

## TECHNICAL MEMORANDUM

**DATE** 7 October 2021

**Reference No.** 20405023-002-TM-Rev0-1000

**TO** Timothy Johnson, CEO  
Granite Creek Copper Ltd.

**FROM** Dale Heffernan and Fiona Esford

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Fiona\_Esford@golder.com

### 2021 ANNUAL INSPECTION OF THE CARMACKS COPPER PROJECT, CARMACKS, YUKON

## 1.0 INTRODUCTION

This memorandum summarises the observations made during the 2021 annual inspection of the Carmacks Copper Project site. The inspection was carried out by Golder Associates Ltd. (Golder) for Granite Creek Copper Ltd. (Granite Creek) to fulfil the requirements of Section 16.1 of the Quartz Mining License (QML-0007) for the site. The work was carried out in accordance with Golder's proposal CX20405023-001-P-Rev0, dated 16 October 2020, and approved by Granite Creek on 19 August 2021.

The purpose of the inspection was to evaluate the condition and stability of the existing facilities in the area of the proposed mine. The existing facilities at the site comprise a mine exploration camp, access roads, and minor drainage structures. Golder also inspected the area of proposed mine development. The proposed mine infrastructure, as described in the approved QML, dated 15 April 2009, includes a heap leach facility, water management ponds, an open pit, a waste rock storage area, a processing plant and related facilities, ore preparation facilities, ore stockpiles, and water diversion structures.

## 2.0 OBSERVATIONS

### 2.1 Overview

The inspection was carried out by Mr. Dale Heffernan of Golder on 26 August 2021. The inspection focused on the existing site infrastructure and a review of the general site conditions. Photographs of the site at the time of the inspection are presented in Attachment 2. Data collected from thermistors, between 2007 and 2021, are presented in Attachment 3.

The project is in the advanced exploration stage. The only infrastructure on site at the time of inspection was the exploration camp and access roads to the proposed open pit mine area and other areas of the property. The access roads were developed to provide access for exploration and investigation activities.

The site development required to support operations has not started yet. Therefore, there is no stability concern associated with the undeveloped facilities and no maintenance is required. No permanent water diversion structures are in place. There are, however, temporary water management structures (i.e., ditches and sediment catch basins) in place that are appropriate for the exploration stage of the property. We recommend that these diversion structures continue to be inspected annually and that ongoing maintenance be conducted, as deemed necessary.

## 2.2 Exploration Camp Area

In previous years, inspections of the camp area have noted the presence of cracking, most likely resulting from thaw induced settlement beneath and adjacent to core storage racks. No cracking was observed in the vicinity of the core storage racks during the 2021 inspection. As in previous years, settlement in this area does not represent a safety concern and the inspection did not indicate erosion of sediments from the pad area into the surrounding natural area.

There are two heated buildings, the core shack and geology office, located adjacent to the core storage racks (Photograph 1). The tanks, valves and hosing were in a satisfactory condition, at the time of inspection. Liners and spill pads have been placed beneath each tank to act as secondary containment for potential leaks and were also in a satisfactory condition. During the 2021 inspection there were several wall tents installed within the camp area to support the 2021 exploration drilling program. The area around these wall tents was in a satisfactory condition, at the time of inspection.

The slope behind the camp (Photographs 2 and 3) is stable and does not pose a safety concern for the camp structures or current operations. There is minor ravelling of small sections of the slope, but these are not impacting camp safety nor would they represent a risk for workers on the project. Some regrowth of vegetation was observed in the camp area.

## 2.3 Proposed Heap Leach Facility Area

The inspection included the area of the proposed heap leach facility and associated water management pond. Site preparation in these areas has been limited to clearing of trees and topsoil. This portion of the site also includes several access roads and drilling platforms previously used for exploration and investigation activities. The sediment control measures include ditches and berms to divert water into sediment catch basins, silt fences, and vegetated areas to break up flow and reduce the potential for erosion.

Clearing and drilling activities were carried out more recently in 2015, 2017, and 2021 at a location down slope of the proposed heap leach facility, near the proposed water management pond. Regrowth of vegetation on the 2015 and 2017, primarily volunteer species of grass, has mitigated loss of sediment from the former drill pads and is suitably rehabilitating. The 2021 drill pads were observed to be in a satisfactory condition at the time of the inspection.

Further downstream, within the floodplain of Williams Creek, silt fences have been installed and the area seeded where sediment from previous site erosion accumulated. Grass seed was applied in 2009 to promote the re-establishment of vegetation and to further stabilize sediment. The approach was noted to be generally effective in 2011 and 2012, but with limited regrowth attributed to periodic pooling of water. The area was also re-vegetated with woody plants (willow cuttings), and these plants are now well established. Volunteer species of grass and woody plants are performing very well. There was no evidence of sediment movement, indicating that re-vegetation has been effective in minimizing erosion. Silt fencing surrounding these areas is now overgrown and there is no evidence of sediment movement through the area.

## 2.4 Proposed Open Pit Area

The area proposed for the open pit mine was inspected. The slopes of the trenches excavated as part of the effort to obtain bulk samples during exploration activities were observed to be in satisfactory condition (Photograph 8). There was no observed slumping or failures of the trenches and the slopes facilitate egress for wildlife. Several of the drill pads were inspected and there did not appear to be any erosion noted from these areas that would require attention.

## 2.5 Proposed Waste Rock Storage Facility Area

The proposed waste rock storage area was inspected. The waste rock storage area is tree covered and the drill pads and access roads in the area are re-vegetating by volunteer species to the extent that access on foot is now difficult.

## 2.6 Fuel Storage Area

The existing fuel storage area was inspected. It comprises a bunded and lined basin constructed to contain any spilled fuel and currently a few dozen drums of diesel fuel. Approximately 0.2 m of water has accumulated in the basin (Photograph 5). The bund is less than 3 m in height and the basin capacity is less than 10,000 m<sup>3</sup>; therefore, the fuel storage area is appropriately permitted under the QML without need for a water license (Yukon Environment Dam Guide).

The damage to the liner along the North slope noted in previous inspections is still visible (Photograph 6). New damage along the South slope was observed during the 2021 inspection (Photograph 7). This damage consists of several holes ranging from 2 cm to 30 cm in diameter. Repairs to the liner have yet to be completed. The fuel drums have since been organized in a manner to allow wildlife egress from the basin. There is some vegetation growth along the top of the containment berms and within the lined basin. There is one 1.2 m high willow on the NW corner and several small willows along the South slope growing within the bermed area. There is the potential that the roots of willows and other shrubs could penetrate through the liner. At the time when repairs to the liner are made, the willows and other shrubs should be removed, the area inspected and repaired, if required.

## 2.7 Site Access Roads

The access road to the north of the proposed waste rock storage area was observed to be in good condition with only minor erosion observed. The North Williams Creek culvert has undergone some crushing and has accumulated some sediment (Photographs 8 and 9). However, the culvert remains adequate to accommodate the relatively minor flows observed at the time of the inspection. There is no visual evidence to indicate that erosion is occurring near the culvert. The access road should be inspected annually and periodic maintenance of drainage features and erosion management should be anticipated.

The ford road crossing installed at Williams Creek in 2013 continues to function as intended (Photographs 10 and 11). The rockfill in the ford is well-graded and there is no indication of movement of finer materials. Ponded water was observed on the upstream side of the road, with flow across the road. It is possible that a large rainfall event could result in erosion. We therefore recommended that the ford continue to be inspected annually and maintenance be carried out, if required. The ford is appropriate for the current status of the project. However, prior to site development, it is recommended that the crossing is upgraded.

The access road crossing at Merrice Creek includes a single-span bridge (Photographs 12 to 15). Following recommendations in the July 2014 inspection memorandum, the bridge was extended by approximately 3 m and seated 1 to 2 m on the abutments. Approximately 3 m of steel was welded to the existing span, bridge decking was replaced and extended, and the approaches were re-graded to the bridge deck elevation.

During the 2019 inspection a beaver dam was observed downstream of the bridge which had caused higher than normal water levels in Merrice Creek, this beaver dam has since been removed and the water levels in Merrice Creek were lower in comparison to 2019 (Photograph 16). The bridge was observed to be in a satisfactory condition and is securely anchored at each of the abutments. The right (or southern) abutment is steep sided and there is evidence that erosion may be continuing to occur at this location under high-flow conditions. The bridge should be monitored annually and following large rainfall events. In the event that erosion

begins to compromise the stability of the abutment, consideration should be given to the installation of erosion protection at this location.

### 3.0 THERMISTOR DATA

Thermistor monitoring data, through 2021 demonstrate that clearing of the Heap Leach Facility area in 1997, promoted thawing of the discontinuous permafrost. However, in recent years that progress has been lost due to vegetation regrowth. Based on thermistor monitoring from 2007 to 2021, shown in Attachment 3, the Heap Leach Facility area would need to be re-cleared to facilitate thawing. The most recent data was provided by Granite Creek on 20 September 2021 to Golder. It consisted of readings taken during August and September 2021.

In general, thermistors BH-01-07, BH-03-07, BH-06-07, BH-17-07, located within the proposed heap leach site, have generally continued to show a gradual year-on-year decrease in temperatures at depths greater than 5 to 7 m, depending on location. Similar trends are also apparent in BH-18-07 and BH-29-07 located within the proposed waste rock storage area. The remaining thermistors, BH-13-07 and BH-26-07, have consistently indicated little or no permafrost, over the depth monitored, and in general show a warming trend. BH-23-07 was noted as “gone” in the 2021 reading sheet indicating that this borehole may have been destroyed in either 2020 or 2021. Note the monitoring depth/elevation varies by location.

The project is located in an area of warm (greater than  $-2^{\circ}\text{C}$ ) discontinuous permafrost. Based on site data, where permafrost exists, the temperature ranges from about  $-0.4$  to  $-2^{\circ}\text{C}$ , below a depth of 10 m. This is evident from the thermistor plots, which can be interpreted to estimate the active thaw layer and permafrost, where present. The thermistor plots indicate the presence of permafrost at the following locations:

- BH-01-07, BH-03-07 and BH-06-07 to the south and west of the proposed heap leach facility area, where the active thaw layer is approximately 5 to 7 m thick with permafrost below. BH-01-07 has shown an increase in ground temperatures in 2019 and 2021 compared to previous years.
- BH-12-07, BH-18-07 and BH-29-07 within the proposed waste rock storage area, where the active thaw layer varies from approximately 5 to 8 m thick with permafrost below. BH-12-07 has shown an increase in ground temperatures in 2021 compared to previous years. This is a reversal of the year over year decrease in ground temperatures observed previously at this location. This sudden increase in temperatures reported at BH-12-07 may indicate damage to the thermistors.
- BH-13-07, within the proposed events pond area, indicates that no permafrost exists to a depth of 18.3 m. However, permafrost may exist below this depth.

No permafrost has been observed at thermistors BH-23-07 and BH-26-07 over the monitored depths of 15.0 m and 12.0 m, respectively. These instruments are within the proposed Heap Leach Facility area. Permafrost likely exists below the depth monitored. Both instruments show a warming trend, possibly indicating an increase in the mean annual air temperature. Below 10 m depth, a decreasing temperature trend approaching  $0^{\circ}\text{C}$  is evident.



## 4.0 RECOMMENDATIONS

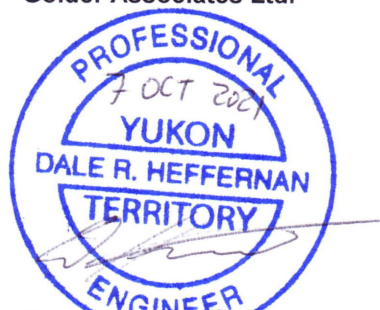
The inspection of the Carmacks Copper Project site was completed on 26 August 2021. Based on the inspection the following recommendations are provided:

- Water crossings, including the bridge abutments at Merrice Creek, should continue to be inspected annually and following major rainfall events. Maintenance should be carried out, as required to maintain the functionality and safety of these crossings.
- The damage to the liner at the fuel storage area should be repaired.

## 5.0 CLOSURE

We draw your attention to the "Important Information and Limitations of this Report" included as Attachment 1, which form an integral part of this document. We trust that this memorandum satisfies your requirements. However, please do not hesitate to contact us should you have any queries or require any further information.

**Golder Associates Ltd.**



Dale Heffernan, P.Eng.  
Geotechnical Engineer

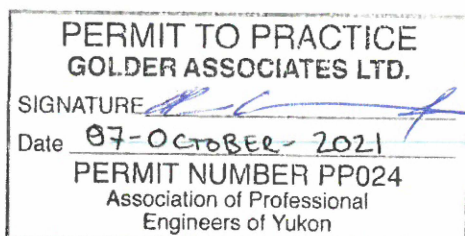
A handwritten signature in blue ink, appearing to read "Fiona Esford".

Fiona Esford, M.A.Sc., P.Eng.  
Principal, Senior Geotechnical Engineer

DH/FE/hp

Attachments: Attachment 1 – Important Information and Limitations  
Attachment 2 – Photographs  
Attachment 3 – Thermistor Data

[https://golderassociates.sharepoint.com/sites/136475/project files/6 deliverables/2. issued/20405023-002-tm-rev0-1000/20405023-002-tm-rev0-1000-2021 annual inspection 07oct\\_21.docx](https://golderassociates.sharepoint.com/sites/136475/project%20files/6%20deliverables/2.%20issued/20405023-002-tm-rev0-1000/20405023-002-tm-rev0-1000-2021%20annual%20inspection%2007oct_21.docx)



**ATTACHMENT 1**

# Important Information and Limitations of this Report

## Study Limitations

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**ATTACHMENT 2**

# Photographs





**Photograph 1: Core Storage Racks Looking South**



**Photograph 2: Slope Behind Camp Geology Office and Core Shack Looking NE**





**Photograph 3: Slope Behind the Camp Geology Office and Core Logging Shack Looking North**



**Photograph 4: Exploration Trench at the Discovery Outcrop Looking SW**





**Photograph 5: Lined Basin at Fuel Storage Area Looking NE**



**Photograph 6: Liner Damage along North Slope at Fuel Storage Area Looking East**





**Photograph 7: Liner Damage along South Slope at Fuel Storage Area Looking East**



**Photograph 8: Culvert Inlet Beneath Road at North Williams Creek Looking SE**





**Photograph 9: Culvert Outlet Beneath Road at North Williams Creek Looking East**



**Photograph 10: Williams Creek Ford Crossing Looking North**





**Photograph 11: Williams Creek Ford Crossing Looking NE**



**Photograph 12: Bridge Crossing at Merrice Creek Looking South**





**Photograph 13: Bridge Crossing at Merrice Creek – Upstream Side Looking South**



**Photograph 14: Bridge Crossing at Merrice Creek – Downstream Side Looking SW**





**Photograph 15: Bridge and Equipment Ford Crossing at Merrice Creek Looking NW**



**Photograph 16: Bridge Crossing at Merrice Creek – Removed Beaver Dam Looking SE**



**ATTACHMENT 3**

# Thermistor Data

