BC EAO EAC Application – Tenas Project

Section 9.0 Accidents and Malfunctions

May 2022

VERSION 1.0

Submitted to:	BC Environmental Assessment Office
Pursuant to:	*Environmental Assessment Act*, S.B.C. 2002, c.43
Submitted by:	Telkwa Coal Limited Suite 1410 – 409 Granville Street Vancouver, BC V6C 1T2

Tenas Project

Section 9.0 Accidents and Malfunctions

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Abbreviations and Acronyms

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
3D	three-dimensional
AIR	Application Information Requirements
ANFO	ammonium nitrate and fuel oil
AP	acid potential
AQMP	Air Quality Management Plan (S13.0-C2)
ARD	acid rock drainage
BAT	Best Achievable Technology
BC	British Columbia
BC EAO	British Columbia Environmental Assessment Office
BC MECCS	British Columbia Ministry of Environment and Climate Change Strategy
BC MEMLI	British Columbia Ministry of Energy, Mines and Low Carbon Innovation
BC MEMPR	British Columbia Ministry of Energy, Mines and Petroleum Resources
BC MOE	British Columbia Ministry of Environment
BC MOF	British Columbia Ministry of Forests
BC MOTI	British Columbia Ministry of Transportation and Infrastructure
BMPs	best management practices
C	Chapter
CDC	Centre for Disease Control and Prevention
CEMP	Construction Environmental Management Plan (S13.0-C4)
CPP	Coal Processing Plant
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CEPA	*Canadian Environmental Protection Act,* SC 1999 c. 33
CMSTHP	Chemicals and Materials, Storage, Transfer, and Handling Plan (S13.0-C3)
CNR	Canadian National Railway
Code	Health, Safety and Reclamation Code in British Columbia (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI 2021])
DFO	Department of Fisheries and Oceans Canada
DMP	Discharge Management Plan (S13.0-C5)
EAC	Environmental Assessment Certificate
ECCC	Environment and Climate Change Canada
EICS	Emergency Incident Command System
EMA	*Environmental Management Act,* B.C. 2003, c. 53 (Government of British Columbia [GovBC] 2003])

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
ERT	Emergency Response Team
EMBC	Emergency Management British Columbia
EMP	Explosives Management Plan (S13.0-C6)
EMS	Environmental Management System (S13.0-C1)
FEL	front-end loaders
FMSCP	Fuel Management and Spill Control Plan (S13.0-C7)
FOS	Factor of Safety
GPS	Global Positioning System
GovBC	Government of British Columbia
GovCan	Government of Canada
IOGP	International Association of Oil and Gas Producers
H:V	slope ratio horizontal to vertical
HRMP	Heritage Resources Management Plan (S13.0-C8)
LSA	Local Study Area
MERP	Mine Emergency Response Plan (S13.0-C9)
MIBC	methyl isobutyl carbinol
MIC	Mine Infrastructure Complex
ML	metal leaching
ML/ARDMP	Metal Leaching (ML)/Acid Rock Drainage (ARD) Management Plan (S13.0-C12)
MTCP	Minesite Traffic Control Plan (S13.0-C10)
MWMP	Minesite Water Management Plan (S13.0-C11)
NOAA	National Oceanic and Atmospheric Administration
NP	neutralization potential
NPR	Neutralization Potential Ratio
NRCAN	Natural Resources Canada
NRCC	National Research Council of Canada
OHSP	Occupational Health and Safety Program (S13.0-C13)
Orica	Orica Canada Inc
PAG	potentially acid generating
PAMP	Public Access Management Plan (S13.0-C14)
PEP	Provincial Emergency Program
PM	particulate matter
PMF	Probable Maximum Flood
Project	Tenas Project
RCP	Reclamation and Closure Plan (S13.0-C15)
RDBN	Regional District of Bulkley-Nechako

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
ROW	right-of-way
RSA	Regional Study Area
S	Section
SC	spontaneous combustion
SEMP	Socio-economic Management Plan (S13.0-C16)
SEPSCP	Surface Erosion Prevention and Sediment Control Plan (S13.0-C17)
SOPs	Standard Operating Practices
SPPs	Standard Practices and Procedures
TAC	Tenas Access Corridor
TCL	Telkwa Coal Limited
TDG	Transportation of Dangerous Goods
TSS	total suspended solids
UN	United Nations
USBR	United States Bureau of Reclamation
US EPA	United States Environmental Protection Agency
VAC	Volts Alternating Current
VC	Valued Component
VDC	Volts Direct Current
VMP	Vegetation Management Plan (S13.0-C18)
VOCs	volatile organic compounds
VRMP	Visual Resources Management Plan (S13.0-C19)
WHMIS	Workplace Hazardous Materials Information System
WMPRE	Waste Management Plan for Refuse and Emissions (S13.0-C20)
WMP	Wildlife Management Plan (S13.0-C21)

Units of Measure

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
%	percent
kg	kilogram
km	kilometre
km/hour	kilometres per hour
kV	kilovolt
kW	kilowatt
L	litre

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
L/day	litres per day
m	metre
m^3	cubic metres
MBCM	million bank cubic metres
MW	megawatt
V	volt

EXECUTIVE SUMMARY

Telkwa Coal Limited's (TCL) goal for the Tenas Project (Project) is to reduce the Likelihood of accidents and malfunctions and the associated Consequence that might impact people and the environment. TCL will develop training and education programs to facilitate a culture of risk awareness designed to prevent accidents and malfunctions. Emergency preparedness and other management plans will be maintained, and adaptive management approaches employed to continuously assess risks, and update management plans and training associated with the Project.

A risk assessment for accident and malfunction scenarios was completed, employing a risk analysis methodology based on the Likelihood and Consequences of the accident or malfunction. The assessment considers the engineering controls incorporated into the Project design, and implementation of the emergency response plans and clean-up and restoration in contingency plans. The assessment is a conservative approach in that the most severe Consequence to potentially affected Valued Component (VCs) is used to determine the risk. Consequences from events that could result in fatalities and injuries (e.g., Human Health VC) generally presented the worst-case scenario and resulted in the highest risk ratings. The release of materials into water or on land affected VCs including Terrain and Soils, Surface Water, Groundwater, and in turn biophysical VCs for Aquatic Resources, Fish and Fish Habitat, Wildlife, and Avian Species. Events that resulted in temporary closure of the Minesite resulted in effects to the Economic Development VC.

None of the risks after mitigations and design requirements fell into the high, very high or critical risk categories. **Table E-1** below summarizes the results of the risk assessment performed for the scenarios selected.

Table E-1: Summary of Risk Assessment for Scenarios

Scenario	Likelihood	Consequence (Worst Case with Mitigation)	Risk Assessment
Containment Failure of the Management Ponds	Rare	Severe	Medium
Inability to Maintain Water Cover for Management Ponds	Rare	Negligible to Minor	Negligible
Misidentification and/or Misplacement of Potentially Acid Generating (PAG)	Unlikely	Minor	Low
Hazardous Material Spills in Water Hydrocarbon Spill in Water Non-hydrocarbon Spill in Water	Rare	Moderate	Low
Hazardous Material Spills On Land Hydrocarbon Spill on Land Non-hydrocarbon Spill on Land	Rare	Moderate	Low
Sediment Release into Water	Rare	Major	Low
Motor Vehicle Accident	Unlikely	Severe	Medium
Rail Accident	Rare	Severe	Medium
Earthworks Failure	Rare	Severe	Medium
Power Failure	Unlikely	Negligible	Very Low
Fires or Explosions	Unlikely	Severe	Medium

1. Introduction

This section of the Environmental Assessment Certificate (EAC) Application evaluates the potential effects of a Tenas Project (Project)-related accident (unexpected occurrence or unintended action) or malfunction (failure of a piece of equipment, a device, or a system to function normally), which may be associated with an adverse effect to a Project Valued Component (VC). Accidents and malfunctions may occur during any phase of the Project.

Telkwa Coal Limited's (TCL) goal is to reduce the Likelihood of accidents and malfunctions and the associated Consequences that might impact people and the environment. TCL will develop training and education programs to facilitate a culture of risk awareness designed to prevent accidents and malfunctions. Emergency preparedness and other management plans will be maintained, and adaptive management approaches will be employed to continuously assess risks, and update management plans and training associated with the Project.

The main objective of this section is to assess potential effects that may result from identified Project-related accidents and malfunctions. This section also identifies operational procedures and management measures to be implemented, including:

- procedures that will reduce or eliminate the Likelihood of accidents and malfunctions;
- initial response measures following an accident or malfunction; and
- processes to remediate and restore the environment to a pre-incident state, including follow-up and monitoring programs.

2. Scope

This section of the EAC Application addresses the accidents and malfunctions that would be associated with the Construction, Operation, Decommissioning and Reclamation, and Post-closure phases of the Project that could potentially result in effects to VCs. The Project's Application Information Requirements (AIR) (British Columbia Environmental Assessment Office [BC EAO] 2022) state the EAC Application will include the following:

- identification of potential accidents and malfunctions;
- the overall methodology for assessing the potential risk of an event (Likelihood and Consequence);
- definitions of each category of Likelihood;
- definitions for each category of Consequence;
- an assessment of the Likelihood of the event occurring, based on historical trends and predictive models;
- identification of proposed measures to reduce the Likelihood of the event;
- assessment of Consequence of the event, in a manner consistent with the direct effects assessment;
- identification of measures to mitigate the Consequence to VCs; and
- conclusions on the potential risk (Likelihood multiplied by Consequence) of the accident or malfunction.

3. MANAGEMENT PLANS

The prevention of accidents and malfunctions associated with industrial activities is a focus of the current regulatory regime for the mining sector in British Columbia (BC) and Canada. The Project will be developed and operated in accordance with the *Mines Act*, RSBC 1996, c 293 (Government of British Columbia [GovBC] 1996) and associated Heath, Safety and Reclamation Code for Mines in British Columbia (British Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI 2021]) (Code). The *Mines Act*, RSBC 1996, c 293 (GovBC 1996) provides guidance and approvals for stages of mine development, from exploration through to construction, operation, decommissioning and reclamation, and closure. It also requires that the stability of stream, river, wetland, and seepage area crossings and the stability of engineered structures (e.g., embankments, piles, slopes) are planned, then inspected, monitored and maintained throughout the Construction, Operations, Decommissioning and Reclamation, and Post-closure phases of the Project.

Provincial legislation and guidance for prevention planning, emergency response, and recovery planning has been incorporated into Telkwa Coal Limited (TCL) management plans (**Section (S) 13.0** of the **EAC Application**). Legislation and available guidelines are summarized in **Table 3-1**.

Table 3-1: Legislation, Regulations, and Guidelines

Legislation, Regulations and Guidelines	Applicable Information
Mines Act. RSBC 1996 c. 293. (Government of British Columbia [GovBC] 1996)	Regulates mines through the Code
Health Safety and Reclamation Code for Mines in British Columbia (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI] 2021) (Code)	Compliance with the Code Part 3, 3.7.1 requires a Mine Emergency Response Plan.
Bill 6 - 2020: *Mines Amendment Act*, 2020 – first reading	Will if passed, establish an auditing unit which is currently auditing the Code requirements for tailings storage facilities.
Environmental Management Act, SBC 2003, c. 53 (GovBC 2003) (*EMA*), Spill Preparedness, Response and Recovery Regulation, BC Reg 185/2017 (GovBC 2017), Spill Contingency Planning Regulation, BC Reg. 63/88 (GovBC 1988), Hazardous Waste Regulation, BC Reg. 63/88 (GovBC 1988)	The *EMA* sets out requirements for disposal of oil and hazardous materials, spill prevention and reporting, and pollution abatement. Authority for provincial spill cost recovery is additionally provided by the *EMA*. Regulations may be applied to a reportable hydraulic or chemical spill, any spill in water, industrial accident, or environmental emergency.
Spill Reporting Regulations, BC Reg 187/2017. (GovBC 2017)	Provides requirements for reporting to Emergency Management British Columbia (EMBC) formerly known as Provincial Emergency Program (PEP)
Emergency Program Act, RSBC 1996 (GovBC 1996), Emergency Program Management Regulation, BC Reg 477/94 (GovBC 1996)	Identifies the requirements for emergency plans and procedures of the Province and of government corporations.

Legislation, Regulations and Guidelines	Applicable Information
Canadian Environmental Protection Act, SC 1999 c. 33 (Government of Canada [GovCan] 1999) (*CEPA*)	Establishes requirements for pollution prevention, environmental emergency plans and spill reporting
Transportation of Dangerous Goods Act, SC 1992, c.34. (GovCan 1999)	Requires any person transporting or importing dangerous goods to prepare an emergency response assistance plan and outline what is to be done if there is an accident transporting the dangerous goods
Mine Emergency Response Plan Guidelines for the Mining Industry (British Columbia Ministry of Energy, Mines and Petroleum Resources [BC MEMPR] 2017)	Provides guidance and information on resources for the creation of an emergency response plan for operating mines.
Guidelines for Industry Emergency Response Plans (British Columbia Ministry of the Environment [BC MOE] 2002a, 2021a)	Provides guidance about spill prevention and reporting pursuant to the Hazardous Waste Regulation, BC Reg. 63/88 (GovBC 1988) and *Emergency Program Act,* RSBC 1996 (GovBC 1996).

Management plans, listed below for reference (see **S13.0** of the **EAC Application** for details), are intended to manage Project activities to prevent accidents or malfunctions. Some plans are focussed on specific incident and emergency responses. The most relevant plans are noted in the discussion for each of the assessed accidents and malfunctions.

- **Environmental Management System (S13.0-Chapter (C) 1) (EMS)**;
- **Air Quality Management Plan (S13.0-C2) (AQMP)**;
- **Chemicals and Materials, Storage, Transfer, and Handling Plan (S13.0-C3) (CMSTHP)**;
- **Construction Environmental Management Plan (S13.0-C4) (CEMP)**;
- **Discharge Management Plan (S13.0-C5) (DMP)**;
- **Explosives Management Plan (S13.0-C6) (EMP)**;
- **Fuel Management and Spill Control Plan (S13.0-C7) (FMSCP)**;
- **Heritage Resources Management Plan (S13.0-C8) (HRMP)**;
- **Mine Emergency Response Plan (S13.0-C9) (MERP)**;
- **Minesite Traffic Control Plan (S13.0-C10) (MTCP)**;
- **Minesite Water Management Plan (S13.0-C11) (MWMP)**;
- **Metal Leaching (ML)/Acid Rock Drainage (ARD) Management Plan (S13.0-C12) (ML/ARDMP)**;
- **Occupational Health and Safety Program (S13.0-C13) (OHSP)**;
- **Public Access Management Plan (S13.0-C14) (PAMP)**;
- **Reclamation and Closure Plan (S13.0-C15) (RCP)**;
- **Socio-Economic Management Plan (S13.0-C16) (SEMP)**;
- **Surface Erosion Prevention and Sediment Control Plan (S13.0-C17) (SEPSCP)**;

- **Vegetation Management Plan (S13.0-C18) (VMP)**;
- **Visual Resources Management Plan (S13.0-C19) (VRMP)**;
- **Waste Management Plan for Refuse and Emissions (S13.0-C20) (WMPRE)**; and
- **Wildlife Management Plan (S13.0-C21) (WMP).**

The **MERP**, as required by the Code, is applicable to the accidents and malfunctions discussed in this section and sets up a response system which identifies responsibilities for emergencies related to onsite events and environmental emergencies. The **MERP** follows guidance from Mine Emergency Response Plan Guidelines for the Mining Industry (British Columbia Ministry of Energy, Mines and Petroleum Resources [BC MEMPR] 2017). It includes responses for fatalities, mass casualties, fires, open pit slope or highwall failure, embankment failure and/or unplanned discharge, incidents involving explosives, vehicle incidents, and spills, as well as evacuation plans, emergency aid agreements, consultation with potentially impacted parties and development of notification policies, communication protocols and post event reporting. The response system for events includes classification of a progressively serious emergency as Level 1 Near Miss, Level 2 Incident, Level 3 Emergency, and Level 4 Major Emergency, and an emergency level decision flow chart is provided. These levels of response are briefly described below.

- **Level 1 Near Miss:** Continue to Work Safely;
- **Level 2 Incident:** Localised Action, Containment, and Rectification;
- **Level 3 Emergency:** Activate Emergency Response Team (ERT); and
- **Level 4 Major Emergency:** Mobilize Emergency Incident Command System (EICS) and ERT.

4. METHODOLOGY

A three (3)-step process was followed to assess potential Project-related accidents and malfunctions:

1. **Scenarios Identified for Assessment:** Scenarios including potential accidents, malfunctions, and unplanned events that might occur during the life of the Project were identified using historical performance data for other similar projects and professional judgment. The analysis is focused on events that may result in risks to personnel, the environment, infrastructure, and human health;
2. **Interactions between Assessed Scenarios and Receptor VCs:** The potential interactions between each event scenario and relevant VC receptors are considered. The VC receptors are the same as considered in the EAC Application, and the interaction analysis serves as a screening tool to identify predicted residual effects of the unplanned event. The interactions between each event and the VCs are analyzed to establish the potential significance and severity of the effects. Mitigation and management measures are considered within this interaction analysis; and
3. **Risk Assessment:** A risk assessment is conducted using the Likelihood and Consequence of the unplanned event in each scenario. The analysis of the effects is used to establish the Consequence associated with the event scenario and Likelihood is derived from experience with past, similar projects, literature sources, and professional judgment.

4.1 Scenarios Identified for Assessment

Accidents and malfunctions were identified by considering the specifics of the Project's design, technology, location, and infrastructure, by using historical performance data for other similar projects, by consultation with Indigenous groups and stakeholders through the development of the AIR, and by applying professional judgment and experience. The selection of the accidents and malfunctions considered the following:

- Project phase for occurrence;
- type of accident and malfunction that may occur; and
- geographic extent, frequency, duration of the potential accident and malfunction.

The assessment of the risks of accidents and malfunctions considers the following events:

- containment loss:
  - containment failure of management ponds;
  - loss of containment of potentially acid generating (PAG) material leachate;
  - hazardous material spills in water;
  - hazardous material spills on land; and
  - sediment release into water.
- transportation accidents:
  - motor vehicle accidents involving construction, operation, or transport crews; and
  - rail accidents.
- power failure;
- earthworks failure including failure or slumping of open pit wall; and
- fires or explosions.

The containment loss of leachate from PAG material has been subdivided to address leachate resulting from the loss of water cover in the management ponds and the misidentification or misplacement of PAG material. The phases and the worst-case scenario for each event are presented in **Table 4.1-1**: .

Table 4.1-1: Summary of Accidents and Malfunctions

Category	Accident/ Malfunction	Project Phase[1]				Description of Scenario
		C	O	D	P	
Containment Loss	Containment Failure of Management Ponds		X	X	X	West Management Pond fails causing a cascading failure of the downstream North Management Pond and Tenas Control Pond.
	Inability to Maintain Water Cover for Management Ponds		X			Inability to maintain 1 m of management pond water cover leading to ARD
	Misidentification and/or Misplacement of PAG	X	X			100,000 m^3 of PAG material is identified as non-PAG materials and/or 100,000 m3 of identified PAG material is not placed within a management pond
	Hazardous Material Spills in Water Hydrocarbon Spill in Water Non-hydrocarbon Spill in Water	X	X	X		Direct spill of a standard hydrocarbon truck load (50,000 L) or MIBC truck (15,000 L) (Operation Phase only) to water
	Hazardous Material Spills On Land Hydrocarbon Spill on Land Non-hydrocarbon Spill on Land	X	X	X		Spill of a standard hydrocarbon transport truck load (50,000 L) or MIBC truck (15,000 L) (Operation Phase only) on land
	Sediment Release Into Water	X	X	X		Failure of CPP Sedimentation Pond
Transportation Accidents	Motor Vehicle Accidents (involving construction, operation, or transport crews)	X	X	X		Single vehicle accident with large wildlife species (e.g., moose)
						A single or multi-vehicle accident between a Project vehicle, a passenger vehicle, or a Project employee transport vehicle
	Rail Accident		X			Derailment or collision of one (1) or more railcars at the Rail Infrastructure site
Earthworks Failure	Failure or slumping of open pit wall	X	X	X	X	Failure or slumping of an open pit wall
Power Failure	Unplanned power outages	X	X			Failure of transmission line where immediate repair is not possible
Fires or Explosions	Fires or explosions	X	X	X		Tank or truck fire at the Minesite
						Fire and/or explosion in the CPP

Category	Accident/ Malfunction	Project Phase[1]				Description of Scenario
		C	O	D	P	
						Explosive Magazine and/or Explosive Facility fire and/or potential explosions

Notes: *C, O, D, P represent Project Phases: (C)onstruction, (O)peration, (D)ecomissioning and Reclamation, (P)ost-closure ARD=acid rock drainage; CPP=Coal Processing Plant; L=litre; m=metres; m^3 =cubic metres; MIBC= methyl isobutyl carbinol; PAG=potentially acid generating; Project=Tenas Project*

4.2 Interactions between Assessed Scenarios and Receptor Valued Components (VCs)

The potential for interactions between each unplanned event scenario and the relevant biophysical, economic, social, heritage and health VCs are ranked. Where a potential interaction is identified, the predicted residual effects to the VC are assessed using a similar system as the effects assessments (**S3.0 Assessment Methodology** of the **EAC Application**) and the Consequence was evaluated (see **4.3 Risk Assessment**). The definitions for the effects characteristics and the Significance of the Consequence are the same as used for the VC assessments.

The potential interactions are ranked using experience, guidance documents, and professional judgement for each of the VCs. If the potential interaction between the scenario and VCs is absent, or negligible, the interaction will not be carried forward. If a potential interaction between the scenario and the VCs is anticipated, then the effects to the VCs are characterised with respect to the Magnitude, Extent, Duration, Reversibility, and Context of the effects. The interactions between each event and the VCs are then analyzed to establish the potential significance and severity of the effects. Where the effects of the accident or malfunction do not completely align with the effects considered for a VC in the VC assessment, a best fit is chosen (for example, unanticipated closure of the Project is considered in the Economic Development VC, and employee injury is considered in the Human Health VC.

A summary of potential interactions between accidents and malfunctions and VCs for the Project is provided in **Table 4.2-1.** The potential interactions are ranked as follows:

- Empty cell: No anticipated interaction or negligible to minor effects with the implementation of best management practices (BMPs), standard mitigation, and management measures; and
- X: Interaction anticipated, including potentially significant effects; requires active mitigation, management, and monitoring.

Table 4.2-1: Valued Components (VC) - Scenario Interactions for Accidents and Malfunctions

Accident or Malfunction		Environment									Economic		Social						Heritage	Health
		Atmospheric Environment	Terrain and Soils	Surface Water	Groundwater	Aquatic Resources	Fish and Fish Habitat	Vegetation	Wildlife	Avian Species	Labour Market	Economic Development	Demographics	Visual Resources	Infrastructure and Services	Land and Resource Use	Community Well-Being	Heritage Resources	Human Health
Loss of Containment	Containment Failure of the Management Ponds		X	X		X	X	X	X	X	X	X		X	X	X	X	X	X
	Inability to Maintain Water Cover for Management Ponds	X	X	X	X	X	X	X	X	X						X			X
	Misidentification and/or Misplacement of Potentially Acid Generating (PAG)		X	X	X	X	X	X											
	Hazardous Material Spills In Water - Hydrocarbon	X		X		X	X		X	X						X			X
	Hazardous Material Spills In Water – Non- Hydrocarbon	X		X		X	X		X	X						X			X
	Hazardous Material Spills On Land - Hydrocarbon	X	X	X	X			X	X	X						X			X
	Hazardous Material Spills On Land – Non-Hydrocarbon	X	X	X	X			X	X	X						X			X
	Sediment Release Into Water		X	X		X	X	X	X	X									X
Transportation Accident	Motor Vehicle Accident								X						X		X		X
	Rail Accident								X	X					X				X
Earthworks Failure	Failure or slumping of open pit wall														X				X
Power Failure	Unplanned power outages						X												
Fires or Explosions	Fires or Explosions	X	X	X		X	X		X		X	X			X				X

4.3 Risk Assessment

The risk for each of the accidents, malfunctions, or unplanned events is assessed through a determination of the Consequences and the Likelihood of the event. The risk assessment is a three (3)-step process:

1. Evaluate the Likelihood of occurrence (probability) for each scenario;
2. Evaluate Consequences (severity of occurrence) by selecting the category which best describes the effects of a credible mishap on personnel, environment, and facilities, assuming that emergency planning and management controls are in place, using the assessment developed for each scenario-VC interaction; and
3. Evaluate the overall risk for each scenario, where the selected risk category is based on a combination of Likelihood and Consequence.

Risk is derived from the product of Likelihood and Consequence. Likelihood is based on assessment of the frequency of events based on experience and professional judgment, and ranges from Rare to Almost Certain. See **Figure 4.3-1**. The severity of the Consequence is based on the description of effects to VCs following implementation of mitigation and management measures, and the characteristics of the VCs. For scenarios with effects to multiple VCs, the most severe effect is used to establish the severity of the Consequence. See **Figure 4.3-2**. Likelihood and Consequence are combined in a risk matrix to establish risk categories ranging from Negligible to Severe. See **Figure 4.3-3**. Risks in the highest category are considered non-routine and would receive additional planning, employee training, and management scrutiny, as appropriate. The Level of Confidence in the risk assessment is ranked into one of the following three (3) categories:

1. **Poor:** The cause-effect relationship(s) between the unplanned event and the VCs is poorly understood and/or subject to a high degree of uncertainty; mitigation, management, and restoration measures are poorly developed and confidence in their effectiveness is low;
2. **Adequate:** The cause-effect relationship(s) between the unplanned event and the VCs is not fully understood and/or subject to some uncertainty; mitigation, management, and restoration measures are established and confidence in their effectiveness is moderate; and
3. **High:** The cause-effect relationship(s) between the unplanned event and the VCs are well understood and are supported by guidelines, best practices, and scientific literature; mitigation, management, restoration measures are established and routine, and their effectiveness is high.

Likelihood	**Almost Certain**	The unwanted event has occurred frequently: occurs in order of one or more times per year and is likely to reoccur within one (1) year
	Likely	The unwanted event has occurred infrequently: occurs in order of less than once per year and is likely to reoccur within three (3) years
	May	The unwanted event has happened in the business at some time or could happen within five (5) years
	Unlikely	The unwanted event has happened in the business at some time or could happen within 15 years
	Rare	The unwanted event has never been known to occur in the business or it is highly unlikely that it will occur within 25 years.

Figure 4.3-1: Summary of Likelihood definitions

Consequence Rating	Effects on Environment
Negligible	**Biophysical Environment:** Resulting adverse effects are barely to not detectable, of very limited extent, and can be reversed in two days or less. **Human Environment:** Resulting adverse effects are not detectable or are in the normal range of variability in the human environment.
Minor	**Biophysical Environment:** Resulting adverse effects are barely detectable, and can be reversed in one month or less, or are low extent. **Human Environment:** Resulting adverse effects are detectable but are not likely to be experienced at the community level.
Moderate	**Biophysical Environment:** Resulting in lethal and/or sub-lethal effects at the individual level indistinguishable from natural variation or resulting adverse effects are detectable and can be reversed in one year or less. **Human Environment:** Adverse effects would result in demonstrable change and are possible at the community-wide level but remain within historic norms and present no or a minor management challenge.
Major	**Biophysical Environment:** Resulting in some structural and functional changes at the population level above natural variation, or resulting adverse effects occur regionally and can be reversed in 10 years or less. **Human Environment:** Adverse effects would result in changes beyond historical norms and present a moderate management challenge.
Severe	**Biophysical Environment**: Resulting in structural and functional changes at the population level to an extent which could potentially result in severe changes at the community and ecosystem levels, or resulting adverse effects occur regionally and will take more than 10 years to reverse. **Human Environment:** Adverse effects would result in changes beyond historical norms and present a major management challenge. One or more fatalities may occur.

Figure 4.3-2: Summary of Consequence definitions

		Hazard Effect/Consequence				
		SEVERE	MAJOR	MODERATE	MINOR	NEGLIGIBLE
Likelihood	ALMOST CERTAIN	CRITICAL	VERY HIGH	HIGH	MEDIUM	LOW
	LIKELY	VERY HIGH	HIGH	MEDIUM	MEDIUM	LOW
	MAY	HIGH	MEDIUM	MEDIUM	MEDIUM	VERY LOW
	UNLIKELY	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
	RARE	MEDIUM	LOW	LOW	VERY LOW	NEGLIGIBLE

Figure 4.3-3: Summary of Risk Assessment ratings

5. Risk Assessment Scenarios

The following subsections provide descriptions of the events, mitigation for the events, the Consequence of the events on VCs and an evaluation of the risk associated with the events.

5.1 Containment Failure of the Management Ponds

The Project will use three (3) management ponds (North, West, and East) for the long-term storage of potentially acid generating (PAG) material underwater. The PAG material includes both processed rock and PAG rock. Approximately 31 million bank cubic metres (MBCM) of PAG material and 3.28 million cubic metres (m^3) of processed rock (tailings) material that will be also placed into these ponds being comingled with the active PAG rock lifts. The management ponds will be backfilled with non-PAG material and overburden when they are complete. Material will be at least 1 to 2 metres (m) above the designed water level to reduce evaporation losses during the Post-closure Phase.

The Tenas Control Pond is located downstream of the mining operations and collects surface runoff from the Mine Infrastructure and overflows from the three (3) management ponds. The Tenas Control Pond was designed large enough such that that during the Operation Phase no water discharge will occur during the period between October 31 and March 31. The Tenas Control Pond provides sedimentation control for the overall site, as well as contingency water to maintain submersion of PAG material in water in a timely fashion during operations, water for the Coal Processing Plant (CPP), wash bays for vehicles, potable and fire water, and a location for water displaced during management pond operations. Under average conditions, the Tenas Control Pond discharges via gravity through a spillway within the Tenas Control Pond, and then via an existing channel connecting to Goathorn Creek during the Operation, Decommissioning and Reclamation, and Post-closure phases.

5.1.1 Description of Possible Scenario

The management ponds could fail due to several reasons:

- a storm event or failure of diversion channels which causes a large increase of inflow into the ponds overwhelming the design and eroding the embankments;
- the foundation conditions do not support the embankment structure causing differential movement of the embankment and subsequent release of the impoundment contents; or
- the materials used and/or the construction methods result in an unstable embankment that undergoes differential settlement and subsequent release of the impoundment contents.

Failure of upstream management ponds may initiate failure in the downstream Tenas Control Pond.

This scenario assumes that the West Management Pond fails causing a cascading failure of the downstream North Management Pond and then the Tenas Control Pond. Several alternatives were considered. Depending on the type and location of the failure of the West Management Pond, water could be released into Tenas Creek, or water could be released into the North Management Pond. Similarly, water could be released from the North Pond to Four Creek, or water could be released into the Tenas Control Pond. If water is released to the Tenas Control Pond and the embankment fails, depending on the location of the failure in the perimeter embankment, or the spillway capacity is exceeded, runoff from the site and cover water and material would be released into Tenas Creek and/or Goathorn Creek and then travel to the Telkwa River. Risks associated with embankment failures were evaluated for two (2) scenarios:

1. failure of the East Management Pond and release of water; and
2. failure of the West Management Pond, releasing water to the North Pond and then to the Tenas Control Pond (see **Appendix 1.0-AA of S1.0 Overview of Project Proponent Description** of the **EAC Application [Appendix 1.0-AA]**). The release of water and materials from the Tenas Control Pond is considered the worst-case scenario, in which the volume of water released could be up to the combined maximum storage in the three (3) management ponds.

Scenario 2 is therefore carried forward for assessment. As the Tenas Control Pond does not receive PAG material, no PAG material would be released from this pond. This assessment assumes that the water quality is the same as would be released by spillways in normal mine operations. Release of PAG materials is addressed in **5.2** and **5.3**.

Additional information for the Consequence of an embankment breach is provided in **Appendix 1.0-AA**. Modelling for the downstream Consequence of an embankment breach indicates that the United States Bureau of Reclamation (USBR) flood hazard level for adults as defined in USBR (1988) will be increased in the Telkwa River floodplain in Telkwa for both sunny-day and rainy-day scenarios. The increases in area to zone 2 (judgement zone) and zone 4 (high hazards) for rainy days are of limited extent, although some buildings may be affected, and are within the existing flood extent with no breach. For a sunny day breach, hazard levels for adults increase along the Telkwa River.

This scenario may cause the access roads into the Project to be closed to traffic. This could result in the cessation of operation except for emergency activities until such time as the management ponds are considered operational.

This scenario is applicable during the Operation Phase following the construction of the West Management Pond, the Decommissioning and Reclamation Phase, and Post-closure Phase.

5.1.2 Mitigation and Management Measures for Failure of the Management Ponds

Project design measures, emergency response measures and clean-up and restoration measures to prevent and, should it occur, manage, and mitigate, the event are presented in this subsection.

5.1.2.1 Project Measures to Minimize Risk

The management and control ponds for the Tenas Project are located on a shallow sloping plateau located between the Tenas and Goathorn creeks and are not subject to hazards due to adverse terrain. Furthermore, there are no large watercourses at the upslope end of the management ponds that would cause mudflows and/or debris flows or the downslope end of the management ponds that would add to the failure scenario discussed. Lastly, with the shallow slope present, the area is not at risk from avalanches.

Pond embankments have been designed as downstream-construction structures which is considered the best practice method for designing an embankment structure. Downstream- constructed embankments are raised in the downstream direction by placing fill on top of the dam crest and downstream slope of the previous raise (rather than building on materials upstream of the embankment).

The primary portion of the management ponds have been designed with upstream and downstream slopes of H:V (slope ratio horizontal to vertical) 2.5H:1V and 3H:1V, respectively. A toe buttress structure of 5.5H:1V has been added to the management and control pond embankments on the downstream side that are higher than six (6) m and it is placed roughly 50 percent (%) of the height of the main embankment.

Integrated stability analyses for the management pond and Tenas Control Pond embankment structures are discussed in **S1.0** of the **EAC Application.** The structures have been designed to meet a minimum static Factor of Safety (FOS) of 1.6 versus the guideline value of 1.50 and a pseudo-static FOS of 1.05 which matches the guideline value, in accordance with suggested stability design criteria (Hawley and Cunning 2017).

In accordance with the Canadian Dam Association (CDA) (2013), the spillways for the North, West, and East Management Ponds were sized for 2/3 of the way between the 1,000 year and Probable Maximum Flood (PMF). The Tenas Control Pond was sized to control average freshet flows with an additional capacity to manage the 10-year 24-hr storm event. The discharge rate to Goathorn Creek is based on the average annual inflow into the pond multiplied by a safety factor of 1.2, and discharge was assumed to occur over a period of five (5) months (May to September). For a maximum Project Footprint of 9 km^2 by end of the Operation Phase, the controlled discharge rate was determined to be 100 litres per second (L/s). The required minimum Tenas Control Pond storage capacity was determined to be 800,000 m^3. Runoff volumes greater than the design capacity are discharged through the emergency spillway to Goathorn Creek. For this regulatory application, the Tenas Control Pond was assigned a “significant” dam classification in CDA 2013 based on a hypothetical dam failure and a dam break analysis, given the proximity to Tenas and Goathorn creeks. The inflow design flood was selected as 2/3 of the way between the 1,000 year and PMF, which was used for spillway sizing.

Standard operating practices (SOPs) for the mine will include a monitoring and inspection plan for the management ponds (**MWMP**) which will adhere to Code requirements for management ponds established under the *Mines Act*, RSBC 1996, c 293 (GovBC 1996). The objective of the monitoring will be to regularly inspect the embankments for safety and function, identify potential issues, and implement measures to address the potential issues that could lead to failure of any portion of an embankment.

5.1.2.2 Emergency Response Approach

TCL will follow the processes in place in the **MERP**. The Minesite will have an ERT (also known as Mine Rescue Team per Code terminology) and personnel trained to deal with a potential embankment break scenario. This event will necessitate the mobilization of the EICS (see **MERP**) and will take effect when the Emergency Incident Command Centre has been established and senior management has assumed direction of emergency operations. Key persons will report to the Emergency Incident Command Centre upon arrival at the Minesite. The Mine Manager or a designate will assume the role of Incident Commander on arrival. Measures regarding casualties, if any, will be implemented and appropriate provincial agencies will be notified.

In the event of an embankment breach, TCL will immediately notify Telkwa Village officials, Regional District of Bulkley-Nechako (RDBN), provincial, federal and residents regarding evacuation requirements along the path of the released waters.

5.1.2.3 Clean-up and Restoration Methods

The potential effects of the event, and the requirements for clean-up and restoration, will be dependent on the stream flow conditions at the time of the event and the level of provincial agency involvement in the emergency response and the clean-up. Clean-up and restoration measures will be implemented to remove and dispose of any material deposited into the surrounding waterways in accordance with a follow-up plan developed for the event. Materials will be disposed in accordance with the relevant regulations and guidelines. Restoration of vegetation and groundcover and stream channels will be conducted, where appropriate.

Predicted residual effects, as described below, on Soils and Terrain, Vegetation, Surface Water, Aquatic Resources, Fish and Fish Habitat, and Wildlife VCs, will be monitored. The monitoring program will assess the recovery of these VCs and identify additional mitigation and management measures.

5.1.3 Assessment of Likelihood

Most active operating mines in BC have not experienced a failure of a water impoundment structure. Review of the failure of the Mount Polley embankment identified the causes as excessive surface water storage, geometry of the embankment (steepness) and inadequate consideration of the strength of the foundation in the design. Organizational issues were also present, including the failure to adequately understand and act on the risk. Recent proposed changes to the Code for increased compliance and monitoring will address these weaknesses in the oversight of the embankment. Embankment failures have also occurred due to proposed use of upstream construction on previously deposited weak and saturated materials, and other foundation instability (United States Army Corp of Engineers 2020 [for Pebble Creek Project]). For this Project, the downstream construction of the embankment on in situ glacial till material and the management of water levels through input control, the pond covers, and the underlying liner will avoid the foundational failures noted for the above events.

Failure of the West Management Pond, and the subsequent cascading failure of the downstream North Management Pond and Tenas Control Pond, is therefore not expected to occur during the life of the Project and is considered a rare event.

5.1.4 Assessment of Consequence

The environmental effects from a failure of the Tenas Control Pond are considered for the Terrain and Soils, Surface Water, Aquatic Resources, Fish and Fish Habitat, Vegetation, Wildlife, Avian Species, Visual Resources, Land and Resource Use, Infrastructure and Services, Community Health and Well-being, Heritage Resources, and Human Health VCs.

5.1.4.1 Terrain and Soils, and Vegetation Valued Components (VCs)

Unintended release of water and material from the Tenas Control Pond is likely to affect the soils and vegetation in its flow path, disturbing the existing vegetation and causing soil erosion. In addition, increased flows in receptor streams could result in erosion of stream banks and loss of riparian habitat. Slope stability issues on Tenas and Goathorn Creek could occur, increasing the potential for erosion and sedimentation. Based on topography, the flow path may be directed to Tenas Creek or Goathorn Creek and then to the Telkwa River. In addition, the release of material could introduce fine particles into the water column of affected watercourses that could affect riparian habitat. No rare plant or lichen occurrences are known to be present along the potential flow pathway; however, Wetlands, Listed Ecological Communities, Old Growth Forest, and Culturally Important Species are located within the potential flow pathway and have the potential to be affected by a release of sediment-laden water. Due to the location of the Tenas Control Pond in the Project Area in the centre of a plateau, sediment is likely to fall out of solution prior to reaching fluvial soils and riparian communities along the Telkwa River, thereby attenuating adverse effects on the Telkwa River.

Following clean-up and restoration, the effects to the VCs are anticipated to be Moderate Magnitude, Local to Regional, Medium-term in Duration, taking more than two (2) years to restore soil and vegetative cover. The Context is considered to be Moderate for the Soil and Terrain VC, and Moderate for the Vegetation VC. As the area affected will remain available to contribute to ecological function, the residual effect is considered **Not Significant** and the Consequence **Minor**.

5.1.4.2 Surface Water Valued Component (VC)

In the rare event of an embankment failure at the Tenas Control Pond, the sudden release of water and material is expected to have direct effects to surface water in the receiving environment. Surface water quality in receptor streams may be adversely affected by the volume of released water and sedimentation.

During normal operation, excess water flow from the Tenas Control Pond is diluted such that water quality guidelines are met in the Goathorn Creek and Telkwa River, however the large water volume from a failure may adversely affect water quality parameters for Goathorn Creek and/or Tenas Creek and for a length of the Telkwa River downstream of the junction with Goathorn Creek or Tenas Creek. Sedimentation in the water would be expected to increase during the event from the released material and from erosion related to the water flow path. Sediment is expected to either fall out of solution and/or have concentrations diluted prior to entering riparian communities along the Telkwa River, thereby attenuating adverse effects. It is anticipated that water quality would return to pre-event variation following the event. However, while restoration will seek to salvage materials, it is likely that some released materials will remain, and that sedimentation would be increased for a longer period. Material released from the Tenas Control Pond is not anticipated to have a high concentration of PAG material.

Characterising the effects of an embankment failure would be completed as a component of the restoration phase, and results would be monitored until such time as water quality guidelines and restoration goals are reached.

Temporary high flows may alter stream morphology in the receiving waters. After emergency response, clean up, and restoration measures are implemented, surface water quantity and quality in the receiving waters is expected to return to pre-mining levels. However, stream morphology in Tenas Creek may remain altered.

High Magnitude effects will extend beyond the Local Study Area (LSA) (which includes Goathorn Creek and downstream on the Telkwa River) to portions of the Regional Study Area (RSA) along Tenas Creek and Telkwa River. They are Partially Reversible, and likely Long-term (more than two (2) years). The Context for the effect is considered Moderate while the predicted residual effect is considered **Significant,** and the Consequence is **Severe**.

5.1.4.3 Aquatic Resources, and Fish and Fish Habitat Valued Components (VCs)

In the rare event of an embankment failure at Tenas Control Pond, the effects of the sudden release of water and material on surface water and hydrology is expected to have High Magnitude effects to Aquatic Resources VC, and Fish and Fish Habitat VC in Tenas and/or Goathorn creek. Effects are Likely to extend beyond the timeframe of the high flows, until such time as Aquatic Resources, and Fish and Fish Habitat populations can be re-established.

With the implementation of remediation, the effects are expected to extend outside of the LSA to portions of Tenas Creek and the Telkwa River in the RSA, and to be Medium- or Long-term depending on the timeframe to re-establish aquatic resources and fish habitat and Partially Reversible. Changes in stream morphology may affect Aquatic Resources VC, and Fish and Fish Habitat VC in Tenas and Goathorn creeks in the long-term. Sedimentation levels may not return to base levels for more than five (5) years. Context for the effects is considered Moderate for aquatic resources, and ranges from Low to High for fish habitat, depending on the watercourse affected. The predicted residual effect is considered **Significant** and the Consequence **Severe**.

5.1.4.4 Wildlife, and Avian Species Valued Components (VCs)

The releases of water and material in an embankment failure may effect wildlife and avian species through direct contact with flows during the event, alteration, and loss of habitat in the flow pathways, changes in movement patterns, and loss of access to water with acceptable quality in receiving environments. The effects from direct contact are expected to be Low in Magnitude, Local (within the LSA) and Short-term, mobile species are expected to immediately avoid affected areas. Loss of habitat is expected to be Short-term and Reversible, until such time as upland vegetation is restored through enhancement measures. Movement patterns may be temporarily disturbed. Following the cessation of the release, water quality is anticipated to return to acceptable standards, although sedimentation levels may take longer to return to existing conditions. Indirect effects to Wildlife VC and Avian Species VC may occur due to a reduction of available food for some species from effects to the Aquatic Resources VC, and Fish and Fish Habitat VC. Recovery of the ecosystems over time would reduce potential effects.

Overall, effects are anticipated to be Moderate in Magnitude as the area affected is expected to be a small percentage of the RSA, Local in Extent, Short- to Medium-term, and Reversible over the long-term. Context varies depending on the effect and the species. Predicted residual effects are not likely to change the sustainability of population levels or biodiversity and ecosystem function and are therefore considered **Not Significant**. Consequence are considered **Major**.

5.1.4.5 Economic Development, and Labour Market Valued Components (VCs)

It is likely that Project operations would be temporarily suspended during and following the event with consequent effects to employment and procurement generated by the Project. The Duration of temporary suspension would be dependent on the time required to restore functionality to the management ponds. The Magnitude would depend on the number of employees temporarily displaced and not employed in restoration activities, and the extent on the location of the primary residences of the employees (residences are expected to be in the LSA for labour market); however, effects are expected to be Reversible within a Moderate Context. Predicted residual effects are assessed as **Not Significant**, and the Consequence as **Moderate** due to the replacement time.

5.1.4.6 Visual Resources Valued Component (VC)

It is possible that the release pathway will be visible from selected visual viewpoints. Following remediation predicted residual effects are anticipated to be Low in Magnitude and Extent, and Short-term until such time as vegetation is restored through enhancement measures, with a Moderate Context, and therefore **Not Significant**. Consequence are considered **Minor**.

5.1.4.7 Land and Resource Use Valued Component (VC)

The event has the potential to affect access, the quantity and quality of harvested resources, and sensory annoyance for non-traditional and traditional land users. It may also affect residential and commercial land uses within Telkwa, in particular if the event coincides with high flow levels in Telkwa and Bulkley rivers. The extent of the water and material pathways from failure of the Tenas Control Pond may temporarily affect access to land use areas if access on the Telkwa River, the recreation trail south of the Telkwa River, or access across Tenas or Goathorn creeks, is affected. The quality of resources supporting existing commercial and public recreation land uses, including fish and wildlife, may be affected as described above for the respective VCs. Sensory annoyance, if present from sound or visual effects, is expected to cease when the event ceases or vegetation is restored, respectively. Regardless of the above effects, there may be avoidance of the area by users for a length of time past remediation activities due to real and perceived effects to the quality of the land and resources that may extend beyond the affected area.

Predicted residual effects would extend from the LSA (same as the Vegetation LSA) to the RSA (same as the Wildlife RSAs) along Tenas Creek; however, would be a small percentage of the RSA. Predicted residual effects would be of High Magnitude and Short to Medium-term Duration, depending on the time to restore potentially damaged infrastructure and buildings. Context is considered to be Moderate. Predicted residual effects to land uses outside of Telkwa are anticipated to be **Not Significant**, and Consequence may be **Major** due to loss of access and perception of users. However, predicted residual effects to Telkwa may be **Significant** and the Consequence **Severe**.

5.1.4.8 Infrastructure and Services Valued Components (VC)

In the event of an embankment breach there may be fatalities or injuries in downstream developed areas which would require emergency services; however, prompt notification of potential flooding in Telkwa via village officials and RDBN is expected to accommodate safe evacuation. TCL may need to source emergency services from Smithers and/or Telkwa and/or Houston and further areas within the RDBN and perhaps even outside of the RDBN. The **MERP** details these local emergency services and the mine response. Decisions would be made as needed to utilize services in other communities based on capacity needed or special expertise that is required, as would be done for other large industrial operations in the region. TCL has initiated engagement with emergency service providers regarding planning and demand for services. An ambulance will be onsite to respond to emergency calls to convey people to the hospital located in Smithers.

The predicted residual effects to emergency services are considered **Not Significant**, based on initial engagement by TCL with services and the preparedness and capacity of the services (see **S6.0-C3 Infrastructure and Services Valued Component** of the **EAC Application**). Following future engagement with the services to determine potential needs in more detail, predicted residual effects are considered regional (services are regionally organized), Low Magnitude, Short-term (for the duration of the emergency) and Reversible in a Moderate Context. The Consequence is considered **Moderate**.

5.1.4.9 Community Health and Well-being Valued Components (VCs)

The event has the potential to affect Community Health and Well-being VC indicators for food security and mental health (see **5.1.4.11** for effects to Human Health). Effects to food security are considered **Not Significant**, as the predicted residual effects to food resources (e.g., fish and wildlife) are within a small portion of the study areas and not likely to constitute a large source for the LSA communities. Community concerns regarding the event may affect mental health for some community members. Should this event occur, TCL will include community members in an engagement and consultation process to advise of the event Consequence, remedial actions, and monitoring results to address potential community concerns. The monitoring results of the event would be considered during this process. Concerns and perceptions regarding the availability of the area for food resources may result in in a Partially Reversible, Moderate Magnitude effect for communities in the LSA (Local Extent) for several years (Long-term) and may present a **Major** Consequence for communities.

5.1.4.10 Heritage Resources Valued Component (VC)

There is the potential that the area affected by the water and material flow may affect unknown Heritage Resources, including archaeological sites, sacred sites, cultural and heritage sites, and harvest sites in the Heritage Resources LSA, RSA and to the north of the RSA. There are no previously recorded or known archaeological sites within the LSA, which includes the Project infrastructure footprint and a 100 m buffer where direct effects may occur, and the known archaeological sites within the RSA (close to Goathorn Creek and south of the Rail Infrastructure) are not located in the potential areas of activity. There are no sacred sites in the LSA. Sacred areas in the RSA and the known cultural and heritage sites within the LSA are not within the potentially affected areas. There are no trails identified within the LSA, however a cultural trail may run along Tenas Creek and a major trail through Telkwa Pass. There are no harvest sites within the LSA, however fishing camps may be used along the Telkwa River. Fossil sites have been identified to the east of Goathorn Creek, outside of the potential flow areas. The colliery sites along Goathorn Creek may be affected, depending on the failure location, however, are likely not in the flow path due to topography. In the absence of known values in the potential flow area, with the exception of the cultural trails, predicted residual effects are considered **Not Significan**t, the Context is considered **Moderate** and the Consequence **Minor**.

5.1.4.11 Human Health Valued Component (VC)

The Human Health VC assessment considers the potential for changes in air quality, drinking water quality, soil or vegetation quality, subsistence food quality and noise levels to affect human health. In the event of an embankment breach there may be multiple fatalities or injuries in downstream developed areas, however prompt notification of potential flooding in Telkwa via village officials and RDBN is expected to accommodate safe evacuation. Air quality is not likely to be affected by this event. Should Telkwa flood, there may be effects to drinking water supply and quality, as well as to other community utilities (emergency services are considered in **5.1.4.8**). Prompt remediation of released materials and a return to existing water quality conditions in affected streams when flows cease is anticipated to minimize the potential for changes in subsistence food quality. Noise levels may be increased during the event and following the event from the use of equipment for remediation activities, however, would be less than Construction and/or Operation phase noise, short term, and are not anticipated to affect Human Health. In the event of a worst-case scenario in which Telkwa floods from water release from the Tenas Control Pond and there is human mortality and damage to infrastructure, predicted residual effects may be High Magnitude, Local to Regional, Long-term in a Moderate Context. The predicted residual effect is expected to be **Significant**, and the Consequence would be **Severe**.

5.1.5 Risk Assessment for Containment Failure of Management Ponds

The Likelihood for this event is considered **Rare**, and the highest Consequence ratings for Surface Water, Aquatic Resources, Fish and Fish Habitat, and Human Health VCs are considered **Severe**. The risk assessment is therefore rated as **Medium**. The Level of Confidence in the assessment is **Low**, as the Consequence are variable, depending on the location and extent of the containment failure and the stream flow conditions at the time of the event.

5.2 Inability to Maintain Water Cover for Management Ponds

The water cover for the management ponds is the primary source control mitigation for dealing with PAG material by submersing all PAG material underwater to prevent it from oxidizing and leading to acid rock drainage (ARD) which is considered the Best Achievable Technology (BAT) for dealing with PAG material. Furthermore, water cover is a means for controlling potential metal leaching (ML) from non-PAG materials which again is considered BAT for this material as well. The management ponds are engineered structures with designed liners to mitigate groundwater seepage and covers to reduce evaporation losses.

5.2.1 Description of Possible Scenario

This scenario considers that the water cover for the management ponds cannot be maintained at 1 m above the submersed PAG rock due to a combination of reasons such as higher groundwater seepage, higher evaporation, and lack of precipitation. If the water cover is not maintained, the PAG material may undergo some oxidation, and upon replacement of the water, soluble contaminants may be mobilized in the subsequent water cover and potentially drain from the management pond to the Tenas Control Pond and be released through the Tenas Control Pond overflow to Goathorn Creek in an existing natural channel via gravity (Larkins 2021). This scenario assumes that processed rock material and PAG material in the ponds would be partially oxidized.

This scenario is applicable during the Operation Phase, prior to reclamation of the management ponds and Tenas Control Pond. The Tenas Control Pond will be reclaimed as a possible wetland. The management ponds will be progressively reclaimed such that the PAG materials are covered by non-PAG material and overburden with approximately 5 to 15% open water areas left open to ensure the water cover is maintained in perpetuity.

5.2.2 Mitigation and Management Measures for Management Ponds

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate, the effects of the event are presented in this subsection.

5.2.2.1 Project Measures to Minimize Risk

Management ponds will be constructed with the following design features to reduce the Likelihood of not maintaining a positive water cover:

- sufficient capacity to accommodate the PAG material, and up to 2.5 m of water cover. Embankments will be progressively increased in height as mining proceeds;
- 2.5 m water cover above PAG material to allow water levels to fluctuate up to 1.5 m annually without exposing the PAG material to oxygen;
- engineered covers to reduce evaporation both in area and efficiency;
- engineered liners to reduce seepage for overburden portions of the management ponds;
- staged construction methods for management ponds to allow monitoring to inform construction methods for the East and West Management ponds;
- storage of 800,000 m^3 of water in the Tenas Control Pond that can be pumped to replace water covers on the management ponds; and
- pumping system installed in Goathorn Creek to pump up to 500,000 m^3 of water annually to assist with the water cover, with capacity to increase to 750,000 m^3 per year for emergency situations when water cover cannot be maintained through regular operating procedures.

SOPs for the Minesite will include a monitoring and inspection plan for the management ponds (see **MWMP**) which will adhere to Code requirements for management ponds established under the *Mines Act*, RSBC 1996, c 293 (GovBC 1996). Practices will be included in the **DMP**.

5.2.2.2 Emergency Response Approach

If monitoring shows that water covers cannot be adequately maintained with the above design measures, the EICS will be mobilized and all or some of the following activities might be initiated:

- suspend coal processing and vehicle washing to reduce water consumption;
- start pumping from Goathorn Creek at a rate of approximately 500,000 $m^{3;}$
- increase pumping rate from Goathorn Creek to 1,500,000 m^3 per year (temporary measure, short duration), and
- trucking water from public providers in the region. Protocols for trucked water supply will be established as a component of the **MERP**.

5.2.2.3 Clean-up and Restoration Methods

Clean-up and restoration methods will be determined based on the length of time the water cover has been absent, the degree of oxidation of the materials and the potential for contaminants in the newly replaced water cover. Restoration will consist of managing the release of the potentially contaminated water to the environment. Options to be considered for the management of the water are:

- direct the initial flush of management ponds to occur during freshet to minimize water quality impacts;
- prior to re-establishing the water cover:
  - If the surface is not uniform, consider redistributing materials to reduce variations in bathymetric depths and maintain a minimum 1 m water cover across the PAG materials;
  - place organic matter above the PAG materials to promote metal sulphide precipitation and contribute alkalinity to the water cover, to promote sulphate-reducing bacterial activity, and to further minimize the potential for oxidation by inhibiting dissolved oxygen migration into the tailings;
- Revegetate the embankment to provide a constant supply of organic inputs to the management ponds, promote sulphate-reducing bacterial activity and improve water quality; and
- Add alkalinity to the open pit and surface water inputs to the management ponds to raise their naturally acidic pH to near-neutral levels.

Water quality would be monitored until such time as compliance with permit conditions are confirmed.

5.2.3 Assessment of Likelihood

Not maintaining a positive water balance is expected to be a **Rare** event due to the engineering controls, and the contingency water supply in place (Goathorn Creek and/or trucking). Furthermore, the design of the ponds considered both low flow and dry climate conditions using a water balance model over a long period of time. Loss of water cover is Likely to be for a short period (up to six [6] months), and the opportunity for oxidation of the materials minimal.

5.2.4 Assessment of Consequence

With the Project design measures in place, and the options for replacing the water cover to avoid release of contaminated water to receiving waters, the predicted residual effects to Atmospheric Environment, Terrain and Soils, Surface Water, Groundwater, Aquatic Resources and Fish and Fish Habitat, Vegetation, Wildlife and Avian Species, Land and Resource Use, and Human Health VCs are anticipated to be **Negligible** and further discussion of the effects is not necessary. The Consequence is also considered to be **Negligible** to **Minor**.

5.2.5 Risk Assessment for Loss of Water Cover in Management Ponds

With the Project design measures and mitigation measures for remediation in place, the Likelihood is **Rare**, the Consequence is **Negligible** to **Minor** thus the risk is assessed as **Very Low** to **Negligible**. The Level of Confidence in the assessment is **High** as the methods for managing PAG material with a water cover are established and contingency measures are available.

5.3 Misidentification and/or Misplacement of Potentially Acid Generating (PAG) Material

The current method for managing PAG requires the Project to strictly adhere to SOPs and the **ML/ARDMP**, to identify PAG material accurately and in a timely manner to allow excavator operators to identify when PAG material versus non-PAG material is being excavated. The PAG management methodology also requires that once material is identified as PAG it is placed within the management ponds.

Approximately 29.3 MBCM of non-PAG material and 3.28 MBCM of processed rock will be generated from the Project. Non-PAG material is planned to be excavated and placed in 1-m to 15-m-high lifts within the embankments of management ponds to act as buttress material on the downstream side. Any excess non-PAG rock will be backfilled into the open pit, in the lower portions of the backfilled areas to provide stable foundations while overburden will be placed on top of this rock in the open pit. Any non-PAG material excavated will not require stockpiling but will be placed in final position either in buttress portion of the dam for the management ponds and/or backfilled into the open pit. Approximately 31.2 MBCM of PAG material will be generated from the Project. PAG material is planned to be excavated and placed in 1-m to 40-m-high lifts within the management ponds. The only anticipated source for PAG material is the excavation of the open pit and processed rock from the CPP, as no other Project activities will encounter bedrock that has been classified as PAG, and overburden and local gravel deposits are non-PAG based on test work completed.

5.3.1 Description of Possible Scenario

The scenario considered is that 100,000 m^3 PAG material has been identified as non-PAG materials and/or 100,000 m^3 of identified PAG material is not placed within the management pond. This represents approximately ten (10) days of production from one (1) excavator. Placement of this material in buttresses may result in acid leachate from buttresses that is not captured and treated prior to travelling to underground or surface receiving waters. Based on site topography and Minesite layout, worst case scenarios are most likely to occur on the west side of the West Management Pond, the east side of the East Management Pond, the north side of the North Management Pond, and the Tenas Control Pond. In these cases, drainage of potential leachate is less inhibited by roads and other Project components. Construction of the Tenas Control Pond during the Construction Phase for the Project will avoid the placement of PAG materials in buttresses for this pond, and leachate from this pond is not considered further.

This scenario is applicable during the Construction, and Operation phases of the Project; as no excavation of PAG or non-PAG material is expected in the Decommissioning and Reclamation, and Post-closure phases.

5.3.2 Mitigation and Management Measures for Misplacement of Potentially Acid Generating (PAG) Material

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage, and mitigate the effects of the event, are presented in this subsection.

5.3.2.1 Project Design Measures to Minimize Risk

The following Project design measures have been put in place to reduce the Likelihood of the above occurrence:

- Most rock material within the open pit has been designated as PAG material, unless the material is designated non-PAG based on a geochemical assessment using a Neutralization Potential Ratio (NPR) cut-off of 12 neutralization potential (NP) to 1 acid potential (AP). Only two (2) rock zones have been identified as non-PAG material, Zones 1, and portions of Zone 4, while the overburden material and growth media are non-PAG;
- Site runoff from mining, including the unlikely occurrence from embankment buttresses that may inadvertently contain PAG material, will be diverted into ponds that are sized and designed appropriately for flood events. Water quality will be monitored at the point of discharge and in the receiving environment. Compliance points downstream at WQS04 on Tenas Creek, WQS03DS on Four Creek and WQS06 on Goathorn Creek will be used to monitor that the Project is meeting the prediction concentrations presented in this assessment; and
- Non-PAG rock excavated will not be stockpiled but will be placed in final position either in the buttress portion of the dam for the management ponds and/or backfilled into the open pit, thus limiting the potential for misidentification and misplacement locations.

Monitoring and management of waste will be implemented through the **MWMP** and the **ML/ARDMP**. Management measures for PAG and non-PAG materials to reduce potential misidentification are:

- Blasthole drilling will take additional confirmatory samples to confirm PAG and non-PAG zones prior to excavation;
- Excavators will be equipped with high precisions Global Positioning System (GPS) systems, and the PAG and non-PAG zones will be available to the operator based on the geology model and blast hole drilling results;
- If a PAG and non-PAG zone occur within the same mining block, a 1 to 2 m unblasted zone will be left in the pattern to provide further visual clues to the operators;
- An electronic tracking system will be put in place to track the excavation and placement of excavated materials to confirm where PAG material is placed in the field;
- The tracking system will be reviewed daily by the Mine Superintendent, Supervisors, and their delegates to identify if any material is placed in the wrong location;
- Stakes will be placed in the field to identify PAG and non-PAG material boundaries;
- Excavators have been selected for primary material loading to allow additional flexibility and selectivity in the mining of PAG material; and
- Sampling of non-PAG material piles will be completed periodically to confirm that PAG material has not been placed in these locations.

5.3.2.2 Emergency Response Approach

The management measures for PAG and non-PAG materials are expected to identify misidentification and misplacement of material in a timely manner such that there is limited opportunity for the development of ARD. Should leachate be detected through monitoring, the potential for adverse effects will be assessed and an emergency response determined.

5.3.2.3 Clean-up and Restoration Methods

The primary restoration approach is removal of PAG materials to an appropriate location. If identified PAG material is not placed within the management pond based on daily reviews, this material will be rehandled and placed within the management ponds. If material has not been identified as PAG but based on the pile sampling program the material is actually PAG material, this material will be rehandled and placed in the management ponds. Material removed from embankment buttresses will be promptly replaced to maintain the integrity of the embankment.

Should leachate from the misplaced PAG material be detected through monitoring (**ML/ARDMP**), the Extent and Magnitude of potential adverse effects will be assessed, and a restoration plan developed. Restoration of affected areas may include:

- collection of drainage from the affected area to minimize the extent of the effects. Water will either be directed to a management pond or if this is not feasible, be treated to meet water quality objectives prior to release to the environment;
- application of amendments (such as lime) to the affected area to reduce the acidity; and
- removal of affected materials to a management pond.

5.3.3 Assessment of Likelihood

The Likelihood that PAG material has been identified as non-PAG materials and/or identified PAG material is not placed within the management pond is considered Unlikely given the above controls.

5.3.4 Assessment of Consequence

The environmental effects from misidentification or misplacement of PAG material are considered for the Terrain and Soils, Surface Water, Groundwater, Aquatic Resources, Fish and Fish Habitat, and Vegetation VCs.

5.3.4.1 Terrain and Soils, and Vegetation Valued Components (VCs)

Terrain, soils and vegetation may be adversely affected by leachate in areas between the embankment and the road or collection channel on the west side of the West Management Pond, the east side of the East Management Pond, and in an area to the north and west of the North Management Pond. With the monitoring and management measures in places, and prompt removal of the PAG material to limit the potential for the creation of leachate, the Magnitude of the effects is expected to be Low, the Extent Low (within the Project Footprint), and the Duration of the effects Short-term (less than one (1) year) at which point restoration is expected to have enhanced the recovery of the affected areas. The Context is considered Moderate. Predicted residual effects are likely to be **Not Significant** and the Consequence **Minor**.

5.3.4.2 Groundwater Valued Component (VC)

There is the potential that leachate will enter groundwater in the vicinity of the embankment where PAG materials have been placed. With prompt removal of the PAG materials limiting the creation of an acid leachate, the volume of leachate entering groundwater is likely to be Low. Contaminated groundwater may migrate to surface water, however concentrations of the leachate will be buffered by the surficial materials and diluted by the time the groundwater has travelled to Tenas Creek or Four Creek, and effects to surface water are not anticipated to result in an exceedance of water quality guidelines. Predicted residual effects are anticipated to be Low in Magnitude and Local in Extent, and contamination to be to be Reversible over time, depending on the rate of flow of groundwater. The existing ground and seepage condition monitoring for the Project will be reviewed to confirm the assessment of effects to groundwater. Predicted residual effects are considered **Not Significant**, the Context Moderate, and Consequence as **Minor** as detectable effects to the biophysical environment are not anticipated.

5.3.4.3 Surface Water Valued Component (VC)

Surface water runoff that may contain leachate from misplaced PAG materials in the West, East, and eastern portions the North Pond embankments will be captured by the collection channels. The volume of the water will be dependent on season and recent precipitation, however with prompt removal of the PAG material the volume is not expected to be high and will be managed by the collection channels, which are designed to manage maximum runoff flows. Water from the collection channels will be directed to the management ponds or Tenas Control Pond and mixing with these larger water volumes will reduce the contamination to acceptable water quality standards. The predicted residual effect is considered Low in Magnitude, Local, Short-term in Duration and **Not Significant**. The context is considered Moderate and the Consequence **Minor**.

5.3.4.4 Aquatic Resources, and Fish and Fish Habitat Valued Components (VCs)

With the management measures and contingency planning in place, it is not likely that contaminated water (exceeding water quality guidelines) will reach Tenas Creek, Four Creek or Goathorn Creek and that the Aquatic Resources VC, and Fish and Fish Habitat VC, will be affected. Predicted residual effects are considered Negligible, and the Consequence **Negligible**.

5.3.5 Risk Assessment for Misidentification and/or Misplacement of Potentially Acid Generating (PAG) Material

With the Project design measures and mitigation measures for remediation in place, the Likelihood is **Unlikely**, the worst-case Consequence is **Minor,** and the risk is therefore assessed as **Low**. With the management plans in place, the Level of Confidence in the risk assessment is **High**.

5.4 Hazardous Material Spills in Water

This subsection considers hydrocarbon and non-hydrocarbon spills into water.

5.4.1 Hydrocarbon Spill in Water

Liquid hydrocarbons will be transported to the Minesite by trucks travelling from either the Lawson Road to the Telkwa Coalmine Road and the west end of the Tenas Access Corridor (TAC) and /or along the TAC to the hydrocarbon storage facilities at one (1) of following locations: Pit Fueling Station, Rail Infrastructure Fueling Station, Process Reagent Storage Site, or the Maintenance Lubricant Storage Facility. The CPP has a designated area for the storage of diesel and methyl isobutyl carbinol (MIBC). These tanks will primarily be used for supplying reagents to the CPP while the diesel tank will also provide a back-up fuel source for site-based fuel trucks. Both of these reagents will be stored in 20,000 litre (L) double-walled steel tanks while diesel at the Pit Fueling Station will be stored in a 100,000 L double-walled steel tank and gasoline will be stored in a 20,000 L double-walled tank. Diesel will also be stored in a 20,000 L double walled steel tank at the Rail Infrastructure. These tanks will be protected by concrete blocks and bollards to avoid collisions. For the TAC, the water crossings include Goathorn Creek and Helps Creek and its tributaries.

5.4.1.1 Description of Possible Scenario

This scenario assumes a worst case in which a trucking accident releases the entire load of a standard hydrocarbon transport truck (50 m^3 or 50,000 L of hydrocarbons) into Goathorn Creek in the spring or fall when the dilution capacity in the creek is the lowest. This scenario is applicable during the Construction, Operation, and Decommissioning and Reclamation phases of the Project; as hydrocarbon transport in the Post-closure phase will be very limited.

Diesel fuel is considered a “Persistent Light Oil” that is moderately volatile and will leave up to 1/3 of the spill amount on the ground after a few days (National Oceanic and Atmospheric Administration [NOAA] 2020). It is lighter than water and may spread to a film on a water surface. It does not generally accumulate on streambeds unless it adheres to sediment in the water column which then settles. Direct contact is considered toxic to invertebrates and fish.

5.4.1.2 Mitigation and Management Measures for Hydrocarbon Spill in Water

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate, the effects of the event are presented in this subsection.

5.4.1.2.1 Project Design Measures to Minimize Risk of Hydrocarbon Spills

Project measures to minimize the risk of hydrocarbon spills largely involve the safe operation of vehicles These measures to minimize the risk (informed by the International Association of Oil and Gas Producers (IOGP 2020) include the following:

- Design, construct, and maintain Project site and access roads so that they are safe for designated uses including, where appropriate, the use of guard rails and berms to prevent overturning and/or capture load loss;
- Install traffic control signs to meet the requirements set out in the 2020 Traffic Management Manual for Work on Roadways (British Columbia Ministry of Transportation and Infrastructure [BC MOTI] 2020);
- Prevent site and access roads from becoming wildlife attractants to avoid wildlife vehicle collisions;
- Control excessive speed on access roads. A speed limit of 55 kilometres per hour (km/hour) will be posted on the TAC;
- Conduct regular inspection, maintenance, and equipping of Minesite and contractor vehicles;
- Train Minesite personnel and contractors for safe driving, emergency response, and spill contingency procedures including reporting, response, and cleanup;

- Provide communication to the Minesite via radio from the truck drivers to provide prompt communication of a spill, either by the driver of the vehicle or the next vehicle on the route;
- Regularly inspect and maintain hydrocarbon handling and storage infrastructure and equipment as described in the **FMSCP**; and
- Incorporate a Soil Treatment Facility for small onsite hydrocarbon spills near the CPP. This will be a lined facility and will use BMPs to encourage bacterial growth to remediate the hydrocarbons that are present. Testing will be done to monitor compliance with regulatory requirements and material will then be used for reclamation purposes.

Relevant management plans include the **MTCP**, **PAMP**, and **FMSCP**.

5.4.1.2.2 Emergency Response Approach to Hydrocarbon Spills

In the event of a spill, the **FMSCP** will be triggered. If an emergency response is triggered, control of the situation will be transferred to the ERT. The team will be guided by the overall **MERP.** Statutory reporting of spills of more than 100 L of hydrocarbon to provincial authorities is also necessary, and spills will be documented in a Spill Report for site review. Reportable spills will be submitted within 24 hours to Emergency Management British Columbia (EMBC), formerly known as the Provincial Emergency Program (PEP). If fish and fish habitat may be affected by the spill, the spill would also be reported to Department of Fisheries and Oceans Canada (DFO).

A site-wide communication system (including access roads) will provide rapid notification of any observed spills. The Minesite will have a trained ERT with resources to contain and recover spills, to reduce the size of any spill and thus reduce any potential adverse environmental or health effects. Onsite equipment will include absorbent pads and booms, skimmers, and dike materials as part of comprehensive spill recovery kits that will be contained on a trailer or truck for rapid deployment to any spill scene. The kits will be easily transferable to enable delivery by helicopter, if required. Comprehensive spill recovery kits will be located throughout the Project to provide availability in the event of an emergency spill.

If the release of hydrocarbon cannot be fully mitigated in clean-up and restoration, a program will be implemented to monitor predicted residual effects in the aquatic and terrestrial environment, including effects to hydrogeology, terrestrial ecology, and wildlife.

5.4.1.2.3 Clean-up and Restoration Methods for a Hydrocarbon Spill in Water

The response to a hydrocarbon spill in water will be to recover as much hydrocarbon as possible from the environment to minimize potential effects. If practical for the circumstances of the spill, the deployment of containment and recovery equipment will occur as soon as feasible. Cleanup techniques to be considered for spills may include the following:

- Contain spill as close to release point as possible. This may require construction of berms around the spill with gravel, earth, or overburden using heavy equipment (e.g., loader, dozer, or excavator);
- Concentrate slicks using spill containment booms;
- Deflect slicks from nearby intakes or other sensitive areas using sorbent booms;
- Use appropriate sorbent pads on small spills;
- For fast current and turbulent water, only use appropriate spill response measures (i.e., standard sorbent booms and pads should not be utilized);

- Intercept moving slicks in quiet areas using sorbent booms;
- Excavate a sump using a backhoe, line it with appropriate impervious lining material (e.g., tarp or poly), and divert spill into the sump;
- Divert spill into settling pond where it can be isolated;
- Divert spill into site drainage sump and block inlet and/or outlet;
- Use vacuum truck to collect spilled material;
- Use absorbents (e.g., oil booms or pads) for hydrocarbon spills; and
- Use granular absorbents where appropriate.

Disposal of hydrocarbon contaminated soil will be treated at the onsite lined Soil Treatment Facility and will comply with the appropriate environmental waste management procedures such as the *Environmental Management Act*, SBC 2003, c 53 (GovBC 2003) and the Hazardous Waste Regulation, BC Reg. 63/88 (GovBC 1988). Clean-up and restoration activities will be conducted in consultation with the appropriate regulatory agencies, including the British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS) and DFO.

5.4.1.3 Assessment of Likelihood

The Likelihood ranking is evaluated based on a review of general industry statistics and Project-specific conditions and facility details. The IOGP provides accident statistics on land transportation of dangerous goods for risk assessment purposes, suggesting 2.1×10^{-8} accidents per loaded vehicle kilometre (km) for product release over 1,500 kilograms (kg) (approximately 2,000 L) (IOGP 2010b). During the Construction, and Operation phase when majority of the fuel usage occurs, the estimated diesel fuel consumption will likely be less than 5.4 million litres per day (L/day) or approximately 100 loaded tanker trucks per year. The estimated distance from Lawson Creek to the Minesite is 15 km so using the above information there is roughly 1.6×10^{-5} Likelihood of an incident during a 25-year mine life. Based on these data and assuming accidents would lead to a spill into Goathorn Creek, there is a Likelihood of less than one (1) accidental tanker truck spill over life of the Project. Project personnel will adhere to strict rules on speed limits, and meet driver qualifications and training requirements, and road use restrictions will be implemented during inclement weather conditions.

In addition, fuel spill incidents in BC are reported through EMBC (GovBC 2021b). Incidents with tanker trucks carrying gasoline, diesel, and crude oil have been reported on BC highways in the reporting period October 2016 to December 2020, however no diesel truck incidents associated with mining roads were identified.

Therefore, the Likelihood of major spill because of a tanker truck accident, whereby the truck releases the entire hydrocarbon load (50 m^3 or 50,000 L of hydrocarbons) into Goathorn Creek is rated as **Rare**.

5.4.1.4 Assessment of Consequence

The environmental effects from a hydrocarbon material spill in water are considered for the Atmospheric Environment, Surface Water, Aquatic Resources, Fish and Fish Habitat, Wildlife, Avian Species, Land and Resource Use and Human Health VCs.

5.4.1.4.1 Atmospheric Environment Valued Component (VC)

Volatilization of the diesel fuel may temporarily affect air quality. Empirical and modelled atmospheric half-lives for most representative structures of gas oils such as diesel are less than two (2) days, indicating that most gas oil components are unlikely to persist in air (Environment Canada 2014). Effects are likely to be focused on the spill location and be Short term, Temporary (less than two [2] days) and Reversible. Predicted residual effects are considered **Not Significant** with Moderate Context, and Consequence is **Negligible**.

5.4.1.4.2 Surface Water Valued Component (VC)

A fuel spill into Goathorn Creek may have effects on water quality. The fuel may be dissolved, volatilized, photo-oxidized, biodegraded, and adsorbed.

Diesel fuel will initially form a thin layer on the surface of the water. Three (3) weathering processes: dissolution in water, volatilization, and biodegradation, typically result in the depletion of the more readily soluble, volatile, and degradable compounds and the accumulation of those most resistant to these processes in residues (Environment and Climate Change Canada [ECCC] and Health Canada 2019). Volatilization will immediately decrease the volume of the spill and limit the volume available for dispersion and transport downstream in Goathorn Creek. Natural processes of dispersion and clean-up operations are expected to remove much of the remaining fuel.

Some diesel fuel would likely encounter the exposed riverbank during low flow conditions (worst case). Diesel fuel is expected to sorb to soil and may have limited mobility if the concentration of organic matter in the soil is high and the volume of fuel released is large (Environment Canada and Health Canada 2015). When fuel is stranded on marsh substrate, retention potential is considered high due to the oleophilic nature of the vegetation substrate. Weathering rates are likely to be reduced as the result of reduced water flow action and evaporation potential. A small fraction of diesel fuel may persist for over a year in sediments (Environment Canada and Health Canada 2015). For stranded fuel in the substrate, volatilization and biodegradation are two (2) important fate processes (Environment Canada and Health Canada 2015). It has been found that nearly all soils and sediments have bacteria and other organisms that are capable of degrading petroleum hydrocarbons (Pancirov and Brown 1975) and, based on its hydrocarbon components, diesel fuel is inherently biodegradable (King et al. 2001). Adsorbed fuel to substrate may potentially enter or re-enter the water column and return to the water surface.

The distribution of the diesel fuel will be dependent on the conditions within the creek at the time of the spill. High flows will likely disperse and dilute the fuel more rapidly; however, may carry the fuel further downstream. Concentrations would be highest in low flow conditions close to the bridge.

Predicted residual effects to water quality are Low in Geographic Extent, as they are not expected to extend beyond Goathorn Creek and are within the LSA. There may be very localized High Magnitude effects, however with the volatility of the fuel, and prompt clean up measures, downstream effects to water quality are Short-term. Clean-up of potentially affected sediments may be longer. Predicted residual effects are considered **Not Significant,** the Context is Moderate and Consequence is **Moderate** due to time for removal of potentially contaminated sediments downstream.

5.4.1.4.3 Aquatic Resources, and Fish and Fish Habitat Valued Components (VCs)

The effects of a diesel spill on aquatic resources, and fish and fish habitat would vary depending on its constituents, duration of exposure, time (season) of exposure, and water depth and flow. Goathorn Creek bridge is located within the fish bearing portion of the creek, which extends from the Telkwa River upstream for approximately 15 km. Fish species are dominated by rainbow trout and Dolly Varden. Direct contact with the spilled fuel in Goathorn Creek could result in the mortality of aquatic species and fish in the immediate vicinity of the spill and a short-term reduction in primary production. Acute lethal effects would likely continue for a short period of time (hours to days) due to the natural dispersion and volatilization processes that would reduce the fuel concentration. Most of the diesel components are not expected to biomagnify (relative to their concentration in the diet) in aquatic or terrestrial food webs, largely because the combination of metabolism (albeit slow), growth dilution, and low dietary assimilation efficiency of these components allows the elimination rate to exceed the uptake rate when exposure occurs from the diet only (Environment Canada 2014). Dispersal into shallow areas and sediment can have an adverse effect to fish eggs and larvae (Schein et al 2009). Density of invertebrates could be reduced for 5 km, recovering within a year, however the community may be altered for longer (Lytle and Peckarsky 2001).

Predicted residual effects are potentially High Magnitude for a localized area (within the LSA), Short- to Medium-term and Reversible, with Moderate Context, and considered **Not Significant**. The Consequence is considered **Moderate**.

5.4.1.4.4 Wildlife, and Avian Species Valued Components (VCs)

A fuel spill into Goathorn Creek could interact with wildlife through direct contact, change in habitat, and sensory annoyance due to the spill constituents and subsequent clean-up and restoration efforts. Most wildlife subcomponents of concern in the event of an accidental spill are highly mobile and would immediately avoid the vicinity of the spill. A fuel spill in water could result in indirect effects to some wildlife subcomponents due to adverse effects on fish, fish habitat, and aquatic resources. For wildlife species including waterbird species feeding on invertebrates and fish in these areas, decreases in ecosystem productivity and prey abundance may reduce the availability of food. Bears may forage for fish in the major watercourses in late fall in preparation for winter hibernation. A fuel spill into a watercourse resulting in fish kills would reduce foraging opportunities.

Under the worst-case scenario, a diesel fuel spill would occur in the spring or fall when the dilution capacity in the creek is the lowest. This suggests that a spill may not evaporate and disperse as readily as under higher-flow conditions, which could lead to greater adverse effects to wildlife associated with wetland or riverine habitats.

In summary, potential effects to wildlife and avian species would likely be primarily associated with food sources. Alternative food sources are available in the neighbouring area for highly mobile wildlife species of concern. With the implementation of response procedures and mitigation summarized in **5.4.1.2**, an accidental spill of a full truck load of diesel fuel to Goathorn Creek is expected to have a Moderate (in Magnitude), Local, Short-term, and Reversible effect, within a Moderate Context, on wildlife and wildlife habitat and avian species. Population level effects to wildlife species are not anticipated. Although the aquatic system would not fully return to baseline conditions until at least surface water quality and sediment quality have returned to background conditions, which may take months to over a year, predicted residual effects on wildlife would likely last a shorter time (i.e., weeks) when considerations are given to the availability of other food sources in the neighbouring area and the highly mobile nature of the wildlife of concern. Effects are expected to be Reversible, and Context for the effects is Moderate. The predicted residual effect of an accidental fuel spill is not likely to change the sustainability of population levels or biodiversity and ecosystem function in the region and is therefore assessed as **Not Significant**, and the Consequence is **Minor**.

5.4.1.4.5 Land and Resource Use Valued Component (VC)

The exposure of wildlife, fish, and other components of the biophysical environment to a diesel fuel spill could make them inedible to subsistence consumers or could lead to changes in consumption due to perceived toxicity. This would therefore impede the ability of individuals to engage in subsistence or traditional economic activities. The direct exposure of individuals engaged in land and resource use activities to diesel could result in incidental soil ingestion, dust inhalation, water ingestion, or absorption through the skin, however public access to the site will be restricted as part of the emergency response measures and until restoration is completed. As the effects to fish and wildlife are expected to be Short-term and Reversible, the resultant effects to the quality of harvested resources are expected to be similar. The effects resulting from the perception of resource quality may endure over the long-term but are still expected to be Fully Reversible with time. No change or a minor change on land and resource use management is anticipated. The predicted residual effects of an accidental diesel fuel spill on land and resource use for components of the biophysical environment used in subsistence and traditional economic activities as well as direct exposure to hazardous materials are therefore assessed as **Not Significant**, within a Moderate Context, and the Consequence as **Minor**.

5.4.1.4.6 Human Health Valued Component (VC)

In the event of a diesel fuel spill, potential routes of absorption by humans includes dermal, oral, or pulmonary exposure. Acute exposure to diesel vapour and ingestion of diesel fuel may lead to intoxication symptoms such as dizziness, headache, nausea, and vomiting. Exposure of skin to diesel may cause dermatitis (Chilcott 2006). Diesel typically persists in water for a short period of time.

When considerations are given to the location of the Project, potential human contact with the spill would primarily involve the ERT and no members of the public. With the implementation of response procedures and mitigation summarized in **5.4.1.2** an accidental spill of a full truck load of diesel fuel to Goathorn Creek would have a Low in Magnitude, Local (a portion of the LSA), Short-term, Reversible effect on human health with a Moderate Context. It is not likely that human health effects would be experienced at the community level. The predicted residual effect is assessed as **Not Significant**, and Consequence is assessed as **Minor**.

5.4.1.5 Risk Assessment for Hydrocarbon Spill into Water

The Likelihood of a hydrocarbon spill into water is considered **Rare**, and the worst-case Consequence is **Moderate** (for surface water), leading to a **Low** risk assessment. The Level of Confidence in the risk assessment is **High**, as there are well-established clean-up and restoration measures for hydrocarbon spills into water and the implementation of appropriate monitoring programs.

5.4.2 Non-hydrocarbon Spill in Water

Hazardous waste materials, such as processing reagents, laboratory waste, oil and lubricants will be generated from Construction, through to the Decommissioning and Reclamation phase. Potentially hazardous substances will be transported to and from site by truck. The primary hazardous substances identified in Project planning are the following:

- MIBC used in the processing of coal;
- flocculants, used in the processing of coal and for assisting with sedimentation;
- explosives; and

- laboratory waste.

MIBC and flocculants are expected to be onsite in the largest quantities (20,000 L and 5,000 L). MIBC is a clear, colorless, flammable liquid that is soluble in water, less dense than water, and its vapours are heavier than air (NOAA 2021a). It is classified as a hazardous material, assigned UN 2053, where United Nations (UN) identification numbers are assigned by the UN Committee of Experts on the Transport of Dangerous Goods. MIBC is used as a frother in mineral flotation in order to reduce the bubble size and increase the stability of the froth in the flotation process. MIBC is an organic chemical compound and is a liquid derivative of acetone with a pungent alcohol odour (Bach 2016). It has limited solubility in water but is miscible with most organic solvents (Bach et al. 2016). Its characteristics indicate that it is likely to exist solely as a vapour in the atmosphere and volatilize from either dry or moist surfaces (United States Environmental Protection Agency [US EPA] 2009).

5.4.2.1 Description of Possible Scenario

The failure modes identified for these accidents and malfunctions are vehicle accidents during transport and unplanned releases during storage and use. The worst-case scenario would be a complete release of the most environmentally toxic of these substances into either land or in water. MIBC will be transported to the Minesite by truck and a spill into the freshwater environment is possible because of an accident that releases some or all of a load of MIBC into a waterbody. MIBC tanker trucks will travel from Telkwa along the TAC to the MIBC storage facilities at the Process Reagent Storage Site. The TAC crosses nine (9) unnamed tributaries of Helps Creek, and Helps Creek, Four Creek, and Goathorn Creek. This scenario assumes the entire load of MIBC (15,000 L) will be deposited into the freshwater environment of the Goathorn Creek at the bridge crossing. To be conservative, it is assumed that all the MIBC enters the freshwater environment. This scenario is applicable during the Operation phase of the Project as MIBC will only be required during operation of the CPP.

5.4.2.2 Mitigation and Management Measures for Non-hydrocarbon Hazardous Substances Into Water

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate, the effects of the event are presented in this subsection.

5.4.2.2.1 Project Design Measures to Minimize Risk

Hazardous materials will be anticipated in advance; segregated, inventoried, and tracked in accordance with applicable legislation and regulations such as the federal *Transportation of Dangerous Goods Act*, SC 1992, c 34 (Government of Canada [GovCan] 1992). A separate secure storage area will be established with appropriate controls to manage spillages. Hazardous waste will be labelled and stored in appropriate containers for manifested shipment to approved offsite disposal facilities.

Employees, contractors, and sub-contractors who are handling hazardous waste for the Project will be provided with Workplace Hazardous Materials Information System (WHMIS) training or required under contract to have that training, so they can identify hazardous waste and know how to handle it appropriately.

Transportation of Dangerous Goods (TDG) training will be provided, or required of employees, contractors, and sub-contractors who are receiving, off-loading, and storing potentially hazardous materials, or involved in the storage and shipment offsite of hazardous waste.

Reputable certified transportation contractors will be used for the transport of goods and materials to and from the Minesite. Project personnel will periodically inspect the transporters' performance and compliance with BC and federal transport regulations, contract requirements, and overall performance.

Hazardous waste will be transferred to an approved hazardous waste facility that will issue a certificate of destruction. This facility will be periodically audited for compliance to proper handling and destruction of hazardous waste.

Management plans for several non-hydrocarbon hazardous materials are presented in **S13.0 Management Plans**. These management plans include:

- **MWMP**;
- **EMP;**
- **CMSTHP;** and
- **WMPRE**.

5.4.2.2.2 Emergency Response Approach

The spill response procedures for a non-hydrocarbon hazardous material spill are the same as those for a hydrocarbon spill. Emergency response measures will adhere to relevant guidance for water miscible/noxious materials (e.g., NOAA 2016, NOAA 2021a). Guidance includes:

- eliminating ignition sources (no smoking, flares, sparks, or flames in immediate area). Equipment used when handling the product must be grounded. Do not touch or walk-through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways and confined areas. A vapour-suppressing foam may be used to reduce vapours. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean, non-sparking tools to collect absorbed material;
- creating berms far ahead of large liquid spill for containment and later disposal. As an immediate precautionary measure, isolate spill, or leak area for at least 50 m (150 feet) in all directions; and
- considering initial downwind evacuation for at least 300 m (1,000 feet).

5.4.2.2.3 Clean-up and Restoration Methods

The clean-up and restoration procedures for a non-hydrocarbon hazardous material spill in water are the same as those for a hydrocarbon spill (see **5.4.1**).

5.4.2.3 Assessment of Likelihood

Like the Likelihood of a diesel spill accident into Goathorn Creek (**5.4.1**), the Likelihood of this event has been rated as **Rare** based on the transport incidents for dangerous good transport in IOGP 2010.

5.4.2.4 Assessment of Consequence

The environmental effects from a non-hydrocarbon material spill in water are considered for the Atmospheric Environment, Surface Water, Aquatic Resources, Fish and Fish Habitat, Wildlife, Avian Species, Land and Resource Use and Human Health VCs.

5.4.2.4.1 Atmospheric Environment Valued Component (VC)

Volatilization of the MIBC may temporarily affect air quality. MIBC is predicted to be photodegraded by reaction with hydroxyl radicals in the atmosphere with an estimated half-life of approximately 10 hours (Bach 2016). Effects are likely to be focused on the spill location and be Short-term and temporary (less than two [2] days) with a Moderate Context. Predicted residual effects are considered **Not Significant** and Consequence to air quality **Negligible**.

5.4.2.4.2 Surface Water Valued Component (VC)

The distribution of MIBC in the creek will be dependent on the conditions within the creek at the time of the spill. High flows will likely disperse and dilute the MIBC more rapidly, however may carry the compound further downstream. Concentrations would be highest in low flow conditions close to the bridge. As MIBC is moderately volatile and slightly soluble in water, it will, when introduced to water, remain in the water. It has low potential to bind to soil or sediment. However, MIBC is an alcohol and is readily biodegraded, which suggests that the chemical will be rapidly and completely removed from water and soil environments (Bach et al. 2016, US EPA 2008).

Predicted residual effects to water quality are Low Extent, as they are not expected to extend beyond Goathorn Creek, given the volatilization of MIBC, and are within the LSA. With prompt clean up measures, downstream effects to water quality are Short-term, and Reversible, however clean-up of potentially affected sediments may be longer (medium term). The Context is considered Moderate. Predicted residual effects are considered **Not Significant**, and Consequence is **Moderate** due to time for removal of potentially contaminated sediments downstream.

5.4.2.4.3 Aquatic Resources, and Fish and Fish Habitat Valued Components (VCs)

The effects of an MIBC spill on aquatic resources, and fish and fish habitat would vary depending on duration of exposure, timing of spill, and water depth and flow. Goathorn Creek bridge is located within the fish bearing portion of the creek, which extends from the Telkwa River upstream for approximately 15 km. Fish species are dominated by rainbow trout and Dolly Varden. Direct contact with the spilled MIBC in Goathorn Creek could result in the mortality of aquatic species and fish in the immediate vicinity of the spill and a short-term reduction in primary production. Acute lethal effects would likely continue for a short period of time (hours to days) due to the natural dispersion and volatilization processes that would reduce the concentration. Based on available data for several aquatic species, MIBC has low toxicity to aquatic organisms (Bach 2016). The effects of MIBC would decrease downstream, as the MIBC concentrations decrease through dilution.

The Magnitude of the environmental effect of a spill is dependent on a number of variables as noted above but is expected to be highly localized due to standard spill response procedures. Recovery of fish and invertebrate populations following a spill can vary from months to years depending on the quality, quantity, location, and timing of the spill and on the sensitivity of the species affected. Predicted residual effects are Local (within the LSA), Short- to Medium-term and Reversible and considered **Not Significant** within a Moderate Context. The Consequence is **Moderate**.

5.4.2.4.4 Wildlife, and Avian Species Valued Components (VCs)

An MIBC spill into Goathorn Creek could interact with wildlife and avian species through direct contact, change in habitat, and sensory annoyance due to the spill constituents and subsequent clean-up and restoration efforts. Most wildlife subcomponents of concern in the event of an accidental spill are highly mobile and would immediately avoid the vicinity of the spill. An MIBC spill in water could result in indirect effects to some wildlife subcomponents due to adverse effects on fish, fish habitat, and aquatic resources. For wildlife species and waterbird species feeding on invertebrates and fish in these areas, decreases in ecosystem productivity and prey abundance may reduce the availability of food. Bears may forage for fish in the major watercourses in late fall in preparation for winter hibernation. A spill into a watercourse resulting in fish kills would reduce foraging opportunities.

Under the worst-case scenario, a spill would occur in the spring or fall when the dilution capacity in the creek is the lowest. A spill may not evaporate and disperse as readily as under higher-flow conditions, which could lead to greater adverse effects to wildlife associated with wetland or riverine habitats.

In summary, potential effects to wildlife and avian species would likely be primarily associated with food sources. Alternative food sources are available in the neighbouring area for the highly mobile species of concern. With the implementation of response procedures and mitigation summarized in **5.4.1.2**, an accidental spill of a full truck load of MIBC to Goathorn Creek is expected to have a Low to Moderate Magnitude, Local Extent (small portion of the LSA), Short-term, and Reversible Effect on wildlife and wildlife habitat and avian species. Population level effects to wildlife species are not anticipated. Although the aquatic system would not fully return to baseline conditions until at least surface water quality and sediment quality have returned to background conditions, which may take months, predicted residual effects on wildlife would likely last a shorter time (i.e., weeks) when considerations are given to the availability of other food sources in the neighbouring area and the highly mobile nature of the wildlife of concern. The predicted residual effect of an accidental MIBC spill on wildlife and wildlife habitat and avian species is not likely to change the sustainability of population levels or biodiversity and ecosystem function in the region and is therefore assessed as **Not Significant**, within a Moderate Context, and the Consequence as **Minor**.

5.4.2.4.5 Land and Resource Use Valued Component (VC)

The exposure of wildlife, fish, and other components of the biophysical environment to a MIBC spill could make them inedible to subsistence consumers or could lead to changes in consumption due to perceived toxicity. This would impede the ability of individuals to engage in subsistence or traditional economic activities. The direct exposure of individuals engaged in land and resource use activities to MIBC could result in incidental soil ingestion, dust inhalation, water ingestion, or absorption through the skin, however public access to the site will be restricted as part of the emergency response measures and until restoration is completed. As the effects to fish and wildlife are expected to be Short-term and Reversible, the resultant effects to the quality of harvested resources are expected to be similar. The effects resulting from the perception of resource quality may endure over the long-term but are still expected to be Reversible with time. No change or a minor change on land and resource use management is anticipated. The predicted residual effects of an accidental MIBC spill on land and resource use for components of the biophysical environment used in subsistence and traditional economic activities as well as direct exposure to hazardous materials are therefore assessed as **Not Significant** and the Context as Moderate. The Consequence is assessed as **Minor**.

5.4.2.4.6 Human Health Valued Component (VC)

MIBC vapour may cause toxic effects if inhaled or absorbed through skin. Inhalation or contact with material may irritate eyes and nose and burn skin and eyes. Vapours may cause dizziness or suffocation (NOAA 2016). Concentrations of MIBC in water could be toxic; however, Goathorn Creek is not presently used for domestic water supply.

Members of the public will be restricted from the spill area as a component of the emergency response and until such time as the affected areas adjacent to and within the Goathorn Creek are cleaned-up. Isolating the spill or leak area for at least 50 m (150 feet) in all directions, keeping unauthorized personnel away, staying upwind, uphill and/or upstream, and downwind evacuation, if necessary, will avoid potential health effects to the public.

Natural dispersion processes combined with active recovery where possible will reduce concentrations over time. Monitoring programs and follow-up programs for groundwater will identify any remaining MIBC in the environment and will support the identification of additional mitigation if needed. Predicted residual effects to human health from a spill along the transport route, should members of the public be present at the time of the spill, are assessed to be Local, Short-term, Reversible and Negligible, in a Moderate Context, and the Consequence is assessed as **Negligible**.

5.4.2.5 Risk Assessment for Hazardous Material Spill in Water

The Likelihood of an MIBC spill into water is considered Rare. With the implementation of mitigation, the Consequence to the VCs range from **Negligible** to **Moderate**, and the worst-case risk is therefore assessed as Low. The Level of Confidence in the assessment is **High** as there is a well-established clean-up and restoration measures for spills in water and the implement of appropriate monitoring programs.

5.5 Hazardous Material Spills on Land

This subsection considers hydrocarbon and non-hydrocarbon spills onto land.

5.5.1 Hydrocarbon Spill on Land

During the Operation Phase, diesel fuel for primary and ancillary mining equipment and light vehicles will be transported to site via the TAC by a licensed third-party vendor such as Imperial Oil in super B-train tanker trucks. Diesel fuel will be stored on land in the following locations:

- one (1) 100 m^3 aboveground, double-walled storage tank located on the Mine Infrastructure Pad in the Pit Fueling Station;
- a 45 m^3 aboveground poly-storage tank contained inside of a sea container to provide heating and insulation for this product to prevent it from freezing;
- a 15 m^3 aboveground double-walled storage tank located adjacent to the CPP for use in the flotation stage of coal processing; and
- a 20 m^3 aboveground double walled storage tank at the Rail Infrastructure to allow the front-end loaders (FEL) based there to be serviced. Design will be in line with the Flammable Liquids Bulk Storage Regulations CRC, c. 1148 (2006) (GovCan 2006), and the *Railway Safety Act*, RSC 1985, c 32 (4th Supp) (GovCan 1985).

Gasoline will be stored in one (1) 15 m^3 aboveground double-walled storage tank at the Pit Fueling Station.

5.5.1.1 Description of Possible Scenario

Liquid hydrocarbons will be transported to the Minesite by truck and a spill into the terrestrial environment is possible because of an accident that releases some or all the load of the truck. Hydrocarbon trucks will travel from Telkwa along the Lawson road, and then along the TAC to the hydrocarbon storage facilities at one of following locations: Pit Fueling Station, Rail Infrastructure Fueling Station, Process Reagent Storage Site, or the Maintenance Lubricant Storage Facility. This scenario assumes the entire load of a standard diesel transport truck (50,000 L or 50 m^3 of hydrocarbons) will be deposited into the terrestrial environment along the transport route. This scenario is applicable during the Construction, Operation, and Decommissioning and Reclamation phases of the Project as hydrocarbon transport in the Post-closure phase will be very limited.

5.5.1.2 Mitigation and Management Measures for Hydrocarbon Spill onto Land

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate, the effects of the event are presented in this subsection.

5.5.1.2.1 Project Design Measures to Minimize Risk

Project design measures to minimize the risk of hydrocarbon spills largely surround the safe operation of vehicles and are presented in **5.4.1.2** and in the **MTCP**.

As well, hydrocarbon handling and storage infrastructure and equipment will be regularly inspected and maintained as described in the **FMSCP.**

5.5.1.2.2 Emergency Response Approach

The emergency response procedures for a hydrocarbon hazardous material spill are presented in **5.4.1.2**.

5.5.1.2.3 Clean-up and Restoration Methods

The response to a hydrocarbon spill onto land will be to recover as much hydrocarbon as possible from the environment to minimize potential effects. If practical for the circumstances of the spill, the deployment of containment and recovery equipment will occur as soon as feasible. Clean-up techniques for spills to be considered include those presented in **5.4.1.2** as well as the following:

- replacing fill or topsoil where required, including measures to minimize erosion prior to the establishment of ground cover;
- revegetation with appropriate vegetation types; and
- weed control measures, if required, to enable the re-growth of a suitable plant community.

A monitoring and follow-up program would be implemented to assess the success of the restoration and revegetation efforts. Additional mitigation measures, such as the application of soil amendments to foster vegetation growth, will be applied as necessary.

Disposal of contaminated soil and residual wastes will comply with the appropriate environmental waste management procedures such as the *EMA* and associated Hazardous Waste Regulation, BC Reg. 63/88 (GovBC 1988). Clean-up and restoration activities will be conducted in consultation with the appropriate regulatory agencies, including the BC MECCS and DFO.

5.5.1.3 Assessment of Likelihood

The Likelihood of major spill as a result of a tanker truck accident is rated as Rare, as described in **5.4.1.3**.

5.5.1.4 Assessment of Consequence

The environmental effects from a diesel spill on land are considered for the Atmospheric Environment, Terrain and Soils, Surface Water, Groundwater, Vegetation, Wildlife, Avian Species, Land and Resource Use, and Human Health VCs.

5.5.1.4.1 Atmospheric Environment Valued Component (VC)

Volatilization of the diesel fuel may temporarily affect air quality. Effects are likely to be focused on the spill location and be Short-term, Temporary (less than two [2] days) and Reversible in a Moderate Context. Predicted residual effects are considered **Not Significant** and Consequence is **Negligible**.

5.5.1.4.2 Terrain and Soils, and Vegetation Valued Components (VCs)

Terrain, soils and vegetation would be affected by a diesel spill along the transport route. However, the clean-up and restoration activities would be implemented rapidly, and are expected to mitigate these effects. Contaminated soil would be removed for appropriate treatment and disposal.

As a result of the clean-up and restoration activities, the effect of a spill on soil is expected to be restricted to the spill site, Low Magnitude (less than 1% of RSA), Short-term in Duration, Reversible, Moderate Context, and **Not Significant**, and the Consequence **Minor**.

Effects to vegetation growth, metabolism, and reproduction may occur from exposure to hydrocarbons. No rare plant or lichen occurrences are known to be present along the TAC. A spill into wetlands (i.e., poorly drained soils or soils with some organic enrichment; no organic soils were identified along the TAC) and/or listed ecological communities located along the transportation route would be a worst-case scenario, due to the sensitivity of these ecosystems to disturbance and the potential for hydrocarbon mobilization to ecosystems downgradient. The presence of diesel has the potential to result in vegetation mortality on the exposed plants. High water table conditions associated with wetlands also have the potential to expand the extent of a spill, depending on the specific hydrological regime. The diesel is likely to collect on the surface of the wetlands. Diesel recovery and ecosystem restoration activities would be implemented as soon as feasible after a spill. The construction of berms and sumps will restrict the mobilization and enhance the recovery of spilled diesel, which will reduce the exposure of vegetation and the predicted adverse residual effects. Revegetation and restoration of the affected ecosystems would be implemented and is expected to enhance the recovery of the affected area to a natural state. The extent of the effects from the spill is expected to be localized because of the hydrocarbon recovery and restoration activities. Monitoring and follow-up programs would be implemented to assess the performance of the mitigation and restoration measures.

The residual effects from a spill on vegetation are expected to be within or adjacent to the Project Area, Low Magnitude, Short- to Medium-term, Reversible, Moderate Context, and **Not Significant** as they will not affect the integrity of the VC within the RSA. The Consequence is **Moderate**.

5.5.1.4.3 Groundwater, and Surface Water Valued Components (VCs)

Spilled diesel has the potential to traverse land areas to surface water, and to infiltrate into groundwater. In the event of a spill, the clean-up and restoration measures will start as soon as feasible. The proximity of the spill to the transport route, in this scenario, will facilitate the rapid response and deployment of containment and recovery equipment. It is expected that much of the spilled diesel will be vapourized naturally and the remainder removed from the terrestrial environment with the rapid implementation of clean-up efforts, such that the spilled diesel is not anticipated to travel to surface water and not to travel through the soil column to groundwater. A monitoring and follow-up program will be implemented to determine the extent and concentration of spilled-related diesel. Further mitigation measures, including the removal of additional source materials, would be implemented as necessary based on the information collected in the monitoring program.

To be conservative, the effects from a spill along the transport route on groundwater and surface water are assessed to be Moderate Magnitude, Localized to a small area around the accident, Medium-term and Reversible because of the implementation of clean-up measures, follow-up monitoring and management, and natural dispersion. Context is considered Moderate. Therefore, the residual effect of the spill is assessed as **Not Significant** and the Consequence as **Minor**.

5.5.1.4.4 Wildlife, and Avian Species Valued Components (VCs)

A diesel spill along the transport route could interact with wildlife and avian species through direct contact, alteration of habitat and the availability of prey, and sensory annoyance due to the spill constituents and the subsequent clean-up and restoration efforts. The effects from direct contact with the spill would likely be minor; mobile wildlife and avian species are expected to immediately avoid the vicinity of the spill. The direct effects would be expected to be Local and Short-term and would be Reversible due to the natural processes of dispersion combined with recovery of any accessible spilled diesel. Likewise, sensory annoyance from restoration activities is expected to have local and short-term effects; odours will dissipate, and the clean-up activities will be short-term. Monitoring and follow-up programs for soil quality will be used to identify and plan further mitigation and management measures.

Indirect effects to wildlife may occur because of effects to vegetation, including wetlands. Decreases in ecosystem productivity could reduce the available food for some wildlife and avian species. However, the availability of food and habitat would increase with the re-vegetation and restoration of the habitat and the effects to the wildlife would be predicted to decrease. As a result, the indirect effects to wildlife and avian species are predicted to be reversible but, to be conservative, the recovery may occur over the medium-term. Furthermore, the road right-of-way (ROW) is not likely a high use habitat for species because of the traffic and existing effects from human activities.

The predicted residual effects of diesel spill on land are assessed to be Low Magnitude, within the Project area (buffer for the TAC), Short-term, Reversible, and Moderate Context. Predicted residual effects are not likely to change the sustainability of population levels or biodiversity and ecosystem function in the region and are therefore considered **Not Significant**. Consequence is assessed as **Minor**.

5.5.1.4.5 Land and Resource Use Valued Component (VC)

The exposure of wildlife, fish, and other components of the biophysical environment to a diesel fuel spill could make them inedible to subsistence consumers or could lead to changes in consumption due to perceived toxicity. This would therefore impede the ability of individuals to engage in subsistence or traditional economic activities in a localized area (Local Extent). The direct exposure of individuals engaged in land and resource use activities to diesel could result in incidental soil ingestion, dust inhalation, water ingestion, or absorption through the skin, however public access to the site will be restricted as part of the emergency response measures and until restoration is completed. As the effects to fish and wildlife are expected to be Local, Short-term, and Reversible, the resultant effects to the quality of harvested resources are expected to be similar. The effects resulting from the perception of resource quality may endure over the Long-term, however are expected to be Reversible with time. No change or a minor change on land and resource use management is anticipated. The Context for effects is considered Moderate. The predicted residual effects of an accidental diesel fuel spill on land and resource use for components of the biophysical environment used in subsistence and traditional economic activities as well as direct exposure to hazardous materials are therefore assessed as **Not Significant** and the Consequence as **Minor**.

5.5.1.4.6 Human Health Valued Component (VC)

In the event of a diesel fuel spill, potential routes of absorption by human includes dermal, oral, or pulmonary exposure. Acute exposure to diesel vapour and ingestion of diesel fuel may lead to intoxication symptoms such as dizziness, headache, nausea, and vomiting. Exposure of skin to diesel may cause dermatitis (Chilcott 2006).

When considerations are given to the location of the Project, potential for human contact with the spill would primarily involve the response team. Community members would be restricted from the spill site following the accident and until site cleanup is complete and community health would not be affected. With the implementation of response procedures and mitigation summarized in **5.4.1.2** an accidental spill of a full truck load of diesel fuel on land would have Negligible predicted residual effects on human health, and Consequence is therefore assessed as **Negligible**.

5.5.1.5 Risk Assessment for Hydrocarbon Spill on Land

The analysis of potential environmental effects from an MIBC spill along the transport route identifies two (2) minor predicted residual effects to surface water, and potentially **Moderate** Consequence should the wetland subcomponent of vegetation be affected. Because the Likelihood is considered Rare, the risk is assessed as Low**.** The Level of Confidence in the risk assessment is High because of the well-established clean-up and restoration measures for hydrocarbon spills onto land and the implementation of appropriate monitoring programs.

5.5.2 Non-hydrocarbon Spill on Land

5.5.2.1 Description of Possible Scenario

MIBC will be transported to the Minesite by truck and a spill into the terrestrial environment is possible because of an accident that releases some or all a load of MIBC. MIBC tanker trucks will travel from Telkwa along the TAC to the MIBC storage facilities at the Process Reagent Storage Site. This scenario assumes the entire load of MIBC (15,000 L) will be deposited into the terrestrial environment along the travel corridor alignment. To be conservative, it is assumed that all the MIBC enters the terrestrial environment. This scenario is applicable during the Operation Phase of the Project; MIBC will only be required during operation of the CPP.

5.5.2.2 Mitigation and Management Measures for Non-hazardous Substance Spill Onto Land

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate, the effects of the event are presented in this subsection.

5.5.2.2.1 Project Design Measures to Minimize Risk

The design measures for a non-hydrocarbon hazardous material spill onto land are the same as for a hydrocarbon spill onto land (**5.5.1.2**).

5.5.2.2.2 Emergency Response Approach

The spill response procedures for a non-hydrocarbon hazardous material spill are the same as those for a hydrocarbon spill (**5.5.1.2**).

5.5.2.2.3 Clean-up and Restoration Methods

The clean-up and restoration procedures for a non-hydrocarbon hazardous material spill are the same as those for a hydrocarbon spill.

5.5.2.3 Assessment of Likelihood

The Likelihood of major spill as a result of a tanker truck accident is rated as **Rare**, as described in **5.4.1.3**.

5.5.2.4 Assessment of Consequence

The environmental effects from an MIBC spill on land are considered for the Atmospheric Environment, Terrain and Soils, Groundwater, Surface Water, Vegetation, Wildlife, Avian Species, Land and Resource Use, and Human Health VCs.

5.5.2.4.1 Atmospheric Environment Valued Component (VC)

Volatilization of the MIBC may temporarily affect air quality. MIBC is predicted to be photodegraded by reaction with hydroxyl radicals in the atmosphere with an estimated half-life of approximately 10 hours (Bach et al. 2016). Effects are likely to be focused on the spill location and be Short-term and Temporary (less than two [2] days) and Reversible with a Moderate Context. Predicted residual effects are considered **Not Significant** and Consequence to air quality **Negligible.**

5.5.2.4.2 Terrain and Soils, and Vegetation Valued Components (VCs)

Soil and vegetation would be affected by a MIBC spill along the transport route. Effects to vegetation growth, metabolism, and reproduction may occur from exposure to MIBC. MIBC is regarded to have low persistence in the environment (Bach et al. 2016, US EPA, 2008). The clean-up and restoration activities would be implemented as soon as possible and are expected to mitigate the effects of MIBC on vegetation. Contaminated soil would be removed for appropriate treatment and disposal.

A monitoring and follow-up program would be implemented to assess the success of the restoration and revegetation efforts. Additional mitigation measures, such as the application of soil amendments to foster vegetation growth, would be applied as necessary. As a result of the clean-up and restoration activities, the effects of a spill on soil and vegetation are expected to the restricted to the spill site, Short-term in Duration, and Reversible. Context is considered Moderate. With the implementation of the monitoring program, the predicted residual effects from a spill on terrestrial ecology are assessed to be **Not Significant** and the Consequence **Minor**.

No rare plant or lichen occurrences are known to be present along the TAC; however, a spill into wetlands (i.e., poorly drained soils or soils with some organic enrichment; no organic soils were identified) and/or listed ecological communities located along the transportation route would be a worst-case scenario, due to the sensitivity of these ecosystems to disturbance and the potential for hydrocarbon mobilization to ecosystems downgradient. A spill within these ecosystems may have effects on vegetation vigour and persistence and exposed soil associated with contact with MIBC. The relatively high soil moisture levels and standing water in wetlands can increase the mobility, and ultimately the potential effects, of spilled MIBC.

Recovery and wetland restoration activities would be implemented as soon as feasible after a spill. The construction of berms and sumps is expected to restrict the mobilization and enhance the recovery of spilled MIBC, which will reduce the exposure of wetland organisms and the predicted residual effects. The revegetation and restoration of the ecosystem would be implemented and is expected to enhance the recovery of the affected area in returning the wetland to a natural state. The extent of the effects from the spill is expected to be localized because of the MIBC recovery and restoration activities. Monitoring and follow-up programs would be implemented to assess the performance of the mitigation and restoration measures.

The effects from a spill to wetlands and listed ecological communities are expected to be within or immediately adjacent to the Project Area, Medium-term and Reversible within a Moderate Context. The predicted residual effects of a spill along the transport route on the wetland subcomponent are assessed to be **Not Significant,** and the Consequence **Moderate** due to the importance of these ecosystems in the ecology and biogeochemistry of the landscape.

5.5.2.4.3 Groundwater, and Surface Water Valued Components (VCs)

Spilled MIBC has the potential for infiltration into groundwater because of its solubility in water, with subsequent decreases in the quality and utility of groundwater resources. The rate and extent of infiltration depend on the soil and environment conditions, including soil moisture and temperature. MIBC is an alcohol and is readily biodegraded, which suggests that the chemical will be rapidly and completely removed from water and soil environments and unlikely to persist in the environment (Bach et al. 2016, US EPA 2008).

In the event of a spill, the clean-up and restoration measures will start as soon as feasible. The proximity of the spill to the transport route, in this scenario, will facilitate the rapid response and deployment of containment and recovery equipment. It is expected that a substantial portion of the spilled MIBC will be removed from the terrestrial environment with the rapid implementation of clean-up efforts. The potential effects from the spill to surface water and groundwater is therefore expected to be minimized, as will the quantity of MIBC infiltrating into groundwater will be minimized. A monitoring and follow-up program will be implemented to determine the extent and concentration of spilled-related MIBC, and to track any further infiltration and movement away from the immediate vicinity of the spill site. Further mitigation measures, including the removal of additional source materials, would be implemented as necessary based on the information collected in the monitoring program.

The effects of a spill may be High in Magnitude within an area confined to the TAC ROW. To be conservative, the Duration of the effects from a spill along the transport route on groundwater and surface water is assessed to be Short-term (e.g., less than a year – persistence is low) but Reversible because of the implementation of clean-up measures, follow-up monitoring and management, and natural dispersion. The Context is considered Moderate. Therefore, the residual effect of the spill on water resources is assessed as **Not Significant** and the Consequence **Moderate**.

5.5.2.4.4 Wildlife, and Avian Species Valued Components (VCs)

An MIBC spill along the transport route could interact with wildlife and avian species through direct contact, alteration of habitat and the availability of prey, and sensory annoyance due to the spill constituents and the subsequent clean-up and restoration efforts. In the environment, fast photodegradation and biodegradation of MIBC is expected to limit the potential exposure of biota, and the persistence is considered low as is the potential for bioaccumulation. (Bach 2016, EPA 2008). The effects from direct contact with the spill would likely be minor; mobile wildlife species are expected to immediately avoid the vicinity of the spill. The direct effects would be expected to be Local and Short-term and would be Reversible due to the natural processes of dispersion combined with recovery of any accessible spilled MIBC. Likewise, sensory annoyance from restoration activities would have local and short-term effects; odours are expected to dissipate, and the clean-up activities will be short-term.

Monitoring and follow-up programs for soil quality will assess the longer-term effects and recovery of these indicators and will be used to assess indirect effects to wildlife and avian species. These monitoring measures will be used to identify and plan further mitigation and management measures.

Indirect effects to wildlife may occur because of effects to soil and vegetation (**5.5.2.4.2**). Decreases in ecosystem productivity could reduce the available food for some wildlife species. However, the availability of food and habitat would increase with the re-vegetation and restoration of the habitat and the effects to the wildlife would be predicted to decrease accordingly. As a result, the indirect effects to wildlife are predicted to be reversible but, to be conservative, the recovery may occur over the medium-term. Furthermore, the road ROW is not likely a high use habitat for wildlife species because of the traffic and existing effects from human activities.

The predicted residual effects of an MIBC spill on wildlife are assessed to be **Not Significant**, in a Moderate Context, based on the Local Geographic Extent (within the TAC) and the predicted recovery of the terrestrial ecosystems, and the Consequence is assessed as **Minor**.

5.5.2.4.5 Land and Resource Use Valued Component (VC)

The exposure of wildlife, fish, and other components of the biophysical environment to an MIBC spill could make them inedible to subsistence consumers or could lead to changes in consumption due to perceived toxicity. This would impede the ability of individuals to engage in subsistence or traditional economic activities in a localized area within the LSA (Local Extent). The direct exposure of individuals engaged in land and resource use activities to MIBC could result in incidental soil ingestion, dust inhalation, water ingestion, or absorption through the skin, however access to the spill area by the public will be restricted as part of the emergency response measures and until restoration is completed. As the effects to fish and wildlife are expected to be Short-term and Reversible, the resultant effects to the quality of these resources for consumption are expected to be similar. The effects resulting from the perception of resource quality may endure over the Long-term and are expected to be Reversible with time. No change or a minor change on land and resource use management is anticipated. Context is considered Moderate. The predicted residual effects of an accidental MIBC spill on land and resource use for components of the biophysical environment used in subsistence and traditional economic activities as well as direct exposure to hazardous materials are therefore assessed as **Not Significant** and the Consequence as **Minor**.

5.5.2.4.6 Human Health Valued Component (VC)

MIBC vapour may cause toxic effects if inhaled or absorbed through skin. Inhalation or contact with material may irritate eyes and nose and burn skin and eyes. Vapours may cause dizziness or suffocation. (NOAA 2021a).

Members of the public will be restricted from the spill area as a component of the emergency response and until such time as the affected areas are cleaned-up. Isolating the spill or leak area for at least 50 m (150 feet) in all directions, keeping unauthorized personnel away, staying upwind, uphill and/or upstream, and downwind evacuation, if necessary, is expected to avoid potential health effects to the public.

Natural dispersion processes combined with active recovery where possible is expected to reduce concentrations over time. Monitoring programs and follow-up programs (**5.5.2.2**) will identify any remaining MIBC in the environment that may affect human health and identify additional mitigation if needed. Predicted residual effects to human health from a spill along the transport route, should members of the public be present at the time of the spill, are assessed to be Localized, very Short-term, Reversible, Moderate Context and likely Negligible, and the Consequence is assessed as **Negligible**.

5.5.2.5 Risk Assessment for Non-Hydrocarbon Spill onto Land

The analysis of potential environmental effects from an MIBC spill along the transport route identifies potentially **Moderate** effects for groundwater and to the wetland subcomponent of vegetation. Because the Likelihood is considered **Rare,** the risk is assessed as **Low**. The Level of Confidence in the risk assessment is **High** because of the well-established clean-up and restoration measures for hazardous material spills onto land and the implementation of appropriate monitoring programs.

5.6 Sediment Release into Water

There are four (4) sedimentation ponds for the Project: the CPP Sedimentation Pond, the Rail Infrastructure Sedimentation Pond, the Explosive Facility Sedimentation Pond, and Explosive Magazine Sedimentation Pond. The Tenas Control Pond is also used for sedimentation control as well as water storage and control for the Minesite; it was assessed previously (**5.1**). Total suspended solids (TSS) will settle in the ponds and improve water quality at the discharge point. The capacity of the sedimentation ponds and the Tenas Control Pond are provided below:

- CPP Sedimentation Pond: 16,780 m^3;
- Rail Infrastructure Sedimentation Pond: 6,550 m^3;
- Explosive Facility Sedimentation Pond: 2,060 m^3;
- Explosive Magazine Sedimentation Pond: 1,330 m^3;
- Tenas Control Pond: 1,060,300 m^3;
- Potable Water Storage Pond: 7,200; and
- Wastewater Storage Pond: 5,000;

Sediment control measures will be implemented along TAC, haul roads, service roads, and powerline infrastructure. Sediment release associated with containment failure of the management ponds is addressed in **5.1**.

5.6.1 Description of Possible Scenario

Failure of the Rail Infrastructure Sedimentation Pond may result in sediment release to the Bulkley River, whereas failure of the CPP Sedimentation Pond may result in sediment release to Goathorn Creek. Failure of either the Explosive Magazine or the Explosive Facility sedimentation ponds would result in sediment release to Tenas Creek. Failure of culverts on the TAC could result in erosion leading to sedimentation of creeks along the route, including Goathorn Creek and Help Creek and its seven (7) tributaries. This scenario considers the erosion and mass wasting resulting from failure of erosion control infrastructure for the CPP Sedimentation Pond, located adjacent to the CPP, as this is considered the worst-case scenario given its size in relation to Goathorn Creek. Planned discharge from this pond will be directed via pumping to the

Tenas Control Pond. Unanticipated sediment release from the Tenas Control Pond could occur on its completion during the Construction, and Operation phases and until such time as it is decommissioned.

5.6.2 Mitigation and Management Measures for Sediment Release into Water

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate, the effects of the event, are presented in this subsection.

5.6.2.1 Project Design Measures to Minimize Risk

Project infrastructure has been designed to minimize soil and vegetation impacts and maintain terrain stability. The Project is located on a shallow sloping plateau located between the Tenas and Goathorn creeks and is not subject to any hazards due to adverse terrain that would lead to substantial erosion concerns at the Minesite.

TCL will implement measures to control sedimentation following activities during the Construction, and Operation Phases, including:

- stabilization of disturbed slopes, with materials such as weed-free mulch, geotextiles, erosion control mats, straw, or gravel bags;
- terracing of slopes to control erosion;
- controlling and directing runoff from disturbed areas by grading slopes and ditching;
- minimizing runoff energy by limiting the length and steepness of bare slopes and applying appropriate surface drainage; and
- revegetating disturbed areas with an appropriate seed mix as soon as possible.

Descriptions of the water conveyance structures, the CPP Sedimentation Pond, and the Rail Infrastructure Sedimentation Pond, are described in **S1.0 Overview of Project Proponent Description.** Design features include:

- a low-level outlet to provide the required attenuation to settle a 10-micron particle;
- emergency spillways for each sedimentation pond designed in accordance with CDA (2013);
- sizing to convey the 200-year peak flow given its proximity to Four Creek. It was sized for sediment only and is designed in accordance with the BC MECCS to collect and store runoff from the Mine Infrastructure Pad and settle sediment for a 24-hour 10-year storm event;
- perimeter embankments with slope ratio horizontal to vertical (H:V) of 2.5H:1V upstream and 3H:1V downstream slopes. The maximum height of the perimeter embankment is about 8 m;
- conservative sizing of spillway assuming no attenuation of peak flows given the size of the pond with an additional freeboard of 1 m above the spillway invert;
- prefabricated flocculation buildings to allow for the efficient delivery of flocculant in response to flows and total suspended solid amounts being received by the pond and discharged by the pond; and
- the ratio of retention time to required retention time provides a safety factor.

In addition, TCL will develop and implement the following environmental management plans:

- **CEMP**;

- **MWMP**; and
- **RCP**.

5.6.2.2 Emergency Response

In the event of a sediment and erosion control event, notifications will be given immediately to the Mine Manager or relevant Supervisor, and where required regulatory agencies, such as for events in which fish and aquatic habitat could be adversely affected or if potential geohazards result form the sediment transport event.

In the event of a failure of the CPP Sedimentation Pond, emergency response will be triggered, and control will be transferred to the ERT per the **MERP**. Heavy equipment crews onsite will be capable of responding to mass wasting events to rehabilitate disturbed slopes, engage ERT if necessary.

5.6.2.3 Clean-up and Restoration

A clean-up and restoration plan will be developed for the erosion site to prevent further sedimentation into watercourses. Measures will include those identified for reclamation of disturbed areas during the Construction, and Operation phases as well as:

- removal of material encroaching in watercourses;
- review of design measures to prevent reoccurrence; and
- monitoring of water quality, sediment quality, aquatic resources in the receiving environment as necessary to determine the extent of residual effects.

5.6.3 Assessment of Likelihood

The CPP Sedimentation Pond has been designed to continuously retain runoff volumes by discharging water to prevent overflow. During peak flows, the pond would fill to capacity and the overflow would discharge through the spillway. Only during events larger than the 200-year peak flow could water exceed the spillway capacity; thus, the corresponding Likelihood of pond or spillway failure is considered **Rare**.

5.6.4 Assessment of Consequence

The environmental effects from a sediment release are considered for the Terrain and Soils, Surface Water, Aquatic Resources, Fish and Fish Habitat, Vegetation, Wildlife, Avian Species, and Human Health VCs.

5.6.4.1 Terrain and Soils, and Vegetation Valued Components (VCs)

Terrain, soils and vegetation could be affected by a sediment release to a watercourse by adverse effects below the release, or loss of areas along watercourse edges due to scouring. Sediment may also smother vegetation, particularly if there is debris associated with the sediment transport. In addition, sedimentation event could affect riparian habitat. Slope stability issues on Goathorn Creek could be exacerbated, increasing erosion and sedimentation. There are no known rare plant or lichen occurrences along watercourses with the potential to be affected by a release of sediment-laden water; however, Wetlands, Old Growth Forest, Listed Ecological Communities, and Culturally Important Species are present downgradient and along the Telkwa River and may be affected depending on the release location and volume. Due to the location of the CPP Sedimentation Pond, sediment is expected to fall out of solution in

Goathorn Creek prior to entering riparian communities along the Telkwa River, thereby attenuating adverse effects on the Telkwa River.

Affected vegetation is expected to recover or regenerate after sedimentation and scouring stops. With the implementation of response procedures and mitigation (including stabilization and revegetation of scoured riparian areas to prevent further erosion, and a monitoring and follow-up program), as described in **5.6.2**, sediment release from the sedimentation pond would not permanently affect any vegetation species such that long-term survival in the region would be threatened.

The residual effects on soil and vegetation are expected to be Moderate Magnitude, Localized to potentially scoured and deposition areas, Short-term, Reversible, of Moderate Context and **Not Significant**. The Consequence of an accidental release of sediment from the CPP Sedimentation Pond on terrain, soil and vegetation is therefore assessed as **Low** due to the limited extent.

5.6.4.2 Surface Water Valued Component (VC)

Failure of the CPP Sedimentation Pond could release a large volume of water and sediment into a receiving stream. The sediment released would consist of a proportionately higher quantity of fines, which would remain suspended until the flow energy decreases to the point where the sediment would settle out. This release would potentially alter the channel form and bedload characteristics at that point on the watercourse. A sediment pond release would also include a substantial volume of water; this would increase the peak flow substantially for a short period of time while this pulse of water moves downstream. In the immediate vicinity of the failure, scour of the streambed and bank erosion would likely occur, and would extend downstream to the point where the additional flow formed a lesser proportion of the peak flows that would be expected to be present naturally during a large storm event. The changes resulting from such a failure would be temporary in nature.

Surface water quality would be affected primarily in terms of suspended solids in concentrations that are anticipated to be further elevated as a result of scouring of the stream channel due to high energy flows of the accidental release. Suspended sediment is expected to be diluted as it is carried downstream and to settle out as flow energy decreases. Sediment may be disturbed by subsequent freshet or other high flow events, resulting in elevated total suspended solids concentrations.

With the implementation of response procedures and mitigation in sediment-laden runoff from the sedimentation pond and associated scouring would have a High in Magnitude, Local to Regional, Short-term, and Reversible effect on surface water quality. The residual effect is assessed as **Not Significant** with a Moderate Context. The Consequence is therefore assessed as **Moderate**.

5.6.4.3 Aquatic Resources, Fish and Fish Habitat, Wildlife, and Avian Species Valued Components (VCs)

Sediment can have a range of sub-lethal to lethal effects on fish, depending on the dose and duration of sediment exposure (Newcombe and Jensen 1996). Increased sediment concentrations can also affect feeding influencing the visual prey detection (Hansen et al. 2013) and changing the benthic community toward burrowing taxa (Suttle et al. 2004). Suspended sediment would be diluted as it is carried downstream and would settle out as flow energy decreases. Scouring could have an adverse effect on riparian and instream habitat and cause morphological changes to stream channels that can take an extended period to recover (Bigelow et al. 2007, Hartman et al. 1996) and affect the benthic invertebrate community that are an important source of food for fish (e.g., Kobayashi et al. 2010). These effects could in turn affect wildlife dependent on the aquatic habitat, such as aquatic birds and amphibians. Scouring would decrease as the additional flow generated from the sedimentation pond release forms a lesser proportion of the peak flows that would be expected to be present naturally during a large storm event.

The release of a large volume of sediment and water, particularly during low-flow periods, would affect aquatic resources, and fish and fish habitat in the watercourses downstream of the Project. Goathorn Creek is a known fish habitat and direct effects to fish are possible. Fish may have the opportunity to avoid increasing total suspended solids concentrations by travelling downstream. If immediate actions to contain a large-scale sediment release are not effective, the release could result in changes in substrate composition in lower portions of the streams which could affect feeding and rearing habitat. With the implementation of response procedures and mitigation summarized in **5.6.2**, it is not anticipated that sediment release from the sedimentation pond would permanently alter fish habitat of the receiving environments or affect long-term survival of aquatic species in a regional context. The predicted residual effects on fish and fish habitat associated with an accidental sediment release from the CPP Sedimentation Pond is expected to be Moderate in Magnitude, Local to Regional, Short-term, and Reversible within a Moderate Context. Consequent effects to wildlife and avian species are expected to be Low Magnitude, Local, Short term, and Reversible with Context varying with the species. The Consequence to the VCs is therefore assessed as **Moderate**.

5.6.4.4 Human Health Valued Component (VC)

In the worst-case scenario, failure of the CPP Sedimentation Pond embankment may result in a fatality or serious injury to Project employees should they be in the vicinity of the pond. A fatality or serious injury is expected to have severe effects on the affected individuals, as well as major effects on the well-being of family and community members. In a worst-case situation, multiple fatalities would be considered a High Magnitude, Irreversible, High Context. Resulting effects may be experienced at the community level and may be particularly felt in smaller communities if the affected employees live in these smaller communities. The residual effect may be **Significant** and the Consequence **Severe**.

5.6.5 Risk Assessment for Sediment Release

Consequence to VCs from this event are assessed as **Moderate** (soil and terrain, vegetation, aquatic resources and fish and fish habitat) to **Majo**r (surface water and health). Given the major Consequence for surface water and human health, and the **Rare** Likelihood of occurrence of the event, the risk associated with an accidental sediment release from the sedimentation pond is assessed as **Low**. The Level of Confidence in the assessment is **Moderate**.

5.7 Motor Vehicle Accident

During the Project's Construction, Operation, and Decommissioning and Reclamation phases, material and personnel will be transported to and from the Minesite by motor vehicle. Personnel and material will travel to the Minesite from Telkwa to the Telkwa Coalmine Road to meet the TAC, or to the TAC.

5.7.1 Description of Possible Scenario

A motor vehicle accident may occur under a range of conditions including road conditions, driver fatigue, collisions with wildlife, vehicle malfunctions, and radio malfunctions. These accidents could occur during Project phases but are most likely to occur during the Construction, and/or Operation, and/or Decommissioning and Reclamation phases when Project traffic would be the highest. Several scenarios for accidents on the TAC are considered here: a single vehicle accident with a large wildlife species (e.g., a moose), a multi-vehicle accident between a Project vehicle and another passenger vehicle, and multi-vehicle accident between a Project employee transport vehicle (bus) and another passenger vehicle.

Measures to address a hazardous material spill into water or on land and/or a fire because of the transportation accident are presented in **5.4, 5.5,** and **5.11** respectively.

5.7.2 Mitigation and Management Measures for Motor Vehicle Accident

Project design measures, emergency response measures and clean-up and restoration measures to prevent and, should it occur, manage, and mitigate, the effects of the event are presented in this subsection.

5.7.2.1 Project Design Measures to Minimize Risk

Vehicle access to the Project site will be controlled under the **MTCP** and the **PAMP**. TCL will be compliant with the legislation and guidelines, as listed in the **MTCP**. This **MTCP** has the following objectives relative to reducing vehicle accidents:

- Design, construct, and maintain Project access roads so that they are safe for designated uses The TAC is not defined as a haul road under the BC *Mines Act*, RSBC 1996, c 293 (GovBC 1996), but follows the BC Forest Road Engineering Guidebook (British Columbia Ministry of Forests [BC MOF] 2002) road guidelines;
- Minimize wildlife mortality due to vehicle collisions along access roads and public highways;
- Prevent access roads from becoming wildlife attractants;
- Require users of roads to be authorized, and behave in accordance with company management plans and policies;
- Protect workers and the public and minimize potential adverse effects of increased human presence on the environment by controlling access along Project access roads (working towards zero unauthorized users); and
- Use buses and vans to transport personnel to the Minesite to reduce the number of vehicle trips and related accidents.

Coordination will occur with the BC MECCS (or the appropriate governing agency) supported by baseline wildlife monitoring to identify areas with higher risk of wildlife collisions so that appropriate warning signs may be posted. Locations identified as having a higher Likelihood for vehicle collisions with wildlife will be managed adaptively. Livestock accidents will be managed through controlled livestock and wildlife crossings with associated bridges and wildlife compatible fencing.

Other traffic-related mitigation measures related to general safety procedures include:

- Heavy vehicles travelling to and from the Project area will follow dedicated heavy vehicle routes;
- Vehicle load rates will be optimized to minimize the number of trips;
- Contractors and workers will be required to adhere to a zero-tolerance policy on alcohol and drugs on the Project site and while transporting goods and materials to and from the Minesite;
- Information on weather and highway conditions will be made available to drivers before departure. Drivers will be required to check road conditions prior to departure and adjust driving styles to conditions; and

- Drivers and personnel will receive appropriate training (e.g., safe driving practices such as maintaining appropriate distances between vehicles, adjusting driving styles to suit road conditions).

Traffic safety measures noted in **5.4.1.2.1** are also applicable.

The Project will adhere to the Code and associated hazard alerts, and management plans will consider relevant traffic safety measures in the Land Transportation Safety Recommended Practice (IOGP 2020).

5.7.2.2 Emergency Response Approach to Vehicle Accidents

In the event of an accident, the **MERP** will be triggered. If an emergency response is triggered, control of the situation will be transferred to the ERT. Specific responses regarding spills of hydrocarbons or hazardous materials resulting from a vehicle accident are discussed in **S6.8.11** of the **MERP**.

A site-wide communication system (including access roads) will provide rapid notification of any accidents. The site will have a trained ERT with resources to respond to vehicle accidents. Clean-up and restoration measures will be employed, if necessary, as described in **6.8.11** and **6.8.12** of the **MERP.**

5.7.2.3 Clean-up and Restoration

It is likely that only minor clean-up and restoration measures will be required for an accident that does not involve a spill (see **5.4** and **5.5** for spills). Damaged vehicles will be removed, and if necessary minor areas of disturbed vegetation on the ROW verge will be restored to prevent potential erosion.

5.7.3 Assessment of Likelihood

Substantial traffic is anticipated on the TAC (approximately 16 km). 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. Other traffic will also be on the TAC. Land transport accident statistics (IOGP 2020) provide road user fatality or killed or seriously injured accidents rates for a light goods vehicle as 0.9 or 11 respectively per 10^9 passenger km and rates are similar for a bus. BC MEMPR notes a traffic hazard between a haul truck and a pick-up truck (BC MEMPR 2020). Transport Canada data indicates 6.9 fatalities per billion vehicle km (GovCan 2018a). The Likelihood of a traffic accident is therefore conservatively rated as **Unlikely**.

The Likelihood of a vehicle encountering wildlife has been rated as **Likely** based of a review of moose mortality statistics (**S4.0-C8 Wildlife VC** of the **EAC Application**).

5.7.4 Assessment of Consequence

The environmental effects from a motor vehicle accident are considered for the Wildlife, Infrastructure and Services, and Human Health VCs.

5.7.4.1 Wildlife Valued Component (VC)

Wildlife may experience mortality through a direct collision with a vehicle. Collision mortality is discussed in **S4.0-C8 Wildlife VC**. Collisions would likely affect a single individual, and therefore the effects from the collision would be minor on the scale of the local population for that wildlife species. Natural migration and population growth would be expected to replace the lost individual, so the effect would be expected to be

Reversible. With the mitigation measures in place, the residual effect of a collision on wildlife and wildlife habitat is therefore assessed as **Not Significant**, in a Moderate Context, and the Consequence as **Minor**.

5.7.4.2 Infrastructure and Services Valued Component (VC)

In the event of an accident on the TAC with multiple fatalities or injuries, TCL may need to source emergency services from Smithers and/or Telkwa and further areas within the RDBN. An ambulance will be onsite to respond to emergency calls to convey people to the hospital located in Smithers. In the event of an emergency, ambulances from the Smithers Station would be first to arrive. They would be supported by Smithers Fire Department for extrication needs, or for additional trained support. The ERT would assess the situation and call for more support from other stations if needed. There may also be a plane that is on standby in Prince George or Terrace to travel to Smithers to be ready to receive patients.

The predicted residual effects to emergency services are considered **Not Significant**, based on initial engagement with services and the preparedness and capacity of the services. Following future engagement with the services to determine potential needs in more detail, the predicted residual effects are considered Regional (services are regionally organized), Low Magnitude, Short-term (for the duration of the emergency), and Reversible in a Moderate Context. The Consequence is considered **Moderate**.

5.7.4.3 Human Health Valued Component (VC)

A vehicle collision between a Project vehicle and another passenger vehicle may result in one (1) or more fatalities or serious injuries. Fatality and fatality rates have been decreasing over time for mining activities (Centre for Disease Control and Prevention [CDC] 2019). Land transport accident statistics (IOGP 2020) provide road user fatality or killed or seriously injured accidents rates for a light goods vehicle as 0.9 or 11 respectively per 10^9 passenger km and rates are similar for a bus. Fatalities associated with the TAC and Minesite are therefore not expected. In a worst-case situation, multiple fatalities would be considered a High Magnitude, Irreversible, High Context and **Significant** residual effect, and the Consequence as **Severe**.

5.7.5 Risk Assessment for Motor Vehicle Accidents

The Consequence for serious injuries or fatalities due to vehicle accident on Human Health is **Severe**. The Likelihood of the scenario (e.g., an accident causing a human fatality) is conservatively assessed to be **Unlikely** because of the extensive mitigation and management measures, including the active monitoring and management of safety performance. Therefore, the risk associated with a vehicle accident is assessed as **Medium**. The confidence in the risk assessment is **High** because of the well-established safety measures associated with vehicle traffic.

5.8 Rail Accident

Rail Infrastructure consists of processed coal stockpiles, scales, dust control facilities and a 2.5 km Rail Loop connected to the Canadian National Railway (CNR) track. The Rail Loop will service approximately 1.2 rail car lines consisting of 116 coal cars and up to 3 locomotives per week.

5.8.1 Description of Possible Scenario

The rail accident scenario consists of a derailment or collision of one (1) or more railcars at the Rail Infrastructure site during the Operation Phase. The worst case would be the collision of a TCL train with another train when entering or leaving the Rail Loop.

Measures to address a hazardous material spill into water or on land and/or a fire because of the accident are presented in **5.4, 5.5** and **5.11** respectively.

5.8.2 Mitigation and Management Measures for a Rail Accident

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate, the effects of the event are presented in this subsection.

5.8.2.1 Project Design

The Rail Infrastructure has been designed to minimize the potential for rail accident through the following measures:

- location adjacent to the main CNR mainline, minimizing the length of rail;
- compliance with the CNR Engineering Specifications for Industrial Track (CNR 2019);
- no public intersections, located only on private land;
- maximum rail curve of 8.0%; and 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;
- loading area of at least 175 m to allow for efficient front end loader operations; and
- compliance with provincial regulations for operations at the Rail Infrastructure (BC *Railway Safety Act, RSC 1985, c 32 [4th Supp] [GovCan 1985]*, Railway Adopted Provisions Regulation, BC Reg 210/2004 [GovCan 2004])

5.8.2.2 Emergency Response

In the event of an accident, the **MERP** will be triggered. If an emergency response is triggered, control of the situation will be transferred to the ERT per the **MERP**.

A site-wide communication system (including access road activities at the Rail Infrastructure site) will provide rapid notification of any accidents. The site will have a trained ERT with resources to respond to railcar accidents. Clean-up and restoration measures will be employed if necessary, as described in the **FMSCP.**

5.8.2.3 Clean-up and Restoration

It is likely that clean-up and restoration measures will be focused on the accident location only, for an accident that does not involve a spill (see **5.4** and **5.5** for spills). Damaged railcars will be removed and appropriately disposed of, and if necessary, minor areas of disturbed vegetation will be restored to prevent potential erosion. Any spilled coal product from trains will be removed from the site and returned to the mine for processing.

5.8.3 Assessment of Likelihood

Statistics for non-main-track rail accidents (collisions and derailments), such as for the Project infrastructure, for regulated railways in Canada are reported by the Transportation Safety Board of Canada (GovCan 2018b).

For 2018, the largest proportion of reported rail accidents comprised non-main-track derailments and collisions (60%). There were 600 non-main-track derailments in 2018, an 11% increase from 541 in 2018 and 14% above the 10-year average of 526. Typically, most non-main-track accidents are minor, occurring during switching operations at speeds of less than 10 mph. Non-main-track collisions totalled 101 in 2018, similar to the 2017 total of 103, but above the 10-year average of 93. Derailments occurred in 47% of non-main-track collisions, and 57% of the derailments resulting from non-main-track collisions involved the derailment of one (1) car. Non-main-track collisions resulted in two (2) fatalities in 2018. Dangerous goods were involved in 33% of non-main-track collisions, none of which resulted in a release of product. In 80% of these accidents, one (1) or two (2) cars derailed. No fatalities or serious injuries resulted from non-main-track derailments in 2018. There was one (1) reportable fatality and no serious injuries for non-main-track derailments between 2008 and 2018, and three (3) reportable fatalities and three (3) reportable injuries for collisions, between 2008 and 2018. In summary, reportable fatalities and injuries from a collision or derailment are considered **Rare** and not likely to be members of the public for this situation given the ability to control access to the site.

5.8.4 Assessment of Consequence

The environmental effects from a rail accident are considered for the Wildlife, Avian Species, Infrastructure and Services, and Human Health VCs.

5.8.4.1 Wildlife, and Avian Species Valued Components (VCs)

Existing wildlife and avian habitat on the Rail Infrastructure site will be removed as part of the Project construction activities and therefore not be available to wildlife. However, should wildlife or avian species access the site, they may experience mortality through a direct collision with a railcar. Collisions would likely affect a single individual, and therefore the effects from the collision would be minor on the scale of the local population for that species. Natural migration and population growth would be expected to replace the lost individual, so the effect would be expected to be Reversible. With the mitigation measures in place, and restricted access to the site for wildlife from fencing, the predicted residual effect of a collision on wildlife and avian species is therefore assessed as Low Magnitude and Extent, Short-term Duration, with Moderate Context and **Not Significant**, and the Consequence as **Minor.**

5.8.4.2 Infrastructure and Services Valued Component (VC)

In the rare event of a rail accident with multiple fatalities or injuries, TCL may need to source emergency services from Smithers or Telkwa and further areas within the RDBN. Decisions would be made as needed to utilize services in other communities based on capacity needed or special expertise that is required, as would be done for other large industrial operations in the region. An ambulance will be available at the Minesite to respond to emergency calls to convey people to the hospital located in Smithers.

The predicted residual effects to emergency services from an event with human injury are considered **Not Significant**, based on initial engagement with services and the preparedness and capacity of the services. Following future engagement with the services to determine potential needs in more detail, the predicted residual effects are considered Regional (services are regionally organized), Low Magnitude, Short-term (for the duration of the emergency) and Reversible in a Moderate Context. The Consequence is considered **Minor,** as the effect is not expected to be experienced at a community level**.**

5.8.4.3 Human Health Valued Component (VC)

A railcar derailment may result in one (1) or more fatalities or serious injuries to employees, although fatalities and fatality rates have been decreasing over time for mining activities as a whole (NIOSH 2021).

In a worst-case situation, multiple fatalities would be considered a High Magnitude, Irreversible, Moderate Context and **Significant** residual effect, and the Consequence **Severe**.

5.8.5 Risk Assessment for Rail Accident

The worst-case risk assessment is for the Human Health VC. The Consequence is assessed as **Severe**, and the Likelihood as **Rare**, leading to a **Medium** risk assessment. The Level of Confidence in the assessment is High, due to the regulated environment and monitoring for rail safety.

5.9 Earthworks Failure

Earthworks will be required for the material storage piles, the pond embankments, and the open pit.

5.9.1 Description of Possible Scenario

This scenario evaluates the effects to VCs in the worst-case scenario, which would be a failure or slumping of an open pit wall. Failures of the pond embankments are assessed in **5.1**. A failure or slumping of an open pit wall would result in the deposition of open pit wall material into the bottom of the open pit. This scenario is applicable during the Construction, Operation, Decommissioning and Reclamation, and Post-closure phases.

5.9.2 Mitigation and Management Measures for Earthworks Failure

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate, the effects of the event are presented in this subsection.

5.9.2.1 Project Design Measures to Minimize Risk

The open pit for the Project is located on a shallow sloping plateau located between the Tenas and Goathorn creeks and is not subject to any hazards due to adverse terrain. Furthermore, there are no large watercourses at the upslope end of the open pit that would cause mudflows and/or debris flows that could initiate wall failure.

TCL has completed a comprehensive review of relevant failure mechanisms of proposed open pit slopes (see **S1.0 Overview of Project Proponent Description.)** The proposed open pit walls were designed to exceed the minimum factor of safety.

Open pit wall stability will be monitored. The anticipated monitoring for the open pit will involve traditional prism installation and monitoring on a periodic basis with increasing frequency in relation to the previous results obtained and any visual observations and geological mapping results. If the situation warrants additional monitoring, three-dimensional (3D) radar equipment can be brought in to provide real time analysis of wall movements.

Written records of routine inspections will be maintained as a permanent record at the Minesite. Any deviations from normal or expected conditions will be immediately reported to the geotechnical engineer.

The backfilling of the open pit will be in lifts using a "bottom up" approach and an overall slope of 2.5 to 1, with non-PAG rock being targeted for the base of these piles to promote improved stability.

TCL will adhere to the Code in relation to open pit wall stability and will be managed as per the Standard Practices and Procedures (SPPs) to be set up by TCL in during the Construction, and Operation phases.

5.9.2.2 Emergency Response

In the event of an accident, the **MERP** will be triggered. If an emergency response is triggered, control of the situation will be transferred to the ERT. Facilities onsite include a Mine Rescue Building with rescue gear and a rescue response vehicle. Specific responses regarding open pit wall failures include:

- immediately evacuating the area and open pit where failure is evident and notify the Pit Supervisor who will select the Emergency Commander;
- isolating the area and restricting access to ERT personnel only; and
- implementing further wall failure monitoring.

5.9.2.3 Clean-up and Restoration

After the initial emergency response, an event-driven inspection will occur as soon as possible to identify follow-up actions. Reporting will include a detailed description of such action with timelines and compliance criteria.

5.9.3 Assessment of Likelihood

With the stability assessments included in the Project design, and ongoing monitoring of wall stability with corrective pre-emptive actions, the Likelihood of a major failure of a open pit wall is rated as **Unlikely**.

5.9.4 Assessment of Consequence

The environmental effects from an earthwork's failure are considered for the Infrastructure and Services, and Human Health VCs.

5.9.4.1 Infrastructure and Services Valued Component (VC)

In the rare event of a rail accident with multiple fatalities or injuries, TCL may need to source emergency services from Smithers or Telkwa from Smithers and/or Telkwa and further areas within the RDBN. Decisions would be made as needed to utilize services in other communities based on capacity needed or special expertise that is required, as would be done for other large industrial operations in the region. An ambulance will be available at the Minesite to respond to emergency calls to convey people to the hospital located in Smithers. In the event of an emergency, ambulances from the Smithers Station would be first to arrive. They would be supported by Smithers Fire Department for extrication needs, or for additional trained support. The ERT would assess the situation and call for more support from other stations if needed. They may also have a plane that is on standby in Prince George or Terrace to travel to Smithers to be ready to receive patients. Burns Lake and Terrace have mass casualty ambulances containing more stretchers, blankets, first aid gear, and extra gear. Extrication or rescue work would be conducted by Fire/Rescue services or Search and Rescue.

A First Aid Room will be set-up in the Administration Building and will be fully stocked to deal with anticipated emergency situations at the Minesite. There are also emergency response facilities located in Telkwa consisting of a volunteer fire department that can respond to any emergencies at the Minesite with the following equipment: Mine Rescue Vehicle, and Ambulance.

The predicted residual effects to emergency services from an event with human injury are considered **Not Significant**, based on initial engagement with services and the preparedness and capacity of the services. Following future engagement with the services to determine potential needs in more detail, the predicted residual effects are considered Regional (services are regionally organized), Low Magnitude, Short-term (for the duration of the emergency) and Reversible in a Moderate Context. The Consequence is considered **Moderate,** as the effect may be experienced at the community-wide level but is likely to remain within historic norms and present no or a minor management challenge**.**

5.9.4.2 Human Health Valued Component (VC)

In the event of an accident with multiple fatalities or injuries, TCL may need to source emergency services from Smithers and/or Telkwa and further areas within the RDBN as described for the Infrastructure and Services VC.

In the worst-case scenario, failure or slumping of open pit walls may result in multiple fatalities or serious injury to Project employees. In a worst-case situation, multiple fatalities would be considered a High Magnitude, Irreversible, High Context and **Significant** residual effect, and the Consequence **Severe.** Resulting effects may be experienced at the community level and may be particularly felt in smaller communities if the affected employees live in these smaller communities. The Consequence is considered **Severe**.

5.9.5 Risk Assessment for Earthworks Failure

The Likelihood of such an accident or malfunction is rated as **Rare**, the Consequence **Moderate** for Infrastructure and Services VC, and **Severe** for Human Health VC. The worst-case risk is therefore for Human Health VC and is assessed as **Medium**. The Level of Confidence in the assessment is **Moderate**, as level of effect to human health is dependent on the site conditions.

5.10 Power Failure

The power source for the Minesite is a 3.6 km long 25-kilovolt (kV) powerline and a 25 kV to 600-volt (V) substation adjacent to the CPP. The 25 kV network at the CPP and Mine Infrastructure Complex (MIC) area will consist of an underground supply to the main CPP substation. The MIC and raw water pumping facilities will be fed from the CPP substation. The power distribution to the Tenas Control Pond will be by means of underground cable, which will be stepped down to 0.60 kV via a ground mounted transformer and switchgear installed at the Tenas Control Pond dam area. Low voltage (600/120 Volts Alternating Current [VAC] and 24 Volts Direct Current [VDC]) distribution in areas will be via mini substations/transformers installed in each of the localized areas. A 0.50 km spur 25 kV powerline and a pole mounted 25 kV to 600 V transformer will be constructed to the silos and garage. Preliminary load lists indicate a combined CPP and MIC demand (inclusive of Mine Infrastructure, raw water infrastructure and CPP) of 3.1 megawatt (MW) and 0.4 MW for the Rail Infrastructure.

The Project line connects to the 500 kV BC Hydro line 5L063, connecting to Terrace. This line splits from a common route for IL385 (130 kV) south of Telkwa, which heads north through Telkwa to Smithers.

5.10.1 Description of the Scenario

A potential power outage may be caused an event such as a windstorm, snowstorm, forest fire, or bird strike to the transmission lines that service the Project. Under the worst-case scenario, where immediate repair of the transmission line is not possible, a long-term power outage may occur at the Project site. The scenario may occur following construction of the powerline and Mine Infrastructure, through the Construction, and Operation phases, until the Decommissioning and Reclamation Phase is completed.

5.10.2 Mitigation and Management Measures for a Power Failure

The Project will have several standby diesel generators located onsite mainly for critical systems such as the Potable Water Treatment Plant, Sewage Treatment Plant and pumps associated with the management ponds. Most of these generators will be less than 100 kilowatt (kW) units except for the ones for pumping which will be 250 kW units. These standby generators will have sufficient power and fuel storage to operate critical equipment such as water management structures if required. A plan will be in place for the orderly shutdown of non-essential machinery to reduce risks of injury or damage to equipment when the power is re-established. Systems and structures are also designed to account for power outages. Furthermore, as the Project is on the same distribution system as the Village of Telkwa and portions of the regional district it is expected the power outages would be limited in both duration and frequency.

5.10.3 Assessment of Likelihood

The TCL power will be provided by an extension of BC Hydro circuit 25F52 from the Smithers substation. TCL reviewed outages in the Project Area and could not find an incident where the power was off for more than 12 hours over the past 7 years (email from BC Hydro). Outages for planned maintenance activities occurred at the Smithers substation over the past 7 years. The event is therefore conservatively rated as **Unlikely**.

5.10.4 Assessment of Consequence

Interactions with VCs were not identified for a full power outage at the Minesite because the backup measures are considered sufficient to avoid interactions. Consequence to VCs were not identified and this scenario is not considered further in the assessment.

Should the power outage be longer than anticipated, and the power from the onsite generators be insufficient to maintain minimal water management operations resulting in loss of water cover, the Consequence would be the same as identified in **5.2**.

5.10.5 Risk Assessment for Power Failure

With the implementation of mitigation, the Likelihood of a power failure is not likely, and the Consequence is anticipated to be **Negligible**, and the resultant risk **Very Low**. The Level of Confidence in the assessment is **High**.

5.11 Fires or Explosions

Fire or explosions at the Minesite could result from accidents or malfunctions associated with fuel storage, and explosives storage and use.

Fuel will be dispensed from a Pit Fueling Station located at the Minesite. Diesel fuel will be stored on land in the following locations:

- one 100 m^3 aboveground, double-walled storage tank located on the Infrastructure Pad in the Pit Fueling Station;
- a 15 m^3 compartment of a 45 m^3 aboveground double-walled storage tank located adjacent to the CPP for use in the flotation stage of coal processing; and

- a 20 m^3 aboveground double-walled storage tank at the Rail Infrastructure to allow the FELs based there to be serviced. Design will be in line with the Flammable Liquids Bulk Storage Regulations CRC, c. 1148 (GovCan 2006), and the *Railway Safety Act*, RSC 1985, c 32 (*4th Supp*) (GovCan 1985).

Gasoline will be stored in one (1) 15 m^3 aboveground double-walled storage tank at the Pit Fueling Station.

Equipment requiring gasoline, especially the smaller sized ancillary equipment and light-duty vehicles will be fuelled at a separate smaller station, close to the Pit Fueling Station but much smaller.

The primary explosives used during Minesite operations will be a combination of ammonium nitrate and fuel oil (ANFO) and emulsion. Required explosives and explosive feed products like ANFO will be obtained through an explosives supply contractor and stored onsite in silos and magazines located distant from CPP and mining activities. The size of the silos is 50,000 kg for ammonium nitrate and 30,000 kg for emulsion. Only emulsion is considered an explosive under Natural Resources Canada (NRCAN) regulations.

Accidents related to explosions in the open pit are comparable to those identified for earthworks failures (see **5.9**) and mitigation and Consequence for that event would be applicable.

5.11.1 Description of Possible Scenario

A fire or explosion at the surface may be caused by a number of failure modes:

- fuel spill;
- blasting resulting in air overpressure or fly rock damage;
- improper storage or handling of processing reagents;
- waste management (e.g., woody debris slash piles); and
- vehicle collision.

This scenario addresses a fire or explosion of a diesel fuel storage tank contained to the Project Minesite during Construction, Operation, or Decommissioning and Reclamation phases. With the mitigation in place, as noted below, a fire or explosion at the surface causing a wildfire surrounding the Project is not anticipated, however is addressed further below.

Events at the explosive storage facilities are also possible, even though the design of explosive storage facilities will meet government regulations and will be located according to required separation distances as regulated by the Explosives Regulatory Division of NRCAN. The transportation of explosives to and from the Minesite will comply with federal and provincial legislation related to the transportation of dangerous goods. Explosive components are stored separately and will be combined as needed. Licenses and permits for an explosive magazines and storage facility will be required from NRCAN (Orica Canada Inc. [Orica] responsibility) and the BC MEMLI. An **EMP** will be implemented. Blast simulations have been conducted to determine appropriate proportions of emulsion and ANFO for blasting.

5.11.2 Mitigation and Management Measures for Fires or Explosions

Project design measures, emergency response measures, and clean-up and restoration measures to prevent and, should it occur, manage and mitigate the effects of the event, are presented in this subsection.

5.11.2.1 Project Design Measures to Minimize Risk

A non-vegetated buffer will be established around Project equipment to limit the spread of fire. Equipment will be maintained to minimize electrical failures. A strict non-smoking policy will be established onsite.

The Minesite facilities will be protected, at a minimum, from fire in accordance with applicable codes and standards. Storage tanks will be constructed and operated in accordance with the National Fire Code (National Research Council of Canada [NRCC] 2015) and in conformity with the Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products (Canadian Council of Ministers of the Environment [CCME] 2003) and CAN ULC S-601-07 (Standards Council of Canada 2007).The fire alarm system will consist of manual pull stations at building exits and audible and visual notification devices throughout the work areas. Surface mobile equipment will be fitted with fire extinguishers. The fleet of open pit mining equipment will also contain fire suppression systems. Forest fire supplies will be located in sea containers beside the Mine Rescue Building.

The tanks and fueling station will have concrete lock blocks and bollards installed to protect the facilities from unintentional contact from mining equipment. Furthermore, a set refuelling area will be provided adjacent to the diesel tanks where mining equipment is fuelled so that any spills in this area are directed back to the center of the lined area to prevent spills from escaping the area into the surrounding environment. There will be a liner under fueling areas.

Spontaneous combustion, a process whereby certain materials can ignite through internal reactions, is also an observed phenomenon in some exposed processed rock piles. However, due to the wet nature of the processed rock, and based on the current plan of disposing of processed rock underwater within six (6) months of it being produced, there is no risk of this occurring.

Additional information can be found in the **FMSCP**.

The Explosive Facility, and Explosive Magazine have been situated at the required distance such that if an explosion were to occur at either location no impact to structures or personnel would occur.

During the Construction Phase, the CPP fire system will consist of fire extinguishers located appropriately around the CPP. A fire alarm system will be installed for early smoke detection which will provide immediate alarm to the CPP's control room. Furthermore, a fire prevention system will be installed as part of the Mine Infrastructure construction to meet both CPP and ancillary infrastructure requirements during the Operation Phase. The fire prevention system will comprise a back-up fire pump installed at the same location as the process water pump that is used for process water supply for the CPP, Maintenance Facility wash bay, and at the Explosive Facility wash bay. Fire lines will be installed on the property and two (2) fire hydrants will be installed at designated locations to allow for onsite firefighting for fixed infrastructure components such as the CPP and the Maintenance Facility.

5.11.2.2 Emergency Response Approach

The emergency response approach will follow the guidance in the **MERP**. The emergency response procedures, as outlined in the **MERP**, will address four (4) levels of response in an emergency:

1. Level 1 Near Miss - Continue to Work Safely;
2. Level 2 Incident - Localised Action, Containment, and Rectification;
3. Level 3 Emergency - Activate Emergency Response Team (ERT); and

4. Level 4 Major Emergency - Mobilize EICS and Emergency Response Team (ERT)

Specific guidance is included for fire emergencies, including those for flammable liquids. An Explosives Infrastructure Emergency Response Plan will be in place before the start of the Construction Phase.

Firefighting equipment will be provided and maintained at locations throughout the site where fire may endanger life or property. Firefighting personnel will be part of the ERT. Water systems for fire suppression are incorporated into the Project design including fire hydrants located within the Mine Infrastructure pad and fire water system. Fire hazard areas, such as hydrocarbon storage areas, may be designated as areas where no means of producing heat or flame will be permitted. Such areas will be clearly marked with warning signs.

Upon discovering a fire, employees and contractors will be expected to be aware of, and capable of, carrying out initial containment measures. These measures will include an attempt to control the fire with the nearest extinguisher, raising the alarm, and seeking assistance. A fire within any building will trigger a building evacuation.

Supervisors and persons named in a notification process will be trained in how to initiate emergency response (see **MERP**).

Extreme fire conditions may cause the access roads into the Project to be closed to traffic. This could result in the cessation of operations until such time as the roads are once again passable. Water for firefighting, if required, will be drawn primarily from the Tenas Control Pond and/or management ponds.

Any fire at the Explosive Facility and/or Explosive Magazines would require an immediate evacuation of all non-emergency personnel from the site and a temporary shut down of operations until the fire can be brought under control.

5.11.2.3 Clean-up and Restoration Methods

Clean-up and restoration measures will be implemented to remove and dispose of any damaged material or infrastructure due to a fire and/or explosion. Materials will be disposed in accordance with relevant regulations and guidelines. Restoration of vegetation and groundcover will be conducted, where appropriate.

Any identified residual effects on affected VCs will be monitored. The monitoring program will assess the recovery of these VCs and help identify any additional mitigation and management measures.

5.11.3 Assessment of Likelihood

In a worst-case scenario, a fire would occur as a result of operation at the Explosive Facility. An accidental fire at the Explosive Facility would be dependent on the presence of an ignition source and the firefighting response. Based on discussions with Orica, no such event has ever occurred at a surface mine operation in Western Canada, so the event has been classified as a **Rare** event.

In a second worst-case scenario, a fire would occur as a result of operation of a Project fuel tank. An accidental tank fire or explosion would be dependent on the presence of an ignition source, the concentration of gaseous components of the leak, and the volume of the leak. Statistics available for Atmospheric Storage Tanks (much larger than the Project tanks) indicate fire and explosion risk as 9.0×10^{-5} per tank year ((IOGP 2010b). To reduce the potential of an accidental tank fire or explosion, the Project's fuel storage tanks will be constructed and operated in accordance with the National Fire Code of

Canada 2015 (National Research Council Canada 2016) and in conformity with the Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products (CCME 2003). Thus, an accidental tank fire or explosion in the Project area is expected to be an **Unlikely** event.

The Likelihood of fires spreading to adjacent areas from the Project is expected to be **Rare** – less than for onsite fire. Wildfire Service statistics from 2012 to 2017 do not include a record of a fire at an active operating mine in BC (Government of British Columbia Public Safety and Emergency Services, Wildfire Service 2021), therefore this event is not assessed further.

5.11.4 Assessment of Consequence

The environmental effects from tank fire or explosion at the Explosive Facility are considered for the Atmospheric Environment, Surface Water, Groundwater, Aquatic Resources, Fish and Fish Habitat, Economic Development, Infrastructure and Services, and Human Health VCs.

Because the fire from a storage tank is anticipated to be contained to the Project site, interactions with other VCs are not anticipated (i.e., Wildlife, Avian Species, Visual Quality, and Land and Resource Use VCs). The effects to VCs from a wildfire offsite are considered in **S10.0 Effects of the Environment on the Project** of the **EAC Application**.

5.11.4.1 Atmospheric Environment Valued Component (VC)

A fire or explosion from Project activities is expected to result in adverse changes to air quality indicators within the Project footprint. A surface fire or explosion may affect the Atmospheric Environment VC through the volatilization of particulate matter (PM), carbon monoxide, and volatile organic compounds (VOCs). This change in air quality is expected to be limited in duration based on the quantity of fuel available for combustion, with conditions returning close to normal within 24 hours of the end of the event.

With the implementation of response procedures and mitigation summarized in **5.11.2.1**, a fire or explosion onsite is expected to have a High Magnitude, Local, Short-term, Reversible effect on air quality with a Moderate Context. The Consequence is therefore assessed as **Moderate**.

Noise from uncontrolled explosions could be audible at more than 10 km from the Project site. The noise generated from explosions would be very Short-term in Duration and would be unexpected. Due to the Short-term Duration of explosion, noise would result in a Short-term interaction during which changes in noise levels would occur. Because these would be uncontrolled explosions, the ability to take measures to reduce or eliminate the noise is not feasible.

5.11.4.2 Surface Water, Groundwater, Aquatic Resources, Fish and Fish Habitat, Wildlife, and Avian Species Valued Components (VCs)

A surface fire or explosion contained to the Project site may have minor effects to surface water, groundwater, aquatic resources and fish and fish habitat as chemicals used to control the fire may reach the aquatic environment. Given the location of the hydrocarbon storage tanks and Explosive Infrastructure, Tenas Creek, Four Creek and Goathorn Creek would most likely be affected. These effects could in turn affect wildlife dependent on the aquatic habitat, such as aquatic birds and amphibians. Emergency response measures will seek to limit the extent of the chemicals, and potentially contaminated materials will be removed promptly. This chemical release would be of limited extent, Short-term Duration, and those materials not able to be removed are anticipated to become diluted by the receiving environment. Context is considered Moderate. Predicted residual effects are assessed as **Not Significant** and the Consequence is **Minor**.

5.11.4.3 Infrastructure and Services Valued Component (VC)

In the unlikely event of a fire or explosion at the Project site, it is possible that external emergency response resources will be required. The accident may involve death, and injury, and could result in demands on local infrastructure and services (e.g., firefighting, and medical services) based in Telkwa and Smithers and further areas within the RDBN. Decisions would be made as needed to utilize services in other communities based on capacity needed or special expertise that is required, as would be done for other large industrial operations in the region. An ambulance will be available at the Minesite to respond to emergency calls to convey people to the hospital located in Smithers. With the implementation of the preventative mitigation measures, the potential effects from a fire or explosion on community infrastructure and services are anticipated to be Low in Magnitude, Local to Regional, Short-term, and Reversible. Resulting effects are not likely to be experienced at the community level in terms of expansion and upgrade of existing infrastructure and services. The predicted residual effect is assessed as **Not Significant**, and the Consequence is therefore assessed as **Minor**.

5.11.4.4 Human Health Valued Component (VC)

In the worst-case scenario, a fire or explosion at the site may lead to fatalities or serious injury to one (1) or more Project employees. Members of the public will not have access to the area and are therefore not expected to be at risk. A fatality or serious injury is expected to have severe effects on the affected individuals, as well as effects on the well-being of family and community members. In a worst-case situation, multiple fatalities would be considered a High Magnitude, Irreversible, High Context and **Significant** residual effect, and the Consequence **Severe.** Resulting effects may be experienced at the community level and may be particularly felt in smaller communities if the affected employees live in these smaller communities.

5.11.4.5 Economic Development, and Labour Market Valued Components (VCs)

It is likely that Project operations would be temporarily suspended during a fire or explosion with consequent effects to employment and procurement generated by the Project. The Project components requiring replacement would depend on the extent of the fire and damage to the components. Duration would be dependent on the time required to procure and install new components. The Magnitude would depend on the number of employees temporarily displaced and not involved in restoration, and the Extent on the location of the primary residences of the employees which is likely to be the LSA for labour market. However, effects would be expected to be reversible within a Moderate Context. Predicted residual effects are assessed as **Not Significant**, and the Consequence as **Moderate** due to the replacement time and the number of employees that may be affected.

5.11.5 Risk Assessment for Surface Fires or Explosions

The risk assessment considers the scenario in which the fire is contained within the Project Area. For potential effects, the Likelihood of occurrence is assessed as **Unlikely** for an onsite fire and **Rare** from an explosion from the onsite Explosive Infrastructure. The Consequence for the affected VCs range from **Minor** to **Severe** (Human Health VC). Thus, the most conservative risk for the event is **Medium**. The Level of Confidence in this risk assessment is **Poor** because of the challenges associated with seasonality and climate conditions contributing to the severity and intensity of the fire.

6. Summary of Risk Assessment for Scenarios Listed

A risk assessment for the accident and malfunction scenarios was completed, employing a risk analysis methodology based on the Likelihood and Consequence of the accident or malfunction. The assessment considers the engineering controls incorporated into the Project design, and implementation of the emergency response plans, clean-up, and restoration in contingency plans. The assessment is a conservative approach in that the most severe Consequence to potentially affected VCs is used to determine the risk. Risks are summarized in **Table 6-1.** Consequence from events that could result in fatalities and injuries (Human Health VC) generally presented the worst-case scenario and resulted in the highest risk ratings. The release of materials into water or on land affected Terrain and Soils, Surface Water, and Groundwater VCs, and in turn biophysical VCs for Aquatic Resources, Fish and Fish Habitat, Wildlife, and Avian Species. Events that resulted in temporary closure of the Minesite resulted in effects to the Economic Development VC. None of the risks fell into the High, Very High or Critical risk categories.

Table 6-1: Summary of Risk Assessment for Scenarios

Scenario	Likelihood	Consequence (Worst Case with Mitigation)	Risk Assessment
Containment Failure of the Management Ponds	Rare	Severe	Medium
Inability to Maintain Water Cover for Management Ponds	Rare	Negligible to Minor	Negligible
Misidentification and/or Misplacement of Potentially Acid Generating (PAG)	Unlikely	Minor	Low
Hazardous Material Spills in Water **Hydrocarbon Spill in Water** **Non-hydrocarbon Spill in Water**	Rare	Moderate	Low
Hazardous Material Spills On Land **Hydrocarbon Spill on Land** **Non-hydrocarbon Spill on Land**	Rare	Moderate	Low
Sediment Release into Water	Rare	Major	Low
Motor Vehicle Accident	Unlikely	Severe	Medium
Rail Accident	Rare	Severe	Medium
Earthworks Failure	Rare	Severe	Medium
Power Failure	Unlikely	Negligible	Very Low
Fires or Explosions	Unlikely	Severe	Medium

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