APPENDIX II

DRAFT CONCEPTUAL FISH HABITAT OFFSETTING PLAN

NOTE TO READER
APPENDIX II

In April 2015, Treasury Metals submitted an Environmental Impact Statement (EIS) for the proposed Goliath Gold Project (the Project) to the Canadian Environmental Assessment Agency (the Agency) for consideration under the Canadian Environmental Assessment Act (CEAA), 2012. The Agency reviewed the submission and informed Treasury Metals that the requirements of the EIS Guidelines for the Project were met and that the Agency would begin its technical review of the submission. In June 2015, the Agency issued a series of information requests to Treasury Metals regarding the EIS and supporting appendices (referred to herein as the Round 1 information requests). The Round 1 information requests included questions from the Agency, other federal and provincial reviewers, and members of Indigenous communities, as well as interested stakeholders. As part of the Round 1 information request process, the Agency requested that Treasury Metals consolidate the responses to the information requests into a revised EIS for the Project.

Appendix II to the revised EIS (Draft Fisheries Compensation Strategy and Plans) summarizes the objectives of a potential offset strategy for fisheries habitat overprinted or impacted by the proposed Project. The framework provides a starting point for subsequent permitting discussion associated with potential Fisheries Act Section 35 Authorization requirements, and offset requirements that may be required under the Metal Mining Effluent Regulations (MMER) Schedule 2 amendment process. Appendix II had undergone major revisions since the original EIS to reflect comments raised by the CEA Agency.

As part of the process to revise the EIS, Treasury Metals has undertaken a review of the status for the various appendices. The status of each appendix to the revised EIS has been classified as one of the following:

- **Unchanged**: The appendix remains unchanged from the original EIS, and has been re-issued as part revised EIS.
- **Minor Changes:** The appendix remains relatively unchanged from the original EIS, and has been re-issued with relevant clarification.
- **Major Revisions**: The appendix has been substantially changed from the original EIS. A re-written appendix has been issued as part of the revised EIS.
- **Superseded:** The appendix is no longer required to support the EIS. The information in the original appendix has been replaced by information provided in a new appendix prepared to support the revised EIS.
- **New**: This is a new appendix prepared to support the revised EIS.

The following table provides a listing of the appendices to the revised EIS, along with a listing of the status of each appendix and their description.

List of Appendices to the Revised EIS		
Appendix	Status	Description
Appendix A	Major Revisions	Table of Concordance
Appendix B	Unchanged	Optimization Study
Appendix C	Unchanged	Mining Study
Appendix D	Major Revisions	Tailings Storage Facility
Appendix E	Minor Changes	Traffic Study
Appendix F	Major Revisions	Water Management Plan
Appendix G	Superseded	Environmental Baseline
Appendix H	Minor Changes	Acoustic Environment Study
Appendix I	Unchanged	Light Environment Study
Appendix J	Minor Changes	Air Quality Study
Appendix K	Minor Changes	Geochemistry
Appendix L	Superseded	Geochemical Modelling
Appendix M	Minor Changes	Hydrogeology
Appendix N	Unchanged	Surface Hydrology
Appendix O	Superseded	Hydrologic Modeling
Appendix P	Unchanged	Aquatics DST
Appendix Q	Major Revisions	Fisheries and Habitat
Appendix R	Major Revisions	Terrestrial
Appendix S	Major Revisions	Wetlands
Appendix T	Unchanged	Socio-Economic
Appendix U	Minor Changes	Heritage Resources
Appendix V	Major Revisions	Public Engagement
Appendix W	Unchanged	Screening Level Risk Assessment
Appendix X	Major Revisions	Alternatives Assessment Matrix
Appendix Y	Unchanged	EIS Guidelines
Appendix Z	Unchanged	TML Corporate Policies
Appendix AA	Major Revisions	List of Mineral Claims
Appendix BB	Unchanged	Preliminary Economic Assessment
Appendix CC	Unchanged	Mining, Dynamic And Dependable For Ontario's Future
Appendix DD	Major Revisions	Indigenous Engagement Report
Appendix EE	Unchanged	Country Foods Assessment
Appendix FF	Unchanged	Photo Record Of The Goliath Gold Project
Appendix GG	Minor Changes	TSF Failure Modelling
Appendix HH	Unchanged	Failure Modes And Effects Analysis
Appendix II	Major Revisions	Draft Fisheries Compensation Strategy and Plans
Appendix JJ	New	Water Report
Appendix KK	New	Conceptual Closure Plan
Appendix LL	New	Impact Footprints and Effects

APPENDIX II

TREASURY METALS: GOLIATH GOLD PROJECT

CONCEPTUAL FISH HABITAT OFFSETTING PLAN

APRIL 10, 2018

Prepared by:

KBM RESOURCES GROUP

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EXECUTIVE SUMMARY

Treasury Metals Limited is proposing to develop an open pit gold mining operation, the Goliath Gold Project, at a site located near Dryden, Ontario. Development of the site will include an open pit, mine rock and overburden stockpiles/storage, a tailings storage facility, processing plant, mine water management components (including polishing pond, seepage collection ponds, drainage ditches), explosive storage facility, and local roads. The mine components will result in the unavoidable harm to fish and fish habitat, and infilling of waters frequented by fish, which requires the development and implementation of offsets (compensation) pursuant to the Fisheries Act. The purpose of this conceptual offsetting plan is to describe the serious harm to fish that is predicted to occur because of the project and to describe offsetting measures that can be implemented to offset that harm.

Permanent loss of habitat will occur where watercourses are overprinted by the project. This will occur n Blackwater Creek Tributary 1 (Reach 2) and Tributary 2 (Reach 2; illustrated in Figure 3.0-1). Tributary 1 - Reach 2 is 590 m long and has three associated beaver ponds with a total area of 3.794 ha. Tributary 2 - Reach 2 is 2,290 m long, with 0.148 ha of beaver pond. A further temporary loss of 717 m from Tributary 1 – Reach 1 will be experienced during the Operational Phase of the Project. Based on field investigations, there are no migratory fish populations that spawn in or otherwise utilize the habitat that will be lost.

Three approaches to offsetting to compensate for this habitat loss are presented in this report.

1. Shoreline stabilization on Wabigoon Lake, a management objective for the MNRF, is considered habitat restoration and has the advantage of being implementable at any stage during the project. Offsetting early in a project can reduce or eliminate time lags between when habitat is harmed or lost, and when the offsetting occurs. As the benefits from this proposed offsetting measure are very different from the losses in terms of the fish communities affected, it will be necessary to develop an appropriate method of determining the amount of shoreline stabilization that would be required to achieve the required offset.
2. Fish habitat can be created during the Post-closure Project phase where water collection ponds 2A and 2B are located during operations. These ponds can be left in place, or even to expand them if necessary to achieve the necessary offsets. Water that discharges from the pit could be directed to the ponds and then from the ponds to Blackwater Creek Tributary 1. The created habitat would be similar to that from the beaver ponds that will be lost, and therefore suitable for the fish species that are present. This potential offsetting measure meets the criterion of benefiting the specific fish populations and areas that are affected by the development project. It is also at or close to the locations where habitat losses will occur, which DFO indicates is preferred.
3. A dam located on Thunder Lake Tributary 2 represented an existing barrier to fish passage near the Project area. Removal of anthropogenic barriers to fish migration is identified as a habitat restoration activity that is appropriate as an offsetting measure.

This potential offsetting measure does not meet the criterion of benefiting the specific fish populations and areas that are affected by the development project. Removal of the dam would not result in gains in habitat area. Instead the gains would be realized through improved fish access, the benefits of which are less easily quantified.

Further, there is an opportunity to create additional fish habitat. A new watercourse will be constructed to convey flow from the portions of the Blackwater Creek Tributary 2 catchment that are upstream of the Project footprint. The new watercourse will be approximately 1260 m long and will be constructed using natural channel design principles to emulate, to the extent possible, the existing Blackwater Creek Tributary 2 - Reach 2. Conceptual designs for the new watercourse are included in this report.

It is the determination of this report that all proposed offsetting measures are technically feasible, and that offsetting that balances project impacts can be readily achieved

1.0 INTRODUCTION

Treasury Metals Limited is proposing to develop an open pit gold mining operation referred to as the Goliath Gold Project at a site located near Dryden Ontario. Treasury has been exploring the Project site since 2008 and has completed more than 370 diamond drill holes totaling approximately 119,000 m. The Project is located within the Kenora Mining Division and is approximately 4 km northwest of the village of Wabigoon, 20 km east of Dryden and 2 km north of the TransCanada Highway 17 and within the Hartman and Zealand townships (Figure 1-1). Treasury proposes to construct, operate, and eventually decommission a new gold mine and is currently conducting engineering studies to confirm and determine the technical and economic aspects of the Project.

The current mine layout places most required mine-related facilities near the proposed open pit, and to the extent possible, on private lands owned by Treasury Metals. The Project footprint will cover approximately 188 ha during the maximum extent of operations with 133 ha or 71% of the footprint on Treasury private lands.

The Project is designed to:

- Use well known, conventional and environmentally sound mining techniques and technologies used commonly in northern environments;
- Minimize overall footprint;
- Minimize associated potential effects;
- Manage water effectively and efficiently;
- Mitigate or compensate for effects on biological habitat; and
- Accommodate effective planning for final closure and site abandonment, rendering the site suitable for other compatible land uses and functions.

Development of the site will include an open pit, mine rock and overburden stockpiles/storage, a tailings storage facility, processing plant, mine water management components (including polishing pond, seepage collection ponds, drainage ditches), explosive storage facility, and local roads. The mine components as described will result in the unavoidable harm to fish and fish habitat and infilling of waters frequented by fish which requires the development and implementation of offsets (compensation) pursuant to the Fisheries Act.

The fisheries protection provisions of the Fisheries Act prohibit causing serious harm to fish. Section 35 (1) of the Fisheries Act states that *No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery.* “Serious harm to fish” is defined in Section 2 of the Fisheries Act as *the death of fish, or permanent alteration to or destruction of fish habitat.*

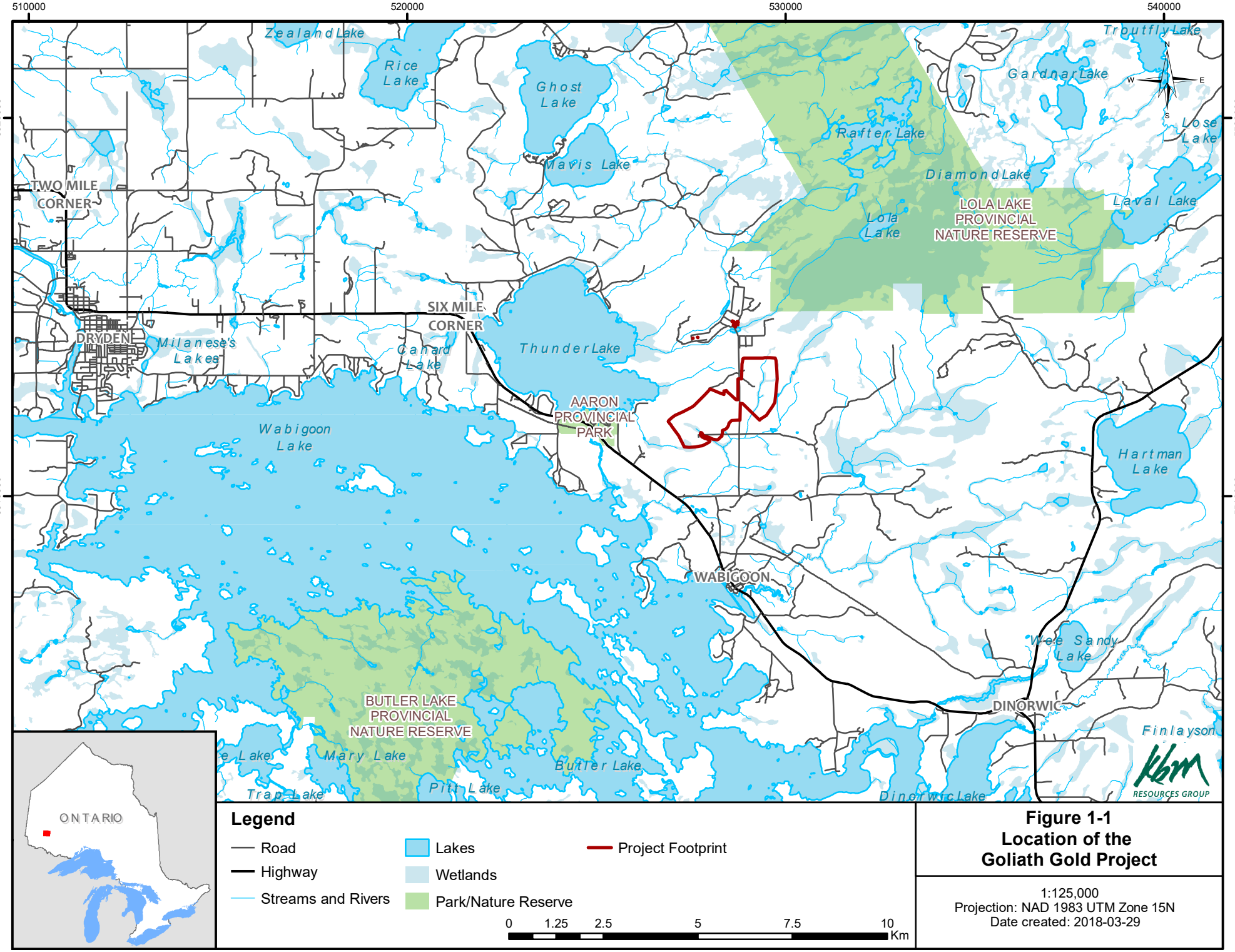

Figure 1-1
Location of the
Goliath Gold Project

1:125,000
Projection: NAD 1983 UTM Zone 15N
Date created: 2018-03-29

When considering an application for an authorization, the Minister must consider whether there are measures and standards to avoid, mitigate or offset serious harm to fish that are part of or that support a commercial, recreational or Aboriginal fishery. These three factors establish a hierarchy of measures where efforts should be made to avoid impacts first. When avoidance is not possible, then efforts should be made to mitigate impacts caused by the project in question. After these actions, any residual impacts would normally require authorization and should then be addressed by offsetting. Based on the existing conditions and the predicted effects of the mine on fish and fish habitat, after avoidance and mitigation measures have been implemented, it is expected that serious harm to fish will occur because of the project. Therefore, offsetting measures will be required for this project. Offsetting measures, also known as offsets, are measures that are undertaken to counterbalance unavoidable serious harm to fish resulting from a project, with the goal of maintaining or improving the productivity of the commercial, recreational or Aboriginal fishery.

The Metal Mining Effluent Regulation (MMER) stipulates that for mine waste to be deposited in a natural, fish-bearing water body, the water body must be listed in Schedule 2 of the Regulations, designating it as a tailings impoundment area (TIA). Section 27.1 of the MMER requires fish habitat compensation to offset losses of fish habitat associated with the deposit of a deleterious substance into the water body(ies) that are added to Schedule 2. Consequently, habitat losses that will result from the project but are not the result of the deposition of mine waster will require offsetting under Section 35(2) and those losses that are due to the deposition of mine waste will require fish habitat compensation under Section 36 of the Fisheries Act. While separate plans will eventually be required, for the purposes of assessing if a feasible and acceptable method or methods of offsetting or compensation are available, the habitat losses and potential offsetting are considered in aggregate.

Baseline investigations of fish and fish habitat, including background information review and field investigations, were conducted by Klohn Crippen Berger Ltd. (KCB) in 2010 and 2011 and by DST Consulting Engineers Inc. (KCB, 2012; DST, 2014). This information was presented in reports by the respective firms. Additional fish sampling was conducted by TMI staff in 2014. C. Portt and Associates conducted reconnaissance level investigations at a number of locations and side-scan sonar investigations of Keplyn's Bay on Wabigoon Lake and an unnamed bay of Thunder Lake in 2016. The results of these investigations are consolidated in the Fisheries Existing Conditions Report, Appendix Q to the Environmental Assessment Report, and are summarized in Section 6.14 of the revised EIS. In the spring of 2017, C. Portt and Associates, with assistance from TMI staff, undertook investigations of white sucker spawning in Blackwater Creek and Thunder Lake Tributary 2. The methods and results of those investigations are also presented in Appendix Q and Section 6.14 of the revised EIS.

In 2014 a cooperative approach was initiated with the Ontario Ministry of Natural Resources and Forestry (MNRF), and subsequently with Fisheries and Oceans Canada (DFO) to form the basis of a fish habitat offset framework to be developed. Treasury Metals will be required to submit an offsetting plan to demonstrate that the measures and standards will be fully

applied to first avoid, then mitigate, and finally offset any residual serious harm to fish that are part of or support commercial, recreational or Aboriginal fisheries.

The purpose of this conceptual offsetting plan is to describe the serious harm to fish that is predicted to occur because of the Project and to describe offsetting measures that can be implemented to offset that harm at the conceptual level. The objective of a conceptual offsetting plan, such as this, is to demonstrate that offsetting is feasible for the project. This plan describes three approaches to offsetting, one or more of which could be incorporated into the final offsetting plan. The final offsetting plan, to be prepared during detailed design, after the Project receives Environmental Assessment Act approval, will build upon one or more of these conceptual approaches. That plan will be developed with consultation with First Nations, DFO, MNRF, and other stakeholders as identified, and will form the basis for a DFO authorization.

This report:

- describes how the project will affect fish habitat and fish,
- describes the existing conditions of the fish habitat and the fish community that it supports, and
- describes approaches to offsetting for the project.

2.0 BACKGROUND

2.1 REGIONAL AREA

The study areas are located in the English River watershed, which is a tributary to the Winnipeg River and in the Nelson River primary watershed. There are two large lakes, Thunder Lake and Wabigoon Lake, within the Regional Study Area for fish and fish habitat. No aquatic species at risk (SAR) inhabit the RSA.

For the purposes of the EIS, an aquatic Regional Study Area (RSA) was defined to include both Thunder Lake and Wabigoon Lake, and the Local Study Area (LSA), discussed below (Figure 2-1).

Thunder Lake is a cold-water lake and has a surface area of 1,123 ha, a mean depth of 11.1 m and a maximum depth of 23.5 m. It supports a cold-water fish community including populations of Lake Trout, Lake Whitefish and Lake Cisco, and populations of cool-water species including Walleye, Northern Pike, Yellow Perch and Smallmouth Bass. Water levels in Thunder Lake are controlled by a small dam at the head of Thunder Creek in Aaron Provincial Park.

The east shore of Thunder Lake is largely undeveloped in comparison to the remaining shoreline of the lake which is dominated by private homes, seasonal camps and public campgrounds.

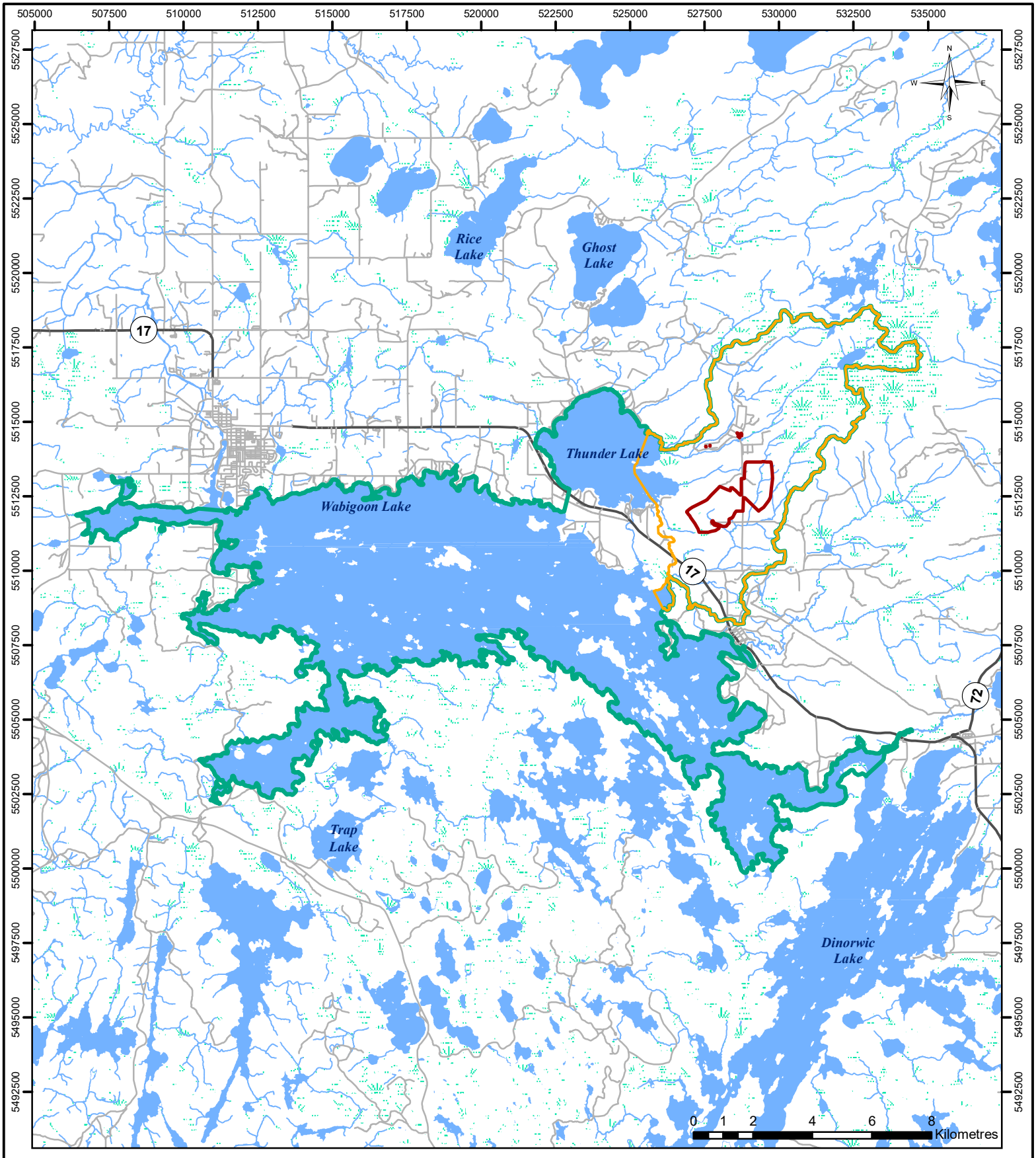

Figure 2-1
Goliath Gold Project
Regional and Local Study Areas

Projection: NAD 1983 UTM Zone 15N
Date created: 2018-03-29
SCALE: 1:167,741

Legend

- Project Footprint
- Road
- Highway
- Stream
- Waterbody
- Wetland
- LSA Aquatic
- RSA Aquatic

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The east end of Thunder Lake consists of two shallow (less than 2 m deep) sandy bays separated by a bedrock point. Cobble and boulder shoals extending out from the bedrock point between the two bays and from the island off that point are known Lake Trout and Lake Whitefish spawning areas and may also be Walleye spawning areas although this has not been confirmed. Other areas of potential Lake Trout and Lake Whitefish spawning habitat have been identified by MNRF based on the presence of coarse substrate, but spawning has not been confirmed.

Wabigoon Lake is a cool-water lake with a surface area of 9,922 ha, a mean depth of 6.1 m and a maximum depth of 14.6 m. The lake has an irregular shoreline that is 204 km in length including islands; this in combination with the generally shallow depth results in a high proportion of littoral zone. The water level of Wabigoon Lake is controlled by a dam at the outflow into the Wabigoon River in Dryden, Ontario. Water Levels range between 368.5 and 369.23 metres above sea level (mASL) annually. Changing water levels due to the dam have caused erosion along the shoreline of Wabigoon Lake releasing sediments that contribute to the turbidity of the lake.

There are several private homes and seasonal camps on Wabigoon Lake, primarily along the Trans-Canada Highway and in other road accessible areas. There are also eight active tourist outfitters operating on Wabigoon Lake. Wabigoon Lake is one of six Specially Designated Waters in Fisheries Management Zone (FMZ) 5 and receives enhanced management and supports an active sport fishery focused on Walleye and Muskellunge angling.

There are two fish sanctuaries on Wabigoon Lake that were created to protect spawning Walleye and Sauger. One of these is along the shoreline of Christie Island, which is just outside (west) of Keplyn's Bay where Blackwater Creek enters the lake. The other is at the mouth of Nugget Creek. Nugget Creek itself, upstream to the spawning area, is also part of that sanctuary. Walleye are also known to spawn in Thunder Creek, which flows from Thunder Lake to Wabigoon Lake. Potential muskellunge spawning areas in Keplyn's Bay and the vicinity, have been identified by MNRF based on the habitat.

A full discussion of these lakes, which form the portion of the RSA that is outside of the LSA, can be found in Section 5.8.4 of the revised EIS.

2.2 LOCAL AREA

A Local Study Area (LSA) was defined to include all watercourses where direct effects associated with the Project could potentially occur, and the lake habitats in the immediate vicinity of the mouths of these creeks (Figure 2-1). The Project design has taken a watershed approach and the Project activities are now confined to the watersheds of Blackwater Creek and four tributaries to Thunder Lake. These include Hoffstrom's Bay tributary, Little Creek, Thunder Lake Tributary 2 and Thunder Lake Tributary 3. Thunder Lake Tributary 3 is the south branch of Thunder Lake Tributary 2, which drains from Lola Lake into Thunder Lake. Hughes Creek, which was included in the LSA in the original EIS, is no longer considered part of the LSA as no activities will take place in the watershed, and no effects are expected to occur. A full discussion of the watercourses in the LSA can be found in Sections 5.8.4.3 and 5.8.4.4 of the revised EIS.

The main branch of Blackwater Creek originates in an area of glaciofluvial outwash and flows southwest across a glaciolacustrine plain, before discharging into Keplyn's Bay of Wabigoon Lake. Most of the watershed is within the flat, silty-clay glaciolacustrine plain with low relief and fine substrates.

The reach of Blackwater Creek from the railway upstream to approximately the limit of lake water level influence includes the portion of Keplyn's Bay that was separated from Wabigoon Lake by the construction of the railway. The water velocities in this reach are low and most of the reach can be characterized as sheltered coastal wetland habitat. The substrates are soft organics and dense beds of submergent and emergent aquatic vegetation are present over most of the area. It is expected that the coastal wetland at the mouth of Blackwater Creek is used as spawning and nursery habitat by most or all the wetland spawning species that occur in Wabigoon Lake, including Northern Pike and possibly Muskellunge.

The remainder of Blackwater Creek and its tributaries provide low gradient stream habitat punctuated by active and inactive beaver dams and ponds. The creek channels are sinuous and primarily pool and run habitat, which is consistent with the low gradient. Consistent with the surficial geology, the substrates are primarily fine silt and clay. Only three areas of gravel, each located downstream from road crossings and thought to have originated from road construction and maintenance, were observed during the 2011 field investigations. A reach with cobble substrate was identified at a pipeline crossing between Anderson Road and Highway 17 and is thought to have been placed there during the reconstruction of the creek channel through the pipeline right-of-way. Woody debris is plentiful, in part because of beaver activity.

No permanent obstructions to fish passage were identified during the 2010 and 2011 field investigations although beaver dams can be impediments and create temporary barriers to upstream movement, depending on flows. In the spring of 2017, three beaver dams on Blackwater Creek between Highway 17 and Wabigoon Lake appeared to be barriers to upstream movement by large fish, as did a fourth beaver dam located upstream from Anderson Road. A culvert on Tributary 2 is probably a barrier to upstream fish migration under some flow conditions, based on observations in August 2016.

The most abundant and widely distributed taxa in Blackwater Creek and its tributaries were the *Chrosomus* species (Northern Redbelly Dace and Finescale Dace; 63% of the total catch), Brook Stickleback (22% of the total catch), and Pearl Dace (10% of the total catch). Fathead Minnow was captured less frequently and in lower numbers (2% of total catch). White Sucker (1% of the total catch) were more common in catches from the downstream reaches of Blackwater Creek; 59 of the 80 individuals captured were in a single minnow trap set. A single Burbot was captured by electrofishing on two occasions between Highway 17 and Anderson Road. In addition, there were 42 Cyprinids captured that were not identified to species

3.0 EXISTING FISH HABITAT AND FISH COMMUNITIES

Throughout the development of the Goliath Gold Project the team at Treasury Metals has been exploring options and alternatives to mitigate the minor potential effects to fish habitat

from the Goliath Gold Project. Despite the best efforts to avoid and minimize impacts, losses to fish habitat will occur. This necessitates the need or requirement to provide measures to offset these losses. Project impacts that will require offsetting are limited to the watercourses within the immediate vicinity of the site, specifically Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 (Figure 3.0-1). There are no direct or meaningful indirect effects expected to local creek systems or the Wabigoon Lake watershed outside of this immediate area. The fish habitat and fish communities in those watercourses are described below.

3.1 EXISTING FISH HABITAT

3.1.1 Blackwater Creek Tributary 1

Blackwater Creek Tributary 1 is first order watercourse that drains the western portion of the project footprint (Figure 3.0-1). Three beaver ponds are evident on this watercourse in the aerial photography used to quantify existing conditions. In fall 2006 and spring 2012 aerial imagery (reviewed on Google Earth), only one beaver pond is evident on this watercourse and in spring 2002 imagery there is none. The largest of the beaver ponds currently present (T1-BPC; Figure 3.1.1-1) was not active during site visits by C. Portt in 2016 and 2017. Figure 3.1.1-2 shows the flow in this watercourse where it crosses Norman's Road on August 3, 2016.

When examined on May 11, 2017, Reach 1 of Tributary 1, between Norman's Road and Blackwater Creek, had an average width of approximately one meter. Most of the watercourse was less than 0.2 m deep, and woody debris was abundant (Figure 3.1.1-3). Only fine substrate was observed in this watercourse except for a small amount of gravel where it flows over Norman's Road (Figure 3.1.1-2).

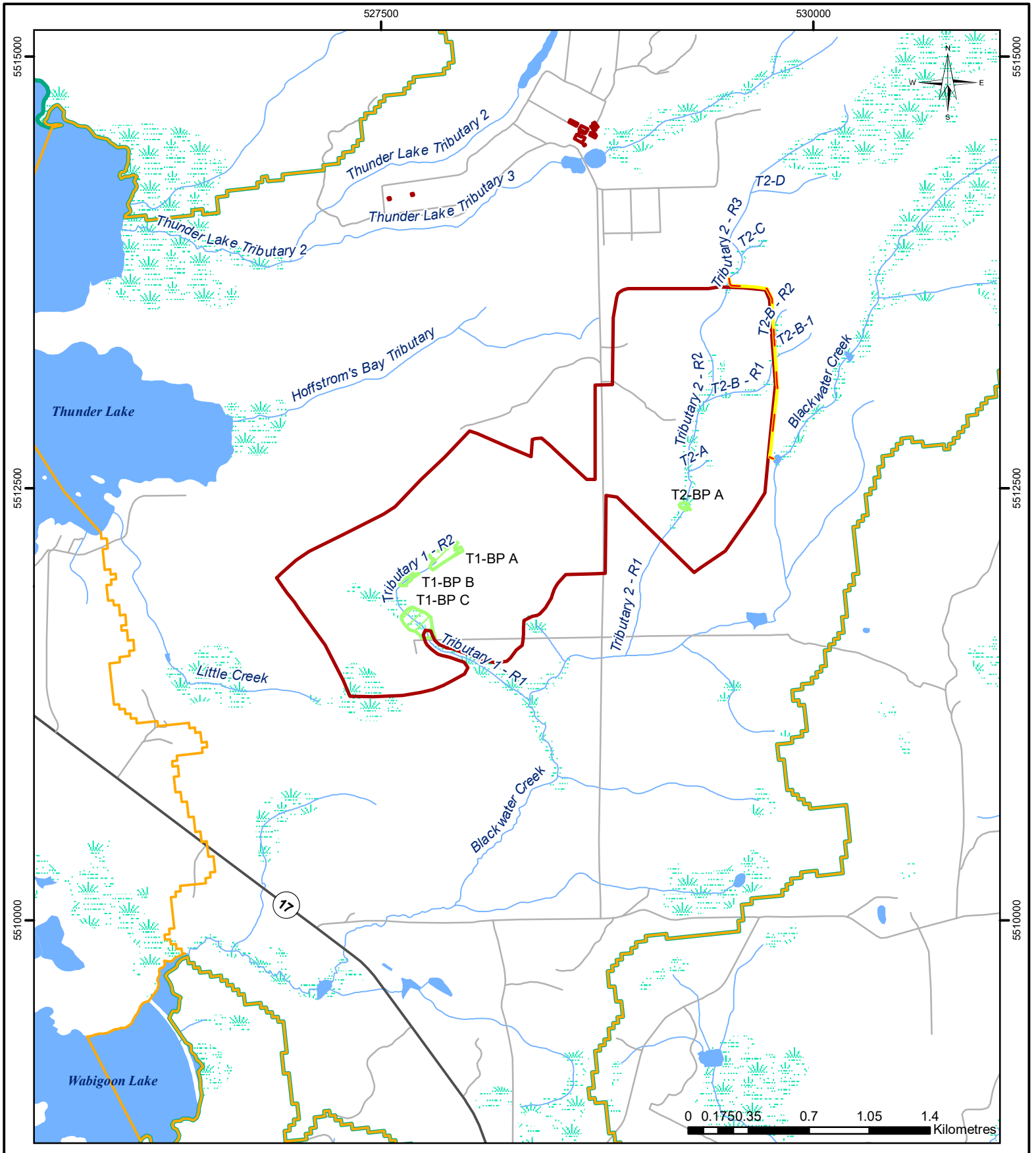

Figure 3.0-1
Goliath Gold Project Footprint and Blackwater Creek Tributaries

Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-10
SCALE: 1:28,785

Legend

- Project Footprint
- Road
- Highway
- Stream
- Waterbody
- Wetland
- Beaver Ponds
- LSA Aquatic
- RSA Aquatic
- Diversion Ditch

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Figure 3.1.1-1. Beaver pond T1-BP C located on Blackwater Creek Tributary 1 immediately upstream from Normans Road. August 3, 2016.

Figure 1.1.1-2. Blackwater Creek Tributary 1 flowing across Normans Road. August 3, 2016.

Figure 3.1.1-3. Typical segment of Tributary 1 – Reach 1, of Blackwater Creek. May 11, 2017.

3.1.2 Tributary 2 of Blackwater Creek

Blackwater Creek Tributary 2 drains the eastern portion of the project footprint (Figure 3.0-1). In the aerial photography used to quantify existing conditions there is one beaver pond evident, with an area of 0.148 ha, located in Reach 2 (Figure 3.1.2-1). The colony did not appear to be active on August 4, 2016 (Figure 3.1.2-1). There are no beaver ponds evident on Blackwater Creek Tributary 2 in aerial imagery from 2002 or 2006, but the existing pond is evident in aerial imagery from 2012.

At Normans Road, the width of Blackwater Creek Tributary 2 was estimated to range from 1 m to 2 m and the maximum depth was approximately 0.5 m on August 3 - 4, 2016. The riparian vegetation is dense along most of this watercourse (Figure 3.1.2-2). The substrate is fine except for a very small area of gravel immediately upstream from Norman's Road and a larger area of gravel downstream from Norman's Road (Figures 3.1.2-3 and 3.1.2-4). Both gravel patches appear to have originated from the road. Woody debris is abundant. Corrugated steel pipes convey Blackwater Creek Tributary 2 beneath Norman's Road (Figure 3.1.2-5 and 3.1.2-6).

Figure 3.1.2-1. Beaver pond (inactive) on Blackwater Creek Tributary 2. August 4, 2016.

Figure 3.1.2-2. Looking upstream in Blackwater Creek Tributary 2 – Reach 2, from the forestry road that crosses it approximately 1.25 km upstream from Normans Road.

Figure 3.1.2-3. Blackwater Creek Tributary 2 immediately downstream from Normans Road. August 3, 2016.

Figure 3.1.2-4. Area of gravel substrate in Blackwater Creek Tributary 2, downstream from Norman's Road. May 10. 2017.

Figure 3.1.2-5. Corrugated steel pipes that convey Blackwater Creek Tributary 2 beneath Norman's Road. Most of the flow is conveyed by the culvert on the right.

Figure 3.1.2-6. Corrugated steel pipe conveying Blackwater Creek Tributary 2 beneath a forestry road in Reach 2, approximately 1.25 km upstream from Normans Road.

3.2 FISH COMMUNITIES

The fish catches from Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 are presented in Table . Catches were dominated by *Phoxinus* spp. (Northern Redbelly Dace and Finescale Dace), Pearl Dace and Brook Stickleback in both of these watercourses. Fathead minnow and 11 individuals identified as shiners were also captured in Blackwater Creek Tributary 1.

No White Sucker have been observed or captured in Tributary 1. Two White Sucker were captured in Blackwater Creek Tributary 2 and a small number of White Sucker were observed spawning in Blackwater Creek Tributary 2 on patches of gravel associated with the Norman's Road crossing in 2011. No White Sucker were observed spawning at this location during spawning surveys in 2013 or 2017. No fish of any species were captured in a fyke net set further downstream in Blackwater Creek during the White Sucker spawning season in 2017. It is thought that the White Sucker observed spawning in 2011 were creek residents and not part of a spawning run from Wabigoon Lake.

The fish communities are typical for low gradient habitats with fine substrates and beaver activity on the Canadian Shield. The life history characteristics of the dominant species are presented in Table . Except for White Sucker, they are small-bodied, early maturing, and short-lived. The two *Phoxinus* species, Brook Stickleback and Fathead Minnow all spawn multiple times during a season, which allows their populations to increase rapidly when habitat becomes available, such as when a beaver pond is created, and to recover rapidly from catastrophic mortality, such as winterkill due to low oxygen concentrations. Most of these species spawn on vegetation or woody debris. White sucker which spawn on coarse substrate, ranging from gravel to cobble, are the exception. All these species are also legal to use as bait in Ontario.

Table 3.2-1. Fishes captured in Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 during the baseline field investigations.

Species	Tributary 1	Tributary 2
Phoxinus spp.	2032	306
Brook Stickleback	224	217
Pearl Dace	304	113
Fathead Minnow	50	
White Sucker		2
Shiner sp. (*Notropis sp*.)	11	

Table 3.2-2. Life history characteristics of fishes that occur in Blackwater Creek Tributary 1 and/or Blackwater Creek Tributary 2. Source: Coker et al, 2001.

Species	Reproductive guild	Maturity attained)		Maximums reported		Diet as adult (1=primary; 2=secondary; 3=minor).					
		Age (years)	Length (mm)	Age	Length (mm)	Phytoplankton	Macrophytes (includes attached algae)	Crustaceans	Annelids	Molluscs	Insects
pearl dace	A.1.3	2	94	4	132		3	1			1
northern redbelly dace	A.1.5	1	46	8	61	1	1	2			2
finescale dace	A.1.4	2	59	8	80					1	1
fathead minnow	B.2.7	1	54	4	73		1	2			1
white sucker	A.1.3	4	253	15	487	2		1		1	1
brook stickleback	B.2.4	1	50	3	87		3	1	3	3	1

4.0 EFFECTS OF THE PROJECT ON FISH HABITAT

4.1 HABITAT LOSSES THAT WILL REQUIRE OFFSETTING

Habitat losses that cannot be prevented or mitigated, and that therefore require offsetting, will occur in Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2. Some of these will be permanent losses and others will be temporary, due to temporary loss of flow. In addition, there is the possibility of a gain in habitat in a new watercourse that will be constructed to convey flow from the portion of Blackwater Creek Tributary 2 catchment that is upstream from the ditch and berm that will surround the project to Blackwater Creek.

Blackwater Creek Tributary 1 and Blackwater Creek Tributary 2 and the surrounding area are shown in Figure 3.0-1 with reaches labeled to facilitate discussion. Reaches of an individual watercourse are assigned numbers beginning at the downstream end (Reach 1, Reach 2, etc.). Tributaries to Blackwater Creek Tributary 2 (there are no tributaries to Blackwater Creek tributary 1) are assigned letters beginning at the downstream end (T2-A, T2-B, etc.). The one tributary to T2-B is labeled T2-B-1. Beaver ponds are also shown.

The habitat losses that will require offsetting are either permanent or temporary. Permanent losses are those which result from either overprinting of the segment by the project, or permanent loss of flow. Temporary loss occurs where flow in a watercourse is temporarily altered to the point where the ability of the watercourse will be lost, but later resumes. The lengths of watercourses and areas of beaver ponds and the type of habitat alteration are provided, by catchment and reach, in Table 4.1-1. The permanent and temporary habitat losses, and possible gains, are discussed below.

4.1.1 Permanent Habitat Losses

Permanent loss of habitat will occur where watercourses are overprinted by the project. On Blackwater Creek Tributary 1, habitat loss will occur on Reach 2 (Tributary 1 – R2). This reach of first order stream is 590 m long and there are three beaver ponds on this reach with a total area of 3.794 ha. This loss falls under Section 35 of the Fisheries Act.

Permanent loss of habitat will also occur in the Blackwater Creek Tributary 2 catchment, inside the containment ditch and berm. A reach of Blackwater Creek Tributary 2 (Tributary 2 - R2), all of its tributary T2-A, and the downstream reach of its Tributary T2-B (T2-B-R1) will be overprinted by the tailings storage facility and the mine water pond. The total stream length that will be lost is 2,290 m as well as a beaver pond on that tributary with an area of 0.148 ha. These losses will fall under Section 36 of the Fisheries Act, as they are the result of the deposit of mine waste, with the exception of the losses created by the placement of the berm itself, which will fall under Section 35.

Table 4.1-1. Reach lengths, area of beaver ponds, and type of habitat alteration, by catchment and reach.

Reach	Reach Location	Reach length (m)	Area of beaver ponds (ha; 2016)	Habitat alteration
Blackwater Creek Tributary 1 Catchment				
Tributary 1 Reach 1	from Blackwater Creek upstream to the berm that surrounds the operations area	750	none	flow temporarily reduced or eliminated
Tributary 1 Reach 2	upstream from the berm that surrounds the operations area	590	3.794	Overprinted
Blackwater Creek Tributary 2 Catchment				
Tributary 2 Reach 1	between Blackwater Creek and the berm that surrounds the operation area	717	none	flow temporarily reduced or eliminated
Tributary 2 Reach 2	within the berm that surrounds the operation area	1616	0.148	Overprinted
Tributary 2 Reach 3	upstream from the berm that surrounds the operation area	1459	none	None to reach. Downstream connection changed.
T2-A	within the berm that surrounds the operation area	138	none	Overprinted
T2-B R1	within the berm that surrounds the operation area	536	none	Overprinted
T2-B R2	upstream from the berm that surrounds the operation area	318	none	None to reach. Downstream connection changed.
T2-B-1	upstream from the berm that surrounds the operation area	269	none	None to reach. Downstream connection changed.
T2-C	upstream from the berm that surrounds the operation area	167	none	None to reach. Downstream connection changed.
T2-D	upstream from the berm that surrounds the operation area	473	none	None to reach. Downstream connection changed.

Reach	Reach Location	Reach length (m)	Area of beaver ponds (ha; 2016)	Habitat alteration
Tributary 2 diversion	New watercourse conveying Tributary 2 Reach 3, T2-B R2 and T2-B-1 to Blackwater Creek	1260	none	New constructed channel

A permanent reduction in flow will occur in the reach of Blackwater Creek Tributary 2 that is downstream from the berm and ditch that surround the project footprint (Tributary 2 – R1). This is predicted to result in a loss 717 m of stream habitat. This loss falls under Section 35 of the Fisheries Act.

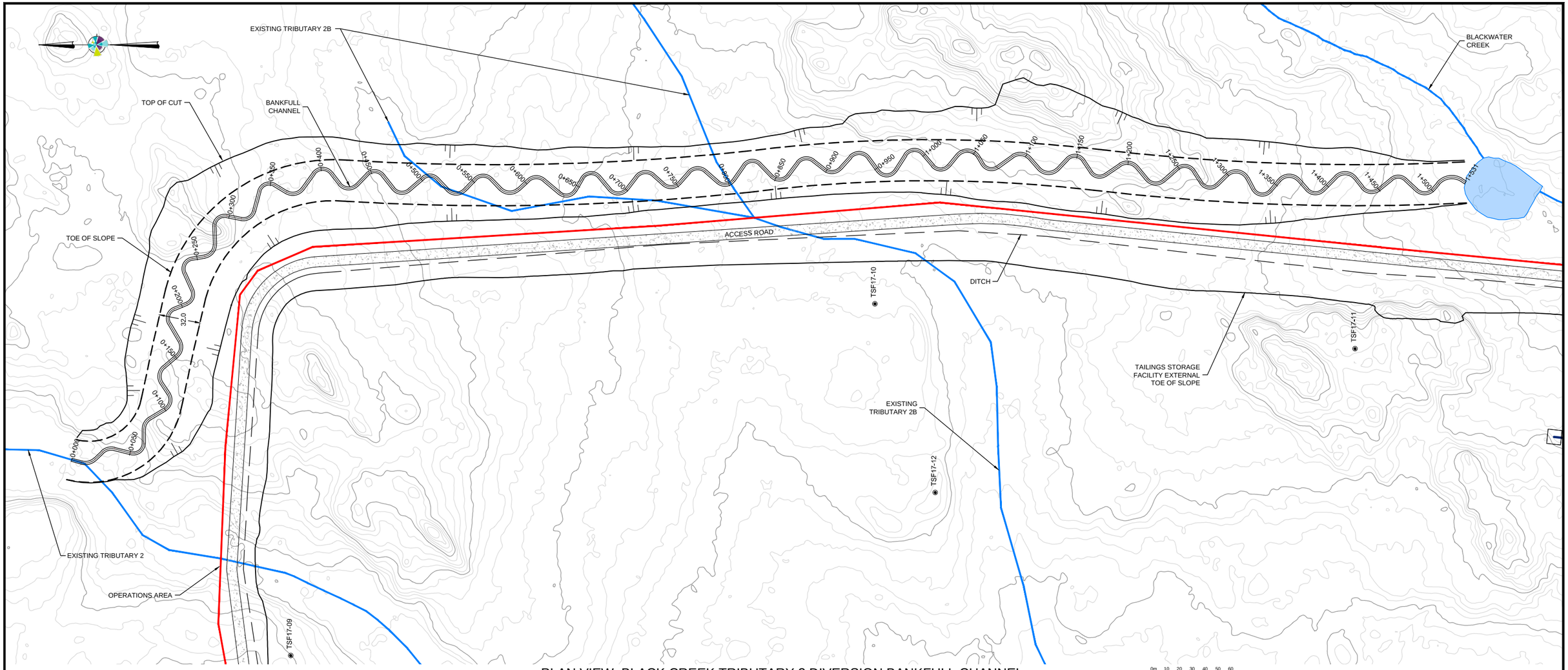
4.1.2 Temporary Habitat Losses

Disruption of flow to the downstream reach of Blackwater Creek Tributary 1 (Tributary 1 – R1) will begin when the berm and ditch is constructed around the site and will continue until post-closure, when the pit is full and overflows to this reach. Groundwater discharge will also be reduced to this tributary during that period and it is not expected that fish habitat will be present. This is a temporary loss, because flow in this reach will resume post-closure, when the pit begins to overflow into this watercourse. This temporary loss of 717 m of stream habitat falls under Section 35 of the Fisheries Act.

4.2 POSSIBLE HABITAT GAINS

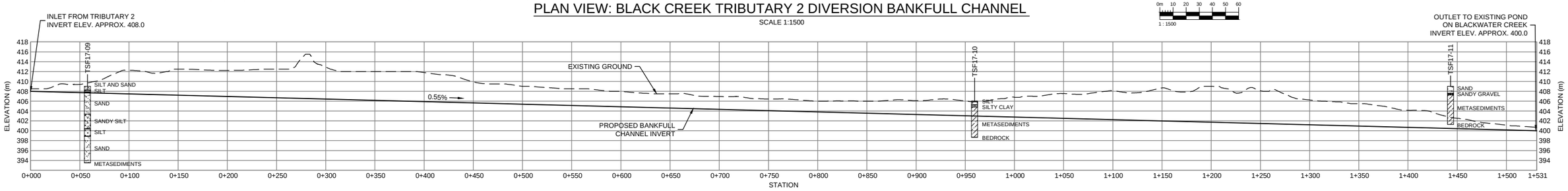
A new watercourse will be constructed to convey flow from the portions of the Blackwater Creek Tributary 2 catchment that are upstream from the containment berm and ditch. These areas are currently drained by Reach 3 of Blackwater Creek Tributary 2 (Tributary T-R3), and its tributaries (T2-C and T2-D) and by the upstream reach of Tributary B to Blackwater Creek Tributary 2 (T2-B-R2) and its tributary T2-B-1. The total length of watercourses that will be connected to Blackwater Creek via this new watercourse is 2686 m. The reaches that drain to this new watercourse will not be directly altered and it has been assumed that they will continue to function as they did prior to the downstream diversion.

The new watercourse will be approximately 1260 m long and will be constructed using natural channel design principles to emulate, to the extent possible, the existing Blackwater Creek Tributary 2 - Reach 2. The conceptual design of the Blackwater Creek Tributary 2 diversion is presented in Figures 4.2-1 to 4.2-3. The ability of this watercourse to support fish will depend on the duration of flow. If flow is perennial, then this watercourse can be expected to provide fish habitat that is equal to that provided by a comparable natural stream. If flow is intermittent or ephemeral then this watercourse will have little value as fish habitat, which would also be equal to a comparable natural stream. For the purposes of this document, it has been assumed that flow will not be perennial in this watercourse and therefore that it will not result in a habitat gain.



PLAN VIEW: BLACK CREEK TRIBUTARY 2 DIVERSION BANKFULL CHANNEL

SCALE 1:1500



PROFILE VIEW: BLACK CREEK TRIBUTARY 2 DIVERSION BANKFULL CHANNEL

SCALE: H=1:2000 V=1:400

HORIZONTAL SCALE: 1 : 2000

VERTICAL SCALE: 1 : 400

DRAFT

NOTES:

1. REFINEMENTS MAY BE CONSIDERED TO THE ALIGNMENT AND PROFILE TO MINIMIZE CUT VOLUMES, ROCK EXCAVATIONS AND TO ACCOMMODATE SEPARATION FROM THE TMF.

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
6	06	04	2018	ISSUED FOR DISCUSSION	NSH	MCR

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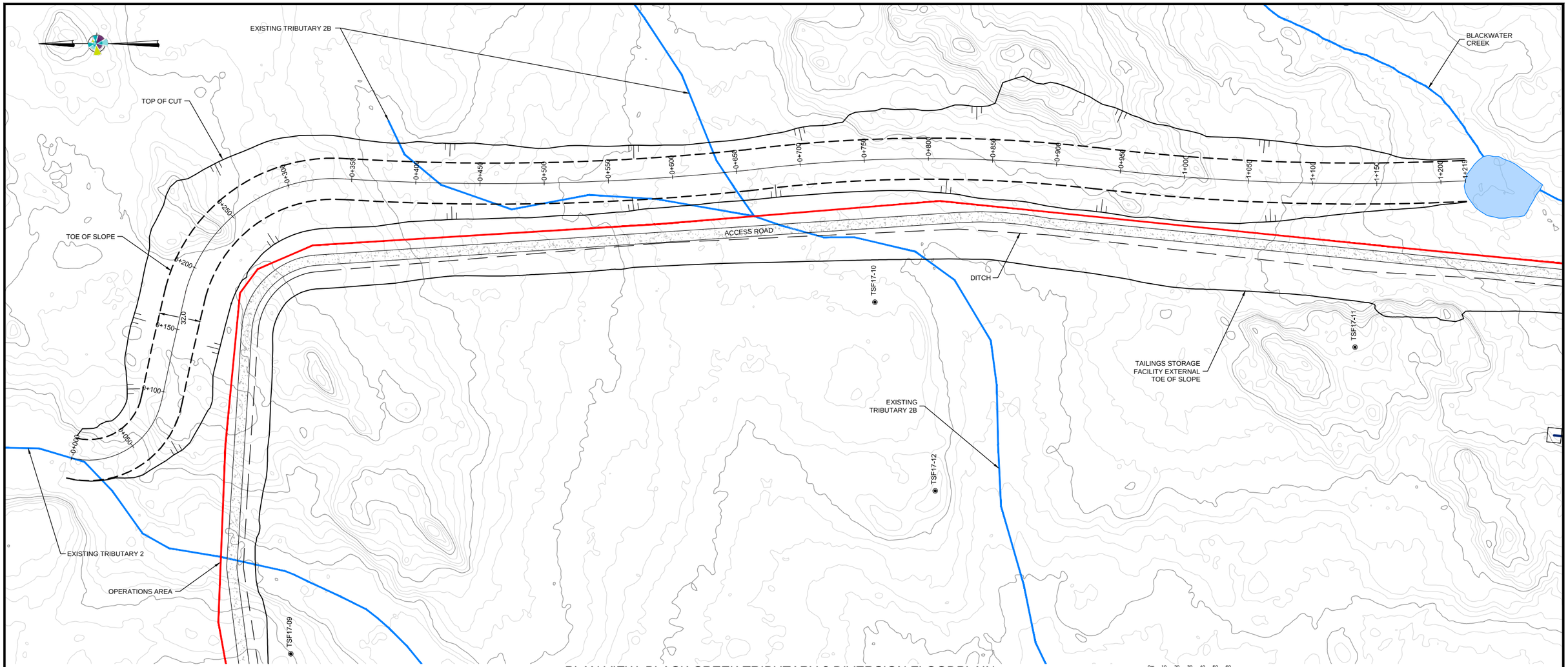
APPROVED BY:	MCR

PROJECT: GOLIATH GOLD PROJECT
FISH HABITAT OFFSETTING

TITLE: BLACKWATER CREEK TRIBUTARY 2 DIVERSION BANKFULL CHANNEL PLAN AND PROFILE

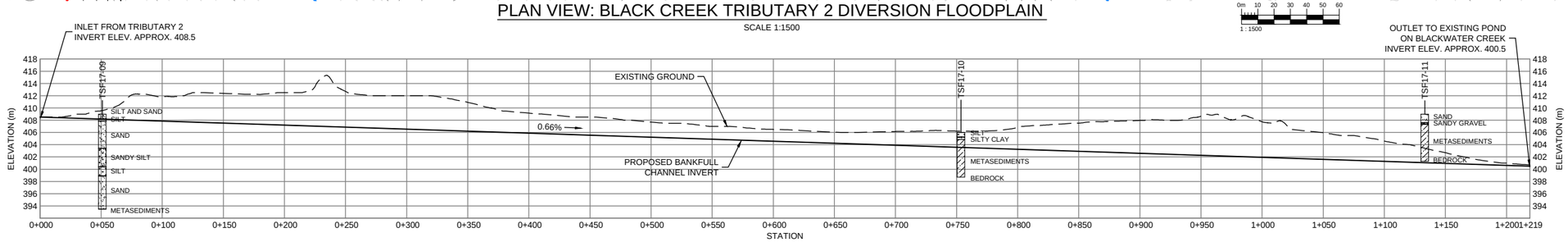
PROJECT NO.:	TC160516
REVISION NO.	A
DATE:	APRIL 2018
SCALE:	AS SHOWN
DRAWING NO.:	Figure 4.2-1



PLAN VIEW: BLACK CREEK TRIBUTARY 2 DIVERSION FLOODPLAIN

SCALE 1:1500

0m 10 20 30 40 50 60
1 : 1500



PROFILE VIEW: BLACK CREEK TRIBUTARY 2 DIVERSION FLOODPLAIN

SCALE: H=1:2000 V=1:400

HORIZONTAL SCALE: 0m 20 40 60 80 — 1 : 2000

VERTICAL SCALE: 0m 4 8 12 — 1 : 400

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NOTES:

1. REFINEMENTS MAY BE CONSIDERED TO THE ALIGNMENT AND PROFILE TO MINIMIZE CUT VOLUMES, ROCK EXCAVATIONS AND TO ACCOMMODATE SEPARATION FROM THE TMF.

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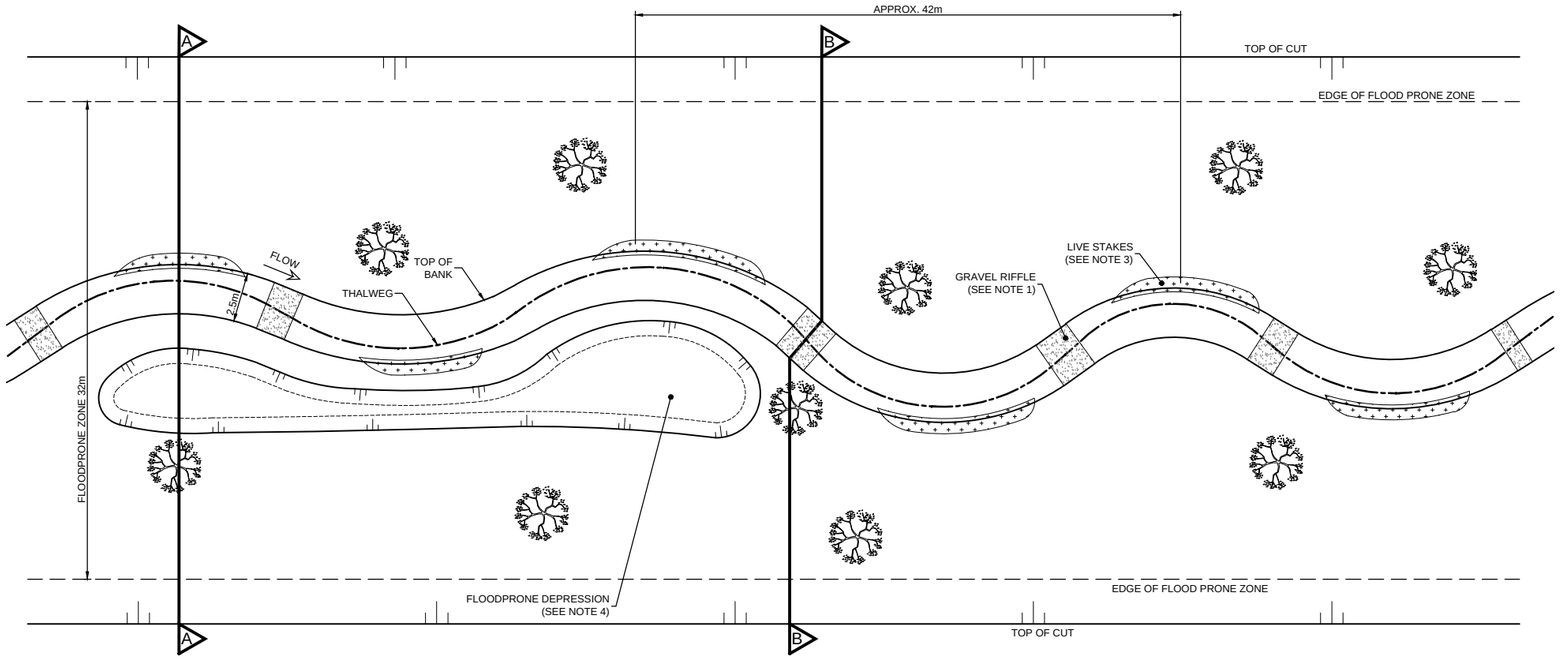
PROJECT: GOLIATH GOLD PROJECT
FISH HABITAT OFFSETTING

TITLE: BLACKWATER CREEK TRIBUTARY 2 DIVERSION FLOODPLAIN GRADING PLAN AND PROFILE

PROJECT NO.:	TC160516
REVISION NO.	A
DATE:	APRIL 2018
SCALE:	AS SHOWN
DRAWING NO.:	Figure 4.2-2



PLAN VIEW: TYPICAL BANKFULL CHANNEL

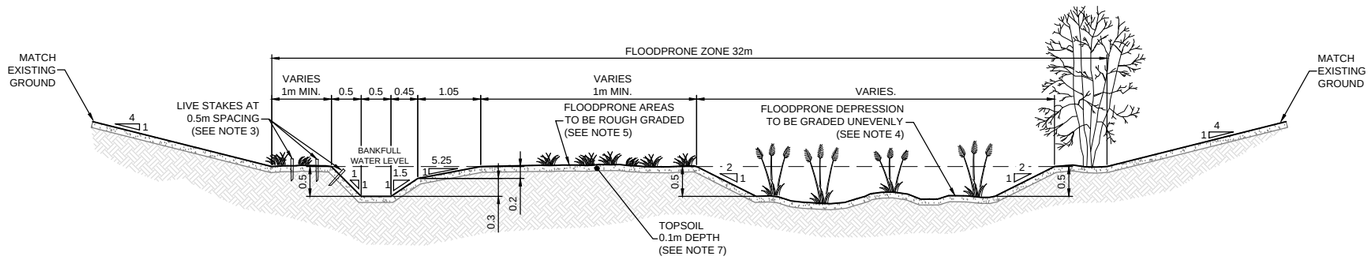
SCALE: N.T.S.

LEGEND

- TREE
- LIVE STAKES
- GRAVEL RIFFLE

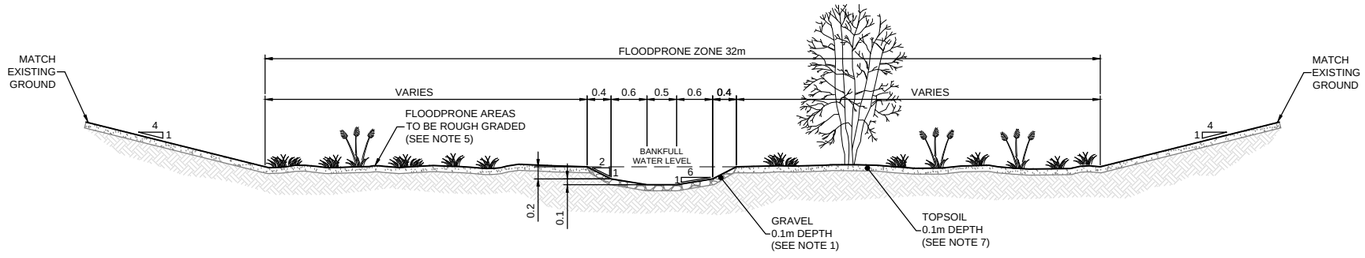
NOTES:

1. GRAVEL RIFFLE SHALL CONSIST OF 60% GRAVEL(2mm-4mm DIAMETER) MIXED WITH 40% PARENT MATERIAL/TOPSOIL AS PER NOTE 2. MIXTURE SHALL EXTEND 100mm BELOW CHANNEL INVERT. THE SPECIFIED 2mm-4mm DIAMETER GRAVEL IS CONSIDERED OPTIMAL SPAWNING SUBSTRATE FOR WHITE SUCKER.
2. PARENT MATERIAL/TOPOIL MIXTURE SHALL CONSIST OF 70% MINERAL SOIL AND 30% TOPSOIL AND MUST BE EVENLY MIXED PRIOR TO MIXING WITH ROCK FILL. TO ENSURE PROPER MIXING WITH THE ROCK FILL NO CLUMPS OF MINERAL SOIL GREATER THAN 100mm IN DIAMETER SHALL BE UTILIZED IN THE MIXTURE. TOPSOIL UTILIZED IN THE MIXTURE SHALL CONTAIN LESS THAN 20% CLAY.
3. LIVE STAKES SHALL BE DORMANT WILLOW OR RED OSIER DOGWOOD 45cm-75cm IN LENGTH AND 20mm-50mm IN DIAMETER. STAKES SHALL BE SPACED AT 0.5m ON CENTER.
4. FLOODPRONE DEPRESSION TO BE GRADED UNEVENLY TO PROMOTE MICROTOPOGRAPHY AND VARIABLE WATER DEPTHS WHEN FLOODED.
5. FLOODPRONE AREAS SHALL BE ROUGH GRADED ONLY SO AS NOT TO CREATE UNIFORM FLOODPRONE AREAS.
6. ANY COMPACTED SOIL DUE TO MACHINERY ACCESS SHALL BE LOOSENED PRIOR TO TOPSOIL AND SEED APPLICATION.
7. ALL AREAS SHALL HAVE 100mm OF TOPSOIL PLACED ON SUBGRADE TO BRING AREA TO FINAL GRADE.
8. ALL DISTURBED AREAS SHALL BE STABILIZED WITH A NURSE CROP OF OATS (*Avena sativa L.*) SEEDED AT 11 kg/ha.
9. ALL DISTURBED AREAS SHALL BE SEEDED WITH NATIVE FLOODPLAIN SEED MIX AT 15kg/ha.
10. TREES SPECIES SHALL BE SELECTED BASED ON CONSULTATION WITH TREASURY METALS' TERRESTRIAL ECOLOGIST.
11. REFINEMENTS MAY BE CONSIDERED TO THE ALIGNMENT AND PROFILE TO MINIMIZE CUT VOLUMES, ROCK EXCAVATIONS AND TO ACCOMMODATE SEPARATION FROM THE TMF.
12. SUB-EXCAVATION AND CLAY CAP INSTALLATION MAY BE REQUIRED IN AREAS WHERE ROCK EXCAVATION IS NECESSARY. THE DETAILS REGARDING SUB-EXCAVATION AND EXTENTS OF SUB-EXCAVATION REQUIRED WILL BE REFINED DURING THE DETAILED DESIGN PROCESS.
13. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.



SECTION A-A: TYPICAL POOL CROSS SECTION WITH FLOODPLAIN DEPRESSION

SCALE: N.T.S.



SECTION B-B: TYPICAL RIFFLE CROSS SECION

SCALE: N.T.S.

NATIVE FLOODPLAIN SEED MIX		
SPECIES	COMMON NAME	PERCENTAGE OF MIX
GRASSES, SEDGES, AND RUSHES (TOTAL 85%, MUST INCLUDE ALL SPECIES)		
CALAMAGROSTIS CANADENSIS	CANADA BLUE JOINT	10-20
POA PALUSTRIS	FOWL BLUE GRASS	10-20
GLYCERIA STRIATA VAR. STRICTA	FOWL MANNA GRASS	10-20
WOOL GRASS	SCIRPUS CYPERINUS	10-20
CAREX VULPINOIDEA	FOX SEDGE	6-15
CAREX BEBBII	BEBBS SEDGE	6-15
JUNCUS EFFUSUS	SOFT RUSH	6-15
TYPHA LATIFOLIA	COMMON CATTAIL	4-10
FORBES (TOTAL 15%, MUST INCLUDE ALL SPECIES)		
DOELLINGERIA UMBELLATUS	FLAT-TOPPED ASTER	2-8
IRIS VERSICOLOR	BLUEFLAG	2-8
SYMPHYOTRICHUM CORDIFOLIUM	HEART-LEAVED ASTER	2-8
EUPATORIUM MACULATUM	SPOTTED JOE PYE WEED	2-8
SAGITTARIA LATIFOLIA	BROADLEAF ARROWHEAD	1-4
EUPATORIUM PERFOLIATUM	BONESET	1-4

HOLD

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PROJECT: GOLIATH GOLD PROJECT
FISH HABITAT OFFSETTING

TITLE: BLACKWATER CREEK TRIBUTARY 2 DIVERSION
TYPICAL PLAN VIEW AND CROSS SECTIONS

PROJECT NO.:	TC160516
REVISION NO.	A
DATE:	APRIL 2018
SCALE:	AS SHOWN
DRAWING NO.:	Figure 4.2-3

4.3 SUMMARY OF HABITAT LOSSES AND GAINS

The total permanent habitat losses as a result of the project are predicted to be 3,597 m of watercourse and, under current conditions, 3.942 ha of beaver ponds. A temporary loss of 717 m of watercourse will also occur from early in the construction phase through closure. It is possible that a habitat gain will be realized in the new watercourse that connects the upper portion of the Blackwater Creek Tributary 2 catchment to Blackwater Creek but, for the present, it has been conservatively assumed that no habitat gains will occur because of the construction of this watercourse.

5.0 OFFSET STRATEGY

Offsetting measures can take a variety of forms ranging from localized improvements to fish habitat to more complex measures that address limiting factors to fish production. The choice of appropriate offsetting measures will be guided by threats to fisheries productivity and fisheries management objectives. In some instances, the most desirable offsetting measures may be a replacement of the same type of habitat (in-kind) that is affected by the project. In other situations, better outcomes for fisheries may be achieved by undertaking offsetting in water bodies or for fish species other than those affected by the project. For example, improving access to off-channel habitats or the removal of anthropogenic barriers might be acceptable offsetting measures.

DFO applies the following principles in applying offsetting measures for fisheries protection (DFO, 2013):

Principle 1: Offsetting measures must support fisheries management objectives or local restoration priorities.

- Offsets should be designed so they contribute to the objectives identified in fisheries management plans, where such plans exist. Where such objectives do not exist or where they do not describe restoration priorities, fisheries managers, Aboriginal groups, local organizations and stakeholders may help to identify areas that require restoration or improvement.
- In situations where offsets are realized away from the project site, a robust rationale is required and should be communicated to potentially affected parties.

Principle 2: Benefits from offsetting measures must balance project impacts.

- Offsets should be scaled such that they are proportional to the impacts caused by the project. Offsets are more likely to successfully balance losses when they benefit the specific fish populations in the geographic areas that are affected by a proposed development project or activity.
- With an “in-kind” approach to offsetting, the habitat that is destroyed or permanently altered is replaced by the same quantity and quality of the same type of habitat, with

additional habitat offsetting required to account for uncertainty and time lags. With this approach, balancing the losses to fish and fish habitat caused by a project with the benefits that result from offsetting measures is a straight-forward calculation.

- With an “out-of-kind” approach to offsetting, offsetting measures target the factors limiting productivity in a given area by means other than replacing what has been lost. It can be more complicated to measure and compare losses caused by the project with offsetting gains when an out-of-kind approach is adopted, but in some cases greater productivity gains may be achieved through this approach.
- Proponents should make all reasonable efforts to avoid time delays between the impacts and the functioning of the offsetting measures. When a time delay is unavoidable, the offset must make up for fisheries productivity that has been lost because of the delay. For example, measures may include building more habitat than is lost so that once the habitat becomes functional it will produce enough fish to make up for the productivity lost during the time lag.
- Where the residual harm to fish cannot be adequately offset because of the irreplaceability or vulnerability of the fish or fish habitat, an authorization may not be acceptable and may be refused.

Principle 3: Offsetting measures must provide additional benefits to the fishery.

- Proposed offsets should provide additional benefits to fisheries productivity. This means that benefits to the fishery are caused by offset actions and not by other factors. Fisheries benefits that are being or will be provided by other programs or activities should not be considered offsets.
- Proposed offsets should not address environmental damage for which another person or organization is clearly responsible. The restoration of orphaned sites – those with no known responsible party or owner or with no possibility of restoration due to company closure, bankruptcy or other similar circumstance – could be considered an appropriate offsetting measure. However, restoration of other sites that are not orphaned would not be considered an appropriate offset because such sites should be cleaned up by the responsible party.

Principle 4: Offsetting measures must generate self-sustaining benefits over the long term.

- Offsets should strive to generate self-sustaining benefits to fisheries productivity. The offset benefits to the fisheries should last at least as long as the impacts from the development project.

6.0 PROPOSED OFFSETTING MEASURES

Treasury Metals has discussed potential offset options with Provincial (OMNRF), and Federal (DFO) agencies. It is proposed that offsetting will be based on the maintenance or improvement of fish productivity where it is determined to provide the most benefit. Treasury

Metals believes that Project stakeholders are interested in improvements of the overall health of Wabigoon Lake and/or the watershed, opposed to direct in-kind improvements on Blackwater Creek. The use of offsite general watershed enhancements as an offset strategy will require acceptance and further development with DFO in terms of how Treasury Metals would achieve the required NNL level. First Nation and local public stakeholders will be informed of the current proposed plan and invited to comment on its design and goals. General watershed improvements are suited to compensation strategies associated with Fisheries Act Section 35(2).

This conceptual offsetting plan includes three primary offsetting measures. They are:

- shoreline stabilization on Wabigoon Lake,
- creation of fish habitat, after mine closure, in ponds adjacent and connected to Blackwater Creek, and
- removal of the dam on Thunder Lake Tributary 2, to allow upstream fish passage.

Each of these concepts is deemed to be worthy of consideration as offsetting for the project by MNRF Dryden, recognizing that the final offsetting plan will be determined during the detailed design phase of the project and that consultation will occur during that preparation. MNRF Dryden also indicated that there are no other habitat restoration projects that are considered a management priority at this time that should be considered as potential offsetting (J. Van Wallegham, Management Biologist, MNRF Dryden District. Personal communication with C. Portt, March 21, 2018).

The three offsetting concepts are described below. It should be noted that removal of an existing dam on Thunder Creek, which flows from Thunder Lake to Wabigoon Lake, which was proposed as a possible offsetting measure in an earlier conceptual offsetting report is no longer under consideration. The removal of that dam, which was proposed as a method to restore upstream fish passage between the two lakes, would not be effective because there is a natural falls in Thunder Creek that blocks upstream fish migration.

6.1 Shoreline Stabilization on Wabigoon Lake

Stabilizing shoreline of Wabigoon Lake is a management objective of MNRF. This option can be considered habitat restoration, as it addresses problems created in the past. Wabigoon Lake is very turbid due to high levels of suspended sediment. The Wabigoon Chain Fisheries Background Report (MNRF, 2014) describes the situation as follows:

A water control structure was built at the outlet of Wabigoon Lake in 1897 for navigation purposes and reconstructed in 1912 for hydroelectric generation. As a result of the dam, water levels increased by 1.2 to 1.5 m... When the water levels were raised by the dam, there was increased erosion of the clay banks on Wabigoon Lake. This erosion contributed a large amount of silt to the lake, and high winds and wave action exacerbated the problem (Lebeau 1992). Lebeau (1992) found that silt in Wabigoon Lake covers and suffocates eggs of muskie and northern pike, causing increased egg mortality. The eggs of other fish species would also be negatively affected by siltation.

Further regarding this issue, the Wabigoon Chain Fisheries Background Report (MNRF, 2014) states:

Any opportunities to stabilize the shoreline and prevent erosion should be pursued. Management discussions should consider that the sedimentation may negatively impact the spawning success of a variety of species.

Guidance with respect to offsetting measures provided by DFO (DFO, 2013) states:

Offsets are most likely to balance losses when they benefit the specific fish populations and areas that are affected by a development project. When determining the location for offsetting, offsets that occur within the vicinity of the project or within the same watershed are preferable . . . Offsetting measures could be undertaken in water bodies or for fish species other than those affected by the project, provided the measures are supported by clear fisheries management objectives or regional restoration priorities.

Stabilizing shoreline of Wabigoon Lake clearly meets the latter criterion. This potential offsetting measure also has the advantage of being implementable at any stage during the project. Offsetting early in a project can reduce or eliminate time lags between when habitat is harmed or habitat losses occur and when the offsetting occurs. Additional offsetting may be required due to those time lags. Early implementation can reduce or eliminate that requirement. As the benefits from this proposed offsetting measure are very different from the losses, in terms of the fish communities affected, it would be necessary to develop an appropriate method of determining the amount of shoreline stabilization that would be required in order to achieve the required offset.

6.2 Creation of Fish Habitat, After Mine Closure, in Ponds Adjacent and Connected to Blackwater Creek

Post-closure, fish habitat could be created where water collection ponds 2A and 2B are located during operations (Figure 6.2-1). Currently, it is proposed to restore these areas by filling in the ponds and restoring terrestrial vegetation. An alternative approach would be to leave these ponds in place, or even to expand them if necessary to achieve the necessary offsets. It would be necessary to remove any contaminated material that may have accumulated during operations. Different substrate could be added if desired. Water that discharges from the pit, which it is currently proposed to discharge to Blackwater Creek Tributary 1, could be directed to the ponds and then from the ponds to Blackwater Creek Tributary 1. Habitat could be created that is very similar to the habitat in beaver ponds and therefore suitable for the fish species that are present.

This potential offsetting measure meets the criterion of benefiting the specific fish populations and areas that are affected by the development project. It is also at or close to the locations where habitat losses will occur, which DFO indicates is preferred. The created habitat would closely resemble the habitat that was lost and therefore determining the amount of habitat creation that would be required in order to achieve the required offset would be relatively straight-forward. A disadvantage would be that the offsetting could not occur until post-closure, which would result in a considerable time lag between the losses and the gains

occurring. Much of the habitat that will be lost, however, is beaver pond habitat which is not permanent; it is created when a new dam is built and then lost when the dam ceases to be maintained. The offsetting ponds would not be subject to these cycles which could offset for the time lag.

6.3 Removal of the Dam on Thunder Lake Tributary 2, to Allow Upstream Fish Passage

A dam located on Thunder Lake Tributary 2 is a barrier to upstream fish passage (Figure 6.2-1). Its removal would reconnect the upstream reaches of this system, which are extensive, with Thunder Lake. Removal of anthropogenic barriers to fish migration is identified as a habitat restoration activity that is appropriate as an offsetting measure by DFO (DFO, 2013).

Generally, dams that are barriers to fish passage can prevent fish from accessing spawning areas, prevent fish from moving seasonally in response to water temperature, and prevent recolonization if a species is extirpated upstream from the dam. The ponds created by dams can also increase water temperature.

This potential offsetting measure does not meet the criterion of benefiting the specific fish populations and areas that are affected by the development project. Removal of the dam would not result in gains in habitat area. Instead the gains would be realized through improved fish access, the benefits of which are less easily quantified. It is intended that the pond created by the dam will be used as a water supply during mine development and operations. Therefore, a disadvantage of this offsetting approach would be that the offsetting could not occur until closure, which would result in a considerable time lag between the losses and the gains occurring. Discussions will be held with MNRF and others to determine if further investigation is warranted to determine what benefits would be realized from the removal of the dam.

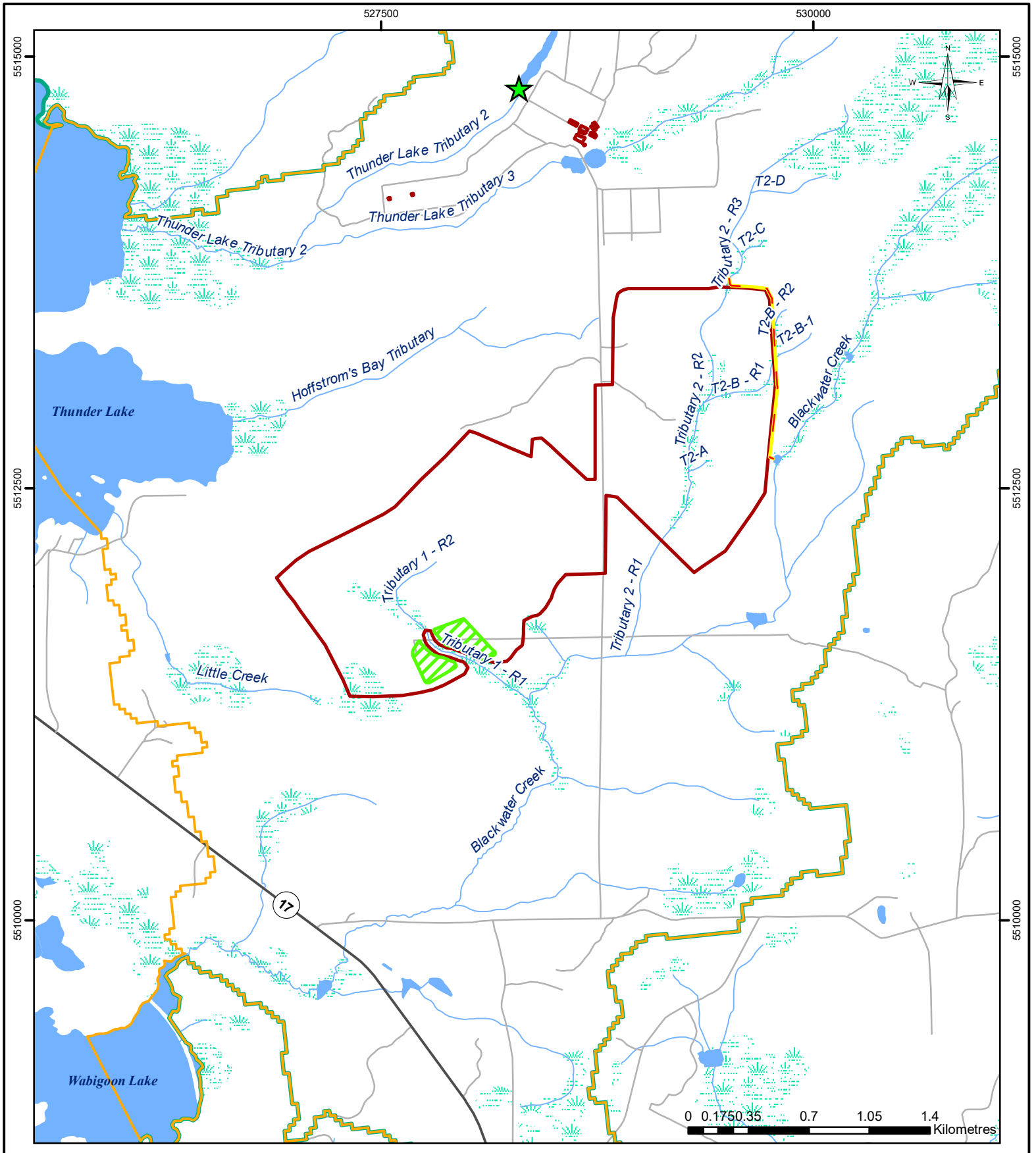

Figure 6.2-1
Goliath Gold Project Proposed Fish Habitat Offset Measures

Projection: NAD 1983 UTM Zone 15N
Date created: 2018-04-10
SCALE: 1:28,785

Legend

- Project Footprint
- Road
- Highway
- Stream
- Waterbody
- Wetland
- LSA Aquatic
- RSA Aquatic
- Diversion Ditch
- Pond Habitat Creation
- Dam Removal

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7.0 CONCLUSION

The total permanent habitat losses as a result of the project are predicted to be 3,597 m of watercourse and, under current conditions, 3.942 ha of beaver ponds. A temporary loss of 717 m of watercourse will also occur. The fish community that occupies these habitats is typical of small streams and beaver ponds in this part of Ontario and consists of resident populations of common, small-bodied fishes and White Sucker, which are also thought to be resident in Blackwater Creek. Based on field investigations, there are no migratory fish populations that spawn in or otherwise utilize the habitat that will be lost.

Three offsetting options are under consideration to address the habitat losses that will occur. One of these, shoreline stabilization on Wabigoon Lake is identified as a management objective by MNRF. A second offsetting option, creation of pond habitat adjacent to Blackwater Creek Tributary 1, creates habitat similar to much of the habitat that will be lost and is at or near where those losses will occur, thus meeting DFO offsetting criteria. The third offsetting option, removing the dam that blocks upstream fish migration on Thunder Lake Tributary 2, is consistent with the offsetting measures described by DFO but requires further consideration to determine if it warrants detailed investigation. All three of the options are technically feasible. Based on the nature of the habitat losses and alterations, offsetting that balances project impacts can be readily achieved.

8.0 REFERENCES

Coker, G., C.B. Portt and C.K. Minns. 2001. Morphological and ecological characteristics of Canadian freshwater fishes. Can. Manuscript Rpt. of Fisheries and Aquatic Sciences No.2554. iv, 86p

DFO. 2013. Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting. 19p.

Lebeau, B. 1992. Historical ecology of pike (*Esox lucius*), muskellunge (*Esox masquinongy*), and maskinonge- a new species of *Esox* (subgenus *Mascalongus*) from North America. Ph.D. Thesis. University of Toronto. Toronto, Ontario, Canada.

Ministry of Natural Resources, 2014. Wabigoon Chain Fisheries Background Report. Dryden District MNR. 91 p.