

1.19.3 Onsite Power Distribution

There are two (2) areas that require power distribution onsite:

- ▶ from the main 25 kV to 600 V substation on the MIC pad around site; and
- ▶ from a pole mounted 25 kV to 600 V transformer on the Explosives Facility pad.

1.19.3.1 *Infrastructure Pad Distribution*

Power will be distributed via underground lines from the last pole off the infrastructure pad to the substation and then around the substation. The electrical lines will share a common trench with the water distribution network to save on excavation costs. **Figure 1.19-9** illustrates a plan view of the planned electrical distribution system for the MIC pad area.

1.19.3.2 *Explosive Storage Facility's Pad Distribution*

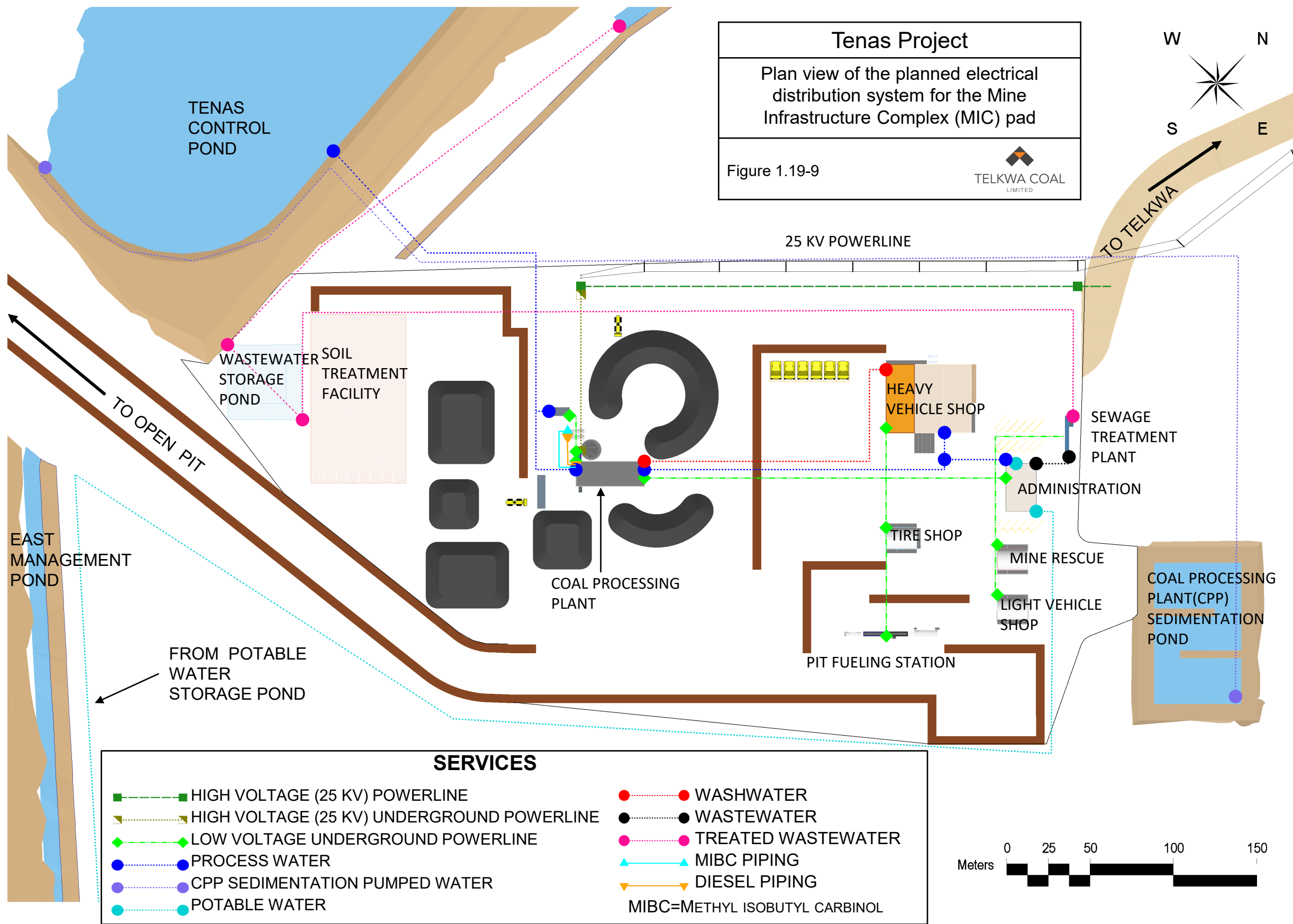
Power will be distributed via overhead lines from the 25 kV to 600 V pole mounted transformer around the Explosive Storage Facility pad as shown by **Figure 1.19-10**.

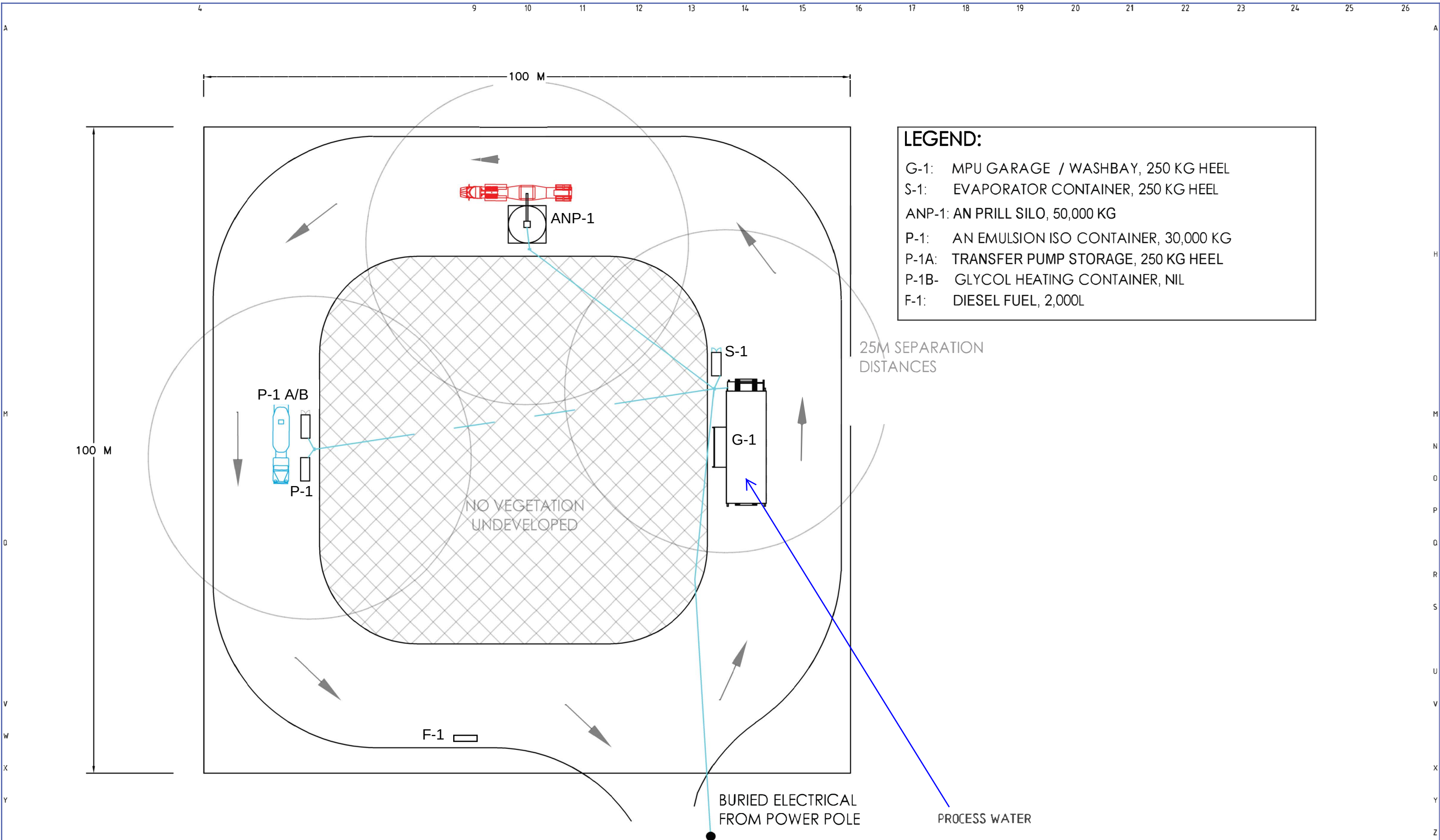
1.19.4 Project Overall Single Line Diagram

The single line diagram for the entire Project is provided below by **Figure 1.19-11. Appendix 1.0-V MCA Engineering Ltd., Additional Electrical Backup Technical Information** contains additional information on the powerline and substation proposed for the Project.

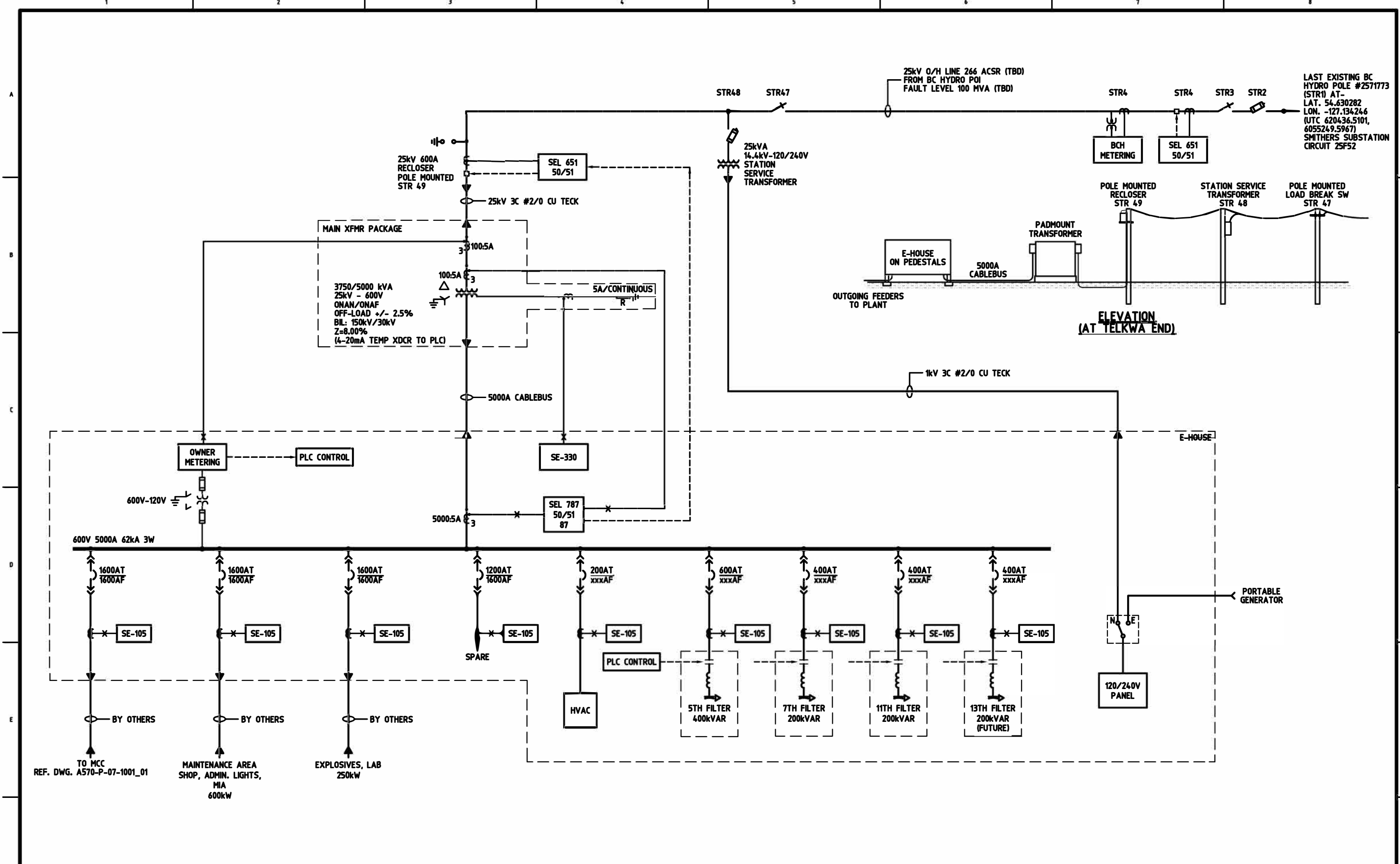
1.19.5 Water Management and Reclamation Materials (Surface Soils) Salvage

The construction of the powerline will not require complete vegetation removal for its route and only portions that need to have power pole pads constructed will have reclamation materials (surface soils) salvaged. Reclamation materials (surface soils) will be placed back on the power pole pads once constructed and only construction style water management features need to be incorporated into this component. There is not distinct effluent discharge locations for this feature like similar powerlines in the region but rather sheet flow into the surrounding environment. As the powerline is only involving surficial materials it is not expected to have any measurable water quality concerns.





- LEGEND:**
- G-1: MPU GARAGE / WASHBAY, 250 KG HEEL
 - S-1: EVAPORATOR CONTAINER, 250 KG HEEL
 - ANP-1: AN PRILL SILO, 50,000 KG
 - P-1: AN EMULSION ISO CONTAINER, 30,000 KG
 - P-1A: TRANSFER PUMP STORAGE, 250 KG HEEL
 - P-1B- GLYCOL HEATING CONTAINER, NIL
 - F-1: DIESEL FUEL, 2,000L



DRAWING NO		TITLE		REV		DESCRIPTION		BY		DRG CHK		ENG CHK		DATE		APPROVED	
REFERENCE DRAWINGS		DRAWING REVISIONS															
A		PRELIMINARY INFORMATION		PJA													
B																	
C																	
D																	
E																	
F																	

CLIENT TELKWA COAL LTD		DRAWN PJA 08.08.18		CHECKED		DESIGNED		LEAD ENG		APPROVED	
CLIENT DRAWING NO		SCALE NTS		OR AS SHOWN		DO NOT SCALE		A1			

TELKWA COAL LIMITED		SEDGMAN		PRELIMINARY		NOT FOR CONSTRUCTION	
TENAS COAL PROJECT		Single line diagram for the Tenas Project		FIGURE 1.19-11		REVISION A	

1.20 Tenas Access Corridor (TAC) Components

The following provides an overview of the proposed access road to the Project which is identified as the TAC and contains the following:

- ▶ improvements to TCL private roads;
- ▶ improvements to Caribou FSR 08;
- ▶ newly constructed Bypass Road; and
- ▶ newly construction private road at the Rail Infrastructure.

The following provides context to the development of the **PAMP** for the Project.

1.20.1 Historical Public Access to Project Area

The Telkwa Mine Road is a Gazetted road to the north boundary of District Lot (DL) 401. However, prior to the Goathorn Creek bridge washing out in the late 2000s, BC MOTI maintained the road beyond the Gazetted section, through DL 401 and 391 to the Goathorn Bridge. Though DL 401 and 391 are private land parcels, with no legal tenure obtained by BC MOTI for a ROW, the road section was under the jurisdiction of BC MOTI due to maintenance activities. After the Goathorn Bridge washed out, BC MOTI reduced road maintenance to the north boundary of DL 401, with no road maintenance conducted on the road south of this boundary within the private land. This road was then designated a private road.

In the late 1990s, Manalta Coal and West Fraser completed an agreement for construction of new roads and use of existing roads on private land (DL 401, 391 & 389) owned by Manalta to provide access for commercial timber harvesting. This agreement included the access road over Goathorn Creek, located within DL 391 and other FSR within DLs 401 and 389. Through several purchases, TCL has acquired all assets of Manalta Coal including the private roads and coal licenses.

Establishment of the Telkwa Caribou Wildlife Habitat area on Nov 30, 2015, led to timber harvest restrictions that did not allow West Fraser to complete their harvesting plans within the Goathorn Creek area. Through discussions with BC MFLNRO, it was determined that BC MFLNRO would take over West Fraser's responsibilities for these forestry service roads, by designating the roads as the Caribou FSR. BC MFLNRO designated the Caribou FSR's with the intent of conducting no maintenance and allowing the roads to self-reclaim. However, when the Caribou FSRs were established, it was not recognized that the FSRs established by West Fraser within DL 401, 391 and 389, were subject to an agreement with the private landowner. No contract or legal authorization was made with the private landowner (Manalta) prior to the designation of the Caribou FSRs. Therefore these FSRs remained private roads owned by TCL. **Figure 1.20-1** illustrates the historical access prior to the bridge of Goathorn Creek being washed out.

Tenas Project

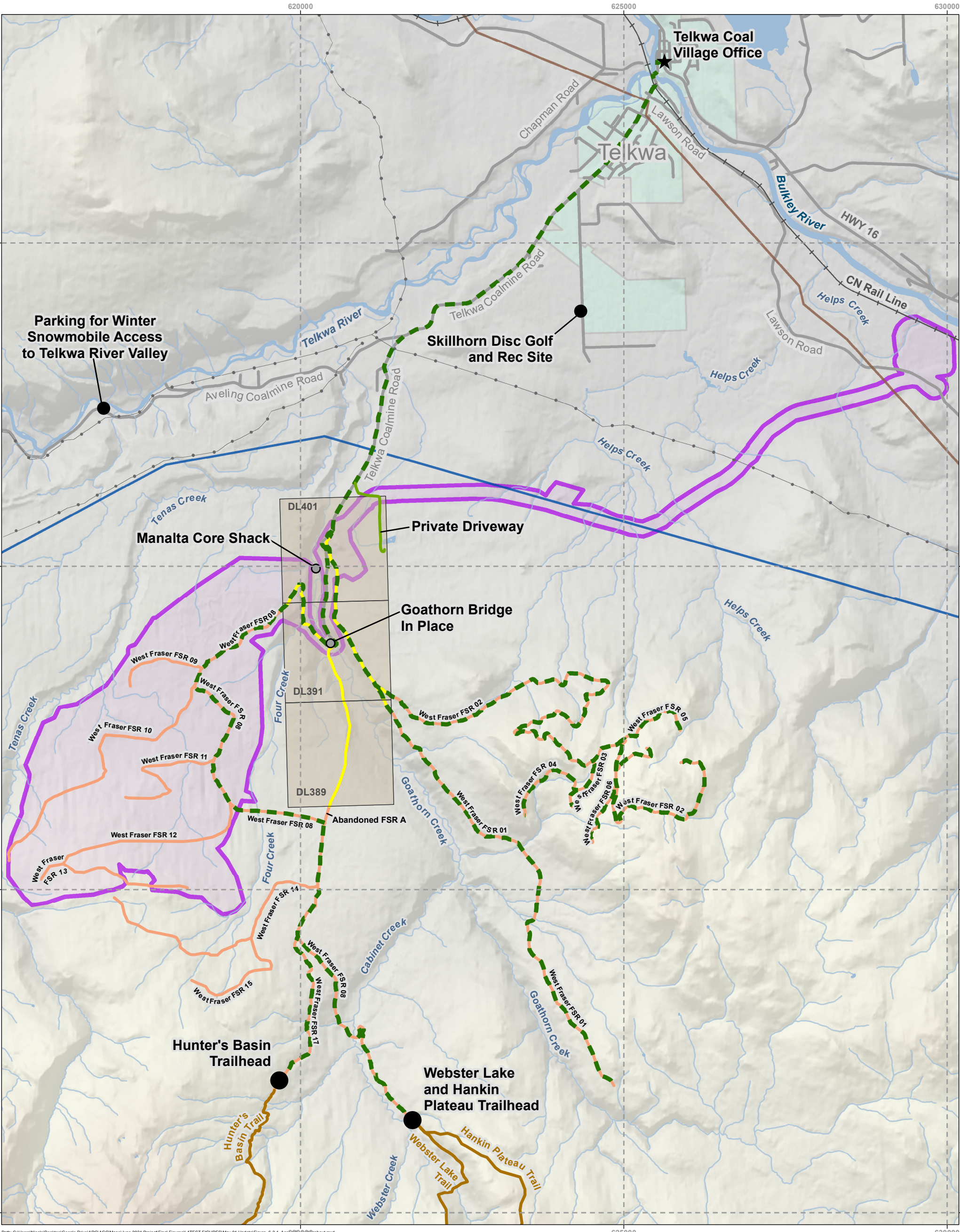
Figure 1.20-1

Historical public access with
road regulatory ownership

NAD 83 UTM Zone 9N
Date Created: March 26 2022
Last updated: May 02 2022
Version: 11
Created by NB
Base Data: Geogratis, Allegiance Coal 2022

0 0.5 1 2 Kilometers

- | | | | | | |
|---|------------------------------|---|-------------------------|---|------------------------------|
|  | Project Area |  | CN Rail Line |  | Ongoing Public Access |
|  | 138 kV Transmission Line |  | Watercourse |  | Forest Service Roads |
|  | 500 kV Transmission Line |  | Waterbody |  | Provincial Roads or Highways |
|  | Pacific Natural Gas Pipeline |  | Telkwa Village Boundary |  | Hiking Trail |
| | | | |  | TCL Private Roads |



1.20.2 Ongoing Public Access to Project Area

Access to the Project today is much the same as when the Goathorn Bridge washed out over 10 years ago, apart from a minor rerouting within TCL private lands (district lots) to avoid a slide area near the Sandpit and periodic installation of a temporary bridge over Goathorn Creek to provide access for exploration and monitoring activities during winter conditions.

BC MOTI continues to maintain the gazetted section of the Telkwa Coalmine Road but has not conducted maintenance beyond this point (onto TCL private land) for over a decade. TCL controls the road within their private land but has not posted signage to this effect or enforced any sort of access restrictions, except during periods of active mineral exploration activity.

When TCL is conducting exploration or monitoring activities, a road use permit is obtained from BC MFLNRO for use of the Caribou FSR's outside of the TCL private land portions. BC MFLNRO's plan for the Caribou FSR's has not changed due to TCL activities or plans, these FSR's are not maintained by BC MFLNRO and are intended to naturally reclaim to become unusable by vehicles in the future. TCL only utilizes a small portion of the Caribou FSR's, located within the Project Area on the west side of Goathorn Creek during exploration programs.

To access the west side of Goathorn Creek, the public utilizes the Gazetted Telkwa Coalmine Road which then connects to the private road through DLs 401 and 391 owned by TCL. Since the washout of the Goathorn Bridge in the late 2000s, an unauthorized ford of Goathorn Creek has been established and is utilized by the public to access recreation sites on the west side of Goathorn Creek. From this ford, the access continues to a TCL private road on the west side of Goathorn Creek. This private road is used until it exits the northwest corner of DL 391 and becomes Caribou FSR 08, which leads to the trailhead for Hunter Basin and to Caribou FSR 015 for accessing the trailhead to Webster Lake.

To access Crown land on the east side of Goathorn Creek, after leaving the Gazetted Telkwa Coalmine Road, the public travels on TCL private road through DL 401, 391 and 389, then enters onto Caribou FSR 001 which allows access to Caribou FSRs 002 through 007 on a plateau above the east side of Goathorn Creek. **Figure 1.20-2** illustrates the access currently used by the public to access the Project Area.

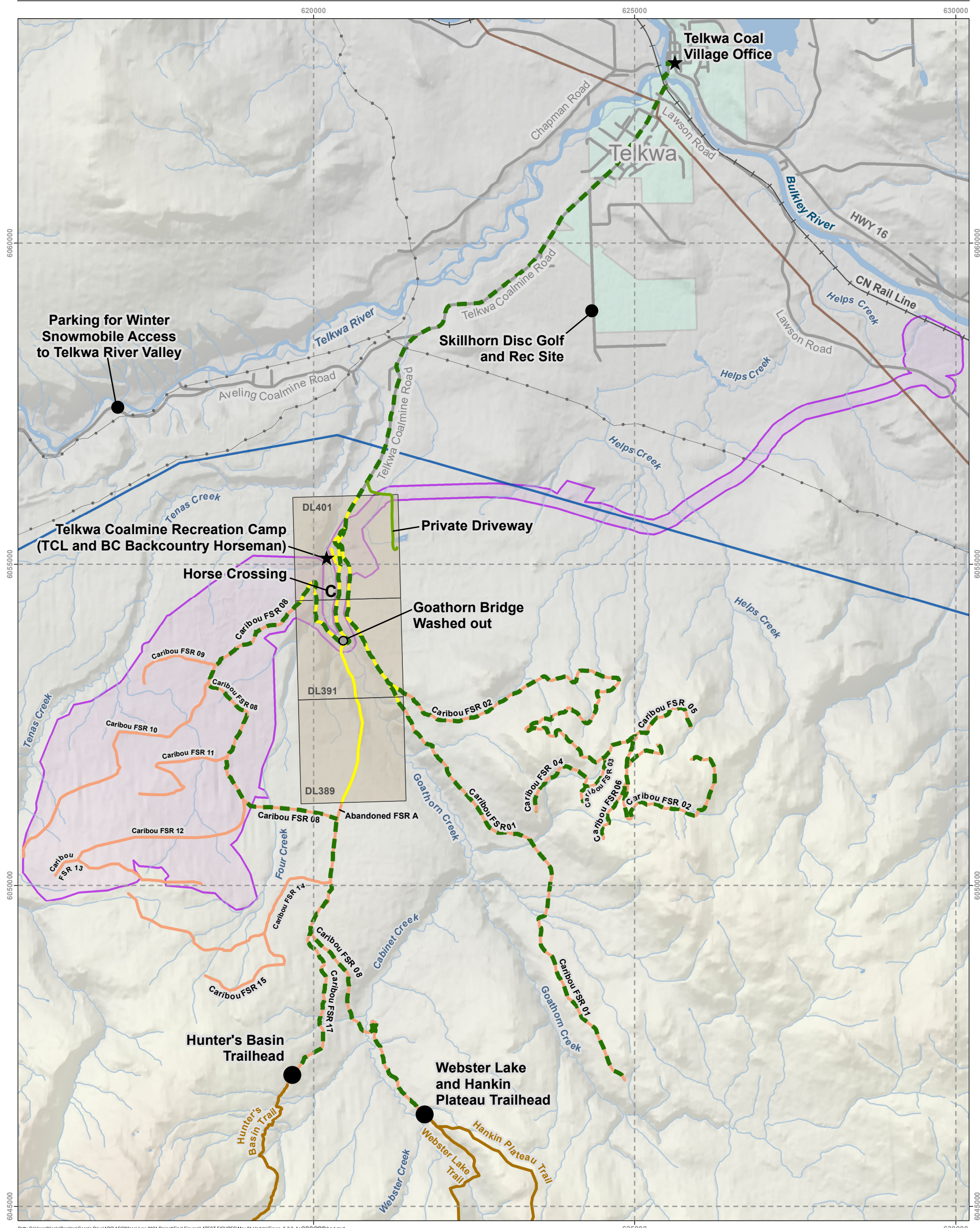
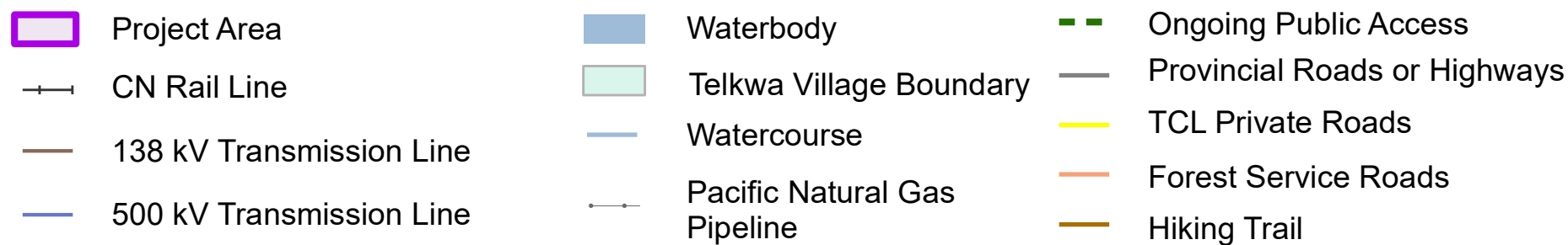


Tenas Project

Figure 1.20-2

Ongoing public access with road regulatory ownership

NAD 83 UTM Zone 9N
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Last updated: May 02 2022
Version: 8
Created by NB
Base Data: Geogratias, Allegiance Coal 2022



1.20.3 Indigenous Nations Access Control Procedures

TCL will work with the OW, Witset First Nation and Wet'suwet'en First Nation to develop a unique set of procedures that fits their individual needs and requirements. Modification of the public access control procedures may be required to ensure Indigenous rights are respected and accommodated. Land uses identified by Indigenous groups include (but are not restricted to) access for:

- ▶ subsistence food gathering (including hunting);
- ▶ plant gathering in areas both within and outside of the Project Area; and
- ▶ performing ceremonial and feasting activities within and outside the Project Area.

It is anticipated that during the engagement process, additional Indigenous land access requirements will be identified. TCL will work with Indigenous groups to develop a workable set of access procedures that accommodate their requirements, while ensuring a controlled and safe access for all parties involved. If a single set of procedures can be developed for Indigenous groups and public access to the Project Area these will be provided for review and agreement. If need be, there can be unique access procedures for each Indigenous group and the public.

1.20.4 Access to Project Area After Regulatory Approvals

If the Project is granted an EAC, safe and controlled access must be provided for Indigenous groups and surrounding public recreation. Industrial access for the Project will be via the TAC which is part of the Project Area.

Per the *Mines Act*, RSBC 1996, c 293 (GovBC 1996c), and *Land Act*, RSBC 1996, c 245 (GovBC 1996b) requirements, a "No Unauthorized Entry, Hunting, and Fishing" boundary will be established at the outset of the Construction Phase around the Project Area to prevent unauthorized access. It will be in effect throughout the Project life.

To help the public understand the **PAMP** that was developed, TCL is providing the ongoing public access conditions to reach Hunter Basin and the groups that have jurisdiction over these access roads which is not widely or correctly understood by the Public. **Figure 1.20-2** provided previously illustrates ongoing public access roads and regulatory ownership of these roads. As shown, there are several parties involved:

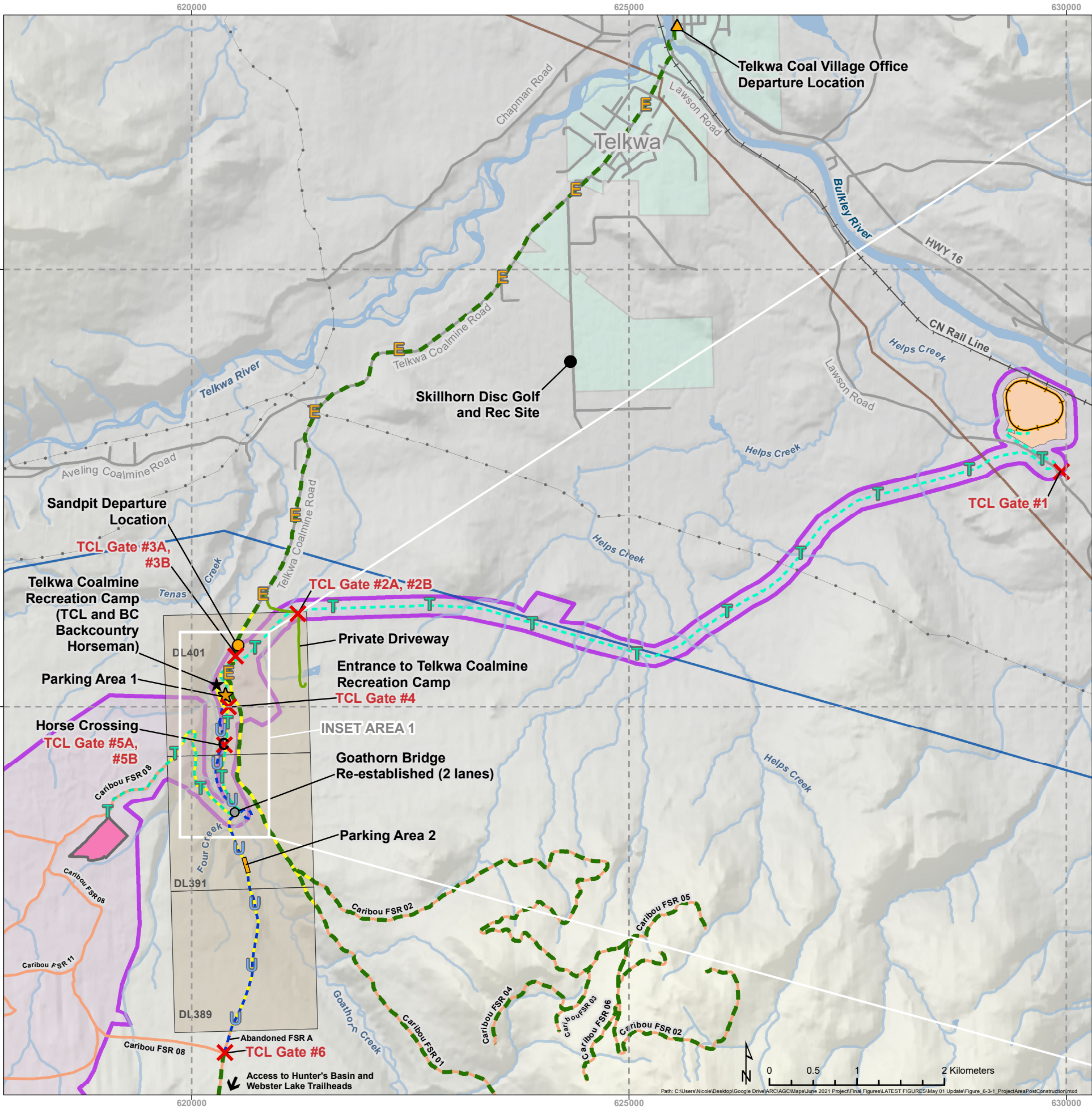
- ▶ BC MOTI;
- ▶ FSR that are controlled BC MFLNRO; and
- ▶ TCL.

TCL is planning to implement Access Control Procedures to maintain public access through and beyond the Project Area to allow access to recreational locations. Public access will utilize the Telkwa Coal Mine Road, existing private roads, construction of a new private road and improvements to an existing private road, and an FSR, all of which will be controlled by access gates on the TAC. **Figure 1.20-3** illustrates the access after the Project is developed.

Project access will stay in place until the Decommissioning and Reclamation Phase of the Project is completed. **Figure 1.20-4** provides an illustration of Inset Area 2 to better understand the areas of proposed new access road for public access versus TCL proposed access road (TAC).

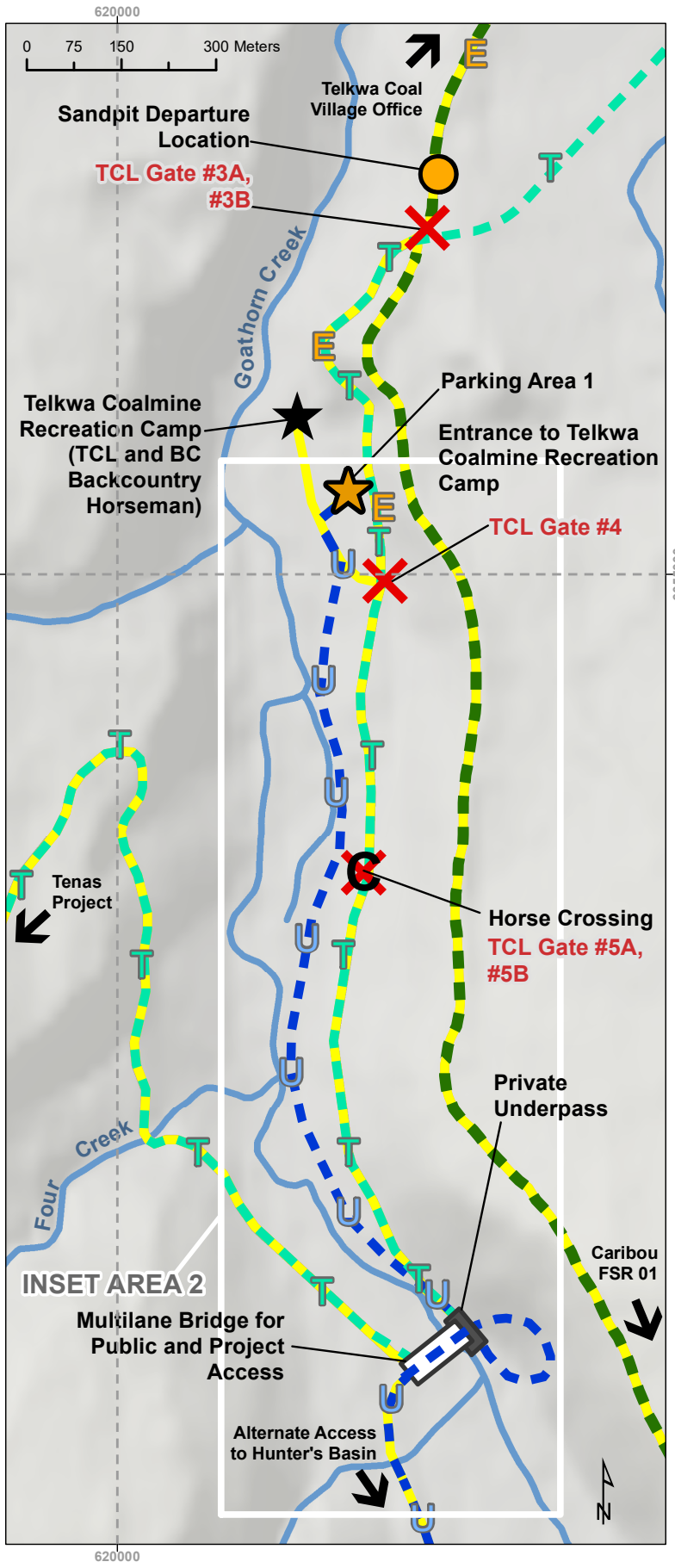
Figure 1.20-3

Public and Project Access with road regulatory ownership



Tenas Project

Inset Area 1



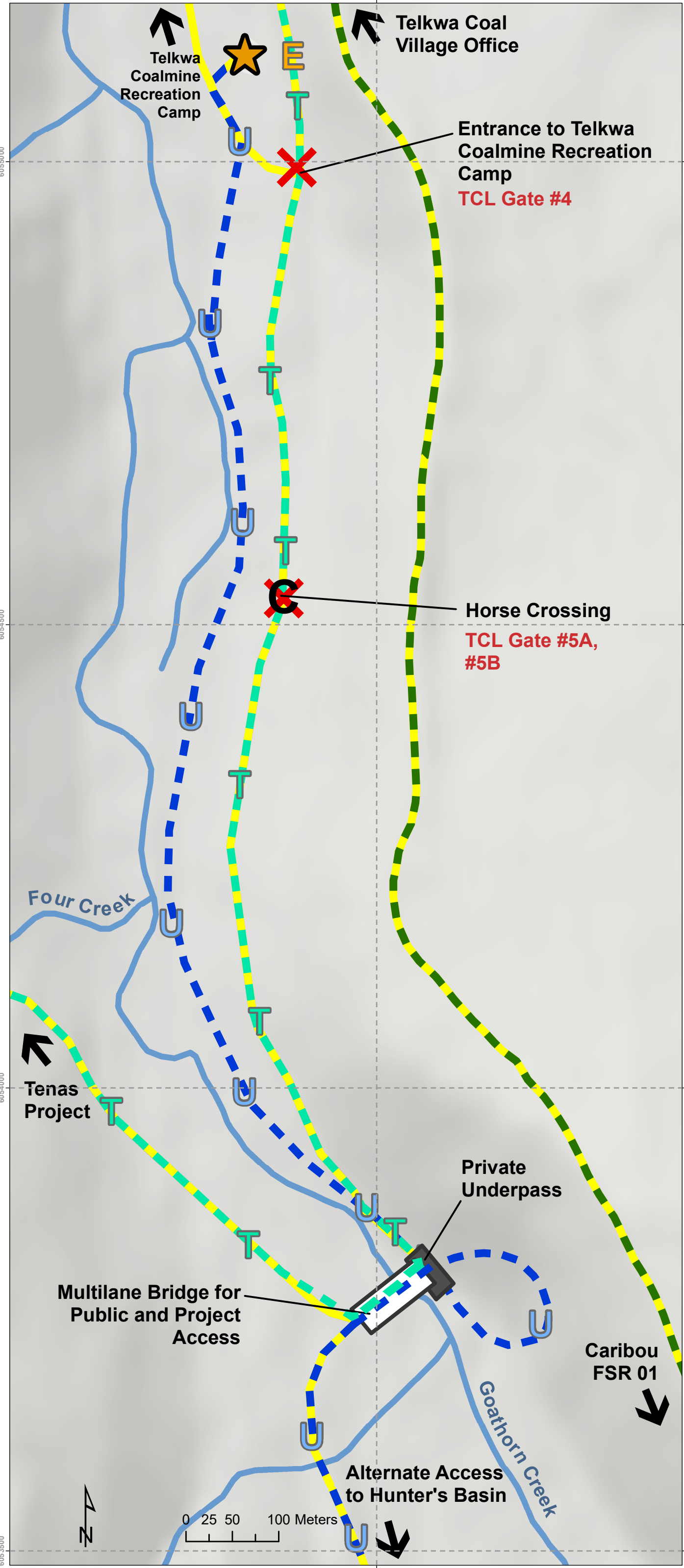
- Project Area
- Mine Infrastructure Complex (Coal Processing Plant, Administration and Mine Dry Building, Maintenance Facility)
- Access Gates
- Pacific Natural Gas Pipeline
- CN Rail Line
- Ongoing Public Access
- Provincial Roads or Highways
- TCL Private Roads
- Forest Service Roads
- Hiking Trail
- Proposed TAC (Proposed access road)
- Proposed Alternate Private Recreational Access Road
- Waterbody
- Telkwa Village Boundary
- Rail Loop
- Rail Infrastructure
- Watercourse
- 138 kV Transmission Line
- 500 kV Transmission Line
- Under TCL Escort
- Unescorted New and Upgraded Public Access
- Telkwa Coal Access for Processed Coal Haul, Supplies, and Personnel

Tenas Project

Figure 1.20-4

Public and Project Access with
road regulatory ownership
for Inset 2

- TCL Private Roads
- Proposed TAC (Proposed access road)
- Proposed Alternate Private Recreational Access Road
- Ongoing Public Access
- Access Gates
- Parking Area 1
- Horse Crossing
- Under TCL Escort
- Unescorted New and Upgraded Public Access
- Telkwa Coal Access for Coal Haul, Supplies, and Personnel
- Watercourse



1.20.5 Tenas Access Corridor (TAC) (Mine Access Road)

Improvements to portions of the existing Caribou FSR 08 and TCL private road through the Goathorn Creek Valley, a newly constructed 11 km dedicated Bypass Road and a newly constructed 0.5 km private road adjacent to the Rail Infrastructure will be used as the primary access to the Project and taken together make up the TAC. In total, 16 km of road will be required to connect the Minesite to the Rail Infrastructure located east of Lawson Road as illustrated by **Figure 1.20-5** below.

During the construction of the Bypass Road, the existing Telkwa Coalmine Road, private roads, Lawson Road, and Caribou FSR will be used to access the Project. These roads have been used for forestry operations in the past, and the current recreational use of the private road and FSR is low due to a washout of the Goathorn Bridge over 10 years ago.

The proposed 11 km Bypass Road will include single-lane and double-lane sections to allow for the safe transportation of people, materials, and processed coal to and from the Minesite.

Typical cross sections for the TAC are provided by **Figure 1.20-6** below. **Figure 1.20-7** below illustrates the gentle grade profile of the TAC.

Tenas Project

Tenas Access Corridor (TAC)
relevant features
Figure 1.20-5

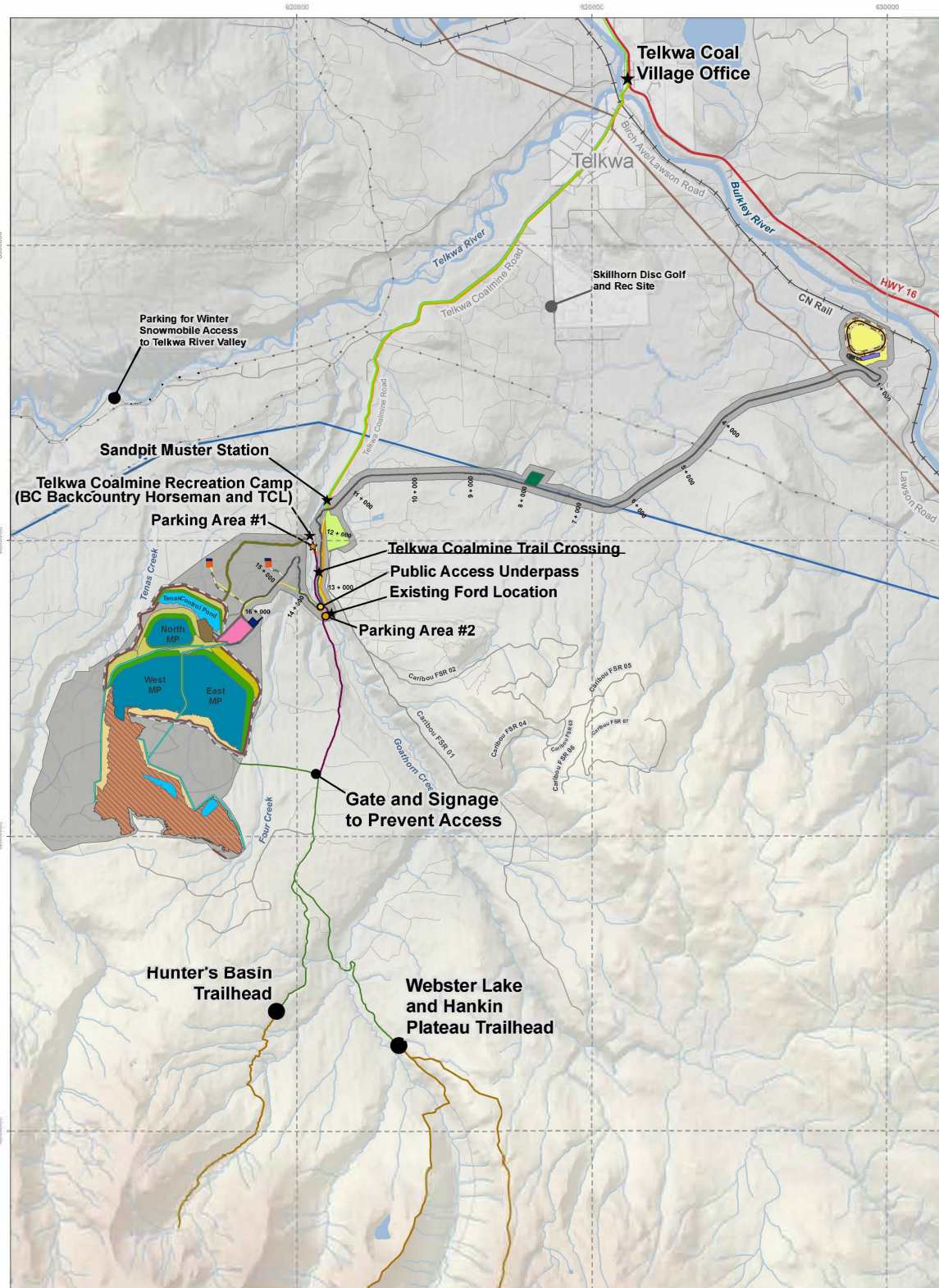
Tenas Access Corridor Features

- No Unauthorized Entry, Hunting, and Fishing Boundary
- Open Pit
- Backfilled Areas
- Explosive Infrastructure
- Water Discharge Route
- Mine Infrastructure Complex
(Coal Processing Plant, Maintenance Facility, and Pit Fueling Station, Administration and Mine Dry Building, Mine Rescue and Light Vehicle Maintenance Buildings)
- Gravel Quarry
- Rock Quarry
- Cleared Areas for Access
- Topsoil Stockpiles
- End Pit Lakes
- Management Pond - Covers
- Management Pond - Dams
- Management Pond - Buttresses
- Rail Infrastructure
- Rail Loop
- Sedimentation Ponds
(Coal Processing Plant, Rail Infrastructure, Explosive Facility, and Explosive Magazine)
- Rail Infrastructure Loading Area
- 25 kV Powerline
- Haul Roads
- Tenas Access Corridor
- Channels (Ditches)
- Service Roads
- Under TCL Escort
- Alternate Access to Recreational Sites Beyond the Project
- Parking Area 1
- Parking Area 2

Base Features

- Hiking Trail
- Rail Line
- Highway
- 25 kV Powerline
- Secondary Roads and Trails
- Pacific Natural Gas Pipeline
- 500 kV Transmission Line
- 138 kV Transmission Line
- Current Access Route to Recreational Sites Beyond the Project
- Watercourse
- Waterbody
- Telkwa Village Boundary

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Base Data: Geographic Information System



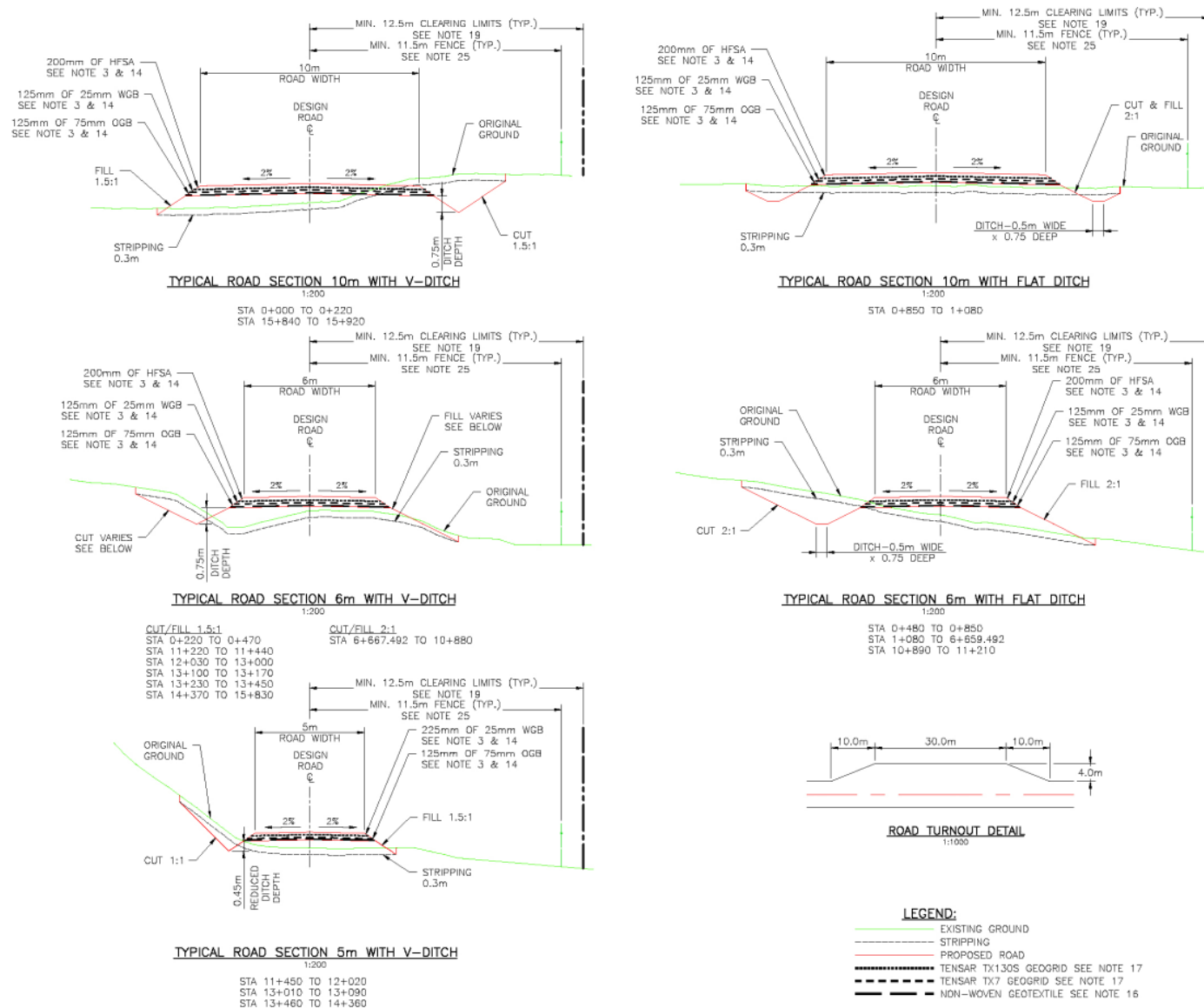


Figure 1.20-6: Typical cross sections for the Tenas Access Corridor (TAC)

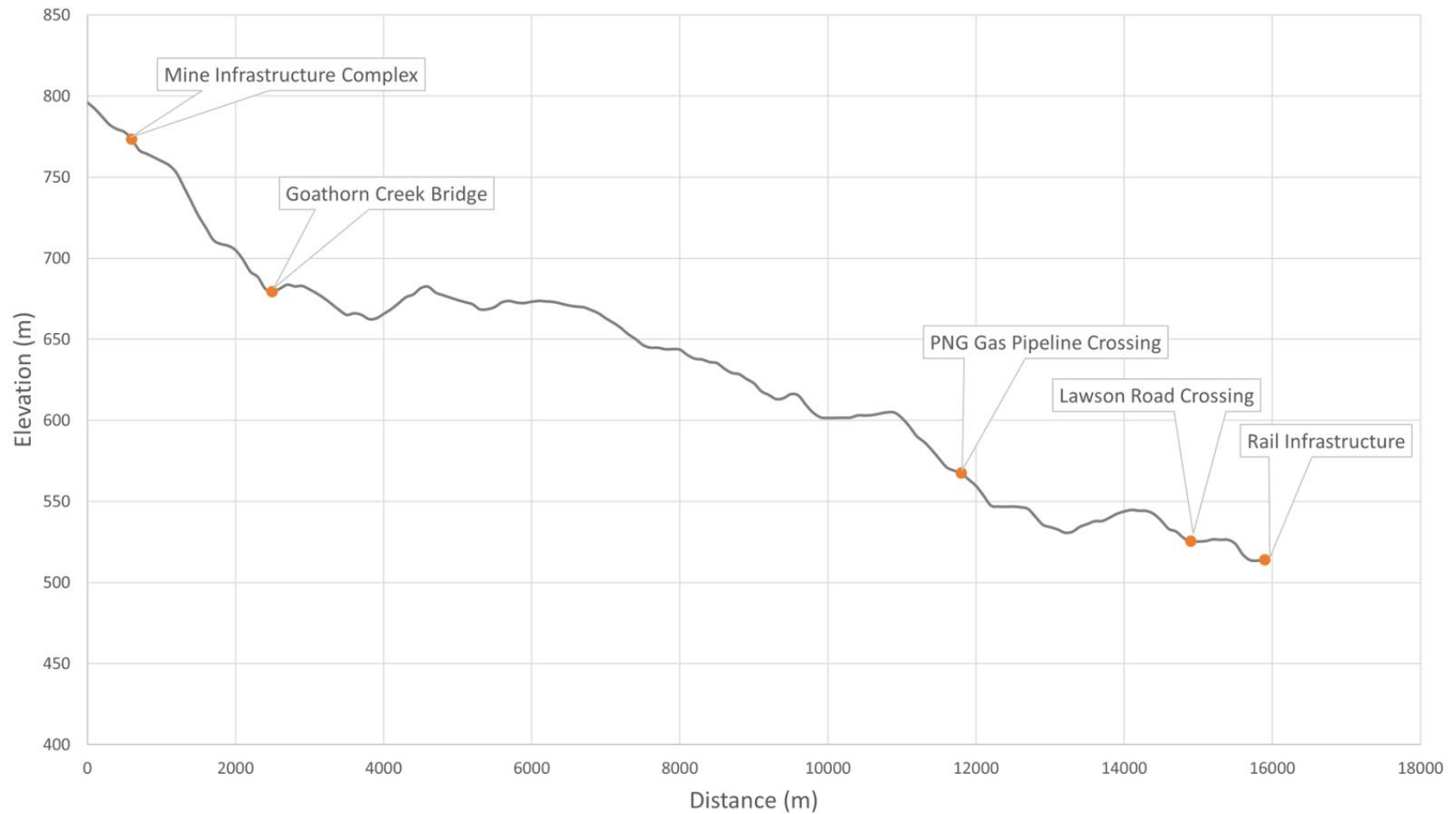


Figure 1.20-7: Profile of the Tenas Access Corridor (TAC)

The full TAC design report, plans, and sections is provided in **Appendix 1.0-W DWB Consulting Services Ltd., Tenas Access Corridor Design Drawings and Technical Report**. The design details for the road are:

- ▶ 6.0 m running surface for single lane sections;
- ▶ 10.0 m running surface for double lane sections and pullouts;
- ▶ variable slopes for fills from 1.5H:1V to 2.0H:1V, and variable slopes for cuts from 1.0V:1V to 2H:1V;
- ▶ 0.75-m-deep channel where required and will have slopes between 1H:1V and/or 2.0H:1V slopes depending on location, and 0.5-m-deep channel in several terrain constrained locations;
- ▶ 2% crown or cross slope;
- ▶ maximum grade of -10% and +8% not including rolling resistance, target is 5%;
- ▶ rolling resistance of 2 to 3%;
- ▶ 500-600 mm CSP cross drains where required;
- ▶ signage as required by the manual of standard traffic signs;
- ▶ typical road cross section will include the following:
 - ▶ 125 mm of a 75 mm Open Graded Base (OGB) course as per 2016 Standard Specifications for Highway Construction (BC MOTI 2016) compacted to 98% proctor 125 mm of a 25 mm Well Graded Base (WGB) course as per BC MOTI 2016 compacted to 98% proctor;
 - ▶ 200 mm of a High Fines Granular Surfacing Aggregate (HFSA) course as per BC MOTI 2016 compacted to 98% proctor;
 - ▶ non-woven geotextile between OGB and subgrade fill; and
- ▶ geogrid material between HFSA and WGB, and WGB and OGB.

The detailed pavement design for the TAC is provided by **Figure 1.20-8**.

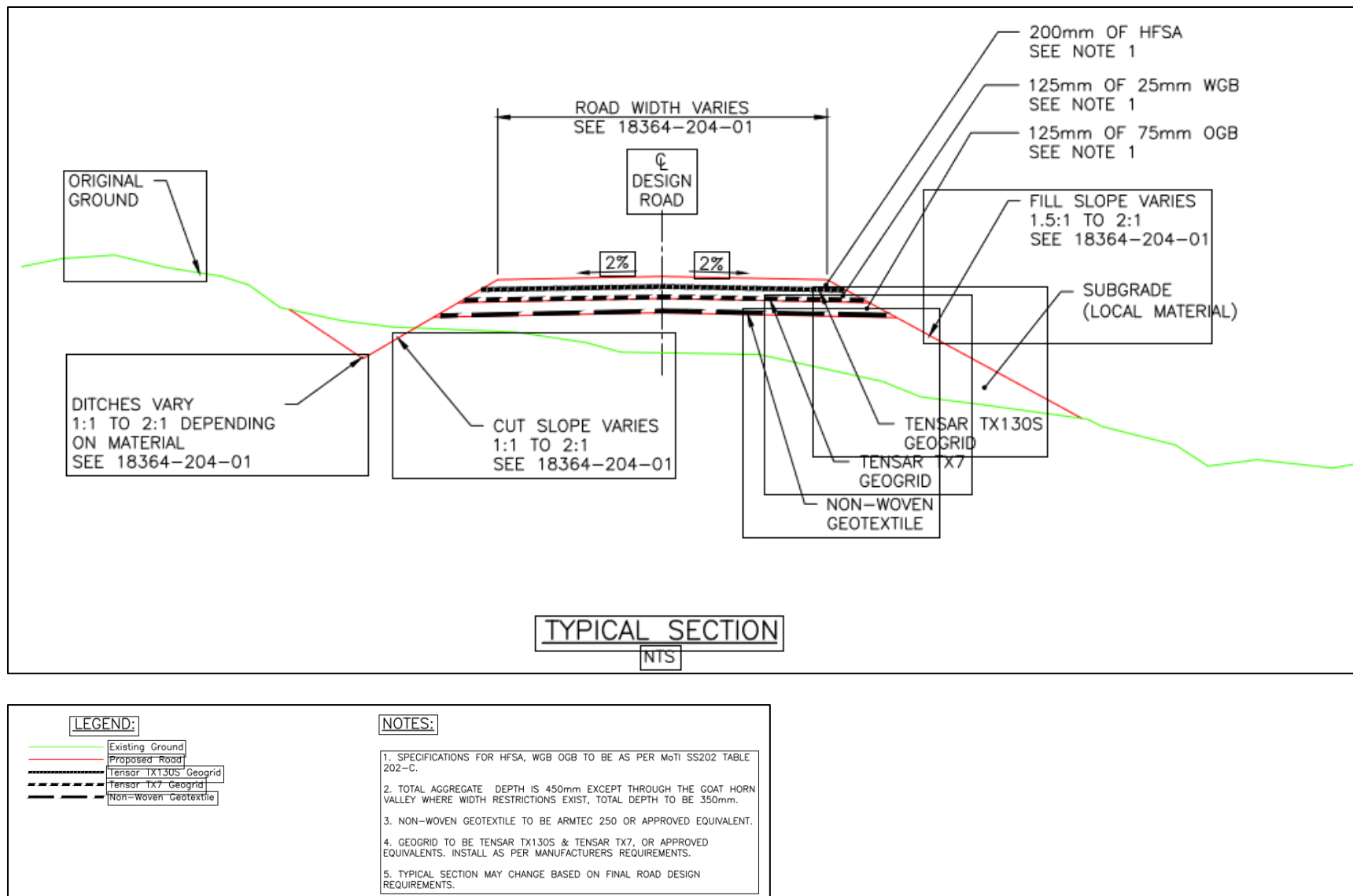


Figure 1.20-8: Pavement design for the Tenas Access Corridor (TAC)

The following list provides the designed quantities for cut, fill, gravel, and geotextiles to be used for the TAC:

- ▶ 110,400 m³ of reclamation material (surface soil) the majority is associated with the Bypass portion;
- ▶ 38,541 m³ of general cut consisting of overburden;
- ▶ 37,354 m³ of general fill consisting of overburden;
- ▶ 21,560 m³ of high fines surface aggregate compacted to at least 98% proctor density;
- ▶ 16,425 m³ of WGB compacted to at least 98% of proctor density;
- ▶ 10,010 m³ of OGB compacted to at least 98% of proctor density;
- ▶ 151,000 m² of non-woven geotextile, Armtex 250 or equivalent;
- ▶ 131,000 m² of Tensar TX130S geogrid or equivalent; and
- ▶ 131,000 m² of Tensar TX7 geogrid or equivalent.

The TAC will require 50 traffic control signs. All signs will meet the requirements set out in the Interim Traffic Management Manual for Work on Roadways (BC MOTI 2015) and will be:

- ▶ standard in size, shape, colour, and message;
- ▶ clean and in good condition; and
- ▶ reflectorized for night use.

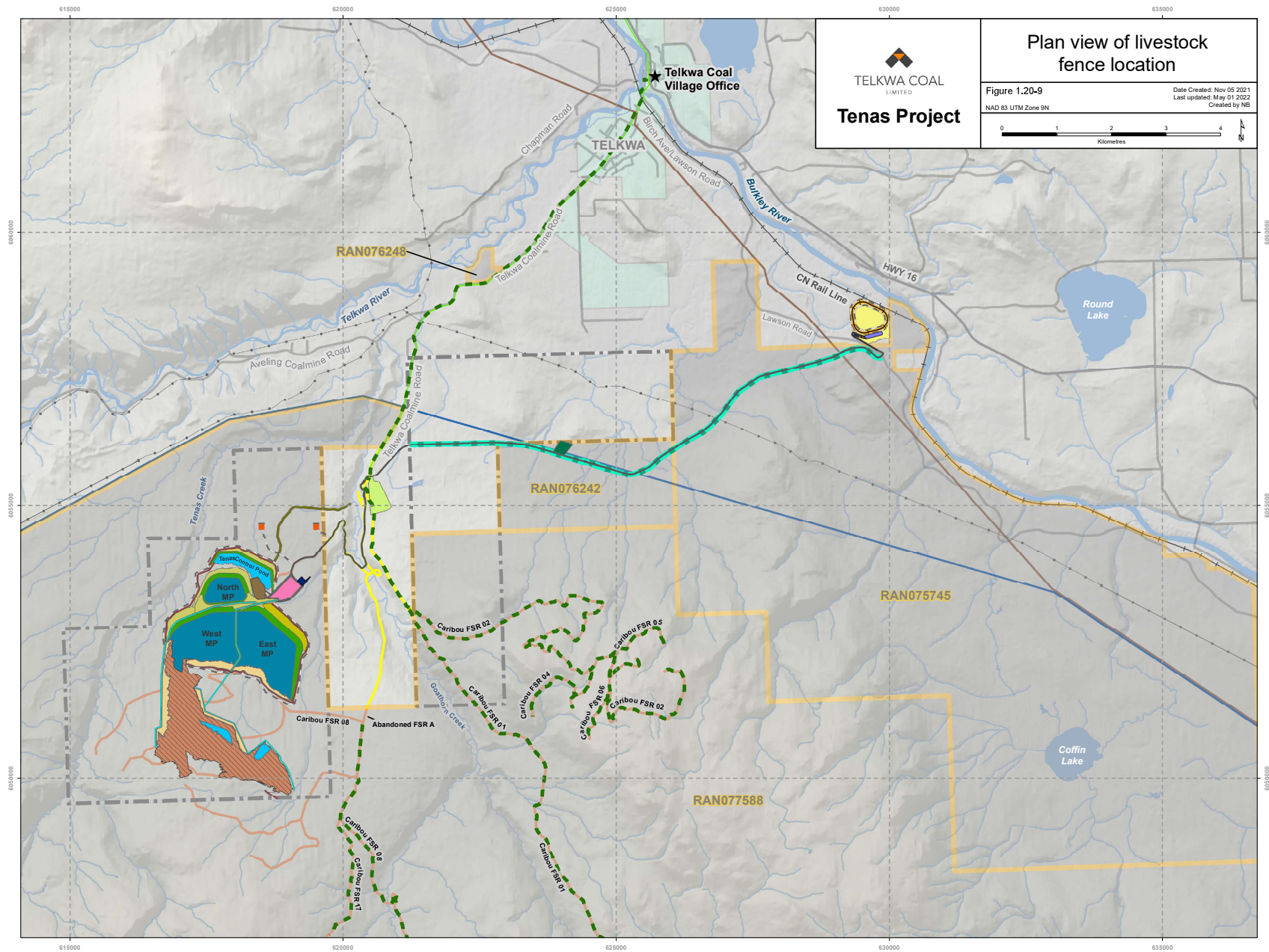
After this upgrade, all Project traffic will use this road, and the existing Telkwa Coalmine Road will no longer be used except for extreme emergency situations by Project traffic.

The TAC will be open to other industrial users and government requirements.

1.20.6 Fencing

Approximately 9 km of the new section of road is through existing grazing licenses. A cattle style fence is required on both sides of the road to ensure that livestock do not interfere with Project traffic.

Figure 1.20-9 illustrates where the livestock fences will be installed for the TAC.



Tenas Access Corridor Features

- Open Pit
- Backfilled Areas
- Explosive Infrastructure
- Water Discharge Route
- Mine Infrastructure Complex
(Coal Processing Plant, Maintenance Facility, and Pit Fueling Station, Administration and Mine Dry Building, Mine Rescue and Light Vehicle Maintenance Buildings)
- Gravel Quarry
- Rock Quarry
- Cleared Areas for Access

- Topsoil Stockpiles
- End Pit Lakes
- Management Pond - Covers
- Management Pond - Dams
- Management Pond - Buttresses
- Rail Infrastructure
- Rail Loop
- Rail Infrastructure Loading Area
- Sedimentation Ponds
(Coal Processing Plant, Rail Infrastructure, Explosive Facility, and Explosive Magazine)
- Project Coal Licenses

- Grazing Leases
- Livestock Fence Location
- 25 kV Powerline Extension
- Haul Roads
- Tenas Access Corridor (TAC)
- Channels (Ditches)
- Forest Service Roads
- TCL Private Roads
- Ongoing Public Access
- Service Roads

Base Features

- Watercourse
- Waterbody
- Rail Line
- Highway
- Secondary Roads and Trails
- Pacific Natural Gas Pipeline
- 500 kV Transmission Line
- 138 kV Transmission Line
- Telkwa Village Boundary

The fence will be constructed using best practices to ensure that wildlife can still travel past this fence either by jumping over it or crawling under it for the entire length of the road within the grazing licenses to mitigate any effects on wildlife movements in the area around the Project. The selected fence design is illustrated below by **Figure 1.20-10**.

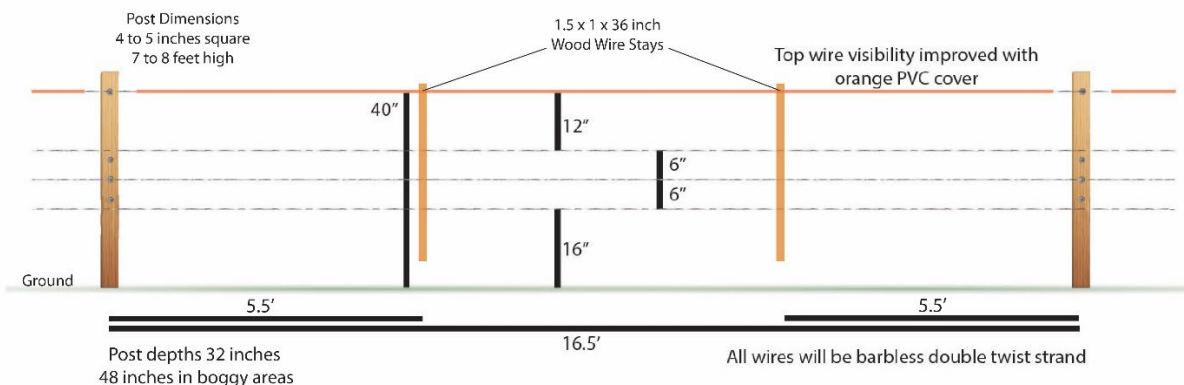


Figure 1.20-10: Typical livestock fence details for Tenas Access Corridor (TAC)

The anticipated quantities of material to be used for this fence are:

- ▶ 60 km of 12-½ gauge twisted double strand barbed wire that has Class 1 galvanizing with a minimum breaking strength of 340 kg (950 pounds [lbs]);
- ▶ 40 km of 12-½ gauge smooth wire with a minimum breaking strength of 340 kg (950 lbs);
- ▶ 3250 * 2.1 m line posts 75-100 mm in diameter, pressure treated, pointed, and domed;
- ▶ 200 * 2.4 m brace posts, 100-125 mm in diameter, pressure treated, pointed, and domed; and
- ▶ 3250 * 35 mm diameter wood or equivalent droppers; 18 km of PVC covers or another high visibility wildlife marker for top wire.

1.20.7 Livestock Crossings

Over the length of the TAC, several locations have been designed as a level crossing for livestock to move between the various range lands that are intersected by the proposed TAC. **Figure 1.20-11** below illustrates the expected operation of the livestock crossings.

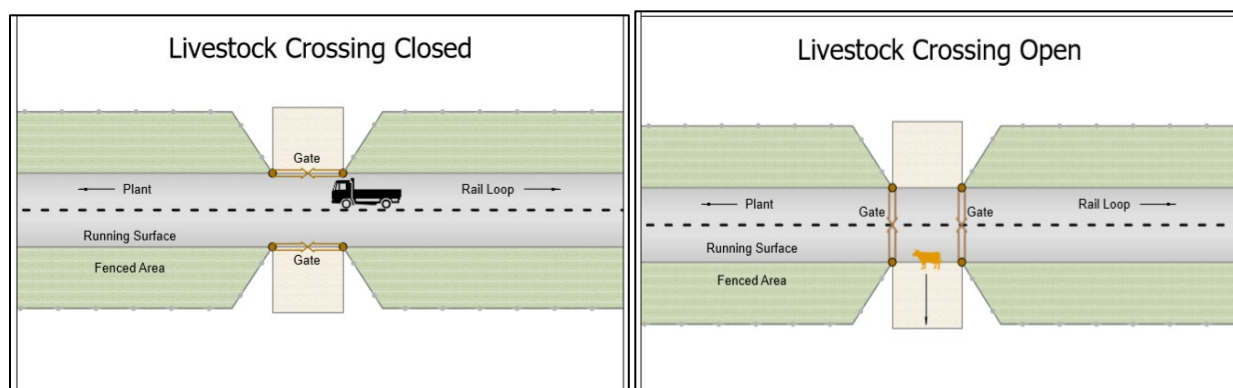


Figure 1.20-11: Typical livestock level crossing for the Tenas Access Corridor (TAC)

These crossings will have gates that are closed most of the time and will be open two (2) to four (4) times a year to allow livestock owners to move livestock between spring and winter grazing areas. In total, there will be four (4) to six (6) livestock crossings incorporated into the design of the TAC.

1.20.8 Vehicle Level Crossings

Over the length of the TAC, several locations have been designed as a semi-controlled level crossing for vehicles to cross the TAC. These crossings will not have gates and will be left open for use by landowners on either side of the road unless the site is also used as a livestock crossing.

There will be stop signs on either side of the road to warn users of the road to stop and wait for any Project traffic prior to crossing over the TAC. In total, there will be four (4) dedicated level vehicle crossings and one (1) livestock/vehicle level crossing incorporated into the design of the TAC.

1.20.9 Public Access

During engagement with stakeholders and regulatory bodies, TCL was directed to maintain public access to Hunter Basin and other recreational areas past the Project. TCL has developed a **PAMP**. In summary, TCL will guide members of the public from a staging area at either TCL's office in Telkwa, BC and/or at the sandpit area located north of the boom gate on Telkwa Coalmine Road to the TCRC area near the Project. From the TCRC, the public will be able to access recreation areas following the existing trail that goes under the TAC and use the dedicated portion of the Goathorn Bridge for public access. This trail will be facilitated by the construction of a dedicated underpass that will be large enough to allow members of the public on horseback, all-terrain vehicles (ATV) vehicles, and/or backpackers.

1.20.10 Water Management

The water management plan for the TAC follows standard procedures for forestry service roads in the region and a specific plan developed by SRK Consulting Inc (SRK) including among other works detailed prescriptions for water management for the Goathorn Creek area (see **Appendix 1.0-F SRK, Tenas Project Water Management Design Technical Report**). The main goal of water management in the design and construction of roads is to maintain surface drainage patterns by keeping water in its own drainage area unless it is more desirable in moving it to another area to avoid unstable or sensitive soils.

Water management for the TAC comprises three (3) main components; bridges, culverts, and road side ditching. Culverts are further classified as major culverts ($\geq 2,000$ mm in diameter, placed in defined

channels, and require engineered design), culverts (<2,000 mm in diameter, placed in defined channels, and are sized based on channel characteristics), and cross drains (typically <1,000 mm in diameter, sizing is based on road design criteria). Each are discussed in more detail in the subsections that follow.

1.20.10.1 Clear Span Bridges

Clear span bridges will be designed for existing watercourses that have been determined to be fish bearing. Assessments of these drainages have been completed by DWB in the Stream Assessment Report, Feasibility Road Design Phase 2 Telkwa Metallurgical Coal Project (DWB Consulting 2020) and detailed surveying which will allow for the design of these drainage structures. Refer to DWB drawing package 18364-204-10 for proposed bridge locations. **Table 1.20-1** below provides the design criteria used for clear span bridges:

Table 1.20-1: Summary of Bridges Required for the Mine Access Road

Parameter	Value	Justification
Design Flood	1 in 200-year event including a climate change allowance	Specific client request. Typically, 1:100-year event for permanent structures.
Height of Bridge Bottom Above Design Flood	1.0 m minimum above the 1 in 200-year event	Based on stream hydraulics
Deck Width	Minimum 4.3 metre (m)	4.3 m is standard single lane bridge width

Table 1.20-2 summarizes the key design features for the bridges to be constructed along the TAC.

Table 1.20-2: Summary of Bridges Required for the Mine Access Road

Location	Width (m)	Span (m)	Type	Storm Event	Freeboard from Bottom of Bridge to Storm Event (m)
5.63 km (Helps Creek)	4.877	14.00	Concrete slab bridge	Q200	1.0
6.32 km (unnamed DS3)	4.877	10.00	Concrete slab bridge	Q200	0.5
6.50 km (unnamed DS4)	4.877	8.00	Concrete slab bridge	Q200	0.5
6.66 km (unnamed DS4)	4.877	8.00	Concrete slab bridge	Q200	0.5
7.03 km (unnamed DS4)	4.877	24.38	Steel / concrete composite	Q200	0.5
7.21 km (unnamed S4)	4.877	21.34	Steel / concrete composite	Q200	0.5
8.05 km (unnamed DS4)	4.877	21.34	Steel / concrete composite	Q200	0.5
8.54 km (unnamed DS3)	4.877	21.34	Steel / concrete composite	Q200	0.5
13.19 km (Goathorn Creek)	4.877 and public access of	30.48	Steel / concrete composite	Q200	2.0

Location	Width (m)	Span (m)	Type	Storm Event	Freeboard from Bottom of Bridge to Storm Event (m)
	approximately 2.5				

Notes: km=kilometre; m=metre; Q200=1 in 200-year return period

The key design specification for most bridges will involve either pile or spread concrete footings. All bridges were designed to carry a 110-tonne dynamic load of a super B-train truck.

The bridge over Goathorn Creek will be a specially designed bridge with two (2) separated lanes of use, with one (1) lane being for Project traffic and the other lane being for public use with sufficient width for a side-by-side ATV or a person on horseback.

1.20.10.2 Roadside Channels

Roadside channels (ditching) will be incorporated along the TAC in cut slopes to collect runoff and seepage from upslope areas and the road surface. The ditching will convey runoff via cross drains to the natural environment. Roadside ditching geometry is based on maximum cross drain size and required cover depths. Typical channels will have a V-notch shape, 0.75 m deep, and have side slopes ranging from 1H:1V to 2H:1V depending on material. Refer to DWB drawing package 18364-204-10 for ditch layout and cross sections in DWB Consulting 2020.

1.20.10.3 Culverts

The following subsection provides a description of culvert requirements for the Project.

1.20.10.3.1 Major Culverts

Due to the small size of planned culverts (see **1.20.10.3.2 Minor Culverts**), there are no major culverts proposed for the TAC.

1.20.10.3.2 Minor Culverts

There are several corrugated steel pipe culverts ranging in size from 800 mm to 1,800 mm proposed for this project. All culverts are associated with non-classified drainages (NCDs) as determined from the DWB Stream Assessment work. Refer to DWB drawing package 18364-204-10 in DWB 2020 for proposed culvert locations. Culvert sizing is determined from stream characteristic data collected in the field during the stream assessment work and includes stream bottom width, top of bank width, and stream depth as per the requirements of the Forest Road Engineering Guidebook (British Columbia Ministry of Forests [BC MOF] 2002).

Table 1.20-1 below provides a list of culverts, locations, and lengths that will be installed as part of the TAC.

Table 1.20-3: Summary of Culverts Required for the Mine Access Road

Culvert (diameter in mm)	Cumulative Length (m)	Culvert Type	Designed Storm Event
500	1,015	CSP	Q200
600	280	CSP	Q200
800	42	CSP	Q200

Culvert (diameter in mm)	Cumulative Length (m)	Culvert Type	Designed Storm Event
900	60	CSP	Q200
1000	16	CSP	Q200
1200	34	CSP	Q200
1400	38	CSP	Q200
1800	20	CSP	Q200
All Total	1,505	CSP	Q200

Notes: CSP=Corrugated Steel Pipe; m=metre; mm=millimetre; Q200=1 in 200 year return period.

1.20.10.4 Cross Drains

Cross drains for this Project will consist of 500 to 600 mm corrugated steel pipes, spaced from 100 to 350 m depending on road grade, soil type and topography as per the Forest Road Engineering Guidebook (BC MOF). The DWB drawing package 18364-204-10 in DWB 2020 shows the proposed location of cross drains along the TAC.

Protection measures including ditch blocks, check dams, sumps and rock armouring are considered in the design process and included where applicable.

1.20.10.5 Sedimentation Ponds

Specific water management plans for the Goathorn Creek area have been developed by SRK. The SRK report proposes two (2) small sedimentation ponds on the east and west sides of Goathorn Creek both of which will receive water from TAC as this is the area where the steepest sustained grades are encountered by TAC. Both sedimentation ponds are two (2)-celled features and will discharge treated water to Goathorn Creek. Details on the sedimentation pond for East and West TAC sedimentation ponds are provided in **Appendix 1.0-F, MWMP**, and **1.22**.

1.20.10.6 Erosion and Sediment Control Requirements

Where possible cut/fill slopes will be constructed to 2H:1V to accommodate reclamation activities. The reclamation activities will incorporate erosion control practices on these slopes to minimize sediment release from these activities such as hydro seeding and coconut matting. As part of annual maintenance activities all water management features including culverts will be inspected to ensure they are functioning correctly and to determine if any repairs are required.

Additionally, prior to the construction of the TAC, a detailed construction level erosion and control plan will be developed for the TAC which will involve temporary sumps, diversion and collection channels and portable sediment control sea containers as required to ensure TSS levels are achieved. These items will have specified erosion control features such as rip-rap or turf mat reinforcement incorporated into their construction to avoid sediment mobilization.

1.20.11 Private Underpass for Public Use

A dedicated underpass crossing will be incorporated into the TAC near the Goathorn Bridge to allow members of the public to access Hunter Basin and other recreational sites on their own time schedule without interfering with mine traffic on the TAC. In terms of height and width, the underpass will be designed to accommodate a side-by-side ATV or a person on horseback. It will have a maximum height of 2.75 m and a width of 3.0 m.

1.20.12 Reclamation Materials (Surface Soils)

The TAC will require logging activities to be completed before reclamation materials (surface soils) are salvaged utilizing the same techniques as elsewhere within the Project Area. Reclamation material (surface soil) salvage will comprise of windrowing materials along the north side of the TAC in a windrow or at the toe of the fill slopes within the Goathorn slopes. As the TAC is constructed the reclamation materials will be placed on slopes of the cuts and fills to promote reclamation.

1.20.13 Geotechnical Aspects of the Tenas Access Corridor (TAC)

The road has been reviewed by Westrek for geotechnical aspects associated with the road. A copy of Westrek's full geotechnical report is attached in **Appendix 1.0-X Westrek Geotechnical Services Ltd., Tenas Haul Road Geotechnical Investigation Report** of this document.

A test pit program was carried out to determine the current condition of the existing road in addition to determining the material that will be used as the general construction materials for the road. In general, most of the road has little to no geotechnical risks.

However, the section of road going through the Goathorn Creek valley has been identified as having a geohazard risk as evidenced by the historical landslides that have occurred on either side of the Goathorn Creek Valley. During the field investigation phase, several monitoring piezometers and slope monitoring devices were installed for the Goathorn Creek section of the road to gather further geotechnical information. This information will be collected over the next six (6) to twelve (12) months to determine if this area is experiencing unmanageable movement levels and additional monitoring might be installed once construction is complete for the Operation, and Decommissioning and Reclamation phases of the Project.

A super B-train on-highway truck will be used to transport processed coal from the CPP to the Rail Infrastructure. The truck will be covered to mitigate fugitive coal dust emissions from the box during hauling. Dust emission mitigations for the Project including the TAC are provided in the **Air Quality Management Plan (S13.0-C2) (AQMP)**. It is estimated that between four (4) and eight (8) trucks per hour, seven (7) days a week, 24 hours per day will be required to deliver the processed coal between the CPP and the Rail Infrastructure location to meet the annual production requirements. All Project traffic will use this TAC once it is available, including but not limited to explosives, fuel, lubricant and part deliveries, recycling, hazardous waste, and general solid waste removal. To reduce traffic effects from the Project, TCL will be providing a bus service from a parking lot located on the east side of the Bulkley River for both employees and contractors, as is the practice at other mine operations in the province. Personal pick-up trucks will be limited to supervisors, selected contractors, and the Mine Manager for travel between the Minesite and residences. Furthermore, freight and fuel deliveries will be scheduled as much as practical to avoid busy periods on the Telkwa Coalmine Road such as the shift change times for the mine.

1.21 Rail Infrastructure

Processed coal will be shipped by rail to the Ridley Coal Terminal located near the Town of Prince Rupert, BC. The nearest rail line to the Project is operated by CNR and is located seven (7) km northeast of the Project near the Village of Telkwa. A 2.0 km Rail Loop will be constructed and connected on one (1) end to the CNR line. The Rail Infrastructure will be on private land that is owned by Telkwa Coal on the west side of the Bulkley River. Several key design aspects for the Rail Loop that are used include:

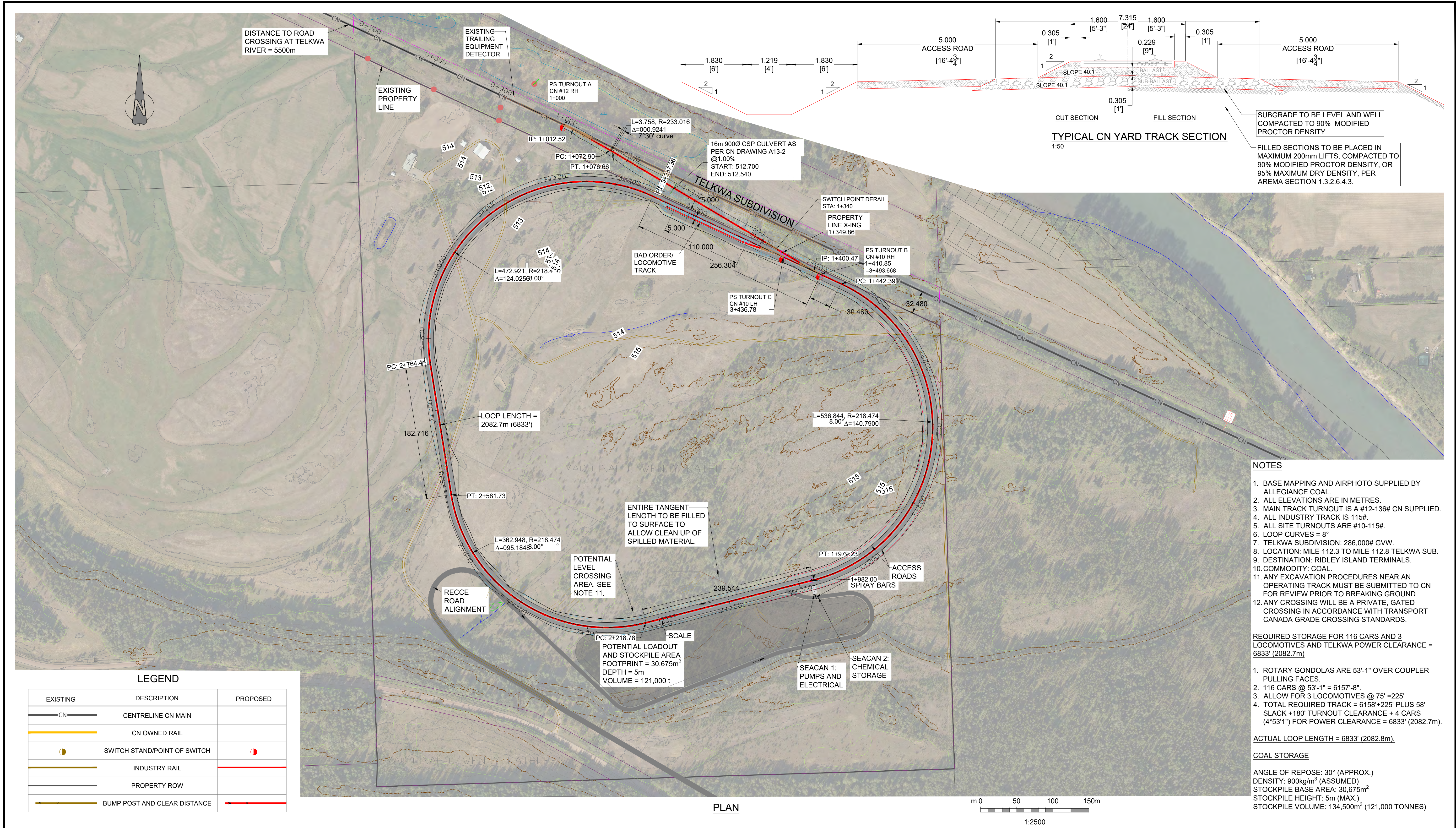
- ▶ maximum rail curve of 8.0%;

- ▶ maximum grade of less than 0.30%;
- ▶ installation of a dedicated set of signals on the main CNR line to enable more efficient main track operation. CNR will be able to bring opposing trains just clear of the loop entrance rather than standing back at the existing block limits;
- ▶ loading area of at least 175 m to allow for efficient FEL operations; and
- ▶ located only on private land.

Materials required for the construction of the rail loop must comply with the CN Engineering Specifications for Industrial Tracks (CNR 2019) and their respective quantities are:

- ▶ all Rail Loop and connecting track: 115# RE bolted rail on #1 hardwood ties with premium fasteners on curves and standard fasteners on straight sections;
- ▶ lead track: 341 m;
- ▶ curve track: 1,373 m;
- ▶ tangent track: 761 m;
- ▶ double point derail: 1 unit;
- ▶ #12 main track turnout: 1 unit;
- ▶ #10 yard turnouts: 2 units;
- ▶ bump posts: 1 unit;
- ▶ signals: 1 unit;
- ▶ reclamation material (surface soil): 45,725 m³
- ▶ cut: 34,000 m³ of overburden material;
- ▶ fill: 22,000 m³ of overburden materials;
- ▶ ballast: 4,000 m³;
- ▶ sub-ballast: 6,000 m³;
- ▶ 7,000 m³ gravel fill for loading areas;
- ▶ culverts: 20 m x 900 mm diameter corrugated steel pipe (CSP) for the lead track; and
- ▶ track scale: 1 unit.

The required infrastructure for rail for the Project is shown on **Figure 1.21-1**. **Figure 1.21-2** also provides a photo of a similar constructed Rail Infrastructure at an existing surface coal mine in BC.



LEGEND		
EXISTING	DESCRIPTION	PROPOSED
CN	CENTRELINE CN MAIN	
	CN OWNED RAIL	
	SWITCH STAND/POINT OF SWITCH	
	INDUSTRY RAIL	
	PROPERTY ROW	
	BUMP POST AND CLEAR DISTANCE	

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
1		1
2		2
3		3
4		4
5		5
6		6
7		7
8		8

PRELIMINARY - NOT
FOR CONSTRUCTION

F	19/02/07	ISSUED FOR CLIENT REVIEW	DMM	NH
E	18/12/07	ADDED TELKWA POWER CLEARANCE	DMM	NH
D	18/11/29	STORAGE NOTES/DERAIL ADDED	DMM	NH
C	18/11/01	TURNOUT DETAIL ADDED, LIDAR ADDED	DMM	NH
B	18/10/11	ISSUED FOR PERMIT	DMM	NH
A	18/09/10	ISSUED FOR CLIENT REVIEW	DMM	DMM
REV	YYMMDD	DESCRIPTION	DRWN	APVD

CLIENT:

TELKWA COAL
LIMITED

Morch Engineering Inc.
Civil Engineering Consulting Services
Nanaimo, BC (250)-713-8905

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TELKWA COAL			
CLIENT NO:	-	DRWN:	DMM
PROJECT NO:	18012	DSGN:	DMM
DRAWING SIZE:	22x34	CHKD:	-
SCALE:	1:2500H 1:250V	APVD:	-

Rail Infrastructure design
for the Project

FIGURE 1.21-1

REV: F



Figure 1.21-2: Photo of similar Rail Infrastructure design for the Project

TCL has had numerous discussions with CNR about the Rail Loop and the capacity of the CNR network to accommodate the additional shipping volume required by this Project. No concerns were raised by CNR, given the long lead time associated with the Project's first coal production planned for several years in the future.

The Rail Infrastructure includes uncovered processed coal stockpiles, and a dust control/suppression system. The Rail Infrastructure stockpile is planned to be approximately 30,000 tonnes of processed coal in two (2) stockpiles. The Rail Loop will service approximately 1.2 trains consisting of 116 coal cars and up to three (3) locomotives per week. The preferred option for the Rail Infrastructure is to locate it adjacent to the CNR main line, which requires super B-train on-highway trucks to transport processed coal between the CPP and the Rail Infrastructure via the existing Caribou FSR and Bypass Road. Direct loading of the trains from the stockpile using a FEL will be carried out seven (7) days a week, between the hours of 06:00 and 20:00 as much as possible. The **AQMP** will describe the mitigation measures to control dust at the Rail Infrastructure site.

1.21.1 Rail Infrastructure Loading Pad

The Rail Infrastructure will be developed from any excess material excavated for the development of the Rail Loop and material excavated for the Rail Infrastructure Sedimentation Pond and a diversion channel on the very south end of this component. The material that makes up the location of the Rail Infrastructure is comprised of suitable gravels once reclamation materials (surface soils) are salvaged and placed into a stockpile. If these activities do not provide sufficient gravel material to finish the loading pad, additional gravel can be brought in from the several commercial gravel operations located in Telkwa or from the Gravel Quarry owned by TCL. The area where the Rail Loading Pad is constructed will have all reclamation materials salvaged and filter fabric will be placed where the loading pad is to be constructed. Gravel will be placed in compacted lifts of between 150 and 300 mm in thickness until the final design elevation of the Rail Loading Pad is reached. The Rail Loading Pad will be graded at approximately 0.5% towards the south and west to ensure all water that falls on the loading area and processed coal stockpiles is directed towards the Rail Infrastructure Sedimentation Pond. **Figure 1.21-3** below provides a photo illustrating a typical Rail Infrastructure Loading Pad



Figure 1.21-3: Typical Rail Infrastructure Loading Pad

1.21.2 Rail Car Loading

Coal delivered by super B-train trucks will be placed on a clearly identified loading pad constructed by compacted lifts of gravel to a height of approximately 1 m above the final grade of the Rail Loop. The loading pad will be constructed with a 0.5% grade for water control to ensure all water stays contained on the loading pad and is directed to the Rail Infrastructure Sedimentation Pond. Processed coal will then be picked up and stockpiled with FELs from windrows placed by super B-train trucks. When trains come into the Rail Loop for loading, FELs will then reclaim material from the stockpile to be dumped into rail cars. Trucks will come into the Rail Infrastructure and place coal onto the ground in windrows. FELs will create two (2) 15,000-tonne stockpiles from these windrows. These two (2) stockpiles will then be reclaimed with FELs feeding the rail cars at a rate of at least 1,000 t/hr.

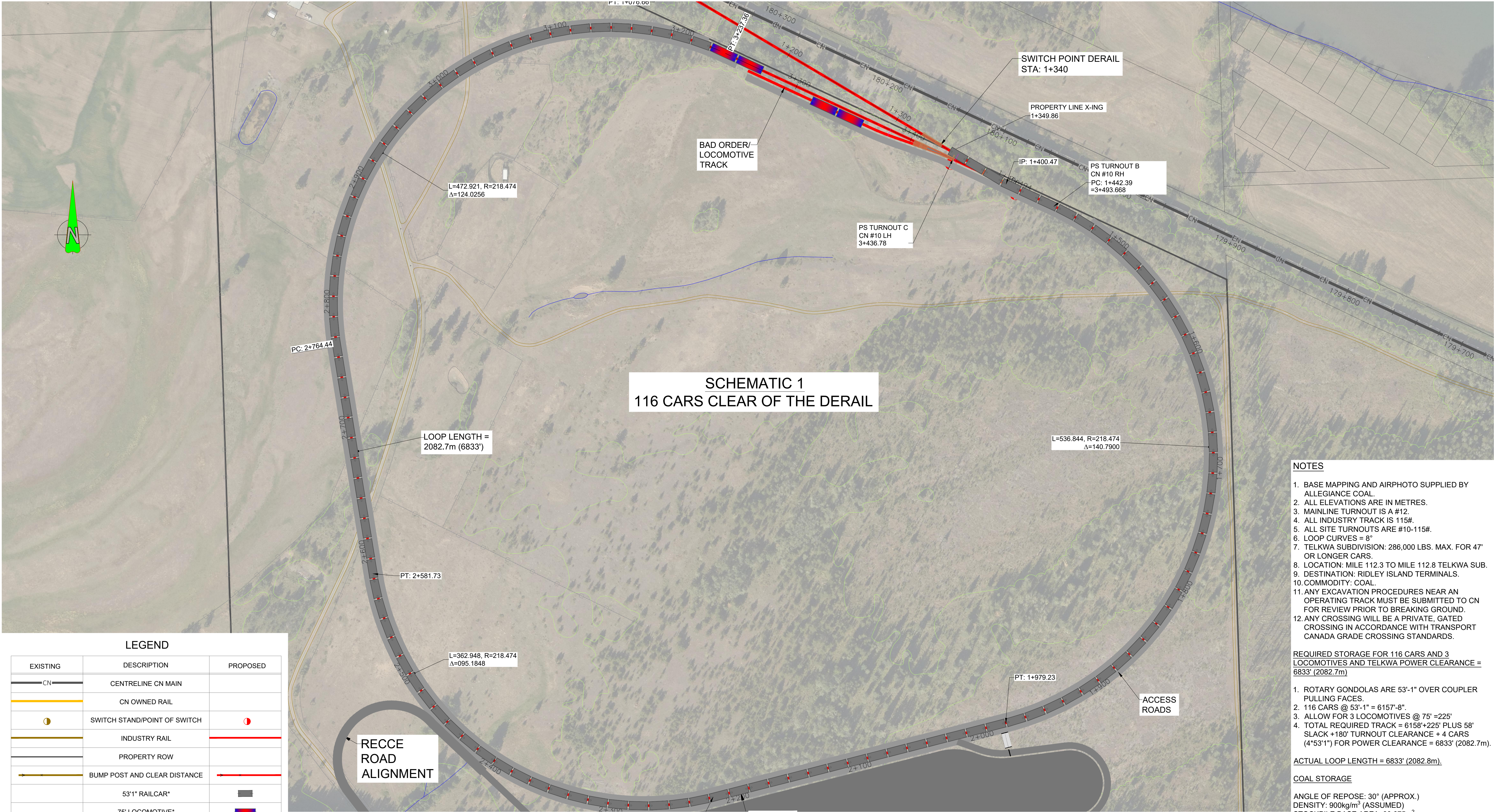
1.21.3 Train Operations

1.21.3.1 Arriving Train

- ▶ CNR will operate the empty coal train to the Rail Loop and drop off as shown in **Figure 1.21-4**;
- ▶ At Mile 112.15 Telkwa Subdivision, the train will enter the Rail Infrastructure lead track. Maximum speed coming in off the main line is 20 km/hour while it is 10 km/hour when actually being loaded via FEL;
- ▶ A derail switch is located on the lead approximately 1,150 ft from the main track switch. The switch to the Rail Loop entry “B” is approximately 1,350 ft from the main track switch. The Rail

Loop track has a set-out spur with a clear distance of 344 ft for bad order cars or locomotive storage. Its switch “C” is lined normal for the Rail Loop;

- ▶ CNR power will be used to power the train during the loading process;
- ▶ The CNR train will enter the Rail Loop in a clockwise direction;
- ▶ When the train's tail end car clears the loop-lead switch “B”, the locomotives will have circled the Rail Loop and be at the clearance point of switch “B”;
- ▶ The tail end of the train will be in full view of the train crew as illustrated by **Figure 1.21-4**;
- ▶ The CNR crew will line switch “B” for the Rail Loop, secure the derail switch, then pull the train around to the crossing at the Rail Infrastructure for hand-over to TCL crew or to secure the train;
- ▶ If a TCL train crew is available, they will take over the train immediately on arrival at the crew change-over point after completing a personnel transfer with the CNR crew; and
- ▶ If a TCL train crew is not available, the CNR crew will leave the train secured as required by their written procedures.



SCHEMATIC 1
116 CARS CLEAR OF THE DERAIL

- NOTES
1. BASE MAPPING AND AIRPHOTO SUPPLIED BY ALLEGIANCE COAL.
 2. ALL ELEVATIONS ARE IN METRES.
 3. MAINLINE TURNOUT IS A #12.
 4. ALL INDUSTRY TRACK IS 115#.
 5. ALL SITE TURNOUTS ARE #10-115#.
 6. LOOP CURVES = 8°
 7. TELKWA SUBDIVISION: 286,000 LBS. MAX. FOR 47' OR LONGER CARS.
 8. LOCATION: MILE 112.3 TO MILE 112.8 TELKWA SUB.
 9. DESTINATION: RIDLEY ISLAND TERMINALS.
 10. COMMODITY: COAL.
 11. ANY EXCAVATION PROCEDURES NEAR AN OPERATING TRACK MUST BE SUBMITTED TO CN FOR REVIEW PRIOR TO BREAKING GROUND.
 12. ANY CROSSING WILL BE A PRIVATE, GATED CROSSING IN ACCORDANCE WITH TRANSPORT CANADA GRADE CROSSING STANDARDS.

REQUIRED STORAGE FOR 116 CARS AND 3 LOCOMOTIVES AND TELKWA POWER CLEARANCE = 6833' (2082.7m)

1. ROTARY GONDOLAS ARE 53'-1" OVER COUPLER PULLING FACES.
2. 116 CARS @ 53'-1" = 6157'-8".
3. ALLOW FOR 3 LOCOMOTIVES @ 75' = 225'
4. TOTAL REQUIRED TRACK = 6158'+225' PLUS 58' SLACK +180' TURNOUT CLEARANCE + 4 CARS (4'53'1") FOR POWER CLEARANCE = 6833' (2082.7m).

ACTUAL LOOP LENGTH = 6833' (2082.8m).

COAL STORAGE
ANGLE OF REPOSE: 30° (APPROX.)
DENSITY: 900kg/m³ (ASSUMED)
STOCKPILE BASE AREA: 30,675m²
STOCKPILE HEIGHT: 5m (MAX.)
STOCKPILE VOLUME: 134,500m³ (121,000 TONNES)

LEGEND		
EXISTING	DESCRIPTION	PROPOSED
	CN	
	CENTRELINE CN MAIN	
	CN OWNED RAIL	
	SWITCH STAND/POINT OF SWITCH	
	INDUSTRY RAIL	
	PROPERTY ROW	
	BUMP POST AND CLEAR DISTANCE	
	53'1" RAILCAR*	
	75' LOCOMOTIVE*	

*NOTE: RAILCARS SHOWN ARE 53'1" COAL CARS, BUT ARE SHOWN TWICE AS WIDE AS THEY ACTUALLY ARE FOR VISIBILITY.

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
1		
2		
3		
4		
5		
6		
7		
8		

PRELIMINARY - NOT
FOR CONSTRUCTION

C	22/04/01	LANDOWNER NAME REMOVED	DMM	-
B	18/12/07	ADDED TELKWA POWER CLEARANCE	DMM	NH
A	18/11/28	ISSUED FOR CLIENT REVIEW	DMM	DMM
REV	YYMMDD	DESCRIPTION	DRWN	APVD

CLIENT:

TELKWA COAL
LIMITED

Morch Engineering Inc.
Civil Engineering Consulting Services
Nanaimo, BC (250)-713-8905

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TITLE: TELKWA COAL			
CLIENT NO:	-	DRWN:	DMM DATE: 18/09/05
PROJECT NO:	18012	DSGN:	DMM DATE: -
DRAWING SIZE:	22x34	CHKD:	- DATE: -
SCALE:	1:1500H 1:150V	APVD:	- DATE: -

PROJECT:

Typical rail car set up prior to loading of the train after Canadian National Rail (CNR) drop off

FIGURE

1.21-4

2022/04/01 18012-101 Rev C Railcars on site.dwg

1.21.3.2 Loading the Train

- ▶ TCL load-out crews will commence loading the first 10-15 cars using FELs when the train is positioned, and signal given;
- ▶ Each loaded rail car will be sprayed with dust binder solution to ensure no dusting occurs during transport to the port;
- ▶ When they have completed the loading, and require a new spot, they will advise the train crew;
- ▶ Once confirming all loading equipment and personnel are clear and using established radio communication procedures, the train will be moved forward (clockwise). Simultaneously, the loaded cars will be weighed;
- ▶ Any car that requires load adjustment will be addressed as soon as the train stops, and the "OK" is given by the train crew. Loading of the next block will also commence;
- ▶ This procedure will be repeated until the entire train has been loaded;
- ▶ The entire train will then be pulled around the Rail Loop and over the scale one (1) more time to determine final weights and to be sprayed with a topping agent; and
- ▶ During winter conditions the train cars shall be sprayed with antifreeze prior to loading with coal to prevent coal from freezing to the side of the coal cars.

1.21.3.3 Departing Train

- ▶ After ensuring that the train is loaded, the TCL train crew will cut off the locomotives and then re-couple them to the last car of the train;
- ▶ This is a change of locomotive operating ends;
- ▶ They will complete locomotive brake and electrical tests, relocate the Sense and Braking Unit to the now trailing end and complete the Train Information Braking System test and release any hand brakes that may have been applied;
- ▶ The train is now ready for movement in the reverse direction and exiting the loop by a CNR crew;
- ▶ If a CNR crew is not available, the TCL crew will leave the train secure as required by CNR written procedures;
- ▶ Once the CNR crew has taken charge of the train, and after performing all necessary checks and tests and securing operating authorities, they will reverse switch "B" and the derail switch;
- ▶ After departing, CNR will leave switch "B" and the derail switch lined for the next arriving CNR train; and
- ▶ If TCL power and/or cars remain in the rail loop, switch "B" and the derail switch will be restored to normal.

1.21.4 Rail Infrastructure Dust Suppression and Winter Requirement Additives

A dust binder chemical solution (APS2 or equivalent) will be applied to the rail cars after filling to effectively seal the top layer of coal and mitigate fugitive dust emissions during the journey to port. Dust binder chemical will be delivered to site by road tanker and will be stored in a fibreglass reinforced plastic

(FRP) tote with a 1,000 L storage capacity. The tank will be heated and insulated to prevent freezing during the winter months.

During the colder months, an anti-freeze solution (Enviromelt SCR-1) will be applied to the empty rail cars prior to filling to prevent coal freezing and sticking to the rail car during unloading at the port. The anti-freeze chemical will be delivered to site by road tanker and will be stored in an FRP tank with a 40,000 L storage capacity. The tank will be heated and insulated as the solution can become difficult to pump at below zero temperatures. The Rail Infrastructure rail car dosing system will have dosing pumps and equipment supplied within a self-contained and heated 40-ft sea container. The system is fitted with an air compressor to clear and purge the dosing lines and spray bars after the last rail car is filled.

Power Chemicals Ltd. completed lab testing for the above agents to come up with anticipated consumption rates and to recommend the best product for the Project. Their entire reports are provided in **Appendix 1.0-Y Power Chem, Dubois Chemical, Chemical Agent Selection for TAC and Processed Coal** attached.

The processed coal stockpiles will be monitored for fugitive dust emissions and water or a water with agent sprayer system will be incorporated to mitigate and dust emissions from these stockpiles. Furthermore, the coal itself will be treated with a dust suppression product at the CPP site prior to be loaded onto trucks to further reduce dust emissions.

1.21.5 Rail Infrastructure Water Supply

1.21.5.1 Process Water Use and Supply

An existing groundwater well at the Rail Infrastructure will provide extra water required for the rail car topping agent system, rail car side release system, and the dust management system. Approximately 12,000 to 24,000 m³ of water per annum will be required, with more of this use in the summer months.

1.21.5.2 Potable Water Use and Supply

An existing system is in place at the Rail Infrastructure, which provides potable water from an established groundwater well. The well will have sufficient capacity for both potable water and process water requirements at the Rail Infrastructure.

1.21.5.3 Sewage/Black/Grey Water Treatment

There is an existing septic system at the Rail Infrastructure which will be utilized for sewage treatment. TCL confirmed that this system will be sufficient for the number of planned personnel at this location which is likely two (2) to three (3) people a day or two (2) a week.

1.21.6 Rail Infrastructure Water Management

1.21.6.1 Rail Infrastructure Water Management Plan

All water that comes into contact with the Rail Loading Pad and processed coal stockpiles of the Rail Infrastructure will be directed to the Rail Infrastructure Sedimentation Pond. The Rail Loading Pad is constructed out of clean compacted gravel up to an approximate height of 1 m and will be graded so that all water flows away from the rail tracks and south towards the Rail Infrastructure Sedimentation Pond. See **Figure 1.21-5**.

TSS will settle in the Rail Infrastructure Sedimentation Pond by gravity during extended retention and/or the addition of flocculent if required. TSS will meet provincial guidelines for this type of pond. Water quality will be measured at the discharge point to compare to predicted water quality parameters.

The Rail Infrastructure Sedimentation Pond was designed to have a low-level outlet to provide the required attenuation to settle a 10-micron particle. The emergency spillway for this pond was designed in accordance with CDA (2013). The Rail Infrastructure Sedimentation Pond was sized to convey the 200-year peak flow. These design elements are specified by provincial guidance.

Spillways were conservatively sized, assuming no attenuation of peak flows given the size of the pond, with an additional freeboard of 1 m above the spillway invert.

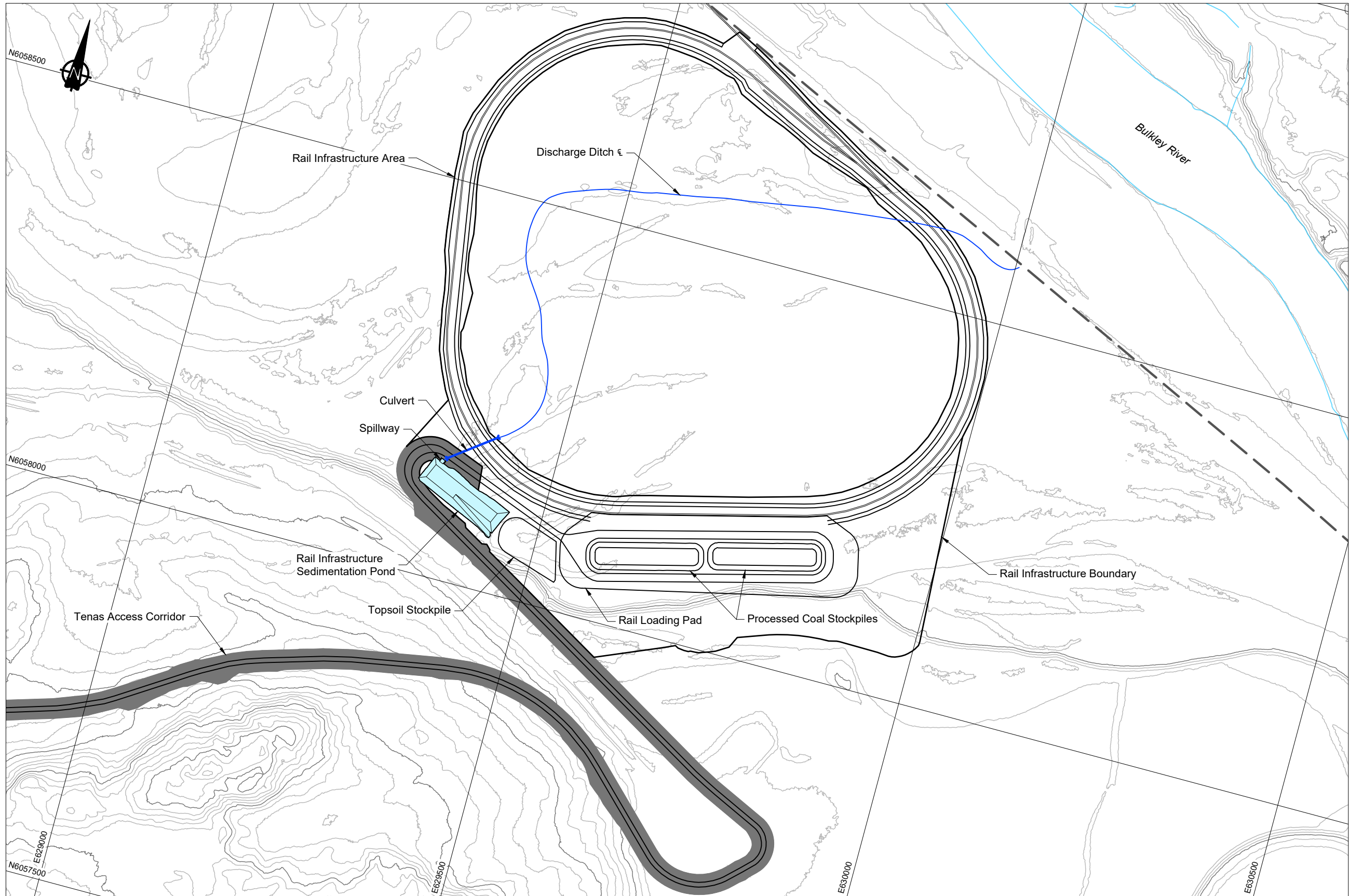
Table 1.21-1 below lists expected design parameters for the Rail Infrastructure Sedimentation Pond and additional information is provided in in **1.17.1.1**, the **MWMP**, and the **SRK Water Management Design Technical Report** provided in **Appendix 1.0-F**.

Table 1.21-1: Design Parameters for the Rail Infrastructure Sedimentation Pond

Parameter	Rail Infrastructure Sedimentation Pond
Dam Crest Elevation	523 m
Crest Width	5 m
Upstream Side Slope	2H:1V
Downstream Side Slope	3H:1V
Spillway Invert	522 m
Pond Volume Below Spillway Invert	1773 m
Pond Depth	1.00 m
Peak Outflow from Low Level Outlet	7.90 L/sec
Required Retention Time to Settle a 10-micron Particle	13.9 hrs
Designed Pond Retention Time	63 hrs

Notes: H:V=ratio of horizontal to vertical; hrs=hours; L/sec=litre per second; m=metre

\\ark-adf\share\env\Projects\01_SITES\Telkwa Coal\040_AutoCAD\Water Management\Mine Plan Progression\1CT027.003_Pond Rail Infrastructure.dwg



LEGEND

- Water Management Feature
- Spillway
- Culvert
- Existing Watercourse
- Proposed Road
- CN Railroad
- Sedimentation Pond

NOTES

- Contours shown at 2.0m intervals.
- All dimensions shown in meters unless otherwise stated.
- Pile designs by SRK Consulting Ltd.

REFERENCE

NAD83 UTM Zone 9.



SRK JOB NO.: 1CT027.003
FILE NAME: 1CT027.003 Pond Rail Infrastructure.dwg



Telkwa Coal

Environmental Assessment

Water Management for
Rail Infrastructure

DATE:
2021/07/16

APPROVED:
SAB

FIGURE:
1.21-5

1.21.6.2 Rail Infrastructure Water Discharge

The Rail Infrastructure Sedimentation Pond is immediately downstream of the stockpile area and discharges into Bulkley River via an existing surface channel.

TCL plans to discharge from the Rail Infrastructure Sedimentation Pond during open water conditions for a given year. After the stockpile area and Rail Infrastructure have been reclaimed and the TSS water quality objectives are met for a period time, the Rail Infrastructure Sedimentation Pond will be decommissioned in final closure.

1.21.7 Rail Infrastructure Noise and Vibration Management

Train operations at the Rail Infrastructure will be strictly managed to ensure all train travel on the Rail Loop is less than 10 km/hr. The low rate of speed will be required to allow for efficient car loading, agent spraying operations, and vibration reduction. Vibration is not expected to be detectable above current baseline conditions.

The Rail Infrastructure will not require train whistles to operate, which will limit noise. By utilizing a low-speed train movement, noise due to train movement will be significantly reduced. Noise emissions due to the Rail Infrastructure are not expected to be above the current baseline conditions. A full EA will be completed under the BC *Environmental Assessment Act*, SBC 2002, c 43 (GovBC 2002b). This information will be provided to the RDBN in the EAC Application.

TCL will use an adaptive management approach to noise and vibration management at the Rail Infrastructure. Results from monitoring will provide feedback to procedures and processes which will help achieve outcomes specified in regulatory approvals.

1.21.8 Geotechnical Aspects of the Rail Infrastructure

As part of the Rail Infrastructure design, geotechnical investigation was completed by Westrek for the Rail Loop and stockpile locations. **Appendix 1.0-Z Westrek Geotechnical Services Ltd., Geotechnical Investigation Proposed Rail Loadout Facility Tenas Project Feasibility Study** attached contains their entire geotechnical report for reference.

The investigation included the excavation of several test pits and one 30-ft-deep sonic hole. In summary, no geotechnical concerns were identified at the Rail Infrastructure area; however, proper field preparation activities and careful loading of the ground needs to be carried out during the Operation Phase.

1.21.9 Geohazards for Rail Infrastructure

The Rail Infrastructure is located on flat ground that is not prone to any mass wasting events such as landslides and/or avalanches. A portion of the Rail Infrastructure is within the 1 in 200-year flood plain for the Bulkley River, however, so is the entire main CNR rail line which has been in place for over 100 years without any flood event that has caused a disruption to rail services in the region. The Rail Infrastructure will be part of the **MERP** especially the subsection on flooding. In summary, the mine will have a triggered response plan to weather conditions whereby operations will cease at the Rail Infrastructure if a flood event greater than a 1 in 150-year event is forecast in the upcoming 48 hours and the temporary diversion dams will be inflated with water to divert flows away from the coal stockpiles and loading area. During this storm event any rail cars at the Rail Infrastructure will be moved to the Ridley Terminals and/or moved to somewhere else on the CNR network for storage until the storm has passed. Any damage due to flooding to the Rail Infrastructure will be repaired and ready for when other infrastructure in the region recovers from this event.

1.22 Management Ponds (Tailings Storage Facility) and Control Pond Aspects

The following provides an overview of the three (3) management ponds and one (1) control pond.

1.22.1 Management Pond

The purpose of the management ponds is to prevent ARD by storing PAG materials under a minimum water cover of 1 m, reducing the potential for oxidation of PAG materials. The effectiveness of subaqueous disposal of the PAG material is described in the water quality model provided in **SRK, Tenas Project Water and Load Balance Modeling Report** in **Appendix 1.0-E** and the **ML/ARDMP**.

There are three (3) management ponds required for the Tenas Project: North Management Pond, East Management Pond, and West Management Pond. In accordance with Canadian Dam Association (CDA) guidelines (CDA 2013), a dam breach inundation study was completed (**Appendix 1.0-AA SRK, Tenas Project Dam Breach Analysis**) to evaluate the consequence of failure and the associated dam classification of each facility. Based on the analysis, all three (3) management pond dams considered have been given a hazard classification of 'Very High', in accordance with CDA guidelines.

Spillways were designed for each dam to convey the peak flow of an event 2/3 between the 1 in 1,000-year storm event and Probable Maximum Flood (PMF) for 'Very High' dam classifications as determined by **Appendix 1-AA SRK, Tenas Project Dam Breach Analysis**. Similarly, operating freeboard criteria were established. **Table 1.22-1** summarizes volumetrics and final elevations. See **Appendix 1.0-F SRK, Tenas Project Water Management Design Technical Report**, attached, for additional information on the water management and the **MWMP**.

Table 1.22-1: Management and Control Ponds Design Volumetric and Elevation Parameters

Parameter	NMP	EMP	WMP	TCP
Total Saturated PAG Rock Volume (m ³)	2,386,000	11,561,000	27,432,000	850,000 of water only
Total Saturated Processed Rock Volume (m ³)	344,000	986,000	3,006,000	0
Top of PAG Elevation (masl)	825.3	847.4	847.4	0
Non-PAG Cover Thickness (m)	1.5	1.5	1.5	0
Non-Cover Volume (m ³)	427,000	1,580,000	1,441,000	0
Top of Non-elevation (masl)	826.8	848.9	848.9	0
Overburden Cover Thickness (m)	1.2	1.1	1.1	0
Overburden Cover Volume (m ³)	338,000	1,222,000	1,138,000	0
Dam Crest Elevation (masl)	830.0	852.0	852.0	800

Notes: EMP=East Management Pond; m=metre; m³=cubic metres; masl=metres above sea level; NMP=North Management Pond; PAG=potentially acid drainage; TCP=Tenas Control Pond; WMP=West Management Pond

To assist with the site water balance, the management ponds will then be backfilled with non-PAG rock and overburden when they have reached their designed PAG material elevations to ensure material is at least 0.5 to 2 m above the designed water level to reduce evaporation losses during the Post-closure Phase.

1.22.2 Tenas Control Pond

The Tenas Control Pond is located downstream of the mining operations and collects surface runoff from the Mine Infrastructure and overflows from the management ponds. The Tenas Control Pond was designed large enough to ensure that during the Operation Phase no water discharge will occur during the period between October 1 and March 31 of the subsequent year and will only discharge to an unnamed tributary of Goathorn Creek between April 1 and September 30. The Tenas Control Pond serves several purposes:

- ▶ sedimentation control for the overall Project except the TAC and Rail Infrastructure;
- ▶ contingency water to ensure PAG material is submersed in water in a timely fashion during the Operation Phase;
- ▶ process water storage and supply for the CPP, wash bays, and fire suppression systems;
- ▶ dilution water for blending with the effluent from the Sewage Treatment Plant if required, and
- ▶ a location for water displaced during PAG disposition into the management ponds.

In accordance with CDA (2013), a dam breach inundation study was completed (**Appendix 1.0-AA SRK, Tenas Project Dam Breach Study**) to evaluate the consequence of failure and the associated dam classification of the Tenas Control Pond. Based on the analysis, the Tenas Control Pond dam has been given a hazard classification of 'Very High', in accordance with CDA guidelines.

A summary of the Tenas Control Pond design criteria is provided in **Table 1.22-2**.

Table 1.22-2: Tenas Control Pond Design Criteria

Parameter	Description	Value
Minimum Storage Volume, V_{min}	Seven (7) months of process water supply + 2.5 m of storage for sediment accumulation	110,000 m ³
Maximum Target Operating Volume Post-Freshet, V_{Target}	Required water inventory as of July 1 st , as determined by 1 in 10-year dry year water balance	850,000 m ³
Contingency Storage, $V_{Contingency}$	Contingency storage capacity for 1 in 10-year 24-hour storm event to provide operational flexibility in terms of discharge rates to Goathorn Creek	210,300 m ³
Pumping Rate	Mean annual runoff inflows: annual process water demand, discharged over five (5)-month open-water period. Considers flood recovery for 1:10-year inflow over seven (7)-days (using backup pump system)	0.10 m ³ /s
Spillway Invert	Based on stage-storage curve, providing storage volume greater than the sum of V_{target} and V_{10yr}	798 masl
IDF Maximum Water Level	Based on routing of the Inflow Design Flood (2/3 between 1,000 year and PMF) through the spillway	799 masl
Minimum Freeboard	Based on freeboard evaluation for 'Very High' dam classification	0.38 m required; 1.0 m available

Parameter	Description	Value
Dam Crest	Selected based on the minimum freeboard and IDF maximum water level	800 masl
Retention Time	Calculated based on the 1 in 10-year inflow and pond volume and compared against the minimum retention time based on pond depth and particle settling velocity.	84 hours required; 302 hours available
Pond Surface Area at V_{min}	Calculated from stage-storage curve and compared against minimum pond surface area for settling	6,100 m ² required; 61,400 m ² available

Notes: m=metre; m²=square metre; m³=cubic metres; m³/s=cubic metres per second; masl=metres above sea level

1.22.3 Geotechnical Stability

Table 1.22-3 provides the management and control ponds embankment design parameters that were used for subsequent stability analysis.

Table 1.22-3: Management and Control Pond Embankment Design Parameters

Parameter	NMP	EMP	WMP	TCP
Dam Crest Elevation (masl)	830.0	852.0	852.0	800
Dam Width at Completion (m)	20	20	20	20
Dam Slopes	Upstream is 2.5H to 1V Downstream is 3.0H to 1V	Upstream is 2.5H to 1V Downstream is 3.0H to 1V	Upstream is 2.5H to 1V Downstream is 3.0H to 1V	Upstream is 2.5H to 1V Downstream is 3.0H to 1V
Buttress Elevation (masl)	812.0	820.0	830.0	792.0
Buttress Width as Completion (m)	25	25	25	0
Buttress Slope	Upstream is tied into dam Downstream slope is 5.5H to 1V	Upstream is tied into dam Downstream slope is 5.5H to 1V	Upstream is tied into dam Downstream slope is 5.5H to 1V	Upstream is tied into dam Downstream slope is 6.0H to 1V
Maximum Water Elevation (masl)	828.0	850.0	850.0	798.0

Notes: EMP=East Management Pond; H:V=ratio of horizontal to vertical; m=metre; masl=metres above sea level; NMP=North Management Pond; TCP=Tenas Control Pond; WMP=West Management Pond

1.22.3.1 Foundation and Material Characterisation of Management and Control Ponds

Geotechnical parameters for the foundation rock mass, foundation soil, PAG, non-PAG, and overburden materials were estimated based on the field and laboratory testing programs completed in 2018 and 2019 and 2021 which are provide in **Appendix 1.0-H; SRK, Field Reports for 2018, 2019, and 2021 and Piteau Engineering Geology and Geotechnical Assessment, Tenas Pit and Waste Dumps**. Where

no information was available, the strength parameters were inferred from SRK (2019b) and by application of engineering judgement. The same materials make up the foundation of the embankments for the management and control ponds.

1.22.3.2 Foundation Materials

The following provides a brief description of the materials that are envisioned to make up the foundation of the management and control ponds based on the field work completed.

1.22.3.2.1 Foundation Bedrock

Field and laboratory testing results presented previously in 1.11 show that rock mass is of good quality (based on the Rock Mass Rating (RMR) 89) and in **Appendix 1.0-G SRK, Tenas Project Open Pit Stability and Slope Design Reports**. Since the geotechnical strength of the bedrock is much higher than the strength of the foundation soils, the rock mass was considered to be an infinite strength material during the stability assessment.

1.22.3.2.2 Foundation Soils

Foundation soils are composed by alternate layers of clay and sand while some gravel lenses from 0.5 to 3 m thick were found between these layers (SRK 2018, SRK 2019a). Unit weights for low plastic clay (CL), high plastic clay (CH), and sand layers (mainly clayey sands – SC) were adopted based on soil classification guidelines and SRK's experience with similar materials and summarized in (**Table 1.22-4**).

The critical effective internal friction angle for CL of 27 degrees, and CH of 20 degrees materials were adopted from direct shear tests based on the following;

- ▶ an average value was adopted for CL; and
- ▶ lower bound value was conservatively adopted for CH due to the limited testing and uncertainty about this material.

For the sand (SC) material layers, a typical value of effective internal friction angle (ϕ) = 30 degrees was considered. The effective cohesion (c') adopted were equal to 0 kPa since no evidence of cementation was observed during the field and laboratory testing programs.

Table 1.22-4: Foundation Soils - Geotechnical Strength Parameters

Foundation Material	Unit weight [kN/m ³]	c' [kPa]	ϕ [°]
CH	18	0	20
CL	18	0	27
SC	20	0	30

Notes: c' =effective cohesion; ϕ =effective internal friction angle; °=degree; CH= high plastic clay; CL= low plastic clay; kN/m³=kilo newton per cubic metre; SC=clayey sands

1.22.3.3 Mine and Construction Materials Characterisation

Expected material geotechnical parameters that might used for the construction of the management ponds geotechnical strength parameters were obtained from SRK (2019b) and considered:

- ▶ The dam and buttress will be constructed with the foundation soil materials, with the appropriate compaction requirements;
- ▶ A soil-bentonite liner will be constructed on bottom of the management ponds by diskings bentonite into the surficial soil. The geotechnical strength parameters of the liner were conservatively adopted equal to those of the CH layer. More detail of the liner system is presented in **1.23.3.4**; and
- ▶ PAG and non-PAG materials are mine rock and only the non-PAG materials will be used in the embankments while PAG materials will make up all the material being placed underwater within the management ponds.

The geotechnical parameters for mine and construction materials are presented in **Table 1.22-5**.

Table 1.22-5: Mine and Construction Materials Geotechnical Parameters

Material	γ [kN/m ³]	c' [kPa]	ϕ [°]
Dam	20.5	0	30
Buttress	20.5	0	30
PAG	23	0	35
Non-PAG	23	0	35
Liner	18	0	20

Notes: c' = effective cohesion; ϕ = effective internal friction angle; ° = degree; kN/m³ = kilo newton per cubic metre; kPa = kilopascal; PAG = potentially acid generating; γ : unit weight

1.22.3.4 Management and Control Pond Embankments Design Criteria

The recommended geotechnical acceptance criteria is based on levels of confidence in the understanding of site conditions and material parameters and the consequences of instability in accordance with the CDA, as presented in **Table 1.22-6** below.

Table 1.22-6: Stability Design Criteria (Canadian Dam Association [CDA])

Possible Consequence	Data Confidence ¹	Static Analysis		Pseudo-Static Analyses
		Minimum FOS	Maximum POF	Minimum FOS
Low	Low	1.3 – 1.4	10 – 15%	1.05 – 1.1
	Moderate	1.2 – 1.3	15 – 25%	1.0 – 1.05
	High	1.1 – 1.2	25 – 40%	1.0
Moderate	Low	1.4 – 1.5	2.5 – 5%	1.1 – 1.15
	Moderate	1.3 – 1.4	5 – 10%	1.05 – 1.1
	High	1.2 – 1.3	10 – 15%	1.0 – 1.15
High	Low	>1.5	<1%	1.15
	Moderate	1.4 – 1.5	1 – 2.5%	1.1 – 1.15
	High	1.3 – 1.4	2.5 – 5%	1.05 – 1.1

Notes: FOS = factor of safety; POF = Probability of Failure

¹ Data confidence in embankment material and foundation shear strength parameters.

The stability assessment was performed following CDA (2014) guidelines and suggested acceptance criteria, presented in **Table 1.22-7** and **Table 1.22-8**, and TCL's internal requirements:

- ▶ during or at the end of construction (steady state static loading condition): FOS >1.50 which is a requirement above CDA requirement of 1.3 (CDA 2014);
- ▶ long-term drained (steady state static loading condition): FOS >1.60 (TCL's internal requirement which is greater than the FOS >1.50 (CDA 2014) required by CDA; and
- ▶ pseudo-static condition: FOS >1.0 (CDA 2014).

Given that materials used for embankment construction will be compacted and that the foundation material will be over-consolidated even for the expected loads, potential for softening under seismic loading, or strength reduction under undrained loads is not expected and has not been considered for these materials in the stability assessment. This assumption should be confirmed during subsequent engineering stages.

For the pseudo-static condition, a horizontal seismic acceleration was adopted from the 2015 National Building Code of Canada (NRCAN 2019) based on local site classification, Site Class C.

Table 1.22-7: Target Factor of Safety (FOS) for Slope Stability in Construction, Operation, and Transition Phases - Static Assessment

Loading Condition	Minimum FOS	Slope
During or at End of Construction Phase	1.50	Typically, downstream
Long Term (steady state seepage, normal reservoir level)	1.60	Downstream
Full or Partial Rapid Drawdown	1.20 to 1.30	Upstream slope where applicable

Source: Canadian Dam Association (CDA) 2014

Notes: >=greater than; FOS= Factor of Safety

Table 1.22-8: Target Factor of Safety (FOS) for Stability in Construction, Operation, and Transition Phases - Seismic Assessment

Loading Condition	Minimum FOS
Pseudo-static	1.0
Post-earthquake	1.2

Source: Canadian Dam Association (CDA) 2014

Notes: FOS=Factor of Safety

1.22.3.5 Management and Control Pond Embankments Stability Assessment

1.22.3.5.1 Two-dimensional (2D) Stability Assessment

SRK completed an integrated stability analysis for the management and control pond embankment structures which is provided in **Appendix 1.0-L SRK, Tenas Project Management and Control Pond Stability Assessment Report** attached. Eleven (11) cross-sections were defined for 2D limit equilibrium

analysis. The cross-section locations were selected to account for the different foundation soil conditions and different ponds' geometric configurations. Based on the results of the previous field and laboratory testing campaigns, two (2) potentially weaker zones were identified under the East Management Pond and West Management Pond:

- ▶ Zone 1 (under East Management Pond): at 15-20 m depth, samples with lower Standard Penetration Test (SPT) values, higher plasticity and lower direct shear test strength values were founded. This potentially weaker layer is underlined by a more competent material, which may encourage a possible failure along the interface between both materials; and
- ▶ Zone 2 (under West Management Pond): SPT values are low, lower direct shear value results and undefined area.

SRK included a drainage layer (composed of non-PAG material) at the toe of the buttresses of the facilities to prevent the development of pore pressures at the toe of the embankments. **Table 1.22-9** presents the main material characteristics of each management pond and control pond facility.

SRK also considers that, since the dam material is a low plasticity clay, for closure conditions a downstream erosion protection layer should be placed to protect the dam material in the long-term. **Figure 1.22-1** presents the plan locations of the cross-sections used for stability analysis and the location of potential weaker zone materials.

Table 1.22-9 also provides the legend for **Figure 1.22-2** to **Figure 1.22-14** which are the stability sections that SRK used to evaluate the management and control ponds for this Project.

Table 1.22-9: Material Characteristics

Material	Failure Criterion	Color	γ [kN/m ³]	c' [kPa]	ϕ'_{cv} [°]	k_h [m/s]	k_v/k_h
Dam	Mohr Coulomb		20.5	0	30	1x10-07	1
Buttress	Mohr Coulomb		20.5	0	30	1x10-07	1
Non-PAG	Mohr Coulomb		23	0	35	1x10-05	1
PAG	Mohr Coulomb		23	0	35	1x10-05	1
Liner	Mohr Coulomb		18	0	20	1x10-10	1
CH	Mohr Coulomb		18	0	20	3x10-06	1
CL	Mohr Coulomb		18	0	27	3x10-06	1
Loose Silt	Mohr Coulomb		18	0	25	3x10-06	1
Sand	Mohr Coulomb		20	0	30	3x10-05	1
Bedrock	Infinite Strength		25.5	Infinite Strength		3x10-07	1

Notes: γ =unit weight; c' =effective cohesion; ϕ'_{cv} =effective internal friction angle; k_h =horizontal permeability coefficient; k_v/k_h =vertical permeability coefficient; CH=Inorganic clays of high plasticity; CL=Inorganic clays of low plasticity







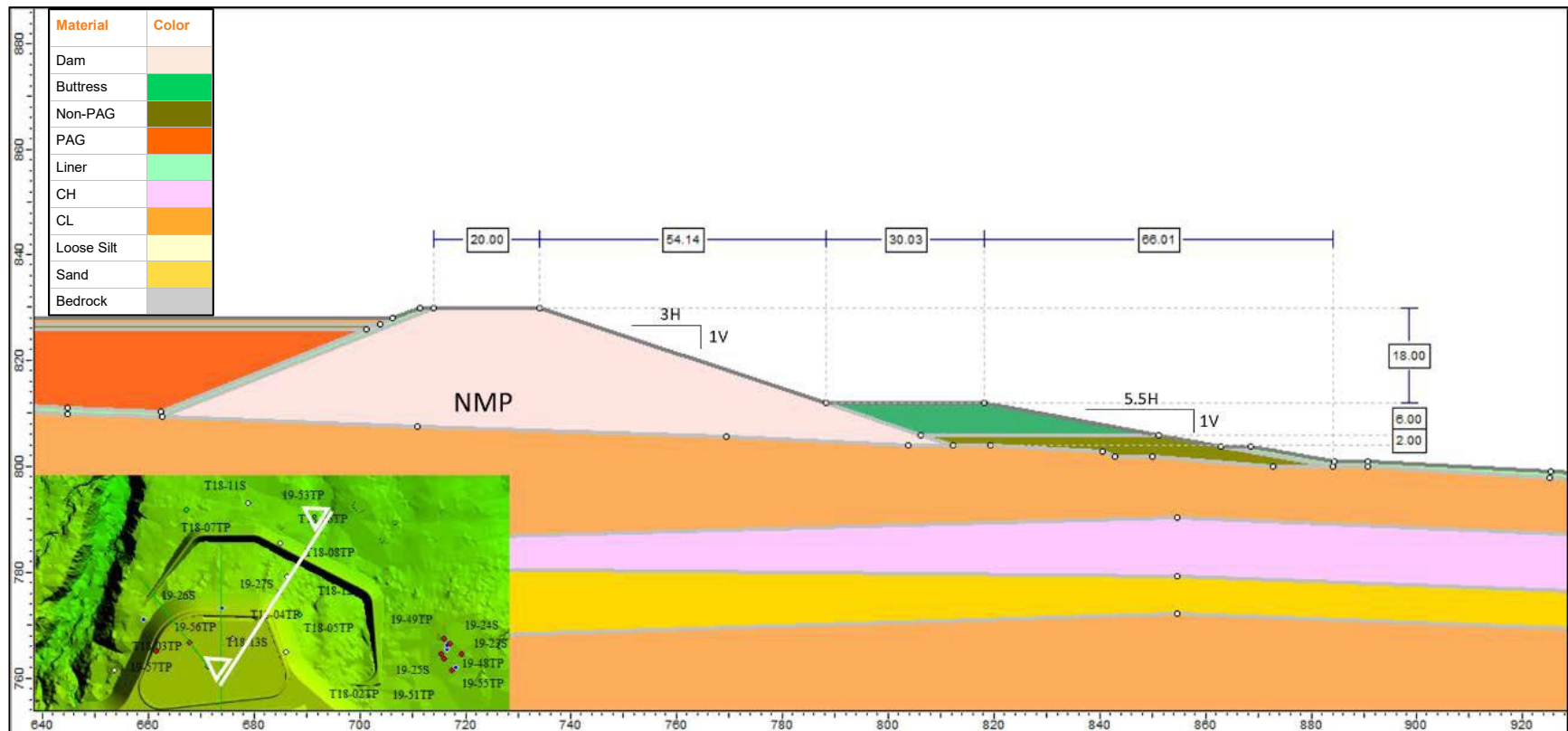


Figure 1.22-4: TCP & NMP-01 (NMP) Stability Cross Section - geometric configuration

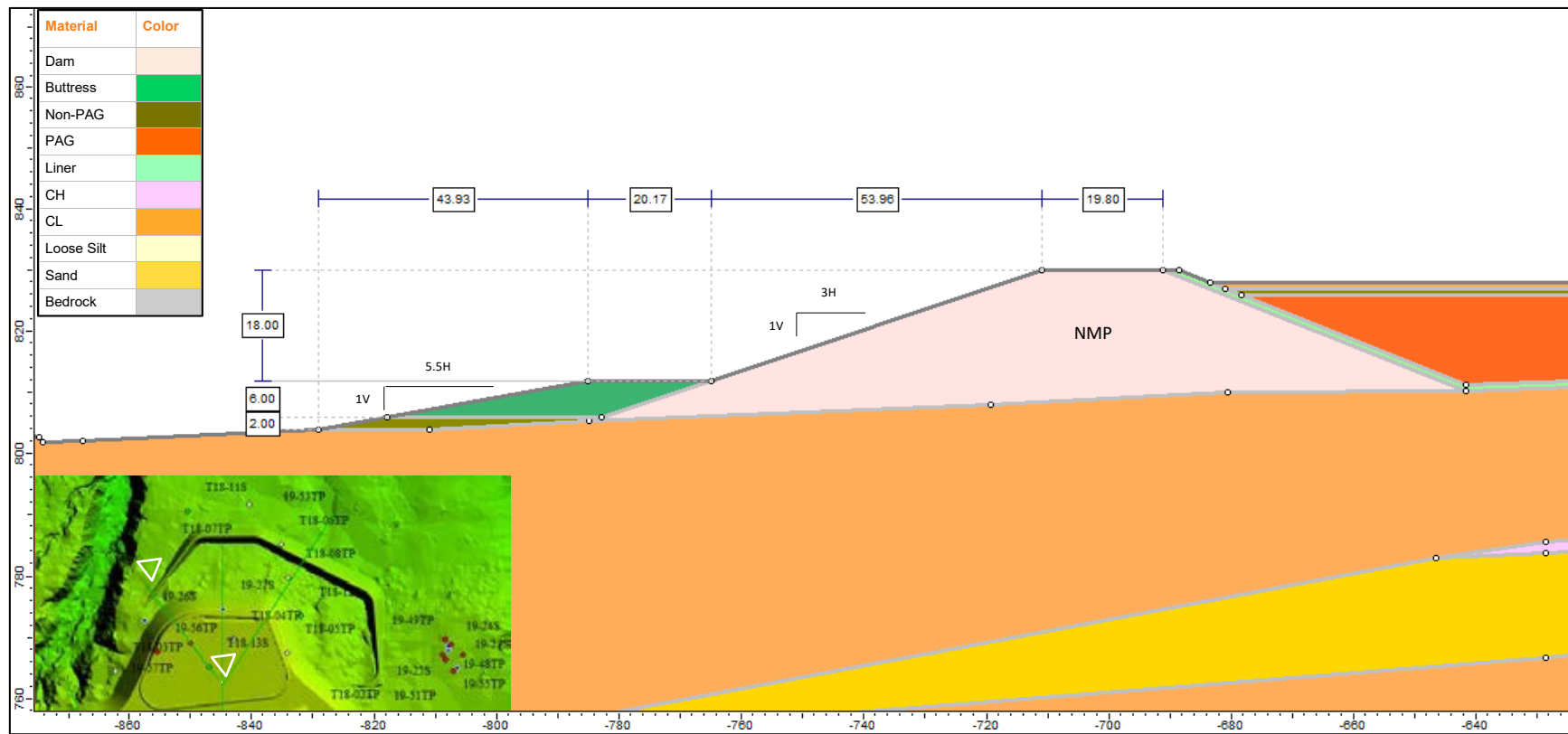


Figure 1.22-5: NMP-01 Stability Cross Section - geometric configuration



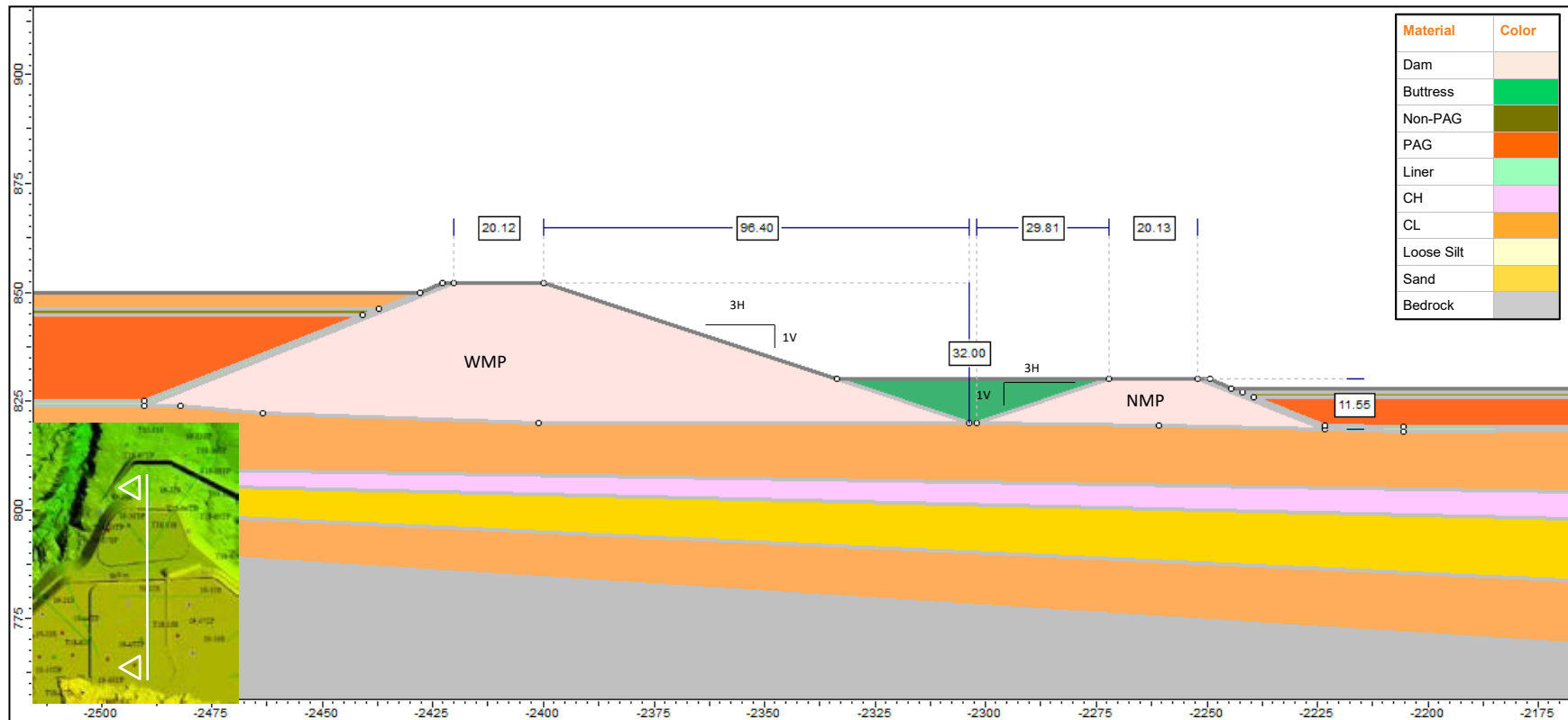


Figure 1.22-7: NMP & WMP-01 (WMP) Stability Cross Section - geometric configuration

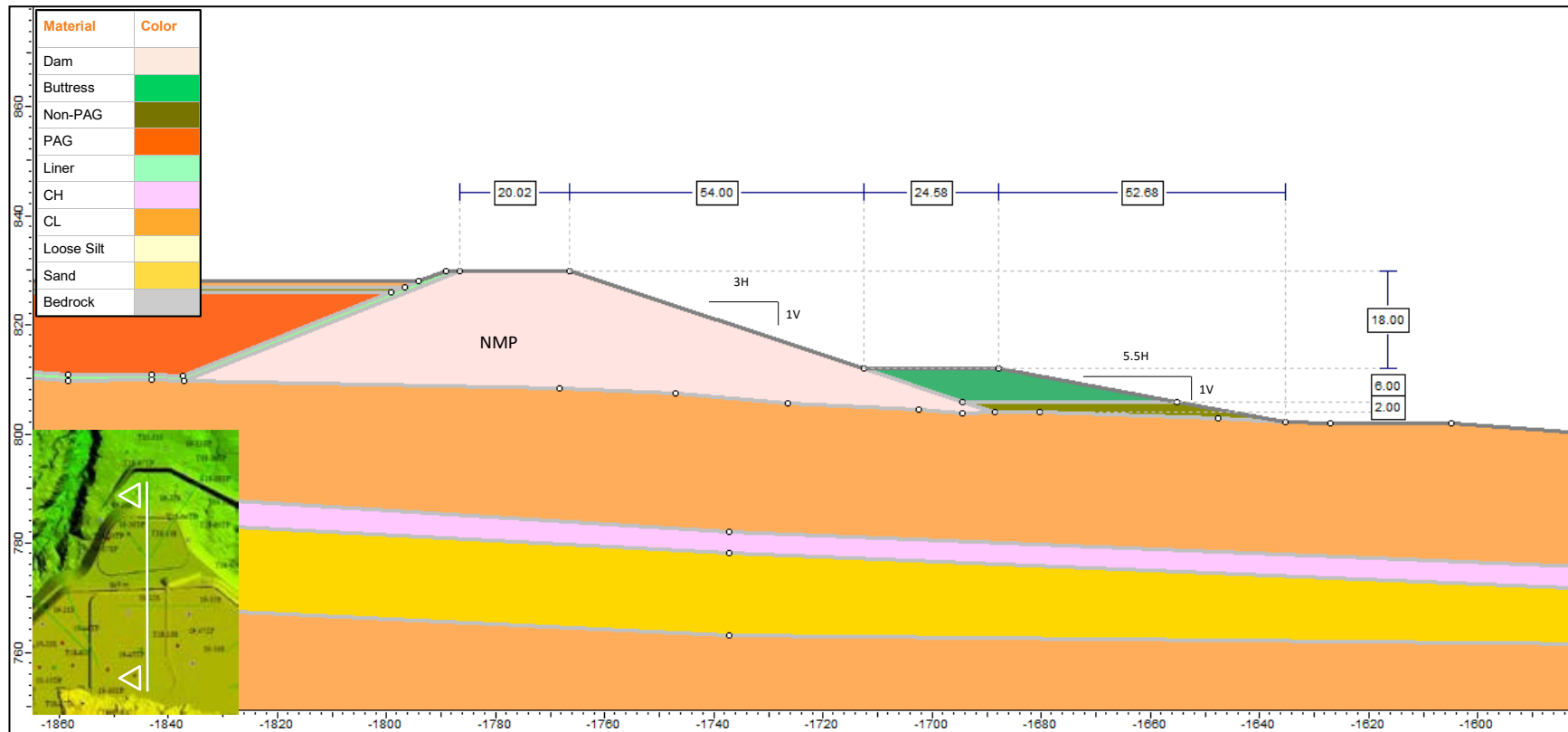


Figure 1.22-8: NMP & WMP (NMP) Stability Cross Section - geometric configuration

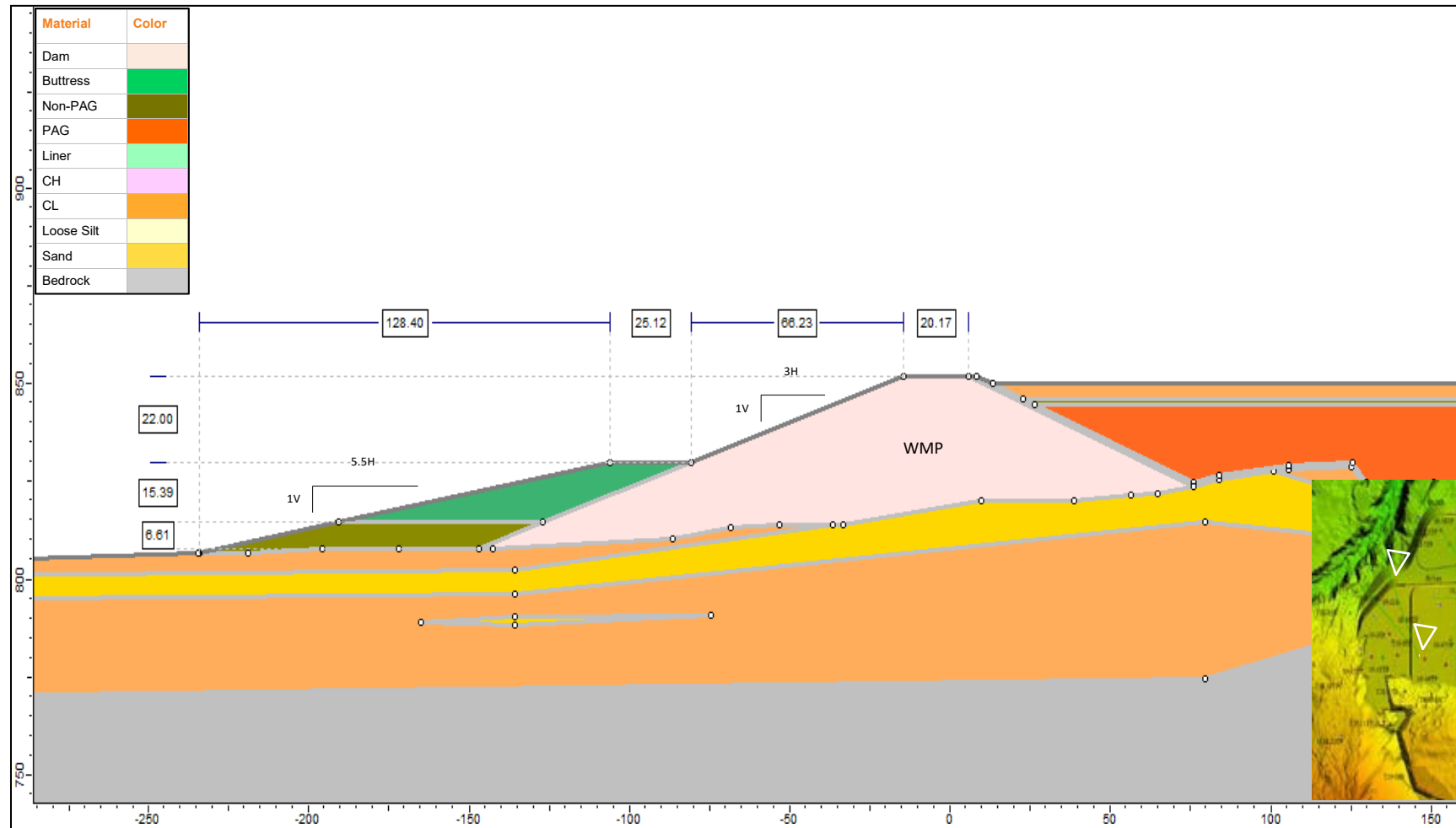


Figure 1.22-9: WMP-01 Stability Cross Section - geometric configuration

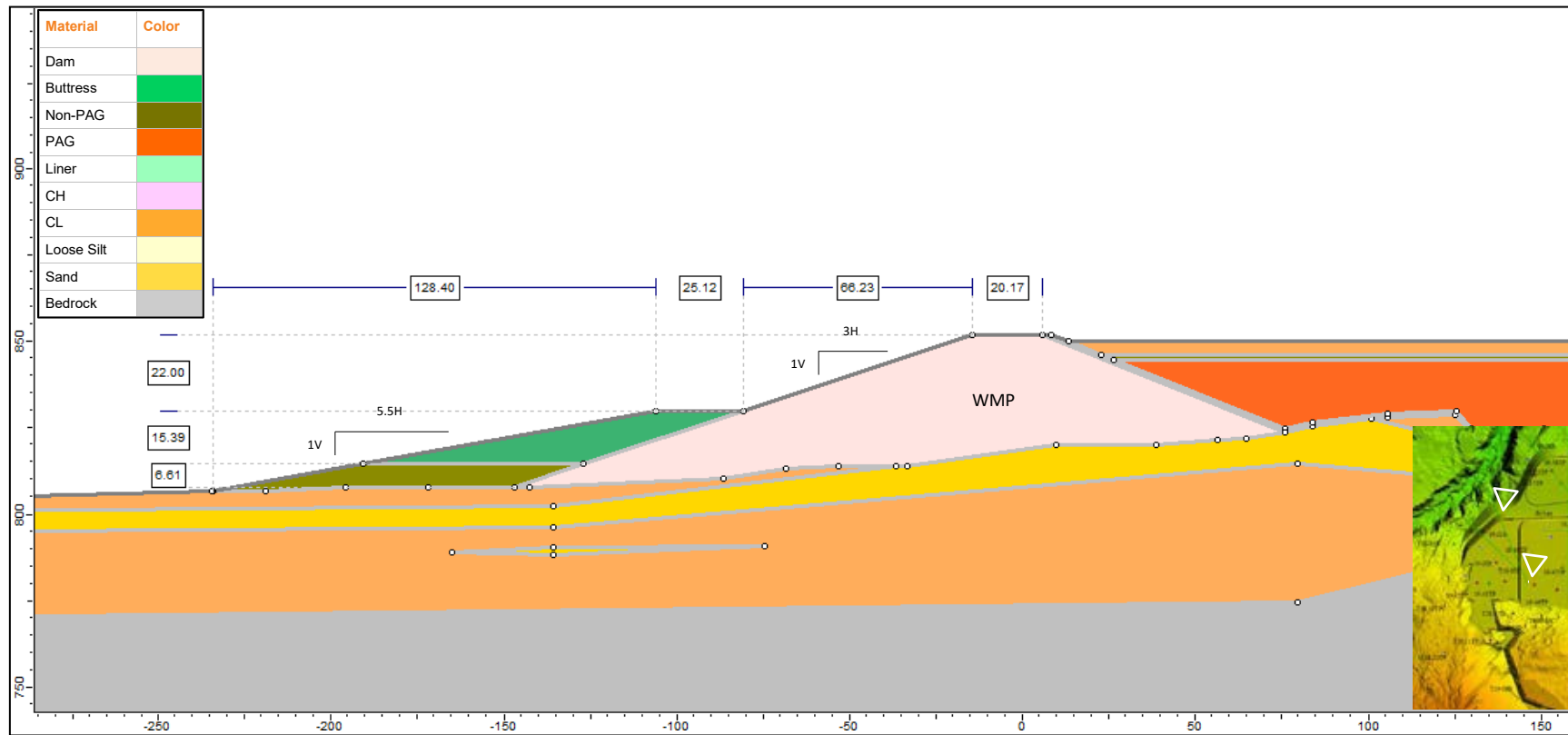


Figure 1.22-10: WMP-02 Stability Cross Section - geometric configuration

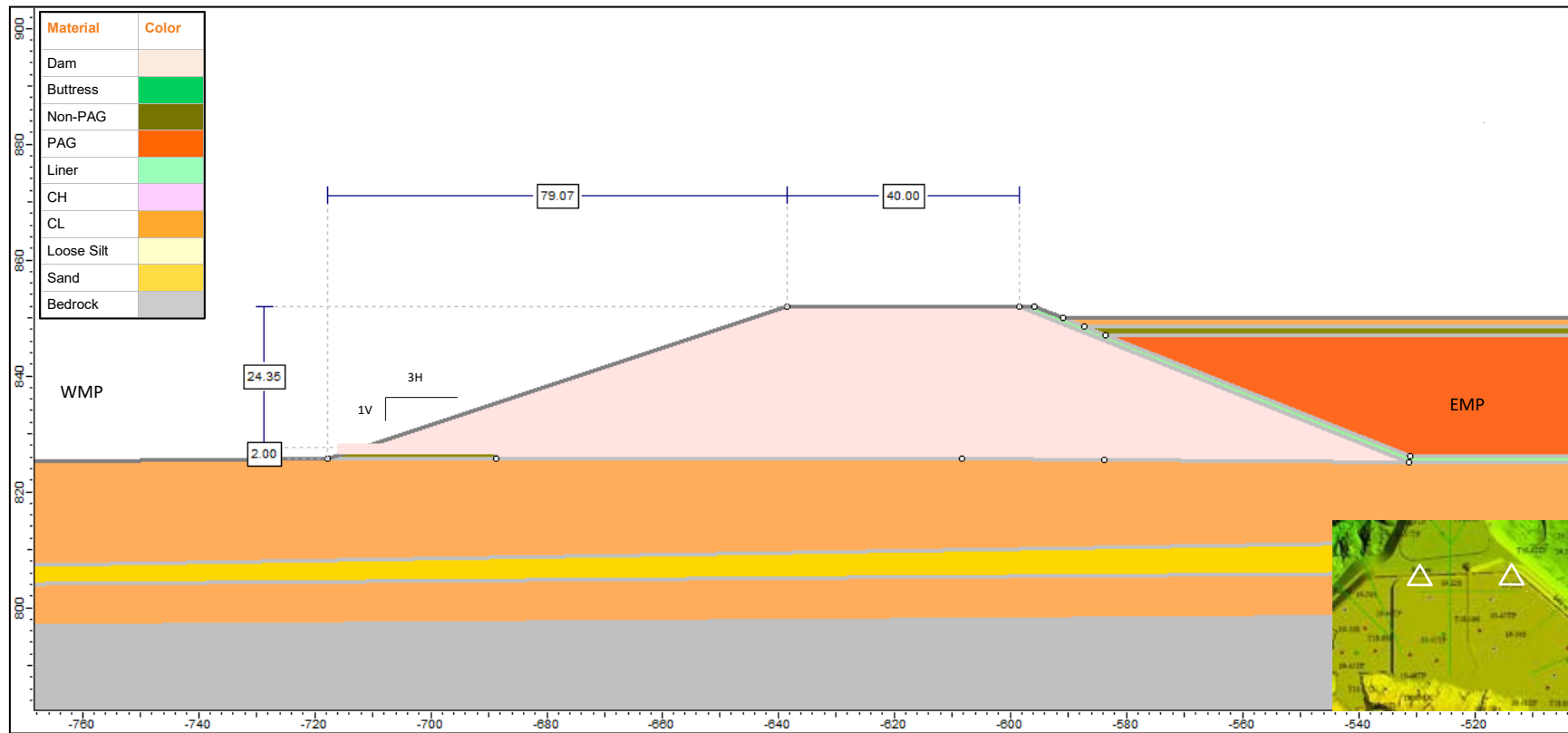


Figure 1.22-11: EMP & WMP-01 Stability Cross Section - geometric configuration

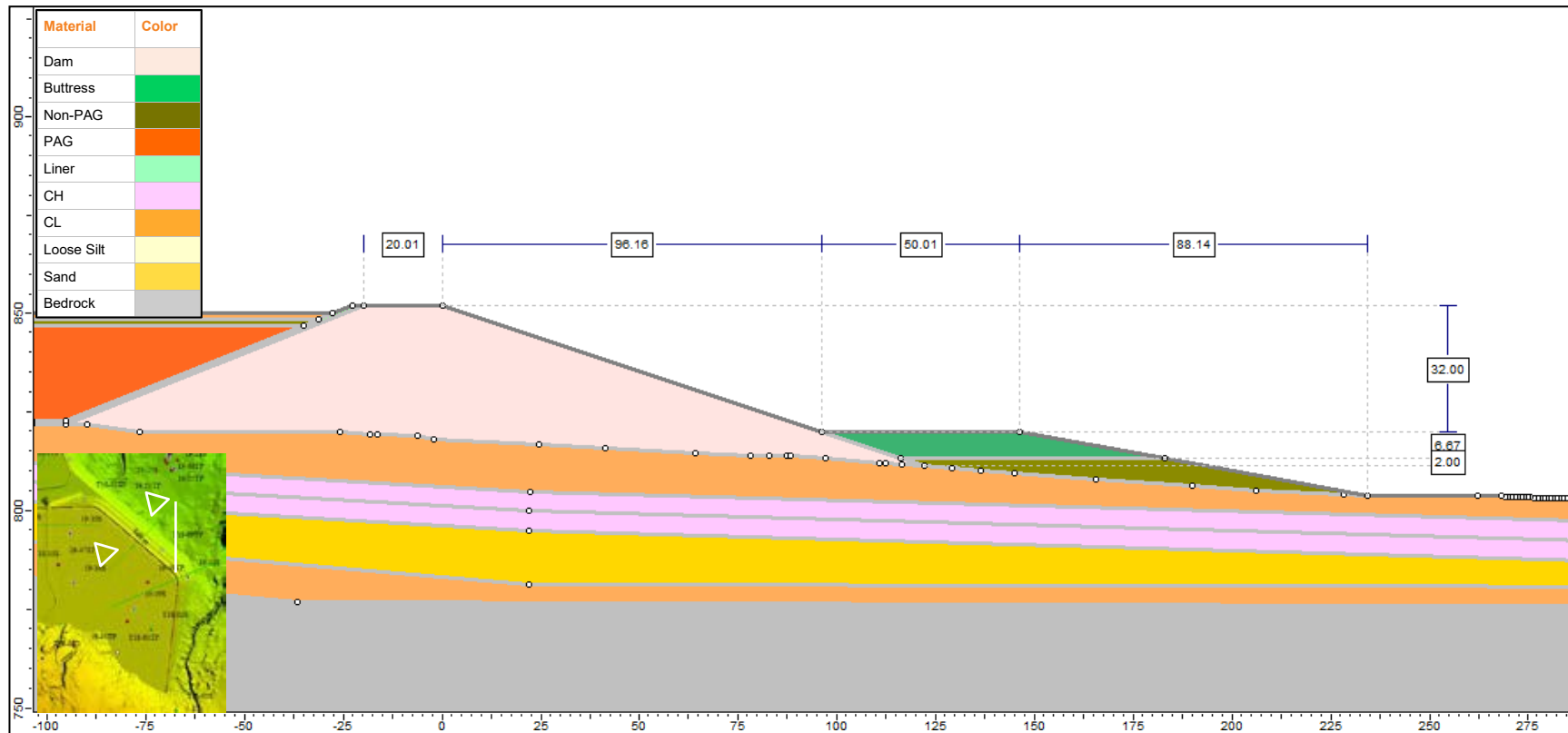
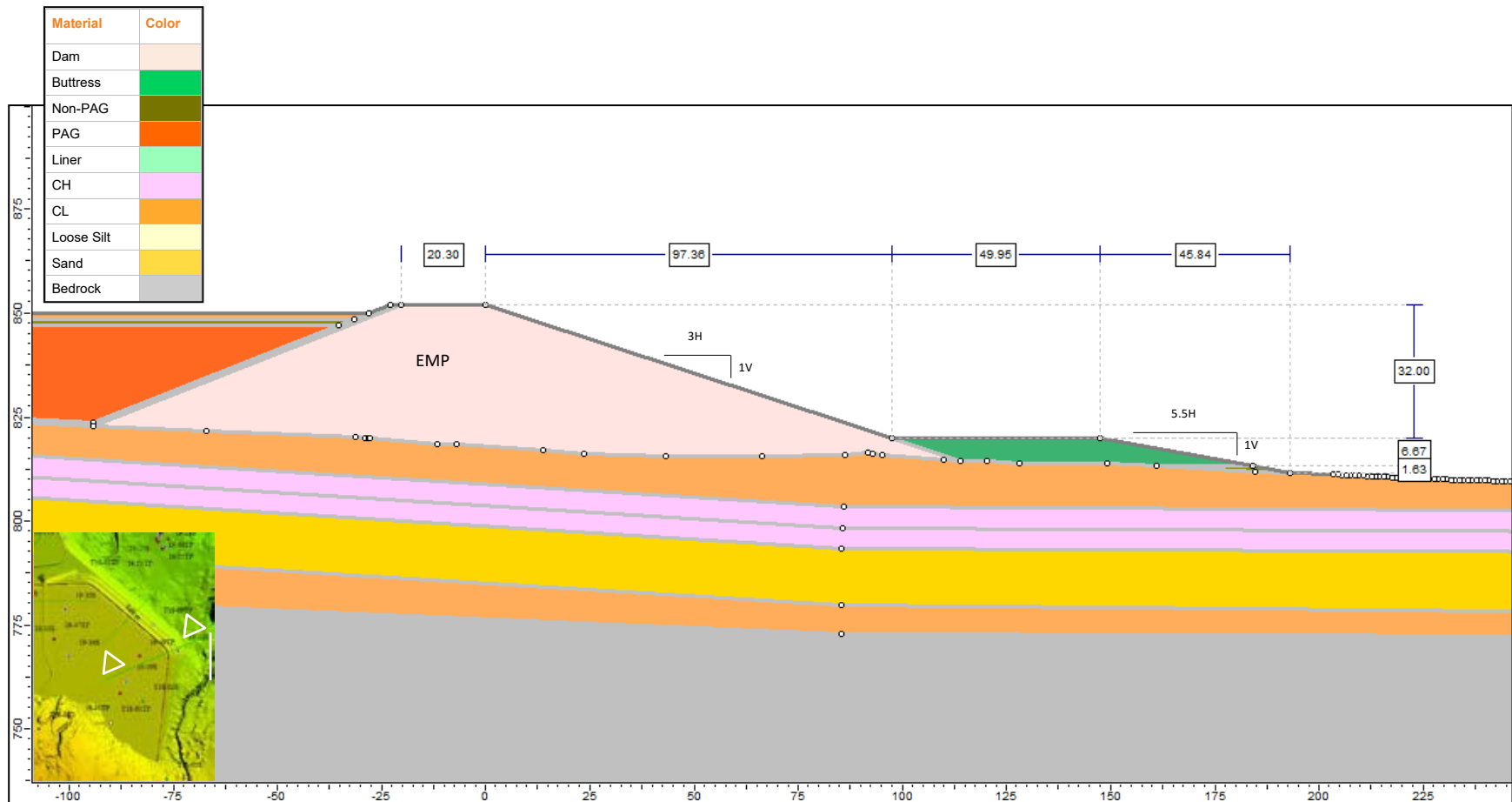


Figure 1.22-12: EMP-01 Stability Cross Section - geometric configuration



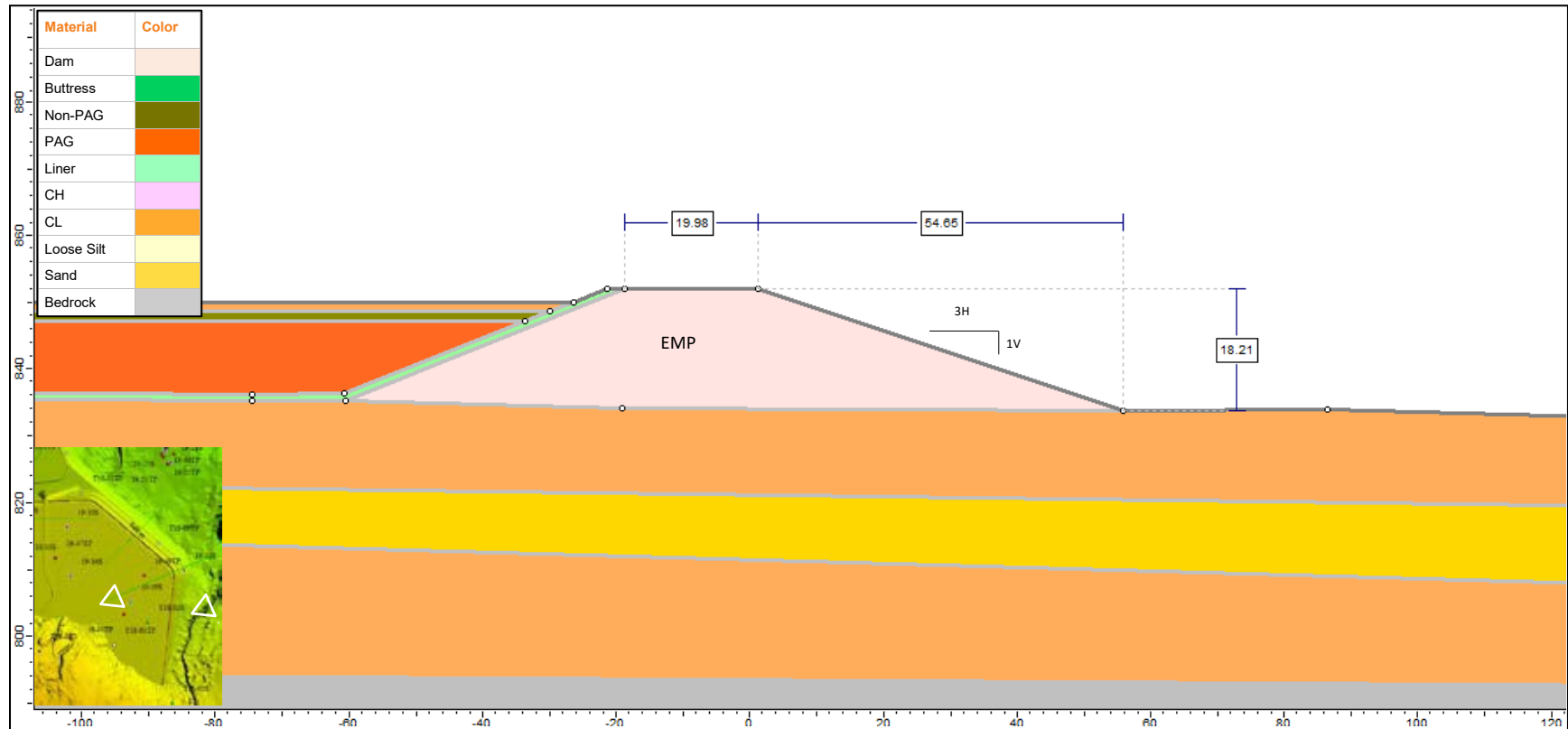


Figure 1.22-14: EMP-03 Stability Cross Section - geometric configuration