APPENDIX F

WATER MANAGEMENT PLAN

NOTE TO READER
APPENDIX F

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, First Nations and other Aboriginal peoples, 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 F to the revised EIS (Conceptual Water Balance) presents the water balance associated with the refined Project configuration. The Conceptual Water Balance replaces Appendix F (Water Management Plan) to the original EIS. Since the filing of the original EIS, Treasury Metals have refined the design of the Project to address several of the Round 1 information requests and optimize the configuration. As a result, much of the information presented in Appendix F to the original EIS was outdated and did not reflect the enhancements made to the Project. Specifically, the document was based on a water management plan that used the tailings storage facility (TSF) for the storage of both tailings and mine water. As part of the refinements to the Project, the decision was made to have a separate mine water pond, simplifying the water management plans for the Project.

As part of the discussions with the Agency regarding the draft and final responses to the Round 1 information requests, it was noted that there could be confusion regarding the replacement of Appendix F to the original EIS. Because the revised version of Appendix F is considerably shorter than the version included as part of the original EIS, the Agency raised the concern that information relevant to the EIS may be omitted in the revised EIS. To avoid confusion and ensure that the pertinent information from Appendix F of the original EIS is captured and included in the revised EIS, a roadmap has been presented (Table 1) indicating where the relevant information can be found in the revised EIS. This table should help readers and reviewers navigate the revisions to each of the technical appendices.

Table 1: Where Technical Information from Appendix F of Original EIS is located in Revised EIS

Information Presented Original EIS	Where is the Information presented in the Revised EIS
1. Executive Summary	There is no technical information in this section. This section is superseded by the revised EIS.
2. Site Water Balance	The information in this section has been superseded. The new site water balance is provided in a new memo, prepared by WSP, entitled Appendix F: Goliath Site – Conceptual Mine Site Water Balance Technical Memo (WSP, February 2017).
3. Cyanide Management Plan	The content of the information presented in the former section of the appendix is provided in the following sections of the revised EIS: • Section 3.6.6.3: Cyanide Detoxification; • Section 3.6.6.6: Reagent Mixing and Storage; and • Section 3.8.7: Cyanide Management
4. Water Treatment and Discharge Facilities	The content of the information presented in the former section of the appendix is provided in the following sections of the revised EIS: • Section 3.8.8: Process Effluent Treatment and Discharge; • Section 3.8.9: Final Effluent Treatment; and • Section 3.8.10: Effluent Discharge Structure
5. Cost Estimate of Alternative Discharge Points	This information was not included in the revised EIS. Consideration of options for water discharge were addressed elsewhere in the revised EIS, specifically within the alternatives assessment (Section 2.4.9) and the accompanying appendix (Appendix X).
6. Closure Water Balance	This section of the original EIS provided only a qualitative discussion of closure measures, rather than a quantitative closure water balance. The content of the information presented in the former section of the appendix is provided in the following section of the EIS: Section 2 of Appendix JJ to the revised EIS.
7. Evaluation of Alternatives for Components of the Water Management Strategy	The content of this section has been superseded by the alternatives assessment (Section 4) and the accompanying appendix (Appendix X) of the revised EIS. That information also appears within the alternatives assessment (Section 4) and the accompanying appendix (Appendix X) of the revised EIS.
A. Effluent Pipeline Routings	These figures are replaced by updated figures in the EIS: Figures 3.0-1A through 3.0-1D
B. Project Site Arrangement	These figures are replaced by updated figures in the EIS: Figures 3.0-1A through 3.0-1D
C. Tetra Tech EIS Water Quality Report (pit lake model)	The information presented in Appendix C of Appendix F of the original EIS has been superseded by the pit lake modelling presented in detail in Section 5: Geochemistry in Appendix JJ: Water Report, to the revised EIS. The pit lake model results are also presented in the geochemistry and geology assessment presented in Section 6.3 of the revised EIS.

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

List of Appendices to the Revised EIS		
Appendix	Status	Description
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

1269 Premier Way, Thunder Bay, ON P7B 0A3
Telephone: 807-625-6700 ~ Fax: 807-623-4491 ~ www.wspgroup.com

MEMO

TO:	TREASURY METALS	**DATE:**	**February 24, 2017**
FROM:	**WSP**		
SUBJECT:	GOLIATH SITE – CONCEPTUAL MINE SITE WATER BALANCE		

1.0 Introduction

Treasury Metals (TM) is in the process of developing the Goliath Mine Site located near to the City of Dryden, ON. The mine operations will consists of both an open pit and underground mining operation with on-site ore milling and processing for gold and includes a tailings storage facility. TM is advancing the permitting for the mine site that has included the submission of the Environmental Impact Statement (EIS) in 2015. Responses to Information Requests (IR's) from the regulatory authorities and stakeholders regarding the EIS submission is currently ongoing and includes IR's related to the mine site surface water management. TM has also revised and advanced the mine site water management concepts for the purpose of containing all mine contact water and to provide water for the ore processing during the operations. TM has requested that WSP complete a conceptual mine site water balance, based on the TM surface water management concepts, to identify the following:

- The quantity of water available for use in processing
- Development of the minimum water cover in the TSF and associated required quantities
- The quantity of water transfer to treatment

The results of the conceptual water balance are provided in the sections below.

2.0 Background Information and Scope of Work

Work previously completed for the proposed TSF has been limited to the Alternatives Assessment that was included with the EIS submission as Appendix D. The Alternatives Assessment was used to identify the preferred location for the TSF and the tailings disposal technology based on 22 potential alternatives. The preferred location for the TSF has been identified and provided in Appendix D of the EIS. The preferred tailings disposal technology was identified as slurry tailings delivery and deposition, during the initial years of operations, with a portion of the tailings being directed for storage in the underground mine in later years of operations.

Previous work for surface water management at the Goliath site was completed by others and is available in the EIS.

The updated surface water concept developed by TM consists of a perimeter runoff and seepage collection ditch/berm system to contain all mine site contact water. Mine site runoff will be collected in on-site collection ponds. Mine dewatering water will be routed to a proposed mine dewatering pond. The boundary or battery limits for the mine site water balance was established as the perimeter containment system and includes the proposed collection ponds, mine dewatering pond and the TSF.

The scope of work for the mine site water balance was identified by TM and consisted of the completion of the conceptual water balance for average, dry and wet annual precipitation conditions. The conceptual water balance is based on the proposed site layout, developed by TM, and was used to identify the reclaim water available, required water transfer to treatment and also to identify if the proposed water cover in the TSF that can be maintained. Water management outside the mine site containment area, in the receiving environment, is being completed by others.

The following sections provide a summary of the input parameters, constraints, assumptions and results of the conceptual mine site water balance.

3.0 Site Layout and Containment Ponds

The current mine site layout has been developed by TM and includes the preferred location of the TSF that was identified by the Alternatives Assessment. The site layout includes a perimeter runoff collection system that will collect and contain surface water runoff from the mine site. TM has identified three (3) collection ponds and a mine dewatering pond to be implemented as part of the surface water management system. The proposed locations of the collection ponds are provided on the Site General Arrangement Drawing. Design of the collection ponds or mine dewatering pond has not been advanced at this stage of the project and therefore assumptions are required to identify the potential holding capacities. TM advised that the collection ponds can be assessed as sub-surface holding ponds at this project stage and will be confirmed as the project is advanced. The conceptual capacity of the mine dewatering pond has been developed based on the assumption that an above-ground containment system will be used due to at and near surface proximity of bedrock as well as the south embankment of the TSF. This concept will be confirmed as the project is advanced and will also include assessing the potential of a below-ground pond.

The conceptual storage capacities that have been used for the mine site water balance are summarized below:

- Collection Pond No. 1 16,000 m^3
- Collection Pond No. 2 79,000 m^3
- Collection Pond No. 3 140,000 m^3
- Mine Dewatering Pond 85,000 m^3

4.0 Design Parameter and Constraints

The mine site water balance has been completed with separate balances for the mine site and the TSF. The water management concept for the site includes operating the TSF as an independent system from the other water management systems. Water in the TSF will be directed to the plant site for use in processing with excess water being sent to treatment. Excess water from the TSF will therefore not be routed to other holding ponds to ensure containment of potential cyanide.

The following provides a summary of the design parameters and constraints that have been applied to the conceptual mine site water balance.

4.1 Meteorological Data

Meteorological data, consisting of annual rainfall and lake evaporation, for the site was provided by Amec and consisted of the annual average, 1:20 year wet and 1:20 year dry values. These values were used for the mine site water balance to maintain consistency for the site. The annual precipitation and lake evaporation values are attached.

4.2 Catchment Areas and Runoff Coefficients

The catchment areas for the mine site water balance were developed from the site arrangement as well as the location of the proposed collection and mine dewatering ponds. The TSF will have perimeter embankments to contain the tailings solids, operational water and stormwater. The perimeter embankments are anticipated to be staged over the life of the facility and as a result the catchment area will also vary. An operational water balance, consisting of a yearly assessment from year 1 to the end of operations, was not part of the scope of work. An assumption was therefore required to identify the catchment area for the TSF as the area will not remain constant over the life of the facility. The TSF arrangement that was used to identify the catchment area for the 1-year water balance was the last year of operations. This area is based on the Alternatives Assessment findings for the TSF with a storage capacity required for the total volume of tailings resulting from directing a portion of the tailings to the underground mine for storage starting in Year 5 to the end of operations. The resultant catchment area of the TSF for the final year of operations is approximately 63.0 ha.

The catchment area of the mine dewatering pond will also be controlled by the perimeter containment berm, based on the assumptions discussed above. The catchment area of the mine dewatering pond that has been applied for the conceptual water balance is 7.6 ha. The catchment area will need to be confirmed as the design is advanced.

The mine site catchment areas have been established based on the mine site layout, perimeter runoff collection system, placement of stockpiles as well as the location of the proposed collection ponds. The following is a summary of the catchment areas that have been identified for the mine site area.

The sub-catchment of Collection Pond 1 covers the northeastern part of the sterile dump and the northern part of the plant. With an area of 19.6 ha, the composition of this sub-basin is primarily the waste rock dump and a small area consisting of mine site developed area. Due to its location, collection pond 1 has the smallest storage capacity at 16,000 m³ based on the layout and potential pond depth inferred from geotechnical data for the site.

The sub-catchment for Collection Pond 2 extends greater than 37 ha making it the biggest of the mine site sub-catchments. It covers the entire southern part of the plant area, the ore stockpile located on the east part on the mine site as well as the majority of the area of overburden stockpiles located at the southern extent of the mine site. The assigned operational level of Collection Pond 2 has a corresponding containment volume of 79 000 m³ for surface water runoff.

The catchment area reporting to Collection Pond 3 is approximately 10 ha. The catchment area extends across the northwest portion of the waste rock storage area and an area of natural ground at the western end of the pit. Collection Pond 3 has a conceptual storage capacity of 140,000 m³.

Ground conditions and corresponding surface water runoff coefficients will vary based on the construction method and the material properties of the stockpile materials. Amec has provided runoff coefficients for the natural ground conditions at the site as well as for site development and rehabilitation that were reviewed and appeared reasonable. Additional runoff coefficients were developed for the catchments for the stockpiled materials and a summary of the runoff coefficients that have been applied to the conceptual mine site water balance are provided below.

Flow Condition	Land Use						
	Natural	Waste Rock Storage Area	Operations Area	Overburden Stock Pile	Developed Area	Low Grade Stockpile	Open Water
1:20 Year Dry	0.24	0.52	0.32	0.43	0.49	0.52	1.0
Average	0.34	0.70	0.45	0.60	0.70	0.75	1.0
1:20 Year Wet	0.46	0.91	0.61	0.78	0.95	0.95	1.0

Runoff coefficient for the perimeter embankments of the TSF and mine dewatering pond were assigned as 0.95 for all precipitation conditions as the embankments have relatively small catchment areas and are sloped towards the upstream pond. The embankments are also anticipated to be lined with low permeable clay or an engineered liner that will reduce the potential infiltration water losses.

4.3 Water Management and Pumping

Water that is collected at the site will be used as reclaim for processing with the excess water being directed to the water treatment facility for release to the environment. The process water requirements are summarized below:

- Process Water 2,226 m^3/day
- Raw/Fresh Water 818 m^3/day

The total reclaim water required from the containment ponds for the process is 3,044 m^3/day. An additional 20 m^3/day of Raw/Fresh Water is required for the processing and is anticipated to be provided from a well. The process water can be provided from the mine dewatering pond or the TSF while the Raw/Fresh Water can be provided from the collection ponds.

Other water transfers that were utilized in the water balance to maintain operational requirements are summarized below:

- Raw/Fresh water deficits were supplemented with water that was directed to treatment.
- Water from the mine dewatering pond was used to maintain the required water cover in the TSF during dry conditions

4.4 Water From Tributaries

A constraint was established for the mine site water balance for the water that can be provided from the tributaries. The allowable water volume from the tributaries for this assessment was provided by Amec and is attached.

Water from the Thunder Lake Tributary's 2 and 3 (TL1 and TL2) was applied to the model to supplement the Raw/Fresh Water requirements for the plant operations and also to recharge the storage volume of the collection ponds.

4.5 Tailings Storage Facility

The tailings storage facility will be required to maintain a minimum water cover of 1.2 m over the tailings beach surface to keep the tailings submerged and prevent exposure to air. The following is summary of the inputs and outputs for the TSF:

Inputs

- Water with tailings slurry
- RW-MIA 62 m^3/day
- Grey Water 17 m^3/day
- Direct Pond Precipitation Varies Based On Pond Area
- Perimeter Embankment Runoff Varies based On Pond Area
- Water transfer from mine dewatering pond (as required to maintain 1.2 m water cover)

Outputs

- Pond Evaporation — Varies Based On Pond Area
- Water Locked in Tailings
- Reclaim to Plant Site — Maximum Rate - 92.8 m^3/hr (2,226 m^3/day)
- Transfer to treatment — As required

The water with tailings slurry is based on the process throughput. The project throughput is 2,700 dtpd at a solids content of 48%. The last year of operations, being used to assess a typical year, will have a reduced throughput to the TSF as a portion of the tailings will be directed to the underground mine for storage. However, the conceptual mine site water balance has applied the design throughput as an input. This provides an assessment with the maximum water output and reclaim required. The water with tailings slurry for the design throughput is 121.4 m^3/hr (2,913 m^3/day). Water locked in tailings is also based on the throughput as well as the in situ density. The in situ density that is being used for the TSF at this stage of the project is 1.1 t/m3 and the corresponding water lock in tailings is 60.6 m^3/hr (1,455 m^3/day).

4.6 Mine Dewatering Pond

The mine dewatering pond will be used to store water from the open pit and also to the underground during the operations. Water from the pond can also be used to maintain the required minimum water cover in the TSF during periods of dry conditions. The following is a summary of the inputs and outputs for the mine dewatering pond.

Inputs

- Direct Pond Precipitation — Varies Based On Pond Area
- Perimeter Embankment Runoff — Varies based On Pond Area
- Mine Dewatering — 55 m^3/hr (1,320 m^3/day)
- Precipitation into open pit — Varies

Outputs

- Evaporation from pond — Varies Based on Pond Area
- Water transfer to Process — As Required Based TSF Water Availability
- Water transfer to TSF — As Required to Maintain 1.2 m Water Cover
- Water transfer to treatment — Excess Water

The mine dewatering rate provided by TM was identified as groundwater only and did not include precipitation into the open pit. The maximum pit perimeter and corresponding area of 31.8 ha was used to identify the amount of water from effective precipitation that would need to be routed to the mine dewatering pond.

4.7 Collection Ponds

The collection ponds will be used to capture mine contact water with storage for use in the processing as Raw/Fresh Water. The following is a summary of the inputs and outputs for the collection ponds:

Inputs

- Direct Pond Precipitation — Varies Based On Pond Area
- Catchment Runoff — Varies Based On Monthly Effective Precipitation

Outputs

- Evaporation from Pond — Varies Based on Pond Area
- Water Transfer to Process — Maximum Rate – 34.1 m^3/hr (818 m^3/day)
- Water transfer to treatment — Excess Water

5.0 Water Balance Results

The conceptual mine site water balance was completed as a monthly balance for the annual average, 1:20 year wet and 1:20 year dry precipitation conditions. This analysis was completed to identify the water available for reclaim to the plant site as well the capabilities of the system to maintain the minimum required water cover in the TSF. The results of the water balance were also used to identify the water that is required to be transferred to treatment.

Snowmelt parameters for the model were completed such that the accumulated snow up to the months of March, April and May melted at a rate of 10 percent in March, 80 percent in April and 100 percent in May, meaning that 100 percent of the accumulated snow has melted by the end of May.

The modeling was completed by assigning a normal operating pond volume, as identified above, for the collection ponds and the mine dewatering pond. The water pond level in the TSF was set at the minimum required height of 1.2 m above the tailings beach surface. All excess water in the ponds and TSF, after water reclaim, was sent to treatment. Water deficits in the collection ponds were provided from the tributaries, to the maximum allowable as discussed above, to maintain the pond volumes. Water deficits in the TSF were supplemented with water from the mine dewatering pond.

The result of the conceptual mine site water balance is provided in Table 1, attached. The results are based on the assumptions provided, input parameters and noted constraints, discussed above. The results generally show that water reclaim from the TSF and mine dewatering ponds can be used to provide process water to the plant under average, wet and dry precipitation conditions. The water cover in the TSF is maintained during average and wet conditions, however water from the mine dewatering pond is required during dry precipitation conditions to maintain the water cover. Water from the collection ponds can also be used to provide the required Raw/Fresh water to the process plant during average and wet precipitation conditions. However, water from treatment is required to supplement a deficit during dry annual precipitation conditions. The results also show that water from the tributaries (TL1 and TL2) is required during average and also during dry annual precipitation conditions. The capacity of the collection ponds should be optimized as the project is advanced to maximize the potential storage capacity to reduce the requirements of water supplements from the tributaries.

6.0 Recommendations

The following recommendations are provided based on the input data available and the results of the conceptual mine site water balance and are required to confirm the assumptions utilized for the water balance assessment and to validate the results.

- Finalize the layout of the mine dewatering pond and collection ponds
- Complete site investigations at the mine dewatering pond and collection pond locations. The results of this site investigation will be used to confirm if the ponds can be sub-surface facilities.
- Complete a design of the collection ponds and mine dewatering pond.
- Finalize the TSF operations and confirm the timelines and volume of tailings that can be directed to the underground mine.
- Complete a monthly water balance for each year of operations. The analysis will need to include the TSF embankment staging and the tailings beach rate of rise.

7.0 Closure

We trust that the information provided above meets your requirements at this time. Please feel free to contact us if you have question or would like to discuss.

Attachments:

- Meteorological Data – Amec

- Evaporation Data – Amec
- Allowable Water From Tributaries – Amec
- Table 1: Mine Site Water Balance – Conceptual Level – Results

Scenario	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Percent
Dryden A (6032119) 1981 - 2010 Climate Normals															
	Precipitation (mm)[1,4]	26.5	20.0	29.9	39.6	73.4	115.2	103.1	83.7	88.9	63.6	46.7	29.1	719.7	100.0%
	Rain (mm)[1]	0.2	2.1	6.7	24.7	69.2	115.2	103.1	83.5	87.7	49.2	13.0	1.2	555.8	77.2%
	Snow (mm water equivalent)[2]	26.3	17.9	23.2	14.9	4.2	0.0	0.0	0.2	1.2	14.4	33.7	27.9	163.9	22.8%
Monthly Distribution of Rain, Snow, and Precipitation as Percentage of Total Annual Precipitation															
	Precipitation (mm)	3.7%	2.8%	4.2%	5.5%	10.2%	16.0%	14.3%	11.6%	12.4%	8.8%	6.5%	4.0%	100.0%	
	Rain (mm)	0.0%	0.3%	0.9%	3.4%	9.6%	16.0%	14.3%	11.6%	12.2%	6.8%	1.8%	0.2%	77.2%	
	Snow (mm water equivalent)	3.7%	2.5%	3.2%	2.1%	0.6%	0.0%	0.0%	0.0%	0.2%	2.0%	4.7%	3.9%	22.8%	
Monthly Rain, Snow, and Precipitation for the Project															
1:20 Year Dry	Precipitation (mm)[3]	17.1	12.9	19.3	25.6	47.4	74.4	66.6	54.1	57.4	41.1	30.2	18.8	465.1	100.0%
	Rain (mm)	0.1	1.4	4.3	16.0	44.7	74.4	66.6	54.0	56.7	31.8	8.4	0.8	359.2	77.2%
	Snow (mm water equivalent)	17.0	11.6	15.0	9.6	2.7	0.0	0.0	0.1	0.8	9.3	21.8	18.0	105.9	22.8%
Average Year	Precipitation (mm)[3,4]	24.7	18.7	27.9	36.9	68.5	107.5	96.2	78.1	82.9	59.3	43.6	27.1	671.4	100.0%
	Rain (mm)	0.2	2.0	6.3	23.0	64.6	107.5	96.2	77.9	81.8	45.9	12.1	1.1	518.5	77.2%
	Snow (mm water equivalent)	24.5	16.7	21.6	13.9	3.9	0.0	0.0	0.2	1.1	13.4	31.4	26.0	152.9	22.8%
1:20 Year Wet	Precipitation (mm)[3]	32.3	24.4	36.5	48.3	89.5	140.5	125.7	102.1	108.4	77.6	57.0	35.5	877.7	100.0%
	Rain (mm)	0.2	2.6	8.2	30.1	84.4	140.5	125.7	101.8	107.0	60.0	15.9	1.5	677.8	77.2%
	Snow (mm water equivalent)	32.1	21.8	28.3	18.2	5.1	0.0	0.0	0.2	1.5	17.6	41.1	34.0	199.9	22.8%

Notes:

1) Environment Canada Climate Normals 1981 - 2010 for Dryden A (6032119) were obtained from Environment Canada's website: <http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=dryden&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=3953&dispBack=0>; accessed on December 6, 2016.

2) Snow values are calculated as precipitation minus rainfall and are reported as mm of water equivalent. Values here do not direcly match 1981 - 2010 climate normals for the Dryden A (6032119) station, which are reported as cm of snow, due to variation in snowfall density leading to some minor deviations from reported climate normals.

3) Total annual precipitation values for average and 1:20 year wet and dry scenarios were determined from annual totals from three Environment Canada climate stations covering a period of 1970 - 2015. The stations were: Dryden A (6032119) from 1970 - 2004; Dryden A (AUT) (6032120) from 2005 - 2009; and Dryden Regional (6032125) from 2011 - 2015. Data for 2010 was excluded from the analysis as it was incomplete, missing values for October through December. A normally distributed random variable with a mean of 671.4 mm and a standard deviation of 125.4 mm was fit to the annual precipitation totals. The 1:20 year dry and wet scenarios are represented by the 5th and 95th percentiles, respectively, of the normally distributed random variable.

4) It is noted that the 1981 - 2010 climate normals for Dryden A have a total annual precipitation of 719.7 mm, while the average annual precipitation for the 1970 - 2015 is only 671.4 mm (see Note 3). This difference may be partially explained by the inclusion of 2011 - 2015 years, all of which had total annual precipitation below 600 mm, and which had an average annual precipitation of 497.5 mm. If only the years 1981 - 2010 are considered in the set of annual precipitation data generated in Note 3, then the annual average precipitation is 698.8 mm, which is still less than the 1981 - 2010 climate normals for Dryden A, but is a deviation of only 2.9%. This remaining difference is likely due to the merging of different data sets; however, this was necessary to do since access to the Dryden A precipitation data was not available from the Environment Canada website beyond the year 2004.

Lake Evaporation (mm)			
Month	1 in 20 Dry Year	Average	1 in 20 Wet Year
January	0.0	0.0	0.0
February	0.0	0.0	0.0
March	0.0	0.0	0.0
April	11.3	8.7	6.9
May	129.5	100.4	79.4
June	151.1	117.1	92.6
July	168.6	130.7	103.3
August	136.4	105.8	83.6
September	71.6	55.5	43.8
October	39.3	30.4	24.1
November	0.0	0.0	0.0
December	0.0	0.0	0.0
Total	707.7	548.6	433.7

Notes:

1) Monthly average lake evaporation was calculated from daily lake evaporation data 1969 - 1999 for Rawson Lake (6036904), obtained from Environment Canada. Missing days were ignored from the monthly average.

2) Total lake evaporation for average and 1:20 year wet and dry scenarios were determined using a normally distributed random variable with a mean of 548.6 mm and a standard deviation of 92.6 mm was fit to the annual evaporation totals.

3) The distribution of monthly lake evaporation is based on the monthly distribution of the observed data (average condition)

Existing Conditions - Flows in Thunder Lake Tributaries 2, 3 and Blackwater Creek (m^3/s)

Creek/Condition	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Thunder Lake Tributary 2 (TL 1) - Watershed Area = 8.679 km2													
Average [1]	0.019	0.014	0.017	0.145	0.164	0.087	0.081	0.032	0.052	0.063	0.050	0.034	0.063
1:20 Dry Year [2, 3]	0.005	0.004	0.005	0.041	0.046	0.025	0.023	0.009	0.015	0.018	0.014	0.009	0.018
1:20 Wet Year [2, 4]	0.033	0.025	0.029	0.249	0.282	0.150	0.139	0.055	0.090	0.109	0.087	0.058	0.109
Thunder Lake Tributary 3 (TL2) - Watershed Area = 7.999 km2													
Average [1]	0.018	0.013	0.016	0.133	0.151	0.081	0.075	0.029	0.048	0.058	0.047	0.031	0.058
1:20 Dry Year [2, 3]	0.005	0.004	0.004	0.037	0.042	0.023	0.021	0.008	0.014	0.016	0.013	0.009	0.016
1:20 Wet Year [2, 4]	0.031	0.023	0.027	0.229	0.260	0.138	0.128	0.051	0.083	0.100	0.080	0.053	0.100
Blackwater Creek (BL1) - Watershed Area = 11.637 km2													
Average [1]	0.026	0.019	0.023	0.194	0.220	0.117	0.109	0.043	0.070	0.085	0.068	0.045	0.085
1:20 Dry Year [2, 3]	0.007	0.005	0.006	0.054	0.062	0.033	0.030	0.012	0.020	0.024	0.019	0.013	0.024
1:20 Wet Year [2, 4]	0.045	0.033	0.039	0.334	0.378	0.201	0.187	0.073	0.121	0.146	0.116	0.078	0.146

Existing Conditions - Flows in Thunder Lake Tributaries 2, 3 and Blackwater Creek (m^3/d)

Creek/Condition	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Thunder Lake Tributary 2 (TL 1)													
Average [1]	1,672	1,241	1,465	12,502	14,166	7,550	7,003	2,754	4,525	5,465	4,361	2,905	5,467
1:20 Dry Year [2, 3]	469	348	411	3,508	3,975	2,119	1,965	773	1,270	1,533	1,224	815	1,534
1:20 Wet Year [2, 4]	2,875	2,134	2,519	21,496	24,357	12,982	12,041	4,735	7,780	9,396	7,499	4,994	9,401
Thunder Lake Tributary 3 (TL2)													
Average [1]	1,541	1,144	1,350	11,523	13,056	6,959	6,454	2,538	4,171	5,036	4,020	2,677	5,039
1:20 Dry Year [2, 3]	432	321	379	3,233	3,663	1,953	1,811	712	1,170	1,413	1,128	751	1,414
1:20 Wet Year [2, 4]	2,650	1,967	2,322	19,812	22,448	11,965	11,098	4,364	7,171	8,660	6,911	4,603	8,664
Blackwater Creek (BL1)													
Average [1]	2,242	1,664	1,965	16,763	18,994	10,124	9,390	3,692	6,067	7,327	5,848	3,895	7,331
1:20 Dry Year [2, 3]	629	467	551	4,703	5,329	2,841	2,635	1,036	1,702	2,056	1,641	1,093	2,057
1:20 Wet Year [2, 4]	3,855	2,861	3,378	28,823	32,658	17,407	16,145	6,349	10,432	12,598	10,055	6,696	12,605

Water Availability from Thunder Lake Tributaries 2 & 3 and Blackwater Creek (5% Taking)

Creek/Condition	Jan (m^3)	Feb (m^3)	Mar (m^3)	Apr (m^3)	May (m^3)	Jun (m^3)	Jul (m^3)	Aug (m^3)	Sep (m^3)	Oct (m^3)	Nov (m^3)	Dec (m^3)	Total (m^3)	Total Apr - Oct (m^3)
Thunder Lake Tributary 2 (TL 1)														
Average	2,592	1,738	2,271	18,753	21,957	11,326	10,855	4,268	6,788	8,470	6,542	4,502	100,061	82,416
1:20 Dry Year [5]	727	488	637	5,262	6,161	3,178	3,046	1,198	1,904	2,377	1,836	1,263	28,075	23,125
1:20 Wet Year	4,456	2,988	3,905	32,244	37,753	19,473	18,664	7,339	11,671	14,564	11,248	7,741	172,046	141,708
Thunder Lake Tributary 3 (TL2)														
Average	2,389	1,601	2,093	17,284	20,236	10,438	10,004	3,934	6,256	7,806	6,029	4,149	92,221	75,959
1:20 Dry Year [5]	670	449	587	4,850	5,678	2,929	2,807	1,104	1,755	2,190	1,692	1,164	25,876	21,313
1:20 Wet Year	4,107	2,754	3,599	29,718	34,795	17,948	17,202	6,764	10,756	13,422	10,367	7,135	158,566	130,605
Total Water Availability (TL1 + TL2)														
Average	4,980	3,339	4,364	36,037	42,193	21,764	20,859	8,202	13,043	16,276	12,571	8,652	192,282	158,375
1:20 Dry Year [5]	1,397	937	1,225	10,111	11,839	6,107	5,853	2,301	3,660	4,567	3,527	2,428	53,951	44,437
1:20 Wet Year	8,564	5,741	7,504	61,962	72,547	37,421	35,865	14,103	22,427	27,986	21,615	14,876	330,612	272,312
Blackwater Creek (BL1)														
Average	3,475	2,330	3,045	25,145	29,440	15,186	14,554	5,723	9,101	11,357	8,772	6,037	134,164	110,505
1:20 Dry Year [5]	975	654	854	7,055	8,260	4,261	4,084	1,606	2,554	3,187	2,461	1,694	37,644	31,006
1:20 Wet Year	5,975	4,006	5,236	43,234	50,620	26,110	25,025	9,841	15,648	19,527	15,082	10,380	230,683	190,005

Creek/Condition	Jan (m^3/d)	Feb (m^3/d)	Mar (m^3/d)	Apr (m^3/d)	May (m^3/d)	Jun (m^3/d)	Jul (m^3/d)	Aug (m^3/d)	Sep (m^3/d)	Oct (m^3/d)	Nov (m^3/d)	Dec (m^3/d)	Average (m^3/d)	Average Apr - Oct [6] (m^3/d)
Thunder Lake Tributary 2 (TL 1)														
Average	84	62	73	625	708	378	350	138	226	273	218	145	273	226
1:20 Dry Year [5]	23	17	21	175	199	106	98	39	63	77	61	41	77	63
1:20 Wet Year	144	107	126	1,075	1,218	649	602	237	389	470	375	250	470	388
Thunder Lake Tributary 3 (TL2)														
Average	77	57	68	576	653	348	323	127	209	252	201	134	252	208
1:20 Dry Year [5]	22	16	19	162	183	98	91	36	59	71	56	38	71	58
1:20 Wet Year	132	98	116	991	1,122	598	555	218	359	433	346	230	433	358
Total Water Availability (TL1 + TL2)														
Average	161	119	141	1,201	1,361	725	673	265	435	525	419	279	525	434
1:20 Dry Year [5]	45	33	40	337	382	204	189	74	122	147	118	78	147	122
1:20 Wet Year	276	205	242	2,065	2,340	1,247	1,157	455	748	903	721	480	903	746
Blackwater Creek (BL1)														
Average	112	83	98	838	950	506	469	185	303	366	292	195	367	303
1:20 Dry Year [5]	31	23	28	235	266	142	132	52	85	103	82	55	103	85
1:20 Wet Year	193	143	169	1,441	1,633	870	807	317	522	630	503	335	630	521

Notes:

1) Flows are prorated from Lake 240 Outlet near Kenora (WSC Station 05PD015)

2) Prorated annualized flows for monthly 1:20 wet and dry are different from monthly 1:20 wet and dry flows; Monthly 1:20 year wet and dry flows would be more extreme

3) 1:20 dry year annualized values prorated by a factor of (0.015/0.053) derived from Lake 240 Outlet near Kenora (WSC Station 05PD015) flow statistics

4) 1:20 wet year annualized values prorated by a factor of (0.091/0.053) derived from Lake 240 Outlet near Kenora (WSC Station 05PD015) flow statistics

5) Individual monthly 1:20 year flows and takings would be lower than annualized values shown. Extended dry periods between January and March and September and December are likely possible based on observed data (WSC Station 05PD015) during a dry year

6) Average water availability for use throughout the year, assuming it is not practically possible to take water during winter / frozen conditions. Water taking from TL1, TL2, and BW1 only takes place April to October however process water demands are required 365 days per year. Calculated as (Total Apr-Oct in m^3) / (365 days).

TABLE 1

TREASURY METALS
GOLIATH PROJECT

MINE SITE WATER BALANCE
CONCEPTUAL LEVEL - RESULTS

	Flow (m^3/day)											
Water Transfer/Condition	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
					TAILINGS STORAGE FACILITY							
Water Reclaim To Plant - PW												
Average	1,592	1,647	1,960	2,226	1,163	1,485	989	1,098	2,174	2,172	2,226	1,615
1:20 Yr. Dry	1,575	1,613	1,830	2,226	115	144	0	7	1,336	1,625	2,116	1,591
1:20 Yr. Wet	1,609	1,681	2,090	2,226	2,055	2,226	2,130	2,023	2,226	2,226	2,226	1,638
Water Transfer to Treatment												
Average	0	0	0	1,180	0	0	0	0	0	0	147	0
1:20 Yr. Dry	0	0	0	504	0	0	0	0	0	0	0	0
1:20 Yr. Wet	0	0	0	1,842	0	417	0	0	700	447	403	0
					MINE DEWATERING POND							
Water Transfer to TSF												
Average	0	0	0	0	0	0	0	0	0	0	0	0
1:20 Yr. Dry	0	0	0	0	0	0	357	0	0	0	0	0
1:20 Yr. Wet	0	0	0	0	0	0	0	0	0	0	0	0
Water Reclaim to Plant - PW												
Average	634	579	266	0	1,063	741	1,237	1,128	52	54	0	611
1:20 Yr. Dry	651	613	396	0	2,111	2,082	2,226	2,219	890	601	110	635
1:20 Yr. Wet	617	545	136	0	171	0	96	203	0	0	0	588
Water Transfer to Treatment												
Average	715	799	1,276	2,376	924	1,558	918	871	2,079	1,861	1,758	749
1:20 Yr. Dry	689	747	1,078	2,043	0	0	0	0	0	264	1,514	713
1:20 Yr. Wet	740	850	1,474	2,708	2,103	2,696	2,424	2,091	2,426	2,123	1,893	785
					SURFACE RUNOFF COLLECTION PONDS							
Water Reclaim to Plant - RW												
Average	818	818	818	818	818	818	818	818	818	818	818	818
1:20 Yr. Dry	818	818	818	818	818	818	818	818	818	818	818	818
1:20 Yr. Wet	818	818	818	818	818	818	818	818	818	818	818	818
Raw Water Supplement from Tributary - To Plant												
Average	158	119	138	11	0	0	0	0	0	0	0	274
1:20 Yr. Dry	45	33	40	337	382	204	189	74	122	147	118	78
1:20 Yr. Wet	0	0	0	0	0	0	0	0	0	0	0	0
Water Transfer to Treatment												
Average	0	0	0	0	0	0	416	407	557	263	58	0
1:20 Yr. Dry	0	0	0	0	0	0	0	0	0	0	0	0
1:20 Yr. Wet	0	0	0	0	842	1,812	1,492	1,122	1,325	792	424	0
					PLANT RECLAIM AND TREATMENT - TOTALS							
Total Water Reclaim - RW and PW												
Average	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044
1:20 Yr. Dry	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044
1:20 Yr. Wet	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044	3,044
Total Transfer to Treatment												
Average	715	799	1,276	3,556	924	1,558	1,335	1,277	2,637	2,124	1,963	749
1:20 Yr. Dry	689	747	1,078	2,548	0	0	0	0	0	264	1,514	713
1:20 Yr. Wet	740	850	1,474	4,549	2,945	4,925	3,915	3,213	4,451	3,362	2,720	785
Treated Water - To Process/Collection Ponds												
Average	0	0	0	0	0	0	0	0	0	0	0	0
1:20 Yr. Dry	483	489	416	0	0	0	0	0	0	264	595	642
1:20 Yr. Wet	0	0	0	0	0	0	0	0	0	0	0	0
Treated Water - Release to Environment												
Average	715	799	1,276	3,556	924	1,558	1,335	1,277	2,637	2,124	1,963	749
1:20 Yr. Dry	206	258	662	2,548	0	0	0	0	0	0	918	71
1:20 Yr. Wet	740	850	1,474	4,549	2,945	4,925	3,915	3,213	4,451	3,362	2,720	785

Notes:

1. Water transfer from Mine Dewatering Pond to TSF to maintain minimum water cover.
2. Reclaim water to plant consisting of process water and raw water. Total water requirements to process is 3,064 m^3/day with 20 m^3/day provided from on-site well.
3. Results presented above are conceptual.
4. Water transferred to treatment to be released to the natural environment and used as supplemental water for process.
5. RW - Raw/Fresh Water, PW - Process Water.
6. Allowable water from tributaries provided by Treasury Metals