and as of the last census in 2013 is at 6 animals, numbering at 105 in 1994 (Furk *et al.* 2011 and Legebokow and Serrouya 2013). Approximately 30% of this herd's home range is in Mount Revelstoke and Glacier National Parks (MRG) the remaining 70% on provincial lands. In national parks and provincial lands there is ski touring, and on provincial lands heli-skiing occurs in addition to forestry operations.

The Duncan Valley herd, a part of the Central Selkirks caribou population and uses the Southern portion of the Glacier National Park (the upper Beaver Valley). As of the last census in 2015 the Duncan Valley herd is at 1 animal, compared to 2 in 2012, and 7 in 2010. A small portion of this herd's home range is in Glacier National Park, but historically the Beaver Valley acted as a dispersal corridor between the Columbia South and Duncan Valley herds, with records of 100s of caribou recorded in the 20 mile and 30 miles areas in the 1920s.

The project is not within mapped critical habitat for Southern Mountain Caribou though critical habitat is present within about 4 kilometers of the project (Her Majesty the Queen in Right of Canada 2010). There is one record of a caribou occurrence within about one kilometer of the project (Figure 2). During the construction period, it is possible that a caribou may encounter highway construction activities, but the probability is likely to be low. No caribou-vehicle collisions have been reported near Rogers Pass (Clevenger *et al.* 2014). Given their listing as Endangered by COSEWIC (Table 2), this species was carried forward as a VC in the effects assessment.





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Wolverine

Wolverine can be found within a wide range of habitats within GNP. Data from the MRG Field Unit indicate several observations of wolverines along the TCH at Rogers Pass and slightly north of Rogers Pass. Wolverines typically utilize a wide variety of forested and alpine habitats and exist in low populations densities with accompanying large home ranges. Preliminary results of non-invasive genetic sampling suggest a combined population of 25 individuals in GNP and Mount Revelstoke NP (Pilgrim and Schwartz 2015). Although no wolverine-vehicle collisions have been reported near Rogers Pass (Clevenger et al. 2014), a recent observation was made of a wolverine crossing the TCH at the top of the Illecillewaet curve in January 2016. A wolverine was struck and killed in summer 2015 at the provincial snowsheds, west of Rogers Pass. This species was not carried forward as a VEC as the effects and mitigations are consistent with other large ranging wildlife species.

Grizzly Bear

Grizzly bears can be found within a wide range of habitats within GNP. Data from the MRG Field Unit indicate a high concentration of incidental observations along GNP roadways and hiking trails (e.g., Balu Pass, Asulkan Valley). Grizzly bears are known to regularly use alder habitats along the TCH. Grizzly bear sightings in GNP are most common at lower elevations (914-1218 m) in spring and at higher elevations (1219-1523 m) in summer (Van Tighem & Gyug 1984). This species was carried forward as a VC in the effects assessment.

Mountain Goat

Mountain Goats are most closely associated with steep slopes and rocky cliffs but can be found moving through a variety of habitats. They often descend to lower elevations to access and consume mineral soils or deposits (salt licks), either natural or artificial. This species is regularly occurring in GNP and in the Rogers Pass area. Numerous goat-vehicle collisions have occurred along the TCH in the vicinity of the east snowsheds and one collision near the Rogers Pass summit monument (Clevenger et al. 2014). Collisions have been found to be more frequent in June and July. Mountain goats may cross TCH while moving between areas of suitable habitat, and may also be attracted to the road due to road salt. This species was carried forward as a VC in the effects assessment.

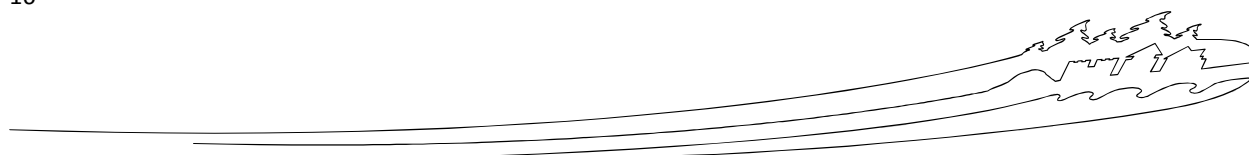
Seed-Eating Birds

Seed-eating birds including White-winged Crossbill, Red Crossbill (*Loxia curvirostra*), Pine Grosbeak (*Pinicola enucleator*), Pine Siskin and Evening Grosbeak (*Coccothraustes vespertinus*) are commonly found along the TCH in winter eating grit from the salt and sand mix applied to the road. Many of these seed-eating birds become casualties from vehicular collisions, sometimes in large numbers. The sand and salt mix applied to the roads includes magnesium chloride (used when very cold) which may have a neurological effects on these birds and reduce their reaction times, compounding the problem (A. Taylor, pers. comm. 2015).

This species guild was carried forward as a VC in the effects assessment.

Other Species

The Short-eared Owl (*Asio flammeus*), and Spotted Bat (*Euderma maculatum*) are both unlikely to occur in the Project area due to lack of suitable habitat but appeared on database searches (Appendix 5). These species were not carried forward as VCs in the effects assessment.





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Wildlife Movements and Vehicle Collisions

Clevenger et al. (2015) conducted a study of wildlife-vehicle collisions in Mount Revelstoke and Glacier National Parks. Large mammal collisions in the Rogers Pass area include Black Bear, deer species, Grizzly Bear and Mountain Goat. Further analysis of animal location data and connectivity modelling identified a high priority wildlife-vehicle collision mitigation site at Rogers Pass and recommend a wildlife overpass structure, at approximately km 24+300, which would target mountain goat, grizzly bear and wolverine. The conceptual design of this wildlife overpass is being completed as part of this project, however, the construction of the wildlife overpass is being pursued as a separate project. The effect of the project on wildlife-vehicle collisions is considered under other wildlife VCs.

Cultural Resources

The project falls within the Rogers Pass National Historic Site. Rogers Pass National Historic Site was declared in 1971 as the area was significant during the completion of the CPR across Canada (PCA 2015b). The Discovery Centre provides the public with the history and culture of the construction of the CPR during the late 1800's.

Additionally, in 2015, a recent review of this national historic site by the HSMBC has expanded its historical significance to include the construction and operation of the TCH through this transportation corridor. As a result, archeological and cultural resources related to the TCH will be evaluated to determine their national significance.

Archaeological Resources

It is known that at least four aboriginal groups used the region in some capacity; however, no occupation sites have been discovered. First Nations' use within GNP is not well understood (PCA 2015b). The use of the area by the CPR is well understood and resources related to its construction and operation are present in and near the project area. Historic viewsapes associated with the railway and road have been identified. Resources related to road construction and operation have not been identified and may be present.

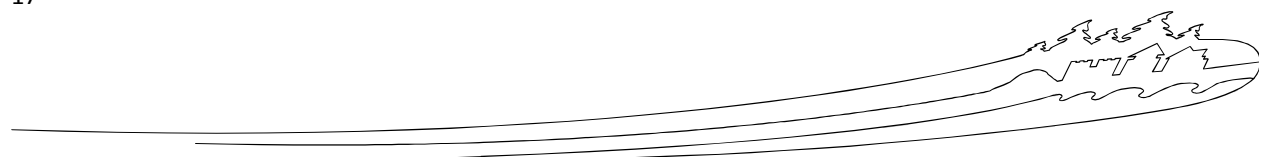
The Heritage Conservation and Commemoration Directorate (HCCD) of PCA completed an Archaeological Overview Assessment (AOA) of the project area. The AOA is included in Appendix 6. The locations of known archaeological sites are shown on the design drawings in Appendix 3.

During the preliminary project design phase, one of the design principles was to avoid known archaeological sites. However some archaeological sites are unavoidable and lie within the project footprint. Furthermore, while some areas of Rogers Pass have been extensively surveyed, others have not. Construction areas within known archaeological sites and others that have high archaeological potential will require Archaeological Impact Assessments (AIAs) prior to clearing and grubbing. The AOA provides a list of areas of archaeological concern (see Appendix 6).

Archaeological Sites was carried forward as a VC in the effects assessment.

Historic Viewsapes

Historic viewsapes are part of the character-defining elements (CDEs) that embodied the historic, cultural, spiritual and aesthetic values associated with Roger Pass cultural landscape. These historic viewsapes are linked to the commemorative intent. HCCD provided a preliminary list of historic viewsapes at Rogers Pass that may be affected by the project:





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- West Bound from the Discovery Centre to Rogers Pass National Historic Site Boundary (descending):
 - Views of slide paths along Mount Cheops, above to the right.
 - Views of Avalanche Ridge and Mt. McDonald behind, above to the left.
 - Views of Illecillewaet and Asulkan Glaciers to the left on the curve, near Glacier Station.
 - View of Bonny Glacier, above to the left after the curve.
 - Sense of the valley opening up, widening out as one descends; the route ahead is clear.
- East Bound from Rogers Pass National Historic Site Boundary to the Discovery Centre (ascending):
 - View of Bonny Glacier, above to the right before the curve.
 - Views entering the curve of Mt. McDonald and Mt. Sir Donald, straight ahead, above.
 - Views of Illecillewaet Glacier and Asulkan Glaciers to the right on the curve, near Glacier Station.
 - View of Avalanche Ridge and Mt. McDonald on the right, leaving the curve.
 - View of avalanche paths to the left on Mt. Cheops and others.
 - View ahead to wall of mountains: Tupper, Sifton, Hermit with TCH arch in foreground, ascending from the curve.
 - Sense of the valley narrowing, vanishing as one approaches the pass; the way through is not visible at various vantage points.

Historic Viewscapes was carried forward as a VC in the effects assessment.

Visitor Experience

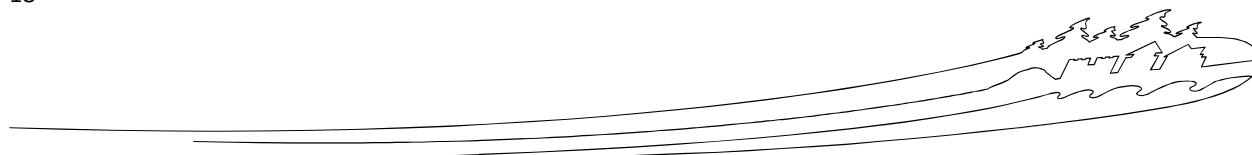
The Rogers Pass area is used by visitors in all seasons and provides a range of visitor opportunities:

- Scenic driving,
- Camping,
- Hiking and mountaineering,
- Ski touring,
- Wildlife viewing, and
- History appreciation.

Visitor facilities that are within or adjacent to the project area include:

- Hermit Trail trailhead,
- Rogers Pass Discovery Centre,
- Balu Pass Trail trailhead
- Abandoned Rails Trail
- Illecillewaet Campground and Picnic Area, and
- Asulkan Valley Trail/1885 Trail trailhead.

Viewscapes and soundscapes above and away from the highway corridor are scenic and natural with little anthropogenic disturbance.





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Visitors to Rogers Pass arrive and depart via the TCH. This section of the TCH is a congested area with known major safety issues related to vehicle speeds and lack of passing opportunities. In particular, the westbound/southbound traffic demonstrates high speed and high-risk passing behaviour at the Illecillewaet curve, which has resulted in multiple fatalities in recent years.

Recreational Opportunities, Viewscales & Soundscapes and Visitor Safety and Health were considered candidate VCs and all three were carried forward as a VC in the effects assessment.

Valued Components

Table 3 provides a summary of the selection of VCs for the Illecillewaet curve assessment, including the candidate VCs, the rationale for selection and inclusion as a final VC that was carried forward to the effects assessment.

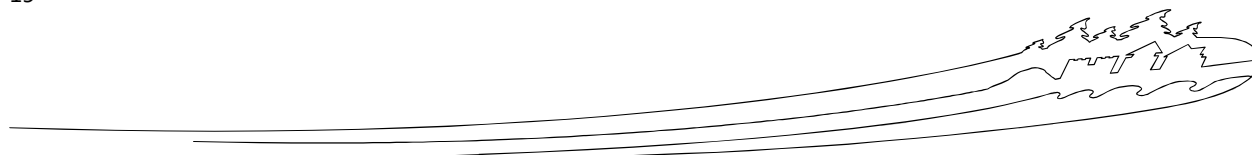
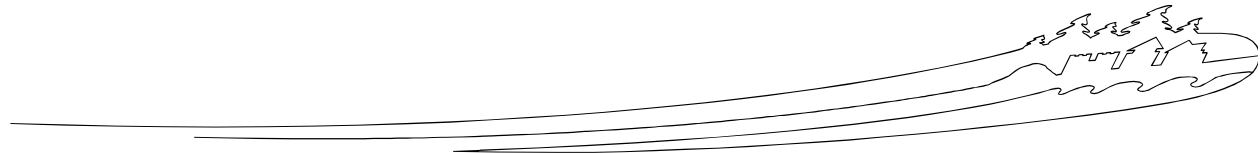




Table 3: Candidate and Final Valued Components Considered for the Illecillewaet Curve Safety Improvements Project

Component Category	Candidate Valued Component	Rationale for Inclusion	Included as Stand-alone VC in Effects Assessment
Air and Noise	Air Quality	Dust and emissions may affect human health and visitor experience. Deposition of dust may affect vegetation. This is an intermediate component and is assessed under Vegetation, Visitor Experience and Human Health.	No
	Noise	Potential to affect Visitor Experience and Wildlife (avoidance). This is an intermediate component and assessed under Wildlife and Visitor Experience.	No
Soil & Landforms	Soil Quality	Spills in work areas may affect soil quality and future use. Risk of spreading existing contaminated soils. Risk to workers from contact with contaminated soils or vapors	Yes
	Soil Compaction	Compacted soils may affect vegetation. An intermediate component that is assessed under Vegetation.	No
	Soil Erosion and Sedimentation	May affect water quality and fish habitat. An intermediate component that is assessed under Fish and Fish Habitat.	No
	Landforms	Rock blasting will modify landforms and landscapes and may affect salamanders and Mountain Goats. An intermediate component that is assessed under Wildlife and Viewsapes.	No





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Table 3: Candidate and Final Valued Components Considered for the Illecillewaet Curve Safety Improvements Project

Component Category	Candidate Valued Component	Rationale for Inclusion	Included as Stand-alone VC in Effects Assessment
Water	Surface Water Quality	An intermediate component leading to primarily aquatic health (fish and benthic invertebrates) though has other possible effects pathways and is therefore included in the effects assessment.	Yes
	Groundwater Quality	Project interactions with groundwater are not anticipated.	No
	Fish	Watercourses are fish bearing (Bull Trout and Mountain Whitefish). This category represents all fish species potentially present.	Yes
Water	Fish Habitat	Potential for loss of riparian habitat, which is essential for aquatic health. Potential for loss of instream habitat through sedimentation.	Yes
	Benthic Invertebrates	Benthic invertebrates are important indicators of freshwater ecosystem health. Baseline data exists for Connaught Creek. Further evaluation of benthic invertebrates was not considered necessary in the context of the proposed project because measures to protect Water Quality, Fish and Fish Habitat would protect Benthic Invertebrates as well.	No
Flora	Listed Plant Species	Potential for the SARA-listed Whitebark Pine. Known and potential presence of other provincially listed species.	Yes
	Vegetation	Project will result in loss of natural vegetation. Vegetation health and vigour may be affected by soil compaction, trampling and dust deposition.	Yes

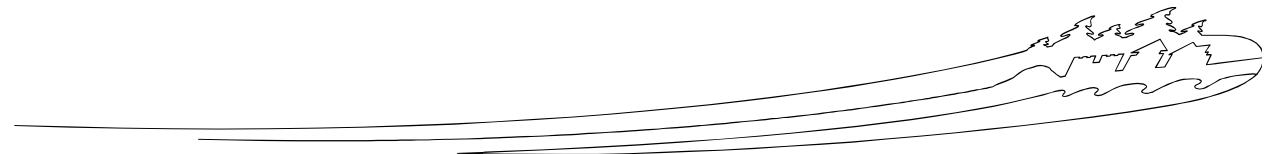
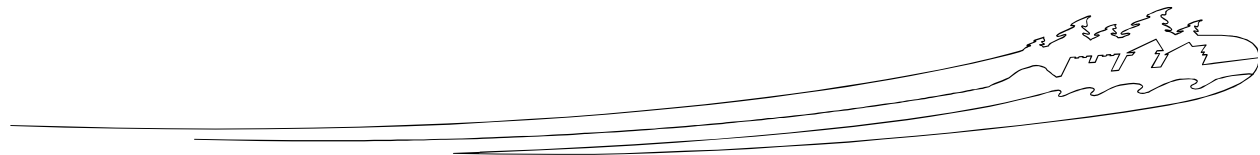




Table 3: Candidate and Final Valued Components Considered for the Illecillewaet Curve Safety Improvements Project

Component Category	Candidate Valued Component	Rationale for Inclusion	Included as Stand-alone VC in Effects Assessment
Fauna	Coeur d'Alene Salamander	Listed species. Suitable habitat and regularly occurring in GNP.	Yes
	Western Toad	Listed species. Breeds near Rogers Pass.	Yes
	Barn Swallow	Listed species. Present at Rogers Pass.	Yes
Fauna	Olive-sided Flycatcher	Listed species. Potentially suitable edge habitat and regularly occurring in GNP	Yes
	Little Brown Myotis	Listed species. Project area has potential foraging habitat and regularly occurring in GNP.	Yes Under combined Bats VC
	Northern Long-eared Myotis	Listed species. Project area has potential foraging habitat and regularly occurring in GNP.	Yes Under combined Bats VC
	Woodland Caribou - Southern Mountain population	Listed species (Threatened under SARA, Endangered under COSEWIC). Project is not within mapped Critical Habitat though known occurrences near project.	Yes
	Wolverine	Listed species. Documented presence in Rogers Pass.	No

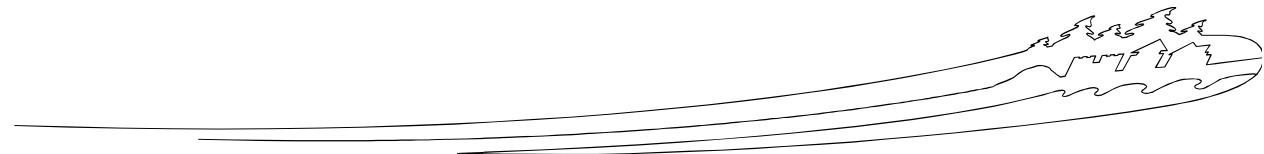




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Table 3: Candidate and Final Valued Components Considered for the Illecillewaet Curve Safety Improvements Project

Component Category	Candidate Valued Component	Rationale for Inclusion	Included as Stand-alone VC in Effects Assessment
	Grizzly Bear	Iconic park species that is known to occur in project area, including being encountered crossing the highway.	Yes
	Mountain Goat	Iconic park species, regularly occurring in GNP with potential to be encountered crossing highway.	Yes
	Seed-eating Birds	Includes a number of seed-eating species. Concerns about mortality resulting from bird-vehicle collisions.	Yes
Cultural Resources	Archaeological Sites	Many known archaeological resources in project area.	Yes
Cultural Resources	Historic Viewpoints	Historic viewpoints have been identified and have the potential to interact with the project.	Yes
Visitor Experience	Recreational Opportunities	Potential for effects on visitor access and traffic delays.	Yes
	Viewscapes and Soundscapes	Potential for increased noise and negative visual aesthetics.	Yes
	Visitor Safety and Health	This section of the TCH is a congested area with known major safety issues related to vehicle speeds and passing behaviour.	Yes





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7. EFFECTS ANALYSIS

This section provides an analysis of potential effects of construction and operation of the project on the Valued Components identified and described in the preceding section. Effects during the operation phase were considered in terms of additional or incremental impacts beyond the baseline or pre-project condition.

The potential effects described below do not include application of mitigation measures (which are discussed in Section 8) but assume application of routine or standard environmental best management practices.

Soil and Landforms

Soil Quality

Construction

- Accidental spills or leaks during construction may adversely affect soils and soil biota, and
- There is known soil contamination in the area of the Parks compound. If contaminated soils are disturbed, they may be spread further if not properly managed. They also pose a health risk if workers come into contact with contaminated soil or vapor.

Operation

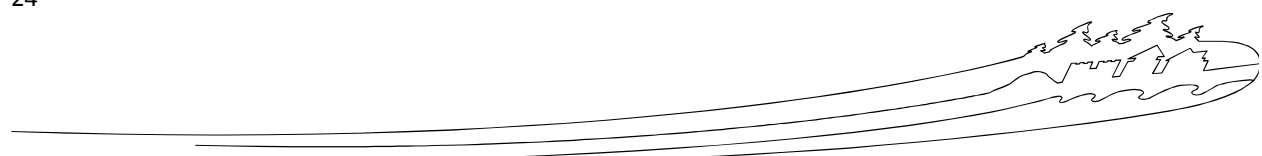
- Accidental spills or leaks from vehicles during operation or during maintenance activities may adversely affect soils. Run-off containing road salt may negatively affect soil chemistry and biota in the immediate vicinity of the roadway. With increased pavement area and consequently increased road run-off, there may be a small, incremental increase in potential impacts to soil quality.

Water

Surface Water Quality

Construction

- Construction will require work over and adjacent to watercourses,
- Accidental spills or leaks during construction may enter the Illecillewaet River or Connaught Creek and their tributaries, and
- Stripping, handling, or storing of soils, or drilling into rock has the potential to create sedimentation, which can be released into watercourses downstream, potentially creating harm for fish and fish habitat.





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Operation

- Surface water may be negatively affected during operation of the road and/or maintenance activities through accidental spills, dust, debris, salt, sand and road run-off. With increased pavement area and consequently increased road run-off, there may be a small, incremental increase in potential impacts to water quality.

Fish

Construction

- Fish could be directly harmed during culvert rehabilitation or installation through direct impact or stranding during dewatering, and
- Stripping, handling, or storing of soils, or drilling into rock has the potential to create sedimentation, which can be released into fish-bearing watercourses and directly affect fish.

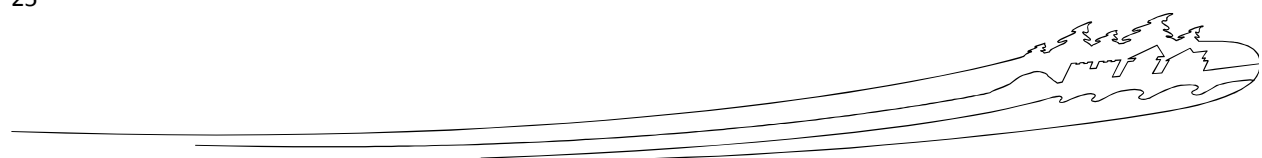
Operation

- Fish may be negatively affected during operation and/or maintenance through accidental spills, dust, debris, salt, sand and road run-off and during ditch, culvert and drainage management. With increased pavement area and consequently increased road run-off, there may be a small, incremental increase in impacts to fish.

Fish Habitat

Construction

- Because the roadway will be wider and culverts longer, there will be a small, incremental loss of fish habitat,
- Removal, rehabilitation and installation of culverts may degrade instream fish habitat,
- Extended culverts and improperly placed culverts (e.g., perched culverts) may create barriers to fish movement,
- Many of the existing culverts are in poor condition and are impeding fish passage. These culverts will be rehabilitated or replaced to improve fish passage. In addition, a new bottomless culvert will be installed over Connaught Creek (at km 22+300), improving fish habitat and passage at this location,
- Clearing and grubbing within 30 m of watercourses may degrade fish habitat through loss of riparian vegetation, and
- An 80 m long downslope retaining wall will be required on the north side of the TCH, beginning at km 27+120. Depending on final design, the retaining wall and associated work area may be within 30 m of the Illecillewaet River.





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Operation

- Fish habitat may be negatively affected during operation and/or maintenance through accidental spills, dust, debris, salt, sand and road run-off and during vegetation, ditch, culvert and drainage management. With increased pavement area and consequently increased road run-off, there may be a small, incremental increase in impacts to fish habitat.

Flora

Vegetation

Construction

- The proposed disturbance footprint between the existing edge of pavement and new daylighting will be approximately 18 ha. Much of this area will require new vegetation clearing; however, because the existing gravel shoulder is mostly unvegetated, the amount of new clearing will be less than the total footprint. An MRG Field Unit approved native seed mix will be used to reseed temporary work areas. Some woody vegetation will become established over time but routine vegetation clearing will prevent this in most roadside areas.
- Vegetation in the immediate vicinity of the project may be affected by dust and debris resulting from clearing activities.
- Soils that become compacted by vehicle and equipment use may impact vegetation growth and restoration through decrease in soil permeability, restriction of root growth and reduced availability of nutrients.
- Adjacent vegetation could be affected by an accidental spill of a harmful substance.
- There is potential for the introduction of weeds and/or invasive species from machinery and after vegetation clearing.

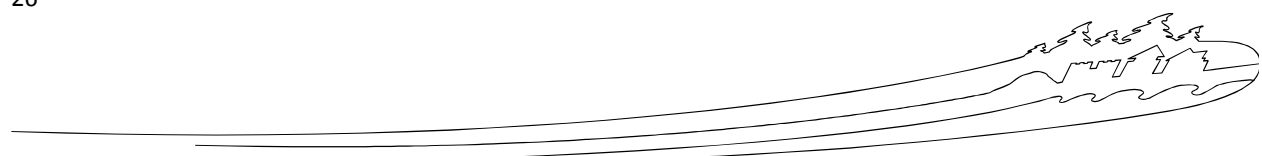
Operations

- Native vegetation may be negatively affected by the normal operation of the road and/or maintenance activities via vehicular emissions, accidental spills, dust, debris, salt, sand, run-off, snow clearing and vegetation management. These effects are not expected to increase as a result of the project.

Listed Plant Species

Construction

- The potential for VEMC within the project footprint was considered low.
- No Whitebark Pine was found near the Project footprint and none are expected.
- The Blue-listed (sensitive) Western St. John's Wort is the only record of a listed plant in or near the project footprint. The record description indicates that it is in a wetland at the base on an avalanche chute. If present within the footprint, the individual plants will be destroyed and suitable habitat will be lost due to the new road embankment.





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Operations

- Listed plant species, if present, may be negatively affected by the normal operation of the road and/or maintenance activities via vehicular emissions, accidental spills, dust, debris, salt, sand, run-off, snow clearing and vegetation management. These effects are not expected to increase as a result of the project.

Wildlife

Coeur d'Alene Salamander

Construction

- There is a rock road cut that may provide suitable habitat for Coeur d'Alene Salamander, located between km 24+000 to km 24+200, just north of Illecillewaet curve. The highway will not be widened in this area and the habitat will not be altered.
- Based on a site reconnaissance, there does not appear to be other suitable rock habitat within the project area. It is possible they are present in non-rock riparian areas.

Operation

- During operations and maintenance, salamanders could be impacted by ditch cleaning, culvert repair and cleaning, water diversion and salt. These effects are not expected to increase as a result of the project.

Western Toad

Construction

- Construction activities can harm Western Toad eggs or tadpoles if they occur in wet areas within the project area.
- Inadequate drainage or irregular surfaces left behind post construction could result in temporary puddles that attract toads to lay eggs but which later dry out resulting in the death of eggs or tadpoles.

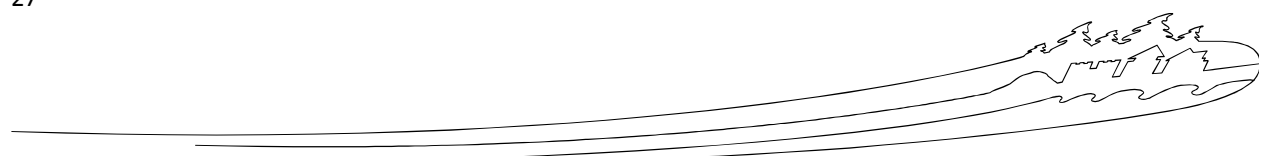
Operation

- During operations and maintenance, Western Toad could be impacted by ditch cleaning, culvert repair and cleaning, and any activity that results in water ponding during the breeding season (spring and summer). These effects are not expected to increase as a result of the project.

Barn Swallow

Construction

- Barn Swallows typically nest on artificial structures such as road culverts and bridges; as such, constructed aspects of the project and work areas may provide suitable nesting habitat, although swallows are unlikely to initiate nesting when work is underway.





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- Barn Swallows that are present in or adjacent to work areas when clearing or construction activities commence may be displaced, potentially affecting breeding and/or foraging.

Operation

- During operations and maintenance, Barn Swallows could be impacted if they have initiated nesting on built structures. If maintenance activities are appropriately scheduled (i.e., when nest are not active), these effects are not expected to increase as a result of the project.

Olive-sided Flycatcher

Construction

- Suitable habitat for Olive-sided Flycatcher may be within project work areas and nests may be destroyed if clearing occurs in the bird breeding season (approximately April 1 to August 31).
- Birds that are present in or adjacent to work areas when clearing or construction activities commence may be displaced, potentially affecting breeding and/or foraging.

Operation

- During operations and maintenance, Olive-sided Flycatcher nest could be impacted by vegetation management. These effects are not expected to increase as a result of the project.

Bats

Construction

- Although there is some evidence in BC that bats potentially use tree roots and large tree as hibernacula, existence of hibernacula within the project area is unknown and considered low.
- Tree clearing in the spring and summer (April 1 to August 31) may impact roosting bats or maternal colonies.
- Bats that are foraging adjacent to work areas when construction activities commence may be displaced.

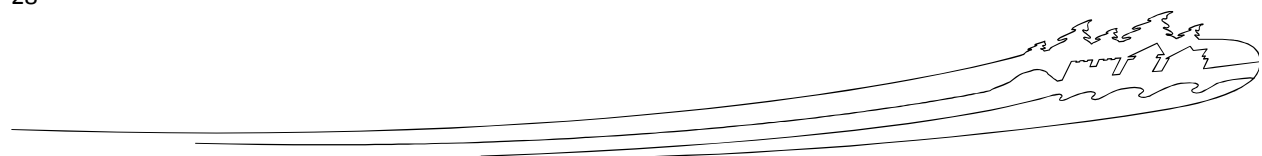
Operation

- Bats are not likely to be impacted during operations and maintenance activities.

Woodland Caribou

Construction

- The project area provides potentially suitable caribou habitat though proximity to the roadway limits its use. The project area is not within mapped critical habitat.
- The potential for caribou to encounter highway construction activities is very low. In the event that caribou are present in the Rogers Pass area during construction, they may be displaced as a result of increased noise and human presence, resulting in temporary disruption or impediment of wildlife movement or use near the work areas.





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Operation

The primary potential impact to caribou during highway operation is the potential for wildlife-vehicle collisions. When crossing the highway, caribou will be required to traverse a wider distance which may possibly affect their crossing behaviour (i.e., decision to cross) or place them at increased risk of collision. The potential magnitude of this could be low to moderate.

Grizzly Bear

Construction

- Grizzly bears are known to occur in the Rogers Pass area and along the TCH. Clearing of natural vegetation will result in a loss of Grizzly Bear food habitat, though it is very small relative to availability in the area.
- If bears are present during construction, they may be displaced as a result of increased noise and human presence, resulting in temporary disruption or impediment of movement or use near the work areas.

Operation

- The primary potential impact to bears during highway operation is the potential for wildlife-vehicle collisions. When crossing the highway, bears will be required to traverse a wider distance which may possibly affect their crossing behaviour (decision to cross) or place them at increased risk of collision. In addition, the closure of the median access at the campground road and Asulkan Trailhead may decrease the permeability of the highway to bear movement at those specific locations. The potential magnitude of this effect could be moderate given the regular crossing rate and slow reproductive rates of the species.
- Other wildlife mitigations may need to be considered as wildlife movements and crossing change due to new TCH barriers or other obstructions.

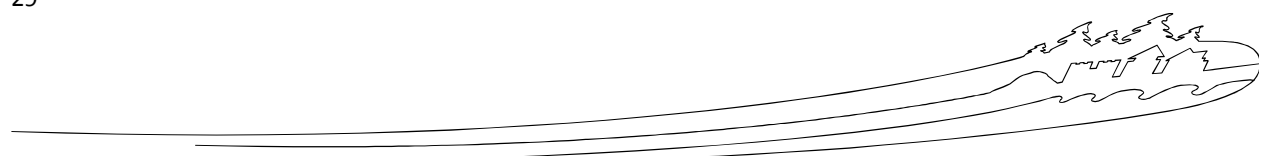
Mountain Goat

Construction

- Mountain Goat may occur near work areas and may be displaced as a result of increased noise and human presence, resulting in temporary disruption or impediment of movement or use near the work areas.

Operation

- The primary potential impact to goats during highway operation is the potential for wildlife-vehicle collisions. When crossing the highway, goats will be required to traverse a wider distance which may possibly affect their crossing behaviour (decision to cross) or place them at increased risk of collision. The potential magnitude of this effect could be low to moderate given the cumulative impact of an increasing trend in Mountain Goat strikes on the TCH within Glacier and Mount Revelstoke National Parks.





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Seed-eating Birds

Construction

- The primary concern with seed-eating birds is vehicle-collisions in winter when they are ingesting grit along the roadway. Because construction will be outside the winter season and further will not involve fast-moving vehicles, construction effects on seed-eating birds is not anticipated.

Operation

- The project is designed to enhance traffic flow through the Rogers Pass area. This will allow traffic to more consistently maintain highway speed to the posted limit. This may result in an incremental increase of higher speed vehicles and could result in an increase in mortality of seed-eating birds. In addition, a wider highway may mean increased escape distance for birds feeding on the highway resulting in increased strike susceptibility.

Cultural Resources

Archaeological Resources

Construction

- Known archaeological resources are present within portions of the footprint and have the potential to be negatively impacted (e.g., destroyed, misplaced, removed) during construction.
- Potential impacts to and recommendations for archaeology have been provide by the HCCD in the AOA:
 - Archaeologists know the railway corridor very well, but not the valley slopes beyond.
 - There are nationally significant archaeological sites here.
 - The cumulative impact to these sites has already been high.
 - Because they cannot be avoided, an Archaeological Impact Assessment is needed for the most vulnerable sites, and monitoring is needed in many other areas.
 - AIA work must be done while the ground is not frozen.

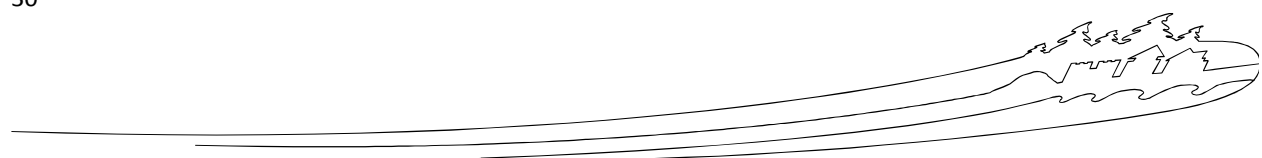
Operation

- During operations, archaeological resources can be affected by any activity involving ground disturbance and existing restrictions and accidental finds protocols must be followed. Once the project is complete, further impacts to cultural resources as a result of the project are not anticipated.

Historic Viewscapes

Construction

- During construction, the form and character of the TCH will be temporarily altered and historic viewscapes may be obscured through presence of construction equipment and temporary facilities.





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Operation

- Although the highway alignment is not changing, the form and character of the TCH will change with the addition of a new travelling lane.
- The historic viewsapes identified in Section 6 will not be changed by the project.

Visitor Experience

Recreational Opportunities

Construction

- Access to all facilities will be maintained throughout project construction.
- Construction activities will cause traffic delays and may result in a negative experience for Park visitors.

Operation

- Park recreational facilities will generally remain unchanged, but there will be impacts of varying significance (below).
- Hermit Trailhead will be enhanced through provision of additional parking and the opportunity for additional day use amenities.
- Access to the Rogers Pass Discovery Centre will be affected by changes to the frontage road, highway access and nearby parking opportunities.
- The visitor experience at the Summit of Rogers Pass Day-Use Area and the Abandoned Rails Trail will be affected by any loss of green space and forest coverage.
- There will be a small increase in travel times and navigational complexity for those accessing or departing Asulkan trailhead or Illecillewaet campground when entering from the east and departing to the west which may lead to opportunity costs and potential for lost revenue.

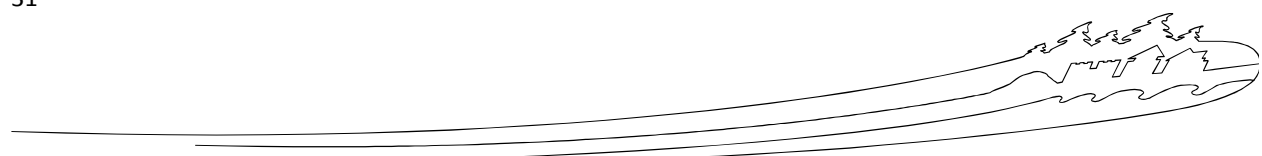
Viewsapes and Soundscapes

Construction

- Temporary noise from construction activities may result in a negative experience for visitors.
- Construction activities will have negative aesthetics and may result in negative experience for GNP visitors.

Operation

- After construction is complete, the project area viewsapes and soundscapes will be similar to the pre-construction condition. The exception will be the Abandoned Rails Trail, where loss of the forest buffer will expose visitors to more pronounced traffic noise.





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Visitor Safety and Health

Construction

- The use of machinery, and the transport of materials and equipment will increase vehicular traffic to the project site and thus increase emissions and dust mobilization into the air, thus temporarily affecting human health.
- Depending on wind direction, changes in air quality during construction (e.g., dust, fumes) may negatively affect nearby wildlife and park visitors using recreational trails in the vicinity.

Operation

- The purpose of the project is to increase vehicular safety, and will therefore result in a positive effect on visitor safety by reducing incidences of injury or mortality.

8. MITIGATION MEASURES

This section describes the environmental management practices and specific Valued Component mitigation measures that will be applied.

Guidance and Specifications

The project will be conducted according to and in compliance with all PCA guidance and specifications:

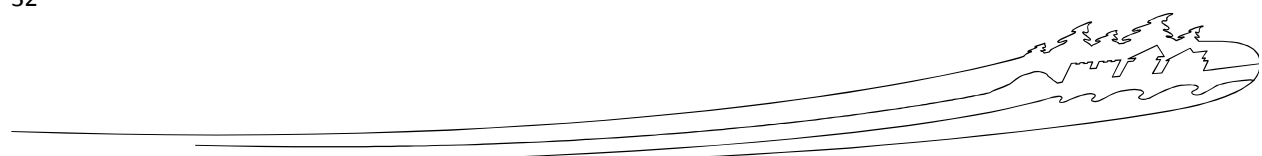
- Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure (PCA 2015d);
- Concrete Waste Management (PCA 2010);
- Nesting Bird Windows Mt Revelstoke & Glacier National Parks (MRG 2012a);
- Best Management Practice 01.00 – Vegetation Removal (MRG 2015);
- Contaminated Soils Guide June 2012 (MRG 2012b);
- Best Management Practices – Asphalt applications – Mt Revelstoke & Glacier National Parks (MRG 2011); and
- General Guidelines for Work within 50 m of Salamander Sites (Ohanjanian. 2003).

It will be expected that project staff and contractors will understand and comply with all National Park regulations within the Park. Pre-work briefings/meetings, including an Environmental Briefing, are required to address environmental sensitivities within the project site, such as potential to harm vegetation, wildlife interactions, equipment spills or leaks. This briefing will be scheduled two weeks prior to contractors arriving on site.

Environmental Protection Plan

An Environmental Protection Plan (EPP) will be prepared and provided to MRG for comment and review two weeks prior to work commencement. The EPP will:

- Be available to all staff during project activities;





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- Include an access plan including access routes, traffic safety, type of equipment used for various construction phases, and lay down areas in order to prevent/minimize disturbance to vegetation and soils. Lay down areas will occur on paved and/or hardened surfaces, where possible. Any new laydown areas will require approval from the assigned MRG Field Unit Environmental Surveillance Officer (ESO);
- Contain spill response procedures, including appropriate containment, storage, security, handling, and transportation of applicable materials/substances, spill kit requirements, and emergency response contacts. The Material Safety Data Sheets (MSDS) for all chemicals used will be made available on-site;
- Include an Emergency Response Plan that outlines procedures to follow in case of emergency (e.g., wildlife encounter, equipment malfunction/failure, fire, avalanche);
- Detailed environmental monitoring and rehabilitation;
- Erosion and sediment control plan, including measures to appropriately winterize the site;
- Include provisions to reduce human-wildlife interactions;
- In-stream works plan including culvert design; and
- Include a traffic safety or management plan.

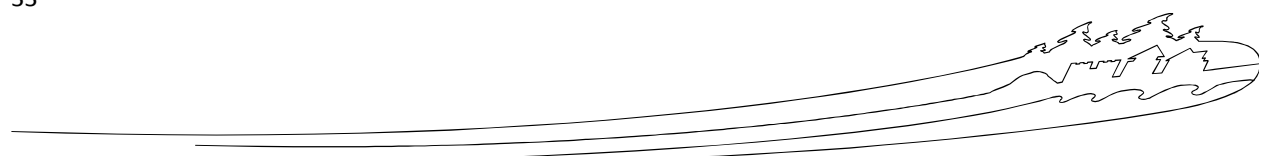
Further details will likely be required in the EPP depending on final design. The MRG Field Unit will be consulted throughout the design phase of the project and in the development of the EPP.

All staff employed at the construction sites shall be instructed by the ESO during an Environmental Briefing regarding their individual and collective responsibilities to ensure that an avoidable adverse environmental impact does not arise from their activities and/or personal decisions. The ESO, assigned by MRG Field Unit, will conduct periodic visits to ensure project operations are being conducted in accordance with identified environmental protection measures. The ESO maintains the right to halt work if required.

All spills (e.g., hydraulic fluids) will be reported immediately according to the Mount Revelstoke-Glacier spill response protocol. In the event of any fluid spills or leaks exceeding 5 litres or any spill quantity in or near water, the Spill Response Plan must be followed including immediate containment, cleanup/mitigation, and immediate reporting to Park's Canada Dispatch and the ESO. Any absorbent materials used in the clean-up or soils contaminated by the spill will be disposed of in the appropriate facilities and transported in accordance with the Transportation of Dangerous Goods Regulations. All spills, regardless of size or location, will be reported to the ESO.

Wildlife are likely to be observed or encountered during construction and the following will be adhered to:

- Notify the ESO immediately of any dens, litters, nests, carcasses (road kills or other), wildlife encounters (for species of interest as directed by the ESO), or carnivore (bears, wolves or cougars) observations on or around the worksite.
- If wildlife is observed at or near the work site, allow the animal(s) the opportunity to leave the work area to the surrounding habitat and away from areas of potential conflict.





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- If potentially dangerous wildlife (e.g., bear, cougar, wolf, coyote, deer, elk, moose, mountain goat) persistently enter the work area or display aggressive behaviour, the contractor will immediately notify Jasper Dispatch (877-852-3100), will stop work and safely evacuate the area.
- The contractor will ensure that all workers receive a wildlife awareness briefing, including the use of bear spray. Bear spray will be mandatory on site.
- Secure all materials that might attract wildlife (e.g. petroleum products, human food, recyclable food and drink containers and garbage).
- No feeding, baiting or luring of any wildlife (including bears, small mammals, birds); do not approach or harass wildlife in any way. Notify the ESO immediately if wildlife obtain garbage or human food. If wildlife get into attractants that have been intentionally or accidentally left out, individuals or the contractor could be charged under the Canada National Parks Act Regulations.

Soil and Landforms

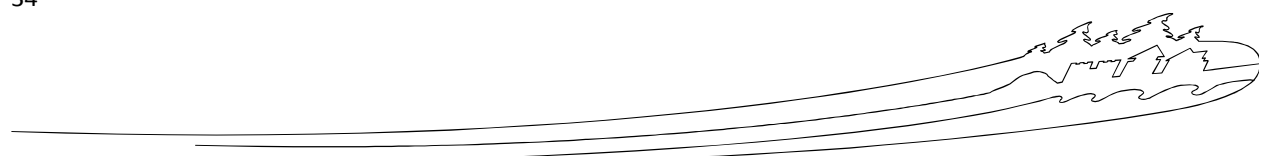
Soil Quality

Construction

- Soil stripping will be minimized. If present, topsoil will be retained to facilitate recovery.
- All fuels, gasses, or harmful substances will be contained within the appropriate and approved containers, and transported according to the Transportation of Dangerous Goods Regulations.
- Prior to use on the work areas, all equipment will be inspected for leaks of any kind. Any detected leaks will be addressed immediately. Inspections will be done daily and recorded. Equipment stored overnight will be stored on tarps with appropriate containment if required.
- In areas where contaminated soils are identified during construction activities, the area will be managed for human and ecological health risks. This may include collecting soil samples to submit to a lab, additional excavations to attempt delineation and consultation with contaminated sites risk management specialists.
- Soil from known contaminated sites will be characterized prior to removal and then sent for disposal to an appropriate waste management facility outside the Park.
- If workers encounter contaminated soils, workers will wear the necessary Personal Protective Equipment to eliminate exposure risk.

Operation

- No additional mitigation measures are required as a result of the project.





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Water

Surface Water Quality

Construction

- Work will be undertaken in such a manner as to prevent the release of sediment-laden water, raw concrete or concrete leachate, or any other deleterious substance into a watercourse, tributary or drainage ditch which leads to fish habitat.
- Fuels, gases, or other deleterious substances will not be stored where leaks and spills have the potential to travel down gradient and enter any watercourse.
- Effective sediment and erosion control measures will be installed before starting work near watercourses. Sediment and erosion control measures will be inspected regularly during the course of construction and repairs shall be made as necessary.
- The site will be secured against erosion during any periods of construction inactivity or shutdown.
- Work within a 30 m buffer of watercourses requires the close oversight of a Qualified Environmental Professional (QEP) and the HES Departmental Representative. Soils disturbed as a result of vegetation clearing within the 30 m buffer of watercourses should be stabilized in as timely a manner as possible to prevent mobilization of sediment to the watercourse.
- Machinery, equipment, and construction personnel will not enter any watercourse associated with the project. All work will occur above the high water mark and in a manner that minimizes disturbances to the natural materials and vegetation that contribute to fish habitat or stream channel stability.
- The clearing of riparian vegetation will be minimized where practical. Riparian vegetation will be re-established as soon as possible. The MRG Fire/Vegetation specialist will be consulted regarding appropriate reclamation measures, including but not limited to rates of reseedling, live-staking and on-going site monitoring.
- Machinery washing and fuel storage is to be at least 100 m away from any watercourse.
- Refueling and servicing (e.g., equipment lubrication) will ideally be at least 100 m away from any watercourse. Because very little of the project area is more than 100 m from a watercourse, locations within 100 m of a watercourse may be required and determined in consultation with the ESO.
- In the event of any fluid spills or leaks exceeding 5 litres or any spill quantity to water all other work shall be stopped and all personnel devoted to spill containment and cleanup.

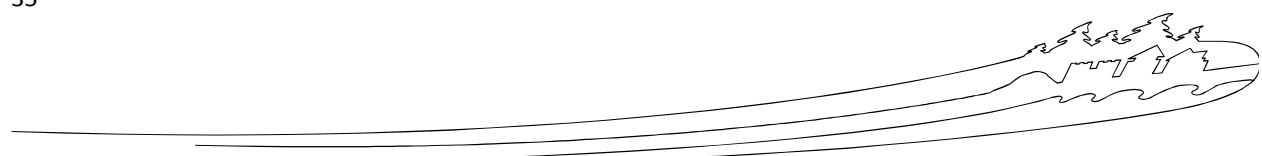
Operation

- No additional mitigation measures are required as a result of the project.

Fish

Construction

- Direct effects of sediment on fish will be minimized by using the practices specified under Water Quality.





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- Work will be conducted according to BC Ministry of Environment's Guidebook for Instream Work (<http://www.env.gov.bc.ca/wld/instreamworks/index.htm>) and Department of Fisheries and Oceans Canada (DFO) guidance on projects near water (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>).
- For watercourses known or expected to support fish, instream work will be conducted during periods of least risk to fish if possible. The DFO reduced risk window is July 1 to July 31 for Bull Trout. For Mountain Whitefish, it is June 1 to September 15. Therefore, in-stream work outside July 1 to July 31 will only be conducted if approved by MRG Field Unit and DFO.
- All in-stream work will be conducted in isolation of water and fish will be salvaged during dewatering. Full details regarding in-stream works, including but not limited to identifying number of pumps, pump capacity, dam designs, screen size and monitoring will be provided in the EPP.
- All existing culverts that are in poor condition or not to current standards will be replaced to improve water connectivity and fish passage. Culvert specifications will be provided in the EPP.

Operation

- No additional mitigation measures are required as a result of the project.

Fish Habitat

Construction

- Removal, rehabilitation and installation of culverts will be conducted in such a manner to minimize the disturbance footprint.
- Direct effects of sediment on fish will be minimized using the practices specified under Water Quality.

Operation

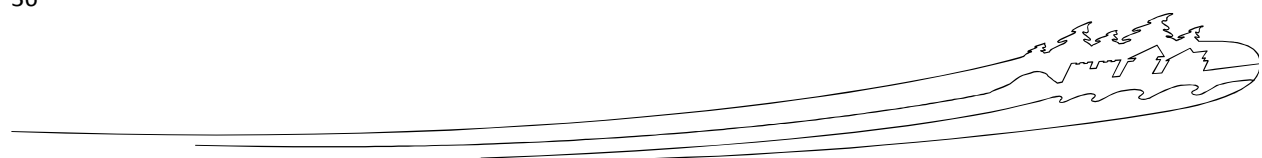
- No additional mitigation measures are required as a result of the project.

Flora

Vegetation

Construction

- Staging equipment, parking for vehicles, materials, etc. must be kept to existing hardened surfaces.
- If vegetation clearing is to occur within the bird breeding window (April 1 to August 31), approval must be obtained by the MRG FUS and pre-clearing bird nest surveys completed by a QEP will be required to ensure that no active nests are destroyed. If an active nest of any bird species is found, a no-disturbance zone will be established and the area will remain undisturbed until young have fledged.





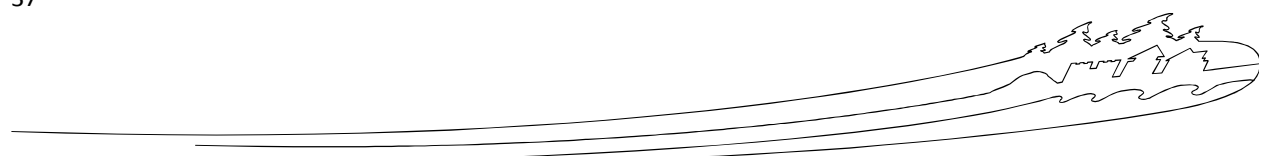
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- All areas to be cleared will be clearly marked and no vegetation will be cut or cleared without the direct approval of MRG Field Unit.
- The Contractor is responsible for all construction equipment that could transport invasive plants into the Project zone. Vehicles must be thoroughly cleaned and free of soil and weed seeds prior to arrival on site. Contractor's equipment should be cleaned regularly, with additional attention to movement between sites to minimize spread of invasive plants. Contractor's equipment and vehicles should avoid staging, parking and turning around at sites where invasive plant infestations exist.
- To prevent the spread of invasive plants, the contractor will ensure that soils, seeds, and debris attached to clothing, footwear and construction equipment to be used on the Project Sites have been removed outside GNP, prior to arrival on the work site, and before leaving the area. Vehicle undercarriages, wheels, blades/buckets and footwear will receive special attention.
- Prior to work commencement, the MRG Fire/Vegetation specialist will be consulted to identify if any pre-work control of invasive species is required.
- If invasive non-native species are identified on-site, MRG Field Unit will be notified to determine appropriate measures of treatment. The Environmental Monitor on site will be trained and qualified to identify invasive non-native plant species.
- The Contractor is responsible for seeding all disturbed areas and exposed soils with MRG approved seed mixes to help prevent invasive plant infestations. Seeds must be worked into the soil to improve germination.

MRG FU staff shall monitor sensitive sites and wetlands adjacent to project works for potential invasive plant spread. Where found, the MRG FU will control weeds appropriately according to site restrictions (i.e., mechanical control/ hand-pulling in wetland areas).
- The Project will provide for the cost of monitoring seed germination, native plant establishment (including native shrub planting) and remediation of invasive plants at a rate of \$1000/ha of disturbed area per year over a period of three years. Native shrub staking will occur at disturbed sites where shrub establishment is required to accelerate re-vegetation and reclamation to prevent invasive plant establishment.
- The contractor will develop a fire prevention plan as part of the EPP. The fire prevention plan will comply with applicable Parks Canada fire prevention policies.
- During clearing activities, trees will be felled towards the project to avoid disturbing adjacent vegetation outside of the project area clearing limits.

Operations

- No additional mitigation measures are required as a result of the project.





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Listed Plant Species

Construction

- The location of the record of the Blue-listed (sensitive) species St. John's Wort located near the project footprint will be determined. If present within the footprint, the MRG Field Unit will be contacted to discuss management options, such as transplanting.

Operations

- No additional mitigation measures are required as a result of the project.

Wildlife

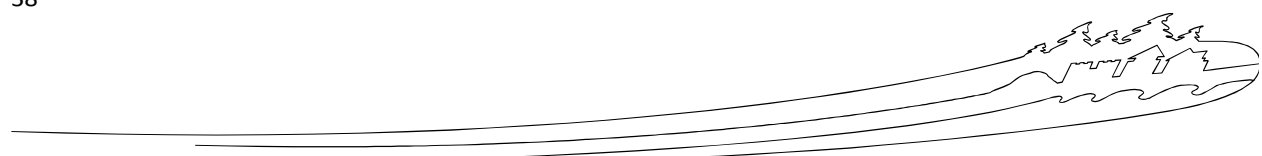
Coeur d'Alene Salamander

Construction

- Although there is a rock cut that may provide suitable habitat for Coeur d'Alene Salamander located between km 24+000 to km 24+200, it will not be within the work areas and no surveys are required.
- It is possible Coeur d'Alene Salamander may be present in other riparian areas. To minimize possible effect on salamanders in these areas, coarse woody debris will be left or restored during culvert repair and replacement to reduce alteration to habitat, wherever possible.
- To prevent direct mortality from blasting, use pry bars or s-mite and not dynamite.
- Do not dump waste materials including sediment closer than 50 m from any rocky formation, boulder pile or stream banks.
- During culvert repair and maintenance, maintain water flow and minimise disturbance to site.
- Move debris to downstream of culvert. Do not remove the material from site.

Operation

- Ditching will be conducted in consultation with MRG. Is will occur as minimal and as infrequent as possible in areas where Coeur d'Alene salamander are likely to occur.
- At the base of rock walls, do not disturb until temperatures are less than 4 degrees, and only disturb ½ m deep.
- If mitigations for alien and invasive plants are required, use biological control for knapweed and use hand or mechanical removal for other species.
- If safety allows, apply gavel and minimise salt use.





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Western Toad

Construction

- Western Toads may potentially breed in water bodies and wetlands in the project sites. They may also breed in temporary pools and tire ruts within the work areas. If pools, wetlands and water-filled tire ruts are present in areas directly impacted by construction activities in spring and summer, the proponent will conduct pre-work Western Toad surveys. If toads are present, MRG Field Unit will be contacted to discuss options to relocate toads to other locations.
- High numbers of western toadlets are often observed migrating from the lagoon towards the apartment buildings within the maintenance compound and toward the TransCanada Highway in the fall. If any toadlets are observed, MRG Resource Conservation will be contacted for advice on how to move forward.
- The final surface will have good drainage and be left in a smooth condition to avoid creating puddles that attract toads to lay eggs but which later dry out to kill the eggs or tadpoles.

Operation

- No additional mitigation measures are required as a result of the project.

Barn Swallow

Construction

- Clearing and Grubbing should occur outside of the Nesting Bird Window, as per the Nesting Bird Windows Mt Revelstoke & Glacier National Parks (MRG 2012a) and Best Management Practice 01.00 – Vegetation Removal (MRG 2015);
- If active Barn Swallow nests are present on structures that will be affected by construction activities, MRG Resource Conservation will be contacted to determine the appropriate action.
- Environment and Climate Change Canada recommends setbacks from active Barn Swallow nests up to 100 m, depending on the nature of adjacent disturbance.

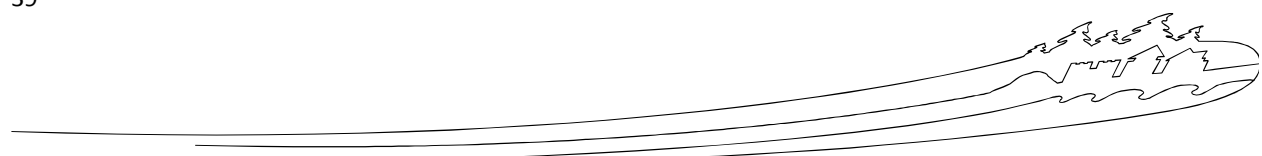
Operation

- If active Barn Swallow nests are present on structures that will be affected by maintenance activities, MRG Resource Conservation will be contacted to determine the appropriate action.

Olive-sided Flycatcher

Construction

- Clearing and Grubbing should occur outside of the Nesting Bird Window, as per the Nesting Bird Windows Mt Revelstoke & Glacier National Parks (MRG 2012a) and Best Management Practice 01.00 – Vegetation Removal (MRG 2015);





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- If vegetation clearing is to occur within the bird breeding window (April 1 to August 31), approval must be obtained by the MRG FUS and pre-clearing bird nest surveys completed by a QEP will be required to ensure that no active nests are destroyed. If an active nest of any bird species is found, a no-disturbance zone will be established and the area will remain undisturbed until young have fledged.
- If nesting behaviour is observed outside of the Besting Bird Window, MRG Resource Conservation will be contacted to determine the appropriate action.
- Environment and Climate Change Canada recommends setbacks from active Olive-sided Flycatcher nest up to 300 m, depending on the nature of adjacent disturbance.

Operation

- No additional mitigation measures are required as a result of the project.

Bats

Construction

- Tree clearing in the spring and summer (April 1 to August 31) may impact roosting bats or maternal colonies. An assessment of the need for bat roost surveys will be conducted if clearing occurs during this period.

Operation

- No additional mitigation measures are required as a result of the project.

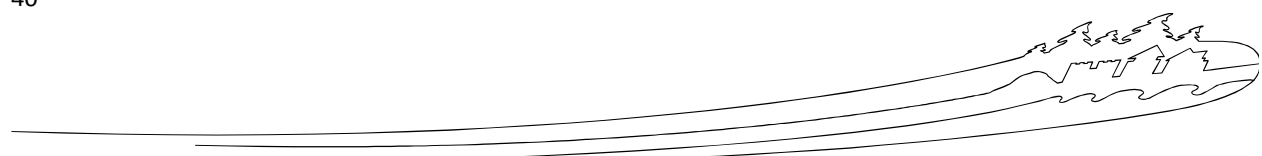
Woodland Caribou

Construction

- In the unlikely event that caribou are present in the Rogers Pass area during construction, they may be displaced as a result of increased noise and human presence, resulting in temporary disruption or impediment of wildlife movement or use near the work areas. Most work will occur during daylight hours and there will often be at least eight hours per day without construction activity. This will provide caribou and other wildlife that are looking to cross the TCH an opportunity to do so without construction noise and human presence.
- If caribou are present in any active work area, work will be temporarily halted until the animal has left the area.

Operation

- Other wildlife mitigations may need to be considered as wildlife movements and crossing change due to new TCH barriers or other obstructions. For example, construction of jump outs on shoulders and in median/jersey barriers, temporary holding of traffic, implementation of wildlife detection system and associated signage.





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- Construction of a wildlife overpass in this area would likely mitigate adverse effects related to reducing the permeability of the highway. The preliminary design of a wildlife overpass is being carried out as part of this project. MRG FU is actively pursuing the construction of a wildlife overpass as a separate project.

Grizzly Bear

Construction

- Most work will occur during daylight hours and there will often be at least eight hours per day without construction activity. This will provide Grizzly Bears and other wildlife that are looking to cross the TCH an opportunity to do without construction noise and human presence.
- If bears are present in any active work area, work will be temporarily halted until the animal has left the area.

Operation

- Other wildlife mitigations may need to be considered as wildlife movements and crossing change due to new TCH barriers or other obstructions. For example, construction of jump outs on shoulders and in median/jersey barriers, temporary holding of traffic, implementation of wildlife detection system and associated signage.
- Construction of a wildlife overpass in this area would likely mitigate adverse effects related to reducing the permeability of the highway. The preliminary design of a wildlife overpass is being carried out as part of this project. MRG Field Unit is actively pursuing the construction of a wildlife overpass as a separate project.

Mountain Goat

Construction

- Most work will occur during daylight hours and there will often be at least eight hours per day without construction activity. This will provide goats and other wildlife that are looking to cross the TCH an opportunity to do without construction noise and human presence.
- If goats are present in any active work area, work will be temporarily halted until the animal has left the area.

Operation

- Other wildlife mitigations may need to be considered as wildlife movements and crossing change due to new TCH barriers or other obstructions. For example, construction of jump outs on shoulders and in median/jersey barriers, temporary holding of traffic, implementation of wildlife detection system and associated signage.





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- Construction of a wildlife overpass in this area would likely mitigate adverse effects related to reducing the permeability of the highway. The preliminary design of a wildlife overpass is being carried out as part of this project. MRG Field Unit is actively pursuing the construction of a wildlife overpass as a separate project.

Seed-eating Birds

Construction

- The seed-eating bird-vehicle collision issue relates to highway operation and there are no mitigation measures specific to the construction phase, because construction will not occur in winter.

Operation

- Use of signage warning motorists to slow down and honk to avoid hitting seed-eating birds feeding on the roads in the winter is recommended.
- Ongoing dialogue between MRG Field Unit, HES and the Highway Operations Unit will be required to develop strategies to further mitigate effects to seed-eating birds.

Cultural Resources

Archaeological Resources

Construction

- The archaeological mitigation measures described in the Archaeological Overview Assessment include a requirement for Archaeological Impact Assessments in select areas and for close monitoring during construction in other areas (Table 4).
- The most sensitive areas are within the second phase of work, from the summit monument area north and east to the snowsheds. The Archaeological Impact Assessments will be completed in the late spring/early summer of 2016, in advance of clearing and grubbing activities that are scheduled for September and October 2016. Additional mitigations may arise from the AIAs.
- For all areas, even if not in areas identified as high priority, a chance find protocol will be developed and will include the following (adapted from the AOA):
 - If significant features (i.e., structural remains and/or high artifact concentrations) are encountered, work will stop in the immediate area.
 - Photographs and a GPS coordinates will be recorded, and the site manager and HES informed.
 - The site manager will then contact the MRG Field Unit and Parks Canada's Terrestrial Archaeology section for advice and assessment of significance that will in turn determine what will be required to mitigate the chance find.

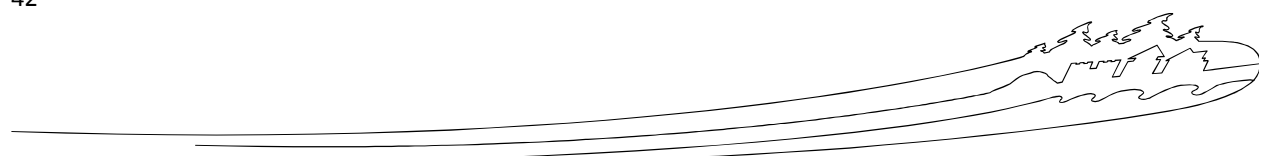




Table 4: Archaeological Mitigation Measures for the Illecillewaet Curve Safety Improvements Project.

Km	Known Site Names	Concern	Mitigation action
20+840 – 22+375 Map sheets 3, 4 and 5.	411T44, Rogers Pass Station #2 on south side of TCH, 1886 – 1899 and includes up to archaeological site 411T5, Rogers Pass Station and yards.	Immediately south of TCH; probably impacted by original TCH construction; while no vegetation clearing is shown on project plans, any expansion of current alignment to the south will impact the site; new Hermit Hut trailhead road and parking on north side of TCH may impact resources associated with site. There is a strong probability of scatter of historic artefacts and features, relating to Rogers Pass siding and stations between the Hermit Hut trail parking area and the Rogers Pass operations centre at 22+375.	Monitor during clearing and grubbing, and during construction of Hermit Hut trailhead and parking on north side of highway
22+375-23+100 Map sheets 5 and 6	Rogers Pass stations 3 and 4, summit siding (411T5, 1247T)	Dense concentration of rail grades, sidings, structures, refuse deposits associated with two different sidings and stations; proposed vehicle ponding area has not been well surveyed ever, and it will have cultural resources; even if surface is currently disturbed by paving, there may well be buried resources; hydrocarbon contamination from industrial use	AIA needed before project begins, to flag known features, and particularly to assess ponding area

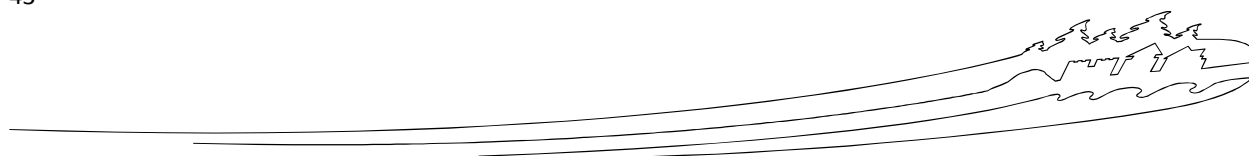




Table 4: Archaeological Mitigation Measures for the Illecillewaet Curve Safety Improvements Project.

Km	Known Site Names	Concern	Mitigation action
23+100 – 23+500 westbound Map sheets 6 and 7	Site 411T6, snowshed on 1885 grade	Shed and grades clearly visible; grubbing and clearing line comes very near to east edge of snowshed feature, which is too close and could damage the feature; removal of vegetation exposes remains to erosion and snow load. Park developing an interpretive trail through these features.	Do not clear vegetation right up to snowshed and abandoned grade, maintain a wider buffer. An AIA needed before clearing begins, to clearly flag the resources
23+500 – 23+700 westbound Map sheet 7	None; snowsheds that were in this area have been destroyed by mudslide	No concerns	None
23+700 – 24+250 westbound Map sheets 7 and 8	Site 411T8, snowshed on 1885 grade immediately north of monument and crossing over to south of highway.	Shed and grades clearly visible; grubbing and clearing line comes right up to east edge of snowshed feature, which is too close and could damage the feature; removal of vegetation exposes remains to erosion and snowload. Park developing an interpretive trail through these features.	Do not clear vegetation right up to snowshed and abandoned grade, maintain a wider buffer. An AIA needed before clearing begins, to clearly flag the resources.
24+160 – 24+250 westbound	TCH monument parking lot, 1885 grade passed under this, probably destroyed	Traces of old grade visible on north and south edges	Monitor and document before any repaving or work on access roads
24+250-26+600 Map sheets 8,9,10,11,12	Section between summit and Glacier siding and Glacier Warden Station.	Old railgrade on the east side of highway. No concerns.	None.
26+700-27+000 Map sheet 12	Glacier warden station, 23T, and beginning of Glacier House Tally-ho road	Structural features and levelled platforms very near current highway cutbank	Monitor before construction, record current condition; avoid

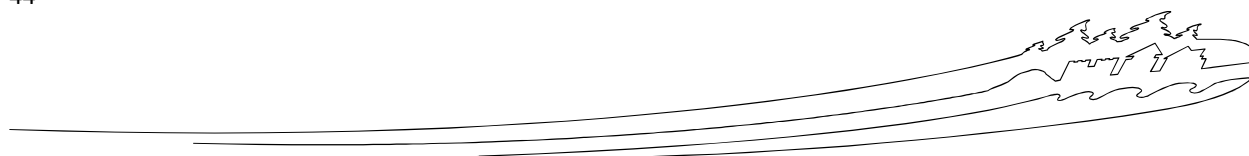


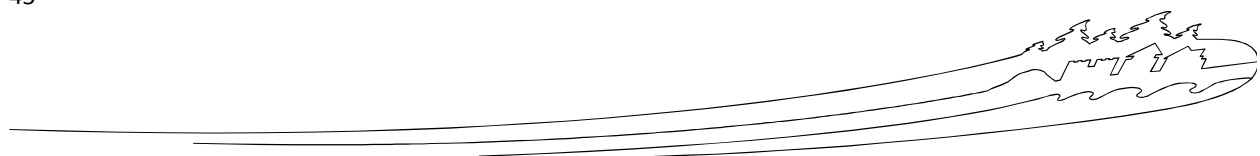


Table 4: Archaeological Mitigation Measures for the Illecillewaet Curve Safety Improvements Project.

Km	Known Site Names	Concern	Mitigation action
26+800-28+000 Map sheets 12, 13, and 14	Glacier siding, 411T42, west portal work camp	Scatter of artefacts, structural remains	AIA required to determine whether any structural or artifacts are present in this area prior to vegetation removal. Monitor during clearing and grubbing. Depending on results of AIA, archaeological monitoring may be required.
28+000 – 27+800 Map sheet 14	-	New turnaround construction	Monitor during clearing and grubbing
28+000-29+100, east and west bound except for area noted below for Cambie siding. Map sheets 14 and 15	-	No concerns	None
28+960-29+100. East and west bound Map sheet 16	Cambie siding 411T31 and 411T50, construction work camp (continues W of project area)	Scatter of structural remains, historic artefacts	Monitor during clearing and grubbing, both sides TCH

Operation

- No additional mitigation measures, beyond what is already in place, are required as a result of the project.





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Historic Viewscapes

Construction

- Prior to construction, recording of current conditions in relation to the historic viewscapes will be conducted by the MRG Field Unit in collaboration with National Office to document the cultural and spiritual beliefs related to the mountain landscapes theme. This recording will contribute to conveying the history of the CP railway as well as the TCH, both part of the commemorative intent of Roger Pass designation. This work will be conducted in conjunction with mitigations that have already approved under the Avalanche Mitigations project (a separate project in MRG).

Operation

- No additional mitigation measures are required as a result of the project.

Visitor Experience

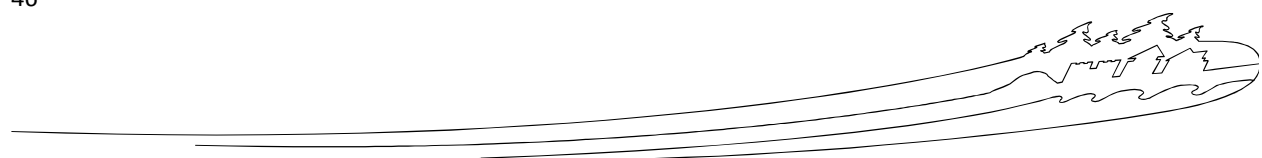
Recreational Opportunities

Construction

- Access to all facilities will be maintained throughout project construction.
- The MRG Field Unit will be kept apprised of timelines, work periods, and construction activities so that their staff (e.g., Discovery Centre and media) can provide information to the public to ensure no additional safety risks are imposed on recreational users in the vicinity of the project work areas during construction.
- Construction activities will take place within the designated hours which will be determined in consultation with MRG Field Unit. No work will be permitted on Civic Holidays or long weekends unless prior written approval is granted. A traffic accommodation plan must be approved prior to construction.
- Road closures during peak traffic times will be avoided.
- To reduce noise and air pollution, construction equipment will be turned off when not in use, all equipment and vehicles will be operated at optimal/efficient performance, and carpooling of personnel will be encouraged as much as possible.

Operation

Park recreational facilities will remain unchanged, with the exception of Hermit Trailhead, which will be enhanced through provision of additional parking and opportunity for additional day use amenities, and traffic access changes to Illecillewaet campground, Asulkan parking lot and the Discovery Centre.





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Viewscales and Soundscapes

Construction

- All construction equipment will be maintained to ensure they operate at optimal performance to reduce noise and air emissions.
- Staging and laydown areas and the office trailer area will be kept in a tidy condition.

Operation

- After construction is complete, the project area viewscales and soundscapes will be similar to the pre-construction condition at most locations. At the Abandoned Rails Trail, a forest buffer must be left in place along the east side of the original trail, to provide some attenuation of highway traffic noise and to reduce the intrusion of traffic into the historic environment viewscape.

Visitor Safety and Health

Construction

- Dust generated by project activities will be controlled by covering stockpiles and, if necessary, use of a water truck to wet down dusty areas.
- No motor vehicles or other equipment should idle when not in use, unless required under extenuating circumstances, in order to reduce air emissions and noise pollution.
- A traffic accommodation strategy or management plan will be prepared to address contractor and public safety around the site.
- The contractor is responsible for posting road signage (e.g., trucks turning, or reduced speed) to ensure public safety.

Operation

- No additional mitigation measures, beyond what is already in place, are required as a result of the project.

9. PUBLIC/STAKEHOLDER ENGAGEMENT & ABORIGINAL CONSULTATION

9 a) Indicate whether public/stakeholder engagement was undertaken in relation to potential adverse effects of the proposed project:

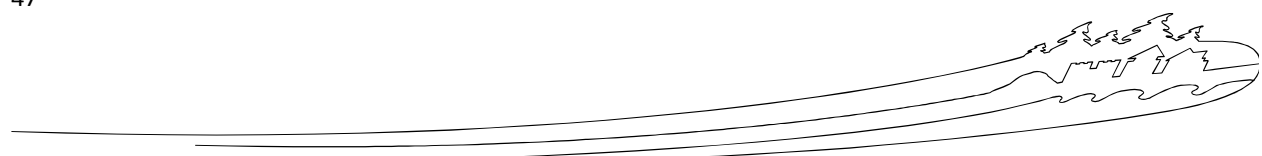
☒ No

☐ Yes (describe the process to involve relevant parties and indicate how comments were taken into consideration).

9 b) Indicate whether Aboriginal consultation was undertaken in relation to potential adverse effects of the proposed project:

☒ No

☐ Yes (describe the process to involve relevant parties and how the results were taken into consideration).





10. SIGNIFICANCE OF RESIDUAL ADVERSE EFFECTS

Residual effects are those effects resulting from the project after application of the mitigation measures. Factors that were considered in the determination of residual effects included spatial scale, duration, ecological/cultural context and likelihood of occurrence.

Table 5: Summary of Residual Effects Resulting from the Illecillewaet Curve Safety Improvements Project

Valued Component	Residual Effect
Soil Quality	With proper soil management and spill prevention and management, no significant residual adverse effects are anticipated.
Surface Water Quality	With proper spill prevention and management and erosion and sediment control measures, no significant residual adverse effects are anticipated.
Fish	Direct fish mortalities are unlikely with application of mitigation. No significant residual adverse effects are anticipated.
Fish Habitat	There will be a small incremental decrease in fish habitat due to culvert extensions; however repair of existing culverts that are impeding fish passage will result in a net habitat increase. Loss of riparian vegetation during construction is temporary and reversible. No significant residual adverse effects as a result of the project are anticipated.
Vegetation	There will be a loss of native vegetation. However, because the loss is small relative to the overall cover of natural vegetation in the Rogers Pass area, no significant residual adverse effects are anticipated.
Listed Plant Species	There will be no impacts to legally protected plant species. Impacts to the Blue-listed (sensitive) Western St. John's Wort (if present in the footprint) may be mitigated through salvage and relocation. There are other known locations of this plant in Rogers Pass. No significant residual adverse effects as a result of the project are anticipated.
Coeur d'Alene Salamander	The highest potential habitat in the project area will be avoided. Mitigation measures to mitigate impacts to fish habitat will also mitigate impacts to Coeur d'Alene Salamander riparian habitat. No significant residual adverse effects as a result of the project are anticipated.

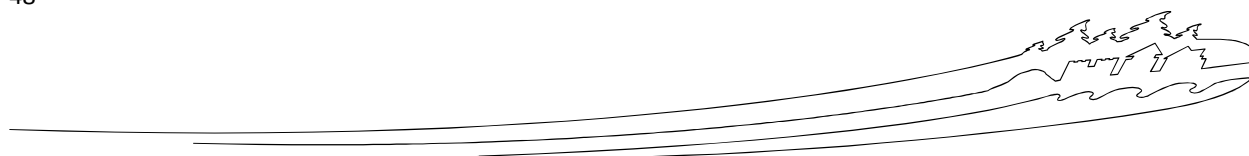




Table 5: Summary of Residual Effects Resulting from the Illecillewaet Curve Safety Improvements Project

Valued Component	Residual Effect
Western Toad	<p>Work in areas of potential Western Toad breeding is unavoidable. Pre-work toad surveys conducted by the contractor will reduce potential impacts.</p> <p>Western toad breeding habitat is available elsewhere in Rogers Pass.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Barn Swallow	<p>Clearing outside the bird breeding season or conducting of pre-clearing bird surveys, will minimize potential for impacts to nesting birds.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Olive-sided Flycatcher	<p>Clearing outside the bird breeding season or conducting of pre-clearing bird surveys, will minimize potential for impacts to nesting birds.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Bats	<p>Clearing outside the bat breeding season or conducting pre-clearing roost surveys (if potential roost trees are present) will minimize potential for residual effects.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Woodland Caribou	<p>Caribou do not normally occur in the project area and there is no designated Critical Habitat there. Potential construction impacts on caribou (if present) are short duration. After project completion, the wider highway may affect crossing behaviour or increase risk of collision. The magnitude of this effect may be low to moderate.</p> <p>With application of mitigations, residual adverse impacts are likely to be low to moderate.</p>
Grizzly Bear	<p>Potential construction impacts on grizzly bear are short duration.</p> <p>After project completion, the wider highway may affect crossing behaviour or increase risk of collision. The magnitude of this effect may be moderate.</p> <p>With application of mitigations, residual adverse impacts are likely to be low to moderate.</p>

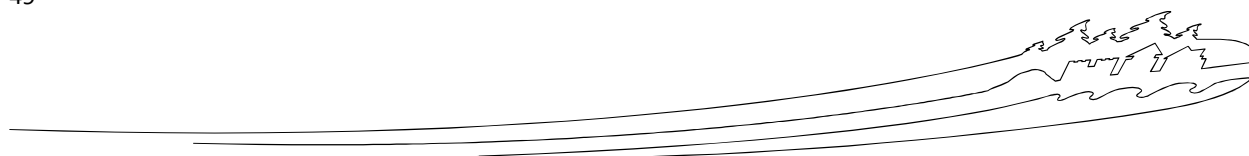




Table 5: Summary of Residual Effects Resulting from the Illecillewaet Curve Safety Improvements Project

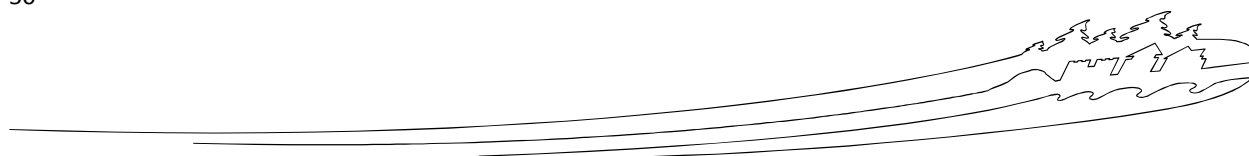
Valued Component	Residual Effect
Mountain Goat	<p>Potential construction impacts on mountain are short duration.</p> <p>After project completion, the wider highway may affect crossing behaviour or increase risk of collision. The magnitude of this effect may be low to moderate.</p> <p>With application of mitigations, residual adverse impacts are likely to be low to moderate.</p>
Seed-eating Birds	<p>The project is designed to enhance traffic flow through the Rogers Pass area, allowing traffic to more consistently maintain highway speed and possibly resulting in an incremental increase in mortality of seed-eating birds. The incremental effects are predicted to be small.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Archaeological Sites	With completion of AIAs and application of mitigation, no significant residual adverse effects are expected.
Historic Viewscapes	Prior to construction, visual documentation of current conditions will be conducted. There will no permanent change to identified historic viewscapes.
Recreational Opportunities	No significant residual adverse effects on recreational opportunities are expected.
Viewscapes and Soundscapes	No significant residual adverse effects on viewscapes and soundscapes are expected.
Visitor Safety and Health	The project will increase visitor safety.

11. SURVEILLANCE

- ☐ Surveillance is not required
- ☒ Surveillance is required

Site Inspection Program Details

An Environmental Monitor will be provided by the contractor to oversee the construction activities and ensure that all project operations are conducted in accordance with all identified mitigation measures, including in-stream works and work in riparian areas. Support will be required to conduct nest surveys if clearing is to be carried out in the bird nesting window. Additional support may be required for bat roost and amphibian surveys.





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A certified archeologist will be required for archeological impact assessment work and on site monitoring during construction – namely clearing, grubbing and any excavation within high risk areas. This work will be conducted in collaboration with the FU CRM advisor.

12. FOLLOW-UP MONITORING

Follow-up monitoring is:

- ☐ not required
- ☐ legally required (e.g. under the *Species at Risk Act* or *Fisheries Act*)
- ☒ required in accordance with the *Parks Canada Cultural Resource Management Policy*
- ☒ required as identified in mitigation measures.

13. SARA NOTIFICATION

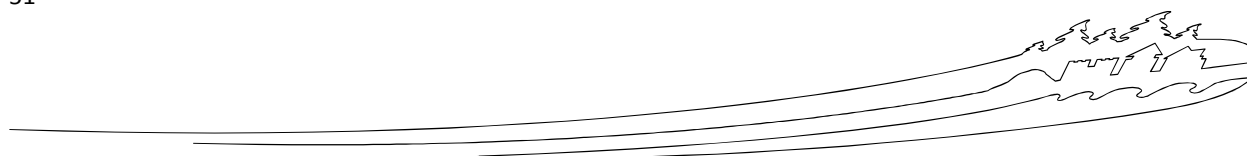
Notification is:

- ☒ not required
- ☐ required under the *Species at Risk Act*

14. EXPERTS CONSULTED

Department/Agency/Institution: Parks Canada Agency	Date of Request: 2015-11-27
Expert's Name & Contact Information: Trevor Kinley Highway Engineering Services, Radium BC Trevor.kinley@pc.gc.ca	Title: Environmental Assessment Scientist
Expertise Requested: Provided information about wildlife occurrences in GNP. Guidance on BIA requirements.	
Response: Provided information about caribou critical habitat and other data and information.	

Department/Agency/Institution: Parks Canada Agency	Date of Request: 2015-12-08
Expert's Name & Contact Information: Sarah Boyle Mount Revelstoke and Glacier National Parks Sarah.Boyle@pc.gc.ca	Title: Ecologist Team Leader
Expertise Requested: Biophysical information for project area. Guidance on BIA scope.	
Response: Provided biophysical information for project area. Guidance on BIA scope.	





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Department/Agency/Institution: Parks Canada Agency	Date of Request: 2015-12-08
Expert's Name & Contact Information: Alexandra Taylor Mount Revelstoke and Glacier National Parks alexandra.taylor@pc.gc.ca	Title: A/ EIA Coordinator, Contaminated Sites and Environmental Management
Expertise Requested: Biophysical information for project area. Guidance on BIA scope.	
Response: Provided biophysical information for project area. Guidance on BIA scope.	

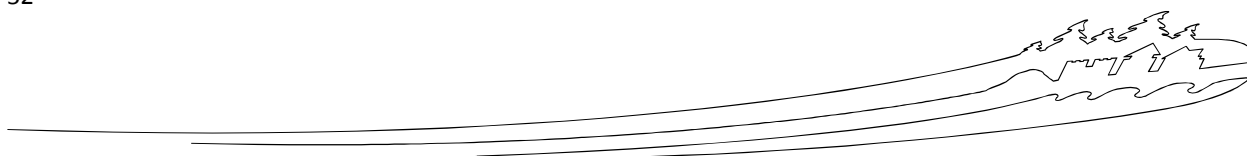
Department/Agency/Institution: Parks Canada Agency	Date of Request: 2015-12-22
Expert's Name & Contact Information: Gwyn Langemann and Bill Perry, HCCD Bill.Perry@pc.gc.ca Gwyn.Langemann@pc.gc.ca	Title: Archaeologists
Expertise Requested: Requested information about heritage data near Illecillewaet Curve.	
Response: Provided an Archaeological Overview Assessment	
Department/Agency/Institution: Parks Canada Agency	Date of Request: 2015-12-08
Expert's Name & Contact Information: Rick Reynolds Mount Revelstoke and Glacier National Parks Rick.Reynolds@pc.gc.ca	Title: Visitor Experience
Expertise Requested: Input on design relating to visitor experience.	
Response: Provided visitor experience input in to design at design review meetings.	

Department/Agency/Institution: Parks Canada Agency	Date of Request: 2016-01-16
Expert's Name & Contact Information: Gwénaëlle Le Parlouër 819-420-9220	Title: Policy Advisor, Cultural Resources Management
Expertise Requested: Request made by MRG field Unit.	
Response: Indicated that the construction and operation of the TCH is of historic significance and that artifacts associated with historic highway construction be protected. Provided a list of preliminary historic viewsapes associated with the TCH and Rogers Pass.	

15. DECISION

Taking into account implementation of mitigation measures outlined in the analysis, the project is:

- ☒ not likely to cause significant adverse environmental effects.
- ☐ likely to cause significant adverse environmental effects.



**FOR SARA REQUIREMENTS:**


- ☒ There are no residual adverse effects to species at risk and therefore the SARA-Compliant Authorization Decision Tool was not required

OR, the SARA-Compliant Authorization Decision Tool ([Appendix 2](#)) was used and determined:

- ☐ There is no contravention of SARA prohibitions
- ☐ Project activities contravene a SARA prohibition and CAN be authorized under SARA
- ☐ Project activities contravene a SARA prohibition and CANNOT be authorized

16. RECOMMENDATION AND APPROVAL

Recommendation and approval are based on the 60% drawings current as of January 2016. Any significant design changes in the Right of Way alignment or disturbance area must be identified prior to work initiation to ensure any changes are adequately mitigated.

Prepared by: Authors: Jeff Matheson, M.Sc., P.Biol., R.P.Bio., Senior Scientist Kristen Mancuso, M.Sc., P.Biol., R.P.Bio., Junior Terrestrial Ecologist. Reviewers: Nigel Cavanagh, M.Sc., P.Biol., R.P.Bio., Senior Aquatics & Fisheries Biologist Jason Jones, Ph.D., P.Biol., R.P.Bio., Senior Scientist	Date: 2016-02-16
Recommended by: Functional manager of the project (name): <i>BRUNO DUBESALLE, Resource Conservation Manager</i>	Date: YYYY-MM-DD <i>2016-03-15</i>
Approved by: Nick Irving, Field Unit Superintendent, Mt. Revelstoke and Glacier National Parks 	Date: YYYY-MM-DD MAR 15 2016
Signature:	





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17. ATTACHMENTS

Figures

Figure 1: Project Location

Figure 2: CDC Occurrences

Appendices

Appendix 1: Environmental Impact Analysis Tools: Effects Identification Matrix

Appendix 2: SARA-Compliant Authorization Decision Tool

Appendix 3: Design Drawings (January 15, 2016)

Appendix 4: Vegetation Elements of Management Concern with Potential to Occur Near the Project

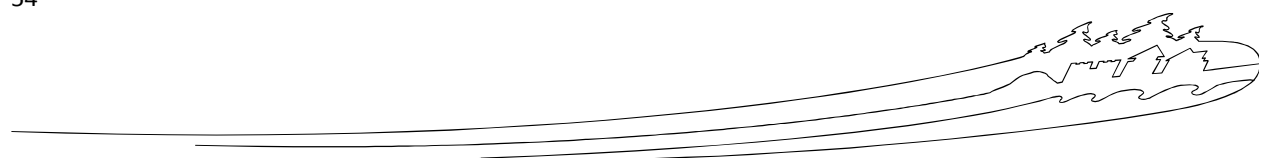
Appendix 5: Wildlife Species of Management Concern Potentially Found Within 1 Kilometre of Illecillewaet Curve

Appendix 6: Archaeological Overview Assessment, Trans Canada Widening Project, Illecillewaet Curve, Glacier National Park

18. NATIONAL IMPACT ASSESSMENT TRACKING SYSTEM

- ☐ Project registered in [tracking system](#)
- ☒ Not yet registered (*CEAA 2012 requires PCA submit a report to Parliament annually. EIAs must be entered in the tracking system **by the end of April** to enable reporting.*)

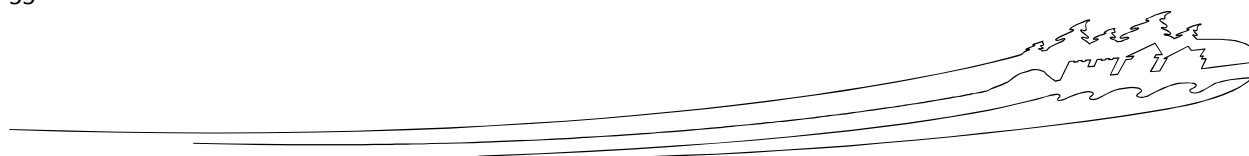
*****Ensure that all required mitigation measures and conditions (e.g. follow-up monitoring requirements) are included in project permits and authorizations*****





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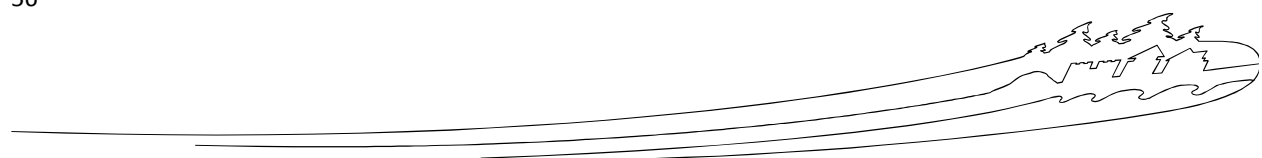
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March 2016

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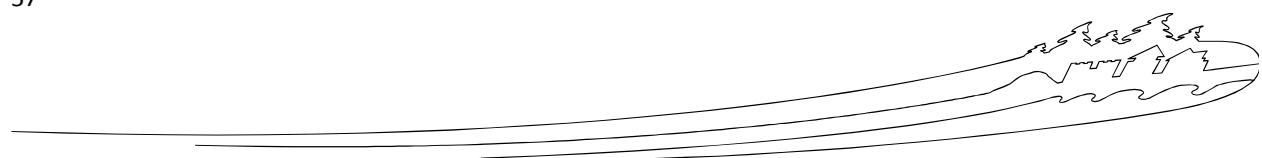
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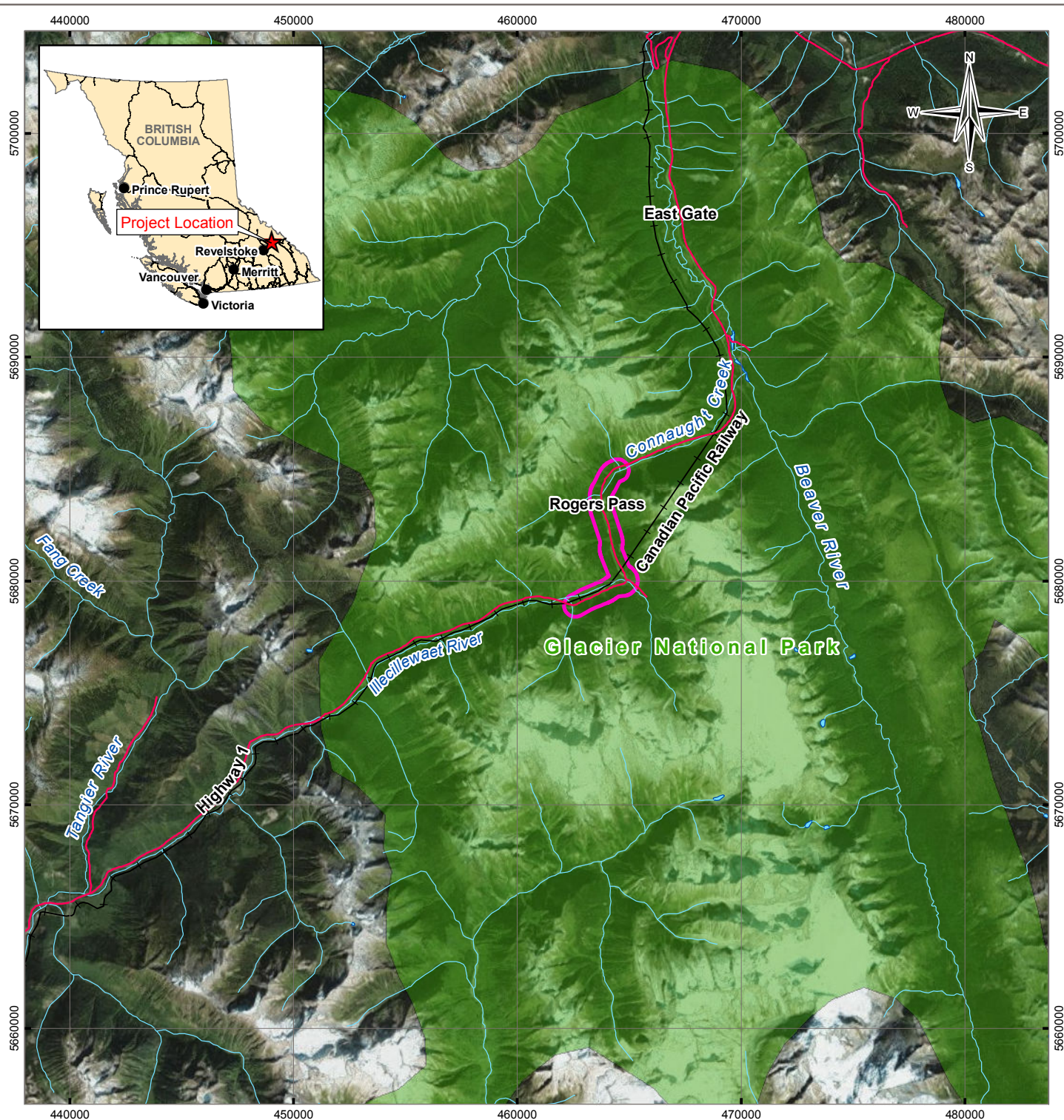
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



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Q:\Vancouver\GIS\ENVIRONMENTAL\IND\IND04067-01\Figure01_Site.mxd modified 2/2/2016 by morgan.zondervan



LEGEND

-  Project Area
-  Road
-  Railway
-  Glacier National Park
-  Watercourse
-  Waterbody

NOTES

Base data source:
Imagery from ESRI; CNES/Airbus DS (2009)
NTS 1:250K

STATUS
ISSUED FOR USE

TCH WIDENING - ILLECILLEWAET CURVE GLACIER NATIONAL PARK

Project Location

PROJECTION

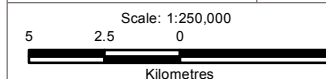
UTM Zone 11

DATUM

NAD83

CLIENT

 Parks Canada Parcs Canada



FILE NO.

IND04067-01_Figure01_Site.mxd

PROJECT NO.

ENVIND04067-01

DWN

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OFFICE

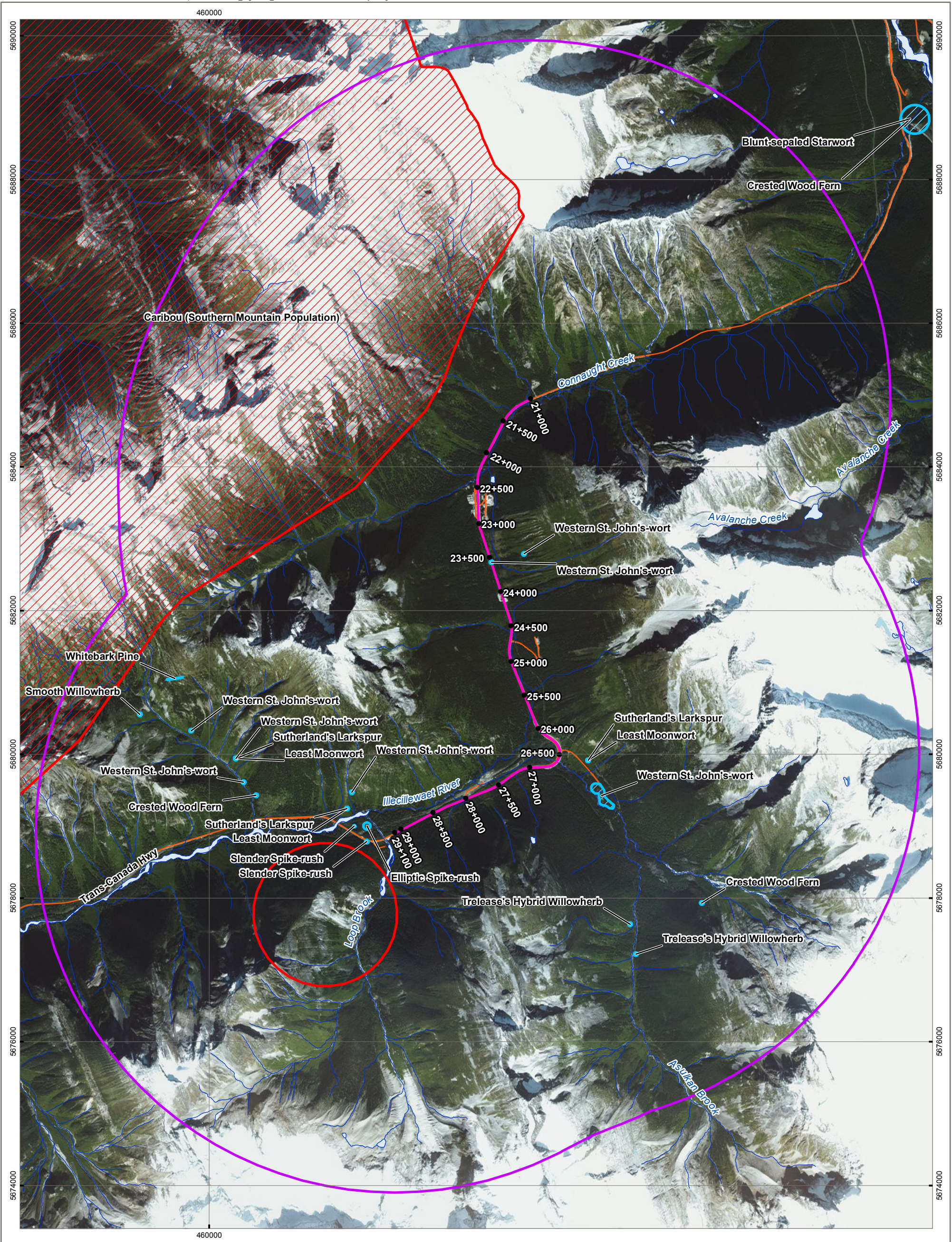
T/EBA-VANC

DATE

February 2, 2016

 **TETRA TECH** EBA

Figure 1



LEGEND

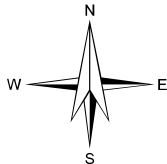
- Project Area
- 5 km Buffer
- Road
- Watercourse
- Waterbody

Conservation Data Centre

Non-Sensitive Occurrences


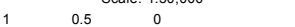
- Red-Listed Nonvascular Plant
- Blue-Listed Vascular Plant
- Red-Listed Vertebrate Animal

NOTES
Base data source:
Imagery from ESRI; DigitalGlobe (2011)
Conservation Data Centre Occurrences
downloaded from DataBC (July 23, 2015)
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Study Area provided by McElhanney (2015)



TCH WIDENING - ILLECILLEWAET CURVE
GLACIER NATIONAL PARK

CDC Occurences

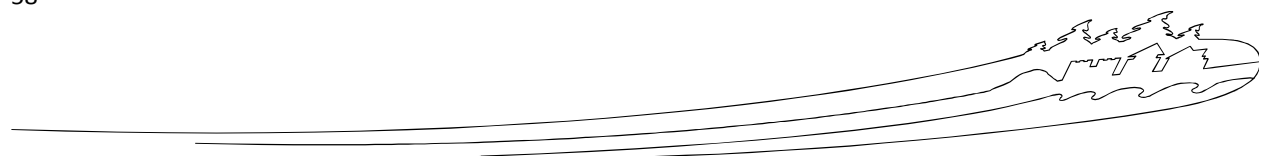
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PROJECT NO. ENVIND04067-01	DWN MEZ	CKD SL	APVD KM	<div>Figure 2</div>
OFFICE TtEBA-VANC	DATE February 2, 2016			

STATUS
ISSUED FOR USE



Appendix 1 Environmental Impact Analysis Tools: Effects Identification Matrix

A. Direct Effects												
			Valued components potentially directly affected by the proposed project									
			Natural Resources					Cultural Resources		Visitor Experience		
			Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora including SAR	Fauna (including SAR)	Historical Value	Archaeological Artifacts	Recreational Opportunities	Views and Soundscapes	Visitor Safety
	Phase	Activities										
Project Components	Preparation / Construction / Operation / Decommissioning	Waste Disposal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Use/Removal of temporary facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Supply and storage of materials	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Clearing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Rock Blasting	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Drilling	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Paving	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Grading	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Use of machinery	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Transport of materials/equipment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Use of Chemicals	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





March 2016

A. Direct effects continued												
			Valued components potentially affected by the proposed project									
			Natural Resources					Cultural Resources		Visitor Experience		
			Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora (specify, including SAR)	Fauna (specify, including SAR)	Historical Value	Archaeological Artifacts	Recreational Opportunities	Views and Soundscapes	Visitor Safety
Project Components	Phase	Activities										
	Operation	Regular Use	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Snow and Ice Management	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Vehicle Traffic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>





March 2016

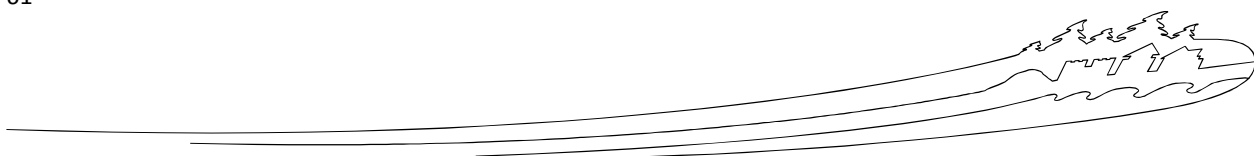
B. Indirect Effects (all phases)							
		Impacts as a result of changes to the environment					
		With respect to non-Aboriginal peoples:	With respect to Aboriginal peoples:		With respect to visitor experience		
		Health and socio-economic conditions	Health & socio-economic conditions	Current use of lands and resources for traditional purposes	Access & services	Recreation & accommodation opportunities	Safety
Phase	Natural resource components affected by the project						
Preparation /construction operation/implementation/decommissioning	Could impacts to <u>air</u> lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>soils and landforms</u> lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>water</u> (e.g. surface, ground water and water crossings) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>flora</u> (including SAR) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>fauna</u> (including SAR) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Other...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





Appendix 2: SARA-Compliant Authorization Decision Tool

There are no residual adverse effects to species at risk and therefore the SARA-Compliant Authorization Decision Tool was not required.





March 2016

Appendix 3: Design Drawings (January 15, 2016)





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for / pour

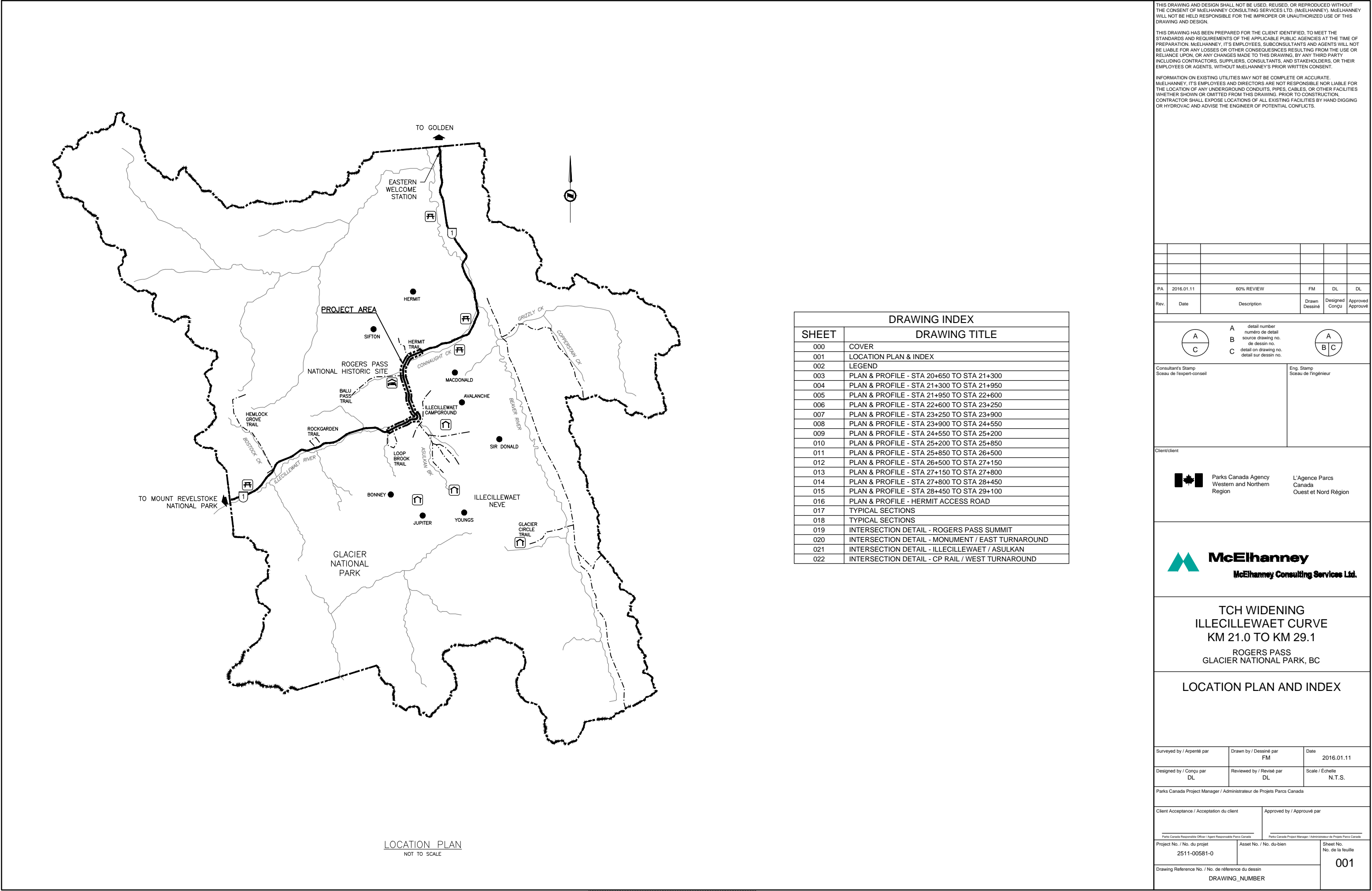


Parks Canada
Agency
Western and
Northern Region

L'Agence Parcs
Canada
Ouest et Nord
Région

TCH WIDENING ILLECILLEWAET CURVE

ROGERS PASS
GLACIER NATIONAL PARK, BC



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détail sur dessin no.



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TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

LEGEND

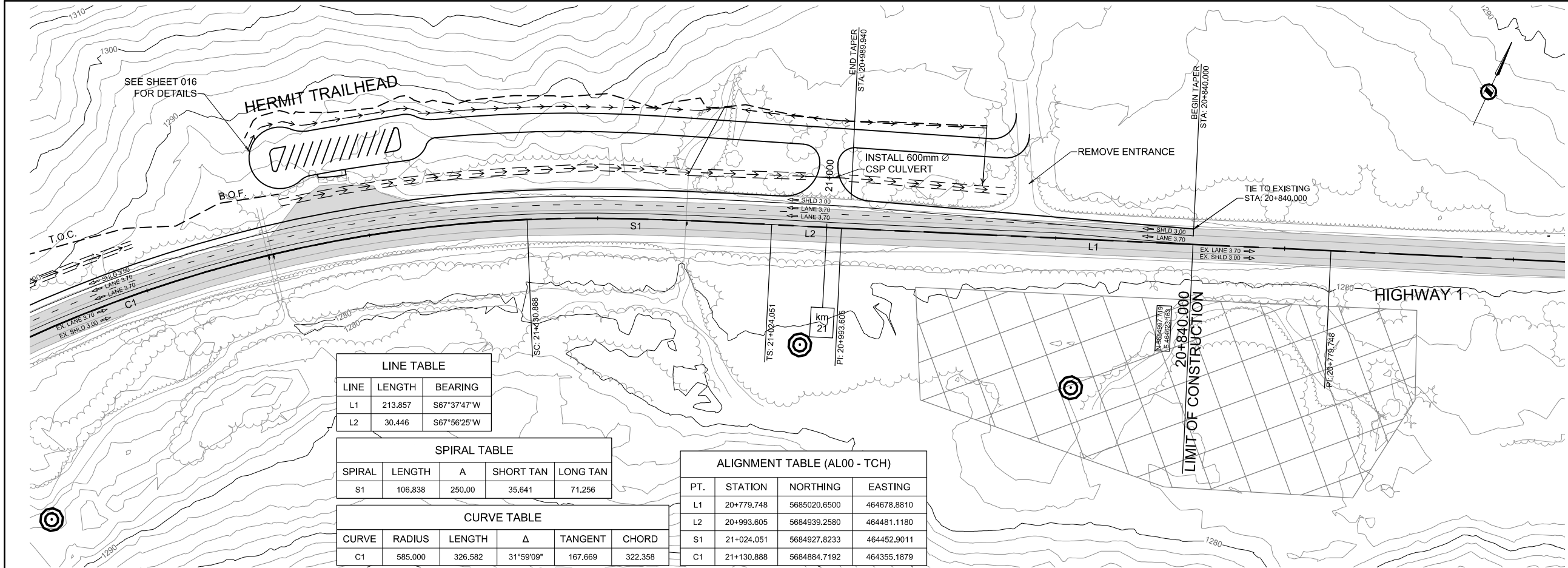
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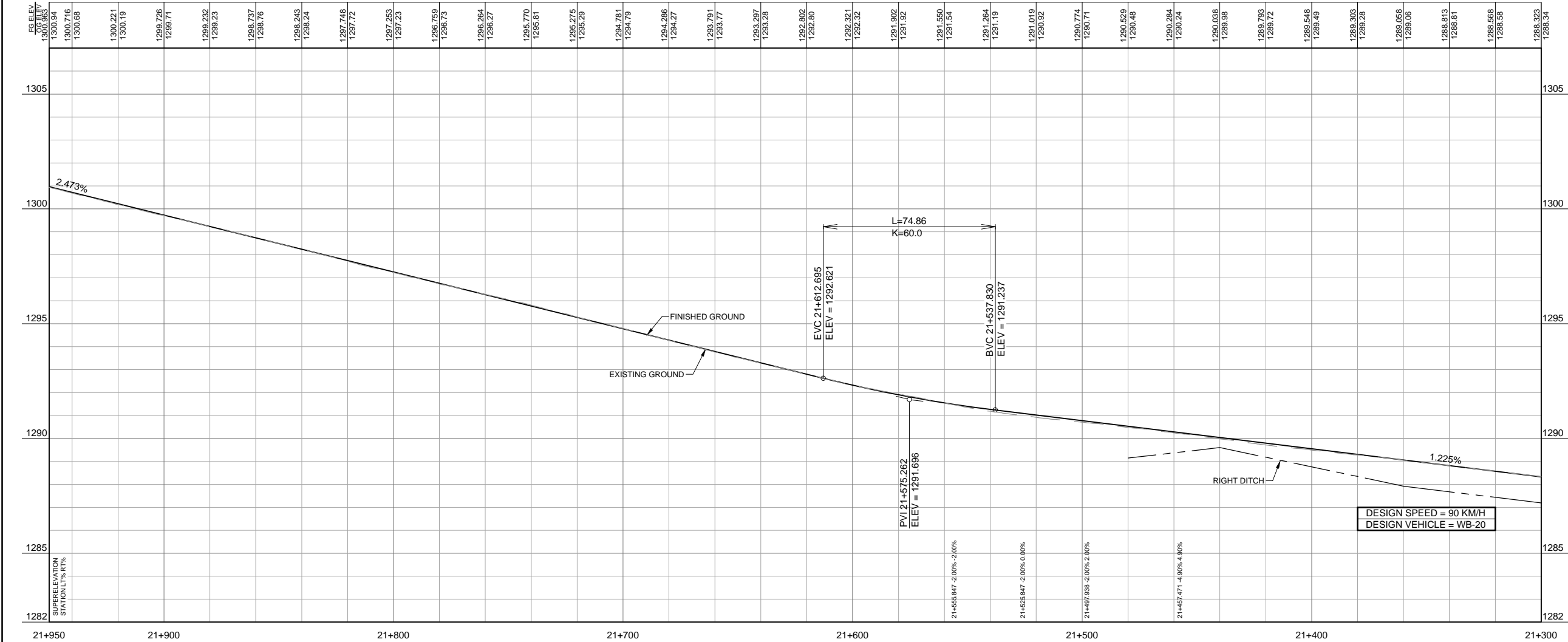
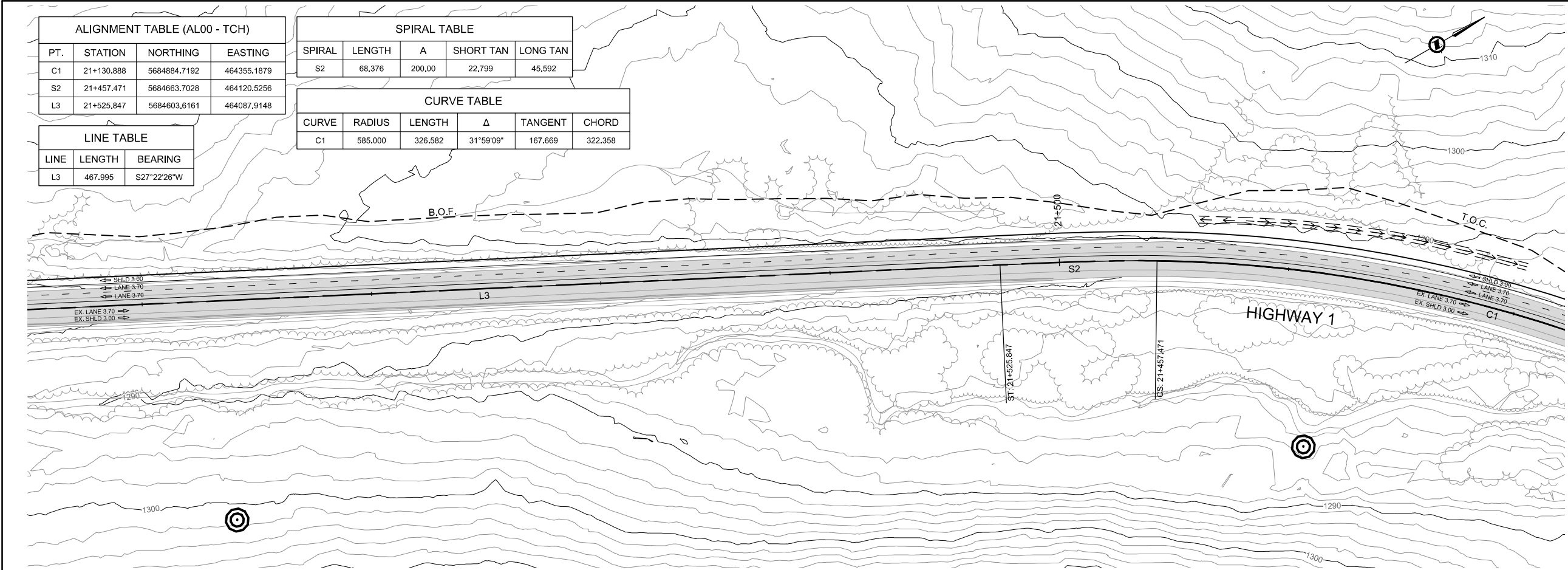
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Parks Canada Responsible Official / Agent Responsable Parcs Canada		Parks Canada Project Manager / Administrateur du Projet Parcs Canada

Project No. / No. du projet 2511-00581-0	Asset No. / No. du-bien	Sheet No. No. de la feuille 002
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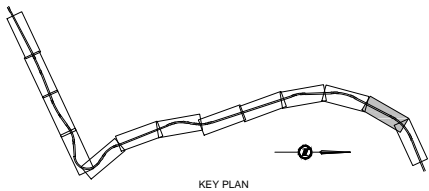




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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



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B numéro de detail
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de dessin no.
C detail on drawing no.
detail sur dessin no.



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TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES
STA 21+300 TO STA 21+950

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

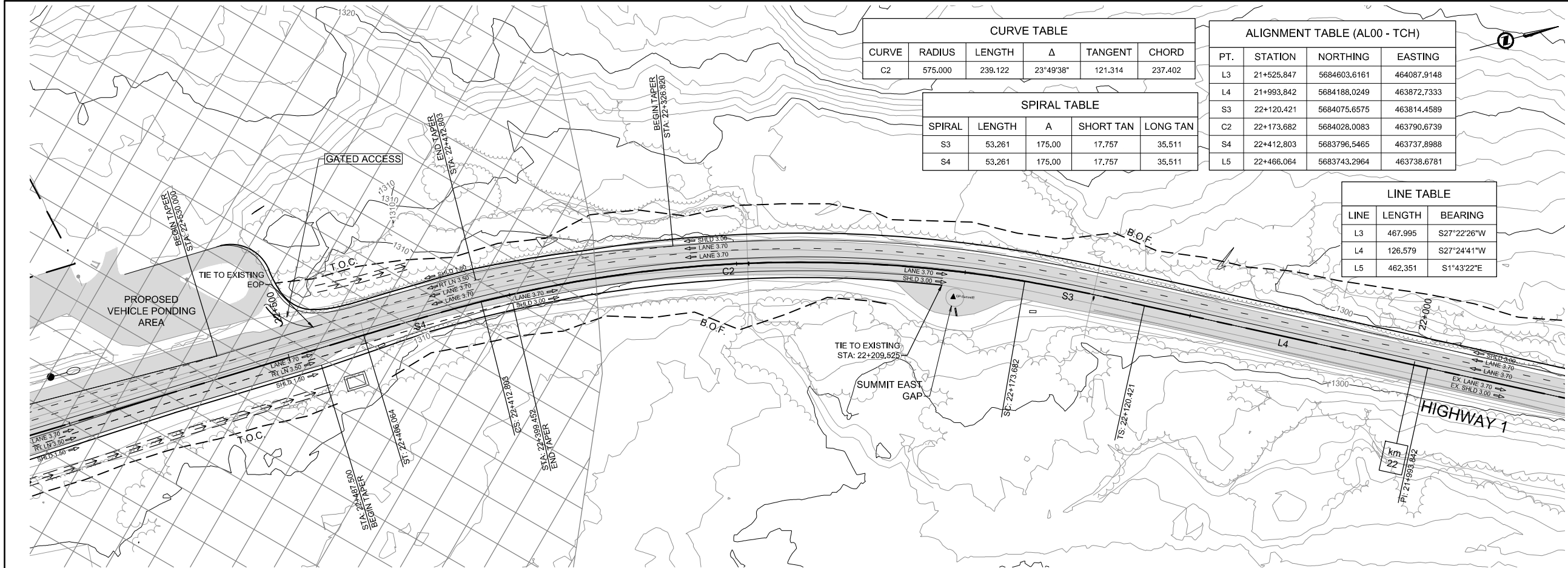
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PP-02



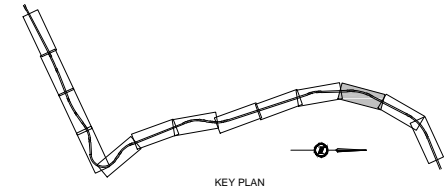


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CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C2	575.000	239.122	23°49'38"	121.314	237.402

ALIGNMENT TABLE (AL00 - TCH)				
PT.	STATION	NORTHING	EASTING	
L3	21+525.847	5684603.6161	464087.9148	
L4	21+993.842	5684188.0249	463872.7333	
S3	22+120.421	5684075.6575	463814.4589	
C2	22+173.682	5684028.0083	463790.6739	
S4	22+412.803	5683796.5465	463737.8988	
L5	22+466.064	5683743.2964	463738.6781	

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S3	53.261	175.00	17.757	35.511
S4	53.261	175.00	17.757	35.511

LINE TABLE		
LINE	LENGTH	BEARING
L3	467.995	S27°22'26"W
L4	126.579	S27°24'41"W
L5	462.351	S1°43'22"E



Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL



A detail number
B numéro de detail
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de dessin no.
detail on drawing no.
detail sur dessin no.



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TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES
STA 21+950 TO STA 22+600

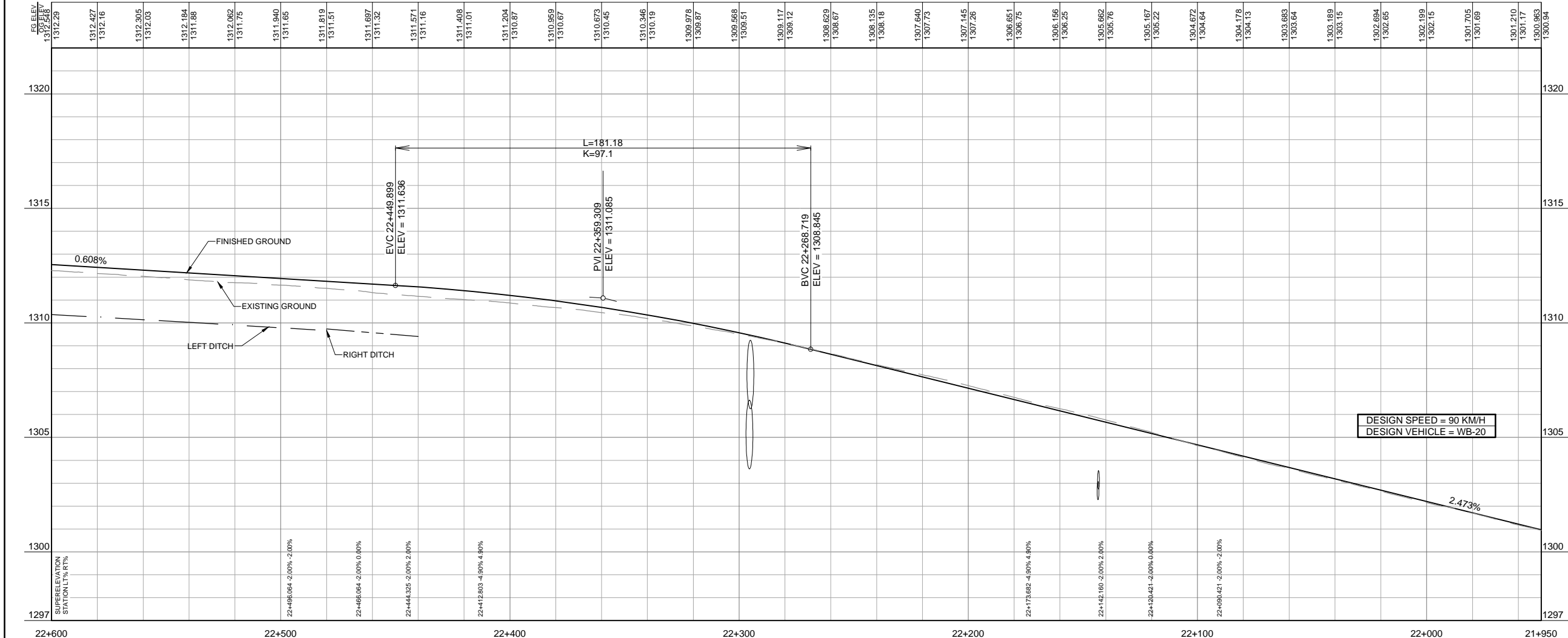
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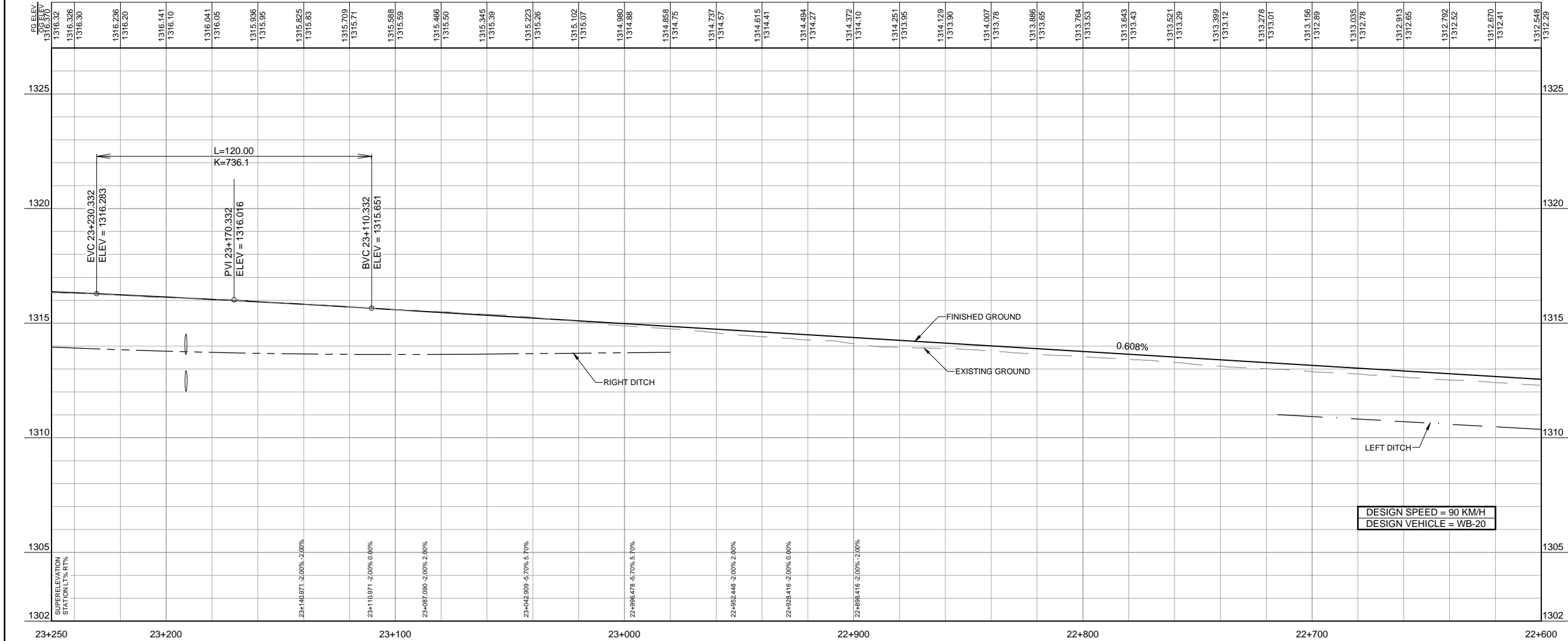
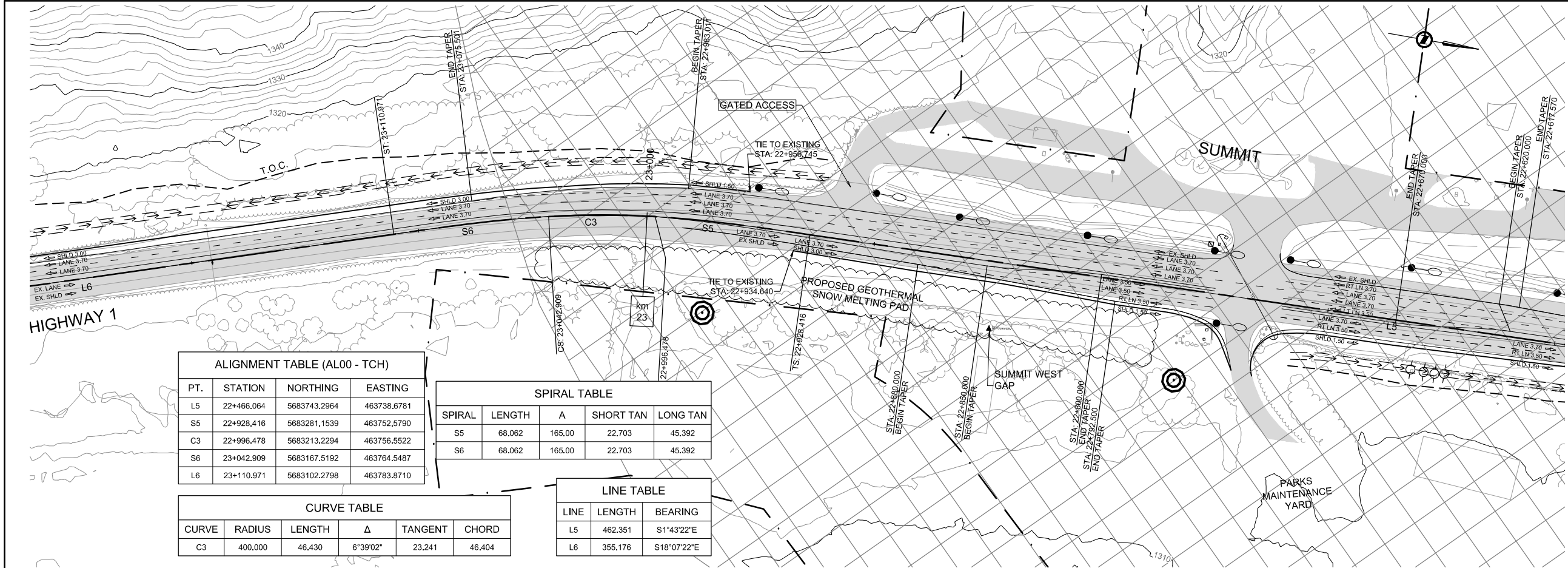
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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A
B
C

A detail number
B source drawing no.
C de dessin no.
detail on drawing no.
détail sur dessin no.

A
B
C

A detail number
B source drawing no.
C de dessin no.
detail on drawing no.
détail sur dessin no.

Consultant's Stamp
Sceau de l'expert-conseil

Eng. Stamp
Sceau de l'ingénieur

Client/client

Parks Canada Agency
Western and Northern
Region

L'Agence Parcs
Canada
Ouest et Nord Région

McElhanney
McElhanney Consulting Services Ltd.

**TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1**

ROGERS PASS
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES
STA 22+600 TO STA 23+250**

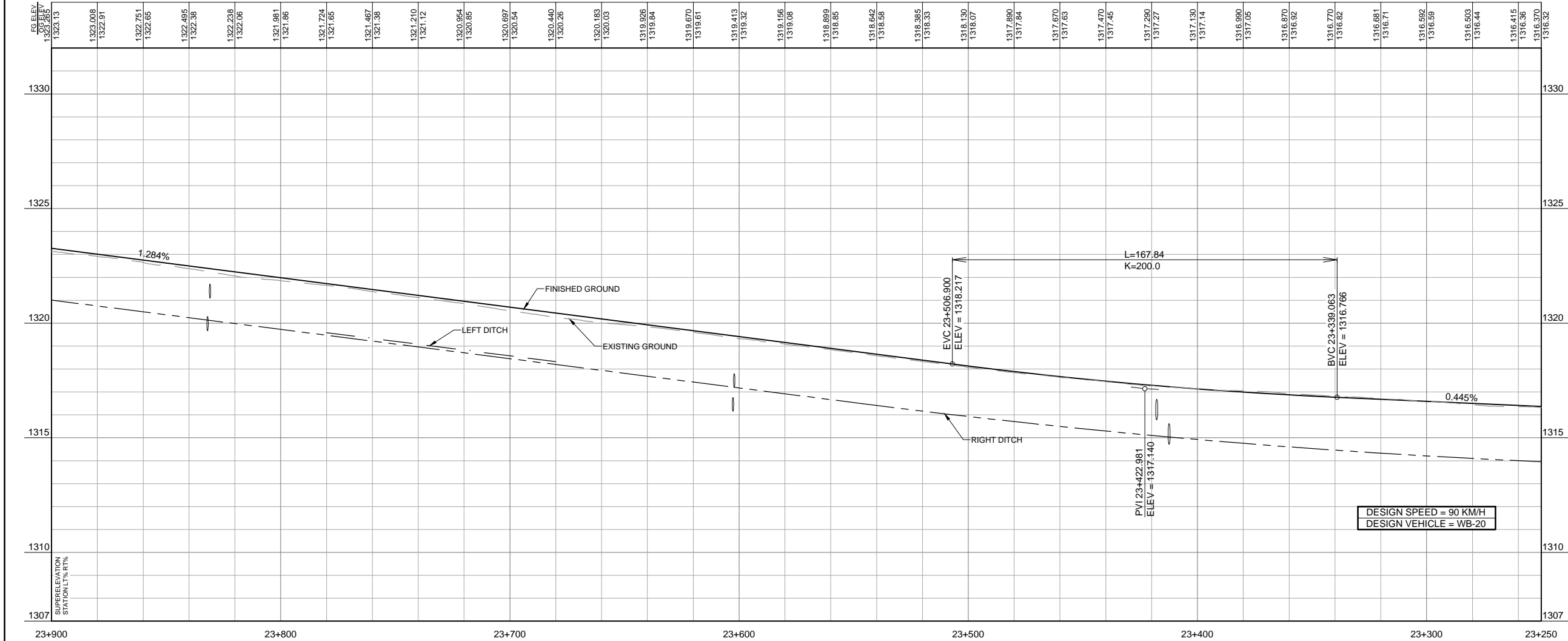
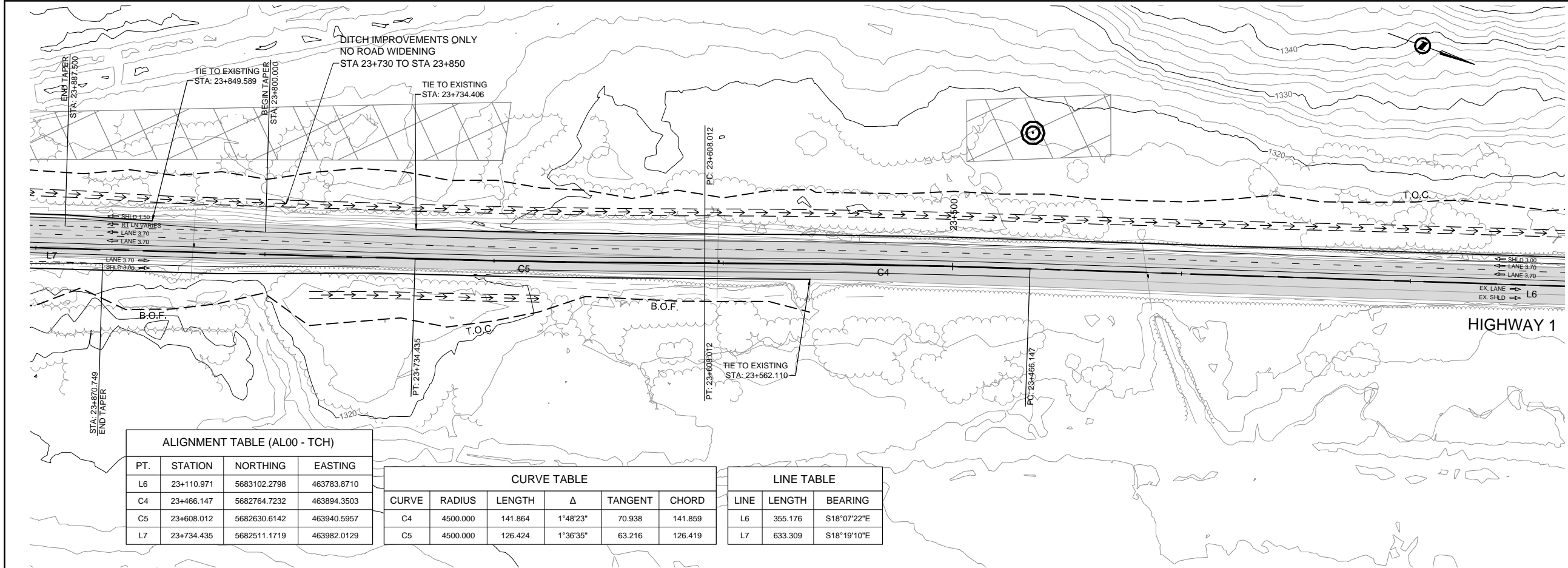
Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
<p>Parks Canada Responsible Officer / Agent Responsable Parcs Canada</p>	<p>Parks Canada Project Manager / Administrateur du Projets Parcs Canada</p>

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 006
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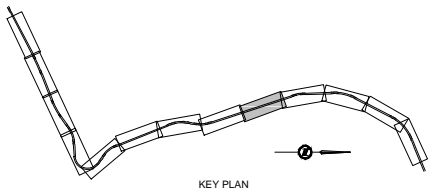
Drawing Reference No. / No. de référence du dessin
PP-04



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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



A detail number
B numéro de détail
C source drawing no.
de dessin no.
detail on drawing no.
détail sur dessin no.



Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	 Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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McElhanney
McElhanney Consulting Services Ltd.

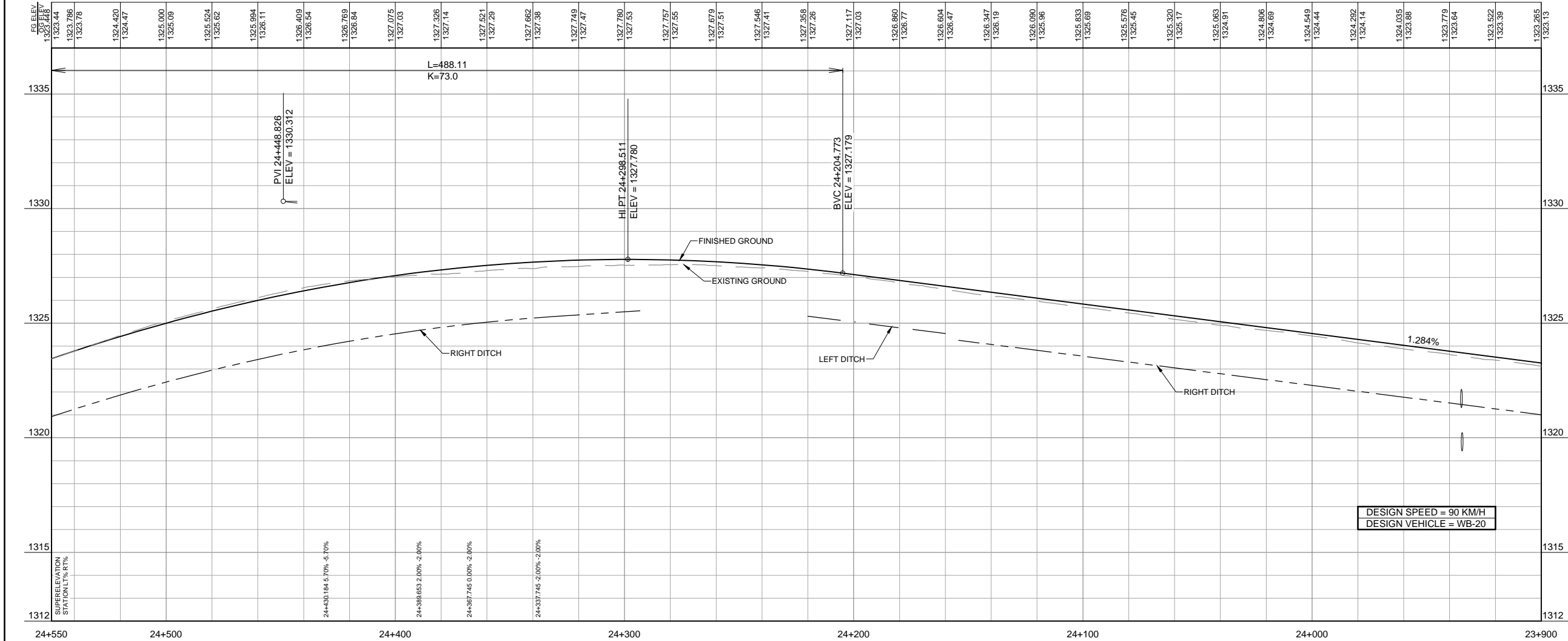
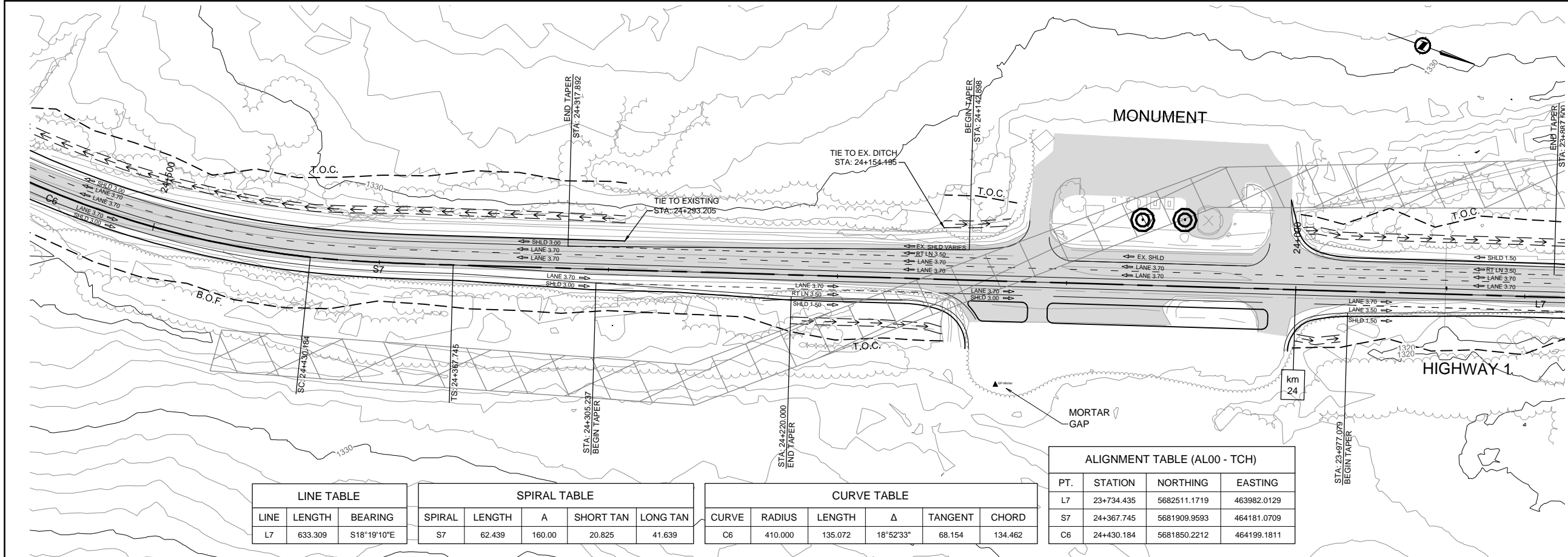
**TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1**
ROGERS PASS
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES
STA 23+250 TO STA 23+900**

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

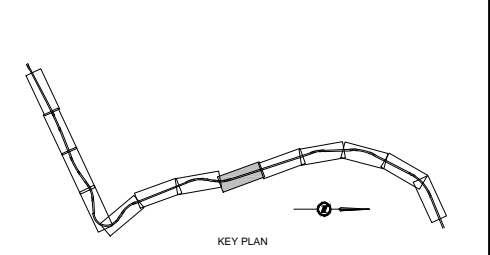
Client Acceptance / Acceptation du client	Approved by / Approuvé par
Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien
Drawing Reference No. / No. de référence du dessin PP-05	
Sheet No. No. de la feuille 007	



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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL

<div><div>A</div><div>B</div><div>C</div></div> <div><div>A</div><div>B</div><div>C</div></div>	<div><div>A</div><div>B</div><div>C</div></div> <div><div>A</div><div>B</div><div>C</div></div>
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
---	------------------------------------

Client/client	<div><div></div><div><div>Parks Canada Agency</div><div>Western and Northern Region</div></div></div> <div><div>L'Agence Parcs Canada</div><div>Ouest et Nord Région</div></div>
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McElhanney
McElhanney Consulting Services Ltd.

**TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1**
ROGERS PASS
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES
STA 23+900 TO STA 24+550**

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
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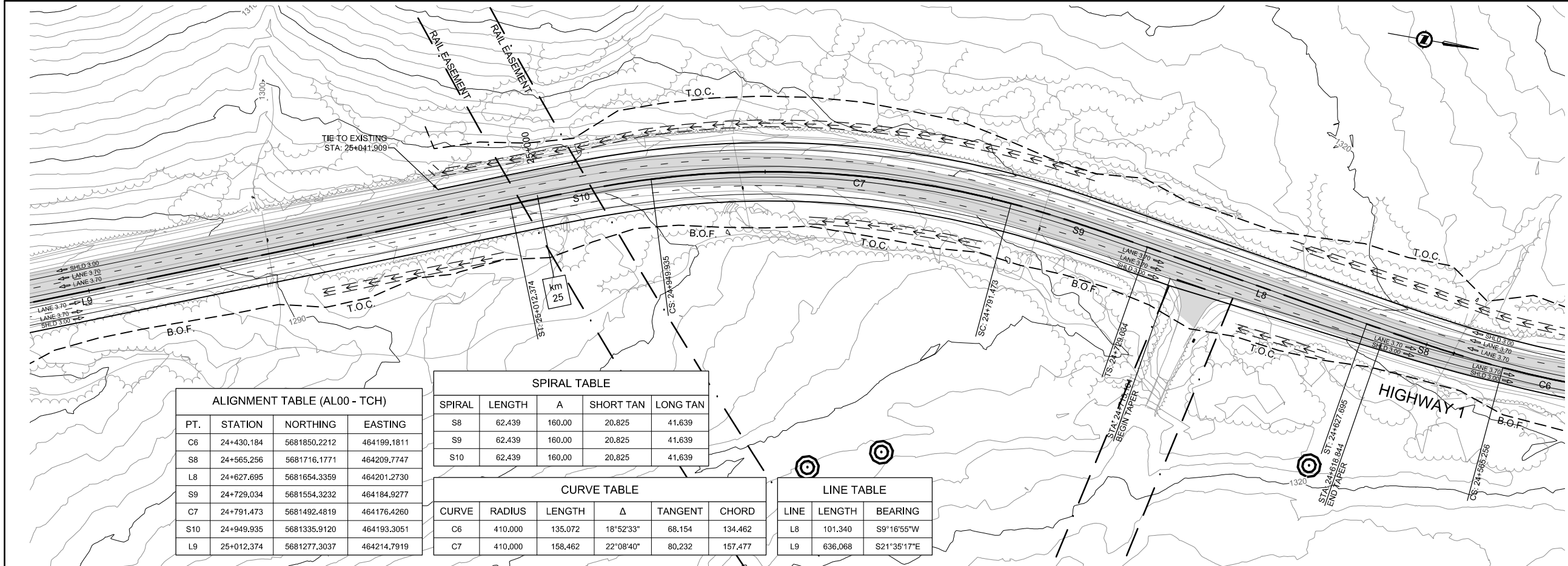
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000
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Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 008
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Drawing Reference No. / No. de référence du dessin
PP-06

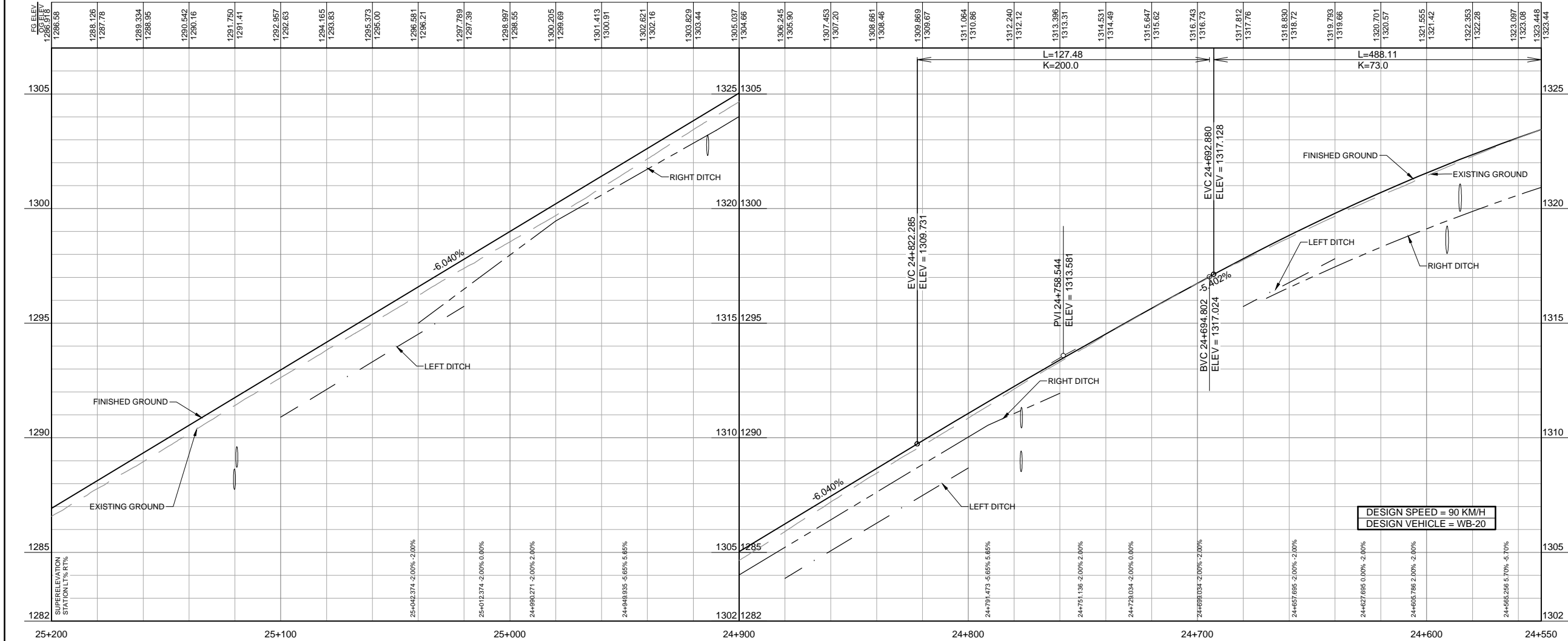


ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
C6	24+430.184	5681850.2212	464199.1811
S8	24+565.256	5681716.1771	464209.7747
L8	24+627.695	5681654.3359	464201.2730
S9	24+729.034	5681554.3232	464184.9277
C7	24+791.473	5681492.4819	464176.4260
S10	24+949.935	5681335.9120	464193.3051
L9	25+012.374	5681277.3037	464214.7919

SPIRAL TABLE					
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN	
S8	62.439	160.00	20.825	41.639	
S9	62.439	160.00	20.825	41.639	
S10	62.439	160.00	20.825	41.639	

CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C6	410.000	135.072	18°52'33"	68.154	134.462
C7	410.000	158.462	22°08'40"	80.232	157.477

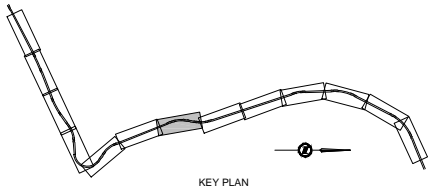
LINE TABLE		
LINE	LENGTH	BEARING
L8	101.340	S9°16'55"W
L9	636.068	S21°35'17"E



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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A	detail number	A
B	source drawing no.	B
C	detail on drawing no.	C

Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
---	------------------------------------

Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

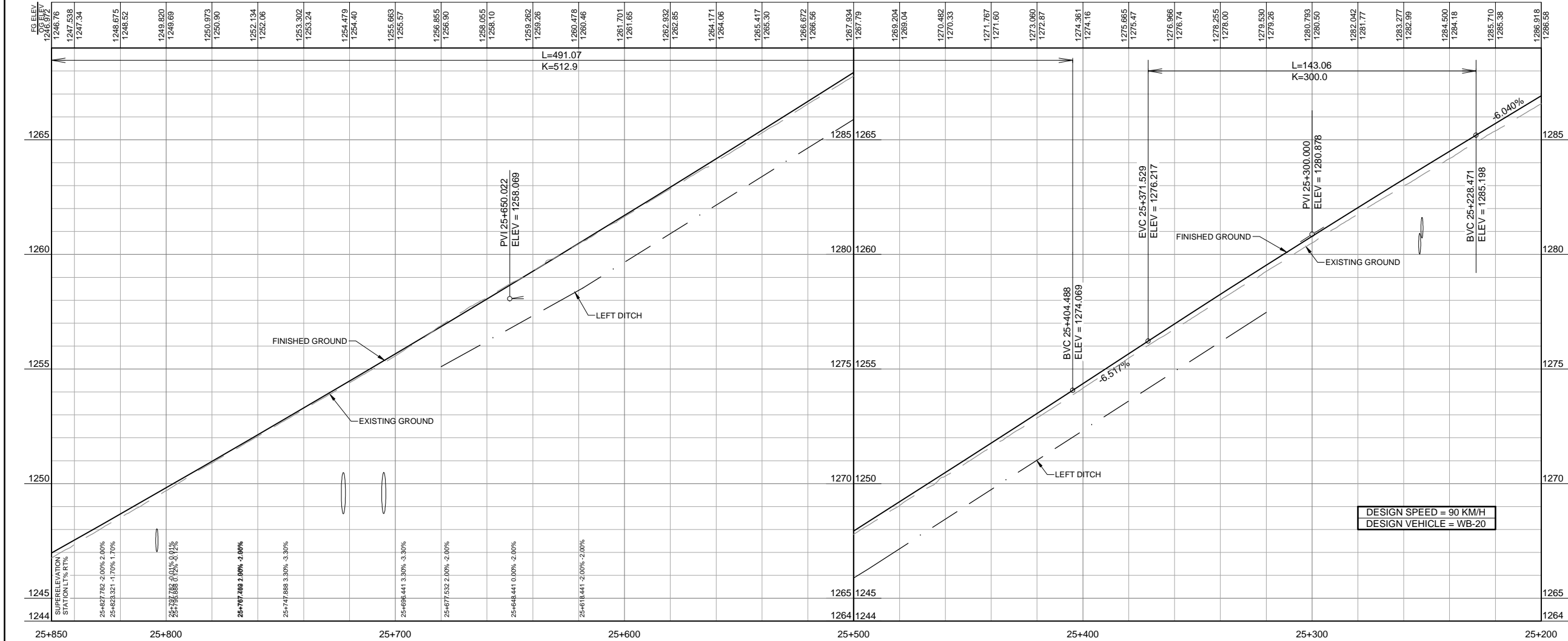
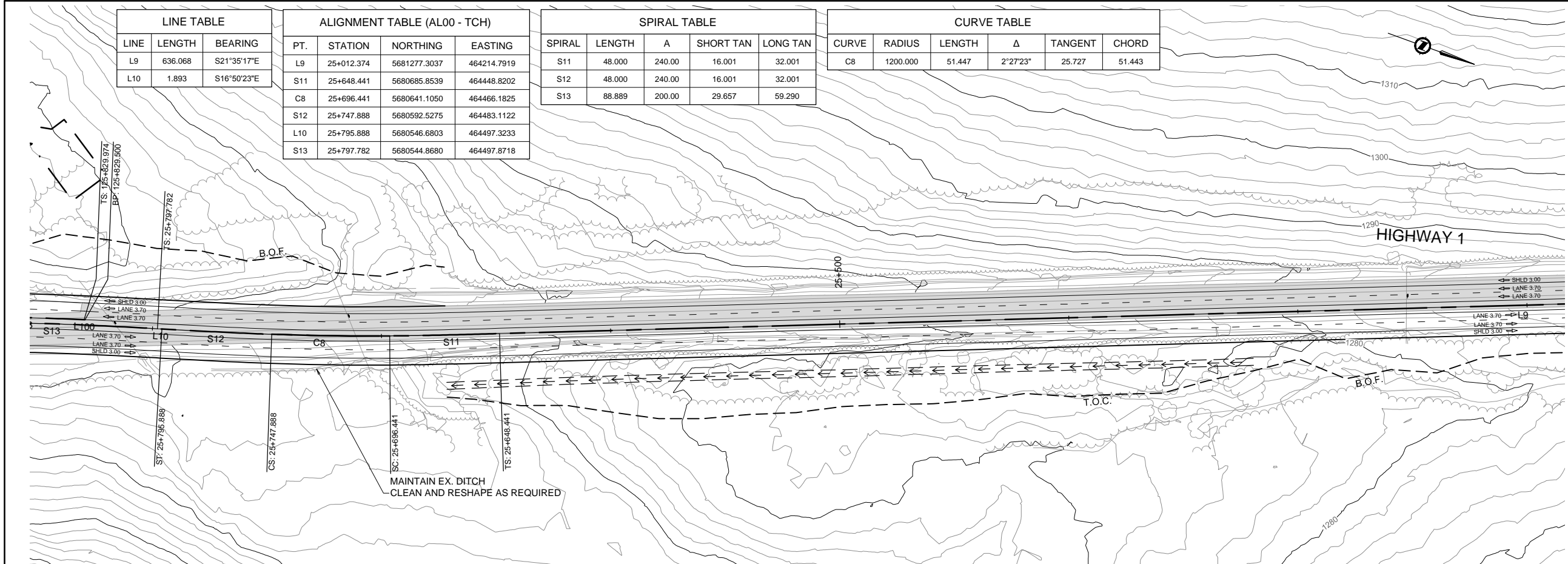
PLAN AND PROFILES
STA 24+550 TO STA 25+200

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
---	----------------------------

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille 009
Drawing Reference No. / No. de référence du dessin PP-07		



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KEY PLAN

PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

Consultant's Stamp
Sceau de l'expert-conseil

Eng. Stamp
Sceau de l'ingénieur

Client/client

Parks Canada Agency
Western and Northern
Region

L'Agence Parcs
Canada
Ouest et Nord Région

McElhanney
McElhanney Consulting Services Ltd.

TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

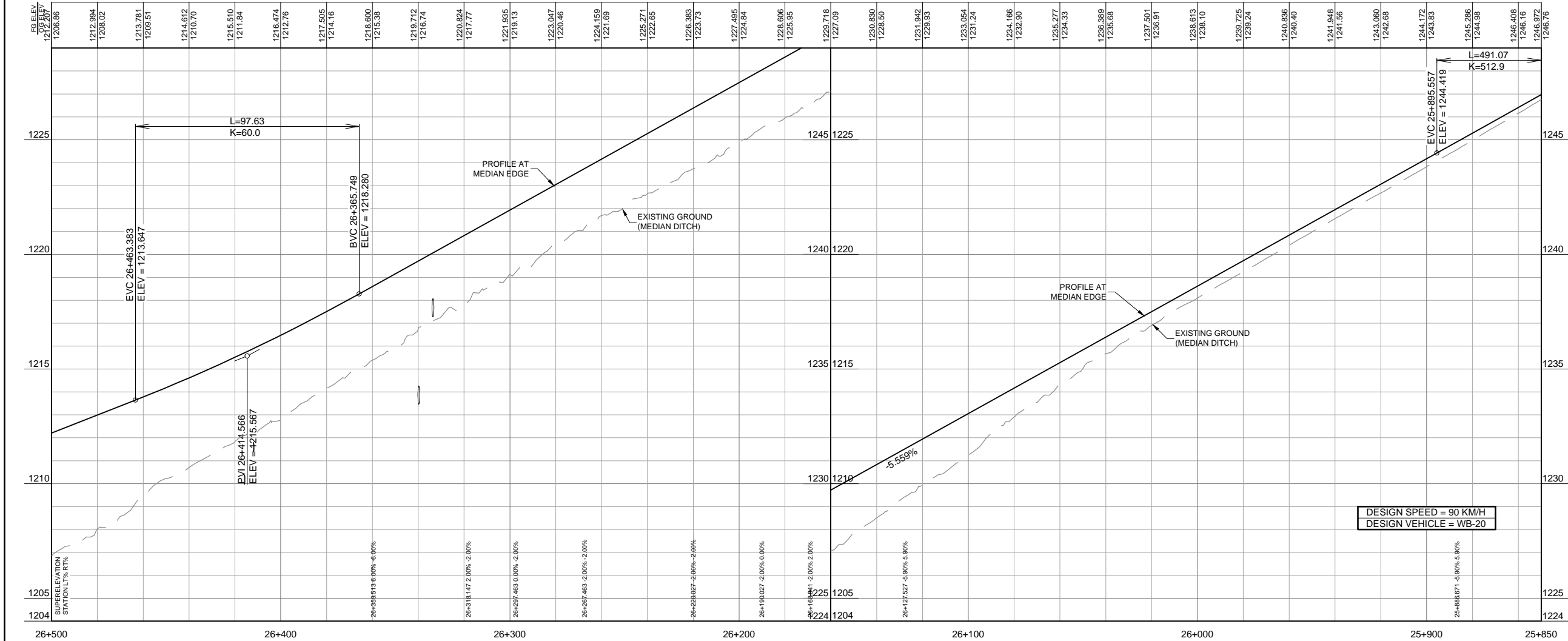
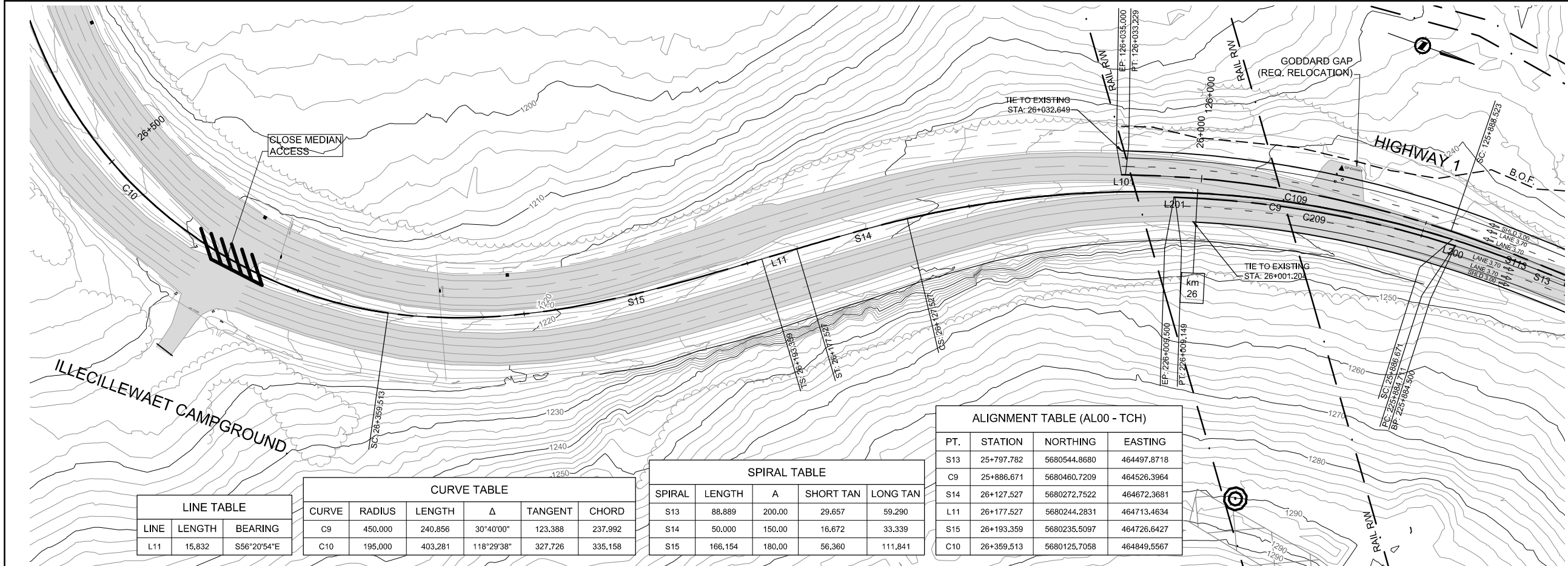
PLAN AND PROFILES
STA 25+200 TO STA 25+850

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
Parks Canada Responsible Officer / Agent Responsable Parcs Canada	Parks Canada Project Manager / Administrateur des Projets Parcs Canada

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille 010
Drawing Reference No. / No. de référence du dessin PP-08		



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KEY PLAN

PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

Consultant's Stamp
Sceau de l'expert-conseil

Eng. Stamp
Sceau de l'ingénieur

Client/client

Parks Canada Agency
Western and Northern
Region

L'Agence Parcs
Canada
Ouest et Nord Région

McElhanney
McElhanney Consulting Services Ltd.

**TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1**

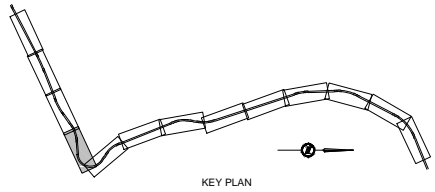
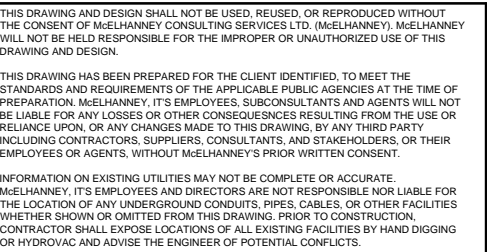
ROGERS PASS
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES
STA 25+850 TO STA 26+500**

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par	
Parks Canada Responsible Officer / Agent Responsable Parcs Canada	Parks Canada Project Manager / Administrateur du Projets Parcs Canada	
Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille 011
Drawing Reference No. / No. de référence du dessin PP-09		



PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A detail number
numéro de detail
B source drawing no.
de dessin no.
C detail on drawing no.
detail sur dessin no.

Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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 Parks Canada Agency
Western and Northern
Region

 **McElhanney**
McElhanney Consulting Services Ltd.

TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1

ROGERS PASS
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES

STA 26+500 TO STA 27+150

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
<hr/> Parcs Canada Responsible Officer / Agent Responsable Parcs Canada	<hr/> Parcs Canada Project Manager / Administrateur de Projets Parcs Canada

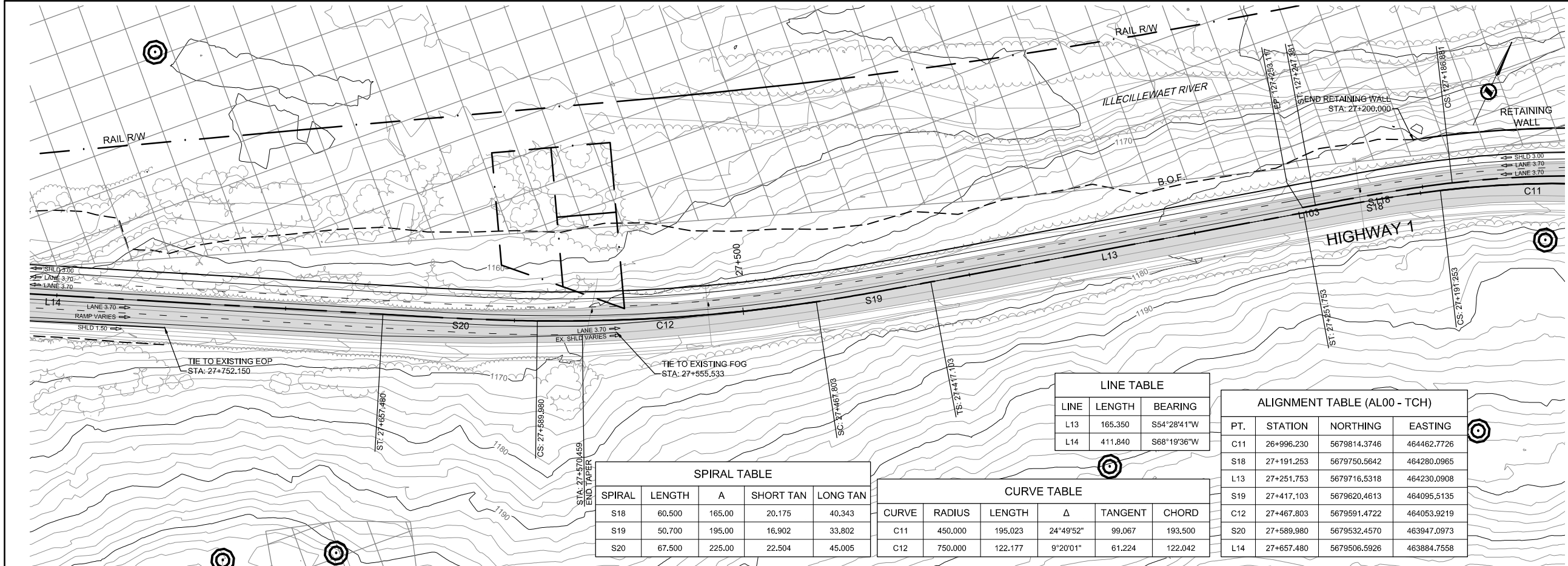
Project No. / No. du projet	Asset No. / No. du bien	Sheet No. No. de la feuille
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2511-00581-0	No. de la feuille
Drawing Reference No. / No. de référence du dessin	012

Drawing Reference No. / No. de référence du dessin

PP-010



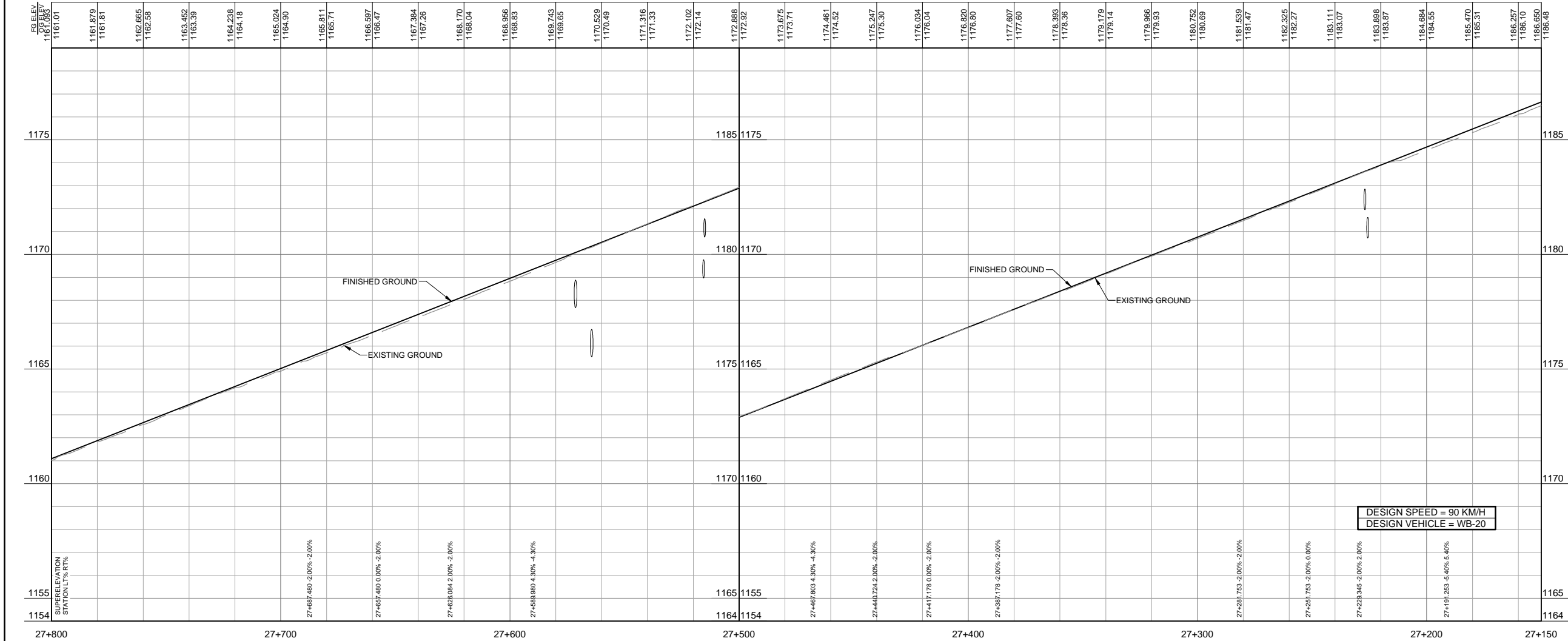


SPIRAL TABLE				
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S19	50.700	195.00	16.902	33.802
S20	67.500	225.00	22.504	45.005

LINE TABLE		
LINE	LENGTH	BEARING
L13	165.350	S54°28'41"W
L14	411.840	S68°19'36"W

CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C11	450.000	195.023	24°49'52"	99.067	193.500
C12	750.000	122.177	9°20'01"	61.224	122.042

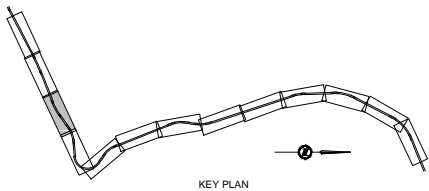
ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
C11	26+996.230	5679814.3746	464462.7726
S18	27+191.253	5679750.5642	464280.0965
L13	27+251.753	5679716.5318	464230.0908
S19	27+417.103	5679620.4613	464095.5135
C12	27+467.803	5679591.4722	464053.9219
S20	27+589.980	5679532.4570	463947.0973
L14	27+657.480	5679506.5926	463884.7558



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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



A detail number
B numéro de detail
C source drawing no.
de dessin no.
detail on drawing no.
detail sur dessin no.



Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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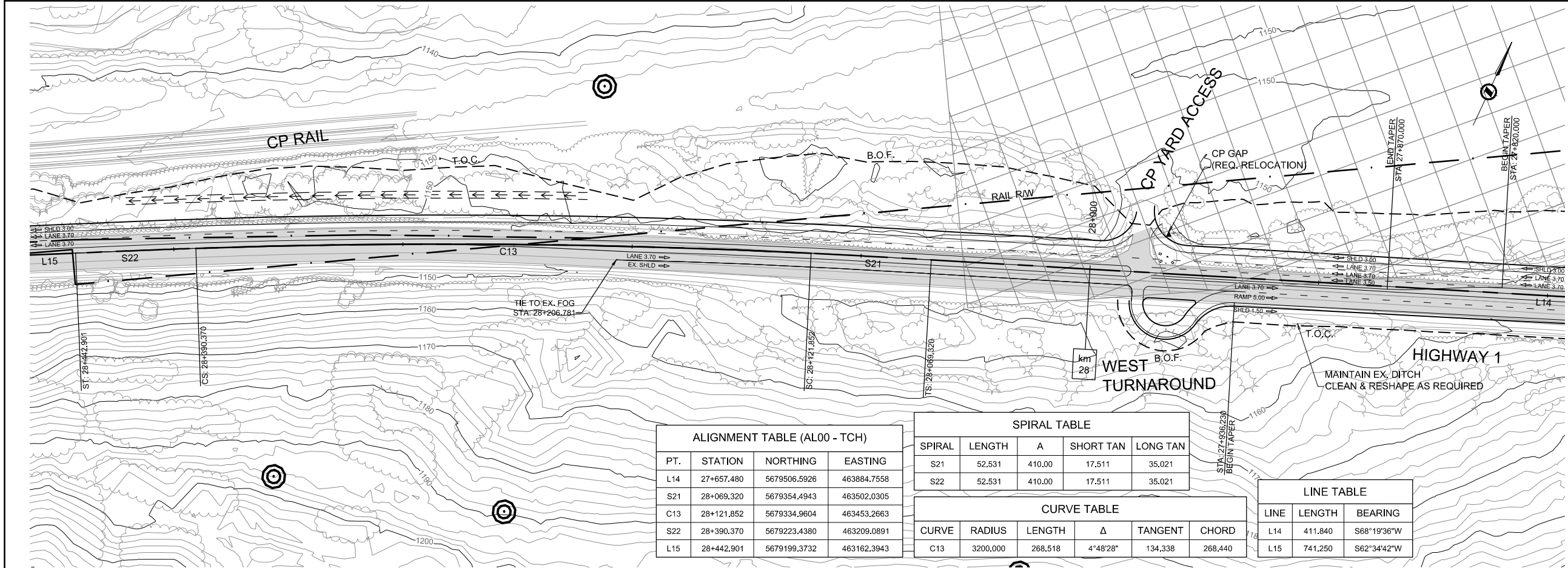
TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES
STA 27+150 TO STA 27+800

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien
Drawing Reference No. / No. de référence du dessin PP-011	Sheet No. No. de la feuille 013

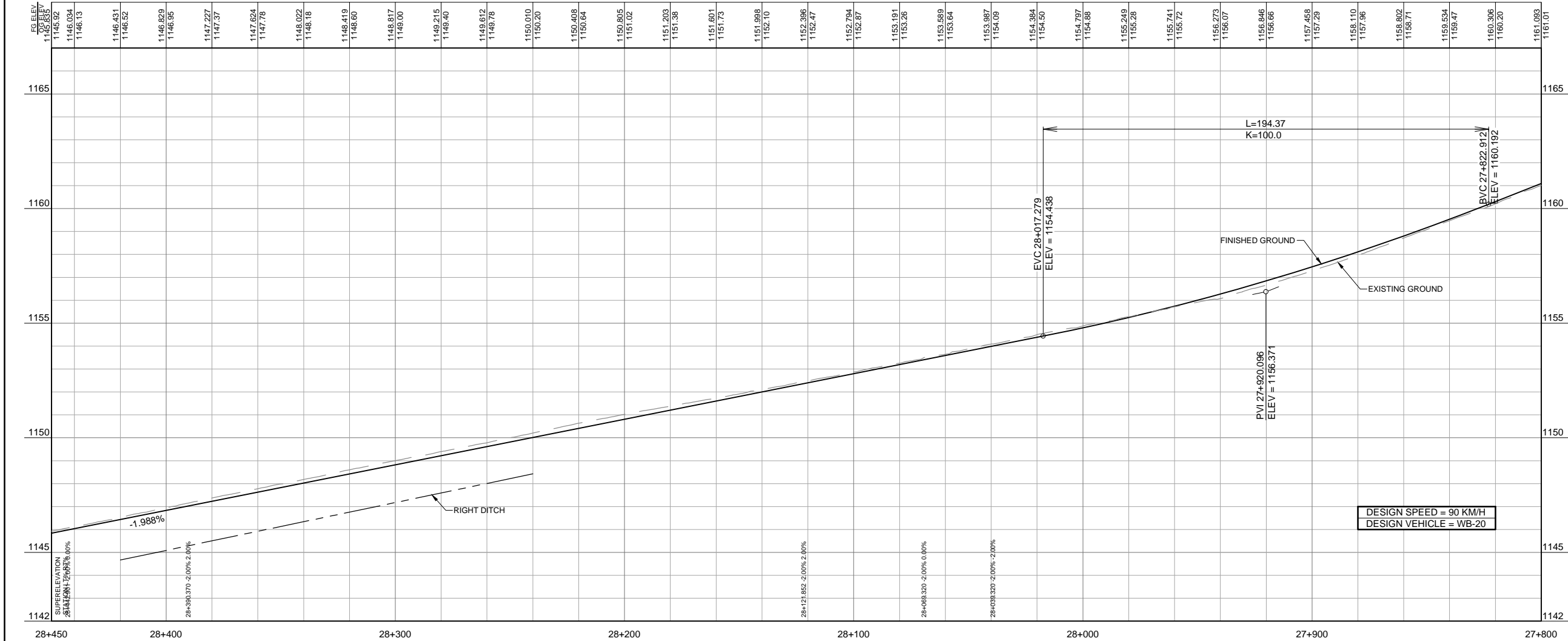


ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
L14	27+657.480	5679506.5926	463884.7558
S21	28+069.320	5679354.4943	463502.0305
C13	28+121.852	5679334.9604	463453.2663
S22	28+390.370	5679223.4380	463209.0891
L15	28+442.901	5679199.3732	463162.3943

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S21	52.531	410.00	17.511	35.021
S22	52.531	410.00	17.511	35.021

CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C13	3200.000	268.518	4°48'28"	134.338	268.440

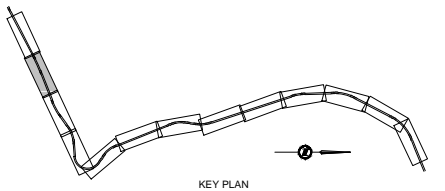
LINE TABLE		
LINE	LENGTH	BEARING
L14	411.840	S68°19'36"W
L15	741.250	S62°34'42"W



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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A	detail number numéro de détail	A
B	source drawing no. de dessin no.	B
C	detail on drawing no. détail sur dessin no.	C

Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

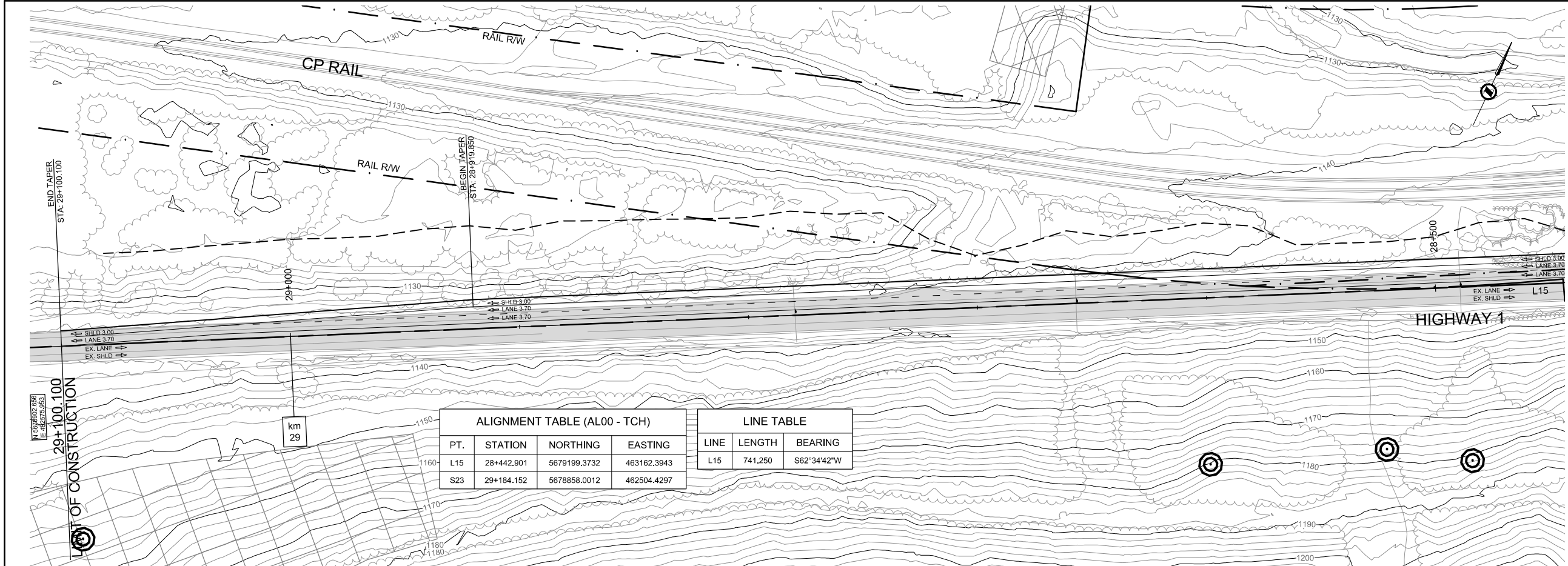
PLAN AND PROFILES
STA 27+800 TO STA 28+450

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

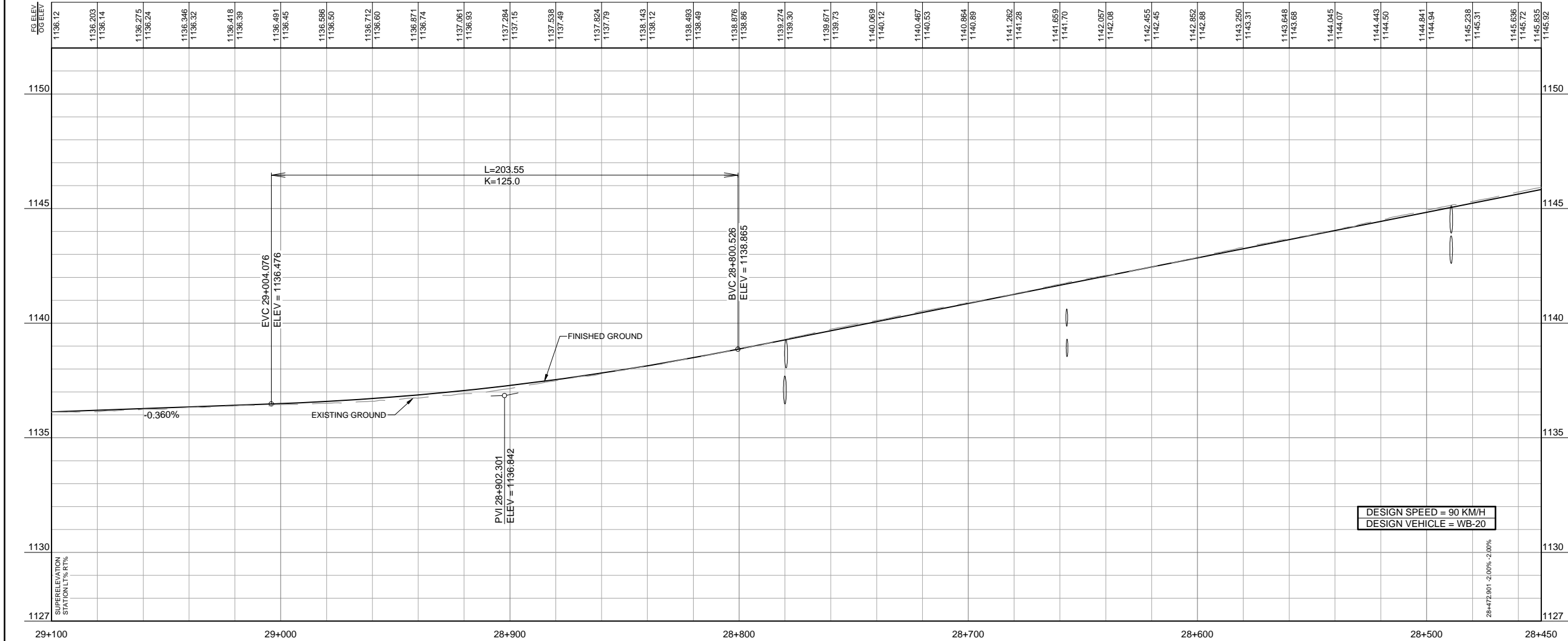
Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
---	----------------------------

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille 014
Drawing Reference No. / No. de référence du dessin PP-012		



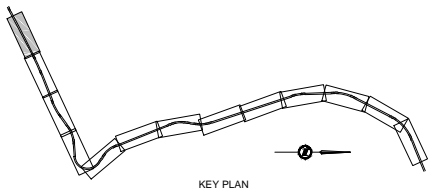
ALIGNMENT TABLE (AL00 - TCH)				LINE TABLE		
PT.	STATION	NORTHING	EASTING	LINE	LENGTH	BEARING
L15	28+442.901	5679199.3732	463162.3943	L15	741.250	S62°34'42"W
S23	29+184.152	5678856.0012	462504.4297			



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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A	detail number	A
B	numéro de detail	B
C	source drawing no.	C
	de dessin no.	
	detail on drawing no.	
	detail sur dessin no.	

Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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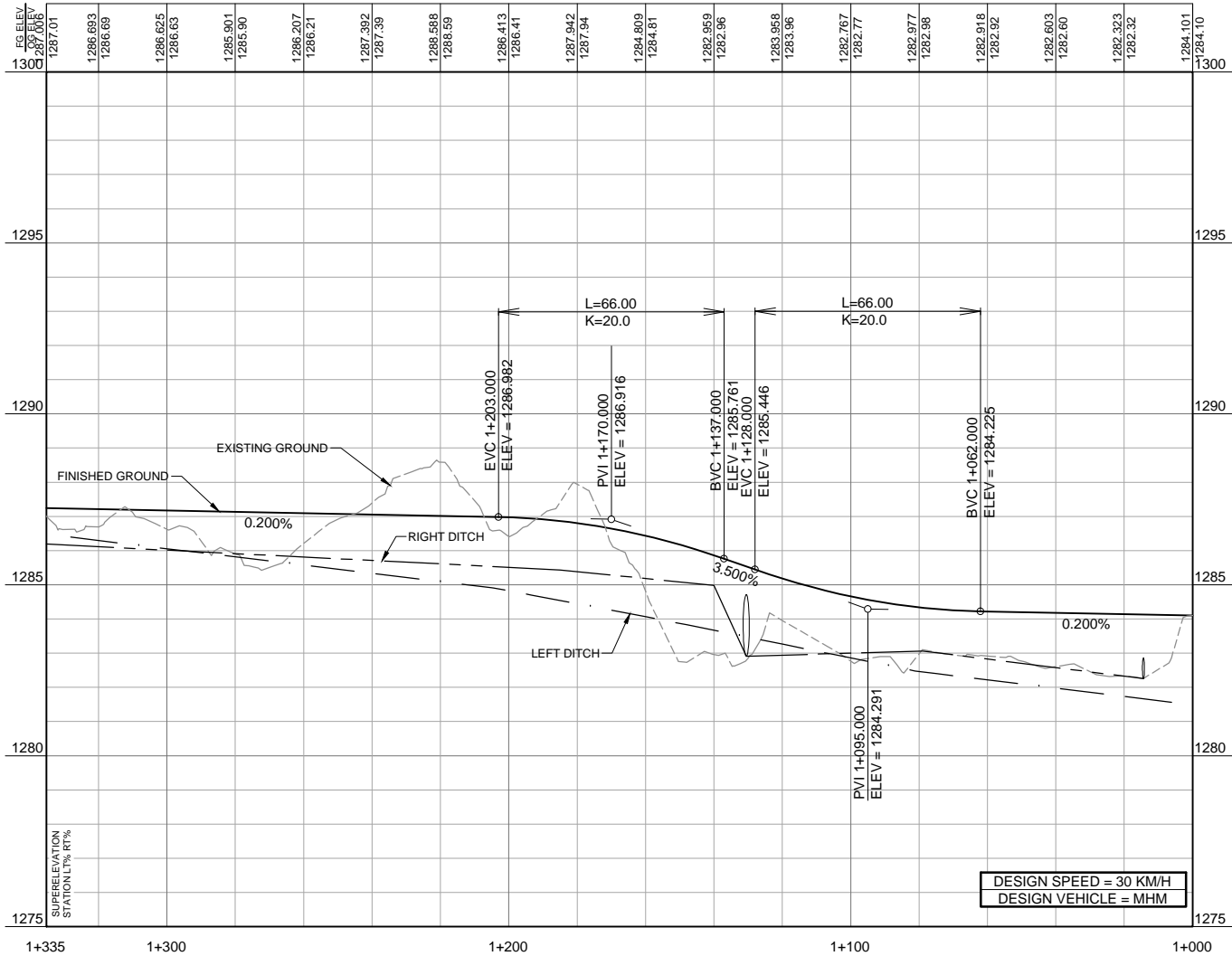
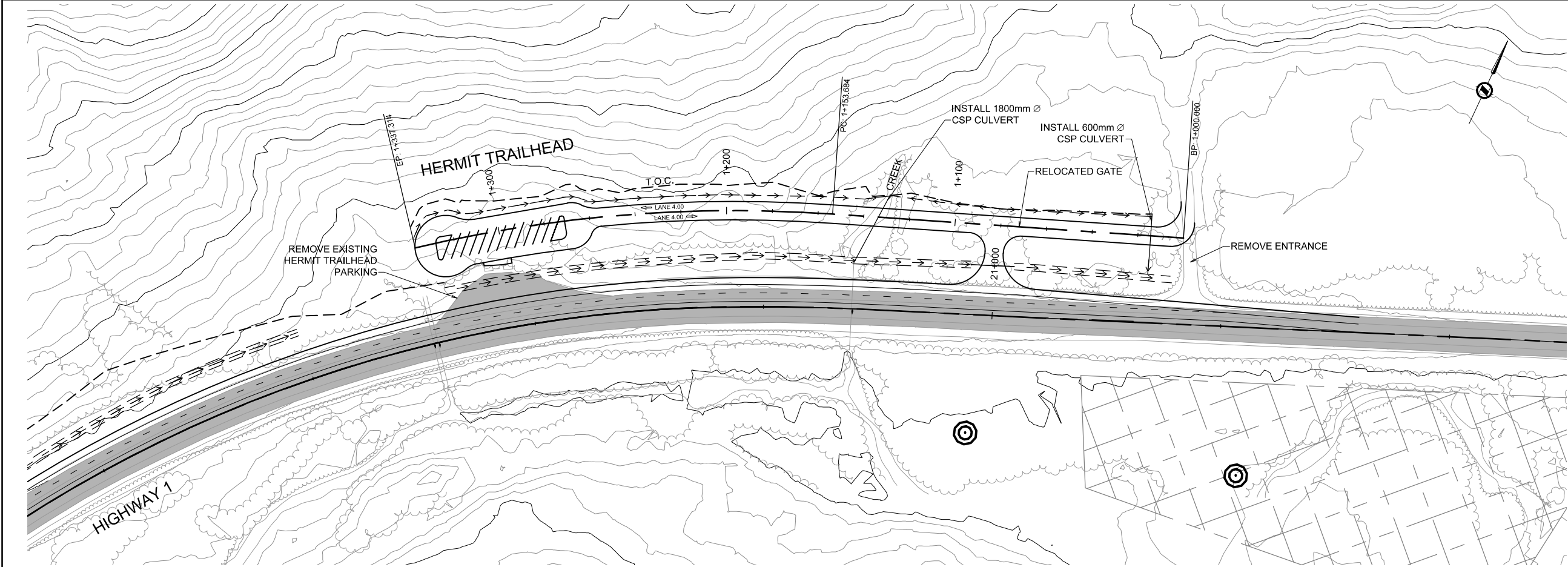
TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES
STA 28+450 TO STA 29+100

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

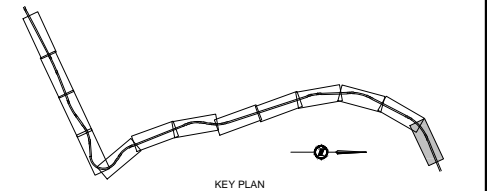
Client Acceptance / Acceptation du client		Approved by / Approuvé par	
Parks Canada Responsible Officer / Agent Responsable Parcs Canada		Parks Canada Project Manager / Administrateur du Projet Parcs Canada	
Project No. / No. du projet 2511-00581-0		Asset No. / No. du bien	
Drawing Reference No. / No. de référence du dessin PP-013		Sheet No. No. de la feuille 015	



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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A	detail number	A
B	numéro de detail	B
C	source drawing no.	C
	de dessin no.	
	detail on drawing no.	
	detail sur dessin no.	

Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

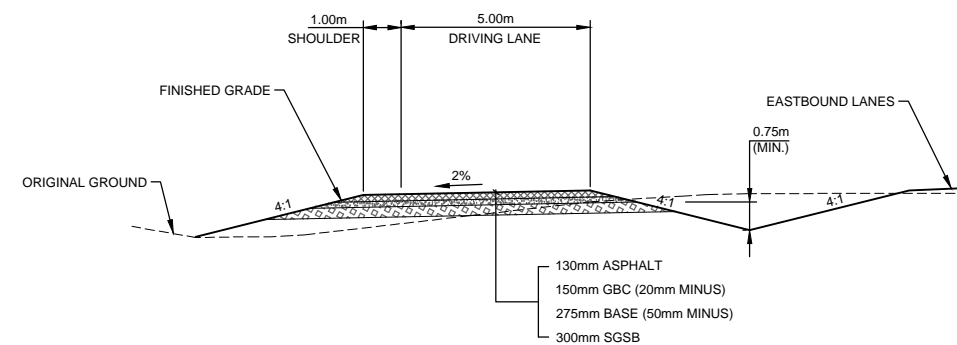
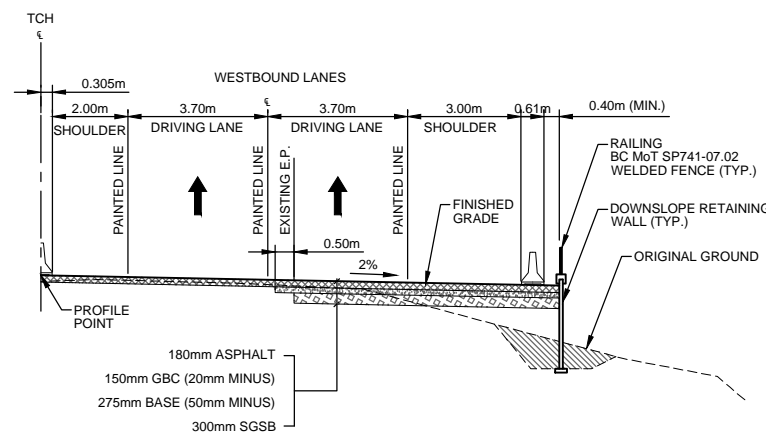
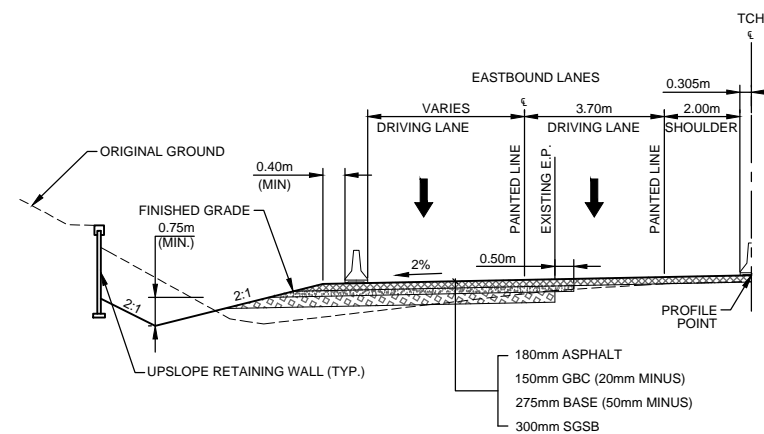
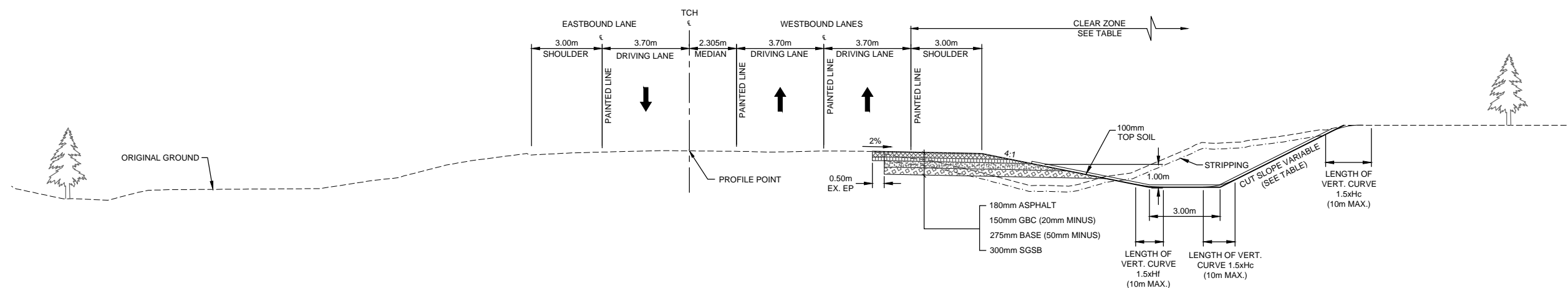
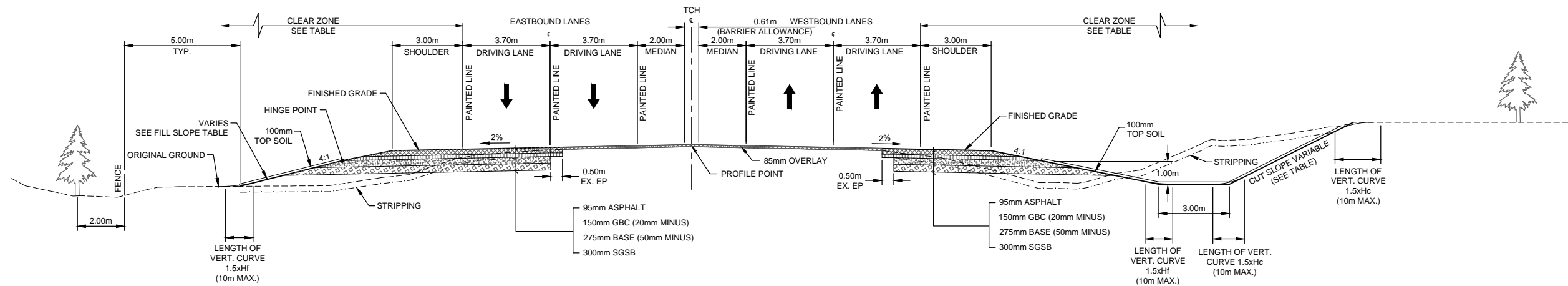
PLAN AND PROFILES
HERMIT ACCESS ROAD

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille 016
Drawing Reference No. / No. de référence du dessin PP-014		



CUT DEPTH (Hc)	SLOPE
<3.0m	4:1
3.0m - 4.0m	3:1
>4.0m	2:1
ROCK CUT	VARIABLE

FILL SLOPE TABLE	
FILL HEIGHT (Hf)	SLOPE
<2.5m	4:1
>2.5m	3:1
MOUNTAINSIDE/RIVERSIDE	2:1 WITH BARRIER

*BENCHES 3.0m WIDE TO BE PROVIDED AT 8.0m VERTICAL INTERVALS OR AS ACCEPTED BY THE ENGINEER



NOT INCLUDED IN 60% SET

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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

	<p>A detail number numéro de detail B source drawing no. de dessin no. C detail on drawing no. detail sur dessin no.</p>	
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	
 <p>Parks Canada Agency Western and Northern Region</p>	<p>L'Agence Parcs Canada Ouest et Nord Région</p>



TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

TYPICAL SECTIONS

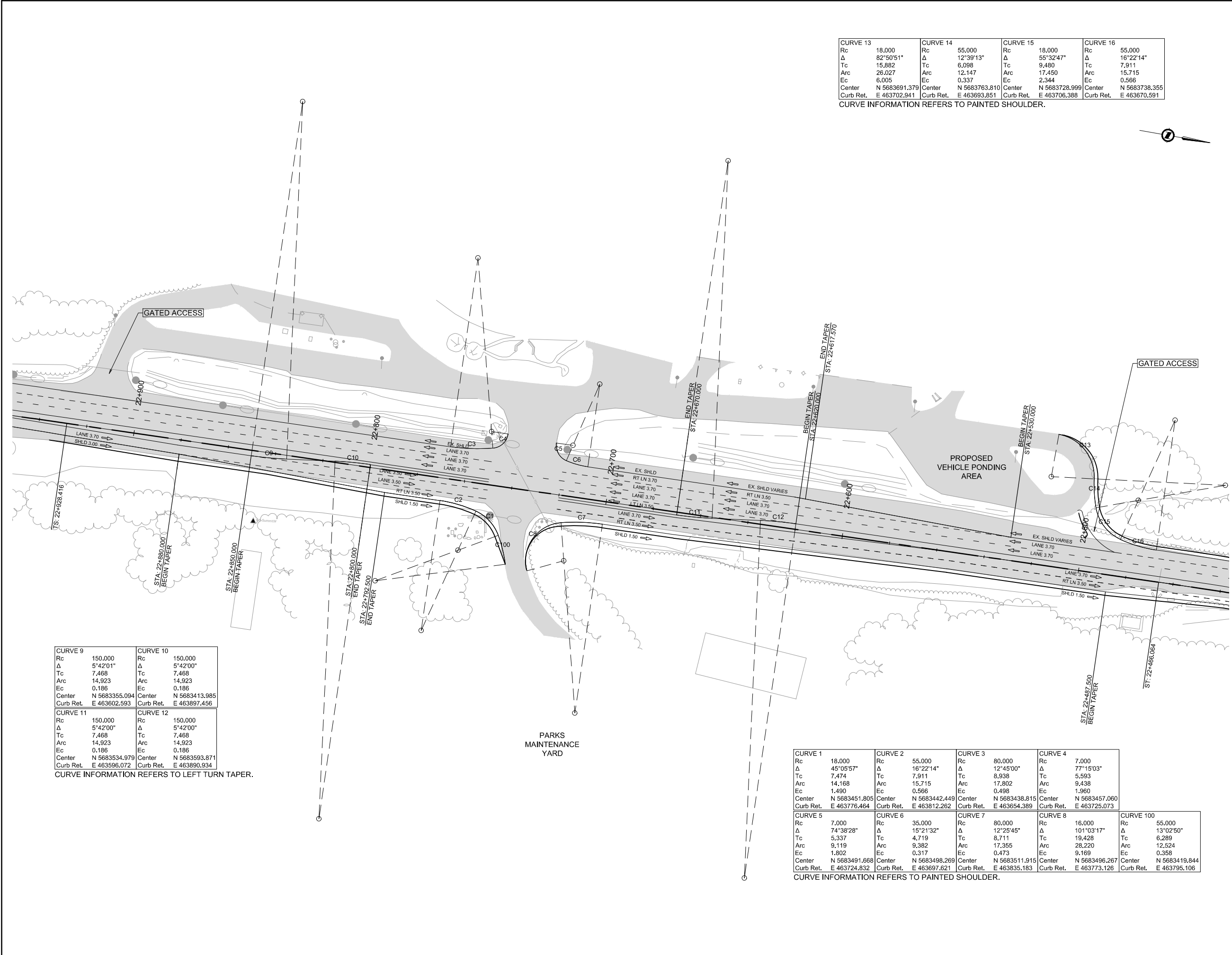
Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:100

	Parks Canada Project Manager / Administrateur de Projets Parcs Canada	
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Client Acceptance / Acceptation du client	Approved by / Approuvé par
<hr/> Parks Canada Responsible Officer / Agent Responsable Parcs Canada	<hr/> Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille 018
Drawing Reference No. / No. de référence du dessin		





CURVE 13	Rc 18.000 Δ 82°50'51" Tc 15.852 Arc 26.027 Ec 6.005 Center N 5683691.379 Curb Ret. E 463702.941	CURVE 14	Rc 55.000 Δ 12°39'13" Tc 6.098 Arc 12.147 Ec 0.337 Center N 5683763.810 Curb Ret. E 463893.851	CURVE 15	Rc 18.000 Δ 55°32'47" Tc 9.480 Arc 17.450 Ec 2.344 Center N 5683728.999 Curb Ret. E 463706.388	CURVE 16	Rc 55.000 Δ 16°22'14" Tc 7.911 Arc 15.715 Ec 0.566 Center N 5683738.355 Curb Ret. E 463670.591
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CURVE INFORMATION REFERS TO PAINTED SHOULDER.

CURVE 9	Rc 150.000 Δ 5°42'01" Tc 7.468 Arc 14.923 Ec 0.186 Center N 5683355.094 Curb Ret. E 463602.593	CURVE 10	Rc 150.000 Δ 5°42'00" Tc 7.468 Arc 14.923 Ec 0.186 Center N 5683413.985 Curb Ret. E 463897.456
CURVE 11	Rc 150.000 Δ 5°42'00" Tc 7.468 Arc 14.923 Ec 0.186 Center N 5683534.979 Curb Ret. E 463596.072	CURVE 12	Rc 150.000 Δ 5°42'00" Tc 7.468 Arc 14.923 Ec 0.186 Center N 5683593.871 Curb Ret. E 463890.934

CURVE INFORMATION REFERS TO LEFT TURN TAPER.

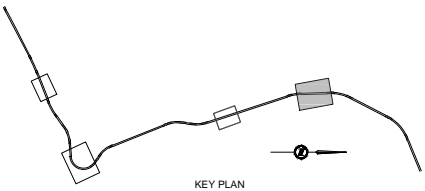
CURVE 1		CURVE 2		CURVE 3		CURVE 4			
Rc	18.000	Rc	55.000	Rc	80.000	Rc	7.000		
Δ	45°05'57"	Δ	16°22'14"	Δ	12°45'00"	Δ	77°15'03"		
Tc	7.474	Tc	7.911	Tc	8.938	Tc	5.593		
Arc	14.168	Arc	15.715	Arc	17.802	Arc	9.438		
Ec	1.490	Ec	0.566	Ec	0.498	Ec	1.960		
Center	N 5683451.805	Center	N 5683442.449	Center	N 5683438.815	Center	N 5683457.060		
Curb Ret.	E 463776.464	Curb Ret.	E 463812.262	Curb Ret.	E 463654.389	Curb Ret.	E 463725.073		
CURVE 5		CURVE 6		CURVE 7		CURVE 8		CURVE 100	
Rc	7.000	Rc	35.000	Rc	80.000	Rc	16.000	Rc	55.000
Δ	74°38'28"	Δ	15°21'32"	Δ	12°25'45"	Δ	101°03'17"	Δ	13°02'50"
Tc	5.337	Tc	4.719	Tc	8.711	Tc	19.428	Tc	6.289
Arc	9.119	Arc	9.382	Arc	17.355	Arc	28.220	Arc	12.524
Ec	1.802	Ec	0.317	Ec	0.473	Ec	9.169	Ec	0.358
Center	N 5683491.668	Center	N 5683498.269	Center	N 5683511.915	Center	N 5683496.267	Center	N 5683419.844
Curb Ret.	E 463724.832	Curb Ret.	E 463697.621	Curb Ret.	E 463835.183	Curb Ret.	E 463773.126	Curb Ret.	E 463795.106

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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

<div><div>A</div><div>B</div><div>C</div></div>	<div>A detail number numéro de detail B source drawing no. de dessin no. C detail on drawing no. detail sur dessin no.</div>	<div><div>A</div><div>B</div><div>C</div></div>
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	<div><div> Parks Canada Agency Western and Northern Region</div><div> L'Agence Parcs Canada Ouest et Nord Région</div></div>
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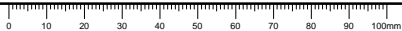
TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

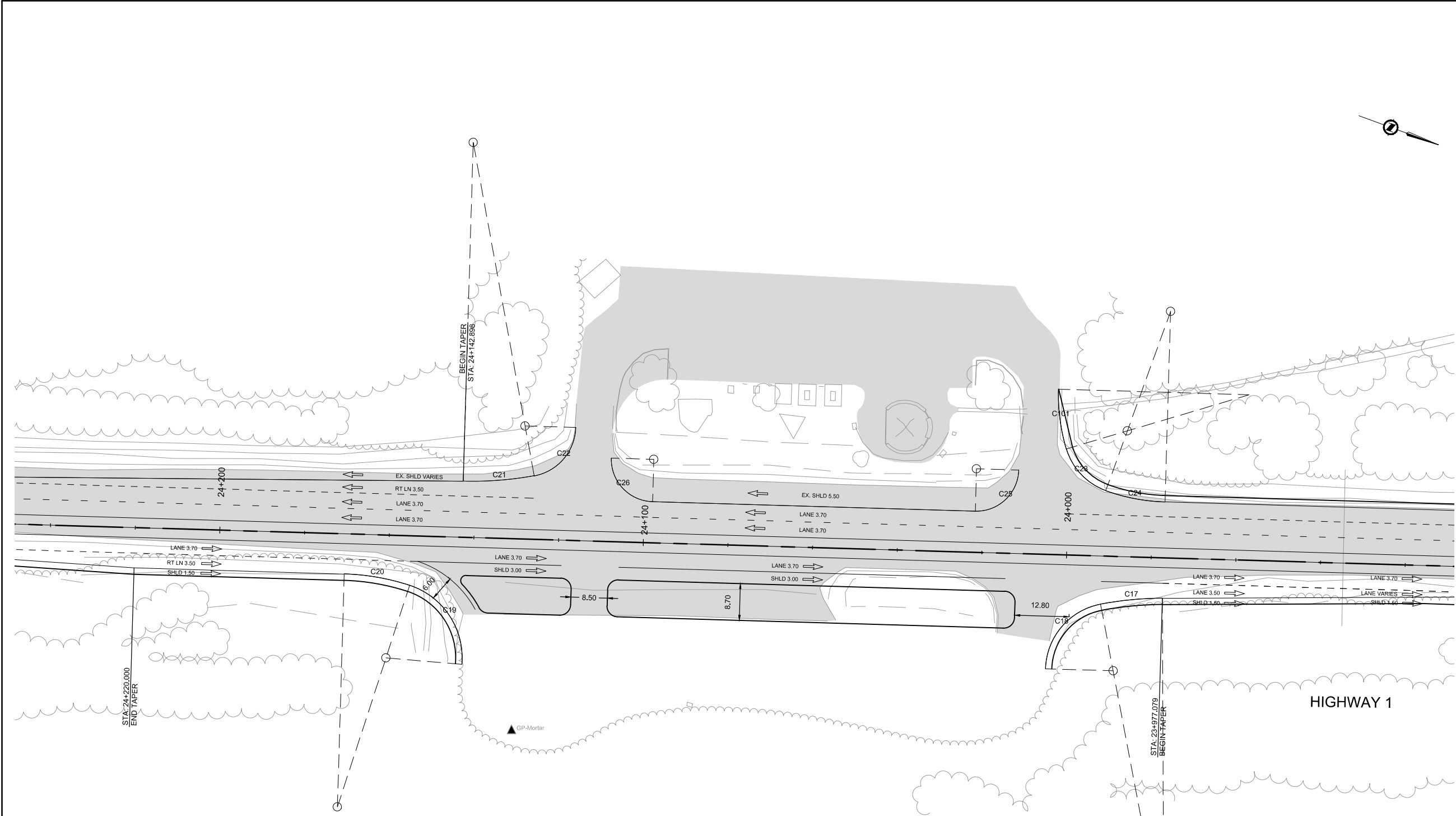
INTERSECTION DETAILS
ROGERS PASS SUMMIT

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:500

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
<div><div></div><div>Project No. / No. du projet 2511-00581-0</div></div>	<div><div></div><div>Asset No. / No. du bien Sheet No. / No. de la feuille 019</div></div>
Drawing Reference No. / No. de référence du dessin	





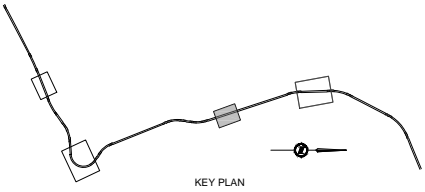
CURVE 17 Rc 80.000 Δ 10°31'12" Tc 7.365 Arc 14.689 Ec 0.338 Center N 5682311.489 Curb Ret. E 464142.410	CURVE 18 Rc 16.000 Δ 77°34'16" Tc 12.858 Arc 21.662 Ec 4.526 Center N 5682278.767 Curb Ret. E 464087.407	CURVE 19 Rc 18.000 Δ 76°47'42" Tc 14.265 Arc 24.126 Ec 4.967 Center N 5682116.370 Curb Ret. E 464143.283	CURVE 20 Rc 55.000 Δ 16°22'14" Tc 7.911 Arc 15.715 Ec 0.566 Center N 5682117.629 Curb Ret. E 464180.261	CURVE 21 Rc 80.000 Δ 12°03'24" Tc 8.448 Arc 16.834 Ec 0.445 Center N 5682094.115 Curb Ret. E 464021.917	CURVE 22 Rc 12.000 Δ 77°56'37" Tc 9.708 Arc 16.324 Ec 3.435 Center N 5682128.501 Curb Ret. E 464080.582
CURVE 23 Rc 15.000 Δ 53°37'14" Tc 7.580 Arc 14.038 Ec 1.807 Center N 5682262.550 Curb Ret. E 464033.039	CURVE 24 Rc 45.000 Δ 18°11'42" Tc 7.206 Arc 14.290 Ec 0.573 Center N 5682262.484 Curb Ret. E 464003.039	CURVE 25 Rc 10.000 Δ 90°00'00" Tc 15.708 Arc 4.142 Ec 0.573 Center N 5682232.143 Curb Ret. E 464053.641	CURVE 26 Rc 10.000 Δ 90°00'00" Tc 10.000 Arc 15.708 Ec 4.142 Center N 5682159.770 Curb Ret. E 464077.603	CURVE 101 Rc 45.000 Δ 18°11'04" Tc 7.202 Arc 14.282 Ec 0.573 Center N 5682286.664 Curb Ret. E 464015.193	

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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

<div>A detail number B source drawing no. C detail on drawing no. detail sur dessin no.</div>	<div>A B C</div>
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	<div> Parks Canada Agency Western and Northern Region</div> <div> L'Agence Parcs Canada Ouest et Nord Région</div>
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McElhanney
McElhanney Consulting Services Ltd.

TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

INTERSECTION DETAILS
MONUMENT

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:250

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille 020
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Drawing Reference No. / No. de référence du dessin



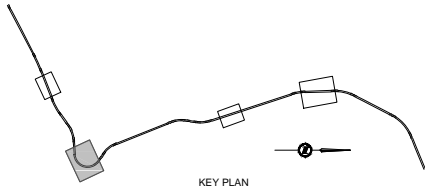
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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



A detail number
numéro de detail
B source drawing no.
de dessin no.
C detail on drawing no.
detail sur dessin no.



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TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

INTERSECTION DETAILS
ILLECILLEWAET CAMPGROUND

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:250

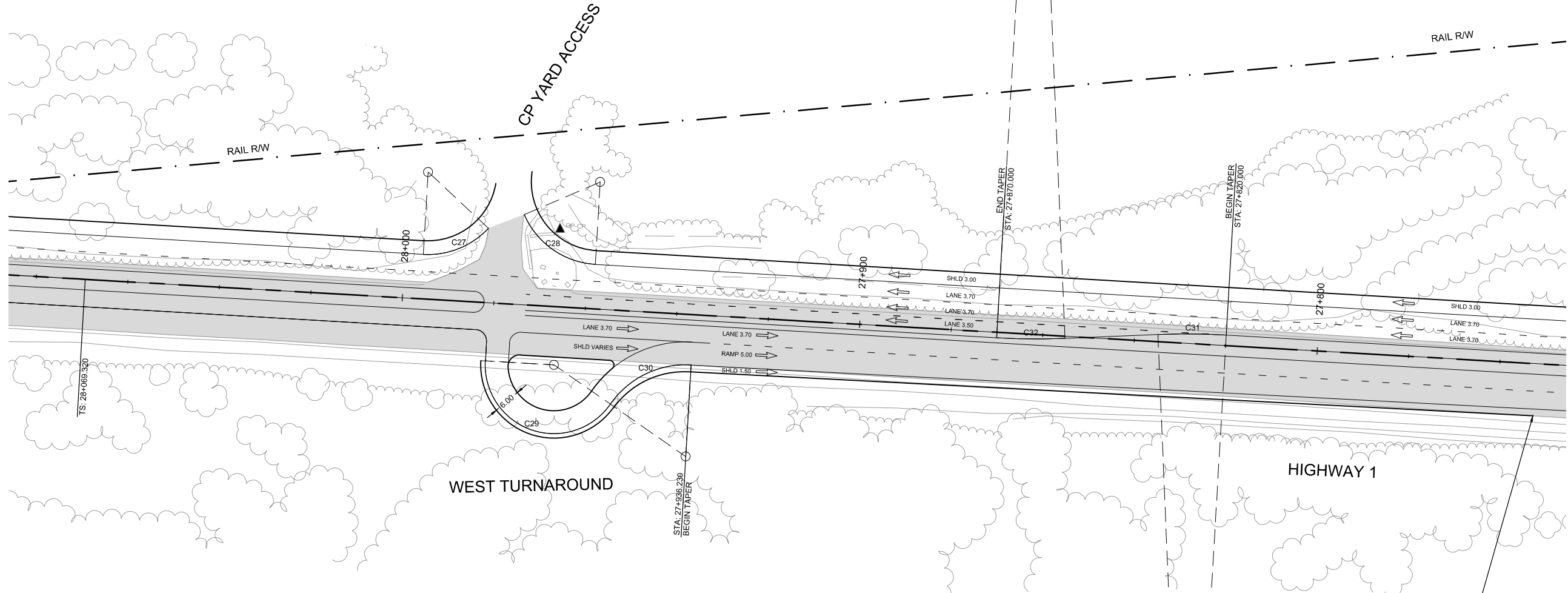
Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du-bien	Sheet No. No. de la feuille 021
Drawing Reference No. / No. de référence du dessin		

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Ec 1.898	Ec 3.158
Center N 5679407.334	Center N 5679421.222
Curb Ret. E 463559.975	Curb Ret. E 463594.920
CURVE 29	CURVE 30
Rc 15,000	Rc 20,000
Δ 148°28'32"	Δ 58°28'33"
Tc 53.142	Tc 11.195
Arc 38.871	Arc 20.412
Ec 40.219	Ec 2.920
Center N 5679380.816	Center N 5679374.828
Curb Ret. E 463602.666	Curb Ret. E 463637.150

CURVE INFORMATION REFERS TO PAINTED SHOULDER.



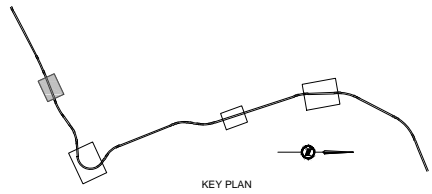
CURVE 31	CURVE 32
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Arc 14.923	Arc 14.923
Ec 0.186	Ec 0.186
Center N 5679309.318	Center N 5679566.391
Curb Ret. E 463788.271	Curb Ret. E 463632.304

CURVE INFORMATION REFERS TO LEFT TURN TAPER.

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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A	detail number	A
B	source drawing no.	B
C	detail on drawing no.	C

Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

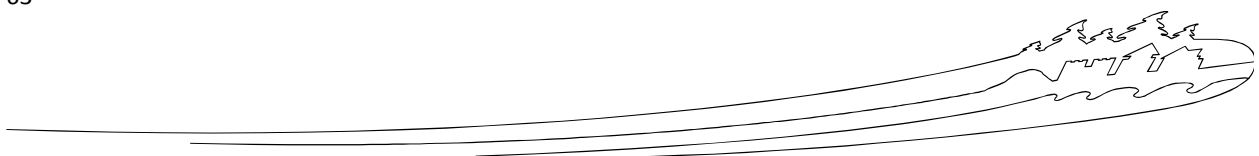
INTERSECTION DETAILS
CP RAIL / TURNAROUND

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:250
Parks Canada Project Manager / Administrateur de Projets Parcs Canada		
Client Acceptance / Acceptation du client		Approved by / Approuvé par
Project No. / No. du projet 2511-00581-0		Asset No. / No. du bien Sheet No. / No. de la feuille 022
Drawing Reference No. / No. de référence du dessin		



March 2016

Appendix 4: Vegetation Elements of Management Concern with Potential to Occur Near the Project



Appendix 4 - Vegetation Elements of Management Concern with Potential to Occur Near the Project

Scientific Name	English Name	BC General ¹	BC Conservation ²	COSEWIC ³	SARA ⁴	Habitat Subtype
<i>Allium geyeri</i> var. <i>tenerum</i>	Geyer's onion	Sensitive	Blue	-	-	Vernal Pools/Seasonal Seeps/Rock/Sparsely Vegetated Rock/Riparian Herbaceous/Garry Oak Vernal Pool
<i>Arnica longifolia</i>	seep-spring amica	Sensitive	Red	-	-	Meadow/Riparian Herbaceous/Alpine/Subalpine Meadow
<i>Atrichum tenellum</i>	-	May Be At Risk	Red	-	-	-
<i>Botrychium crenulatum</i>	dainty moonwort	Sensitive	Blue	-	-	-
<i>Botrychium lineare</i>	Linear-leaf moonwort	May Be At Risk	Blue	-	-	Pasture/Old Field/Cliff/Rock/Sparsely Vegetated Rock/Mixed Forest (deciduous/coniferous mix)/Riparian Herbaceous
<i>Botrychium simplex</i> var. <i>compositum</i>	least moonwort	Sensitive	Blue	-	-	-
<i>Botrychium spathulatum</i>	spoon-shaped moonwort	May Be At Risk	Blue	-	-	Pasture/Old Field/Meadow/Alpine/Subalpine Meadow
<i>Bryum blindii</i>	-	Undetermined	Blue	-	-	-
<i>Campyllum calcareum</i>	-	May Be At Risk	Red	-	-	-
<i>Carex krausei</i>	Krause's sedge	Sensitive	Blue	-	-	Tundra/Meadow/Grassland/Sagebrush Steppe/Antelope-brush Steppe/Gravel Bar
<i>Carex lenticularis</i>	lakeshore sedge	Secure	Blue	-	-	Marsh/Lake/Riparian Herbaceous/Gravel Bar
<i>Cryptogramma cascadiensis</i>	Cascade parsley fern	Sensitive	Blue	-	-	Cliff/Rock/Sparsely Vegetated Rock/Talus
<i>Delphinium sutherlandii</i>	Sutherland's larkspur	Sensitive	Blue	-	-	Rock/Sparsely Vegetated Rock/Shrub - Natural/Conifer Forest - Dry
<i>Didymodon subandreaeoides</i>	-	Sensitive	Red	-	-	-
<i>Draba lactea</i>	milky draba	Sensitive	Blue	-	-	Cliff/Rock/Sparsely Vegetated Rock/Talus/Tundra/Meadow/Alpine/Subalpine Meadow
<i>Dryopteris cristata</i>	crested wood fern	Sensitive	Blue	-	-	Swamp/Riparian Shrub/Conifer Forest - Moist/wet
<i>Eleocharis elliptica</i>	elliptic spike-rush	Sensitive	Blue	-	-	Fen/Meadow
<i>Eleocharis nitida</i>	slender spike-rush	May Be At Risk	Blue	-	-	Fen
<i>Epilobium glaberrimum</i> ssp. <i>fastigiatum</i>	smooth willowherb	Sensitive	Blue	-	-	Stream/River/Cliff/Rock/Sparsely Vegetated Rock/Talus/Tundra/Glacier/Icefield/Avalanche Track/Krummholtz/Alpine/Subalpine Meadow/Alpine Grassland/Heath/Fellfield/Nivation/Zoogenic
<i>Epilobium x treleasianum</i>	Trelease's hybrid willowherb	Sensitive	Blue	-	-	Stream/River/Cold Spring
<i>Grimmia mollis</i>	-	Sensitive	Blue	-	-	-
<i>Hygrohypnum alpinum</i>	-	Secure	Blue	-	-	-
<i>Hypericum spouleri</i> ssp. <i>nortoniae</i>	western St. John's-wort	Sensitive	Blue	-	-	Rock/Sparsely Vegetated Rock/Meadow/Alpine/Subalpine Meadow
<i>Isoetes howellii</i>	Howell's quillwort	May Be At Risk	Blue	-	-	Vernal Pools/Seasonal Seeps
<i>Juncus albenscens</i>	whitish rush	Secure	Blue	-	-	Fen/Pond/Open Water/Heath
<i>Lescurea saxicola</i>	-	-	Blue	-	-	-
<i>Mnium arizonicum</i>	-	Sensitive	Blue	-	-	-
<i>Orthotrichum pallens</i>	-	Sensitive	Blue	-	-	-
<i>Pellaea gastonyi</i>	Gastony's cliff-brake	Sensitive	Blue	-	-	Cliff/Rock/Sparsely Vegetated Rock/Talus/Conifer Forest - Dry
<i>Pinus albicaulis</i>	whitebark pine	Sensitive	Blue	Endangered	Endangered , Schedule 1	Cliff/Rock/Sparsely Vegetated Rock/Talus/Conifer Forest - Mesic (average)/Conifer Forest - Dry
<i>Pinus flexilis</i>	limber pine	Sensitive	Red	Endangered	-	Rock/Sparsely Vegetated Rock/Grassland/Conifer Forest - Dry/Krummholtz/Alpine Grassland
<i>Platyhypnidium riparioides</i>	-	Sensitive	Blue	-	-	-
<i>Pohlia elongata</i>	-	Sensitive	Blue	-	-	-
<i>Pohlia lescuriana</i>	-	Sensitive	Red	-	-	-
<i>Pohlia longicollis</i>	-	Sensitive	Red	-	-	-
<i>Pohlia melanodon</i>	-	May Be At Risk	Red	-	-	-
<i>Pyrola elliptica</i>	shinleaf wintergreen	Sensitive	Blue	-	-	Conifer Forest - Mesic (average)/Conifer Forest - Dry/Conifer Forest - Moist/wet/Mixed Forest (deciduous/coniferous mix)
<i>Ranunculus pedatifidus</i> ssp. <i>affinis</i>	birdfoot buttercup	Sensitive	Blue	-	-	Rock/Sparsely Vegetated Rock/Tundra/Meadow/Deciduous/Broadleaf Forest
<i>Salix tweedyi</i>	Tweedy's willow	Sensitive	Blue	-	-	Fen/Marsh/Stream/River/Meadow
<i>Stellaria obtusa</i>	blunt-seeped starwort	Sensitive	Blue	-	-	Riparian Forest/Riparian Shrub/Meadow/Alpine/Subalpine Meadow
<i>Tayloria splachnoides</i>	-	May Be At Risk	Red	-	-	Tundra/Meadow/Grassland/Sagebrush Steppe/Antelope-brush Steppe/Gravel Bar
-	-	-	Red	-	-	Terrestrial

Notes:

Grey denotes species confirmed within 5 km of Project Sites

¹ General Status of Wild Species 2010 (Canadian Endangered Species Conservation Council 2011).

² BC Species and Ecosystems Explorer. Yellow=Secure; Red=Extirpated, Endangered or Threatened; Blue=Special Concern (B.C. Conservation Data Centre 2015a).

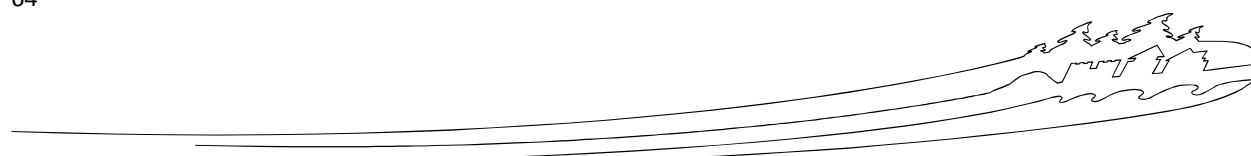
³ Status under the Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2015).

⁴ SARA - Species at Risk Act (Government of Canada 2002).



March 2016

Appendix 5: Wildlife Species of Management Concern Potentially Found Within 1 Kilometre of the Project



Appendix 5 - Wildlife Species of Management Concern Potentially Found Within 1 Kilometre of Illecillewaet Curve¹

Common Name	Scientific Name	Period of Occurrence	Protected Under the MCBA? ²	BC Conservation ³	COSEWIC ⁴	SARA ⁵	Federal Setback ⁶		
							Distance	Time of Year	Feature
Amphibians									
Coeur d'alene Salamander	<i>Plethodon idahoensis</i>	Resident	N/A	Yellow	Special Concern	Special Concern, Schedule 1	-	-	-
Western Toad	<i>Anaxyrus boreas</i>	Resident	N/A	Blue	Special Concern	Special Concern, Schedule 1	-	-	-
Birds									
American Bittern	<i>Botaurus lentiginosus</i>	Migrant	Yes	Blue	-	-	-	-	-
American Kestrel	<i>Falco sparverius</i>	Migrant	No	Yellow	-	-	-	-	-
Barn Swallow	<i>Hirundo rustica</i>	Migrant	Yes	Blue	Threatened	-	100	May 1 - Aug. 31	Nest
California Gull	<i>Larus californicus</i>	Migrant	Yes	Blue	-	-	-	-	-
Common Nighthawk	<i>Chordeiles minor</i>	Migrant	Yes	Yellow	Threatened	Threatened, Schedule 1	50-200	May 1 - Aug. 31	Nest
Gyr Falcon	<i>Falco rusticolus</i>	Migrant (Winter)	No	Blue	Not at Risk	-	-	-	-
Harlequin Duck	<i>Histrionicus histrionicus</i>	Migrant	Yes	Yellow	-	-	-	-	-
Lewis's Woodpecker	<i>Melanerpes lewis</i>	Migrant	Yes	Red	Threatened	Threatened, Schedule 1	-	-	-
Olive-sided Flycatcher*	<i>Contopus cooperi</i>	Migrant	Yes	Blue	Threatened	Threatened	50-300	May 1 - Aug. 31	Nest
Short-eared Owl	<i>Asio flammeus</i>	Migrant	No	Blue	Special Concern	Special Concern, Schedule 1	100-200	Apr. 1 - Jul. 31	Nest
Swainson's Hawk	<i>Buteo swainsoni</i>	Migrant	No	Red	-	-	-	-	-
Mammals									
Bighorn Sheep	<i>Ovis canadensis</i>	Resident	N/A	Blue	-	-	-	-	-
Fisher	<i>Martes pennanti</i>	Resident	N/A	Blue	-	-	-	-	-
Black Bear	<i>Ursus americanus</i>	Resident	N/A	Yellow	-	-	-	-	-
Grizzly Bear	<i>Ursus arctos</i>	Resident	N/A	Blue	Special Concern	-	-	-	-
Little Brown Myotis	<i>Myotis lucifugus</i>	Resident	N/A	Yellow	Endangered	Endangered, Schedule 1	-	-	-
Moose	<i>Alces alces</i>	Resident	N/A	Yellow	-	-	-	-	-
Mountain Goat	<i>Oreamnos americanus</i>	Resident	N/A	Yellow	-	-	-	-	-
Northern Long-eared Myotis	<i>Myotis septentrionalis</i>	Resident	N/A	Blue	Endangered	Endangered, Schedule 1	-	-	-
Spotted Bat	<i>Euderma maculatum</i>	Unknown	N/A	Blue	Special Concern	Special Concern, Schedule 1	-	-	-
Western Small-footed Myotis	<i>Myotis ciliolabrum</i>	Resident	N/A	Blue	-	-	-	-	-
Woodland Caribou - Southern Mountain population*	<i>Rangifer tarandus pop. 1</i>	Resident	N/A	Red	Endangered	Threatened, Schedule 1	-	-	-
Wolverine	<i>Gulo gulo luscus</i>	Resident	N/A	Blue	Special Concern	-	-	-	-
Fish									
Bull Trout	<i>Salvelinus confluentus</i>	Resident	N/A	Blue	Not at Risk	-	-	-	-
Other									
Benthic Invertebrates	N/A	Resident	N/A	N/A	N/A	N/A	-	-	-

Notes:

* Denotes species confirmed as regularly occurring in GNP by Parks Canada Biotics Web Explorer (Parks Canada 2013).

¹ Species Range Data compiled from Ridgely et al., 2007; International Union for Conservation of Nature, 2014.

² Migratory Birds Convention Act

³ BC Species and Ecosystems Explorer. Yellow=Secure; Red=Extirpated, Endangered or Threatened; Blue=Special Concern (B.C. Conservation Data Centre 2015a).

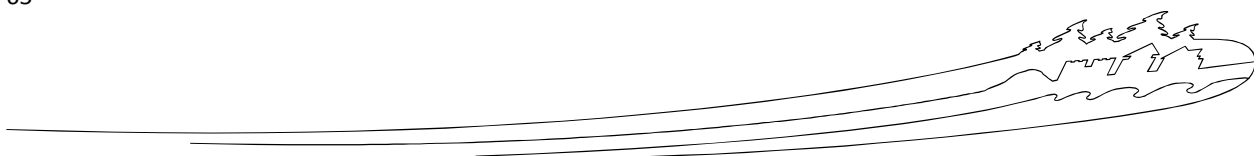
⁴ Status under the Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2015).

⁵ Status under the Species at Risk Act (Government of Canada 2002).

⁶ Federal Setbacks from Environment Canada 2011; P. Gregoire, personal communication August 15, 2013.



Appendix 6: Archaeological Overview Assessment, Trans Canada Widening Project, Illecillewaet Curve, Glacier National Park



(Revised) Archaeological Overview Assessment
Trans Canada Widening Project, Illecillewaet Curve, Glacier National Park
Prepared by Gwyn Langemann and Bill Perry, Archaeologists, HCCD
February 3, 2016

Purpose

This Archaeological Overview Assessment (AOA) update is to take into account project design changes outlined in the January 2016 60% review set of plans received February 2, 2016. Specifically, changes have been made to the alignment and the vegetation clearing line and the cut/fill lines to accommodate cultural resource concerns voiced over the previous set of plans. The new recommendations are highlighted below and accompanying maps have also been updated.

The purpose of this AOA is to conduct an initial overview assessment for the Trans-Canada Highway (TCH) widening project, at the Illecillewaet Curve and the summit of Rogers Pass in Glacier National Park. This overview will identify possible impacts to archaeological resources, and provide recommendations to mitigate these impacts. This review is done for the route as a whole, and not site by site. The area is well known, and portions are highly significant archaeologically, so we are able to provide well-informed recommendations at a site specific level.

Background

To improve traffic safety, Highways Engineering Services (HES) plans to widen the TCH in Glacier NP through the summit of Rogers Pass and the Illecillewaet Curve, from east of the Hermit Hut parking lot to just east of Loop Brook (km 20 + 840 to km 29 + 100). This will involve widening the highway from 2 lanes to 4, installing a central barrier, widening the exit approaches to various parking lots, expanding parking areas, improving roadside drainage, and clearing and grubbing vegetation from the slopes that parallel the highway. This construction method has the potential to severely impact historic archaeological resources.

The entire project is within the boundary of Rogers Pass National Historic Site. This was commemorated for its importance in the exploration, construction, and operation of the main line of the CPR, and the engineering solutions that overcame formidable obstacles in difficult terrain. The archaeological resources include the remains of the 1885 railway grade and sidings, a series of snow sheds designed to deal with the dangers of a series of steep avalanche slopes, and the Loop Brook pillars. This grade was eventually abandoned as too dangerous, and the Connaught Diversion and Tunnel opened in 1917. The TCH was constructed in the early 1960s through Rogers Pass, and because of the constrained landscape, it was built on top of many of the railway features. The same formidable operational difficulties face the TCH today, and it too has had to build snow sheds and develop substantial avalanche control measures. The HSMBC is currently considering expanding the commemoration to include the construction and operation of the TCH through this transportation corridor. If it does, then archaeological and cultural resources related to the TCH will also be resources of national significance.

The construction will proceed in two phases: Year 1 will be from the monument west to Loop Brook, and Year 2 will be from the monument east to Hermit Hut trailhead. Vegetation and clearing will also be scheduled prior to the main construction.

Observations

This assessment is based on our extensive knowledge of the archaeological resources in Glacier NP, gained through reviews of the archaeological records and our own extensive field work. Based on this knowledge I am able to provide the following observations.

- The entire railway route has been intensively surveyed, and the archaeological resources described and inventoried. The research is summarised in Francis and Perry (2000). The CIS (Parks Canada 1998) presents the nationally significant cultural resources and messages for the Rogers Pass NHS, including archaeological sites.
- While the railway corridor has been intensively surveyed, the valley slopes and riverbanks have not. It is possible that there are other historic sites to be found, such as remains of logging and tie camps, railway construction camps, and TCH construction camps.
- No pre-contact sites have been discovered.
- The dense concentration of historic sites in the project area relates primarily to construction and use of the railway in the period between 1885 and 1917, when the Connaught Diversion and Tunnel opened and the original route was abandoned.
- Archaeological sites include the remains of a series of wooden snow sheds, stretches of railway grade between the sheds, rail grades that parallel the sheds for summer use, construction camps at the Connaught Tunnel entrance, and railway sidings with all their associated structures and features.
- Archaeological sites are present throughout Rogers Pass, and completely cover the north end of the summit; it is not possible for the current highway project to avoid severely impacting them.

Many of these sites have already been extensively disturbed by developments such as the construction of the TCH in the early 1960s. Portions of this route crossed extant portions of the abandoned rail grade, such as at the TCH monument parking lot (km 24 + 100). Archaeological sites have also been affected by natural erosion from the Beaver and Illecillewaet Rivers, from avalanches and debris flows, and from the sheer weight of winter snows. The whole project area is subject to violent natural events. It is important to protect the remaining intact historic features, where the cumulative impact has already been so severe.

Recommendations

The ideal stage for archaeologists to work with the project engineers and designers is before the plans are finalised. In many cases, an impact to the archaeological sites can be mitigated by a change in design to avoid the site, or to minimize construction disturbance. During the TCH twinning through Banff NP, archaeologists successfully worked with the project designers to avoid key highly significant and extensive sites at an early design stage, and we would like to build on this success. The known archaeological site locations in Glacier NP have been provided to HES, and they have considered them in their road design.

Unfortunately, given the constrained landscape, it is not possible for road construction to completely avoid the known historic archaeological sites. Therefore, mitigative measures are presented here. In many stretches, particularly in the west half of the project area, no measures are needed (*shaded in green on the attached maps*). Where there are known sites nearby, monitoring during the clearing and grubbing

phase is required (*shaded in yellow on the attached maps*). Where there are known sites directly in the project area, an Archaeological Impact Assessment (AIA) is required (*shaded in pink on the attached maps*). This will involve an archaeologist doing an inspection of the area before any disturbance and when the ground is not frozen, possibly shovel testing, and recording what is found. Depending on the results of the AIA, further monitoring during the clearing and grubbing phase may be recommended. At all times during construction, even in the “green” areas where no mitigative measures are proposed, the Accidental Finds protocol applies (see below).

Recommendations are presented from west to east, following the order of the map sheets (January 2016-60% version).

Km	Known Site names	Concern	Mitigation action
20+840 – 22+375 Map sheets 3, 4 and 5.	411T44, Rogers Pass Station #2 on south side of TCH, 1886 – 1899 and includes up to archaeological site 411T5, Rogers Pass Station and yards.	Immediately south of TCH; probably impacted by original TCH construction; while no vegetation clearing is shown on project plans, any expansion of current alignment to the south will impact the site; new Hermit Hut trailhead road and parking on north side of TCH may impact resources associated with site. There is a strong probability of scatter of historic artefacts and features, relating to Rogers Pass siding and stations between the Hermit Hut trail parking area and the Rogers Pass operations centre at 22+375.	Monitor during clearing and grubbing, and during construction of Hermit Hut trailhead and parking on north side of highway
22+375-23+100 Map sheets 5 and 6	Rogers Pass stations 3 and 4, summit siding (411T5, 1247T)	Dense concentration of rail grades, sidings, structures, refuse deposits associated with two different sidings and stations; proposed vehicle ponding area has not been well surveyed ever, and it will have cultural resources; even if surface is currently disturbed by paving, there may well be buried resources; hydrocarbon contamination from industrial use	AIA needed before project begins, to flag known features, and particularly to assess ponding area
23+100 – 23+500 westbound Map sheets 6 and 7	Site 411T6, snowshed on 1885 grade	Shed and grades clearly visible; grubbing and clearing line comes very near to east edge of snowshed feature, which is too close and could	Do not clear vegetation right up to snowshed and abandoned grade, maintain a wider buffer. An AIA needed

Km	Known Site names	Concern	Mitigation action
		damage the feature; removal of vegetation exposes remains to erosion and snow load. Park developing an interpretive trail through these features.	before clearing begins, to clearly flag the resources
23+500 – 23+700 westbound Map sheet 7	None; snowsheds that were in this area have been destroyed by mudslide	No concerns	None
23+700 – 24+250 westbound Map sheets 7 and 8	Site 411T8, snowshed on 1885 grade immediately north of monument and crossing over to south of highway.	Shed and grades clearly visible; grubbing and clearing line comes right up to east edge of snowshed feature, which is too close and could damage the feature; removal of vegetation exposes remains to erosion and snowload. Park developing an interpretive trail through these features.	Do not clear vegetation right up to snowshed and abandoned grade, maintain a wider buffer. An AIA needed before clearing begins, to clearly flag the resources.
24+160 – 24+250 westbound	TCH monument parking lot, 1885 grade passed under this, probably destroyed	Traces of old grade visible on north and south edges	Monitor and document before any repaving or work on access roads
24+250-26+600 Map sheets 8,9,10,11,12	Section between summit and Glacier siding and Glacier Warden Station.	Old railgrade on the east side of highway. No concerns.	None.
26+700-27+000 Map sheet 12	Glacier warden station, 23T, and beginning of Glacier House Tally-ho road	Structural features and levelled platforms very near current highway cutbank	Monitor before construction, record current condition; avoid
26+800-28+000 Map sheets 12, 13, and 14	Glacier siding, 411T42, west portal work camp	Scatter of artefacts, structural remains	AIA required to determine whether any structural or artifacts are present in this area prior to vegetation removal. Monitor during clearing and grubbing. Depending on results of AIA, archaeological monitoring may be required.
28+000 – 27+800 Map sheet 14	-	New turnaround construction	Monitor during clearing and grubbing
28+000-29+100,	-	No concerns	None

Km	Known Site names	Concern	Mitigation action
east and west bound except for area noted below for Cambie siding. Map sheets 14 and 15			
28+960-29+100. East and west bound Map sheet 16	Cambie siding 411T31 and 411T50, construction work camp (continues W of project area)	Scatter of structural remains, historic artefacts	Monitor during clearing and grubbing, both sides TCH

It is important to note that other infrastructure projects are also occurring in the Rogers Pass, and the cumulative impact of these measures must be taken into account. For example, there are also avalanche mitigation measures being considered that could impact historic snow sheds and stretches of the original 1885 rail grade, as well as traffic ponding measures.

Accidental Finds

As archaeological testing is by nature sampling (not 100 percent coverage) there could be a chance, however low, that features or artifact concentrations are encountered in the course of vegetation clearing and construction. If significant features (i.e., structural remains and/or high artifact concentrations) are encountered, development work should stop in the immediate area, photographs and a GIS reading should be taken, and the Parks Canada project manager informed. The project manager should then contact Parks Canada's Terrestrial Archaeology section for advice and assessment of significance that will in turn determine what will be required to mitigate the chance find.

What is a significant find? It is highly likely that a scattering of historic objects will be found throughout this historic transportation corridor. Isolated finds of such things as tin cans, bottles, or railway spikes are not reason to stop work. Concentrations of them are significant, however, and so are structural features like log cabin foundations, tent platforms, log cribbing retaining features, rail grades, or masonry. These would be stop work situations.

Rationale

We make the above recommendations based on these factors:

- archaeologists know the railway corridor very well, but not the valley slopes beyond
- there are nationally significant archaeological sites here
- the cumulative impact to these sites has already been high
- since they cannot be avoided, an AIA is needed for the most vulnerable sites, and monitoring is needed in many other areas
- AIA work must be done while the ground is not frozen

References

Francis, Peter D. and John E. P. Porter

2000 *Archaeological Resource Description and Analysis, Mount Revelstoke and Glacier National Parks*. Cultural Resource Services, Western Canada Service Centre, Calgary, Parks Canada.

Parks Canada

1998 *Commemorative Integrity Statement, Rogers Pass National Historic Site*.

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Attachment 1: Areas of archaeological concern drawn onto the December 2015 route plan. Known archaeological sites are shown as cross-hatched areas. On the attached map, I have marked the route in three colours.

- Green: we have no concerns with the project as currently defined, and see no need to monitor
- Yellow: we know an archaeological site is in the area, and monitoring during clearing is required
- **Pink:** it is a known and highly significant archaeological sites, or an area with high potential; an Archaeological Impact Assessment is required before work starts, and monitoring will be required afterwards during construction

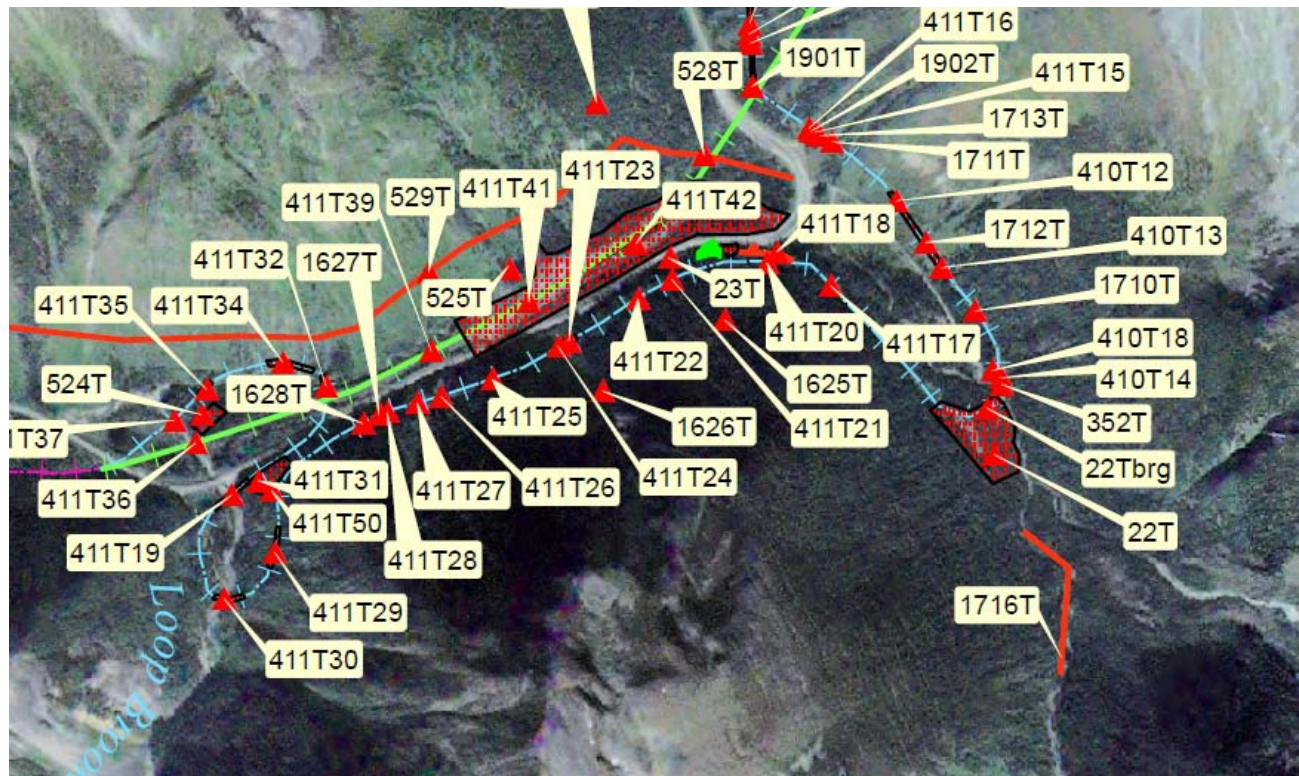


Figure 1. Known historic site locations in the southern part of Rogers Pass NHS. NB: site 23T, the Glacier warden station, should be at the green triangle. For all these figures, the blue line is the 1885 rail grade; and the green line is the current 1916 rail grade.

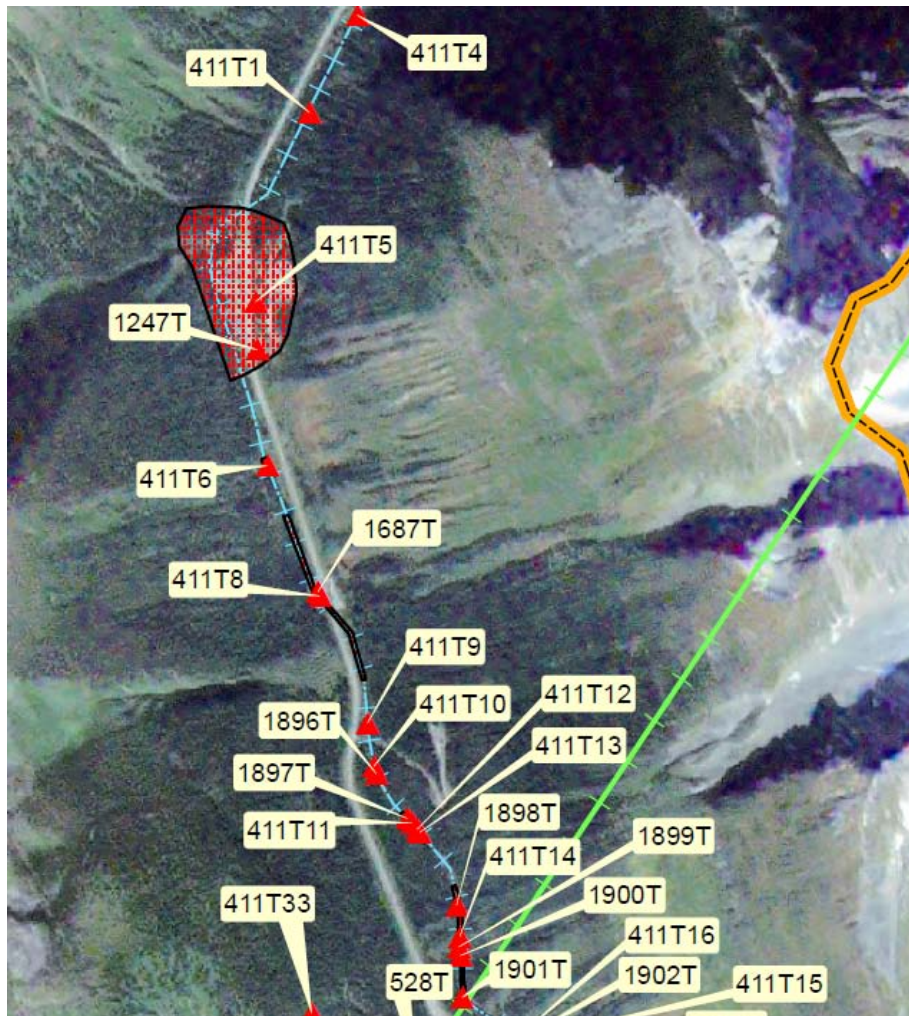


Figure 2. Known historic archaeological sites in the central portion of Rogers Pass NHS. The TCH monument is at 1687T.



Figure 3. Known historic archaeological sites in the northern portion of the Rogers Pass NHS.



Figure 4. Site 411T44, Rogers Pass station no. 2, 1886 – 1899, view to NE. This is where the new access to Hermit Hut trailhead will leave the TCH. This photo illustrates the constrained nature of the landscape; imagine this location as it is today, with the current TCH grade passing through it along the left edge of the historic siding. You cannot go very far off the current TCH grade without impacting historic railway features.



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TCH WIDENING ILLECILLEWAET CURVE

*Accidental finds clause
applies throughout.*



*Known site/high potential
AIA + potential archaeological
monitoring required.*



monitoring only.

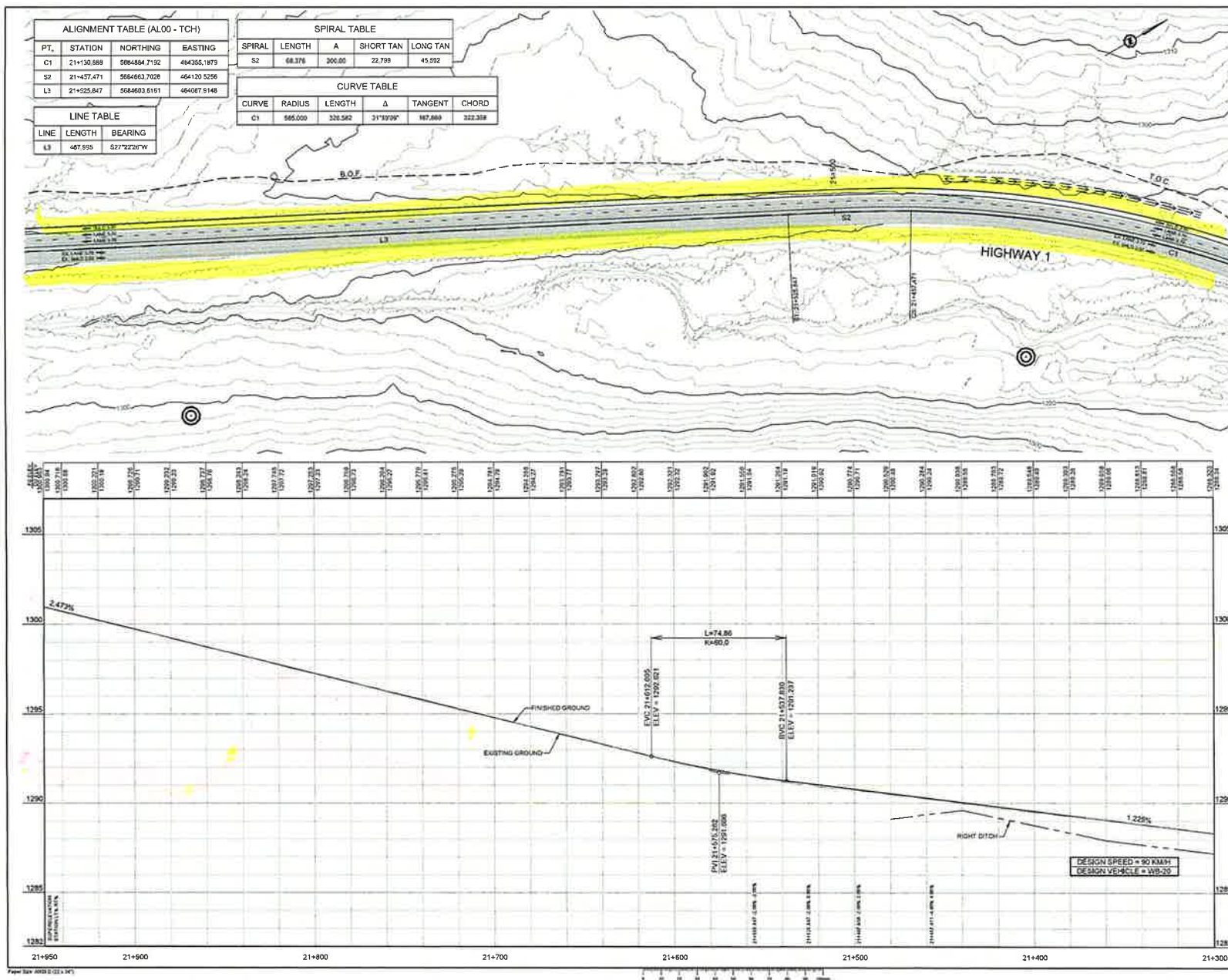
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GLACIER NATIONAL PARK, BC



No concerns ☺

PROJECT NO. 2511-00581-0

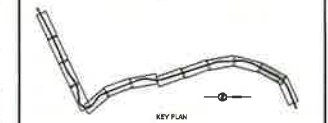
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C	Sheet number	C	Sheet number

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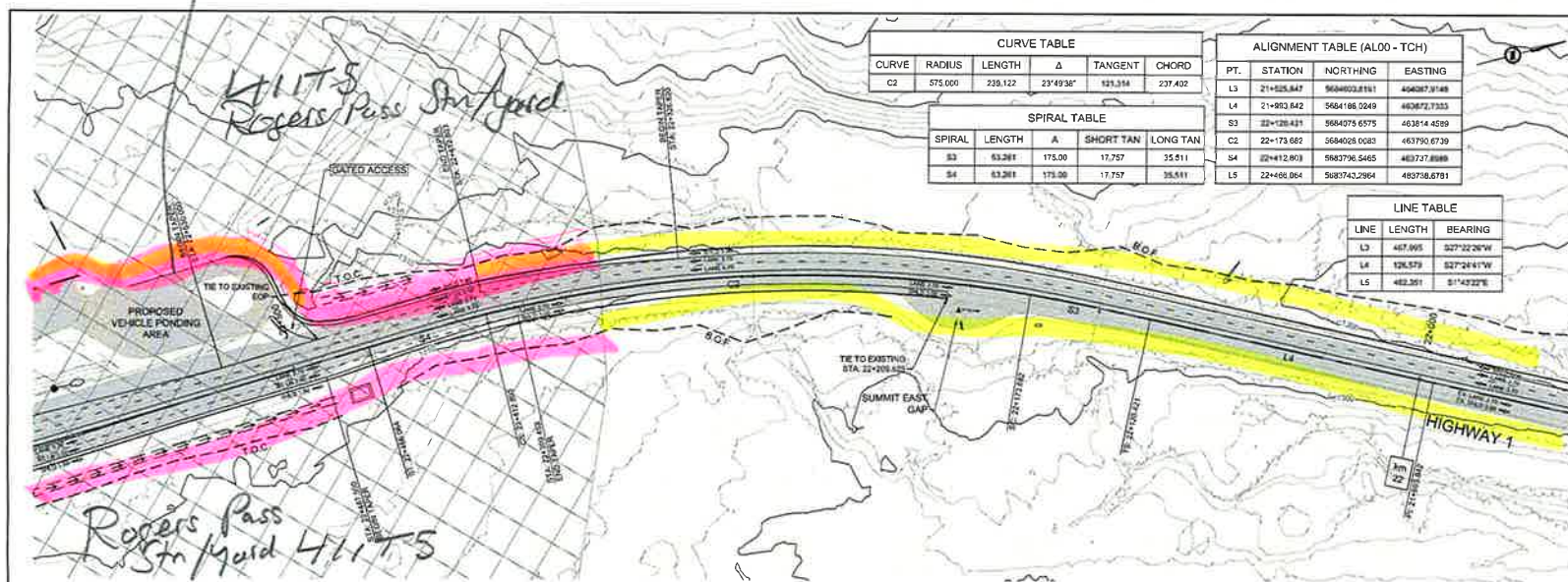
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once boundaries of ponding area is known
-re-assess archaeological requirements



CURVE TABLE				
CURVE	RADIUS	LENGTH	Δ	CHORD
C2	575.000	228.122	23°49'36"	193.334

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S3	63.381	175.00	17.757	35.511
S4	63.381	175.00	17.757	35.511

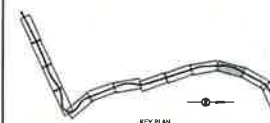
ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
L3	21+525.847	568402.8161	464087.3148
L4	21+903.842	568418.0849	463872.1353
S3	22+128.431	568407.6575	463814.4559
C2	22+173.067	568405.0083	463790.6739
S4	22+412.903	568376.5465	463727.8888
L5	22+668.064	568374.2964	463758.6781

LINE TABLE		
LINE	LENGTH	BEARING
L3	467.895	S27°22'26"W
L4	126.579	S27°24'17"W
L5	462.351	S1°43'22"E

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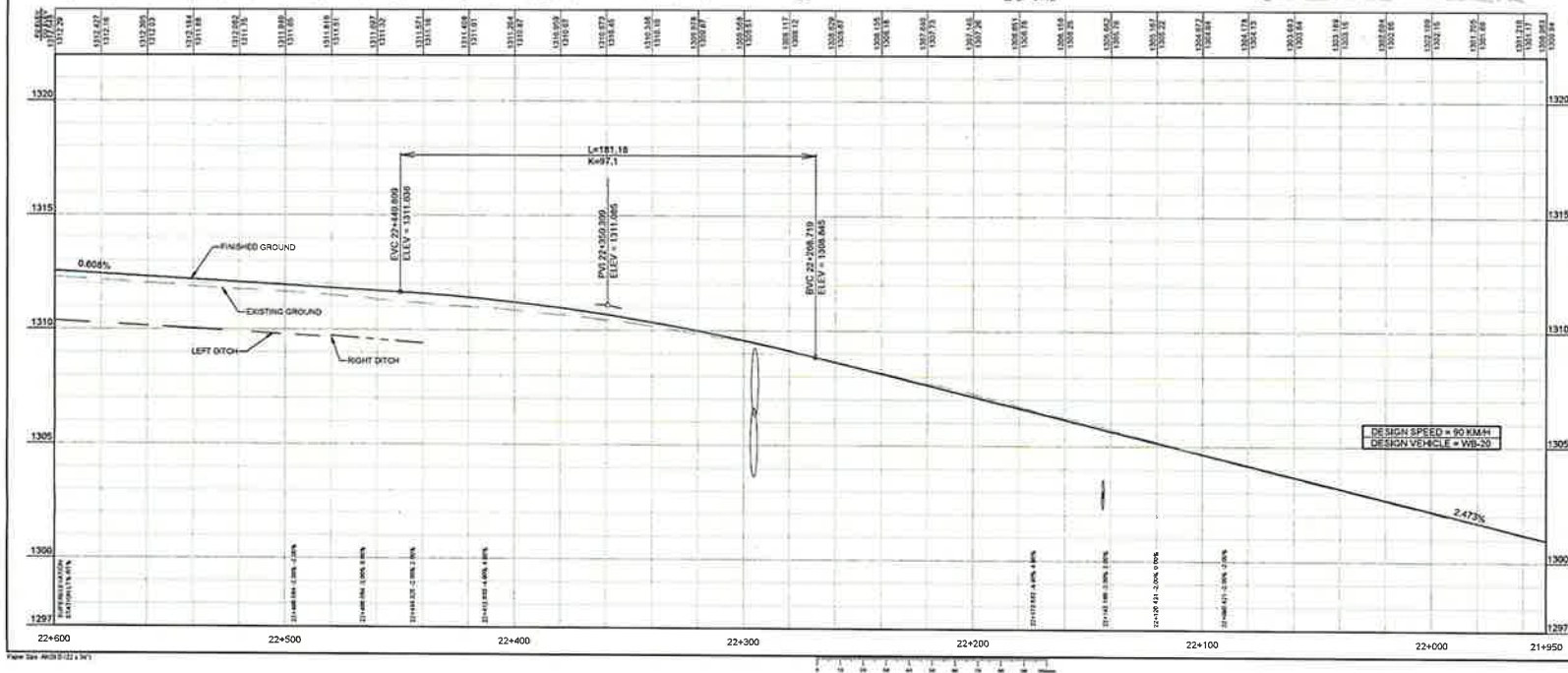
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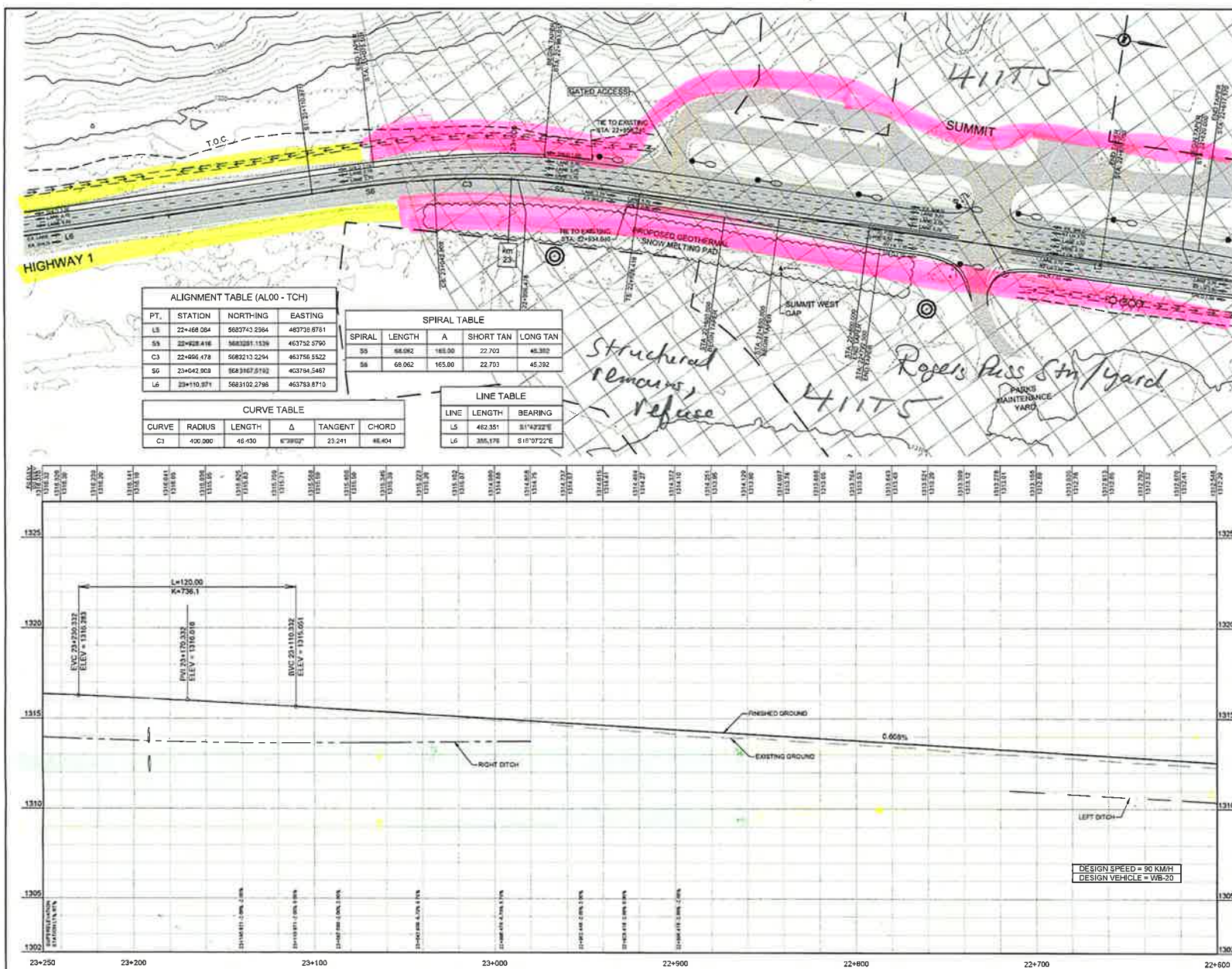
TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES
STA 21+950 TO STA 22+600

Designed by / Révisé par MCS	Drawn by / Dessiné par NJ	Date 2018.01.11
Designed by / Révisé par DL	Reviewed by / Vérifié par NJ	Scale / Échelle 1:1000
Project No. / No. du projet 2511-00581-0		
Drawing Reference / Référence du dessin PP-23		

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ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
L1	22+468.084	5687743.2564	463736.8761
S1	22+468.084	5683281.1326	463752.5790
C1	22+468.478	5683212.2254	463756.5522
S2	23+042.908	5683167.5192	463764.5487
L2	23+110.871	5683102.2788	463763.8710

SPIRAL TABLE				
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S2	68.062	165.00	22.703	46.382

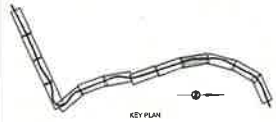
LINE TABLE		
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L1	462.351	S17°49'22"E
L2	355.178	S18°07'22"E

CURVE TABLE				
CURVE	RADIUS	LENGTH	Δ	TANGENT
C1	400.000	45.430	6°39'02"	23.241

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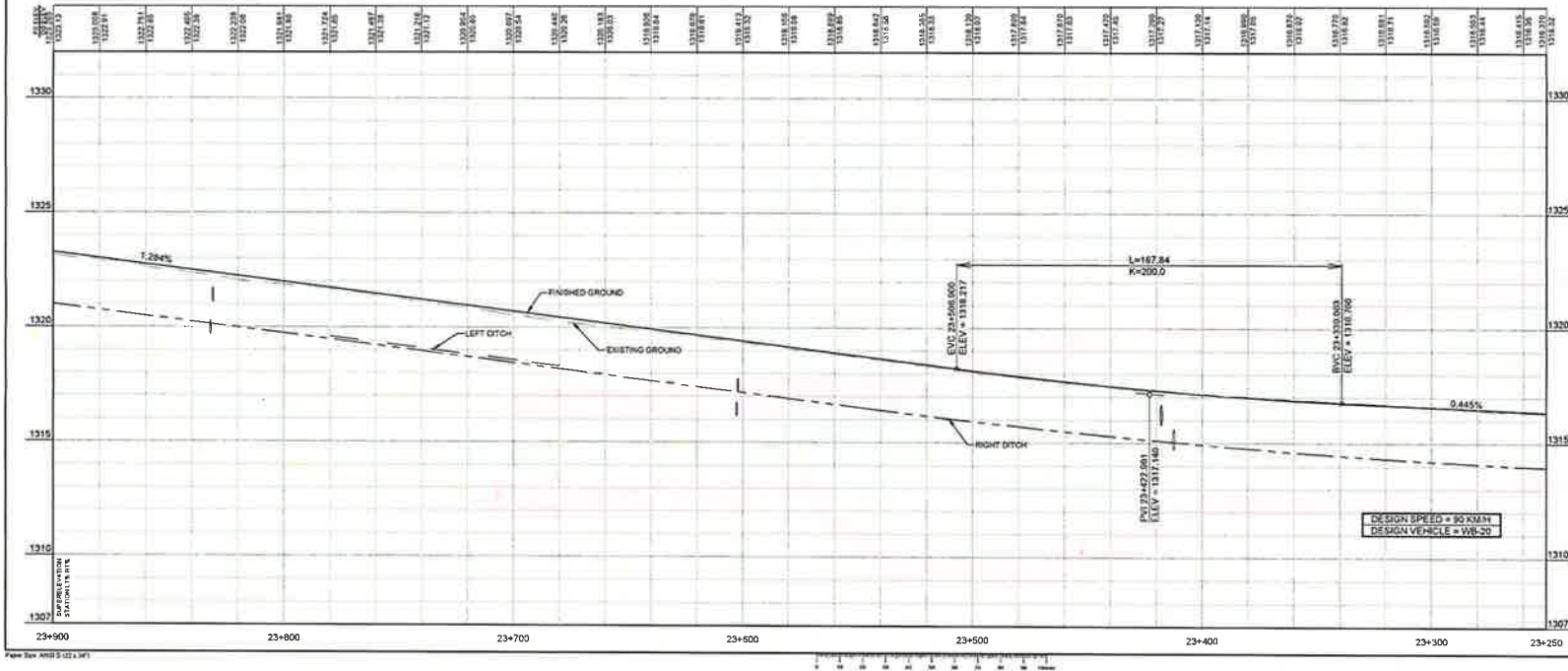
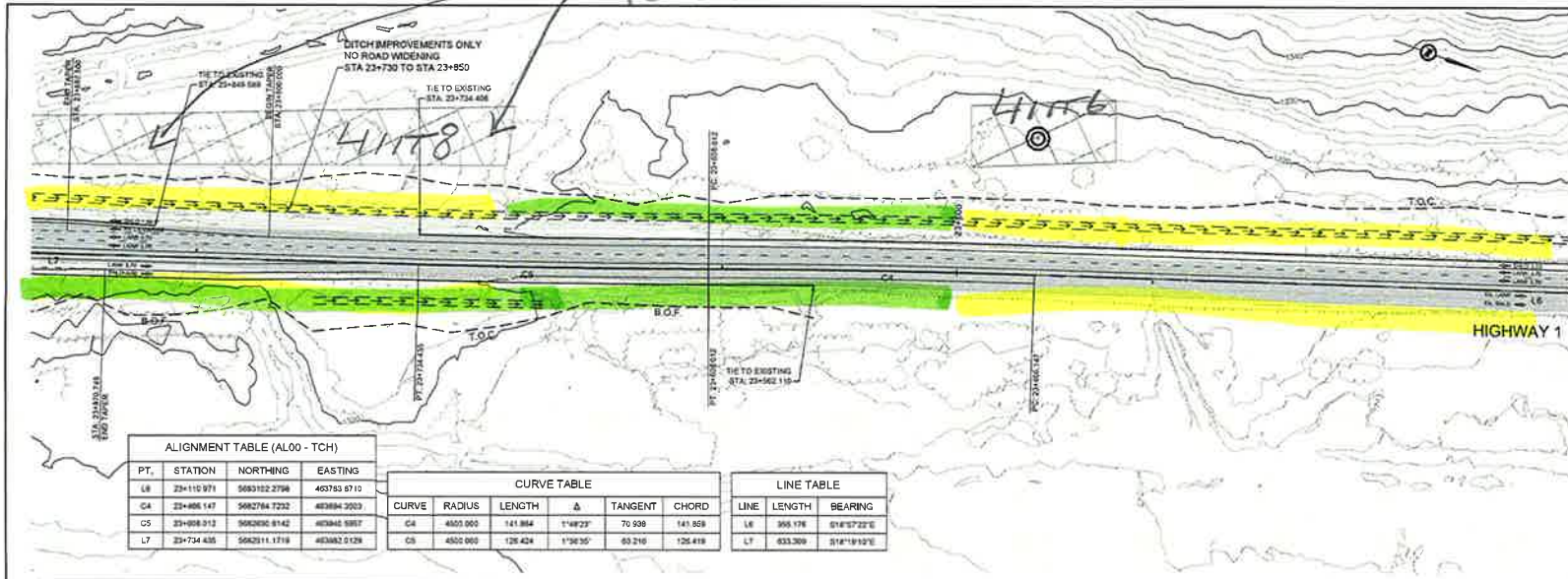
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PLAN AND PROFILES
STA 22+600 TO STA 23+250

Designed by / Conçu par MCEL	Drawn by / Dessiné par NSJ	Date 2018.01.11
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Project No. / No. du projet 2011-00581-0	Drawn No. / No. du dessin [Blank]	Sheet No. / No. de la feuille 006

in between snowshed
berm & highway are summer track
& P.C. trail. Veg. clearing to
leave buffer



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TCH WIDENING ILLECILLEWAET CURVE KM 21.0 TO KM 29.1

ROGERS PASS GLACIER NATIONAL PARK, BC

PLAN AND PROFILES STA 23+250 TO STA 23+900

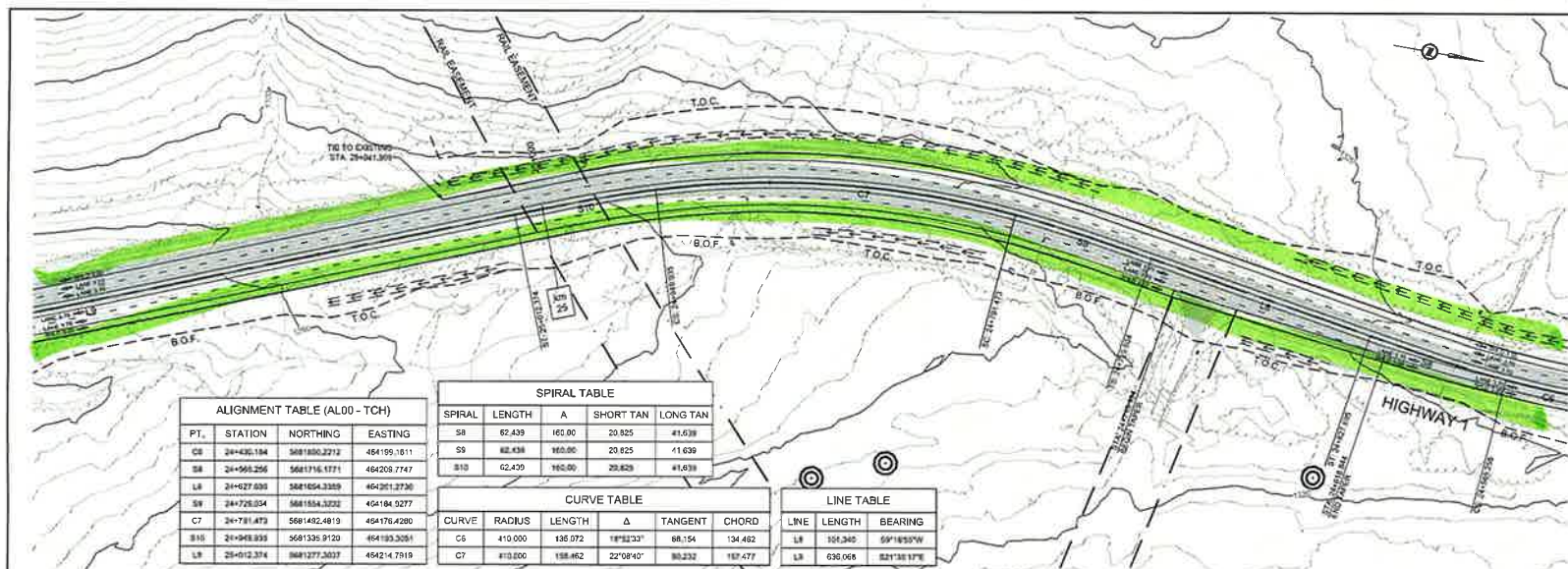
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Engineered by / Ingénieur par **Reviewed by / Vérifié par** **Scale / Échelle**

Client Acceptance / Acceptation du client **Approved by / Approuvé par**

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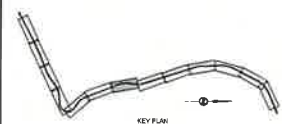
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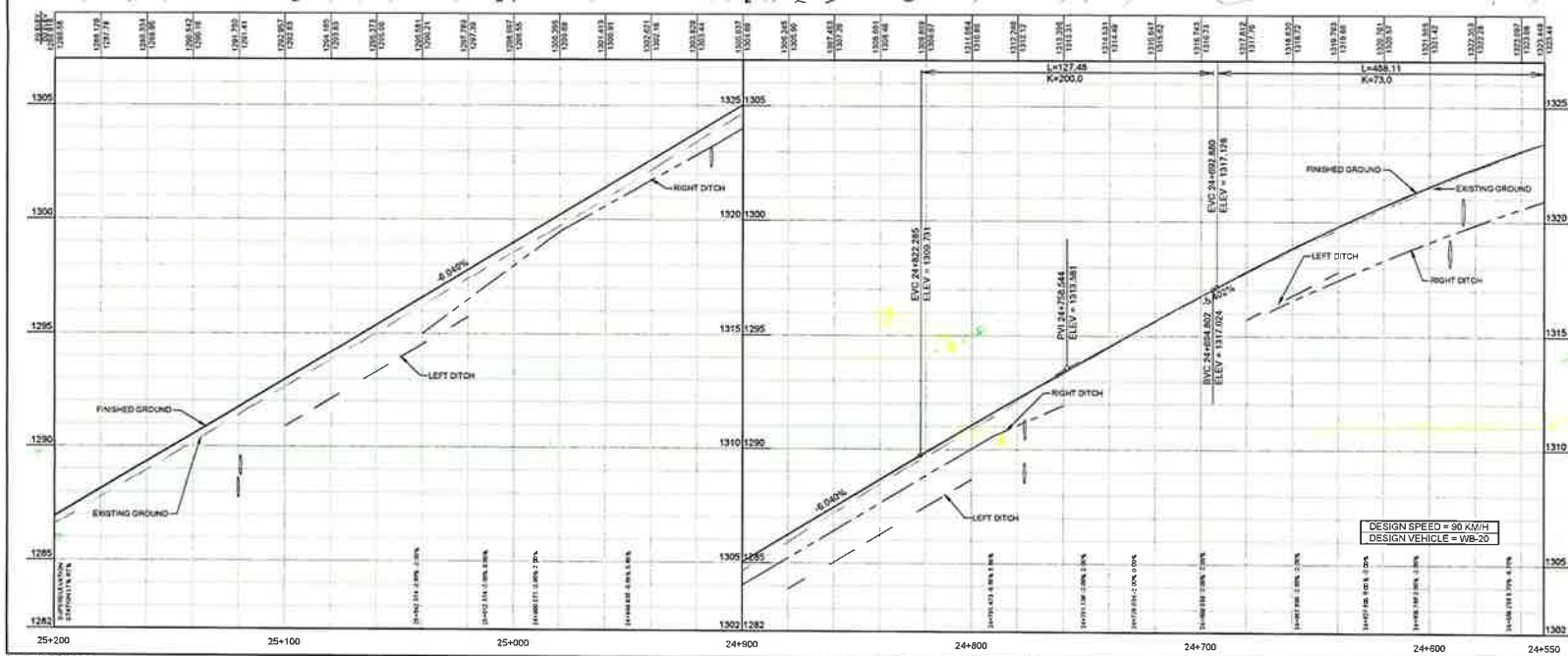
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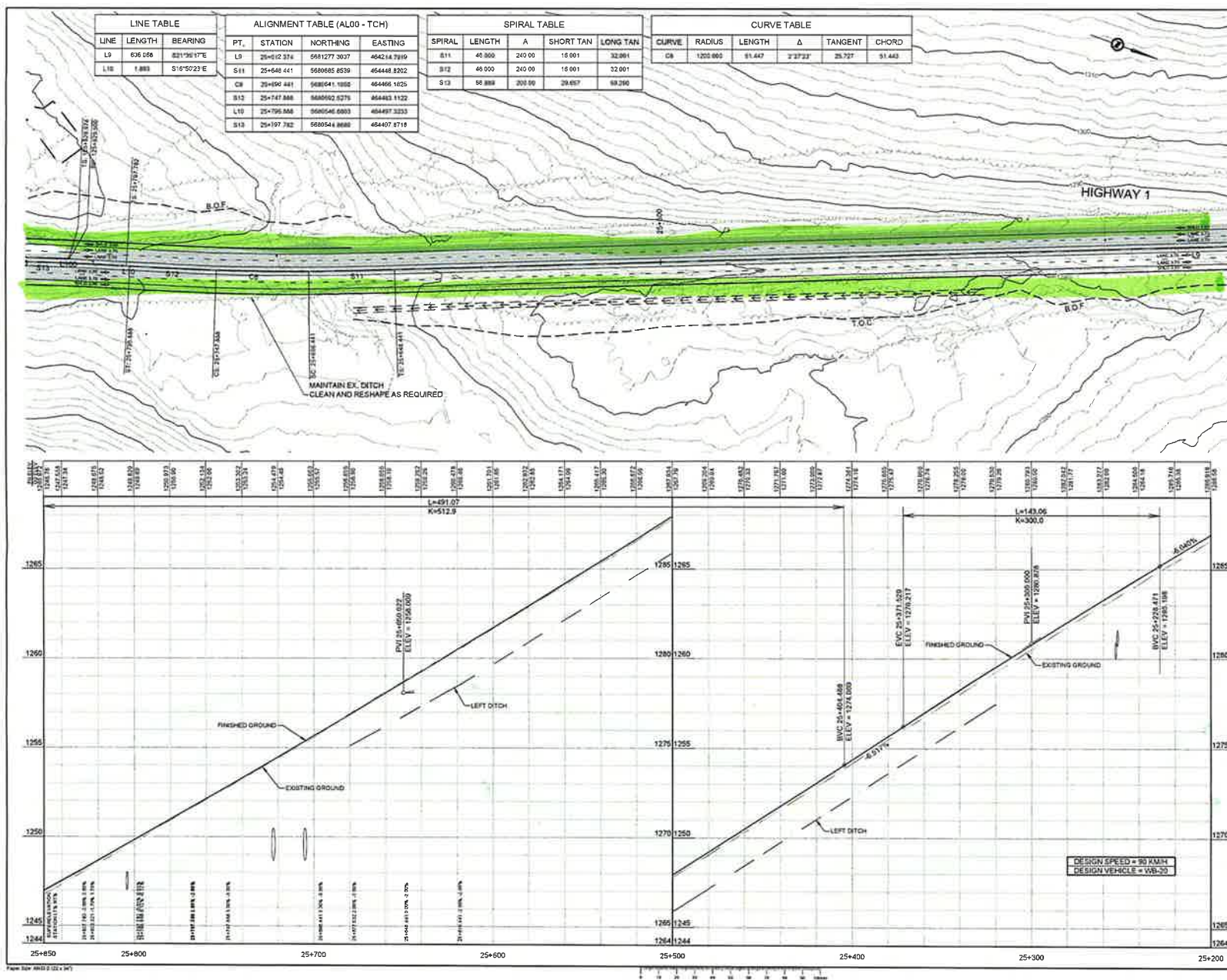
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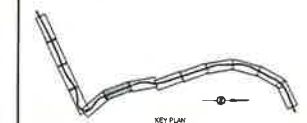
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PA	2018.01.11	60% REVIEW	HJ	SL	UL
Rev	Date	Description	Drawn	Designed	Approved
			Design	Check	Approve

A	B	C	A	B	C
Initial number	Number as used	Number as used	Initial number	Number as used	Number as used
in design no.	in design no.	in design no.	in design no.	in design no.	in design no.

Consultant's Stamp (to be completed)

Eng. Stamp (to be completed)

Client: Parks Canada Agency
Western and Northern Region

Client: L'Agence Parcs
Canada
Ouest et Nord Région

McElhanney
McElhanney Consulting Services Ltd.

**TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1**
ROGERS PASS
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES
STA 25+200 TO STA 25+850**

Designed by / Conçu par: [Name]
Drawn by / Dessiné par: [Name]
Date: 2018.01.11
Scale / Échelle: 1:1000

Parks Canada Project Manager / Responsable du Projet Parcs Canada

Client Acceptance / Acceptation du client

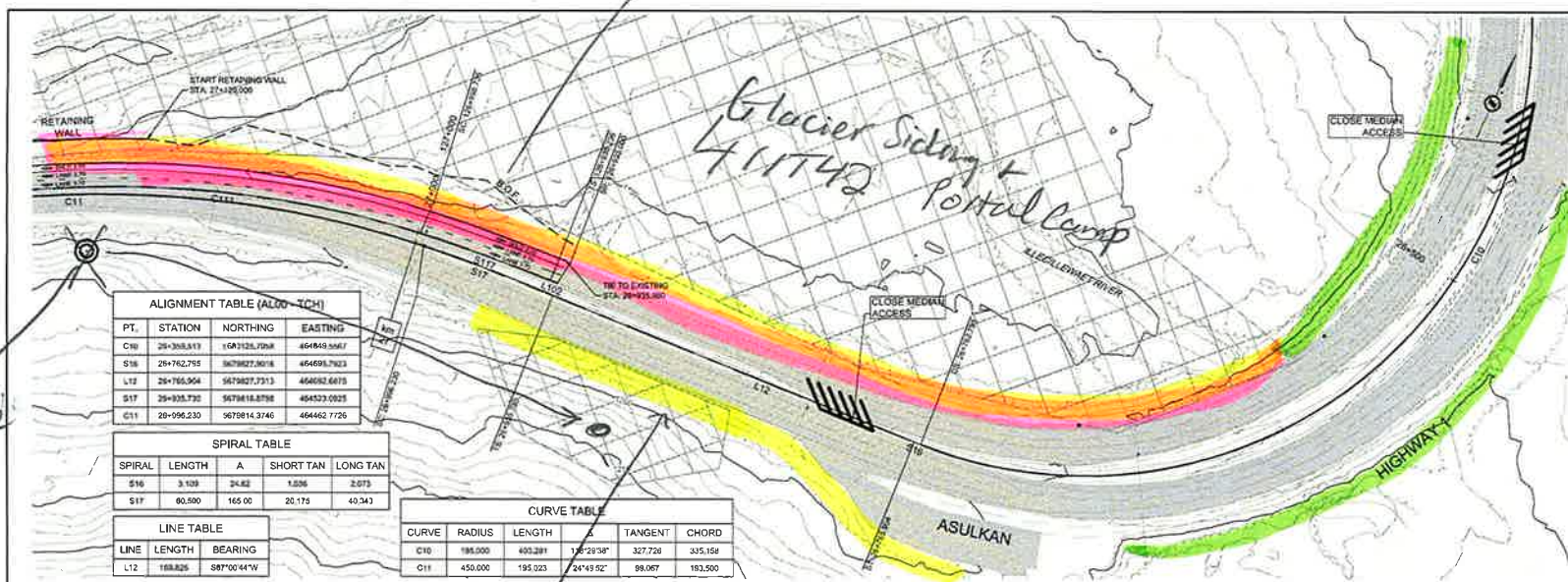
Approved by / Approuvé par

Project No. / No. du projet: 2018-0001-0

Sheet No. / No. de la feuille: 010

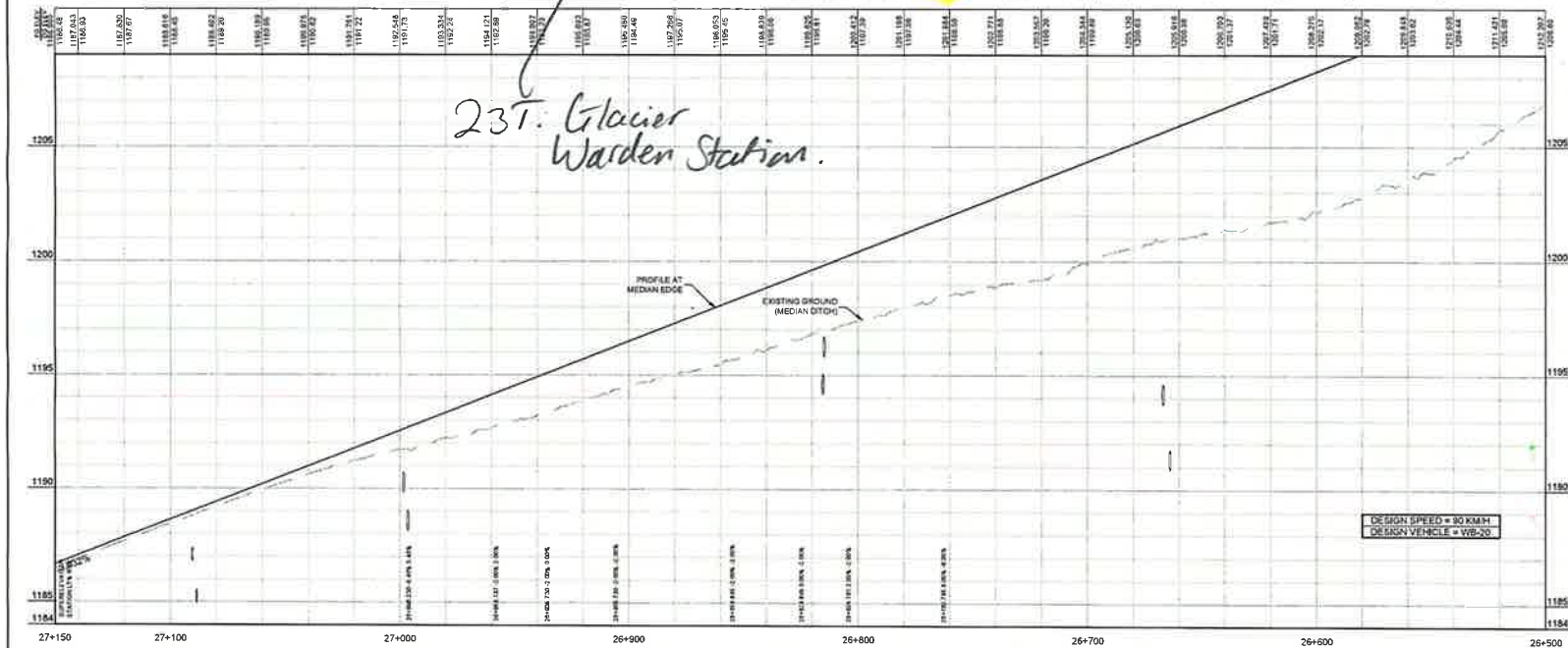
Drawing Number / No. de la feuille en dessin: PP-05

area in orange/pink
needs AIA first, then monitoring



error
- noise

237: Glacier
Warden Station.



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No.	Date	Description	Drawn	Designed	Approved
1	2018.01.11	McELHANNNEY	NSJ	NSJ	NSJ

Client's Stamp	Drawn	Designed	Approved

McElhannney
 McElhannney Consulting Services Ltd.

TCH WIDENING
 ILLECILLEWAET CURVE
 KM 21.0 TO KM 29.1
 ROGERS PASS
 GLACIER NATIONAL PARK, BC

PLAN AND PROFILES
 STA 26+500 TO STA 27+150

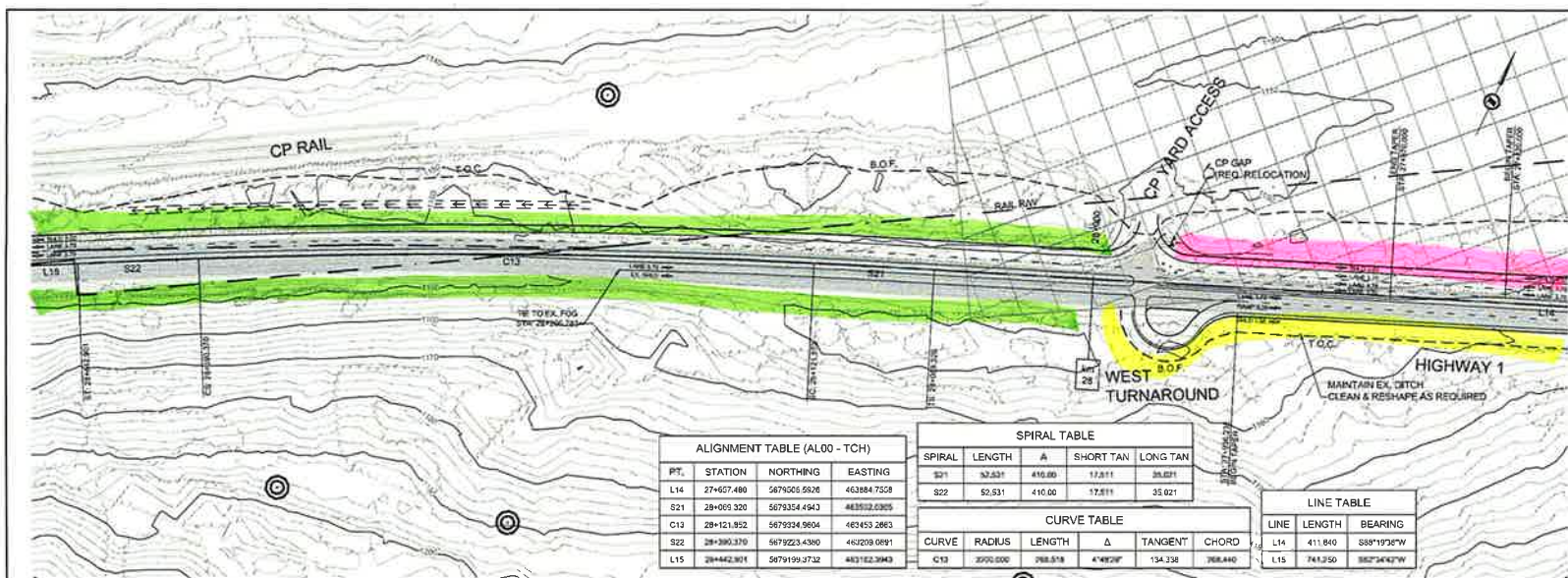
Drawn by / Revisé par	Drawn by / Revisé par	Date
NSJ	NSJ	2018.01.11

Drawn by / Revisé par	Drawn by / Revisé par	Scale / Échelle
NSJ	NSJ	1:1000

Client Acceptance / Acceptation du client: _____
 Approved by / Approuvé par: _____

Project No. / No. du projet: 2511-0058-1-0
 Sheet No. / No. de la feuille: 012

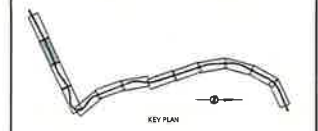
Drawn by / Revisé par: NSJ
 Date / Date: 2018.01.11



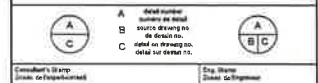
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Rev.	Date	Description	Drawn	Designed	Approved
PA	2018.01.11	SURV. REVISED	NSJ	DL	DL



Consultant's Stamp (Seal or Registration)

Seal Stamp (Seal or Registration)

Project Name: TCH WIDENING ILLECILLEWAEET CURVE KM 21.0 TO KM 29.1

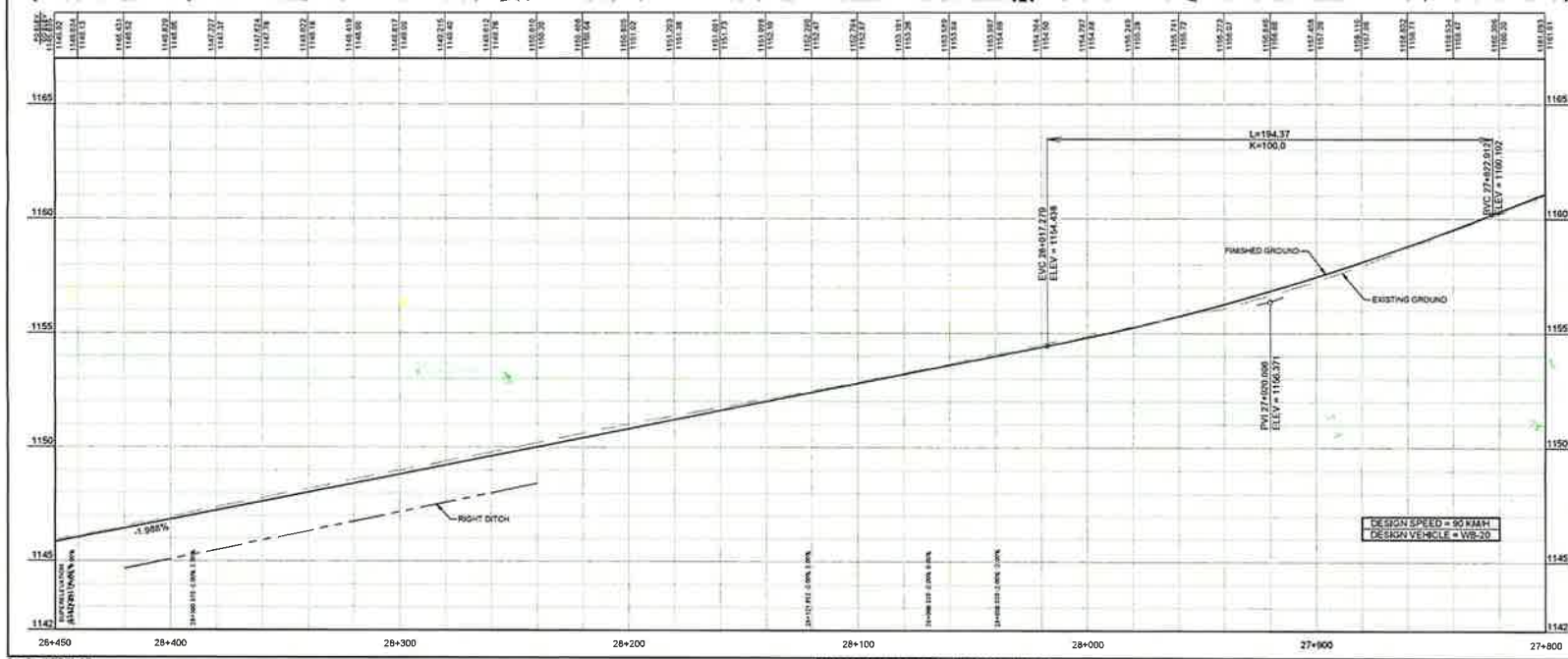
Client: Rogers Pass, Glacier National Park, BC

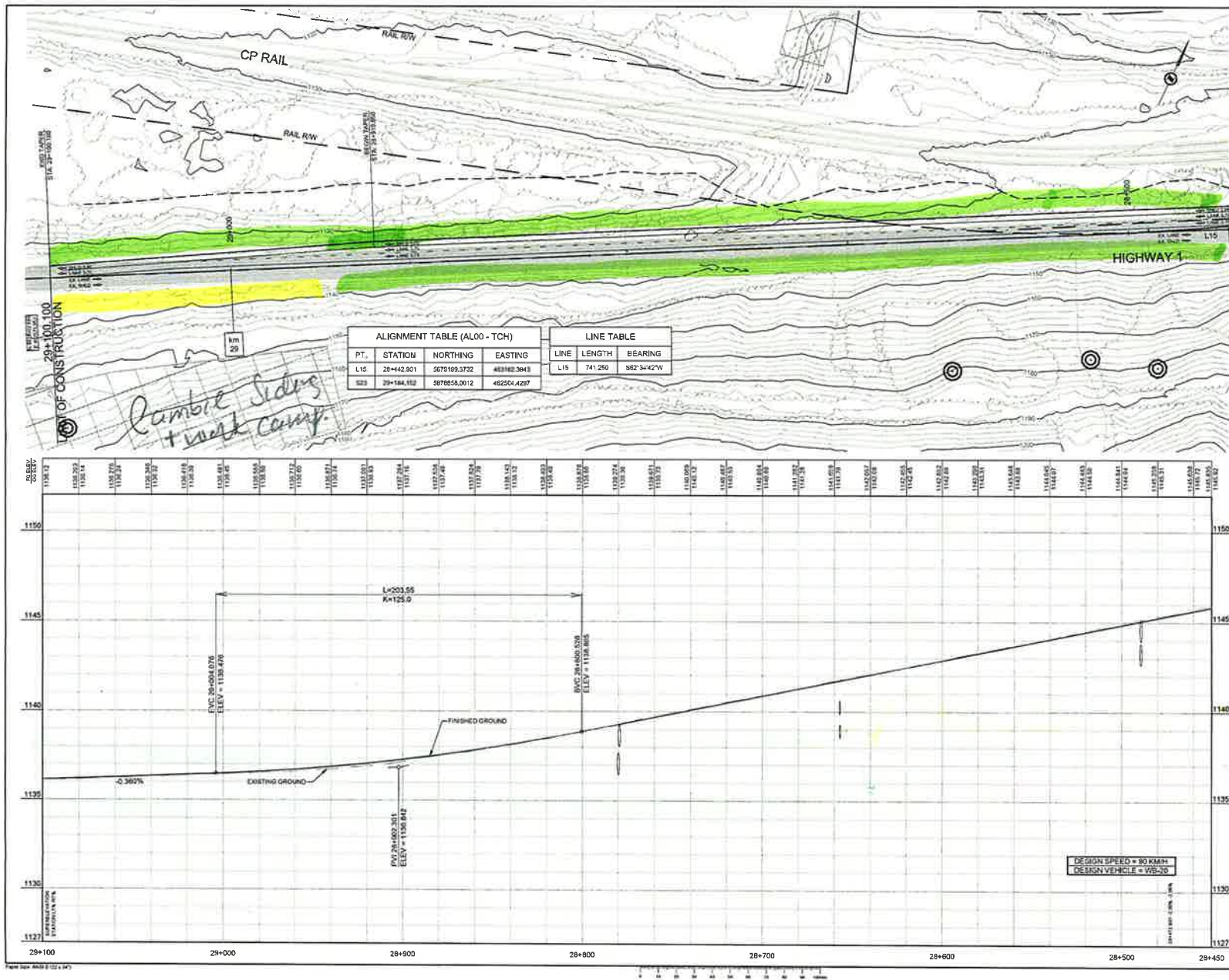
McElhanney
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TCH WIDENING
ILLECILLEWAEET CURVE
KM 21.0 TO KM 29.1
ROGERS PASS
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES
STA 27+800 TO STA 28+450

Designed by / Revisé par DL	Drawn by / Dessiné par NSJ	Date 2018.01.11
Designed by / Revisé par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000
Project No. / No. de projet 2511-00081-0		
Drawing Name / Nom de la feuille PP-012		

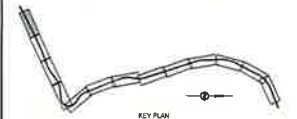




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PR	2846.01.11	2846.01.2020	N/A	DL	DL
Rev.	Date	Description	Drawn	Designed	Approved
			Desai	Conroy	Apparicio

<div> <div>A</div> <div>B</div> <div>C</div> </div>	A: total number of sheets B: sheet number C: sheet title	<div> <div>A</div> <div>B</div> <div>C</div> </div>	A: total number of sheets B: sheet number C: sheet title
Client Name (Nom du Client)	Client Address (Adresse du Client)	Client Phone (Téléphone du Client)	Client Email (Courriel du Client)

Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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McElhannney
McElhannney Consulting Services Ltd.

**TCH WIDENING
ILLECILLEWAET CURVE
KM 21.0 TO KM 29.1**
ROGERS PASS
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES
STA 28+450 TO STA 29+100**

Surveyed by / Révisé par MCL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Vérifié par R.S.J.	Scale / Échelle 1:1000
Parks Canada Project Manager / Responsable de Projet Parcs Canada	Approved by / Approuvé par	
Project No. / No. du projet 2511-0581-0	Sheet No. / No. de la feuille 015	
Drawing Reference No. / No. de référence du dessin PP-013		