Tulsequah Chief Mine

# Project Description: Proposed Investigation Activities

March 2024

Legacy Properties / Teck

# TABLE OF CONTENTS

# 1.0 Project Overview

The Tulsequah Chief Mine is an underground mine that was operated under majority ownership by Cominco in the 1950s. Approximately 580,000 tonnes of zinc ore were produced and shipped offsite for processing at the Polaris-Taku concentrator on the west side of the Tulsequah River. Mining ceased in 1957 and further work is required to manage acidic mine drainage to close the site in accordance with current practices. The mine is located on the Tulsequah River about 10 km upstream from its confluence with the Taku River, in the traditional territory of the Taku River Tlingit First Nation (TRTFN). The Taku River crosses the Alaska border into the Taku Inlet and represents a high-value salmon and trout habitat that supports an important fishery.

The Tulsequah Chief Mine was managed under Joint Venture between Teck Resources (Teck) and Redfern Resources (Redfern) from 1987 to 1992, at which time Redfern exercised the option to purchase. In 1994, Redfern applied for a mine development permit, which ultimately led to issuance of an Environmental Assessment Certificate in 2002. Redfern was issued a Mines Act permit (M-232) in 2008 for early mine development works and conducted some remediation activities, including installing an underground passive water treatment system and clean water diversion, and sealing of mine openings. Redfern filed bankruptcy in 2009 and Chieftain Metals acquired the Site in 2010. Chieftain Metals constructed a treatment plant, which operated during 2012, with the intent of restarting operations, but did not follow through with plans to develop the mine. Chieftain filed for bankruptcy in 2016.

The Province of British Columbia has been managing the property during the receivership period, including contracting the development of a remediation plan, which was finalized in 2020, and completing site activities to upgrade access in support of executing the remediation plan, with Teck providing financial support for the work. In 2023, Teck initiated a review of the 2020 conceptual Reclamation and Closure Plan to identify and address data gaps and information needs to inform a detailed closure plan for the legacy Tulsequah Chief mine.

The Project Description detailed here outlines the initial technical investigations proposed to occur in the next 12-18 months to assist with closure planning activities. These investigations are to be overseen by Teck, with support from consultants contracted by Teck.

# 2.0 Location

The Tulsequah Chief Mine is located on the east side of the Tulsequah River approximately 100 km south of Atlin, British Columbia, and approximately 10 km upstream of the confluence with the Taku River and 30 km upstream from the Canada/US border (Figure 2.1). Access is fly in from either Whitehorse or Atlin via small aircraft, helicopter, or barge up the Taku River from Alaska. The site tenure is currently held by Chieftain Metals in the form of 25 Crown granted mineral claim parcels, and 4 Fee Simple lots, all with a lien or charge applied to the title, as well as 1 recently renewed Mineral Tenure Cell Claim (see Figure 2.2). Aside from the Fee Simple lots, the Crown holds the surface rights for the area represented by the legacy mine disturbance.

The Tulsequah Chief Mine includes a barge landing site on the Taku River, access road connecting the barge landing site to the airstrip and camp, mine site that includes the underground workings, waste rock storage, ore storage, water treatment plant and exfiltration pond, and several other sites that had been prepared ahead of the previous proposed mine development project (Figure 2.3 and Figure 2.4).

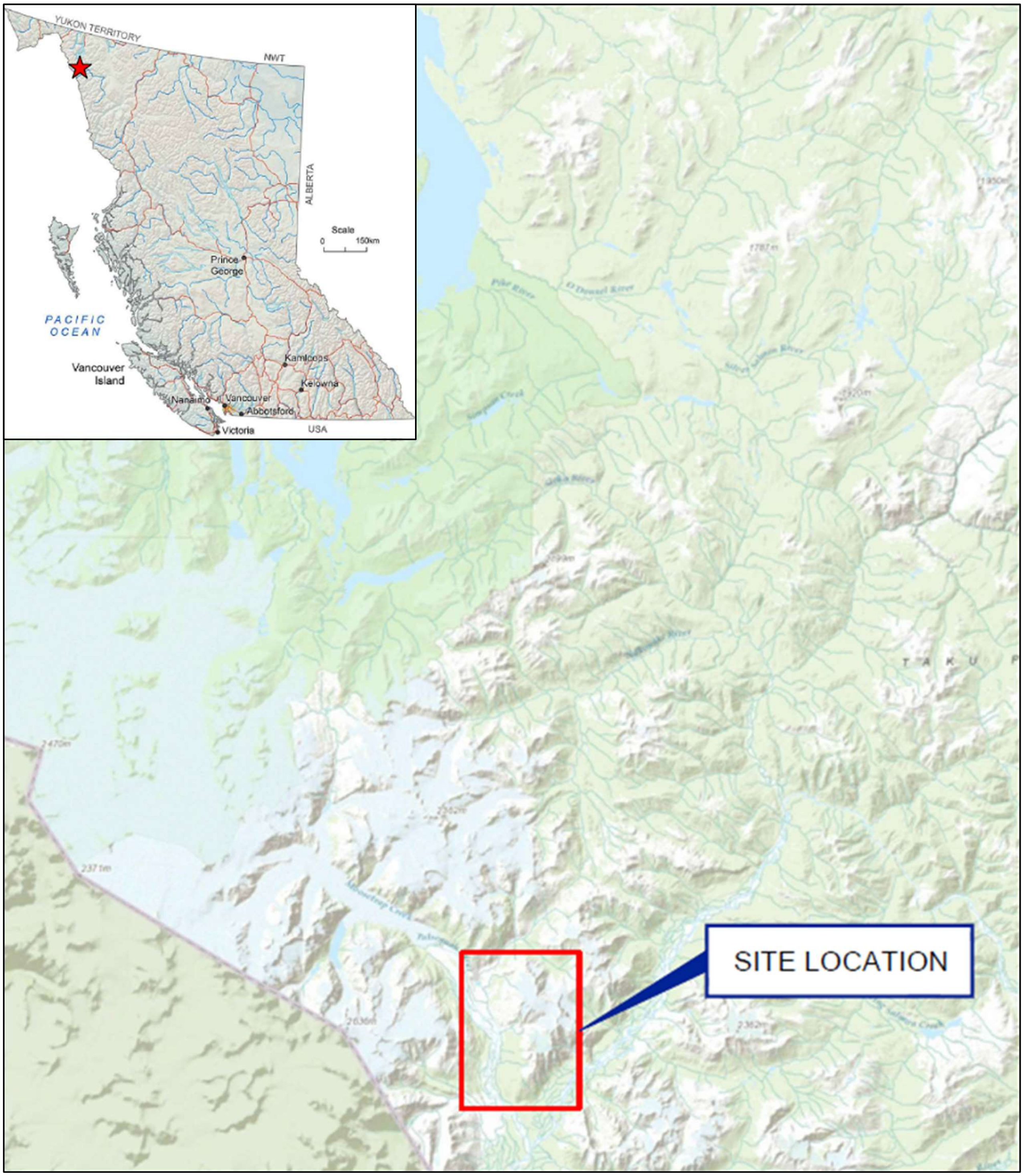


Figure 2.1 Tulsequah Chief Mine Location

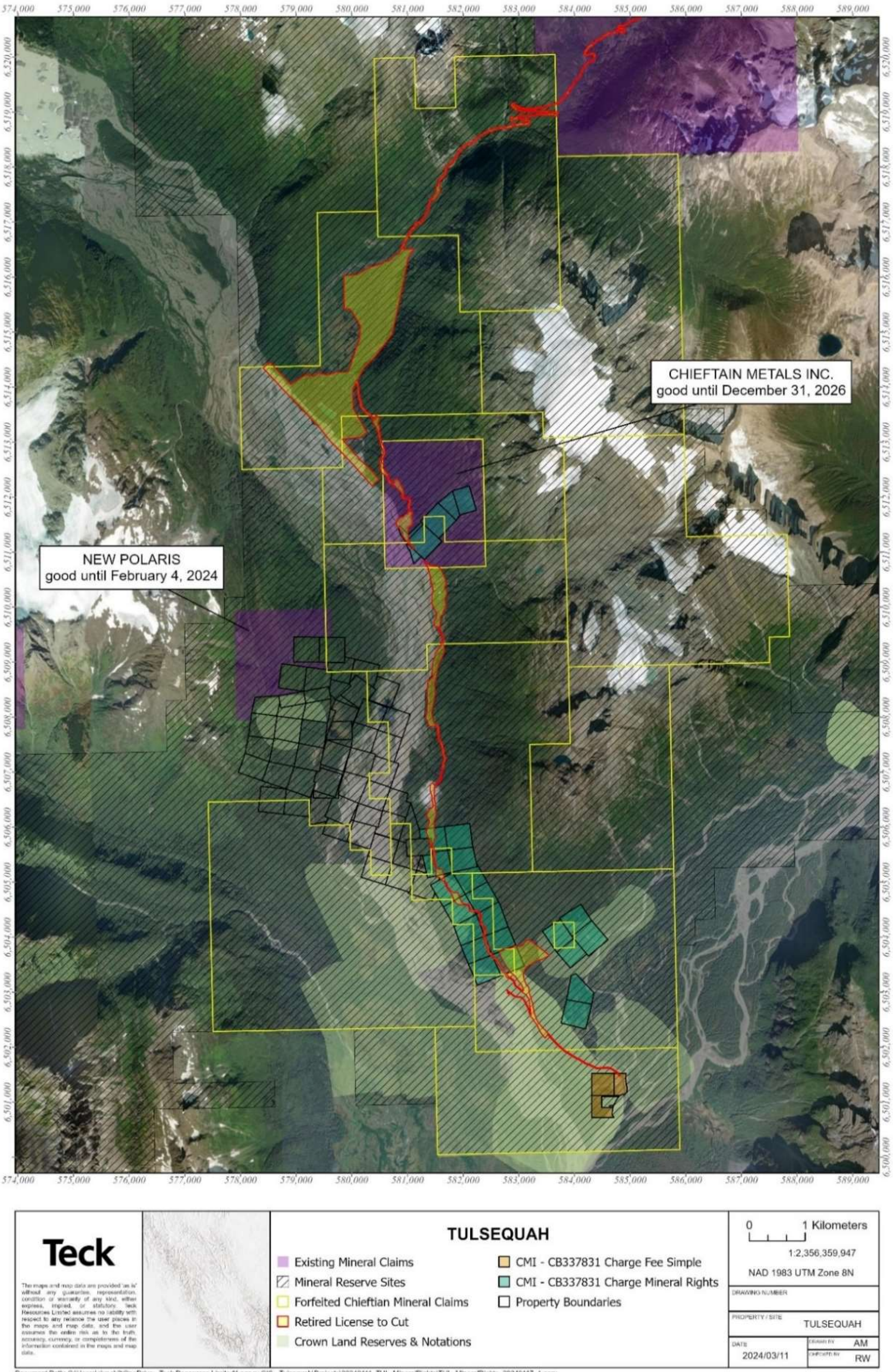


Figure 2.2: Tulsequah Chief Mineral Rights

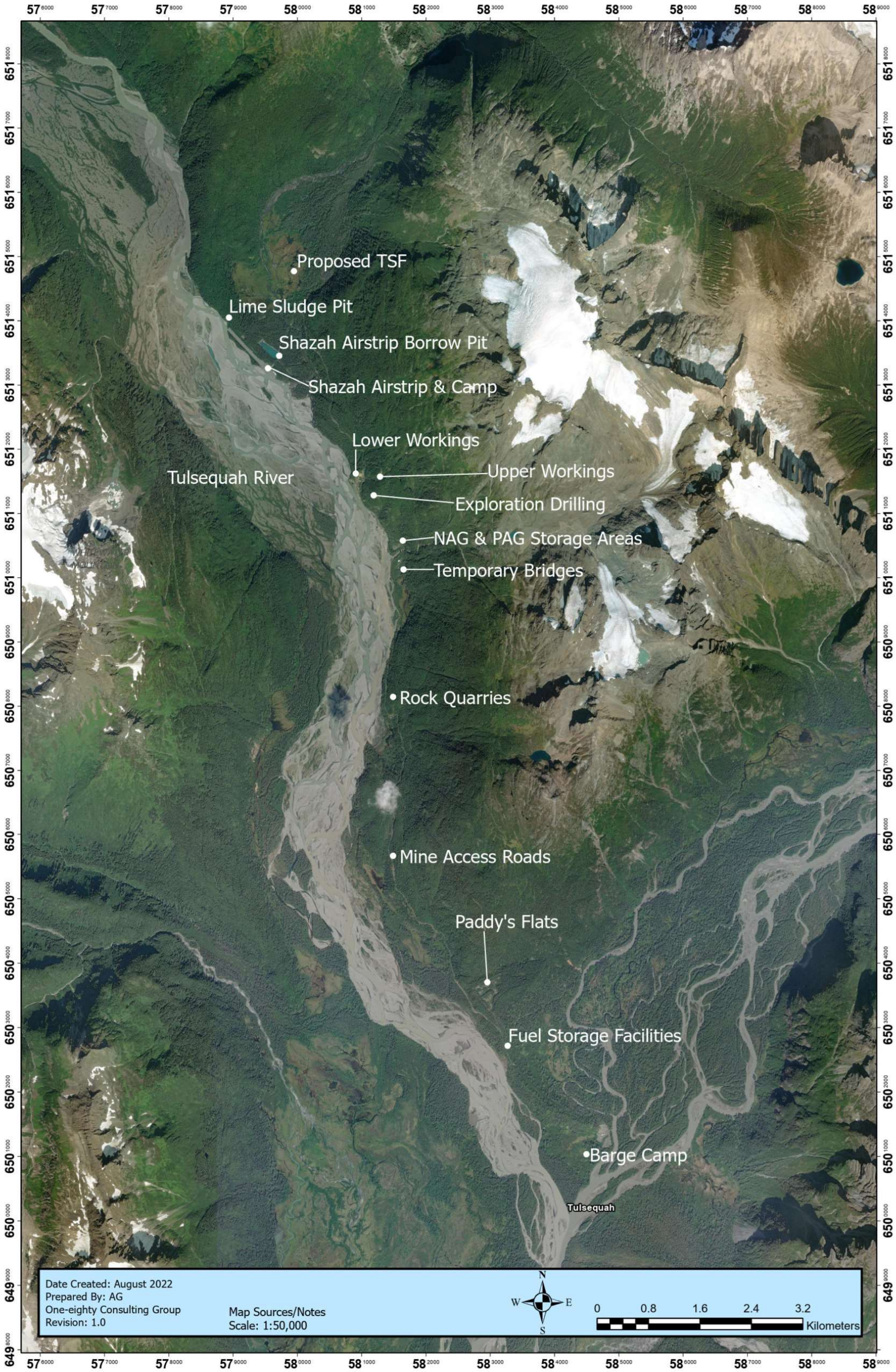


Figure 2.3: Tulsequah Chief Mine Components

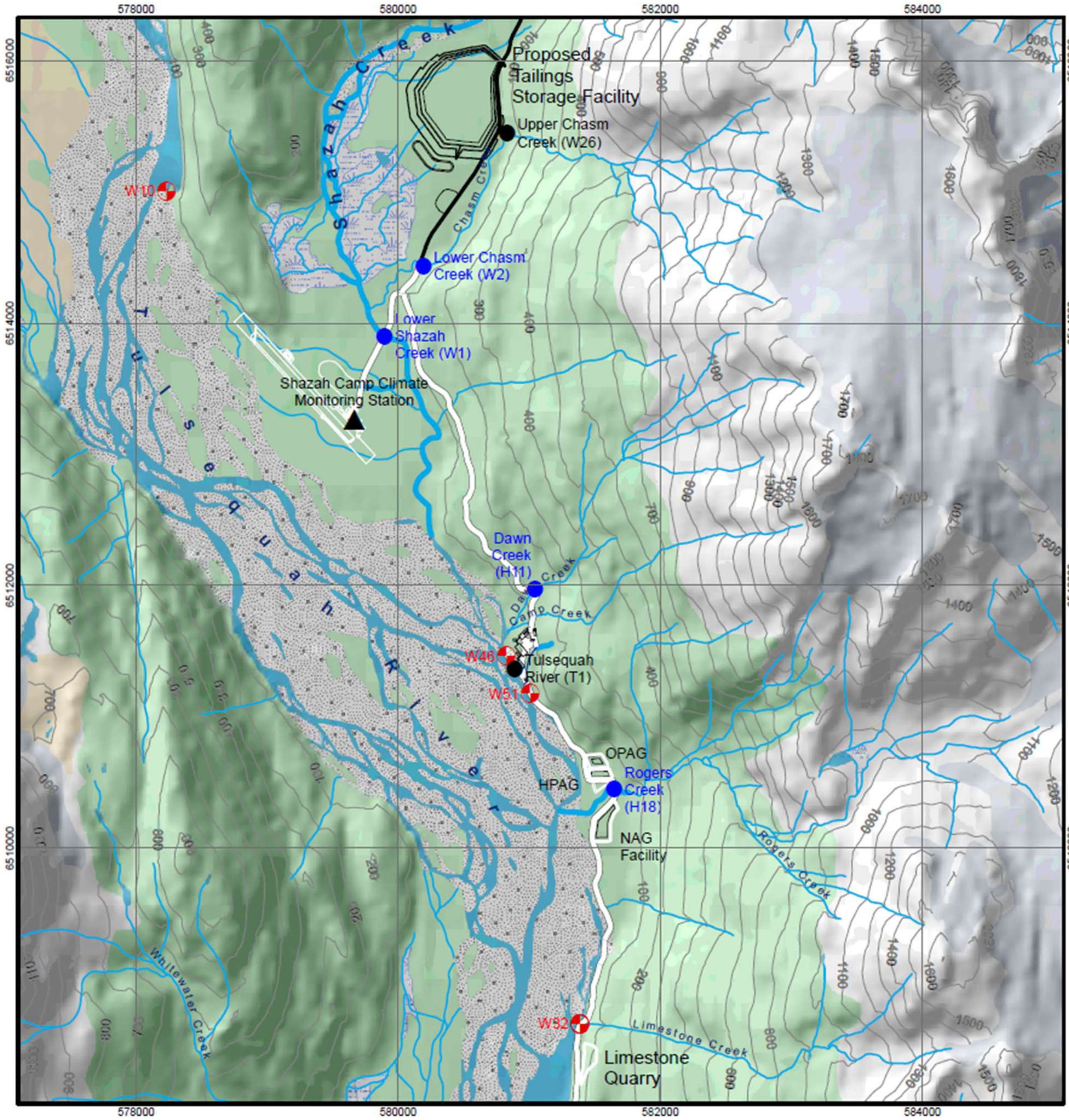


Figure 2.4: Tulsequah Chief Mine Existing (white) and previously proposed (black) infrastructure, water quality monitoring stations (red) and hydrology stations (blue)

# 3.0 COMMUNITY CONTEXT

The Tulsequah Chief Mine is located with the Traditional Territory of the Taku River Tlingit First Nation (TRTFN). TRTFN are located in Atlin, BC, a small remote community of approximately 400 people. Taku River Tlingit Territory covers over 40,000 $km^2$ and includes British Columbia, Yukon and Alaska.

Teck has been meeting with TRTFN since early 2023 and is committed to conducting closure planning in collaboration with TRTFN in a way that is informed by the Taku River Tlingit First Nation *Wóoshtin wudidaa* Atlin-Taku Land Use Plan[1] and with the Tlingit land use vision, *Hà Tlátgi Hà Khustìyxh Sìti*: Our Land Is Our Future: Vision and Management Direction for Land and Resources[2]. To date, Teck has signed a letter of understanding (July 2023) with TRTFN, and together Teck and TRTFN are in the process of establishing a Steering Committee and corresponding Technical Working Group to support collaboration on the Closure Plan for the Tulsequah Chief Mine. Regular meetings have been occurring and the investigation program described herein has been part of these discussions.

# 4.0 INVESTIGATION OBJECTIVES

Following conversations with the province in early 2023, Teck has conducted a review of the 2020 conceptual Reclamation and Closure Plan (RCP) prepared by the Province. The 2020 RCP highlighted information gaps that would need to be addressed to advance the concepts presented to detailed design level. The investigation work proposed here is largely aligned with the 2020 RCP approach, however there are additional activities contemplated that are intended to re-evaluate previous decisions made as part of the 2020 planning 1) to inform Teck's overall due diligence process and 2) to determine how the long-term closure outcomes could be further improved by optimizing or altering the 2020 closure concepts.

The overarching goal for long-term closure is to keep **clean water clean** and **control the sources of contaminant loading** using low or no maintenance solutions as much as possible to materially reduce the environmental risks and **minimize the long-term monitoring and maintenance** required for this site.

Toward this goal, Teck's review confirmed the gaps outlined in the 2020 RCP, identified additional gaps related to identified concepts, and highlighted further opportunities to improve the closure concepts proposed. The following outlines some key questions Teck will be seeking to answer (in no particular order of priority):

- What is the quality, quantity, and stability of the waste rock on site?

[1] Wóoshtin wudidaa Atlin Taku Land Use Plan. https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/skeena/atlin-taku-lup
[2] Our Land is Our Future. https://www.roundriver.org/wp-content/uploads/pubs/taku/reports/TRTFNVMD.pdf

- If the rock should need to be saturated to improve the long-term water quality outcomes for the site, is there sufficient room underground to re-place waste rock back underground? Is there a flooded location that currently exists on-site that would be suitable to keep the material saturated in the long-term?
- Can or should the material be processed off-site?
- Can the materials be placed on surface for a suitable long-term closure outcome?
- What are the main water sources to the underground workings (surface infiltration; fracture-controlled; groundwater)?
- How does water move internally within the mine and does this change seasonally?
- What is the range of flow rates (peak seasonal flows; extreme seasonal flows)?
- What is the water quality from each mine level and how does it change seasonally?
- What are all the opportunities to control the sources of water and contamination throughout the mine?

As such, the high-level objectives of the site investigation program described below are to:

- Characterize inflow water sources and identify ways to reduce the volume of water reporting to the underground.
- Characterize water sources currently flowing through the underground and identify ways to segregate water sources and reduce the flow of water discharging from the underground.
- Characterize water sources currently flowing through the underground and identify ways to improve water quality of any residual discharge that may come from the underground once closure measures are installed.
- Identify ways to reduce source and loading of poor-quality water from residual waste rock areas both underground and on surface.

The 2020 RCP provides a foundation on which the updated Reclamation and Closure Plan will be developed. The scoping of the updated RCP is underway, and it is Teck's intent that the update will be advanced in parallel with the investigation activities. This process will be communicated with stakeholders as it is better understood.

# 5.0 Investigation Activities

There are four primary investigation programs Teck proposes to initiate:

1. Establish safe site access:
    - Establish safe, reliable access to site.
    - Install temporary camp facilities to support the program and potentially subsequent activities.
2. Underground mine:

- Conduct drone supported investigations of the underground access and workings to support geotechnical assessments, inform ground support requirements to ultimately provide safe access to the underground mine for subsequent investigations and water sampling.
- Conduct assessments of available underground void space to determine the potential for backfilling voids with waste rock and ore.

3. Water quality and flow:
   - Collect updated water quality and flow measurements to quantify the water in the underground workings.
   - Collect samples over a range of flow regimes to quantify the seasonality of the chemistry and flow conditions.
   - Augment the database of surface water flows and chemistry.
4. Waste rock:
   - Quantify waste rock stored on surface.

These programs are further described below.

## 5.1 Safe Site Access

The proposed investigations will be conducted seasonally, during the snow-free window, approximately mid-May to mid-October. Barging is not required for the work proposed at this time.

Personnel will be staged out of Whitehorse, as the nearest commercial flight centre.

Site access for the investigative programs will be staged. Initially, access will be via helicopter from Whitehorse (Horizon Helicopters[3] EC135 twin engine helicopter), as the suitability of the Shazah airstrip (Figure 5.1) for fixed wing access is unknown. The EC135 can seat 5 passengers.

If and when the Shazah airstrip is deemed suitable, fixed wing aircraft may be able to use the airstrip to transport passengers and supplies for

Figure 5.1 Shazah Airstrip

[3] https://www.horizonhelicopters.ca/

subsequent programs. If a fixed wing aircraft is used, it will be a twin-engine plane provided by Alkan Air[4] in Whitehorse.

If the Shazah airstrip is not suitable, access will continue to be via helicopter for the duration of the program.

Assessments will be conducted of the road and bridges between the airstrip and mine and the airstrip river revetement. Any necessary work here would be planned after the assessments. Establishing safe, reliable access to the site may also include:

- installing/establishing new temporary helipads (vegetation brushing only).
- installing remote surveillance equipment to acquire instantaneous images of current site conditions – these will be used to inform subsequent site visits, and monitor the site as needed.

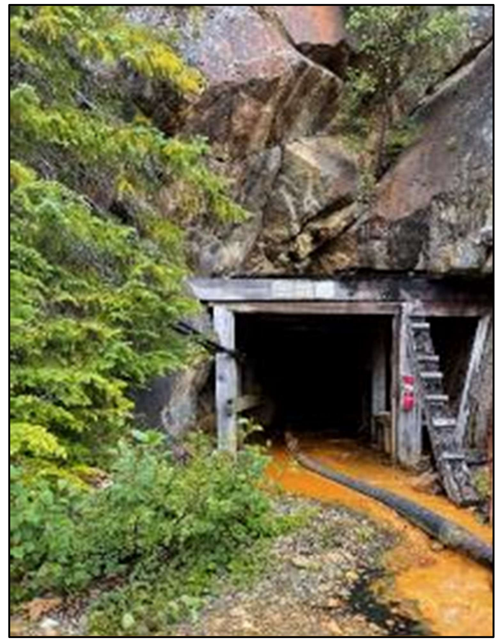

Figure 5.2 5400 Level Portal

Temporary camp facilities to support the 2024 investigations are currently being finalized; however, will be limited to those that can be flown in via helicopter. These types of remote camps typically include:

- stand-alone sleeper tents.
- separate kitchen tent.
- wash tent with first aid support.

The existing camp facilities will not be used at this time.

## 5.2 Underground Mine

The primary purpose of the 2024 underground mine investigations is to collect more up to date information on the status and condition of the underground mine to 1) acquire rock mass information to inform required ground support (if any) to support safe underground access for personnel to complete the investigations, and 2) survey the underground to quantify the available void space, improve the accuracy of the modeled mine geometry, and support closure water management planning, including portal plug strategy and design.

[4] https://alkanair.com/

The site surface geotechnical conditions will also be assessed. Areas of interest for investigations of the underground mine workings include:

- surface outcrops to collect geotechnical and structural data for informing the site engineering geology model.
- underground workings (Figure 5.4) – specifically at the 5200[5] (Figure 5.5), 5400 (Figure 5.6), 5900 (Figure 5.7), 6200, and 6400 levels.
- exploration drill core (if it can be located on surface) to inform geotechnical parameters and used for initial rock strength laboratory test work (if suitable samples exist).

Once deemed safe or upgraded to allow safe access underground, studies in the underground workings will include:

- an initial drone survey to collect point cloud data that will be used to generate a 3-dimensional shape of the entire underground workings for all stopes, ramps and drifts, and the overall void space and video of all underground spaces that can be reached via drone.
- safety assessment for human access (see Section 6.0).
- Geotechnical data collected including:
    - cell and/ or line mapping of targeted sections of safely accessible levels to generate geotechnical parameters.
    - collection of geotechnical and structural data for informing the site engineering geology model.
    - scaling will be utilized while accessing mine workings to ensure safe working conditions for person access. Scaled materials will remain in the underground unless it needs to be removed to surface temporarily to support access needs.

## 5.3 Hydrology and Hydrogeology

There have been substantial data collected since 2003 to characterize the water quality and flow conditions for the underground mine and the receiving environment (e.g., Chasm Creek, Rogers Creek, Shaza Creek, Dawn Creek, Camp Creek, Portal Creek, and the Tulsequah River) to support the long-term source control and water management planning for the site. Data collection will aim to address the following data gaps in the existing data set:

- Synoptic flow rates from portals and in creeks.
- Seasonal flow variation.
- Movement of water internally within the mine (from one level to another).
- Rate of surface infiltration as a driver of seasonal flows.

[5] Consolidated Mining & Smelting Ltd. (Cominco) established a sea level datum approximately equivalent to 5000 feet. That is the 5400 level is approximately 400 feet or 121 meters above sea level.

- Sources of inflows into the mine.
- Existing mine water quality at each level and seasonal fluctuations.

Water quality and flow monitoring will be completed to capture seasonal range of water quality and flows at all accessible underground locations and surface water sites. Water quality and flow will be measured over 5 discrete sampling programs over approximately 12 months.

Synoptic flow measurements and water sampling will be taken at all underground and surface water sampling sites. During sampling, field water quality measurements will be taken, and will include:

- pH (pH units)
- electrical conductivity (µS/cm)
- dissolved oxygen (% and mg/L)
- turbidity
- redox (oxidation-reduction) state (Eh - volts).

All water quality samples will be submitted for laboratory analysis of:

- pH (pH units)
- electrical conductivity (µS/cm)
- turbidity (NTU)
- total dissolved solids (mg/L)
- total suspended solids (mg/L)
- total and dissolved metals (by ICP)
- anions (mg/L)
- alkalinity (mg/L)
- dissolved organic carbon (mg/L)

A subset of water samples would be also submitted for acute lethality testing, including samples collected from the 5400 neutral mine water outlet and from Camp Creek under low flow conditions. Where possible, flumes will be installed with dataloggers connected to a satellite-telemetry system close to the portal entrances to measure flow and water quality underground on a continuous basis.

The sampling locations are described further below. Monitoring of the underground workings will occur following the drone survey and subsequent safety assessment.

### 5.3.1 Surface Water

Water quality sampling for surface water sites will be conducted concurrently with underground water quality monitoring. Flow monitoring will include manual measurements during water quality sampling site visits, and, where possible, continuous data loggers to measure water level, that may be connected to remote monitoring telemetry.

Water quality and flow monitoring will be completed at accessible surface water sites (Figure 5.3). Potential sites include:

- exfiltration pond
- airport borrow pit

- Camp Creek above 5900 level discharge and at access road
- Dawn Creek at access road
- Gully Creek
- Portal Creek above 5400 level
- Tulsequah River upstream of the confluence with Camp Creek and Dawn Creek (water quality sampling only)

### 5.3.2 5200 Level

The 5200 Level workings are approximately 800 m long, with a 2-stage treatment system, comprised of a 28 m sulphate reducing bacteria (SRB) cell and a 58 m limestone cell located approximately 300 m down the workings. There are also four 1.8 m pervious angular limestone sludge retention dams between the 2-stage treatment system and the end of the drift (Figure 5.5). Water from the 5400 level flows to the 5200 level via a stope at the end of the 5200 level drift.

Water quality and flow conditions will be monitored at the 5200 level from the portal to the level barrier at the downstream end of the treatment system, approximately 360 m from the portal (Figure 5.5). Assessments will also be conducted at the locations shown in Figure 5.5:

5. the portal
6. approximate plug location
7. the barrier
8. If accessible from the 5400 level, the area of poor-quality water behind a 1.3 m timber settling dam and the reported neutral water settling pond.

### 5.3.3 5400 Level

The main access to the original underground mine in the 1950s was through the 5400 portal. Much of the waste rock produced during historic mining is located outside both the 5200 and 5400 Level portals. In addition, most of the mine water from upper levels drains downward through the shaft and various stopes to the 5400 Level. This water then flows out of the 5400 portal or is partially/fully re-routed to the 5200 portal. As a result, the combined flow and chemistry from these two portals represents the majority of output from existing workings. A two-compartment 1,017 ft vertical shaft connects the 5400 to 6400 levels.

If accessible, conditions and existing infrastructure will be documented from the portal to the neutral mine water (NMW) inlet, approximately 850 m from the portal. If air quality mitigation measures are in place, conditions along the 5452 N cross cut, including the NMW drillholes, will be documented. Sample locations will be based on the field water quality readings, and, as shown in Figure 5.6, will include:

1. the portal

2. the potential plug location
3. the neutral mine water inlet
4. other flow locations including ore chutes and drillholes

Valves for drillholes with neutral field pH discharging upstream of the NMW inlet will be left open at the end of the first visit to evaluate steady state flow conditions in succeeding visits.

### 5.3.4 5900 Level

The 5900 level is approximately 550 m long, with a known fall of ground approximately 80 m from the entrance. Geotechnical conditions are relatively unknown beyond the fall of ground, and hence monitoring will depend on drone survey results and health and safety risk assessment.

If accessible, water quality and flow conditions will be monitoring on the 5900 level from the portal to the end of drift (Figure 5.7), including:

5. the portal
6. the potential plug location
7. close to the end of the 5900 drift

If accessible, the 5900 crosscut diamond drill holes, the flows down the 5902 north drift; and the flows down the shaft and man way will also be monitored.

### 5.3.5 6400 and 6500 Levels

The 6400 level is blocked by a full drawpoint an unknown distance from the portal. Conditions at the 6400 level, and at the approximately 100 m long 6500 level drift are unknown, and hence will require initial investigations using the drone.

Existing conditions will be documented in accessible locations, to evaluate the potential for inflow through open vent raises to inform how to reduce or eliminate the inflows if possible to support options development for ultimately reducing the discharge from the underground. Water quality sampling locations will be selected based on field water quality and estimated flows.

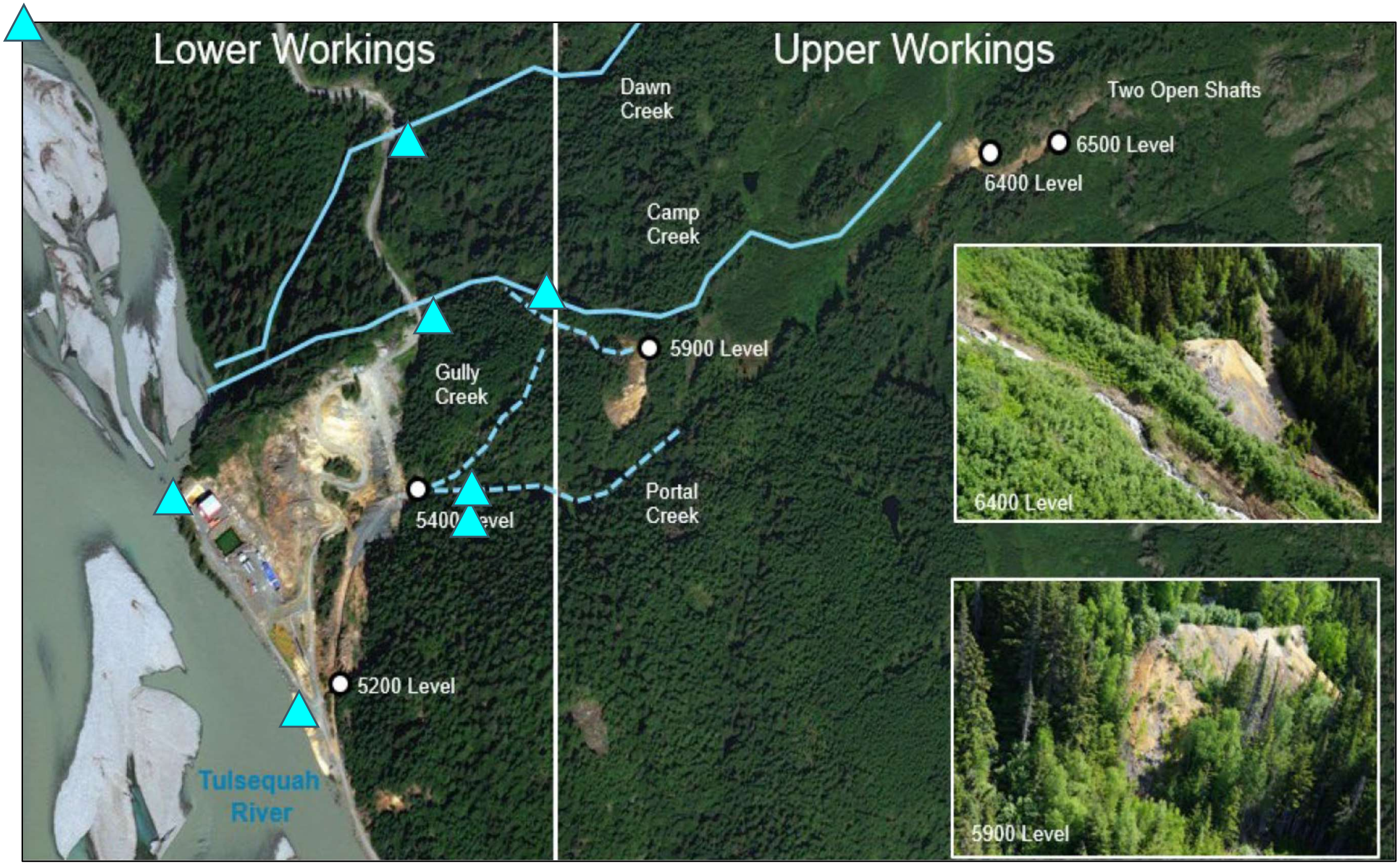


Figure 5.3: Proposed Surface Water Quality Monitoring Locations

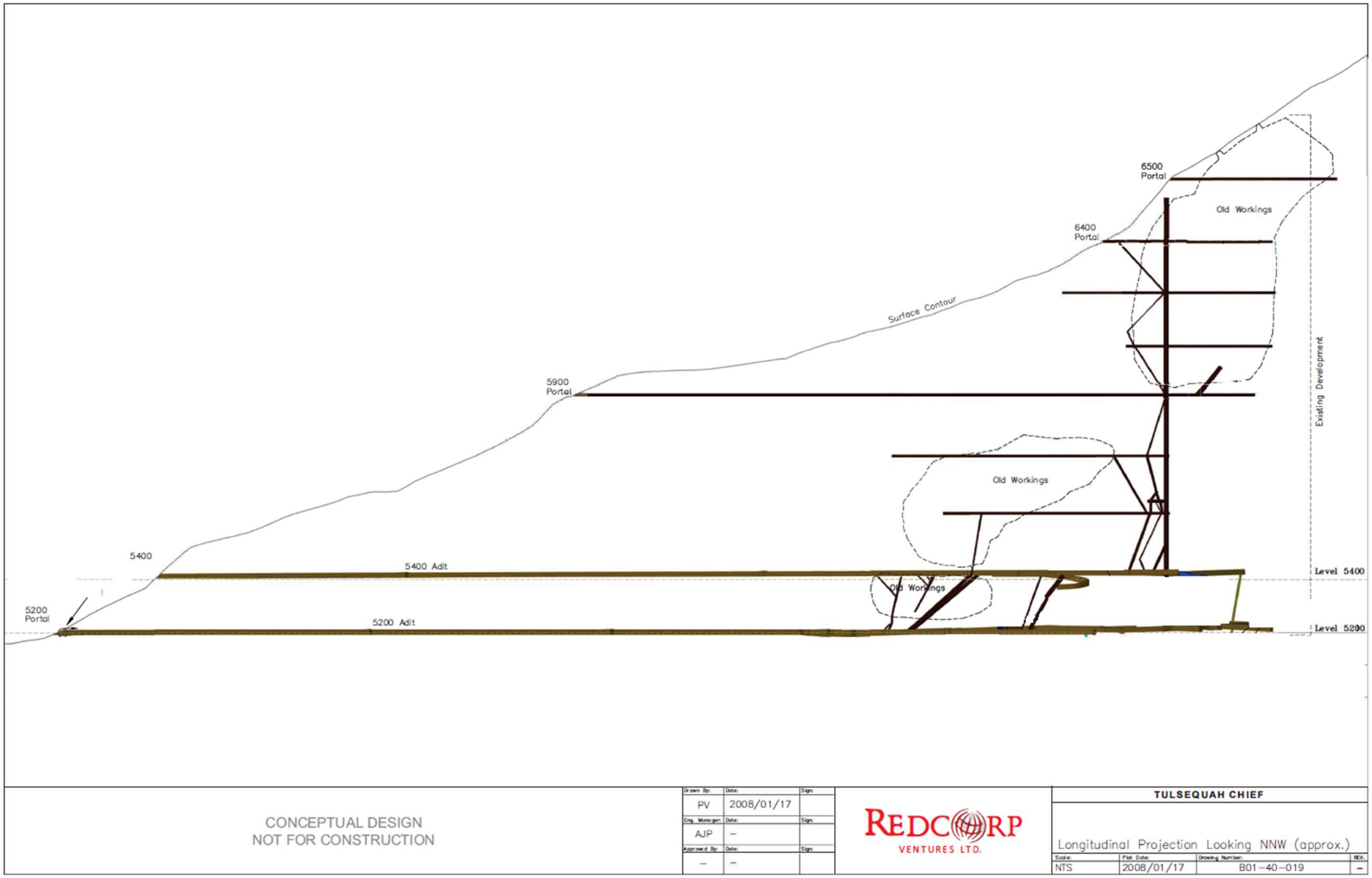


Figure 5.4: Historic Underground Workings

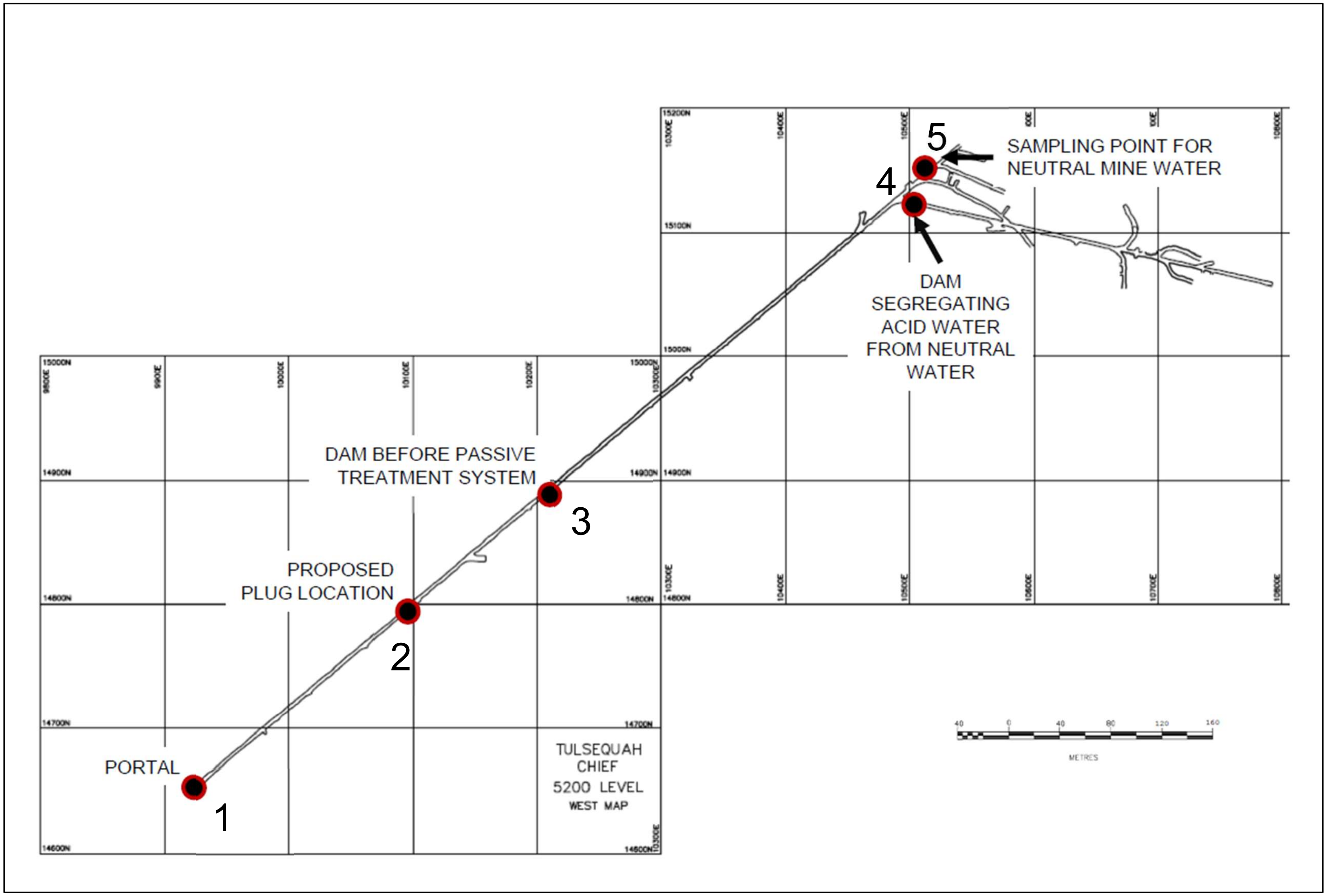


Figure 5.5: 5200 Level Underground Workings with Proposed Inspection Locations

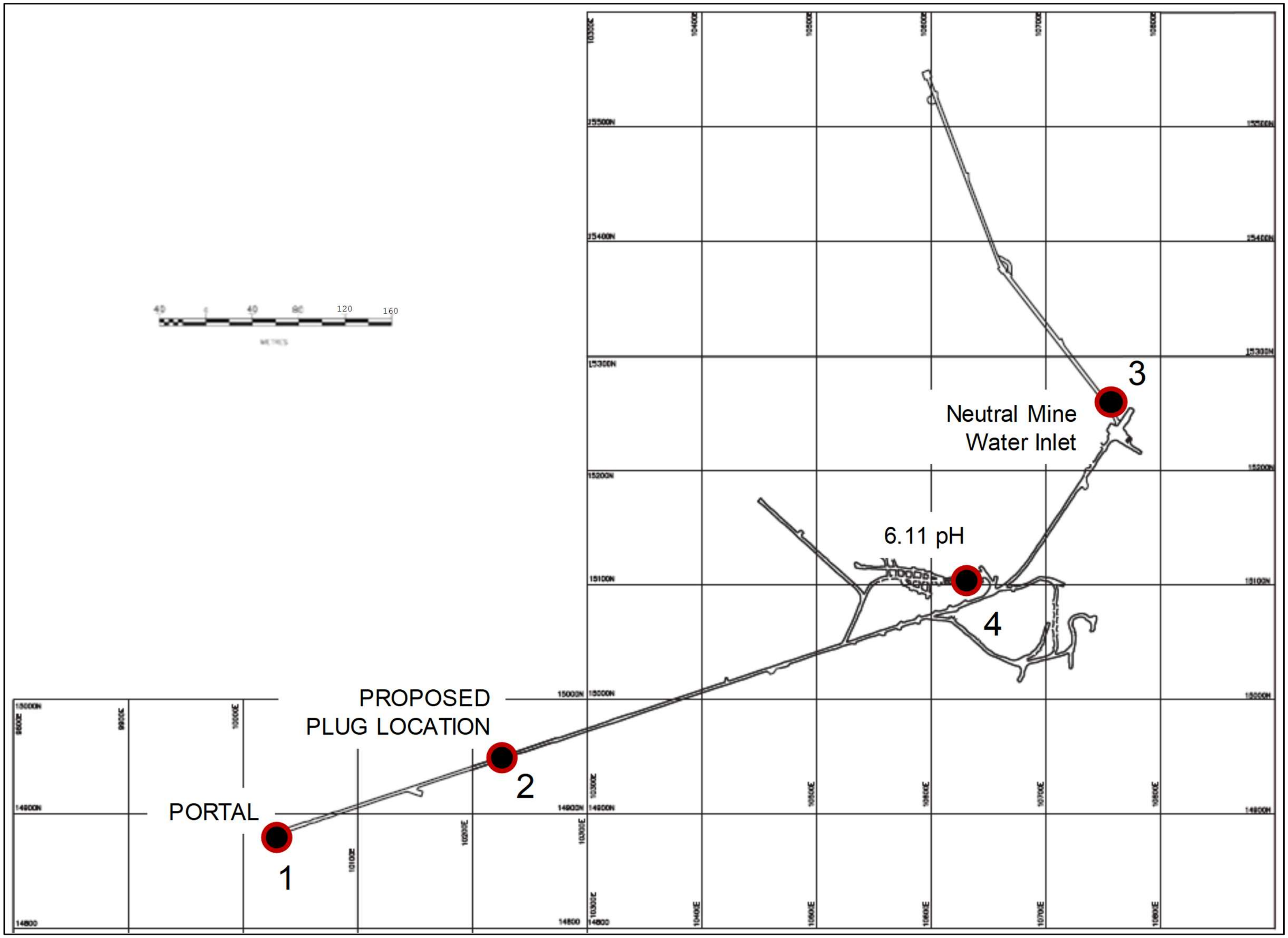


Figure 5.6: 5400 Level Underground Workings with Proposed Inspection Locations

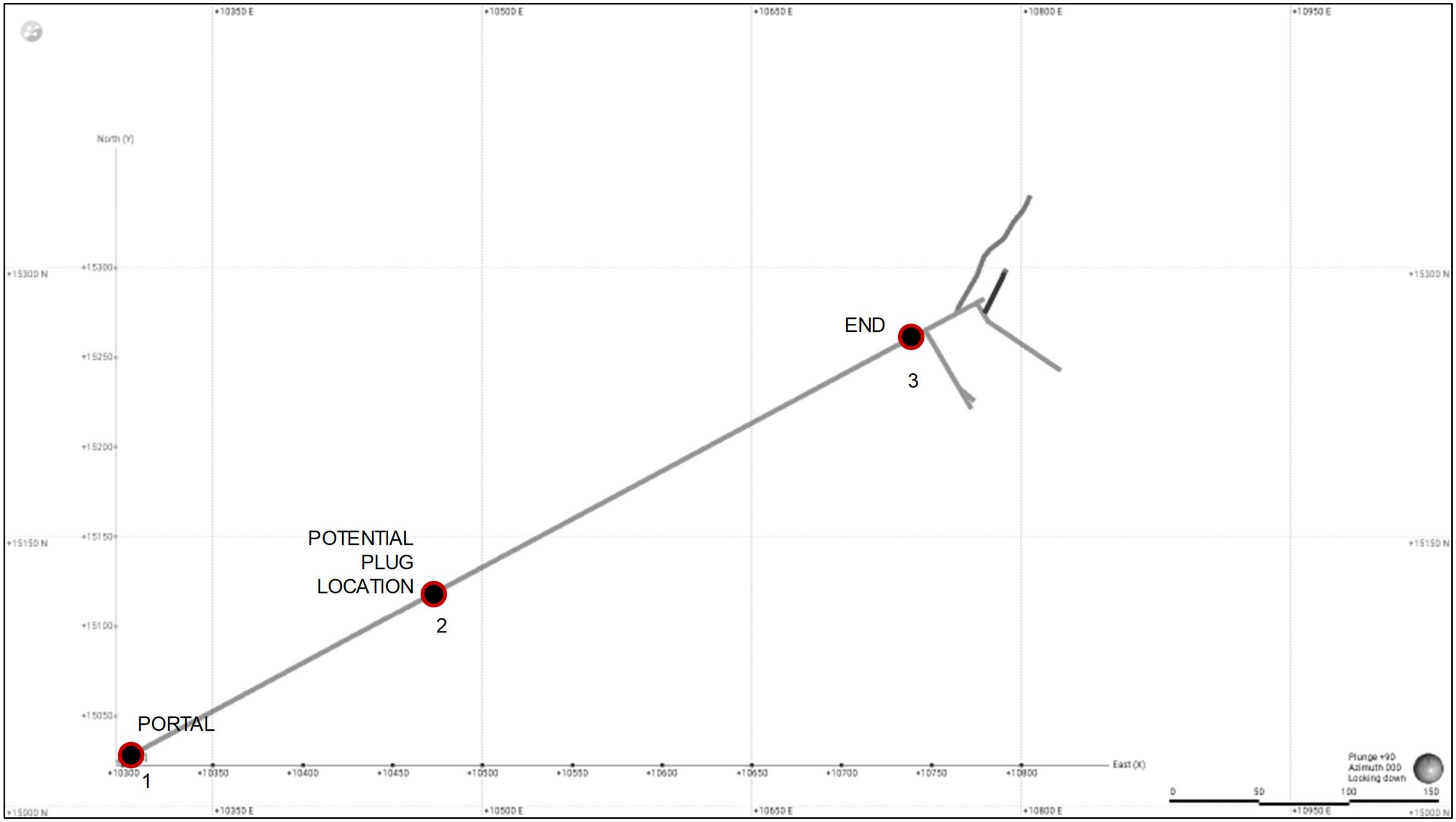


Figure 5.7: 5900 Level Underground Workings with Proposed Inspection Locations

### 5.4 Waste Rock Dumps

Inspections of current waste rock disposal locations will be conducted to better understand locations, composition, geometry, and current performance to inform planning for long-term permanent storage of these materials.

The waste rock investigation will include an assessment of the following sites for long term management of consolidated waste rock:

- Adjacent to the hillside below the 5400 level.
- On the exposed bedrock used to provide riprap for the North Causeway.
- At Paddy's Flats borrow area.
- In the site on the Roger's Fan.

The waste rock investigations will include:

- documentation of physical attributes of existing waste rock dumps.
- estimation of volumes of existing waste rock materials in each dump.
- assessment of the projected groundwater flow through the base of the consolidated waste rock piles.

### 5.5 Assumptions

- Daily helicopter travel is limited to 10 hours of fly time due to pilot's restriction.
- Flight from Whitehorse to Tulsequah Chief Mine is approximately 1.25 hours each way.
- Safe access for people can be established in the underground, and alternative plans developed if safe access can't be established or takes longer than expected in some areas.

## 6.0 Health and Safety

Teck has a comprehensive program to ensure the health and safety of all workers, consultants, and visitors to all Teck Legacy properties. This program would be applied for this site.

Prior to each site visit, Environment, Health, Safety, and Community (EHSC) Work Plans will be prepared tailored to each specific scope of work planned, and will be reviewed and signed off by all workers, consultants and visitors.

Prior to accessing any underground workings, a detailed underground re-entry Health and Safety Plan will be developed using both the drone survey results, and the findings of a site visit by ground control & ventilation specialists and geotechnical engineers. The underground re-entry plan will include the following considerations:

SITE HISTORY AND DOCUMENTATION:

- Review historical mining records and documentation to understand the mine's history and past issues.
- Evaluate previous incidents, if any, and the lessons learned from them.

GEOLOGICAL AND GEOTECHNICAL ASSESSMENT:

- Assess the conditions of the underground workings by a qualified person.
- Identify potential geotechnical hazards, such as unstable rock formations or ground subsidence.

STRUCTURAL INTEGRITY AND GROUND STABILITY:

- Assess the structural integrity of tunnels, shafts, and support systems by a qualified person.
- Evaluate the stability of underground workings, including the risk of roof collapses.
- Develop ground support designs (if required).

VENTILATION AND AIR QUALITY:

- Evaluation of UG ventilation by a qualified person.
- Evaluate the ventilation system, including airflow and gas monitoring equipment.
- Identify potential risks related to poor air quality or gas accumulation.

COMMUNICATION:

- Develop communication plan / protocol for underground access.

HAZARDOUS SUBSTANCES:

- Identify and quantify hazardous substances present in the mine, such as toxic gases or chemicals.
- Assess the risk of exposure and the potential for leaks or spills.

EQUIPMENT AND MACHINERY INSPECTION:

- Inspect all mining equipment and machinery for their condition and functionality.
- Assess the potential risks associated with outdated or damaged equipment.

EMERGENCY RESPONSE CAPABILITY:

- Review the mine's emergency response plan and equipment, such as escape routes, emergency shelters, communication systems and first aid stations.
- Access and egress plans including a separate means of egress, or a refuge plan if not available or uncertain.
- Equipment requirements should also include cache of spare self-rescuers commensurate to the numbers of personnel underground.
- Emergency response procedures including details of mine rescue personnel, either on surface or, if on call, demonstrated ability to rapidly deploy.
- Identify any gaps in the emergency response capability.

ASSESSMENT OF EXTERNAL INFLUENCES:

- Review external influences which could impact mine infrastructure e.g. rain events, seismic events, air blast risk associated with large stope or crown pillar collapse.

ENVIRONMENTAL IMPACT ASSESSMENT:

- Conduct an environmental impact assessment to evaluate potential environmental risks.
- Identify any environmental safeguards that need to be put in place.

SECURITY AND ACCESS CONTROL:

- Assess the security and access control measures to prevent unauthorized entry.
- Evaluate the risk of theft or vandalism during the reopening process.

All aspects of the site investigations will be conducted in accordance with the following legislation:

- Workers Compensation Act.
- Occupational Health and Safety Regulation.
- Occupational Health and Safety Guidelines.
- Health, Safety and Reclamation Code for Mines in British Columbia.
- Other relevant legislation, codes and standards.

# 7.0 SCHEDULE

The schedule proposed for the investigation program is milestone based to account for uncertainty in timeframes and durations for key elements of the safe underground access requirements. Currently Teck is contemplating a series of seven site visits needed to complete the program during the snow-free window, approximately mid-May to mid-October

2024 and likely 2025, as below. Development of the overall reclamation and closure plan would occur in parallel.

Table 7.1 Preliminary Site Visit Scope

| Visit | Days | Access Details | Scope |
|---|---|---|---|
| **1** | 1 | Helicopter | Inspect airstrip and fuel storage locations |
| **2** | 4 | Helicopter | Install temporary camp |
| **3** | 5 | Fixed wing and/or Helicopter | Conduct underground drone survey to determine ground control and ventilation requirements; Collect surface outcrop mapping and waste rock assessment. |
| **4** | TBD | Fixed wing and/or Helicopter | Install ground control and ventilation measures for safe underground access; Conduct underground geotechnical data collection |
| **5** | 5 | Fixed wing and/or Helicopter | Surface walkover and helicopter flyover for hydrogeological assessment; Underground flow and WQ sampling; Surface flow and WQ sampling; Deploy hydrometric instrumentation |
| **6** | 2 | Fixed wing and/or Helicopter | Underground flow and WQ sampling; Surface flow and WQ sampling |
| **7** | 2 | Fixed wing and/or Helicopter | Underground flow and WQ sampling; Surface flow and WQ sampling |
| **8** | 2 | Fixed wing and/or Helicopter | Underground flow and WQ sampling; Surface flow and WQ sampling |
| **9** | 5 | Fixed wing and/or Helicopter | Underground flow and WQ sampling; Surface flow and WQ sampling |

Note that Site visits 2 and 3 may be combined into a single visit, and, after site visit 3, a detailed assessment would be carried out to determine ground control and ventilation requirements to allow safe access to the underground for personnel to complete geotechnical and water quality/flow investigations. Depending on timing, the camp may be demobilized before the full site visit list outlined here is complete and then remobilized when weather permits to complete the remainder of the site visits the following year.

In addition to the activities listed above, site visits would be offered to community, First Nations, and government representatives to increase their familiarity with the site and to gain input. Subject to obtaining access to the existing active water treatment facility and other infrastructure on site, assessments and potential trials of this equipment would be carried out.