EAGLE GOLD PROJECT

WATER LICENCE QZ14-041

QUARTZ MINING LICENSE QML-0011

2017 ANNUAL REPORT

Version 2018-01

MARCH 2018

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

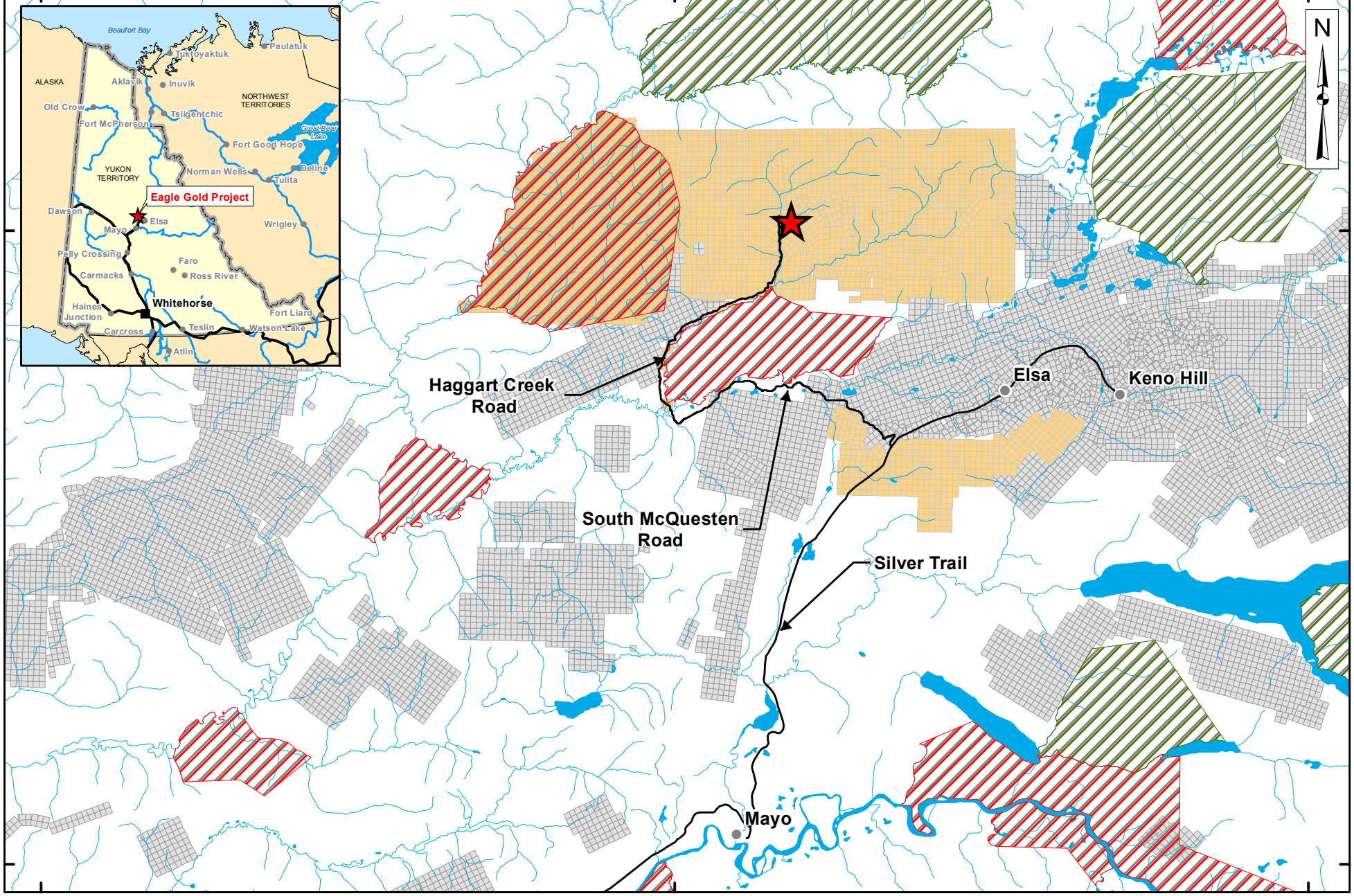
1. INTRODUCTION

StrataGold Corporation (SGC), a directly held-wholly owned subsidiary of Victoria Gold Corp., has proposed to construct, operate, close and reclaim a gold mine in central Yukon. The Eagle Gold Project ('the Project') is located 85 km from Mayo Yukon using existing highway and access roads (Figure 1.1-1). The Project will involve open pit mining and gold extraction using a three-stage crushing process, heap leaching, and a carbon adsorption, desorption, and recovery system over the mine life (Figure 1.1-2).

The Project is being operated in accordance with the terms of the Type A Water Use Licence (WUL) QZ14-041 and the Quartz Mining License (QML) QML-0011. The reporting period for this Annual Report is from January 1 to December 31, 2017 and serves to report on both WUL and QML conditions and associated management plans. The specific requirements for the Annual Report as outlined in the respective licences are summarized in Appendix A.

On July 14, 2017, SGC provided written notice of its intent to commence works on Phase I of the Project construction program on August 15, 2017, as required by Clause 23 of the WUL, and Paragraph 3.2 of the QML. Work completed under this program included:

- Lower Dublin South Pond construction;
- Project access road and bridge upgrades to improve safety;
- Advancement of Project engineering and design;
- Heap leach facility clearing, grubbing, grading and foundation improvements;
- Pioneering of site roads to the crusher and gold recovery plant areas; and
- Expansion of camp to 250 bed capacity.



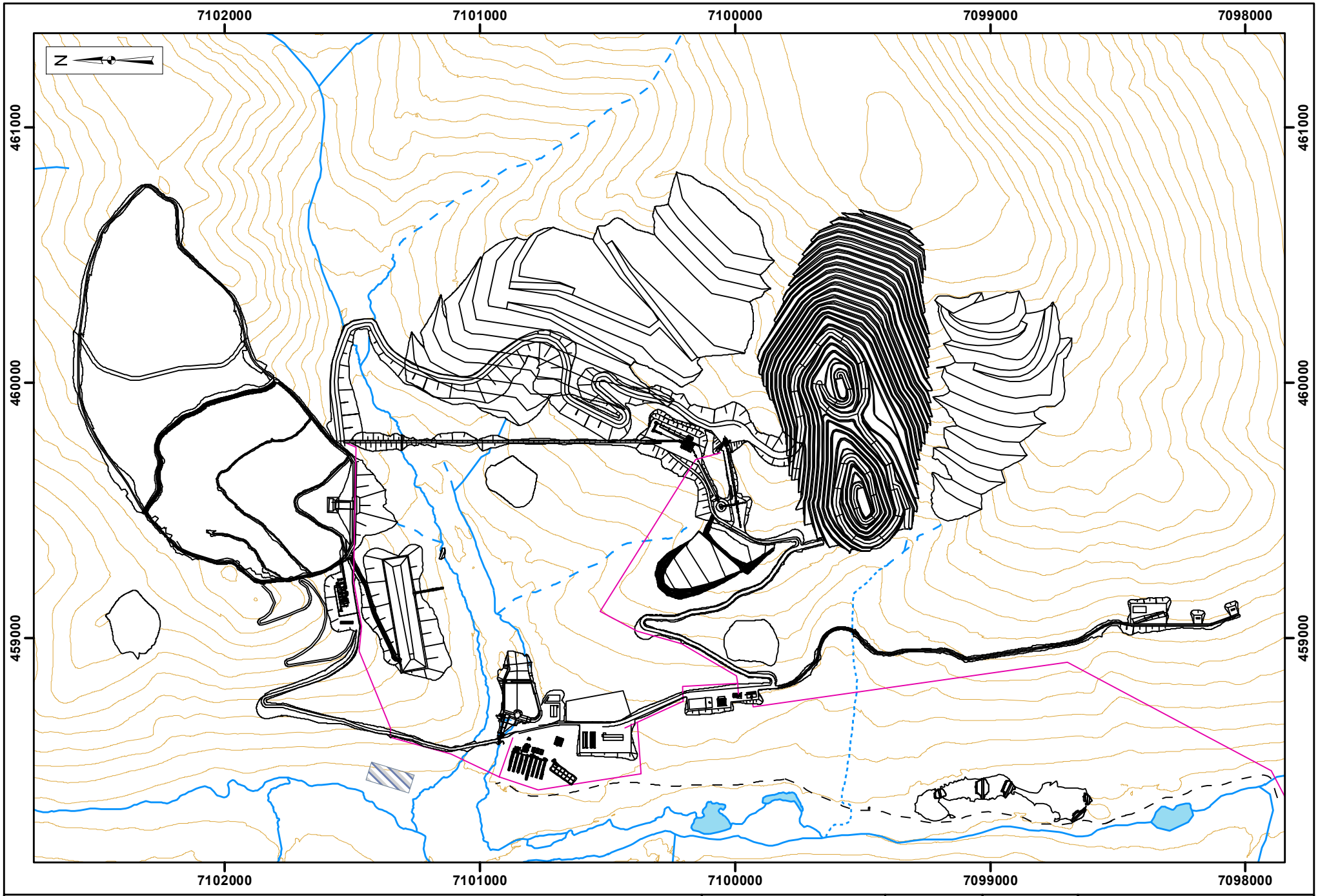
Legend:

- Eagle Gold Project
- StrataGold Claims
- Other Claims
- Town / Village
- Road
- Watercourse
- Category A Settlement Land
- Category B Settlement Land

StrataGold Corporation

0 3 6 12 Kilometres

Projection:	Drawn By:	EAGLE GOLD PROJECT YUKON TERRITORY
NAD 83 Zone 8N	HC	
Date:	Figure:	Project Location
2017/03/28	1.1-1	



Legend:

- Facility
- Site Power
- Access Road
- Perennial
- Ephemeral
- Intermittent
- Contour (25m)
- Reserved Area

StrataGold Corporation

0 125 250 500
Metres

Projection:	Drawn By:	EAGLE GOLD PROJECT YUKON TERRITORY
NAD 83 UTM Zone 8N	HC	
Date:	Figure:	General Arrangement
2018/03/29	1.1-2	

2. SITE ACTIVITIES

The Development Phase of the Project officially commenced on August 15, 2017. The program focused on preliminary site capture to support major construction activities planned for 2018.

No activities related to Production or the Production Phase of the Project have been undertaken to date.

2.1 OVERVIEW OF CONSTRUCTION

2.1.1 Summary of Construction Activities

The primary focus of the 2017 construction program was the development of the expanded construction camp facilities, the construction of the Lower Dublin South Pond (LDSP), development of laydown areas, access road maintenance and upgrades and preliminary clearing, grubbing and grading in the areas for future construction of the pit/crusher access road, the ADR Service road, the primary crusher, and a portion of phase 1 of the heap leach facility (HLF). The construction works were also supported by the construction and operation of various water management infrastructure such as exfiltration basins and silt fencing to control sediment laden runoff.

The 2017 construction schedule is presented in Table 2.1-1 and the activity locations are depicted in Figure 2.1-1.

Table 2.1-1: 2017 Construction Schedule

Activity	Start	Finish	2017				
			Aug	Sep	Oct	Nov	Dec
Lower Dublin South Pond	**Aug-17**	**May-18**					
LDSP - Install Eagle Pup Diversion	Aug-17	Sep-17					
LDSP - Low Level Outlet Discharge	Oct-17	Oct-17					
LDSP - Embankment Preparation	Oct-17	Oct-17					
LDSP - Install Underdrain	Oct-17	Nov-17					
LDSP - Bulk Excavation	Sep-17	Nov-17					
LDSP - Pond Floor Preparation	Nov-17	Nov-17					
LDSP - Liner Subgrade Preparation	Nov-17	Nov-17					
LDSP - Spillway Armoring & Dissipation	Nov-17	Nov-17					
LDSP - Pond Lining	Nov-17	Nov-17					
Laydown Pads	**Sep-17**	**Jul-18**					
East Laydown Pad - Fill from Control Pond	Sep-17	Oct-17					
West Laydown Pad - Fill from Control Pond	Oct-17	Nov-17					
Process Plant Area	**Aug-17**	**Jul-18**					
Process Plant Pad - Clearing & Grubbing	Aug-17	Sep-17					
Process Plant Service Road - Clearing & Top Soil Removal	Oct-17	Oct-17					
Process Plant Service Road - Cut-to-Fill (Ph1)	Oct-17	Oct-17					
Crusher Area	**Aug-17**	**Dec-18**					
Crusher Service Road - Clearing & Stripping	Aug-17	Aug-17					
Crusher Service Road - Clearing & Grubbing	Oct-17	Oct-17					
Crusher Service Road - Import Fill from Control Pond	Sep-17	Oct-17					

Activity	Start	Finish	2017				
			Aug	Sep	Oct	Nov	Dec
Crusher Service Road - Cut to Fill (Top-Dwn)	Oct-17	Oct-17					
Heap Leach Facility	**Aug-17**	**Jul-19**					
HLF - Construct HLF Area Sediment Basin	Aug-17	Aug-17					
HLF - Install Dublin Temp Crossing	Sep-17	Sep-17					
HLF - Clear, Grub, & Remove Topsoil	Aug-17	Sep-17					
HLF - Excavation to Type 3 Rock (Ph1)	Sep-17	Oct-17					
Access Road Upgrades	**Aug-17**	**Jun-18**					
McQuesten Road & Bridge Upgrades	Aug-17	Aug-17					
Haggart Creek Access Road Improvements	Aug-17	Dec-17					
Ancillary Facilities	**Aug-17**	**Jun-19**					
Gatehouse - Construct & Cap Pad	Sep-17	Sep-17					
Camp/Office Complex	Aug-17	Aug-18					
Fuel Storage & Distribution - Various Locations	Oct-17	Oct-18					
Waste Management - Various Locations	Aug-17	Aug-18					

2.1.1.1 Camp Expansion

Camp facility expansion commenced in August 2017 and is schedule to continue through until August 2018. The works completed to date include increasing available bed capacity to 250 people, expansion of the office/administration area, kitchen and dining facilities, and gym and recreation area to full construction capacity. The expansion of the camp septic system also commenced with final connection and use anticipated in April/May 2018. Appendix B1 provides designs, status reports, and inspections of the camp facilities.

2.1.1.2 Lower Dublin South Pond Construction

The construction of the LDSP commenced in August 2017 and began with the upgradient diversion of Eagle Creek into Dublin Gulch to ensure that the work could be undertaken in dry conditions. In accordance with the requirements specified by the Department of Fisheries and Oceans Canada (DFO) in their letter received on August 14, 2017 (Appendix B2) and ongoing communication with DFO, a pumping station was established on Dublin Gulch to ensure that flow to the lower fish bearing reaches of Eagle Creek was maintained during the construction and filling of the LDSP.

Construction of the LDSP was completed in early December 2017 in accordance with the design specifications provided to YG-EMR and the YWB; however, minor modifications were required to meet the design specifications as shown in the as built construction report provided as Appendix B2. The diversions established for the construction of the LDSP remain in place and will be removed post freshet at which point the LDSP will be integrated with other water management infrastructure and will become a discharge location in accordance with the conditions of QZ14-041.

2.1.1.3 Site Road and Pads

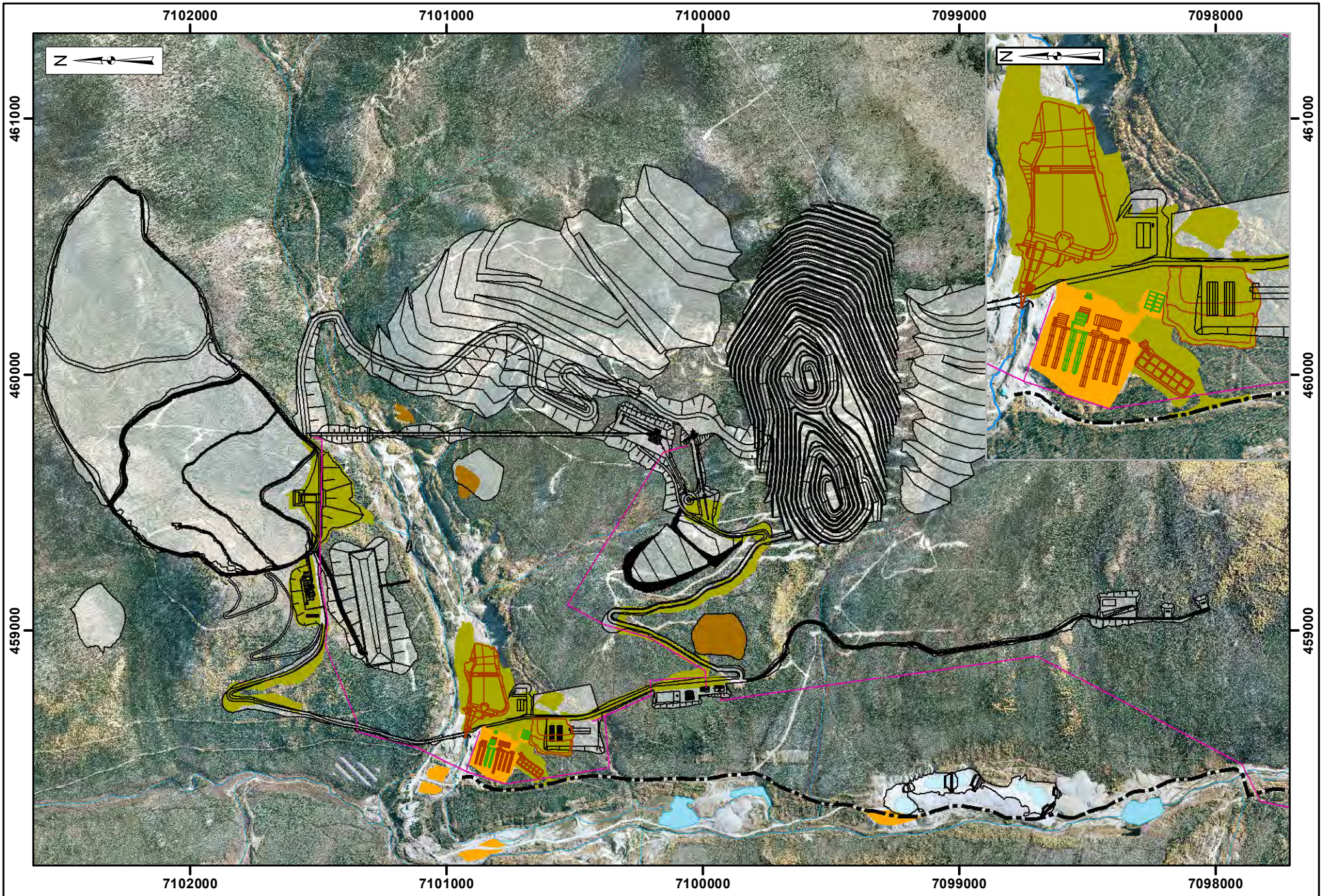
To support site contractors, laydown pads in areas of previously disturbed areas were established. The primary locations are within the backfilled placer management ponds created during historic placer mining activities in the Dublin Gulch and Haggart Creek valleys. Minimal construction work was required in these areas other than basic

grading. Clearing, grubbing and some preliminary grading was also undertaken in the areas proposed for future mine haul road construction.

The locations for preliminary haul road development and laydown pads are provided as Appendix B3.

2.1.1.4 Heap Leach Facility Preparatory Works

In preparation for approval of construction works related to the HLF, a program consisting of clearing, grubbing, grading and excavation to Type 3 bedrock in the area of the HLF embankment was undertaken in 2017. The scope of work undertaken was in accordance with the Frozen Materials Management Plan, the Heap Leach Facility Foundation Improvement Plan and the Stage 1 Heap Leach Facility Preparatory Works Plan. Appendix B4 provides survey data of the work areas and oversight reports from the Engineer of Record.



Legend:

- 2017 Clearing
- Topsoil Stockpile
- Pre-Existing Pad/Laydown
- Reserved Area
- 2017 Construction
- Pre-existing Structure
- Facility - Future Construction
- Site Power - Future Construction
- Access Road
- Watercourse

StrataGold Corporation

0 125 250 500
Metres

Projection:	Drawn By:
NAD 83 UTM Zone 8N	HC
Date:	Figure:
2018/04/02	2.1-1

EAGLE GOLD PROJECT
YUKON TERRITORY

2017 Construction

2.2 OVERVIEW OF MINING

No mining or production activities authorized by the Type A WUL QZ14-041 nor the QML-0011 has taken place. Mining or production activities are scheduled to commence in 2019.

During operations, the open pit will be developed using standard drill and blast technology. Ore will be transported from the open pit by haul truck and delivered to the first stage crushing plant (the primary crusher), situated on the north side of the open pit rim. Waste rock will be removed from the open pit by haul truck and delivered to one of two WRSAs (Platinum Gulch or Eagle Pup WRSAs) or will be used as haul road and infrastructure construction material.

Ore will be crushed to a passing 80 percent (P80) particle size of 6.4 mm in a 3-stage crushing process. All three crushing stages will be located north of the open pit. Ore will be conveyed between the primary crushing station and the secondary and tertiary crushing stations by covered conveyor or enclosed conveyor gallery. After the tertiary crushing stage, ore will be transported by covered conveyor to the HLF area where the ore will be stacked on the heap leach pad via a series of portable conveyors and finally a radial stacking conveyor.

Gold extraction will utilize cyanide heap leaching technology. Process solution containing cyanide will be applied to the ore to extract gold and will then be collected by the HLF leachate collection and recovery system.

Gold-bearing “pregnant” solution (pregnant leach solution [PLS]) will be pumped from the HLF to the gold recovery plant. Gold will be recovered from the PLS by activated carbon adsorption and desorption, followed by electro-winning onto steel cathodes, and on-site smelting to gold doré. This process is referred to as the adsorption, desorption, and recovery (ADR) process. The gold-barren leach solution that remains after passing through the carbon columns will be re-circulated back to the HLF.

2.2.1 Ore, Waste and Gold Production

For the reporting period, no material has been removed from the proposed open pit and no gold production has occurred.

The total amount of ore and waste to be removed from the open pit over the life of the Project is approximately 86 Mt and 98 Mt, respectively (Table 2.2-1). Figure 2.2-1 shows ore and waste to be removed from the open pit by year.

Upon the commencement of open pit development, waste rock is scheduled to go to one of two areas:

- Platinum Gulch WRSA: The Platinum Gulch WRSA will be filled within the first three years of production and contain approximately 13.7 Mt.
- Eagle Pup Waste WRSA: The Eagle Pup WRSA will contain the remaining life of mine waste rock.

Table 2.2-1: Mine Production Schedule

Year	Construction		Operations									
	-2	-1	1	2	3	4	5	6	7	8	9	Total
Ore to Crusher (kt)	0	16	8,760	10,950	10,949	10,950	10,950	10,950	10,951	10,900	624	**86,000**
Ore Grade (g/t)	0	0.49	0.75	0.81	0.77	0.78	0.8	0.71	0.62	0.61	0.58	**0.731**
Contained oz (kt)	0	0	212	287	272	275	282	251	218	213	12	**2,022**
Expected Recovery (%)	0	-	72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	**72.9**
Recovered oz (kt)	0	0	155	209	198	200	206	183	159	155	8.5	**1,474**
Waste Mined (kt)	0	2,074	7,990	15,712	13,639	15,686	11,418	9,458	10,003	11,105	877	**97,962**
Total Mined (000's)	**0**	**2,090**	**16,750**	**26,662**	**24,588**	**26,636**	**22,368**	**20,408**	**20,954**	**22,005**	**1,501**	**183,962**

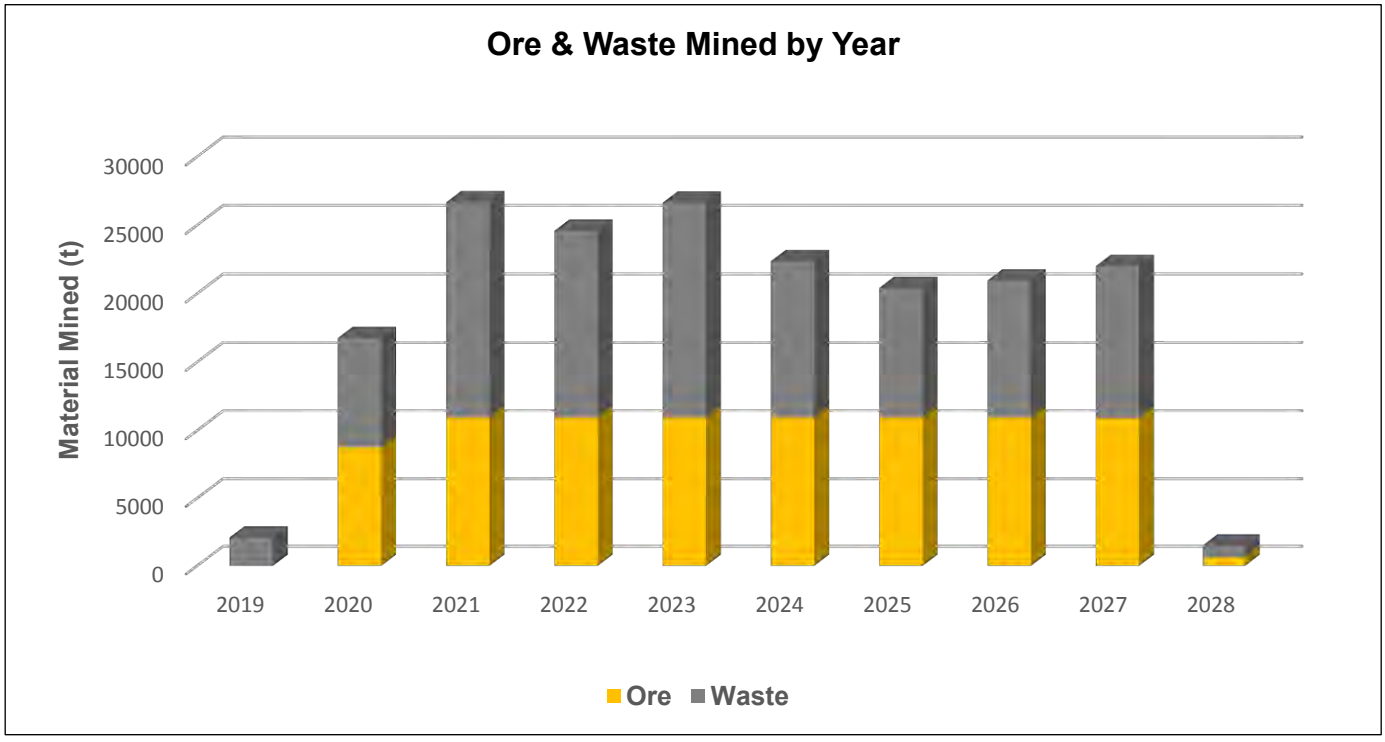


Figure 2.2-1: Ore and Waste Mined by Year

2.2.2 Reserves and Mine Life Update

The reserve and mine life update discussed herein has not been presented to any regulatory body for formal consideration within the context of any regulatory approval. The discussion below has been provided to comply with the annual reporting requirements of the existing licenses for the Project.

An updated mineral resource and reserve estimate for the Eagle Pit was prepared in 2016 and publicly disclosed in the "NI 43-101 Feasibility Study Technical Report for the Eagle Project, Yukon Territory, Canada" prepared by JDS Energy & Mining Inc. (JDS), published September 12, 2016. The mineral resource estimate has been classified as "Measured", "Indicated" and Inferred" according to the Canadian Institute of Mining and Metallurgy (CIM) "CIM Standards on Mineral Resources and Reserves: Definitions and Guidelines" (May 2014). The current Eagle mineral resources (Table 2.2-2) are reported as in-pit resources at a cut-off grade of 0.15 g/t Au.

Table 2.2-2: Constrained Eagle Deposit Mineral Resources Estimate

Classification	Quantity (Mt)	In situ Gold Grade (g/t)	Contained Gold (koz)
Measured	29.4	0.81	761
Indicated	151.3	0.59	2,870
Combined	**180.7**	**0.63**	**3,631**
Inferred	17.4	0.49	276

Source: JDS 2016.

NOTES:

1. Eagle Deposit Mineral Resources estimate only
2. Mineral Resources are estimated at a cut-off of 0.15 g/t Au
3. Gold price used for this estimate was US$1,700/oz
4. High-grade caps were applied as per the text of JDS 2016
5. Specific gravity was estimated for each block based on measurements taken from core specimens
6. Resources are In-pit resources as defined by pit parameters described in the text of JDS 2016
7. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. There is no certainty that all or any part of the Mineral Resources estimated will be converted into Mineral Reserves. The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues
8. The quantity and grade of reported Inferred Resources in this estimation are uncertain in nature and there has been insufficient exploration to define these Inferred Resources as an Indicated or Measured Mineral Resource and it is uncertain if further exploration will result in upgrading them to an Indicated or Measured Mineral Resource category

Mineral reserve estimates (Table 2.2-3) are based on the mineral resource estimate, and developed by determining the optimum and practical mining method. Cut-off grades were then determined based on appropriate design criteria and the adopted mining method (JDS 2016).

Table 2.2-3: Eagle Deposit Mineral Reserve Estimate

Classification	Quantity (Mt)	Diluted Gold Grade(g/t)	Contained Gold (koz)
Proven	27	0.80	685
Probable	90	0.62	1,778
Total	**116**	**0.66**	**2,463**

Source: JDS 2016.

NOTES:
1. Eagle Deposit Mineral Resources estimate only
2. Mineral Reserves are included within Mineral Resources

2.3 PROPOSED DEVELOPMENT & PRODUCTION IN 2018

2.3.1 Construction

Construction activities contemplated in 2018 will include:

- Continued camp expansion including septic field expansion to accommodate the construction and operation workforce, and installation and commissioning of a potable water treatment plant.
- Access road upgrades such as minor realignments, construction of pullouts, grading, resurfacing and drainage improvements.
- Site road construction to provide access to construction and mining areas.
- Water management including the construction of diversions, ditches and other sediment and erosion control measures.
- Clearing, grubbing and bulk earthworks for roads, infrastructure and facilities.
- Waste management including the construction of a solid waste management area and a hazardous waste management area for temporary storage of hazardous waste prior to final disposal in approved facilities.
- Transmission line construction from Silver Trail tap point to site, including clearing and grubbing of right of way (RoW), pole installation, conductors and substation construction.
- Construction of concrete foundations and erection of buildings including installation of mechanical, piping, electrical and instrumentation.
- Development of the Heap Leach Facility (HLF) including the embankment (dam) and the In-Heap Pond; a composite liner system; solution recovery wells; associated piping network for solution collection and distribution; a leak detection and recovery system (LDRS); and a down-stream Events Pond.

A detailed schedule of 2018 construction activity is provided in Table 2.3-1. The current schedule is subject to contractor and material availability, regulatory approvals, and ongoing consideration of workforce loading and capital deployment.

Table 2.3-1: 2018 Construction Schedule

Activity	Start	Finish	2018											
			J	F	M	A	M	J	J	A	S	O	N	D
Mine Equipment Assembly	**Jul-18**	**Sep-18**												
200mm Rotary Drill -Assembly & Commissioning	Jul-18	Aug-18												
22m^3 Front Shovel -Assembly & Commissioning	Jul-18	Aug-18												
144t Haul Trucks -Assembly & Commissioning	Jul-18	Sep-18												
Lower Dublin South Pond	**Aug-17**	**May-18**												
LDSP - Diversion removal and activation	May-18	May-18												
Laydown Pads	**Sep-17**	**Jul-18**												
HME Assembly/Batch Plant Pad - Cut to Fill	Apr-18	Apr-18												

Activity	Start	Finish	2018											
			J	F	M	A	M	J	J	A	S	O	N	D
Substation/Fuel/WM Pad - Cut to Fill	Jun-18	Jul-18												
Process Plant Area	**Aug-17**	**Jul-18**												
Process Plant Pad - Topsoil Removal	Apr-18	Apr-18												
Process Plant Service Road - Clearing & Top Soil Removal	Apr-18	Apr-18												
Process Plant Pad - Excavate (Fill to Process Plant Road)	Apr-18	May-18												
Process Plant Service Road - Cut-to-Fill (Ph2)	Apr-18	May-18												
Process Plant Pad - Excavate (Fill to HLF Embankment)	May-18	Jun-18												
HLF Service Road - Clearing & Stripping	Jun-18	Jul-18												
HLF Service Road - Cut-to-Fill	Jul-18	Jul-18												
Crusher Area	**Aug-17**	**Dec-18**												
Crushing Area Pads - Clearing & Topsoil Removal	Mar-18	Apr-18												
Crusher Service Road - Cut-to-Fill (Ph2)	Mar-18	Apr-18												
Crusher Bypass Road - Cut-to-Fill	Mar-18	Apr-18												
HLF Rd/Primary Crusher Apron - Cut to Fill	Apr-18	May-18												
Primary Crushing & Transfer Pad - Cut to Fill	Apr-18	May-18												
Secondary/Tertiary Crushing Area Pads - Cut to Fill	Apr-18	May-18												
Ore Transfer & Reclaim Area - Cut to Fill	May-18	Jun-18												
90-Day Storage Pad/Laydown Area - Cut to Fill	May-18	Jun-18												
Primary Crusher MSE Wall & Backfill	Nov-18	Dec-18												
Surface Water Ditches	**Aug-18**	**Nov-18**												
Surface Water Diversions - Ditch A	Aug-18	Sep-18												
Surface Water Diversions - Ditch B	Sep-18	Oct-18												
Surface Water Diversions - Ditch C	Oct-18	Nov-18												
Conveyor RoW	**Jun-18**	**Oct-18**												
Overland Conveyor ROW (8m)	Jun-18	Sep-18												
Ore Preparation Pad - Cut to Fill	Sep-18	Oct-18												
Explosives Storage Area	**Jul-18**	**Aug-18**												
AN Service Road - Cut to Fill	Jul-18	Aug-18												
Explosives & Magazine Storage Pads - Cut to Fill	Aug-18	Aug-18												
Primary Crushing	**Jul-18**	**May-19**												
Primary Crushing - Concrete Installations	Jul-18	Oct-18												
Primary Crushing - Install Gyratory Discharge Bin	Nov-18	Dec-18												
Primary Crushing - Structural Steel Installations	Nov-18	Dec-18												
Primary Crushing - Cladding & Architectural	Dec-18	Jan-19												
Primary Crushing - Mechanical Installations	Dec-18	Apr-19												
Coarse Ore Handling & Reclaim	**Jun-18**	**Jun-19**												
Coarse Ore Handling - Reclaim Tunnel Installation	Jun-18	Jul-18												
Coarse Ore Handling - Concrete Installations	Jul-18	Sep-18												
Coarse Ore Handling - Structural Steel Installations	Dec-18	Feb-19												
Secondary & Tertiary Crushing	**Jul-18**	**Jul-19**												
Sec/Ter Crushing - Concrete Installations	Jul-18	Oct-18												
Sec/Ter Crushing - Crushing Building - West Wall Erection	Dec-18	Apr-19												
Sec/Ter Crushing - Structural Steel Installations	Nov-18	Mar-19												
Sec/Ter Crushing - Mechanical Installations	Nov-18	May-19												
Transfer Conveyors - Concrete Installations	Sep-18	Oct-18												

Activity	Start	Finish	2018											
			J	F	M	A	M	J	J	A	S	O	N	D
Transfer Conveyors - Structural Steel Installations	Dec-18	Feb-19												
Overland Conveying	**Oct-18**	**Jun-19**												
Overland Conveying - Foundation Preparations	Oct-18	Dec-18												
Heap Leach Facility	**Aug-17**	**Jul-19**												
HLF Embankment - Excavate Ice & Snow in HLF Footprint	Mar-18	Apr-18												
HLF Embankment - Install Underdrain Headers	Apr-18	Apr-18												
HLF Embankment - Excavate to Type 3 Rock (Ph2)	Apr-18	May-18												
HLF Embankment - Place Embankment Fill (from Stockpile)	Apr-18	May-18												
HLF Embankment - Place Embankment Fill (from Plant cut)	May-18	Jun-18												
HLF Embankment - Place Embankment Fill (from Events Pond)	Jun-18	Sep-18												
HLF Embankment - Install PLS & LDRS Casings	Aug-18	Sep-18												
HLF Pad - Clear & Grub	Apr-18	Apr-18												
HLF Pad - Strip Topsoil	May-18	May-18												
HLF Pad - Install LDRS System	Jul-18	Jul-18												
HLF Pad - Produce Overliner	Jun-18	Aug-18												
HLF Pad - Install Underdrain System	Jun-18	Aug-18												
HLF Pad - Install Liner System	Jun-18	Sep-18												
HLF Pad - Install Solution Collection Piping	Jul-18	Sep-18												
HLF Pad - Place Overliner	Jul-18	Sep-18												
HLF Pad - Install Monitoring Vault	Aug-18	Sep-18												
Pregnant Solution Pumping - Install Overland Piping	Aug-18	Sep-18												
Pregnant Solution Pumping - Install PLS & LDRS Pumps	Nov-18	Dec-18												
Pregnant Solution Pumping - Perform Electrical Installation	Dec-18	Dec-18												
Event Ponds - Clear & Grub	Apr-18	Apr-18												
Event Ponds - Strip & Stockpile Topsoil	May-18	Jun-18												
Event Ponds - Excavate (Haul to HLF Embankment)	Jun-18	Aug-18												
Event Ponds - Excavate (Haul to Local Fill)	Aug-18	Sep-18												
Event Ponds - Install Spillway Armouring	Aug-18	Sep-18												
Event Ponds - Install Underdrain System	Sep-18	Oct-18												
Event Ponds - Install Liner System	Sep-18	Oct-18												
Event Ponds - Install Spillway & Pond Fencing	Sep-18	Oct-18												
Process Plant Building & Utilities	**Jul-18**	**May-19**												
Process Plant Building - Install Concrete Foundations	Jul-18	Oct-18												
Process Plant Building - Install Structural Steel	Oct-18	Nov-18												
Process Plant Building - Erect Pre-Engineered Building	Oct-18	Dec-18												
Process Plant Building - Install Building Services	Dec-18	Jan-19												
Fresh/Fire Water	Dec-18	Mar-19												
Carbon Adsorption	Dec-18	Apr-19												
Barren Solution Storage & Distribution	Dec-18	Mar-19												
Access Road Upgrades	**Aug-17**	**Jun-18**												
Site Access Road - Access (Snow Clearing)	Mar-18	Mar-18												
Secret Creek Culvert Replacement	Apr-18	May-18												
Haggart Creek Access Road Improvements (Phase 2)	Mar-18	Jun-18												
69kV Power Supply	**Aug-18**	**May-19**												
69kV Transmission Line - Line Flagging & ROW Clearing	Aug-18	Oct-18												

Activity	Start	Finish	2018											
			J	F	M	A	M	J	J	A	S	O	N	D
69kV Transmission Line - Install Structures	Sep-18	Jan-19												
McQuesten 69kV Substation	Apr-18	May-19												
Ancillary Facilities	**Aug-17**	**Jun-19**												
Camp/Office Complex	Aug-17	Aug-18												
Shops & Warehouses	Jul-18	Sep-18												
AN Storage Facility	Aug-18	Sep-18												
Fuel Storage & Distribution - Various Locations	Oct-17	Oct-18												
IT & Communications	Feb-19	Mar-19												
Waste Management - Various Locations	Aug-17	Aug-18												
Commissioning	**Sep-18**	**Sep-19**												
Leaching & Gold Plant	Sep-18	Sep-19												

2.4 DESCRIPTION OF WATER USE AND DEPOSIT OF WASTE

2.4.1 Description of Water Use

During the 2017 program, groundwater was required for camp operations only and there was no water required for process solution, dust suppression, gold elution or concrete production. Water to supply the camp was sourced from the existing groundwater well located immediately north or the main camp.

The daily volume of water withdrawn from the camp supply well is shown in Figure 2.4-1.

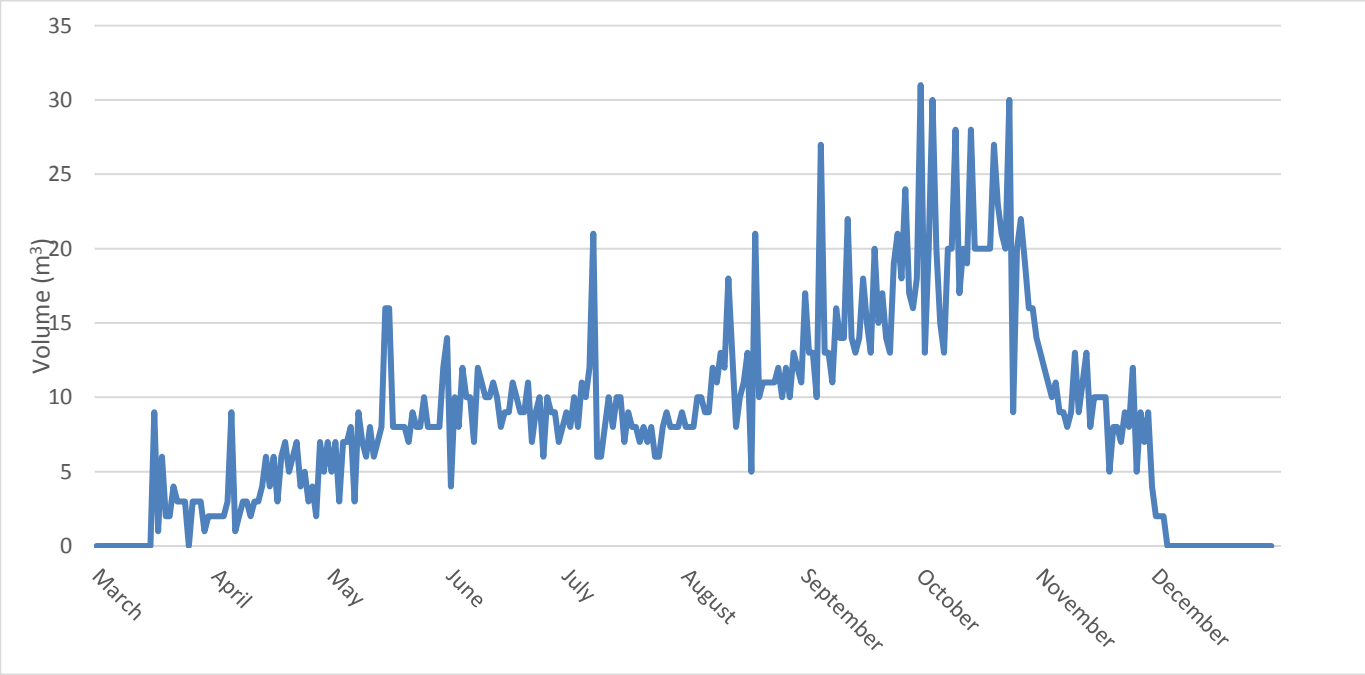


Figure 2.4-1: Daily Water Usage

2.4.2 Deposit of Waste

There has been no deposit of a waste during the construction phase of the Project. All contact water during the 2017 program has been managed with a combination of exfiltration basins and sediment and erosion control measures such as silt fences.

3. ENVIRONMENTAL MONITORING

The SGC Environmental Monitoring, Surveillance, and Adaptive Management Plan (EMSAMP) includes environmental monitoring and surveillance objectives, work completed to date, methods, adaptive management, and reporting for environmental resources and Project facilities for the pre-construction, construction, operations, closure and post closure phases of the Project.

SGC continued baseline data collection in accordance with Clause 113 of the WUL until the initiation of the Development Phase of the Project in August 2017. SGC initiated Development phase environmental monitoring as per the EMSAMP as follows:

- Surface hydrology flows;
- Surface water quality;
- Groundwater quantity and quality;
- Geochemical field barrel testing and waste rock/acid-based accounting;
- Aquatic environment conditions (stream sediment, benthic macroinvertebrates, fish and fish habitat);
- Meteorological data;
- Snow course surveys;
- Terrestrial environment conditions (vegetation, soils, wildlife); and
- Noise levels.

Baseline collection and EMSAMP monitoring locations are shown in Figure 3.1-1. Construction phase EMSAMP monitoring locations are shown in Figure 3.1-2.

3.1 SURFACE WATER HYDROLOGY

The Eagle Gold Hydrology Baseline Report 2018 Update included as Appendix C presents a summary of baseline streamflow data collected for the Project since August 2007, including hydrometric information summarized in previous reports (Stantec 2012; Knight Piésold 2013 and Lorax 2016) and data collected in 2016 and 2017. Raw data in excel format is provided electronically as Appendix C1. Table 3.1-1 lists the locations of Project hydrometric stations monitored and Table 3.1-2 presents station monitoring records and drainage information. Surface water hydrology and quality data gathered have been incorporated into the updated site water balance and water quality models (Appendix D).

3.1.1 Surface Water Hydrology Monitoring

Table 3.1-1: Project Hydrology Monitoring Stations – Construction

Station	Location Description	Coordinates (Zone 8)	
		North	East
W1[a]	Dublin Gulch above Stewart	7101545	460249
W21[d]	Dublin Gulch below Events Pond	7101261	458359

Station	Location Description	Coordinates (Zone 8)	
		North	East
W4[a]	Haggart Creek below Dublin	7101223	458144
W22[a]	Haggart Creek above Project Influence	7101378	458319
W5[a]	Haggart Creek above Lynx Creek	7095888	457814
W6[a]	Lynx Creek above Haggart Creek	7095964	458099
W20[b]	Bawn Boy Gulch	7101961	461945
W23[b]	Haggart Creek below Lynx Creek	7095682	457790
W26[a]	Stewart Gulch	7101443	460331
W27[a]	Eagle Creek near Camp below Lower Dublin South Pond	7100997	458235
W29[a]	Haggart Creek below Eagle Creek and Platinum Gulch	7099583	458225
W39[c]	Haggart Creek above South McQuesten River	7086504	449780
W45[a]	Eagle Creek at mouth above Haggart Creek	7099684	458243
W49[c]	South McQuesten River below Haggart Creek	7085495	449221
EPS[d]	Eagle Pup WRSA Seepage*	7100909	459834
PDI[d]	Platinum Gulch Ditch (Ditch A) into Lower Dublin South Pond*	7099523	459184
LDSPI[d]	Lower Dublin South Pond Inflow*	7100824	458926
LDSPO[d]	Lower Dublin South Pond Outflow*	7100857	458672
CS-01[d]	Sediment Basin – below lower Process Access Road*	7101146	458528
CS-02[d]	Sediment Basin – below Truck Shop*	7100380	458476
CS-03[d]	Sediment Basin - below AN/Emulsion access and storage area*	7098410	458407
CS-04[d]	Sediment Basin – below Ice Rich Storage Area*	7098627	458268

NOTES:
* Discharge points to be monitored as they become active; no surface discharge points were developed during the reporting period.
[a] Automated monitoring. Manual monitoring weekly during freshet until loggers installed and twice a month during winter
[b] Manual monitoring on a monthly basis
[c] Manual monitoring on a quarterly basis
[d] Station may be either manual or automatic. Measurements taken weekly when discharging if manual measurement only

Table 3.1-2: Project Hydrology Stations Records and Drainage

Station	Station Name	Record Period	Drainage Area (km^2)[a]	Median Basin Elevation (m)[a]	Notes
W1	Dublin Gulch above Stewart Gulch	2007 – 2017	6.8	1,303	Continuous discharge time-series
W4	Haggart Creek below Dublin Gulch	2007 – 2017	76.9	1,125	Continuous discharge time-series
W5	Haggart Creek above Lynx Creek	2007 – 2017	97.5	1,091	Continuous discharge time-series
W6	Lynx Creek above Haggart Creek	2007 – 2017	100.9	1,049	Continuous discharge time-series

Station	Station Name	Record Period	Drainage Area (km^2)[a]	Median Basin Elevation (m)[a]	Notes
W22	Haggart Creek above Dublin Gulch	2007 – 2017	66.8	1,113	Continuous discharge time-series
W26	Stewart Gulch	2007 – 2017	1.3	1,183	Continuous discharge time-series Manual data only for 2007–2009, 2011
W27	Eagle Creek	2007 - 2017	2.7	1,037	Continuous discharge time-series Manual data only for 2007
W29[b]	Haggart Creek below Eagle Creek	2010 - 2015	86.1	1,112	Manual measurements for 2010, continuous, data thereafter

NOTES:
a. Source of UTM co-ordinates, drainage area and median basin elevation (Knight-Piésold, 2013).
b. No continuous water level data are available for this station for 2016-2017. See Section 2.2.3 for details.

Streamflow data for the eight stations listed in Table 3.1-2 are presented in Appendix C in the following formats:

- Monthly tables showing average, maximum and minimum 15-minute discharge values (m^3/s);
- Monthly tables showing average discharge (m^3/s), average unit yields ($L/s/km^2$) and total runoff (mm);
- Time-series plots of continuous average daily discharge (m^3/s) and spot flow measurements (m^3/s), and;
- Time series plots of average daily unit yields ($L/s/km^2$), by year.

Tables 3.1-3 to 3.1-9 below compare the complied streamflow summary statistics (average, minimum and maximum flows) for 2017 to the same statistics compiled over the full baseline period (2007 to 2017). W29 is not included. This site has experienced difficulty in gauging due to channel instability issues, such that the gauge record for 2017 is not reliable. Flows recorded from August 2017 to December 2017 when construction began are highlighted in gray. The highlighted construction flows are fall within the normal range of flows for all stations, including all stations downgradient of project activities.

For all stations, the 2017 August streamflow averages and maximums were substantially lower than the long-term average, while the 2017 August minimums were greater than the long-term record. In contrast, for all stations in September and October, the 2017 averages were generally higher than the long-term records, while the 2017 maximums were typically slightly less or similar and the minimums were substantially or slightly above the long-term record. None of the streams experienced flows that were outside the range of the long-term minimums or maximums.

Table 3.1-3: W1 Comparison of 2017 Summary Statistics to Baseline Record

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	Average	--	--	--	--	0.34	0.07	0.07	0.04	0.06	0.21	--	--
	Maximum	--	--	--	--	1.01	0.28	0.20	0.08	0.29	0.53	--	--
	Minimum	--	--	--	--	0.00	0.02	0.04	0.02	0.01	0.00	--	--
All Years	Average	--	--	--	0.02	0.22	0.10	0.09	0.09	0.09	0.10	0.07	--
	Maximum	--	--	--	0.10	1.30	0.33	0.35	0.29	0.56	0.72	0.09	--

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Minimum	--	--	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	--

NOTE: All values are in m^3/s
Grey shading indicates streamflow statistics from the construction phase

Table 3.1-4: W4 Comparison of 2017 Summary Statistics to Baseline Record

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	Average	--	--	--	--	--	0.72	0.67	0.52	0.93	1.25	--	--
	Maximum	--	--	--	--	--	5.41	1.43	0.77	2.55	2.90	--	--
	Minimum	--	--	--	--	--	0.41	0.41	0.40	0.31	0.17	--	--
All Years	Average	--	--	--	--	2.03	0.99	0.83	0.85	0.91	0.83	0.85	--
	Maximum	--	--	--	--	7.03	5.41	4.83	6.65	2.70	5.00	1.15	--
	Minimum	--	--	--	--	0.06	0.31	0.09	0.16	0.02	0.02	0.56	--

NOTE: All values are in m^3/s
Grey shading indicates streamflow statistics from the construction phase

Table 3.1-5: W5 Comparison of 2017 Summary Statistics to Baseline Record

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	Average	--	--	--	--	--	0.77	0.72	0.58	1.56	2.39	--	--
	Maximum	--	--	--	--	--	6.14	1.73	0.84	4.20	4.63	--	--
	Minimum	--	--	--	--	--	0.28	0.36	0.39	0.52	0.23	--	--
All Years	Average	--	--	--	--	2.75	1.31	1.05	0.97	1.02	1.01	--	--
	Maximum	--	--	--	--	17.27	6.14	6.88	4.57	4.20	4.90	--	--
	Minimum	--	--	--	--	0.82	0.26	0.23	0.16	0.12	0.08	--	--

NOTE: All values are in m^3/s
Grey shading indicates streamflow statistics from the construction phase

Table 3.1-6: W6 Comparison of 2017 Summary Statistics to Baseline Record

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	Average	--	--	--	--	--	0.68	0.78	0.46	1.29	1.57	--	--
	Maximum	--	--	--	--	--	3.13	1.96	0.64	3.25	3.26	--	--
	Minimum	--	--	--	--	--	0.30	0.44	0.37	0.39	0.33	--	--
All Years	Average	--	--	--	--	3.23	1.22	1.01	1.12	1.23	0.99	0.90	--
	Maximum	--	--	--	--	17.95	6.77	7.12	5.35	4.25	5.17	1.79	--

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Minimum	--	--	--	--	0.57	0.14	0.04	0.27	0.25	0.11	0.39	--

NOTE: All values are in m^3/s

Grey shading indicates streamflow statistics from the construction phase

Table 3.1-7: W22 Comparison of 2017 Summary Statistics to Baseline Record

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	Average	--	--	--	--	--	0.79	0.75	0.48	1.04	1.43	--	--
	Maximum	--	--	--	--	--	5.29	1.47	0.73	2.85	3.33	--	--
	Minimum	--	--	--	--	--	0.43	0.47	0.32	0.40	0.06	--	--
All Years	Average	--	--	--	0.61	1.77	0.80	0.68	0.78	0.80	0.70	0.94	--
	Maximum	--	--	--	1.45	20.63	5.29	3.20	3.93	2.85	3.33	1.34	--
	Minimum	--	--	--	0.13	0.19	0.10	0.00	0.19	0.11	0.06	0.56	--

NOTE: All values are in m^3/s

Grey shading indicates streamflow statistics from the construction phase

Table 3.1-8: W26 Comparison of 2017 Summary Statistics to Baseline Record

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	Average	--	--	--	--	--	0.003	0.002	0.003	0.008	--	--	--
	Maximum	--	--	--	--	--	0.080	0.029	0.005	0.033	--	--	--
	Minimum	--	--	--	--	--	0.000	0.001	0.001	0.001	--	--	--
All Years	Average	--	--	--	--	0.018	0.019	0.016	0.016	0.014	0.009	--	--
	Maximum	--	--	--	--	0.060	0.094	0.143	0.050	0.063	0.058	--	--
	Minimum	--	--	--	--	0.010	0.000	0.001	0.000	0.000	0.004	--	--

NOTE: All values are in m^3/s

Grey shading indicates streamflow statistics from the construction phase

Table 3.1-9: W27 Comparison of 2017 Summary Statistics to Baseline Record

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017	Average	--	--	--	--	--	0.017	0.013	0.01	0.01	0.07	--	--
	Maximum	--	--	--	--	--	0.100	0.095	0.03	0.10	0.08	--	--
	Minimum	--	--	--	--	--	0.010	0.009	0.01	0.01	0.05	--	--
All Years	Average	--	--	--	--	0.092	0.040	0.030	0.024	0.023	0.026	--	--

Year	Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Maximum	--	--	--	--	0.335	0.144	0.315	0.138	0.123	0.105	--	--
	Minimum	--	--	--	--	0.005	0.003	0.001	0.001	0.001	0.001	--	--

NOTE: All values are in m^3/s
Grey shading indicates streamflow statistics from the construction phase

3.1.2 Site QA/QC Programs

3.1.2.1 Stage Measurements and Corrections

All stations were instrumented with metric staff gauges, mounted to vertical angle iron in the stream channel, and regularly surveyed to nearby benchmarks. Continuously recording HOBO pressure transducers were installed in stilling wells and set to record water level every 15 minutes. These readings were corrected for fluctuations in barometric pressure in a post-processing step. During each site visit, the water level was noted on the staff gauge. These readings formed the basis for the continuous water level records, which were adjusted to match the manual stage readings. Regular surveys were conducted to determine the staff gauge zero datum and water level, and these measurements were used to correct the station records for changes due to shifts in the channel bed (i.e., aggradation or scour), frost-jacking or station relocation following a high-magnitude flood event.

No notable issues were encountered with the stage records for 2017, with the exception of W29, where in June 2017, the stilling well had thawed from the channel ice, but had frost jacked completely out of the streambed. The logger was relaunched in the stilling well, which was laid horizontally in the creek bed. However, the logger recorded unreliable data for 2017, and thus no continuous water level data are available for this station for 2017. This station is located in a highly mobile channel that has not reached equilibrium yet, following historical placer mining disturbances, and is therefore challenging to gauge.

3.1.2.2 Rating Curve Error

The overall quality of the discharge record can be assessed by reviewing the average and standard errors calculated from the differences between the measured discharges, and those estimated from the rating equation. A positive rating curve error is defined where the discharge calculated from the rating curve overestimates the value when compared to the measured discharge, and vice-versa for a negative error.

A summary of the error metrics for all stations is presented in Table 3.1-10. Table 3.1-10 also reports rating curve control percentages by monitoring station. These values indicate the percent of time that a continuously recorded observation (15-minute intervals) falls between the highest and lowest manually recorded measurements for each monitoring station. Overall, the rating curves provide reasonable estimates of discharge across a wide range of flows at most of the Project stations. The rating curve errors presented in Table 3 1 indicate that the average errors are relatively low, ranging from -5% to 0%. Thus, no adjustments to the rating curves were necessary in 2017. The standard error, or the degree of variability about the average error values varies more between stations, from a high or 26% for station W1, to a low of 8% for station W6.

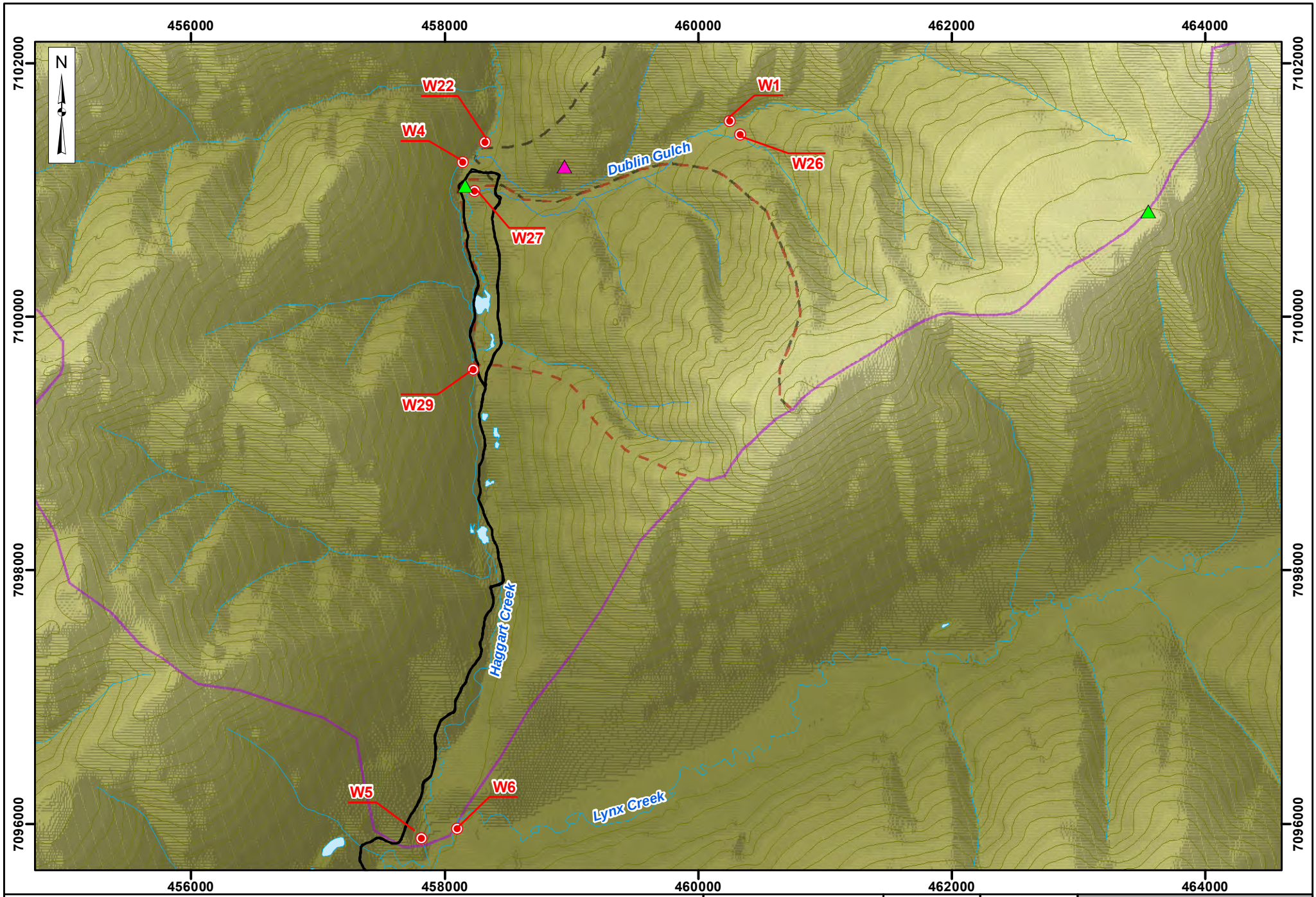
Table 3.1-10: Rating Curve Error Summary for Project Hydrometric Stations

Station	Measurements (n)	Average Error (%)	Standard Error (%)	Rating Curve Control
W1	57	-5%	26%	99%
W4	55	0%	15%	94%
W5	42	0%	12%	98%
W6	40	-2%	8%	96%
W22	59	0%	17%	99%
W26	23	--	--	99%
W27	56	--	--	99%
W29	30	-2%	10%	95%
Average	45	-2%	15%	97%

NOTES:
Stations W26 and W27 currently have Parshall flumes installed, and therefore rating curves have not been developed for these sites as part of this baseline streamflow update.

3.1.3 Adaptive Management

Development phase hydrology remained within the range of the long-term minimums and maximums at locations monitored. As such, adaptive management responses were not required.



Legend:

- Climate Station
- Snow Course Survey
- Streamflow Monitoring Station
- Eagle Project Access Road
- Watercourse
- Dublin Gulch Basin
- Eagle Creek Basin
- Upper Haggart Creek Basin

StrataGold Corporation

0 0.5 1
Kilometers

Projection: NAD83 UTM Zone 8N

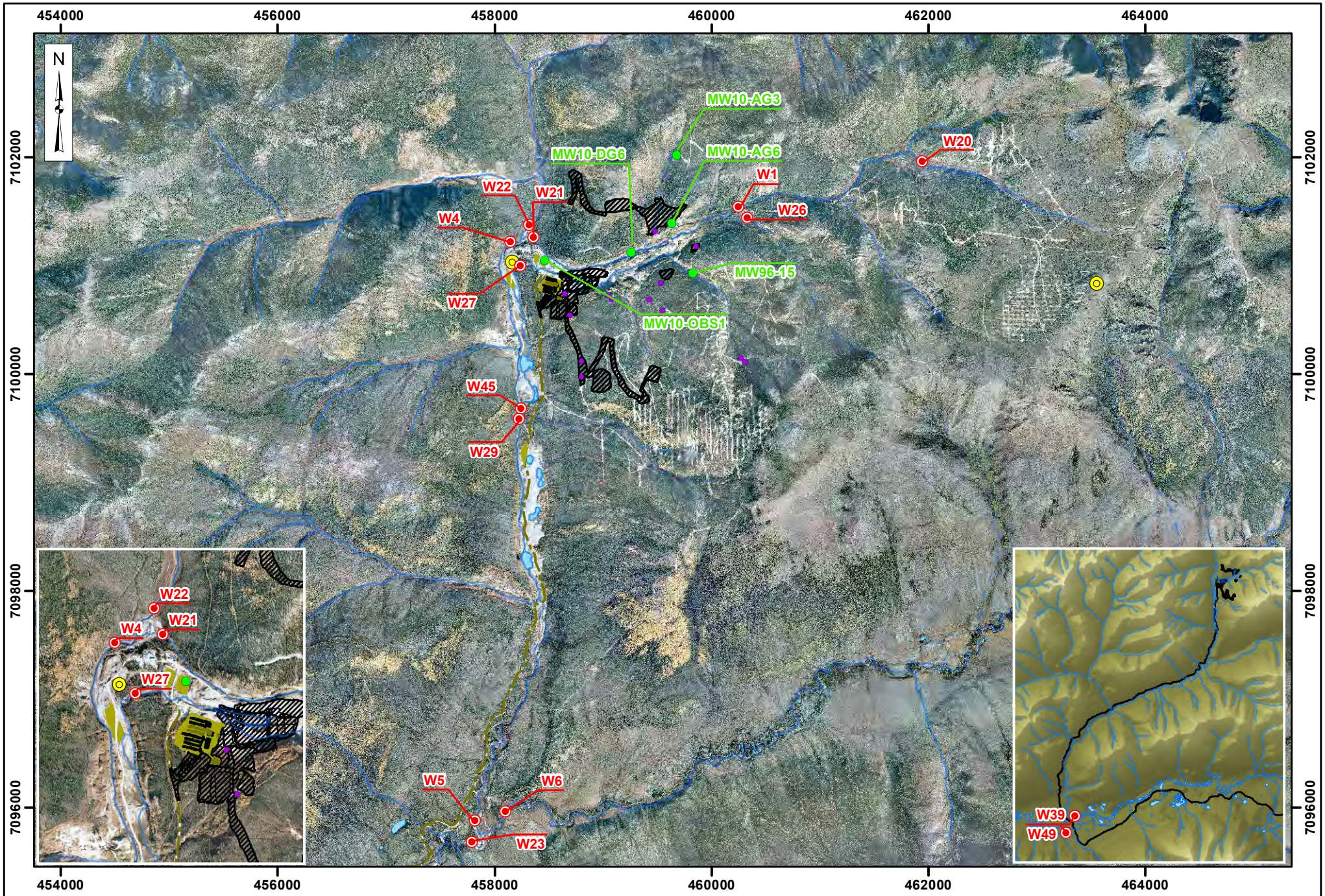
Drawn By: JK

Date: 2018/04/03

Figure: 3.1-1

EAGLE GOLD PROJECT
YUKON TERRITORY

2017 Baseline Monitoring Locations



Legend:

- 2017 Construction
- Pre-existing Structure
- 2017 Construction
- Pre-Existing Pad/Laydown
- Hydrometric & Water Quality Monitoring Station
- Climate Station
- Groundwater Monitoring Station
- Thermistor Location
- Perennial
- Ephemeral
- Intermittent

StrataGold Corporation

Projection: NAD 83 UTM Zone 8N	Drawn By: JK	**EAGLE GOLD PROJECT YUKON TERRITORY**
0 0.75 1.5 Kilometers	Date: 2018/04/03	Figure: 3.1-2
		2017 Construction Environmental Monitoring

3.2 SURFACE WATER QUALITY

3.2.1 Surface Water Quality Monitoring

3.2.1.1 Baseline Program

Surface water quality monitoring in 2017 included both pre-construction (baseline) and construction phase monitoring. The Eagle Gold Project baseline water quality program began in 2007 and was designed to:

- Obtain (pre-mining) baseline data on water quality to assess potential changes that could be related to construction, operation, closure, and post-closure phases of the Project;
- Identify parameters with concentrations that are naturally elevated and may therefore require the development of management plans (e.g., site specific objectives); and
- Provide baseline data for receiving aquatic environments to be used as input for the water quality modeling and development of water quality predictions for key mining phases of the project.

The baseline water quality dataset includes samples from 2007 to 2012 (Lorax 2013), in addition to updates to the water quality dataset which incorporates samples collected in 2013, 2014, 2016 (Lorax 2017) and 2017 from aquatic environments located within the project area. No water quality samples were collected in 2015. The full water quality baseline database is provided electronically as Appendix D1.

The baseline study area includes the Haggart Creek, Dublin Gulch, Eagle Creek, and Lynx Creek basins. For the period of 2007 to 2017, a total of 21 monitoring stations were sampled within the study area (Table 3.2-1). Portions of Haggart Creek, Dublin Gulch, and Eagle Creek drainage basins have the potential to be affected by the proposed Project and thus, sites located upstream and downstream of the Project footprint were selected within these basins, where possible. Lynx Creek drains a large catchment to the south of the Project area, is unaffected by development activities and serves as reference monitoring location.

Table 3.2-1: Surface Water Quality Monitoring Locations and Frequency - Baseline

Site	Location Description	Coordinates		Rationale
		Northing	Easting	
Haggart Creek Drainage Basin				
W22	Haggart above Dublin Gulch	7101377	458319	Above Project influence
W4	Haggart below Dublin Gulch	7101223	458144	Below Project influence
W68	Haggart upstream of Gill Gulch	7100482	458175	Below Project influence
W29	Haggart below Eagle Creek	7099583	458225	Below Project influence
W5	Haggart above Lynx Creek	7095887	457815	Below Project influence
W23	Haggart below Lynx Creek	7095682	457790	Below Project influence
W39	Haggart above South McQuesten River	7086504	449780	Far field Below Project
Dublin Gulch Drainage Basin				
W20	Bawn Boy Gulch	7101961	461945	Above Project influence
W1	Dublin Gulch above Stewart Gulch	7101545	460249	Above Project influence
W26	Stewart Gulch	7101443	460331	Above Project influence

Site	Location Description	Coordinates		Rationale
		Northing	Easting	
W32	Ann Gulch	7101211	459412	Below Project influence
W21	Dublin Gulch above Haggart Creek	7101261	458359	Below Project influence
Eagle Creek Drainage Basin				
W9	Eagle Pup	7101052	459630	Below Project influence
W10	Suttles Gulch	7100841	459161	Below Project influence
W61	Eagle Creek below Suttles Gulch	7100895	459139	Below Project influence
W27	Eagle Creek midway	7100997	458235	Below Project influence
W67	Platinum Gulch at road	7099624	458896	Below Project influence
W45	Eagle Creek above Haggart Creek	7099684	458243	Below Project influence
Lynx Creek Drainage Basin				
W13	Lynx Creek above Ray Creek	7098295	464770	No Project influence
W6	Lynx Creek above Haggart Creek	7095964	458099	No Project influence
LC1[a]	Upper basin of Lynx	7103295	470813	No Project influence
LC2[a]	Upper basin of Lynx	7101698	469571	No Project influence
LC3[a]	Upper basin of Lynx	7101702	469572	No Project influence
LC4[a]	Upper basin of Lynx	7099942	467979	No Project influence
LC5[a]	Upper basin of Lynx	7099927	467974	No Project influence
LC6[a]	Upper basin of Lynx	7099997	467888	No Project influence
LC7[a]	Upper basin of Lynx	7104354	471115	No Project influence
South McQuesten Drainage Basin				
W49	South McQuesten below Haggart Creek	7085495	449221	Far field below Project

NOTES:
Source: Lorax 2017b
No sampling occurred in 2015
[a] One-time Upper Lynx Creek sampling (7 stations) collected on August 20, 2012 to provide additional water quality characterization of reference stream

3.2.1.2 Construction Program

The surface water quality monitoring program during construction includes monitoring of water quality of watercourses within the Project area at strategic locations used for baseline and at water management facilities that will discharge to the environment. The water quality monitoring plan has been designed to meet the following objectives:

- Continue to collect water quality data in the receiving environment as the Project transitions from construction to operations at stations upstream and downstream of Project influences.
- Collect water quality data to verify compliance with the discharge criteria specified in QZ14-041.
- Provide a continuous water quality database to support adaptive management strategies to meet water quality compliance criteria and protect aquatic life.

Surface water quality monitoring has two main focuses: compliance monitoring and environmental effects. Environmental effects monitoring focuses on the following key Project watersheds:

- Haggart Creek from below the confluence of Fisher Gulch to immediately downstream of the confluence of Lynx Creek;
- Dublin Gulch;
- Eagle Creek;
- Lynx Creek; and
- South McQuesten River at the confluence of Haggart Creek

The water quality monitoring program is not intended to be a static program; stations will be added or removed according to the conditions and adaptive management as required.

Surface water quality monitoring was ongoing since the onset of construction in August 2017, including one sampling round (mid-August) prior to the initiation of construction (considered baseline), and then through December as listed in Table 3.2-2. All eleven monthly surface water quality monitoring stations and the three quarterly monitoring stations were visited in 2017. The remaining stations were not yet established due to no discharge. Complete analytical datasets for all sampled locations for the entire baseline period (2007-2017) and the construction period (September to December 2017) are provided in Appendices D1 and D2.

Table 3.2-2: Surface Water Quality Monitoring Locations and Frequency – Construction

Station	Location Description	Coordinates (Zone 8)		Sampling Frequency**			
				Field Measurements		Laboratory Analysis	
		North	East	Turbidity	pH, Temperature, Dissolved Oxygen, Turbidity and Conductivity	Turbidity and Total Suspended Solids	Full Analytical Suite
W1	Dublin Gulch above Stewart	7101545	460249	-	M	-	M
W21	Dublin Gulch at mouth	7101261	458359	-	M	-	M
W4	Haggart Creek below Dublin	7101223	458144	-	M	-	M
W22	Haggart Creek above Project Influence	7101378	458319	-	M	-	M
W5	Haggart Creek above Lynx Creek	7095888	457814	-	M	-	M
W6	Lynx Creek above Haggart Creek	7095964	458099	-	Q	-	Q
W20	Bawn Boy Gulch	7101961	461945	-	M	-	M
W23	Haggart Creek below Lynx Creek	7095682	457790	-	M	-	M
W26	Stewart Gulch	7101443	460331	-	M	-	M
W27	Eagle Creek near Camp	7100997	458235	-	M	-	M
W29	Haggart Creek below Eagle Creek and Platinum Gulch	7099583	458225	-	M	-	M
W39	Haggart Creek above South McQuesten River	7086504	449780	-	Q	-	Q
W45	Eagle Creek above Haggart Creek	7099684	458243	-	M	-	M

Station	Location Description	Coordinates (Zone 8)		Sampling Frequency**			
				Field Measurements		Laboratory Analysis	
		North	East	Turbidity	pH, Temperature, Dissolved Oxygen, Turbidity and Conductivity	Turbidity and Total Suspended Solids	Full Analytical Suite
W49	South McQuesten River below Haggart Creek	7085495	449221	-	Q	-	Q
EPS	Eagle Pup WRSA Seepage*	7100909	459834	D	Md	Wd	Md
PDI	Platinum Gulch Ditch into Lower Dublin South Pond*	7099523	459184	D	Md	Wd	Md
LDSPI	Lower Dublin South Pond Inflow*	7100824	458926	D	Md	Wd	Md
LDSPO	Lower Dublin South Pond Outflow*	7100857	458672	D	Md	Wd	Md
CS-01	Sediment Basin - below Lower Process Access Road*	7101146	458528	D	Md	Wd	Md
CS-02	Sediment Basin – below Truck Shop*	7101146	458476	D	Md	Wd	Md
CS-03	Sediment Basin - below south infrastructure*	7098410	458407	D	Md	Wd	Md
CS-04	SB-G4 – below Ice Rich Overburden Storage Area*	7098627	458268	D	Md	Wd	Md

NOTES:
* Discharge points to be monitored as they become active; no surface discharge points were developed during the reporting period.
**D - Daily when discharging; M – Monthly; Md - Monthly when discharging; Q – Quarterly; Wd - Weekly when discharging

Since mid-August, when Stage 1 Construction began, while earthworks, water management, and sediment and erosion control was ongoing, there was no discharge of contact water from any facility thus no development effluent discharge points were established. To ensure no adaptive management measures were required through construction works, sediment concentrations were monitored up and downstream of the project and within the receiving environment (Table 3.2-3). All concentrations were within natural variations.

Table 3.2-3: Surface Water Quality TSS During Construction Period

Station	Location Description	Total Suspended Solids (mg/L)			
		Sep	Oct	Nov	Dec
W1	Dublin Gulch above Stewart	3.3	8.0	5.6	4.2
W21	Dublin Gulch at mouth	19.5	3.4	8.2	5.0
W4	Haggart Creek below Dublin	4.4	<3.0	<3.0	<3.0
W22	Haggart Creek above Project Influence	<3.0	<3.0	<3.0	3.6
W5	Haggart Creek above Lynx Creek	<3.0	8.9	<3.0	3.2
W6	Lynx Creek above Haggart Creek	<3.0	4.9	Q	Q
W23	Haggart Creek below Lynx Creek	NS	3.3	<3.0	3.4
W26	Stewart Gulch	<3.0	<3.0	NR	NR

Station	Location Description	Total Suspended Solids (mg/L)			
		Sep	Oct	Nov	Dec
W27	Eagle Creek near Camp	3.5	9.2	NR	NR
W29	Haggart Creek below Eagle Creek and Platinum Gulch	5.0	7.5	<3.0	3.4
W45	Eagle Creek above Haggart Creek	3.4	8.4	<3.0	3.8
W39	Haggart Creek above S.McQuesten River	Q	Q	<3.0	Q
W49	South McQuesten River below Haggart Creek	Q	Q	<3.0	Q

NOTES:

NR – no results, stream frozen; Q - quarterly frequency – no sample; NS – no sample collected

Additionally, samples were collected at each of the stations listed in Table 3.2-2 and analyzed for the full suite of surface water quality parameters (e.g., general parameters, nutrients, metals). Results are provided in Appendix D2.

3.2.2 Quality Assurance and Quality Control Program

Since 2007, a well-established quality assurance/quality control (QA/QC) program has been in place to ensure the surface water quality program for the Eagle Gold Project is reliable, representative of the water quality conditions throughout the project area and of the highest quality. This program is intended to validate the monitoring data, and to identify any potential methodological and/or analytical errors in the data set that might require modifications to the program and or laboratory analyses. The following section provides a summary of the QA/QC program with respect to field quality, analytical data processing and internal laboratory procedures. The focus of the QA/QC analysis is on the surface water quality data collected during the period of 2013 to 2017.

The integrity of the water quality sampling program is evaluated by the collection of quality control samples, including field blanks and replicates described in detail below.

3.2.2.1 Field Blanks

Field blank samples are analyte-free reagent water samples used to assess the purity of chemical preservatives and potential contamination sources at the sampling location due to the collection method, handling, preservation, and exposure to the environment. Blank samples are generated by pouring de-ionized (DI) water into clean sample bottles in the same environment in which actual samples are collected, and then proceed with the elemental analysis as is routinely performed in the remaining collected samples.

The widely used acceptability criterion of 2×Reported Detection Limit (RDL) was used to evaluate the integrity of the collected field blanks. Detected values in blanks that were higher than the proposed criterion were flagged as a sample that required further investigation.

3.2.2.2 Travel Blanks

Travel blanks are provided by the analytical laboratory and are used during field surveys to identify potential contamination during storage and transport. These blanks are kept sealed and transported with water collected samples. Concentrations in these blanks are generally below detection limits, however if any measured parameter is detected above detection limit this may suggest a potential contamination during sample handling and transport.

3.2.2.3 Field Replicates

The British Columbia Field Sampling Manual (Clark 2013) specifies that a relative percent difference (RPD) greater than 20 percent indicates a possible sample contamination. An RPD greater than 50 percent indicates a definite sample integrity problem; however, it is not unusual to find high variability for the field duplicates, especially if the water is turbid (total suspended solids [TSS] greater than 25 mg/L). Field duplicate samples are generally collected at the same location and time at a site sample to assess the natural variability of the site. For the purpose of this analysis, originals and duplicates are considered paired replicates collected from the same location sequentially in time and were used to calculate the RPD.

3.2.2.4 Analytical QA/QC - Elemental Analysis Quality

All analytical analyses were performed by ALS laboratories (Burnaby, BC) a member of the Canadian Association for Laboratory Accreditation Inc. (CALA). The laboratory QA/QC program included analysis of certified reference materials, laboratory control samples, laboratory duplicates, method blanks and matrix spikes to determine accuracy and precision of instrumentation and methods. The majority of reported data met the laboratory data quality objectives (DQOs). However, in some instances, method recovery was not accurately calculated due to matrix interferences; thus, detection limits were adjusted to prevent any influence on analytical results. Overall, reported data were of good quality and met the laboratory QA/QC objective.

3.2.2.5 Dissolved Metal versus Total Metal Concentrations

For this QA/QC program, a dissolved metal concentration that was higher than the corresponding total metal concentration was considered an indicator of potential sample contamination and/or analytical error. Samples for total and dissolved metals are collected in separate bottles and are handled differently. For example, samples for dissolved metal analysis are filtered through a 45 µm filter and the filtering process can introduce error or contamination into the sample.

Dissolved metal concentrations were flagged as a potential QA/QC issue if the concentration was >20% higher than the corresponding total metal value in the same sample. Variability of less than 20% is excluded because it generally falls within the analytical margin of uncertainty (or error). Dissolved and total metal pairs are included in this analysis if the dissolved value is greater than five-times its RDL (Clark 2013).

3.2.2.6 Results and Discussion

This section summarizes the results of the QA/QC program for Eagle Gold. The program included an evaluation of field blanks, replicate samples, and total vs. dissolved metal concentrations. The QA/QC results for the surface water quality sampling program for 2013 to 2017 provides a reasonable level of confidence in the water quality data set. More importantly, the minor issues noted during the QA/QC assessment are not expected to alter the interpretation of the reported data. Based on the results of field replicates, field blanks, travel blanks, and dissolved vs total metal concentrations, the reported analytical data are considered reproducible, of good quality and representative of current water chemistry in the Project area. A brief description of methodological and analytical QA/QC results is provided below.

Field Blanks

Field blanks were collected and analyzed to assess purity of chemical preservatives and potential contamination sources at the sampling location. Several parameters exceeded the detection limit for a blank collected in May

2014. This may be related to the DI water used for field blanks over the course of multiple sampling events, potentially resulting in environmental concentration of ions and other metals entering the DI water. The remaining field blanks have parameters occasionally exceeding detection limits. The concentrations of exceeding parameters rarely occurred at the levels observed in the collected water samples at the monitoring stations with detected values are slightly above detection limits. These suggests that results in the field blanks may be due to matrix interferences within blank sample and the consequently adjustments of detection limits by the analytical laboratory (e.g., barium) (Appendix D1 provided electronically).

Travel Blanks

All measured parameters from travel blanks were below detection limit. These results indicate that good protocols of sample handling and transporting were applied in the field, given all values were reported as non-detects (< detection limit).

Field Replicates

A total of 32 field duplicates were collected as part of the surface water quality sampling program during the period 2013 to 2017. Appendix D1 (provided electronically) shows the number of duplicates that had parameters with RPDs greater than the acceptability criteria of 20% and 50% (calculated only if the reported parameter value was greater than five-times the RDL in at least one of the sample duplicates). In general, water quality results were generally similar between field duplicates. Most duplicates had at least one parameter with an RPD between 20 and 50%, but typically less than half of duplicates had one or more parameters with an RPD greater than 50%. An RPD greater than 50 percent indicates a definite sample integrity problem; however, it is not unusual to find high variability for the field duplicates, especially if the water is turbid (TSS greater than 25 mg/L). For example, most of the duplicates that exceed the 50 percent DQO occurred in freshet (March-June) and fall following precipitation events (September-October) when high TSS values are common.

Dissolved Metal versus Total Metal Concentrations

Dissolved vs total metal concentrations are presented in Appendix D1 (provided electronically). The number of analyte pairs with dissolved metal values greater than 120 and 150% of the corresponding total are uncommon (< 3 occurrences of the total collected samples). Parameters such as chromium, selenium, silver and zinc showed > 120% exceedances in more than 3 total collected samples representative of cross contamination or mislabeling of bottles occurring during sample collection or at the laboratory. However, the number of recorded incidents in metal concentrations were generally below the 120% acceptability criteria in most of the analyzed samples and parameters, which reflects reasonable confidence in the reported results.

3.2.3 Discharge Compliance - Water Quality

During the period of this report (2017) no development effluent compliance points were established and no discharge of contact water to surface water occurred.

3.2.4 Water Balance and Water Quality Modeling

The Eagle Gold Mine water balance and water quality model (WBQM) was updated following changes to the water management plan and water management assumptions around the heap leach facility (Appendix D).

3.2.4.1 HLF Water Balance Model Integration

The WBQM incorporates the HLF water balance model (Appendix E), which required updates to accommodate the following:

- Decreased total ore tonnages and volume (from 92 Mt to 86 Mt) comprising an additional year of stacking at a monthly average of 29,500 tonnes per day for 12 months/year.
- Maximum In-Heap sump storage of 120,095 m^3 and maximum event pond storage of 299,851 m^3.
- Change in start date of liner placement to March Year 1 (previously assumed at May Year 1);
- Implementation of a discharge cap (20 L/s) to the event pond during draindown; and
- Updated HLF seepage rates from the Mines Group at the end of draindown as the post-closure seepage rate in the Goldsim model.

All other inputs, assumptions and parameterizations for the HLF WBM were carried forward from the previous iterations.

3.2.5 Water Balance and Water Quality Model Development

The Eagle Gold WBWQM is a GoldSim-based integrated water balance and quality model that was originally developed in two parts. The initial water balance model design was led by Knight-Piesold (KP) who used a runoff-based approach to determine natural and mine-impacted runoff from the catchments that comprise the Eagle mine site. Precipitation was back-calculated from runoff where a precipitation input was required. KP also integrated the Excel-based monthly heap leach facility (HLF) water balance model provided by the Mines Group. The water quality component was developed by Lorax Environmental Services Ltd. (Lorax) and integrated within the WBM to combine source concentrations of potential contaminants of concern with contact and non-contact flows to track contaminant loading throughout the mine site and into the receiving waters of Haggart Creek. The culmination of both these efforts was the 2014 water quality model used in support of Stratagold's Type A Water Use License Application submitted in August 2014 (Appendix 28 Water Quality Model Report).

The report (Appendix D) presents an update of the Eagle Gold water balance model (WBM) and water quality model (WQM) that fully integrates the following:

- Revisions to the water management plan as described in: Eagle Gold Project Construction and Operations Water Management Plan. Version 2107-01. July 2017;
- Revisions to the HLF water balance modeling as described in: Water Balance Modeling for the Eagle Gold Mine Proposed Heap Leach Pad Facility, Final Design. Report prepared by The Mines Group, January 2018;
- Baseline climate and hydrology data collected since 2007 and inclusive of data collected in 2016 and 2017 (Lorax 2016a, 2016b, 2018a and 2018b);
- Updated baseline surface water quality monitoring data collected from 2007 to 2017 prior to initiation of construction in August 2017; and
- Geochemical source term data collected from active field bins of waste rock and leached ore materials, with consideration of data collected up through end of 2017 ice-free season.

The revisions to the operations water management plan are reflected in the updated schematic (Figure 3.2-1). Water quality from mine discharge during operations is driven by the contact water reporting to the Lower Dublin South Pond. Contact water from the Eagle Pup and Platinum Gulch WRSAs, the temporary ore stockpile, and the sump water from the open pit all report to the LDSP at some point during operations. Excess water from the LDSP is treated through the MWTP to meet the discharge criteria in Table 3.2-4 and discharged to Haggart Creek upstream of W4 (Figure 3.2-1).

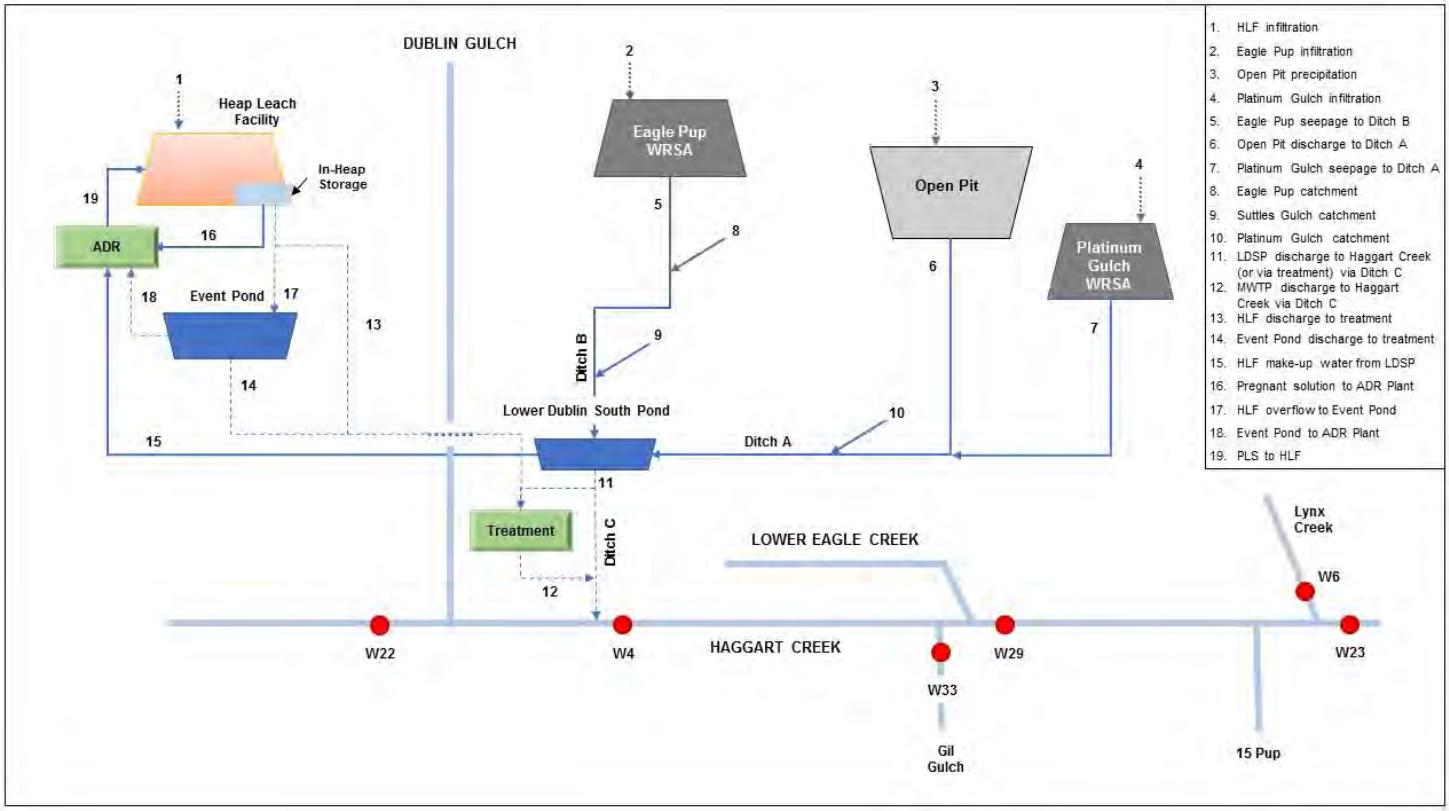


Figure 3.2-1: Water Balance Model Schematic

Table 3.2-4: MWTP Discharge Criteria

Parameter[1]	Maximum Concentration in a Grab Sample
pH	6.5 – 8
Total Suspended Solids (TSS)	15.00 mg/L
Sulphate	1850 mg/L
Chloride	250 mg/L
Nitrate-N	19.5 mg/L
Nitrite-N	0.12 mg/L
Ammonia-N	7.5 mg/L
Total Cyanide	1.0 mg/L
WAD Cyanide	0.03 mg/L

Parameter[1]	Maximum Concentration in a Grab Sample
Aluminum (Dissolved)	0.4 mg/L
Antimony	0.13 mg/L
Arsenic	0.053 mg/L
Cadmium	0.00125 mg/L
Copper	0.026 mg/L
Cobalt	0.026 mg/L
Iron	6.4 mg/L
Lead	0.05 mg/L
Mercury	0.00008 mg/L
Manganese	7.7 mg/L
Molybdenum	0.45 mg/L
Nickel	0.50 mg/L
Selenium	0.025 mg/L
Silver	0.01 mg/L
Uranium	0.09 mg/L
Zinc	0.23 mg/L

1 – All concentrations are total values

3.2.5.1 Results

Results are presented in downstream order for the three Haggart Creek receiving environment stations (W4), (W29) and (W23), for the main parameters of interest, namely As and Se. Time-series of all predicted parameters are provided in Appendix A of Appendix D.

Figure 3.2-2 summarizes the updated 2018 water quality model predictions for As at station W4. Peak As concentrations for the modeled period are approximately 0.008 mg/L which occur typically in the higher flow periods of May to July during HLF draindown. Corresponding peak As values during the winter low flow months are approximately 0.0065 mg/L during this same period. Post closure As concentrations (Year 23 onwards) are predicted to be on the order of 0.0067 mg/L with winter low flow peak concentrations of approximately 0.005 mg/L.

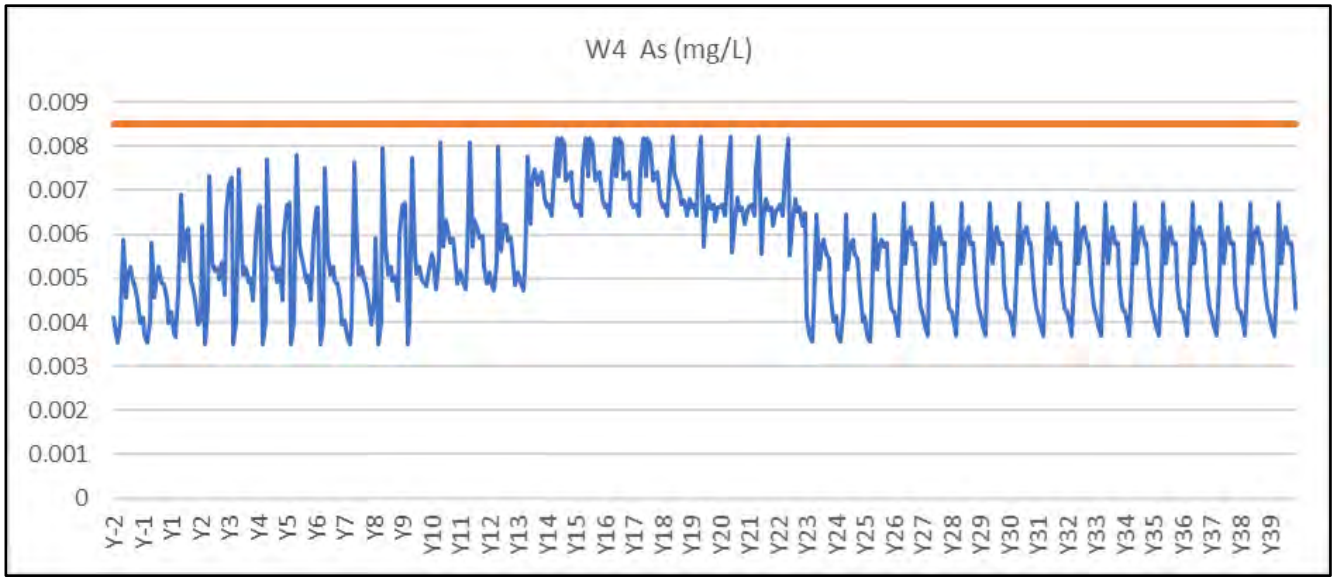


Figure 3.2-2: Water Quality Model Predictions for Total As at W4

Peak As concentrations at W29 are predicted to be slightly lower as compared to station W4 during the operation and draindown period (e.g. Year 1 to Year 22) and well below the water quality objective. Peak As concentrations for this period are approximately 0.007 mg/L and occur during the higher flow month of May. During post closure, additional As loadings occur to Haggart Creek from the open pit overflow and Platinum Gulch PTS resulting in higher peak As concentrations as compared to W4 of approximately 0.008 mg/L (Figure 3.2-3).

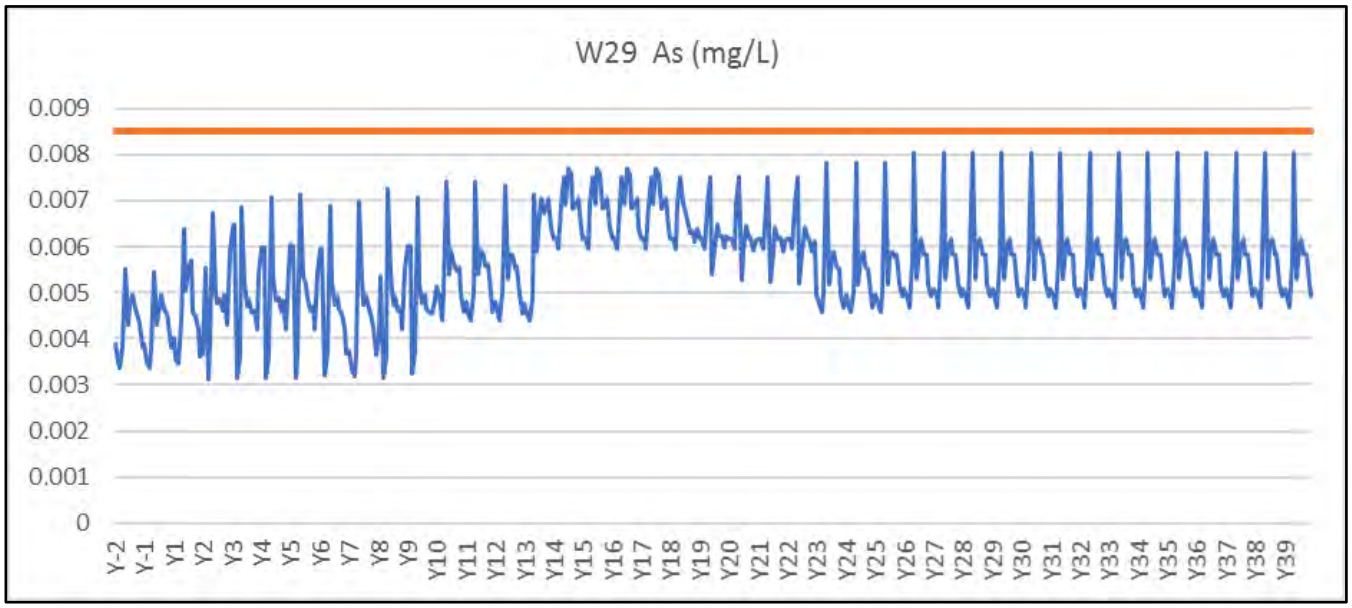


Figure 3.2-3: Water Quality Model Predictions for Total As at W29

Unlike stations more proximal to the Eagle Mine in Haggart Creek (e.g. W4 and W29), predicted peak As concentrations at W23 are less variable throughout the life of mine period (Figure 3.2-4). For example, peak As concentrations during the operations and draindown period are approximately 0.0072 mg/L and peak As concentrations during the post closure period are roughly 0.0074 mg/L. The less variable As concentrations at W23 are a result of the natural background As loadings from Lynx Creek that enter Haggart Creek immediately upstream of W23.

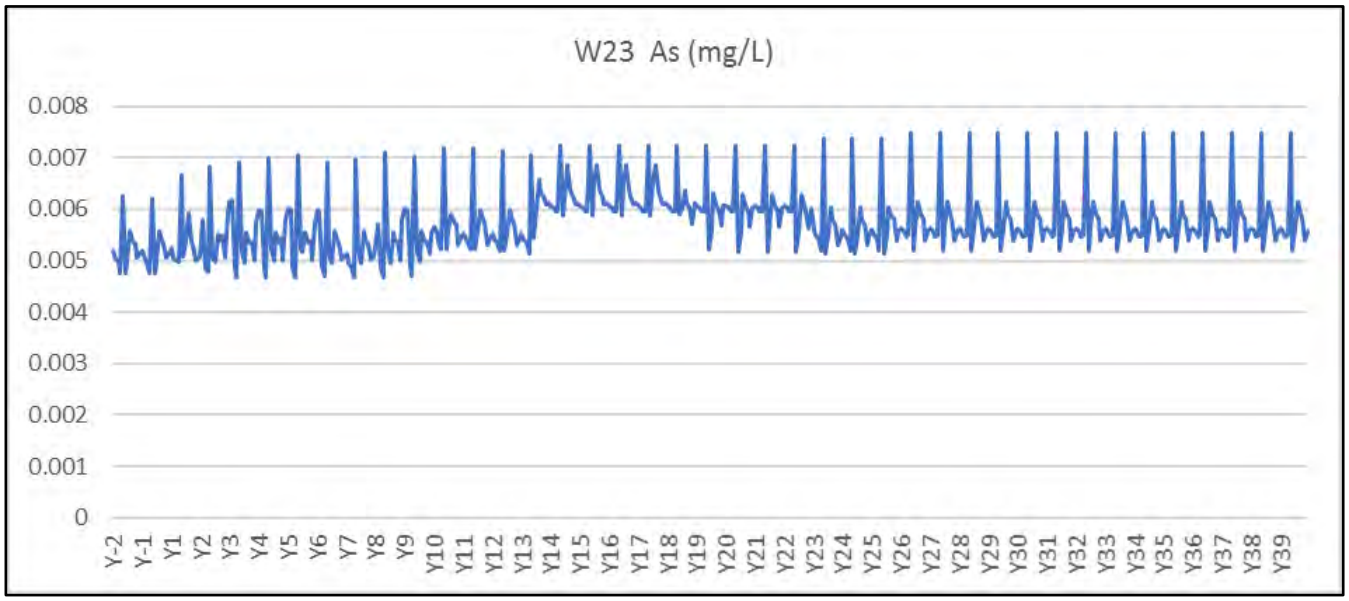


Figure 3.2-3: Water Quality Model Predictions for Total As at W23

3.3 GROUNDWATER

The majority of the Project is situated within the Dublin Gulch basin, which is part of the Haggart Creek basin. The hydrogeologic zones used to characterize groundwater in the Project area include Eagle Pup and the Ann, Suttles, Olive, Bawn Boy, Platinum and Dublin gulches. The groundwater monitoring program during construction will vary from baseline data collection to emphasize the spatial zones where facilities will be constructed to monitor Project effects on the groundwater flow system. The zones requiring groundwater monitoring are depicted in Figure 3.3-1 and include the following areas:

- Heap Leach Facility (HLF).
- Eagle Pup Waste Rock Storage Area (EP WRSA).
- Platinum Gulch Waste Rock Storage Area (PG WRSA).
- Event Pond.
- low pH treatment solids storage cells area.
- Truck Shop area, and
- Lower Dublin South Pond (LDSP).

3.3.1 Groundwater Quantity Monitoring

The objectives of the groundwater quantity monitoring program during 2017 were to provide continuous and spot-level groundwater level measurements to monitor potential Project effects on the occurrence and quantity of groundwater as the Project transitions from the baseline characterization period through construction and into operations.

Baseline groundwater level data have been collected from 2009 to 2017 from the wells listed in Table 3.3-1. Upon initiation of the Development phase, and as per the EMSAMP, the quarterly sampling and water level monitoring was conducted at the locations listed in Table 3.3-2. The rationale for using the well and any impacts to the well that may arise due to construction activities is listed in Table 3.3-3.

Table 3.3-1: Groundwater Monitoring Well Network Used for Baseline Data Collection

Instrument ID	Catchment	Facility	Data Logger Installation Date
MW10-AG3a	Ann Gulch	Heap Leach	31-May-10
MW10-AG5	Ann Gulch	Heap Leach	-
MW10-AG6	Ann Gulch	Heap Leach	-
DH95-152	Dublin Gulch	Lower Dublin South Pond	-
MW09-DG1	Dublin Gulch	Heap Leach	16-May-10
MW09-DG2	Dublin Gulch	Lower Dublin South Pond	-
MW09-DG4	Dublin Gulch	Mine Site	1-Apr-11
MW09-DG5	Dublin Gulch	Mine Site	-
MW10-DG6	Dublin Gulch	Heap Leach	1-Apr-11
MW10-OBS1	Dublin Gulch	Lower Dublin South Pond	-
MW10-OBS2	Dublin Gulch	Mine Site	-
MW96-23	Platinum Gulch	PG WRSA	-
MW10-PG1	Platinum Gulch	PG WRSA	19-May-11
MW96-19	Suttles Gulch	Open Pit	27-May-10
MW09-Stu2	Suttles Gulch	General Dublin Gulch valley	-
MW96-12a/b	Eagle Pup	EP WRSA	-
MW96-13a/b	Eagle Pup	EP WRSA	19-May-11
MW96-8	Bawn Boy Gulch	Background	-
MW96-9a	Bawn Boy Gulch	Background	-
MW96-9b	Bawn Boy Gulch	Background	27-May-10
DH95-150	Stewart Gulch	Background	-
MW09-OG3	Olive Gulch	Background	-

NOTES:
Existing monitoring network is shown on Figure 3.3-1
Nested ground water wells are indicated by a and b distinction
Source: SGC 2018.

Table 3.3-2: Groundwater Quantity Monitoring 2018 – Construction

Instrument ID	Catchment	Facility
MW10-AG6	Ann Gulch	Heap Leach
MW10-AG3A	Ann Gulch	Heap Leach
MW10-AG3B	Ann Gulch	Heap Leach
BH-BGC11-26	Ann Gulch	Heap Leach
MW10-DG6	Ann/Dublin Gulch	Heap Leach
MW10-OBS1	Dublin Gulch	Lower Dublin South Pond
MW96-15	Eagle Pup	EP WRSA
MW96-13A	Eagle Pup	EP WRSA
MW96-13B	Eagle Pup	EP WRSA
MW96-14B	Eagle Pup	EP WRSA
MW96-17A	Suttles Gulch	Open Pit
MW96-17B	Suttles Gulch	Open Pit
09-BGC-GTH2a	Suttles Gulch	Open Pit
10-BGC-GTH-05	Suttles Gulch	Open Pit
10-BGC-GTH-06	Suttles Gulch	Open Pit
10-BGC-GTH-07	Suttles Gulch	Open Pit
10-BGC-GTH-08	Suttles Gulch	Open Pit
10-BGC-GTH-10	Suttles Gulch	Open Pit
BH-BGC11-74	Lower Dublin Gulch	Lower Dublin South Pond
MW10-PG1	Platinum Gulch	PG WRSA
BH-BGC11-72	Lower Dublin Gulch	Lower Dublin South Pond

Table 3.3-3: Groundwater Monitoring Well Network – Construction

Instrument ID	Facility	Datalogger [1]	Groundwater Level Sample Frequency [2]	Groundwater Quality Sample Frequency	Rationale	Construction Impacts to Well
MW10-AG6	Heap Leach	Equipped	Downloaded quarterly	Quarterly	Evaluate seasonal flow in HLF embankment area	Will not be excavated during construction and will remain throughout operations and post-closure.
MW10-AG3A	Heap Leach	Equipped	Downloaded quarterly until decommissioned during construction	Quarterly	Evaluate seasonal water level variability and infiltration rates in the Ann Gulch basin (HLF area) within the Phase 1 footprint	Will be excavated during initial construction.
MW10-AG3B	Heap Leach	None	Quarterly	No	Evaluate depth to the water table in the Ann Gulch basin (HLF area)	Will be excavated during initial construction.

Instrument ID	Facility	Datalogger [1]	Groundwater Level Sample Frequency [2]	Groundwater Quality Sample Frequency	Rationale	Construction Impacts to Well
					within the Phase 1 footprint	
BH-BGC11-26	Heap Leach	Equipped	Downloaded quarterly	Quarterly	Evaluate seasonal water level variability and infiltration rates in the Ann Gulch basin (HLF area) above the Phase 1 footprint	Will not be excavated during initial construction and will remain in place as operations monitoring well until Phase 2 of HLF construction.
MW10-DG6	Heap Leach	Equipped	Downloaded quarterly	Quarterly	Evaluate seasonal water level variability in the Eagle Creek basin	Will not be excavated during construction and will remain throughout operations and post-closure.
MW10-OBS1	Lower Dublin South Pond	Equipped	Downloaded quarterly	Quarterly	Evaluate vertical and seasonal flow in Eagle Creek Pond area	Will not be excavated during construction and will remain throughout operations and post-closure.
MW96-15	EP WRSA	Equipped	Downloaded quarterly	Quarterly	Evaluate vertical and seasonal flow in EP WRSA area	Will not be excavated during construction and will remain throughout operations and post-closure.
MW96-13A	EP WRSA	Equipped	Downloaded quarterly until decommissioned during construction	Quarterly	Evaluate vertical and seasonal flow in the EP WRSA area during construction	Will be excavated during construction or covered during operations
MW96-13B	EP WRSA	Equipped	Downloaded quarterly until decommissioned during construction	No	Evaluate vertical and seasonal flow in EP WRSA area during construction	Will be excavated during construction or covered during operations
MW96-14B	EP WRSA	None	Quarterly until decommissioned during construction	No	Evaluate seasonal flow and vertical gradients in EP WRSA area	Will be excavated during construction
MW09-DG2	Lower Dublin South Pond	None	Quarterly	Quarterly	Evaluate seasonal water level variability along Eagle Creek	Will not be excavated during construction and will remain throughout operations and post-closure.
MW96-17A	Open Pit	None	Quarterly until decommissioned during construction	No	Evaluate seasonal water level patterns in the Open Pit during initial depressurization	Will be excavated during open pit pre-stripping activities
MW96-17B	Open Pit	None	Quarterly until decommissioned during construction	No	Evaluate seasonal water level patterns in the Open Pit during initial depressurization	Will be excavated during open pit pre-stripping activities

Instrument ID	Facility	Datalogger [1]	Groundwater Level Sample Frequency [2]	Groundwater Quality Sample Frequency	Rationale	Construction Impacts to Well
09-BGC-GTH2a	Open Pit	Equipped	Downloaded monthly until decommissioned during construction	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-05	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-06	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-07	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-08	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-10	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures and vertical gradients in pit during depressurization	Will be excavated during open pit pre-stripping activities
BH-BGC11-74	Lower Dublin Gulch	Equipped	Downloaded quarterly	No	Evaluate flow near Haggart Creek and long-term change in water table	Will not be excavated during construction – will remain throughout operations and post-closure
MW10-PG1	PG WRSA	Equipped	Downloaded quarterly	No	Consistency with ongoing baseline and evaluate flow downgradient from PG WRSA and Open Pit	Will not be excavated during construction – will remain throughout operations and post-closure
BH-BGC11-72	Lower Dublin Gulch	Equipped	Downloaded quarterly or as construction conditions dictate	No	Evaluate flow near Haggart Creek and evaluate long term change in water table	Will not be excavated during construction – will remain throughout operations and post-closure

[1] Dataloggers: column indicates wells that currently have dataloggers installed and wells that will not have loggers installed

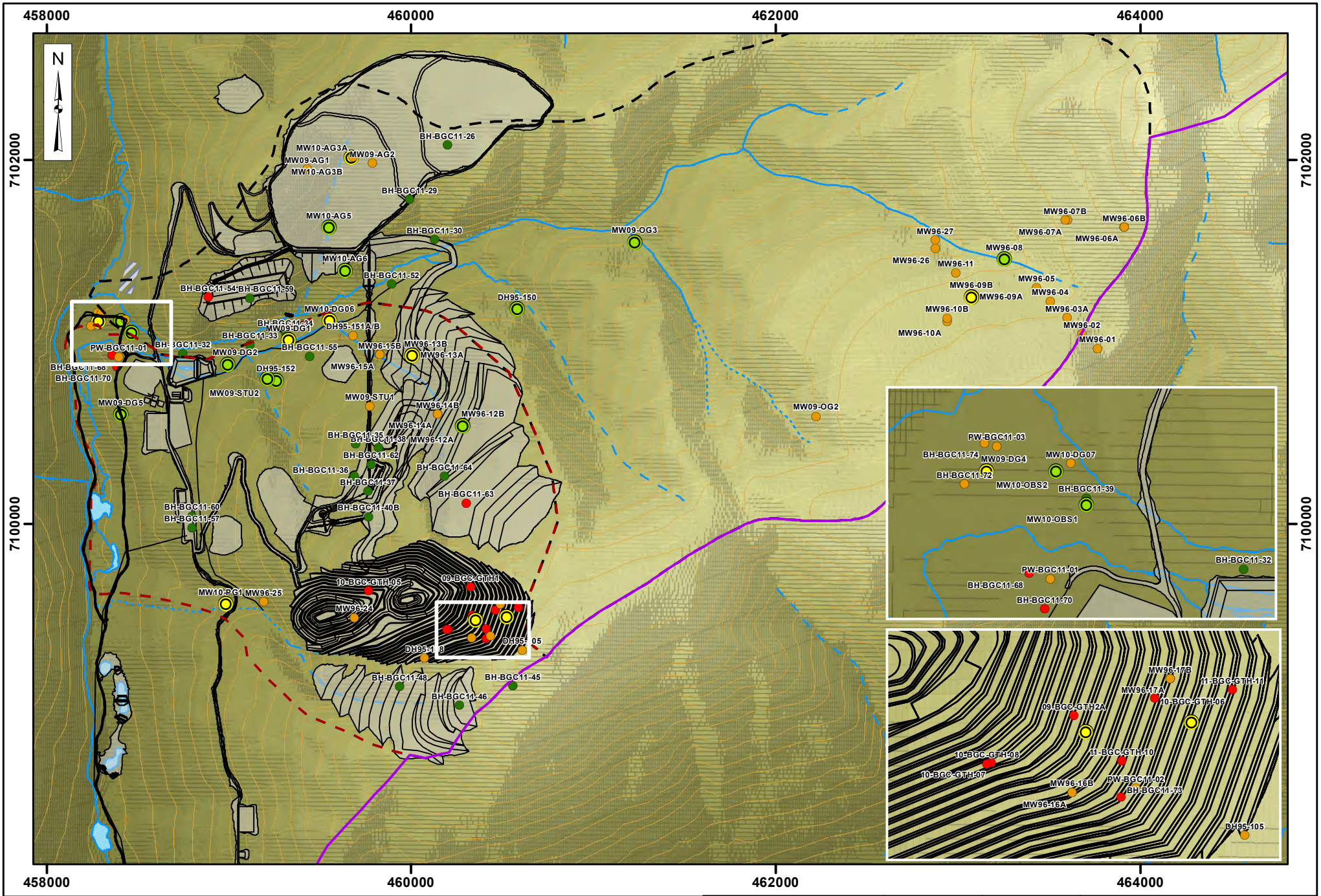
[2] Frequency: for wells that will be excavated as a result of construction this column provides the monitoring frequency as stated until well excavation

Groundwater hydrographs showing available electronic water level data for each well are provided as Figures 3.3-2 through 3.3-15. Due to some inconsistencies in manual water level data measurement and documentation compared to electronic data, these data are still being examined and have not yet been included with the hydrographs. Further some of the electronic data have apparent elevation outliers or discrete breaks, which are likely due to the monitoring/collection event when the transducer was moved. These events will be eliminated

when finalizing the graphs. However, the hydrographs still show the general trends of groundwater elevation changes over time for each well. The electronic groundwater elevation data were compensated for changes in barometric pressure using data from the Camp barologger.

In general, water levels in some wells demonstrated clear seasonal variability, with lower levels in the winter and spring, and higher levels in the summer and fall. Water levels in other wells generally did not vary substantially from quarter to quarter. Most wells showed generally relatively flat small changes in elevations, but generally increasing elevation trends were observed in a few wells.

Overall, the collected groundwater elevation data adequately demonstrate baseline depth-to-water and elevation variability conditions in the proposed mining area. Although some data sets illustrate some data collection issues, as the mine is now in the construction phase these issues will be addressed to ensure data collected in 2018 and beyond will support the EMSAMP objectives.



Legend:

- Facility
- Reserved
- Monitoring Well
- Monitoring Well - Data Logger
- Monitoring Well - Manual Read
- BGC Vibrating Wire
- BGC Standpipe Piezometer
- Contour (100ft)
- Perennial
- Ephemeral
- Intermittent
- Dublin Gulch Basin
- Eagle Creek Basin
- Upper Haggart Creek Basin

StrataGold Corporation

0 400 800
Meters

Projection:	Drawn By:	EAGLE GOLD PROJECT YUKON TERRITORY
NAD 83 UTM Zone 8N	HC	
Date:	Figure:	Existing Groundwater Monitoring Network
2018/02/19	3.3-1	

Figure 3.3-2: Groundwater Hydrograph for MW09(10)-DG6

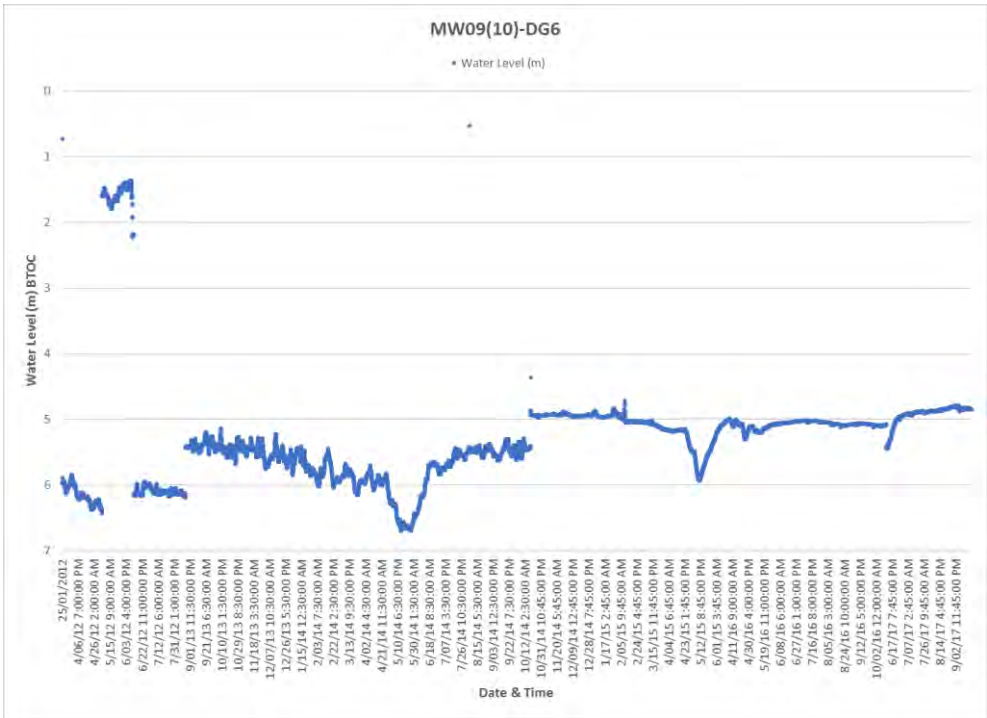


Figure 3.3-3: Groundwater Hydrograph for MW09-DG1

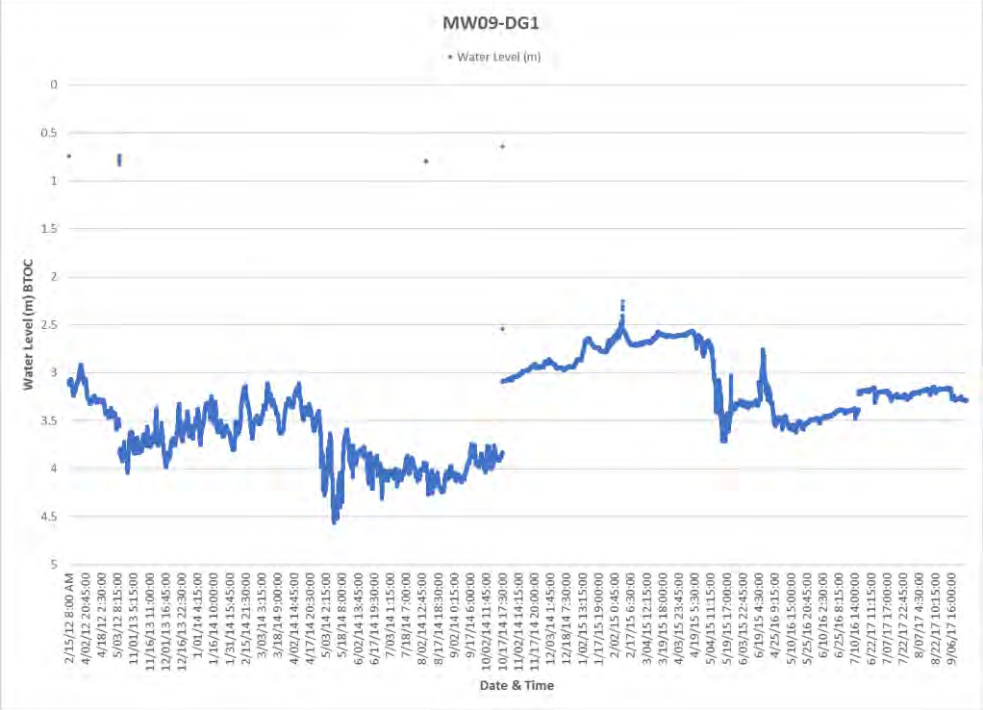


Figure 3.3-4: Groundwater Hydrograph for MW09-DG4

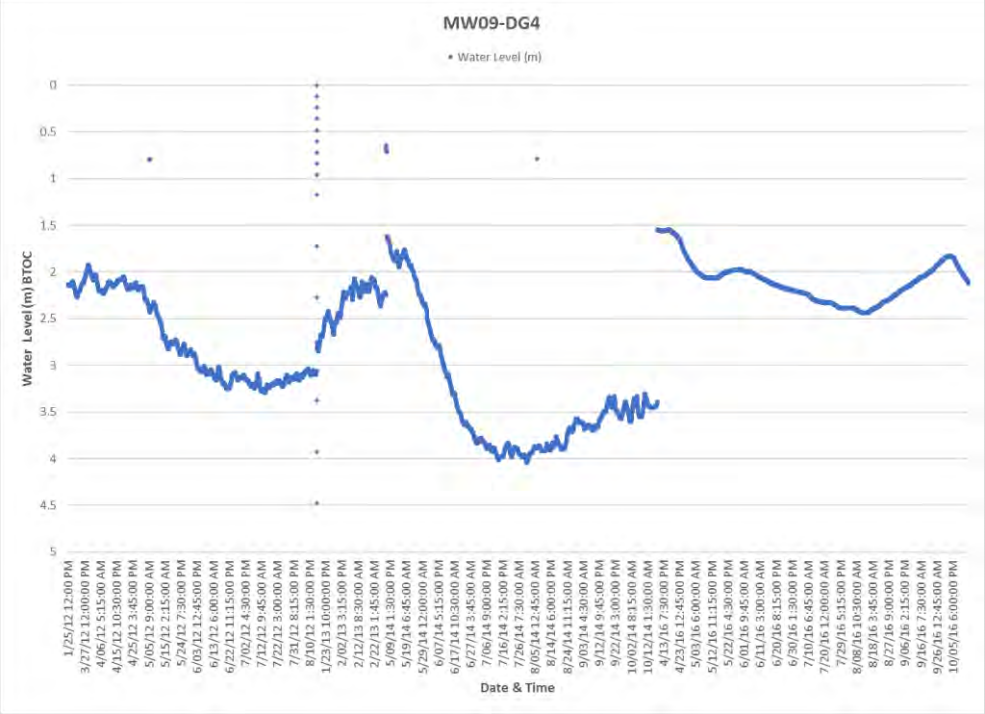


Figure 3.3-5: Groundwater Hydrograph for MW09-OG3

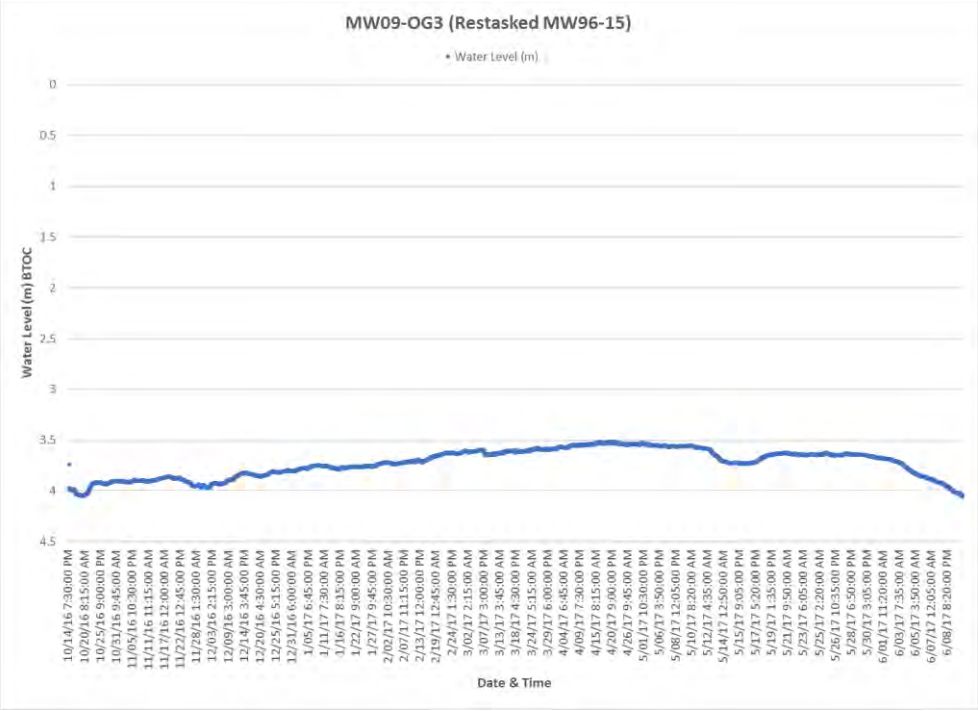


Figure 3.3-6: Groundwater Hydrograph for MW10-AG3A

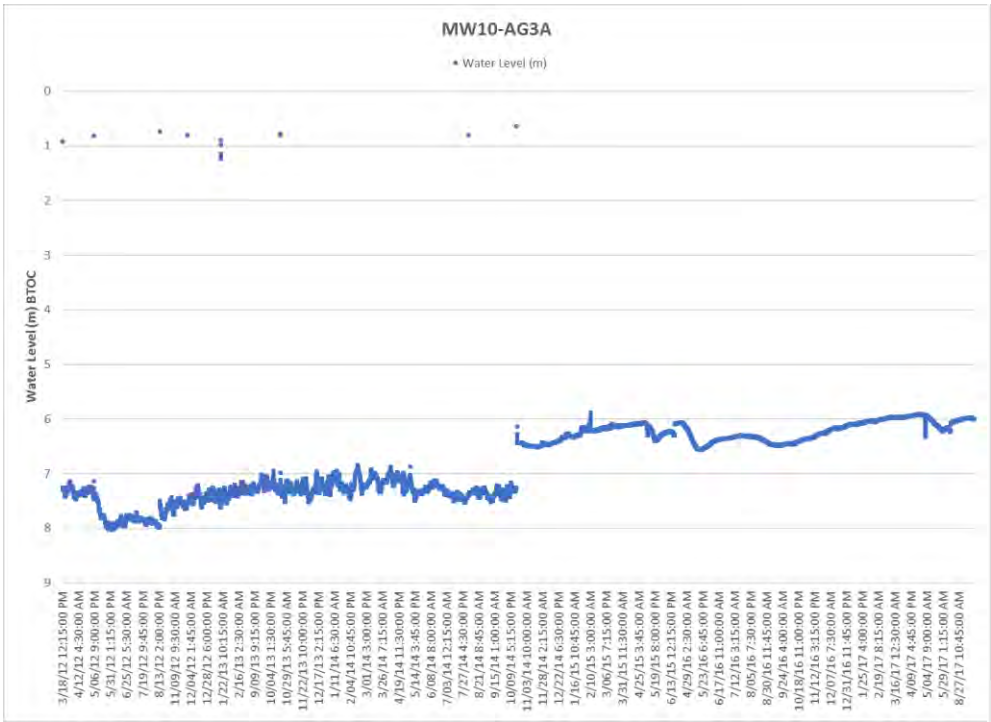


Figure 3.3-7: Groundwater Hydrograph for MW10-PT1 (PG1)

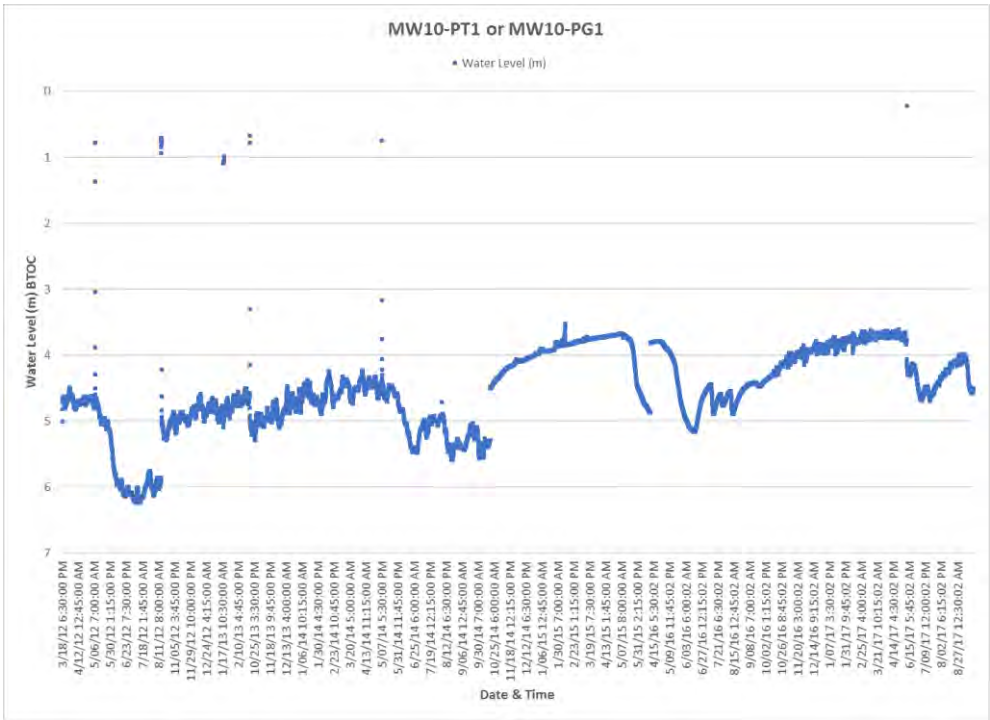


Figure 3.3-8: Groundwater Hydrograph for MW96-9A

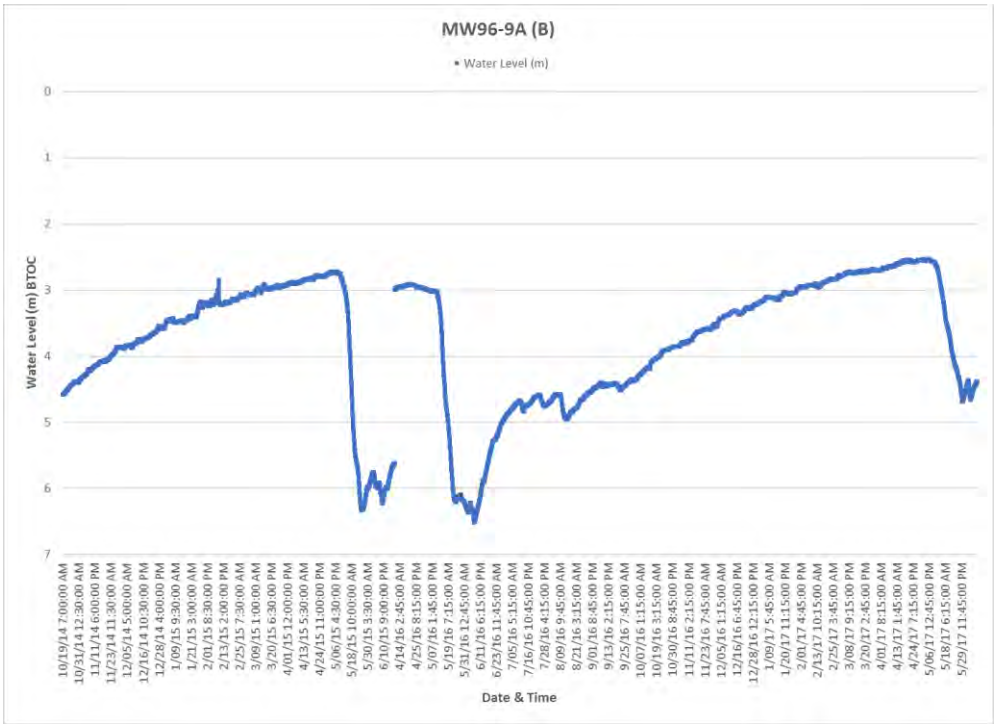


Figure 3.3-9: Groundwater Hydrograph for MW96-9B

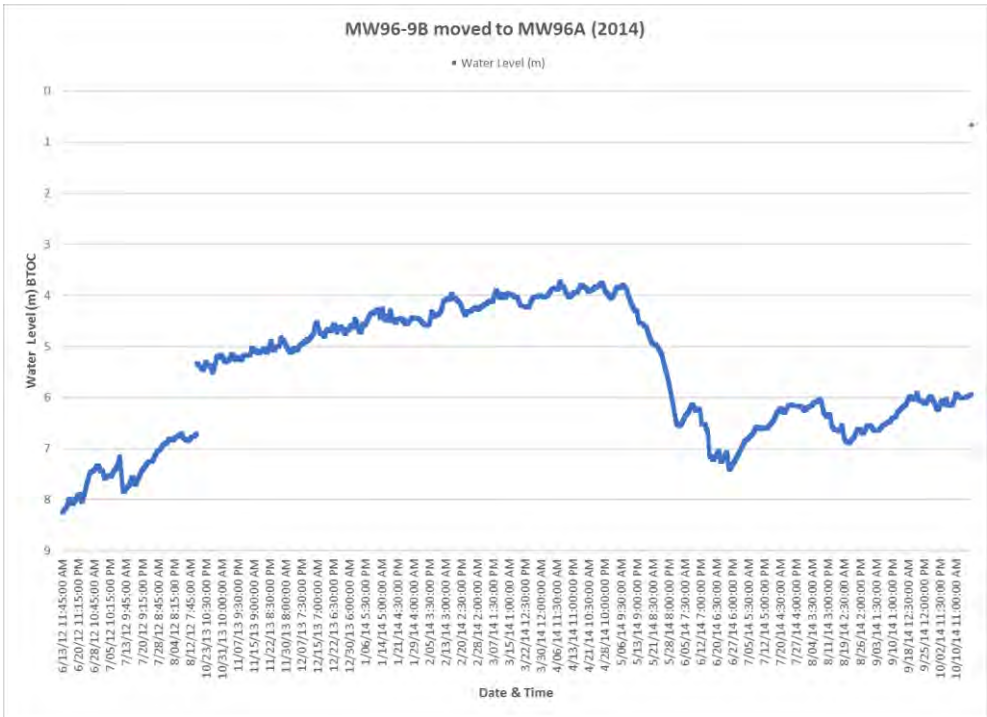


Figure 3.3-10: Groundwater Hydrograph for MW96-13A

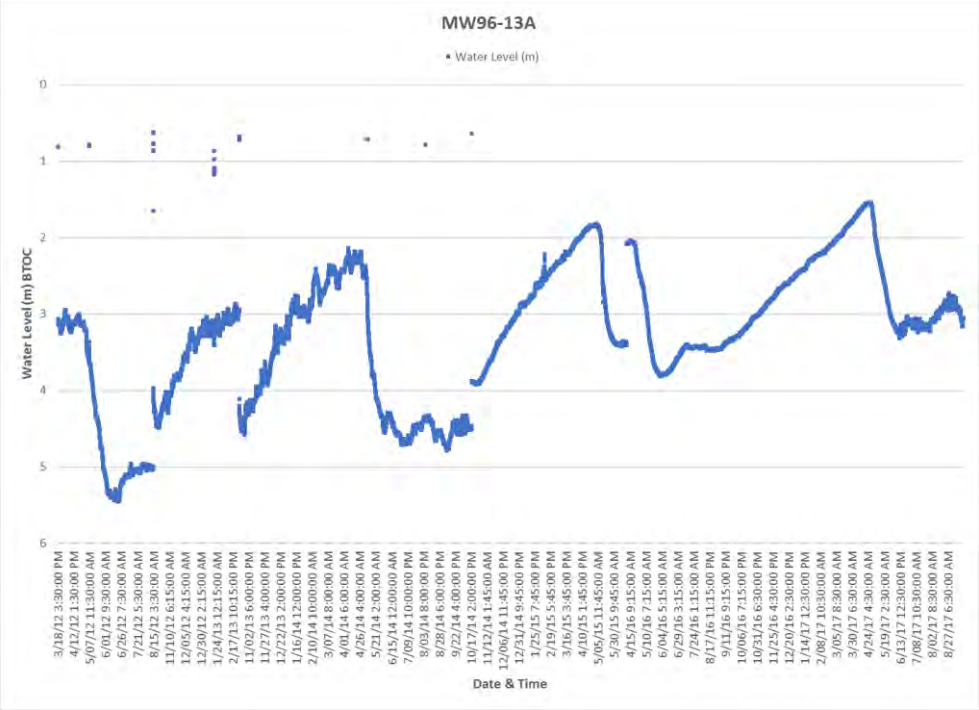


Figure 3.3-11: Groundwater Hydrograph for MW96-13B

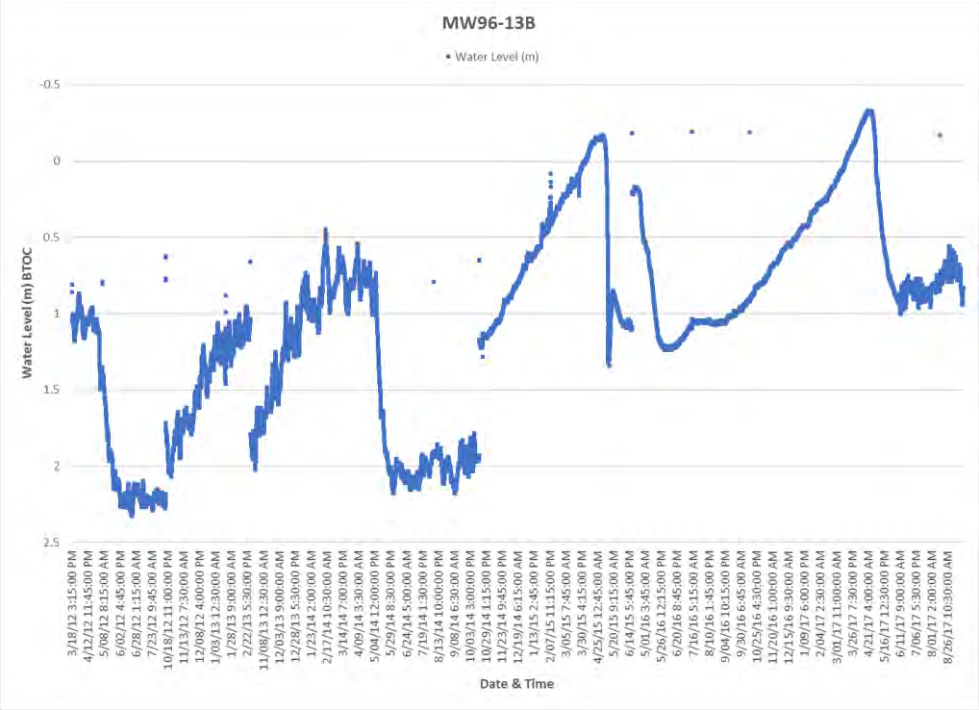


Figure 3.3-12: Groundwater Hydrograph for MW96-15

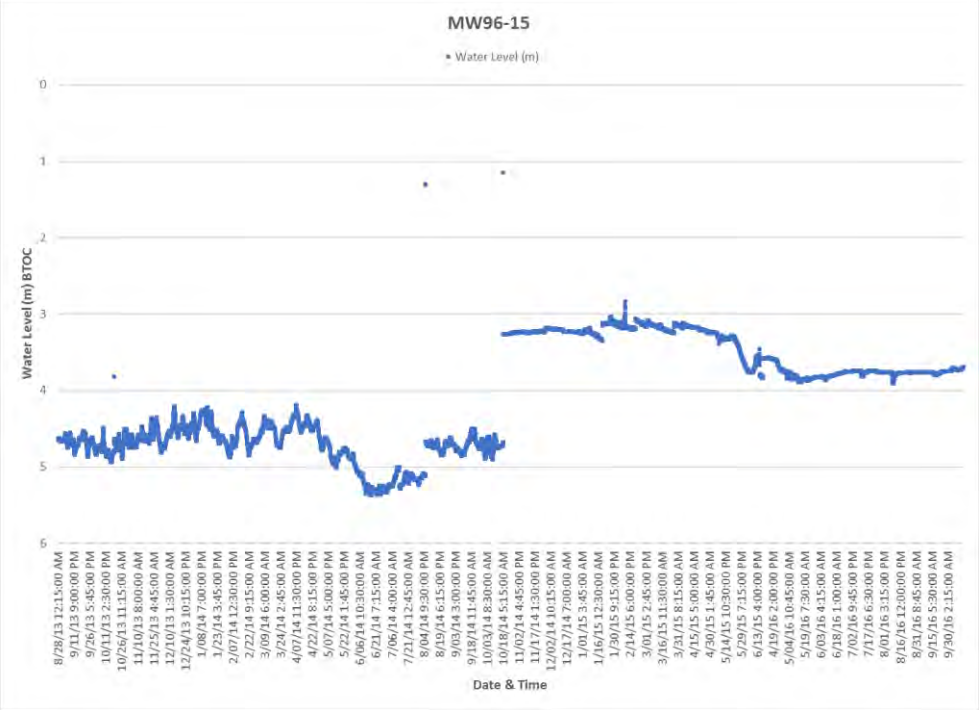


Figure 3.3-13: Groundwater Hydrograph for MW96-17A

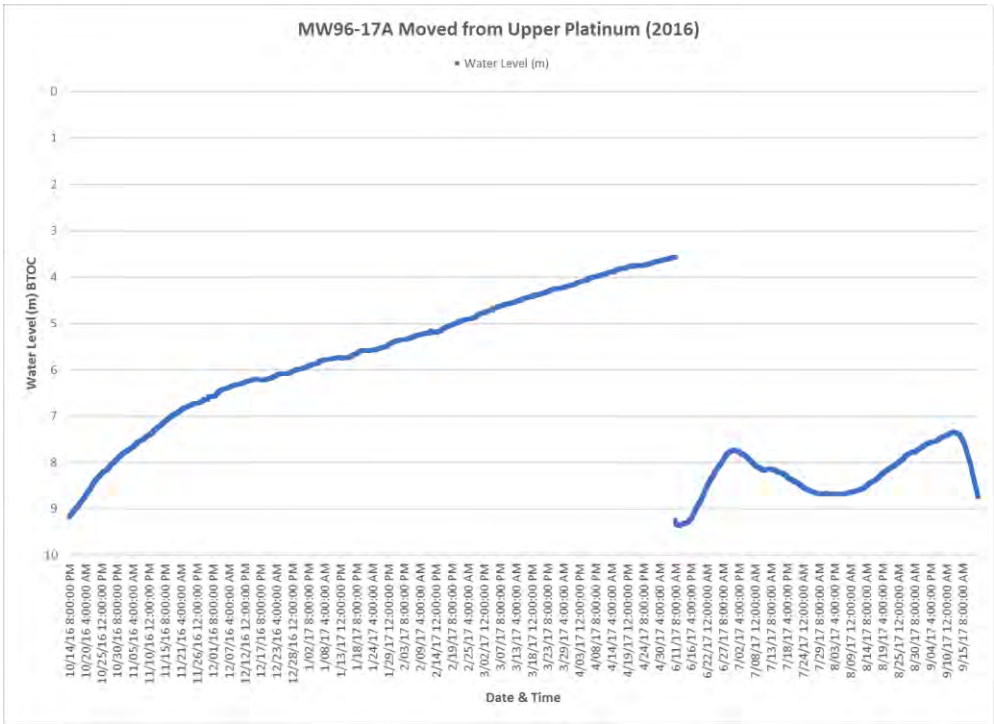


Figure 3.3-14: Groundwater Hydrograph for MW96-19

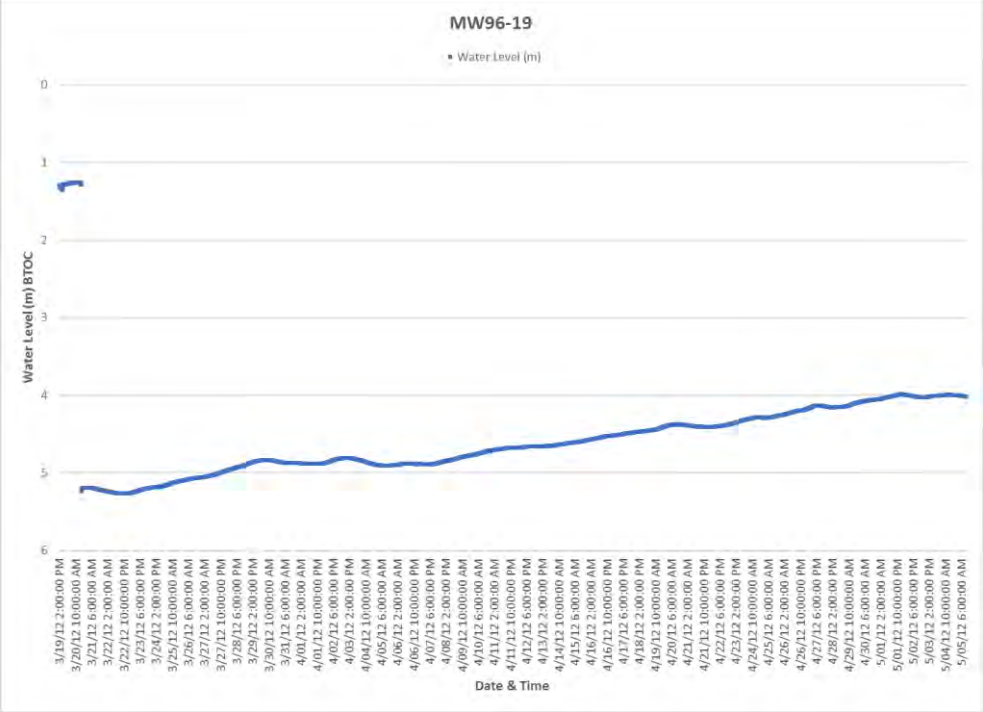
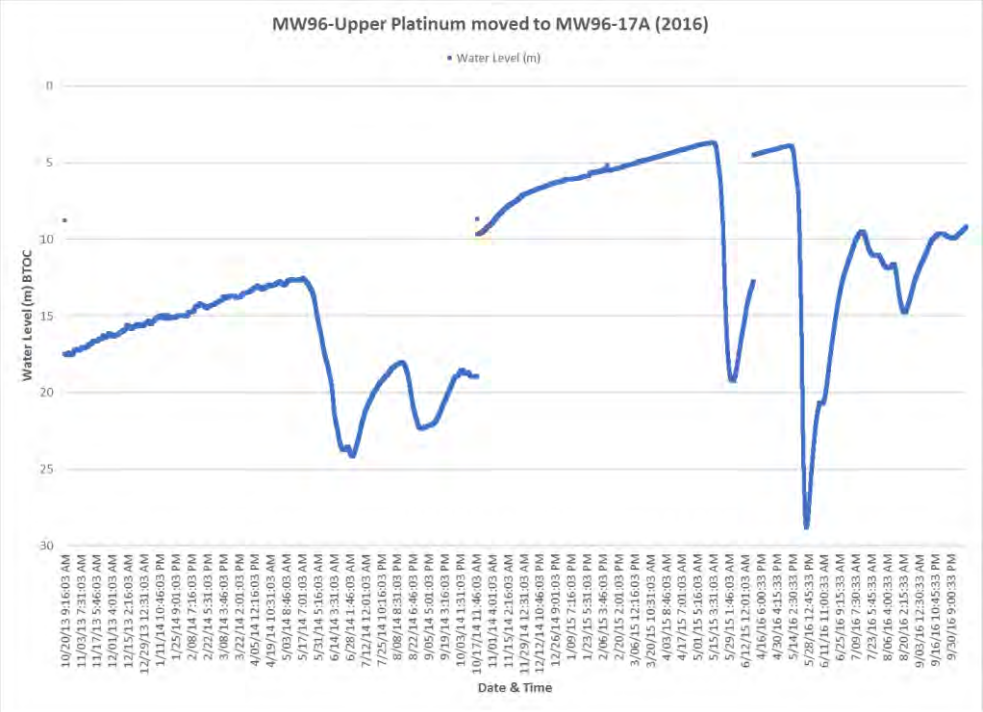


Figure 3.3-15: Groundwater Hydrograph for MW96-Upper Platinum



3.3.2 Groundwater Quality Monitoring

The objectives of the 2017 groundwater quality monitoring program were to monitor Project effects on the quality of groundwater as the Project transitions from baseline conditions through construction and operations. The primary objective of the groundwater quality monitoring once operations has begun is the detection of process solution leakage from the HLF and Events Pond as well as seepage migration of contact water from WRSAs, water management ponds and other infrastructure facilities that may indirectly result in effects on surface water.

The groundwater quality monitoring program is integrated with the groundwater quantity monitoring program and utilizes the wells described in Table 3.3-2. Groundwater quality monitoring results are provided electronically as Appendix F.

To meet quarterly groundwater quality monitoring requirements, six groundwater monitoring wells were sampled between October 9 and 13, 2017. A summary table of groundwater monitoring activity in October is presented in Table 3.3-4.

Table 3.3-4: Groundwater Quality Monitoring 2017

Parameter	MW10-AG6 (mg/L)	MW10-AG3a (mg/L)	BH-BGC11-26 (mg/L)	MW10-DG6 (mg/L)	MW10-OBS1 (mg/L)	MW96-15 (mg/L)	MW96-13a (mg/L)
Fluoride	0.416	0.275	NS	0.28	0.065	0.228	0.418
Arsenic	0.231	0.0832	NS	3.37	0.0649	2.29	0.13
Aluminum	4.72	4.16	NS	1.23	3.69	1.61	0.243
Chromium	0.0107	0.0223	NS	0.00177	0.00611	0.00164	0.00043
Cadmium	0.0000265	0.0000849	NS	0.0000093	0.000109	0.000116	0.0000133
Copper	0.0352	0.109	NS	0.00113	0.0326	0.0268	0.00095
Lead	0.00399	0.00437	NS	0.000619	0.0208	0.00118	0.000388
Mercury	0.000032	0.0000125	NS	0.0000025	0.000068	0.0000125	0.0000025
Iron	11	11.3	NS	13.4	14.5	8.36	0.674
Selenium	0.00148	0.00006	NS	0.000025	0.000515	0.000514	0.000025
Silver	0.00674	0.00397	NS	0.000142	0.00779	0.000334	0.000013
Uranium	0.000861	0.000655	NS	0.00104	0.00115	0.00826	0.00777

NS – Not sampled insufficient water

Of note, wells MW10-AG3b, MW09-DG1, MW96-25, MW96-23, and DH95-151 A/B were previously removed from the groundwater sampling program due to insufficient water or well damage. Replacement wells, as needed, and new wells as required are planned to be drilled and installed in early Q2 2018.

In January 2017, SGC submitted the results of a comprehensive characterization of background groundwater quality based on groundwater quality data collected throughout the project area in 1995, 1996 and from 2009 to 2016 (Core/Watterson Geoscience 2017). The report provided the background parameters present in groundwater at the 95th percentile, in accordance with the Yukon Contaminated Sites Regulation (CSR) Protocol No. 10. Concentrations of fluoride, arsenic, aluminum, chromium, cadmium, copper, lead, mercury, iron, selenium,

silver, and uranium are compiled with previous baseline monitoring results and illustrated in Figures 3.3-16 to 3.3-27.

Figure 3.3-16: Fluoride Concentrations 2009 - 2017

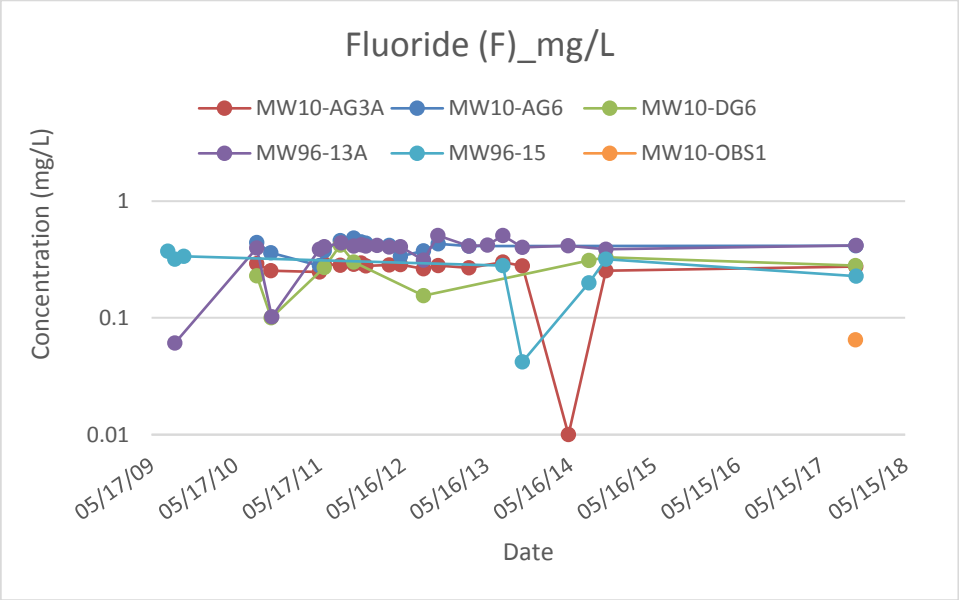


Figure 3.3-17: Arsenic Concentrations 2009 - 2017

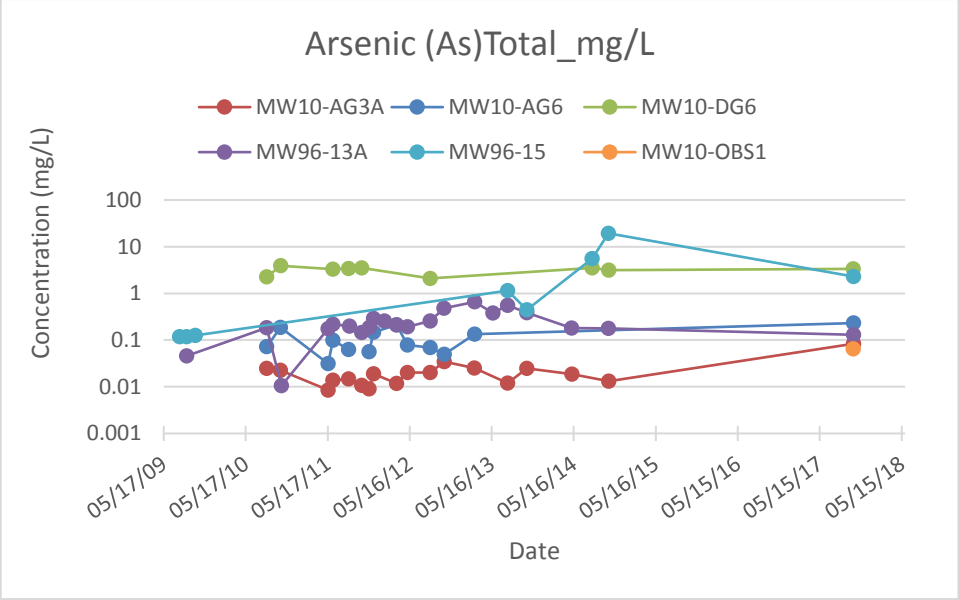


Figure 3.3-18: Aluminum Concentrations 2009 - 2017

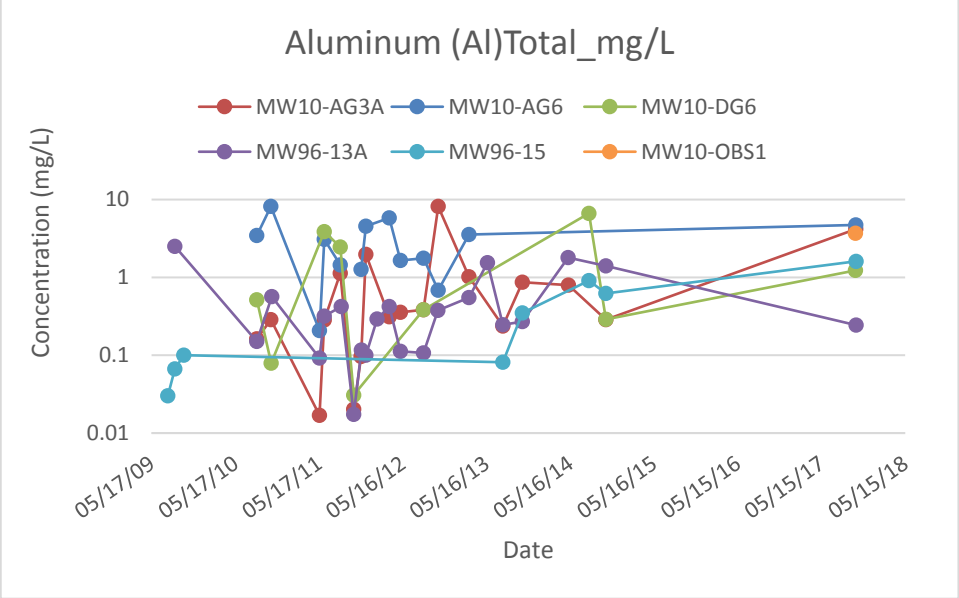


Figure 3.3-19: Chromium Concentrations 2009 - 2017

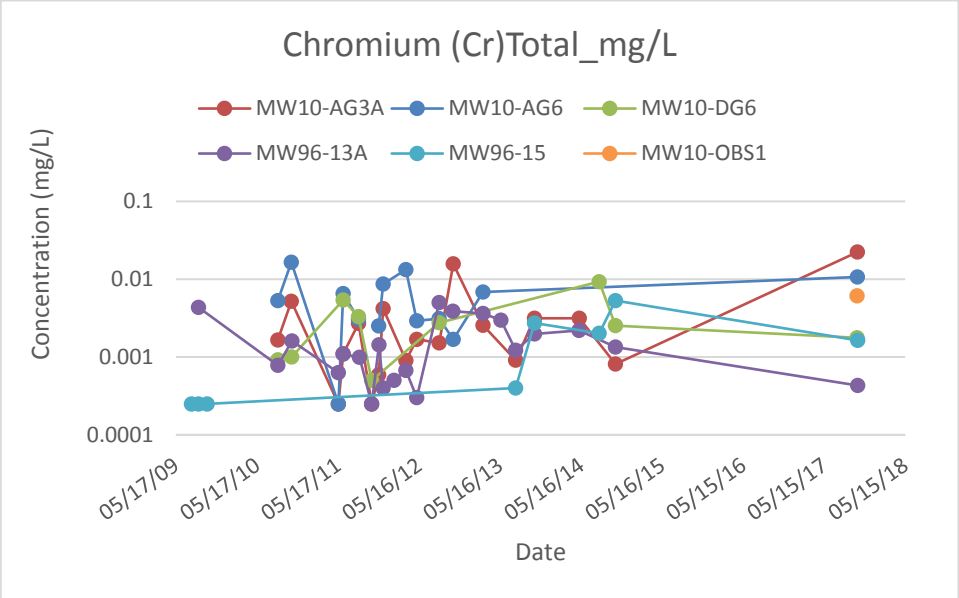


Figure 3.3-20: Cadmium Concentrations 2009 - 2017

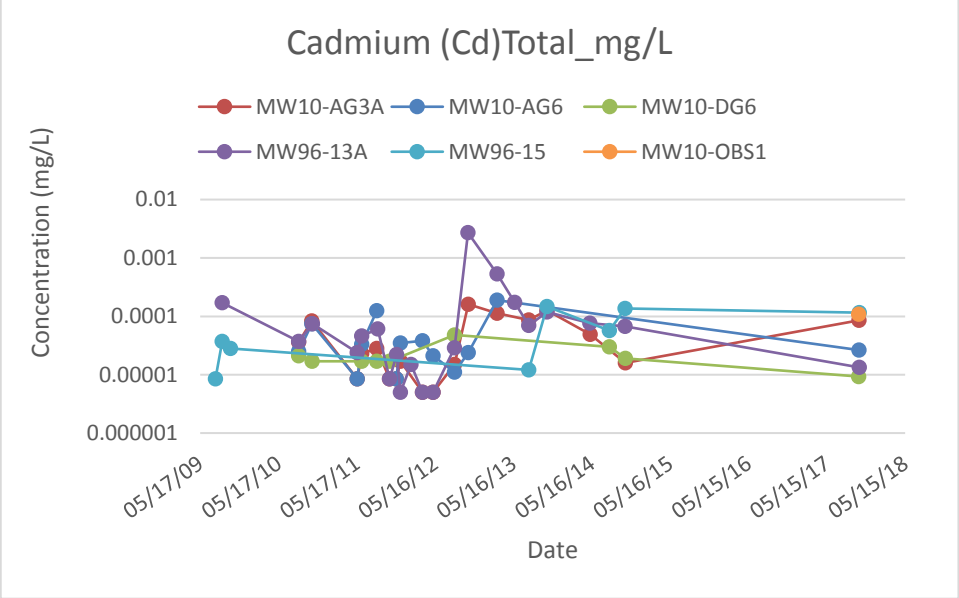


Figure 3.3-21: Copper Concentrations 2009 - 2017

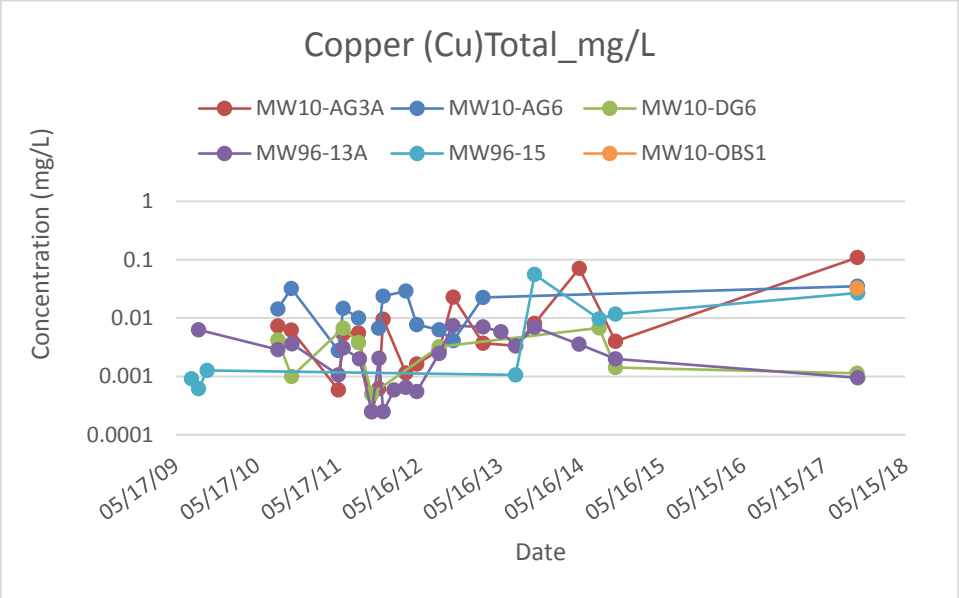


Figure 3.3-22: Lead Concentrations 2009 - 2017

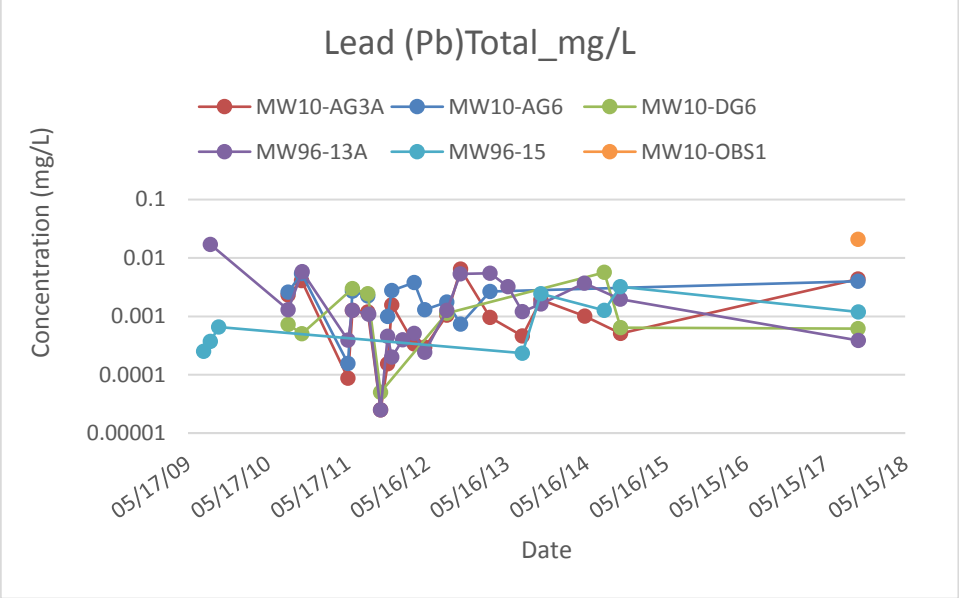


Figure 3.3-23: Mercury Concentrations 2009 - 2017

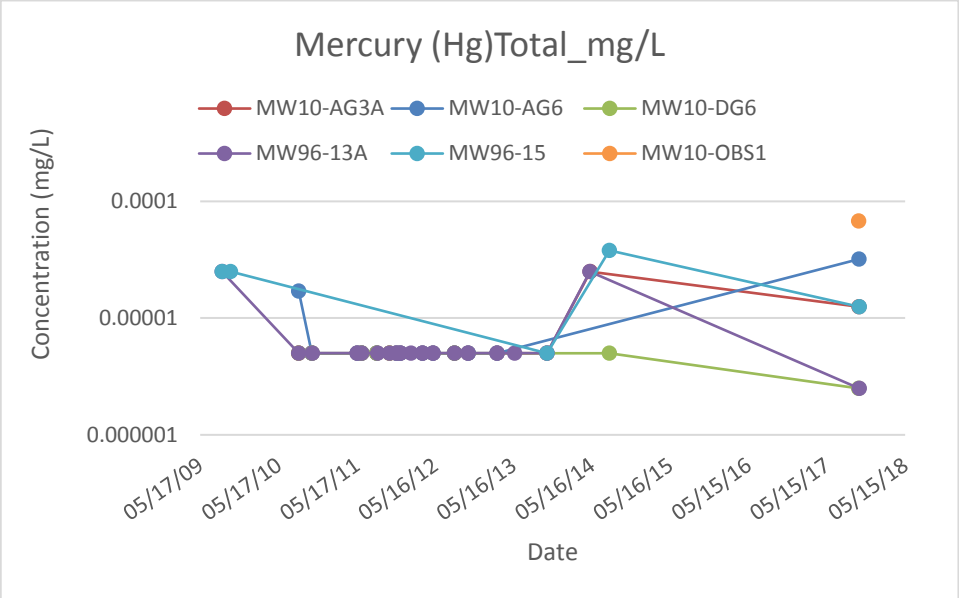


Figure 3.3-24: Iron Concentrations 2009 - 2017

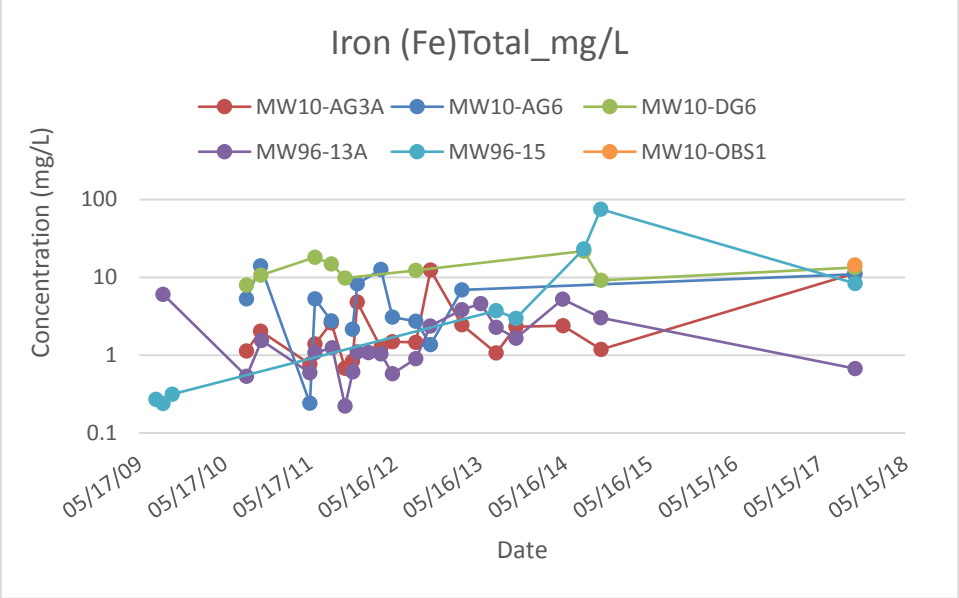


Figure 3.3-25: Selenium Concentrations 2009 - 2017

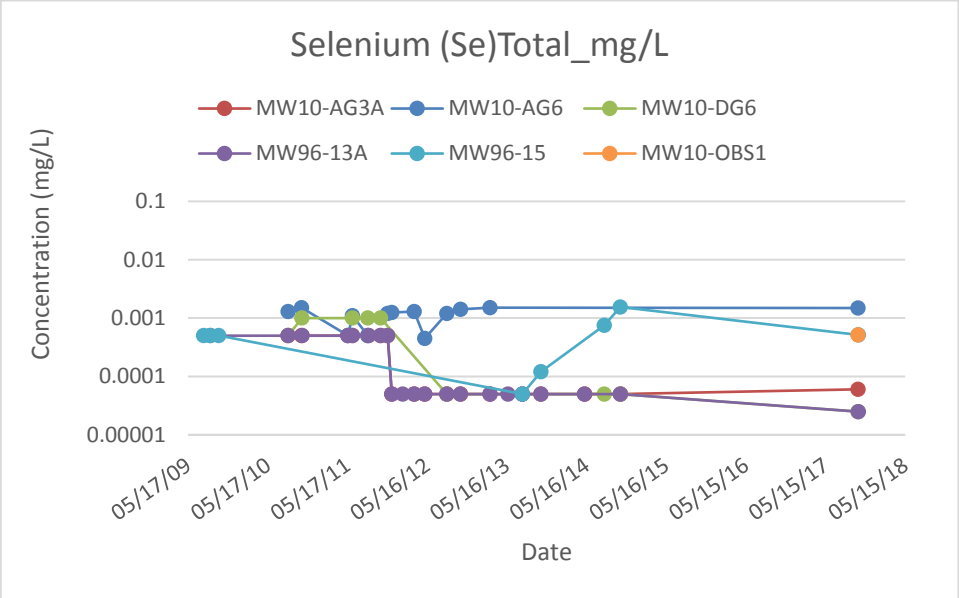


Figure 3.3-26: Silver Concentrations 2009 - 2017

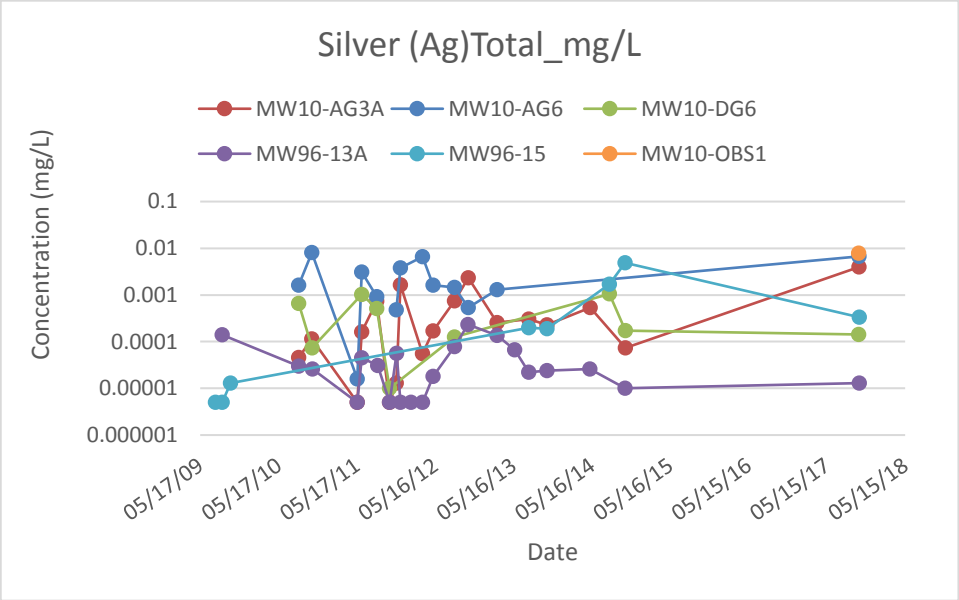
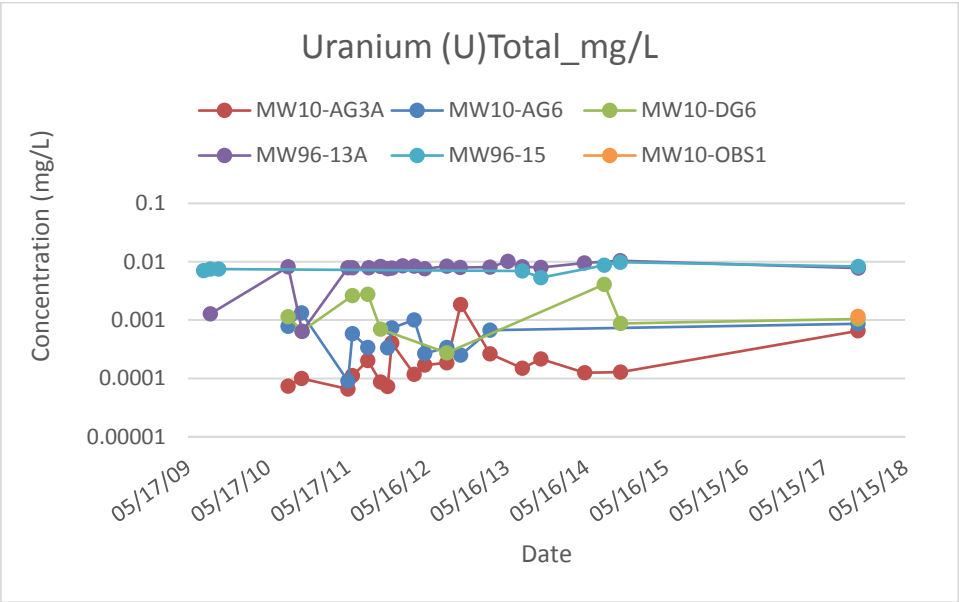


Figure 3.3-27: Uranium Concentrations 2009 - 2017



Although limited data points representing the construction phase are available, well samples analyzed during the development phase appear to have concentrations generally similar or lower to preceding samples. No obvious concentration trends are apparent, indicating minimal impacts from mine site operations to date on groundwater quality.

3.3.3 Site QA/QC Programs

As required by Clause 16 of the Type A WUL QZ14-041 and Schedule D of QML-0011, SGC is required to submit the results and interpretations of the Quality Assurance and Quality Control Program (QA/QC Program) as part of the annual report.

The QA/QC program, developed using recognized QA/QC protocols, is imbedded in the Environmental Monitoring, Surveillance and Adaptive Management Plan (EMSAMP). Components of the QA/QC Program that were implemented during the reporting period are presented in the appended studies.

3.3.4 Adaptive Management

Described groundwater monitoring wells are or will be located in specific areas designed to collect groundwater chemistry data in the areas associated with facilities that will be built and then commissioned for operations. Thus, in practice the monitoring program during construction is designed to maintain a continuous groundwater level and analytical chemistry data record from baseline and into operation and will serve to identify or help characterize any trends prior to operations. As a result, adaptive management thresholds for the construction stages are not required.

3.4 GEOCHEMICAL MONITORING

The geochemical monitoring program is intended to provide on-going characterization of rock encountered during the construction and operation of the Project. The geochemical monitoring program for construction rock has been designed to:

- Assess the potential for metal leaching and acidic drainage from excavated rock to determine if it is suitable for construction material;
- Verify geochemical predictions made during the mine planning phase;
- Assess the level of weathering-driven reaction products and their potential to migrate; and
- Evaluate the effectiveness of measures to prevent and control metal leaching and acidic drainage (if applicable).

3.4.1 Geochemical Barrel Testing

In 2012, a field kinetic test program with eight field barrels (Figure 3.4-1), each containing ~225 kg, was initiated to support the development of water quality predictions that reflects geochemical and hydrogeological processes occurring at the Project. The geochemistry of field bin leachates collected during 2017 (Appendix G) were reviewed by Lorax and the potential effects of the additional data on the source term model were assessed (Appendix H). In summary, it was found that the source term predictions are still valid and do not require updating; however, SGC continues the sampling and analysis of the leachates on a monthly basis from late Spring to early Fall.

Figure 3.4-1: Geochemical Field Barrel Test Site

3.4.2 Site QA/QC Programs

Quality control and quality assurance on geochemistry samples involves a rigorous laboratory test program that includes the use of blanks, control samples, and matrix spikes.

3.4.3 Waste Rock / Acid-Base Accounting

No waste rock was generated during 2017 construction activities.

3.4.1 Construction Material Testing

Four samples were collected on September 7, 2017 from earth-fill material proposed for use in construction of the Lower Dublin South Pond. These samples were sent to ALS Geochemical Laboratory in Whitehorse on September 8, 2017. The four samples were composited into one sample and submitted for Acid Base Accounting (ABA) analyses. Results were received by SGC on November 3, 2017 (Appendix I).

Samples collected on September 7, 2017 were alkaline and had a pH of 8.1. The neutralization ratio of 6.4:1 is greater than 3:1, indicating a non-acid producing material. These results, when considered in conjunction with the

low total sulfur percentage of 0.04%, demonstrate low acid generating potential of construction material sampled and are within the requirements for construction grade rock as defined in the WUL and the QML.

3.5 AQUATIC ENVIRONMENT

This section describes the stream sediment, benthic macroinvertebrate and fish and fish habitat monitoring conducted on the Project site with the initiation of the development phase. Although this monitoring was not required pursuant to the Metals Mines Effluent Regulations (MMER), as the site is not yet subject to those regulations, it serves as additional baseline data for the Project.

3.5.1 Stream Sediment

The stream sediment monitoring program has been designed to provide data on pH and metal levels in the fine fraction of the stream sediments in watercourses of the study area. These parameters are relevant to toxicity and physical habitat requirements for benthos, fish eggs and juvenile fish. The objectives of the sediment monitoring program are to:

- Obtain data on sediment quality that can be used to evaluate changes related to all phases of the Project
- Provide ongoing data to support the refinement of future monitoring programs.

Sediment quality monitoring focuses on the following key Project watersheds:

- Haggart Creek from below the confluence of Fisher Gulch to immediately downstream of the confluence of Lynx Creek;
- Dublin Gulch;
- Lower Eagle Creek; and
- Lynx Creek.

Annual sampling for stream sediment was conducted in September 2017 at sites in Table 3.5-1. Results as compiled by Laberge Environmental Services (LES) are provided in Appendix J. Samples were analyzed for soil pH, total organic carbon and a suite of 32 metals (Table 3.5-2). The triplicate samples at each site were averaged and these data were used for the tables and discussions.

Table 3.5-1: Construction Phase Stream Sediment Quality Monitoring Locations and Frequency

Site	Location Description	Coordinates		Rationale	Frequency Of Sampling
		Northing	Easting		
Haggart Creek Drainage Basin					
W22	Haggart above Dublin Gulch	7101377	458319	Above Project influence	Annual
W4	Haggart below Dublin Gulch	7101223	458144	Below Project influence	Annual
W29	Haggart below Eagle Creek	7099583	458225	Below Project influence	Annual
W5	Haggart above Lynx Creek	7095887	457815	Below Project influence	Annual
W23	Haggart below Lynx Creek	7095682	457790	Below Project influence	Annual

Site	Location Description	Coordinates		Rationale	Frequency Of Sampling
		Northing	Easting		
Dublin Gulch Drainage Basin					
W1	Dublin Gulch above Stewart Gulch	7101545	460249	Above Project influence	Annual
W26	Stewart Gulch	7101443	460331	Above Project influence	Annual
Eagle Creek Drainage Basin					
W27	Eagle Creek	7100997	458235	Below Project influence	Annual
Lynx Creek Drainage Basin					
W6	Lynx Creek above Haggart Creek	7095964	458099	Reference, No Project influence	Annual

The averages of selected metals are also presented in Table 3.5-2, as compiled by in Appendix J. These elements were chosen for closer examination as they can be potentially toxic to aquatic systems, some may be present in the mineral deposit and several have environmental guidelines for the protection of freshwater aquatic life. Since there are no Canadian Environmental Quality Guidelines established for nickel, selenium and silver, the British Columbia Working Sediment Quality Guidelines (BCWSG) were used. Concentrations that exceeded the Interim Sediment Quality Guidelines (ISQG) are displayed in bold and gray highlighted. The ISQG guideline represents where adverse biological effects may only rarely occur. Concentrations that exceeded the Probable Effects Level (PEL) are displayed in bold and highlighted in orange and indicate a 50% incidence of creating adverse biological effects.

Table 3.5-2: Summary of Mean Stream Sediment Concentrations, September 2017

Drainage	Haggart Creek					Dublin Gulch		Eagle Creek	Lynx Creek	CEQG Guidelines	
Site	**W22**	**W4**	**W29**	**W5**	**W23**	**W1**	**W26**	**W27**	**W6**	**ISQG**	**PEL**
pH	7.61	7.68	7.79	7.87	7.27	7.42	7.69	8.49	7.77	na	na
Total Organic Carbon (%)	2.09	0.92	0.45	0.84	1.35	0.56	0.82	0.21	0.92	na	na
Arsenic (mg/kg)	**55.5**	**109.6**	**127.2**	**76.8**	**88.8**	**458.0**	**209.0**	**200.3**	**85.8**	5.9	17
Cadmium (mg/kg)	**0.6**	0.4	0.5	0.3	0.4	0.6	0.5	0.3	**0.9**	0.6	3.5
Chromium (mg/kg)	20.1	20.0	21.8	20.8	20.8	**45.3**	30.8	18.6	21.2	37.3	90
Copper (mg/kg)	20.0	21.4	26.5	23.3	23.3	30.9	20.3	**36.3**	22.0	35.7	197
Lead (mg/kg)	15.9	20.5	**40.3**	24.3	23.3	**47.2**	23.9	32.7	15.4	35	91.3
Mercury (mg/kg)	0.114	0.069	0.069	0.049	0.049	0.052	0.074	0.046	0.039	0.170	0.486
Nickel* (mg/kg)	**31.3**	**28.0**	**31.7**	**26.9**	**25.9**	**57.2**	**28.7**	**31.0**	**27.5**	16	75
Selenium* (mg/kg)	0.37	0.35	0.39	0.27	0.34	0.49	0.54	0.30	0.74	5	na
Silver* (mg/kg)	0.15	0.23	0.25	0.18	0.19	0.43	0.29	0.20	0.14	0.5	na
Zinc	89.7	88.0	106.4	80.0	89.6	**150.3**	92.7	80.5	102.7	123	315

NOTES:
Source: Appendix J
* British Columbia Working Sediment Quality Guidelines
na = not applicable
bold and gray highlight = concentrations that exceeded the Interim Sediment Quality Guidelines
bold and orange highlight = concentrations that exceeded the Probable Effects

The highest concentrations of six of the ten metals examined were reported at W1, upstream of all Project activities on Dublin Gulch. Lynx Creek, W6, also a reference site, had the highest concentrations of cadmium and selenium in the stream sediments. Guidelines were met in the study area for mercury, selenium and silver (Appendix J).

Several guidelines were exceeded for the protection of freshwater aquatic life. The concentration of nickel exceeded the BCWSG low level effect guideline (16 mg/kg) in the stream sediments at all of the sites. Previous studies during the same time period show concentrations of nickel generally exceeded the ISQG throughout the study area (Stantec 2011). The ISQG was exceeded for cadmium at W6 and W22, for chromium at W1, for copper at W27, for lead at W29 and W1, and for zinc at W1.

Arsenic is prevalent in the stream sediments throughout the study area and the PEL for arsenic, 17 mg/kg, was significantly exceeded at all sites.

Arsenic is typically associated with the mineralogy of gold. The high concentrations documented at W1, Dublin Gulch upstream of Project activities, indicate that this stream drains a mineralized area. The standard deviation showed a small spread of values and the coefficient variation (CV) was 17.5% (Section 3.5.1.1) confirming that the arsenic concentrations at W1 are representative of the site. Previous stream sample data collected at the Project site from varying years between 1976 to 2010 (Stantec 2011) show continuously high levels of arsenic at all sites, exceeding the PEL, and with concentrations fluctuating from year to year (Appendix J).

3.5.1.1 QA/QC

In attempts to determine the reliability of the current data set and the heterogeneity of each site, standard deviation (SD) and CV were calculated on the means of the sample triplicates. The target for CV is no more than 20% when replicate samples collected at the same time and location are all at least five times the detection limit. These results are included in technical report (Appendix J). The parameters where CV was 20% or less for all sites were aluminum, barium, calcium, lithium, magnesium, phosphorus, selenium, sodium, strontium, thallium, tin, titanium, uranium and vanadium. The CV was greater than 20% for the remainder of metals at a minimum of at least one site. The higher CVs frequently occurred at the sites W22 and/or W29. This would indicate that the stream sediments at these sites are not homogeneous throughout the stream reach sampled (Appendix J).

A set of duplicate stream sediment samples was collected from W29 and the relative percent difference for all parameters in each sample was less than 25% (see Appendix J, Table A-2). Although there were higher CVs for some parameters at W29, the duplicate sampling shows that each of the triplicate samples was representative of the area within site W29 where it was collected.

3.5.2 Benthic Macroinvertebrates

The objectives of the benthic invertebrate monitoring program are to:

- Characterize community diversity and abundance during the transition from baseline and through construction of the Project;
- Determine variation relative to baseline data; and
- Provide supporting information for fisheries assessments and to comply with future MMER requirements.

Environment Canada recommends that benthic invertebrates be used as the primary indicator organisms for use in monitoring effects on fish habitat (Environment Canada 2012). Annual sampling for benthic invertebrates was conducted in September 2017 and represents the first survey completed during the construction phase of the Project. Benthic samples and water quality samples were collected at sites detailed in Table 3.5-3. Methods and results are provided in Appendix K.

Table 3.5-3: Construction Phase Benthic Invertebrate Monitoring Locations and Frequency

Site	Location Description	Coordinates		Rationale	Frequency of Sampling
		Northing	Easting		
Haggart Creek Drainage Basin					
W22	Haggart above Dublin Gulch	7101377	458319	Above Project influence	Annual
W4	Haggart below Dublin Gulch	7101223	458144	Below Project influence	Annual
W29	Haggart below Eagle Creek	7099583	458225	Below Project influence	Annual
W5	Haggart above Lynx Creek	7095887	457815	Below Project influence	Annual
W23	Haggart below Lynx Creek	7095682	457790	Below Project influence	Annual
Dublin Gulch Drainage Basin					
W1	Dublin Gulch above Stewart Gulch	7101545	460249	Above Project influence	Annual
W26	Stewart Gulch	7101443	460331	Above Project influence	Annual
Eagle Creek Drainage Basin					
W27	Eagle Creek	7100997	458235	Below Project influence	Annual
Lynx Creek Drainage Basin					
W6	Lynx Creek above Haggart Creek	7095964	458099	No Project influence	Annual

The data was subjected to several metrics and indices to describe the benthic populations, according to best management practices applied by the scientific community studying benthic populations (detailed in Appendix K).

Abundance was determined by summing all of the individuals present in a known sample area, the abundance per site was calculated as density (organisms/m^3) to allow comparisons with previous surveys. Taxonomic richness was a measure of diversity where each type of invertebrate is counted per site. The Simpson's Diversity Index was also applied as a measure of diversity which takes into account the number of species present, as well as the relative abundance of each species, and was chosen to allow comparisons to previous surveys. Finally, the Hilsenhoff Biotic Index (HBI) was applied to determine the general water quality at a particular site based on a formula using pre-assigned pollution tolerance scores for benthic families.

The resulting benthic invertebrate data indicated healthy robust populations at each of the sites sampled, with good representation of Ephemeroptera, Plecoptera, Trichoptera throughout. When examined against previous surveys (Stantec 2011) the 2017 habitat conditions have not changed significantly and appear to support healthy benthic populations at all sites. The benthos population documented well represented communities that are typically present in lotic waters

Of note, the healthy communities were documented in an aquatic environment with background concentrations of water quality and stream sediments (Section 3.5.1) showing arsenic levels that exceeded CCME guidelines for the protection of aquatic life and PEL concentrations. The abundant presence of pollution sensitive organisms at

each of the sites suggests that the arsenic concentrations found in the water column and in the stream sediments are not in a bioavailable form.

3.5.3 Fish and Fish Habitat

In accordance with the EMSAMP, fish and fish habitat monitoring were undertaken in 2017 to assess any impacts due to the commencement of construction of the Project. The annual inventory sampling and documenting of fish and fish habitat was conducted in September 2017 at historic background monitoring locations on Ironrust, Haggart, and Lynx Creeks (Table 3.5-4). Detailed results are provided in Appendix L.

Table 3.5-4: Construction Phase Fish and Fish Habitat Monitoring Locations and Frequency

Site	Location Description	Coordinates		Rationale	Frequency of Sampling
		Northing	Easting		
Haggart Creek Drainage Basin					
HC1	Haggart above Lynx Creek	7096518	457967	Above Project influence	Annual
HC2	Haggart below Dublin Gulch	7101152	458085	Below Project influence	Annual
HC3	Haggart above Dublin Gulch	7101584	458427	Above Project influence	Annual
Ironrust Creek Drainage Basin					
IR2	Ironrust Creek above Fisher Gulch	7103153	458005	Above Project influence	Annual
Lynx Creek Drainage Basin					
L1	Lynx Creek above Haggart Creek	7095825	458003	No Project influence	Annual

While all sites shared a similar riffle-pool-run morphology, specific habitat characteristics varied and were dependent on stream gradients that link hydrological processes to substrate materials and channel form (Appendix L). Monitoring locations within the Haggart Creek drainage below Dublin Gulch (HC1 and HC2) displayed historic disturbance indicators related to placer mining activities.

The composition of the catch from this annual study was represented by three fish species that included in decreasing frequency of capture: slimy sculpin (58) Arctic grayling (20) and Chinook salmon juveniles (7) as detailed in Table 3.5-5. All three species have been previously documented in the Haggart Creek watershed (Hallam Knight Piesold 1995, 1996; Madrone 2006; DFO 2010, and Stantec 2010). Other species reported to be present in the watershed but not captured during the current study include round whitefish, burbot, northern pike and Arctic lamprey. These species have been sporadically captured in the past and largely associated with sampling sites in the lower reaches of the watershed.

Table 3.5-5: Construction Phase Fish Capture Methods and Results

Site	Capture Method	Catch			Observed
		Artic Grayling	Chinook Salmon	Slimy Sculpin	
Haggart Creek Drainage Basin					
HC1	Angling	0	0	0	-
	Electrofishing	10	1	7	4 grayling and 2 sculpin
	Minnow trapping	3	1	3	-
HC2	Electrofishing	1	0	10	2 sculpin
	Minnow trapping	0	0	1	-

Site	Capture Method	Catch			Observed
		Artic Grayling	Chinook Salmon	Slimy Sculpin	
HC3	Electrofishing	1	4	5	4 sculpin
	Minnow trapping	0	1	4	-
Ironrust Creek Drainage Basin					
IR2		0	0	2	-
Lynx Creek Drainage Basin					
L1	Angling	0	0	0	-
	Electrofishing	2	0	22	1 grayling, 4 sculpin and fry
	Minnow trapping	3	0	4	-

Biophysical characteristics observed and fish captured at each of the five monitoring sites during September of 2017 were similar to previous surveys. While the absolute number of captured fish varied, the species composition showed consistency and was indicative of a stable fish community. Notable during this project was the capture of several Chinook salmon juveniles (age 0+) in the mainstem of Haggart Creek at monitoring sites HC1 and HC3. Chinook salmon juveniles have not been previously documented at these sites or this far upstream in the Haggart Creek watershed. In the most recent baseline study previous to 2017 (Stantec 2010) Chinook salmon were not captured at any of the Haggart creek mainstem monitoring sites despite four separate sampling occasions.

Fish and fish habitat monitoring to meet MMER guidelines will come into effect once effluent discharge or waste rock storage is occurring.

3.6 METEOROLOGY AND AIR QUALITY MONITORING

3.6.1 Climate Monitoring

Temperature, rainfall, wind speed and direction, relative humidity, barometric pressure and solar radiation all continue to be measured at 15-minute intervals at the Potato Hills and Camp climate stations. Appendix M provides an updated climate baseline report based on all data compiled for the Project. Raw data files for 2017 are provided electronically as Appendix M1.

3.6.2 Air Quality Monitoring

Visual air quality monitoring took place during Phase 1 construction from August 15 to mid October when the surface became continuously frozen or wetted. The goal of the visual monitoring program was to identify areas where fugitive dust emissions from roadways and construction sites was prevalent. Fugitive dust events observed during the reporting period were minor and easily addressed through the application of water in heavy traffic areas.

The air quality monitoring program will be initiated in 2018, prior to the start of major construction activities, with installation of the Beta-Attenuation Particulate Monitors (EBAMs).

3.7 TERRESTRIAL

3.7.1 Vegetation Monitoring Program

The vegetation monitoring program was designed to evaluate changes to vegetation during Project activities. The objectives of the vegetation monitoring program include:

- To measure plant metal uptake during construction,
- Establish monitoring sites that will be monitored during future activities, and
- Help identify whether any trends in metal uptake could be attributed to site activities.

Vegetation monitoring plots will be established and sampled in summer 2018 in accordance with the EMSAMP.

3.7.2 Soils

The soils monitoring is designed to provide data to determine changes to metal and nutrient levels in soils adjacent to the Project as a results of dust deposition. Soil sampling locations will be established in conjunction with the permanent vegetation monitoring plots in summer 2018.

3.7.3 Wildlife

2017 construction activities, with the exception of mobilization, were conducted outside of the breeding bird window (early May to late August). No wildlife habitat features (e.g., mineral licks, dens, nest trees, snags, rocky outcrops, small ponds/seepages) were identified in work areas. Wildlife Protection Plan procedures and monitoring were implemented during 2017 construction, including site orientation and bear awareness, and company policies training; and implementation of wildlife observation and incident reporting program.

3.7.3.1 Wildlife Observations

As standard procedure, SGC requires all field staff to follow the requirements of the Wildlife Records Program which involves reporting wildlife observations, incidents, and interactions. Wildlife observations at the Project during the period of this report are presented in Appendix N. Section 3.7.3.2 describes the one significant wildlife incident that occurred during the reporting period

3.7.3.2 Wildlife Incidents

On July 18, 2017 a black bear was observed three times throughout the day walking around the waste management area, tents, and later near the core shack. The bear was in close proximity to SGC employees and contractors who fired bear bangers; however, the deterrents only proved effective for driving the animal away from the area for short periods of time. SGC contacted the local Conservation Officer to resolve the issue and ensure the safety of staff and contractors at site. The Conservation Officer trapped and removed the animal from the Project site without further incident. Subsequent to this issue, site staff conducted additional inspections of the waste management area to confirm that the electrical exclusion fence was sufficiently charged and that all waste that could act as an attractant to wildlife was stored in bear proof containers. The inspections confirmed that StrataGold staff had been following established protocols and no additional actions were necessary.

During the construction phase of the Project, there were no wildlife-traffic or access incidents reported. Wildlife observations, including those made along the access roads, are provided in Appendix N.

3.8 NOISE

3.8.1 Sounds Levels Related to Blasting

No blasting activities took place during the 2017 reporting period.

3.9 SPILLS AND ACCIDENTS

3.9.1 Spill Contingency Plan Review

An update to the Spill Contingency Plan is required as part of the Annual Report in accordance with Paragraph 2.5 of Schedule C, Part 2 of QML-0011. SGC has reviewed and updated the Spill Contingency Plan (provided in Appendix O). Updates completed include an:

- Updated site general arrangement (Figure 2.4-1 Storage Areas for Hazardous Materials) and confirmed solid waste handling and special waste storage areas
- Updated site general arrangement (Figure 3.1-1 Planned Location of Spill Response Equipment) and confirmed location of spill response equipment.
- Updated Table 3.1-1 (Inventory of Spill Response Equipment Planned for the Project) to account for refinements to the site general arrangement
- Added Appendix E, Material Safety Data Sheets to reflect the materials SGC anticipates at the Project Site and ensure accessibility of the material safety data sheets.

3.9.2 Spill Summary

During the period of this report, three reportable spills (Table 3.9-1) and 14 non-reportable spills (Table 3.9-2) occurred at the Project site.

Table 3.9-1: Reportable Spills

Date	Volume (L)	Substance	Cause and Remediation Measures Taken
14-Sep-17	~12 L	Septic	Expansion of a drainage pipe caused a break in the joint resulting in the release of a small volume of grey/black water. The spill was reported to the Spill Hotline. Soils and the spilled material was collected and disposed of in the area where the expanded septic field was under construction as discussed with Yukon Government representatives. YG Environmental Health requested that a mixture of ¾ cup of bleach be mixed with 4 liters of water and poured over the spill area. Expansion joints are now being installed such that they allow for expansion/contraction without damage due to the effects of changing temperature.

Date	Volume (L)	Substance	Cause and Remediation Measures Taken
03-Oct-17	~1 L	Septic	A vacuum truck gasket leak occurred adjacent to the existing septic field. The spill was reported the Spill Hotline. Soils removed and area (50 cm x 20 cm) treated with bleach solution.
28-Oct-17	~20 L	Septic	A septic line broke at lift station due to tension/stress on line when moved inadvertently at the Eagle Gold Camp. The spill was reported the Spill Hotline. The material was contained within a natural depression off lift station location. The vacuum truck was used to collect spilled liquid and discharged into current receiving septic field. Bleach solution (1:4) was applied to impacted area. The repaired hose was reconfigured to minimize strain on hose. This lift station will no longer be utilized when the expanded septic field is activated.

Spills described in Table 3.9-1 were reported to the Yukon Spill Report Line as required by the *Spills Regulations* of the *Yukon Environment Act* and recovery efforts were undertaken on the site.

Table 3.9-2 Non-Reportable Spills

Date	Volume (L)	Substance	Cause and Remediation Measures Taken
11-Sep-17	15-minute leak	Propane	New propane tank (300lb Pig) being fitted by gas fitter who noticed leak originating from site gauge. Tank immediately shut off when leak noticed; taken offsite to be replaced
12-Sep-17	~ 0.25 L	Hydraulic	Loose hose fitting. Spill pad placed under hose fitting while fitting was repaired. Spill pad used to clean up remaining oil on ground, pad bagged and placed in waste management area
14-Sep-17	~ 2 L	Hydraulic	O-ring failure on 7401 CAT HT. Spill pads laid under equipment leak, ground under pads shoveled into bin.
14-Sep-17	~ 5 L	Hydraulic	Loose bracket caused o-ring to fail on hydraulic line. Spill pads laid underground, ground under pads shoveled into machine bucket, spill tray used during mechanical repair.
01-Oct-17	~ 0.3 L	Hydraulic	Hydraulic machine leak. Cleaned with spill pad, pad taken to disposal area
10-Oct-17	~ 0.25 L	Engine Oil	Leaking vehicle. Spill pad applied to remove access oil
12-Oct-17	~ 0.1 L	Engine Oil	Leaking vehicle. Spill pad applied to remove access oil
13-Oct-17	~ 0.5 L	Engine Oil	Leaking vehicle. Spill pad applied to remove access oil
14-Oct-17	~ 5 L	Hydraulic	Excavator 375-1 malfunction - leak under machine while stationary. Excavator moved to access contaminated soils, spill tray placed under machine, excavator tagged out, contaminated soils shovelled into bucket, delivered to hazardous waste area.
15-Oct-17	~ 0.25 L	Engine Oil	Leaking vehicle. Spill pad applied to remove access oil.

Date	Volume (L)	Substance	Cause and Remediation Measures Taken
			Multiple leaks from same machine - announced at daily contractor meeting and requested that all toolboxes the following day discuss the leaking vehicle and inspections are conducted. Leaking vehicle identified and locked out. Leak resulted from faulty oil filter gasket.
18-Oct-17	<1 L	Hydraulic	Failed seal. Spill tray used, maintenance crew reminded of need to use spill trays under equipment
30-Oct-17	~ 0.5 L	Hydraulic	Hydraulic hose failure on Hitachi 350 Excavator Unit #729. Spill quantity to ground mitigated with absorbent pad and drip tray placed below leak; contaminated soils collected and stored at Cobalt lower laydown
06-Nov-17	~ 15 L	Engine Oil	Truck struck a rock or frozen soil, tearing off oil filter, and releasing approximately 15 L of crank case oil. Truck was immediately parked in place. Spill pads were placed over spilled oil and oil was partially cleaned up. The following morning the truck was repaired in the field and moved so the remainder of oil could be cleaned up.
24-Nov-17	~ 20 L	Hydraulic	Broken stick cylinder on machine. Equipment was shut down and locked out while contaminated snow and materials were collected and disposed of in hazardous material storage area.

3.10 TRAFFIC AND ACCESS, UPCOMING MAINTENANCE

3.10.1 Level of Traffic

From Mayo, access to the Project site is along approximately 85 km of existing paved and gravel roads. Roads from Mayo to the site include the Silver Trail (Highway 11) and via the existing South McQuesten Road and the Haggart Creek Road. All but the Haggart Creek Road are government-maintained roads. During the period between January and August 2017, Project traffic levels were extremely low and consisted of pick-up trucks used during ongoing fieldwork. Traffic levels increased between August and December 2017 and consisted of construction-related vehicles. One-way trips along the access roads are estimated at approximately 511 heavy vehicle trips and approximately 282 light vehicle trips.

3.10.2 Access Control Issues

No access control issues were experienced during the period of this report.

3.10.3 Incidents

In 2017, the Project experienced, two minor incidents along the access roads. Neither incident resulted in injury, lost time or environmental damage, however minor property damage occurred.

On August 11, a contractor was hauling equipment to the Project site with a Kenworth truck and a lowbed trailer. The truck lined up to the running deck of the Haldane Bridge (located on the South McQuesten Road) but, due to the tight geometry of the crossing, the trailer tracked to the right side and damaged cross timbers and contacted the guardrail. The load and configuration were permitted for this roadway and it was determined that there was

inadequate signage on the bridge deck. Under the supervision of the Department and Highways and Public Works contractors, repairs were made and all operators have been made aware of the approach. No further incidents have been reported at this location.

On September 11, a contractor's gravel truck was travelling to the site and migrated too close to the edge of the road, which was extremely soft due to rainfall, and the vehicle slid into the drainage ditch. The site was assessed for any evidence of hydrocarbon release and, once it was determined that there had been no impact to the integrity of any fuel containment, the truck was hauled out of the ditch without further incident.

In order to respond to incidents on site and along the access roads, the Project maintains a current Emergency Response Plan supported by a complement of emergency response personnel trained and certified in advanced first aid, firefighting and mine rescue along with equipment required for all response types. In addition, reporting and investigation of incidents is standard practice at the site.

During the reporting period, there were no wildlife-traffic or access incidents reported. Wildlife observations, including those made along the access roads, are included in Appendix N.

3.10.4 Planned Access Road Work

To ensure the safety of visitors, employees and contractors to the site through 2018, SGC plans on conducting routine snow clearing from the Silver Trail to the Dublin Gulch camp; conducting routine maintenance along Haggart Creek Road (e.g., maintaining culverts and ditches, repairing pot holes, etc.); and replacing the culvert at Swede Creek (Km 32+650) with a larger, 3 m diameter, 27 m long corrugated steel pipe to safely convey the 1:100-year flood event.

Ongoing maintenance and roadway improvements will be in accordance with SGC's current Work within a Right of Way Permit U0081 issued by HPW and Land Use Permit 2017-F775 issued by Yukon Energy, Mines and Resources. The replacement of the Swede Creek culvert, will be in accordance with Water Use Licence MS17-089 and Fisheries and Oceans Canada best management practices.

SGC has also engaged the Department of Highways and Public Works to determine if upgrades can be made to the Haldane Bridge to ensure ongoing safe travel to the Project.

3.11 WATER MANAGEMENT AND SEDIMENT AND EROSION CONTROL

During the reporting period, a number of earthworks and other related construction activities were supported by the construction and installation of sediment and erosion control measures. Steps taken were largely determined by Section 6.2 of the Project's *Construction and Operations Water Management Plan*, and included:

- Limiting the footprint of newly disturbed areas wherever possible;
- Daily monitoring of construction activities by environmental department staff and EPCM contractors, with a focus on recently disturbed sites following precipitation events;
- Installation of roadside ditching and silt fencing where appropriate (Figure 3.11-1); and
- Construction of temporary water conveyance structures, sediment basins, and exfiltration sumps (Figure 3.11-2 and 3.11-3).

Figure 3.11-1: Silt Fence Downgradient of HLF Embankment

Figure 3.11-2: Temporary HLF Runoff and Exfiltration Basin

Figure 3.11-4: Temporary Exfiltration Sump

4. PHYSICAL MONITORING

All construction activities undertaken to date have been under the observation of the engineer of record for each facility or an appropriately qualified designate in their absence from site. Relevant sign off for each construction area are provided in Appendix B for each facility.

4.1 ENGINEER'S PHYSICAL STABILITY ANNUAL INSPECTION

Based on the scope of construction works completed prior to the due date specified in QML-0011 for the annual inspection of the physical stability of engineered structures, works and installation (October 1st), StrataGold requested that this requirement be deferred to 2018. The request to defer the inspection for 2017 was approved by the Department of Energy, Mines and Resources on September 18, 2017.

4.2 PERMAFROST

Permafrost monitoring during the reporting period consisted of visual site inspections, subsurface temperature monitoring via thermistors, and inferring subsurface temperatures through surface water quality monitoring.

Construction activities in late September exposed two small areas of permafrost on the crusher access road and within the HLF 2017 preparation limits. A minimal amount of surface runoff occurred at each site and was managed by the installation of silt fencing and ditching. As colder temperatures persisted into October, runoff gradually subsided until flow was no longer observable.

In accordance with the permafrost monitoring schedule with respect to quarterly thermistor visits, all 13 thermistor monitoring locations were visited in September. Data is summarized in Table 4.2-1. In October, two thermistor strings (BH-BGC11-57 and BH-BGC11-58) were decommissioned (Table 4.2-2) due to construction activities along the crusher road. Ground temperatures were recorded at two thermistors, BH-BGC11-44 and BH-BGC11-51, on November 16, 2017 (Table 4.2-3).

Table 4.2-1: Summary of Ground Temperature Monitoring - September

Thermistor	Date	Downhole Temperatures ºC								Notes
	(dd/mm/yy)	1	2	3	4	5	6	7	8	
DH-BGC09-AG-3	09/20/17	NR								Damaged, removed from monitoring program
DH-BGC09-STU-3	10/07/17	7.1	6.8	0.7	2.8	-0.4	-0.1			
DH-BGC09-STU-4	09/20/17	6.8	5.4	4.0	NR	0.0	0.0	-0.1		
BH-BGC10-7	09/20/17	8.0	8.8	8.3	5.9	1.4	0.0			
BH-BGC11-42	09/20/17	4.3	4.8	3.6	2.5	0.1	-0.1	-0.2	-0.1	
BH-BGC11-44	09/20/17	11.7	5.7	5.4	4.8	3.0	0.9	0.0	-0.1	
BH-BGC11-51	09/20/17	14.7	10.9	8.6	9.0	2.6	0.5	0.1	-0.2	
BH-BGC11-57	09/20/17	19.1	7.2	NR	NR	2.6	0.3	-0.1	0.0	
BH-BGC11-58	09/20/17	20.8	13.6	3.6	2.1	0.1	-0.2	-0.3	-0.3	
BH-BGC11-63	09/20/17	8.0	2.5	1.0	-0.1	-0.5	-0.2	-0.2	0.0	

Thermistor	Date	Downhole Temperatures ºC								Notes
	(dd/mm/yy)	1	2	3	4	5	6	7	8	
BH-BGC12-80	09/20/17									Damaged, removed from monitoring program
BH-BGC12-81	09/20/17	NR	3.8	2.3	1.6	0.3	-0.2	-0.3	-0.4	PVC frost jacked ~ 30 cm above casing monument
BH-BGC12-83	09/20/17									Thermistor lost, removed from monitoring program

Table 4.2-2: Summary of Ground Temperature Monitoring - October

Thermistor	Date (dd/mm/yy)	Temperature ºC								Notes
		1	2	3	4	5	6	7	8	
BH-BGC11-57	08/10/17	0.1	1.9	NR	NR	2.1	0.4	-0.1	0.0	Thermistor decommissioned
BH-BGC11-58	08/10/17	-1.1	0.1	1.7	1.0	0.1	-0.2	-0.3	-0.3	Thermistor decommissioned

NR – no results available; data not recordable due to bead instability

Table 4.2-3: Summary of Ground Temperature Monitoring - November

Thermistor	Date	Temperature ºC								Notes
	(dd/mm/yy)	1	2	3	4	5	6	7	8	
BH-BGC11-44	16/11/17	-3.6	-0.8	0.4	0.7	1.3	1.1	0.1	-0.2	Good condition
BH-BGC11-51	16/11/17	1.4	-3.4	0.3	1.9	2.8	0.4	-0.1	-0.2	Good condition

NR – no results available; data not recordable due to bead instability

4.3 OPEN PIT

No open pit development activities took place in 2017.

4.4 MATERIAL STORAGE AND STOCKPILE MANAGEMENT AREAS

No construction or development work on the Waste Rock Storage Areas (WRSAs) or the Ice-Rich Overburden Storage Area (IROSA) was completed in 2017. However, preliminary work was completed on Topsoil Stockpile A and B, as well as on temporary Topsoil Stockpiles D and E during the month of September (Table 4.4-1).

Once constructed, topsoil stockpiles were monitored daily by the environmental department staff and contractors for stability and erosion management. No concerns were noted during the daily inspections.

Table 4.4-1: 2017 Topsoil Stockpile Development

Stockpile ID	Description of Activities	2017 Storage Volume (m^3)
A	Grubbing	0
B	Grubbing, stockpiling	18,686
C	No construction activity	0
D	Grubbing, stockpiling	6,000
E	Grubbing, stockpiling	4,000

4.5 HEAP LEACH AND PROCESS FACILITIES

As detailed in Section 2.1, above, in preparation for approval of construction works related to the HLF, a program consisting of clearing, grubbing, grading and excavation to Type 3 bedrock in the area of the HLF embankment was undertaken in 2017. No heap leach facility construction or operation took place in 2017.

5. CYANIDE MANAGEMENT

No cyanide-related transport, storage, handling, use or disposal, was conducted in 2017.

6. RECLAMATION & CLOSURE

SGC submitted an updated Reclamation and Closure Plan (RCP) for review and approval as required by Section 7.2 of QML-0011 and Clause 171 of QZ14-041 in November 2016.

The updated RCP included a refined reclamation cost estimates to satisfy Clauses 191 to 193 of QZ14-041. At the time of preparing this annual report, the review and approval of the RCP pursuant to QZ11-041 was ongoing however version 2016-01 of the RCP has been approved under QML-0011 subject to conditions identified in that license.

Through 2017, SGC has continued to update the RCP in response to the review and approval process under QZ14-041 and to reflect final detailed design of mine site infrastructure.

6.1 RECLAMATION RESEARCH

SGC has continued a component of the research programs to support closure and reclamation measures. Laberge Environmental Services has been conducting vegetation trials at the Peso Mineral Exploration Site located on claims held by SGC but independent of the Project site, which continue to be monitored. The objective of the revegetation program is to test the viability of incorporating biochar and other soil amendments into the Project with the goal of refining and improving the reclamation and revegetation plan. Results from ongoing monitoring of the revegetation trials are presented in Appendix P.

Further work with reclamation experts has been ongoing with respect to the design and timing for reclamation research programs for onsite passive treatment systems and closure covers and the most recent information will be included in the next update to the RCP.

7. SOCIO-ECONOMIC MONITORING

Victoria Gold Corp. (VGC) and the First Nation of Nacho Nyäk Dun (FNNND) signed a Comprehensive Cooperation and Benefits Agreement (CBA) on October 17, 2011 that applies to Project development and exploration activities conducted by VGC anywhere in FNNND Traditional Territory located south of the Wernecke Mountains.

The objectives of the CBA are to:

- Promote effective and efficient communication between VGC and the FNNND in order to foster the development of a cooperative and respectful relationship and FNNND support of VGC's exploration activities and the Project.
- Provide business and employment opportunities, related to the Project, to the FNNND and its citizens and businesses in order to promote their economic self-reliance.
- Establish a role for the FNNND in the environmental monitoring of the Project and the promotion of environmental stewardship.
- Set out financial provisions to enable the FNNND to participate in the opportunities and benefits related to the Project.
- Establish a forum for VGC and the FNNND to discuss matters related to the Project and resolve issues related to implementation of the CBA.

Consultation with FNNND as required by the CBA has been ongoing during 2017. An annual CBA report will be published in April of 2018 reflecting the socio-economic progress and updates between VIT and FNNND throughout 2017.

8. REFERENCES

DFO (Fisheries and Oceans Canada). 2010. Yukon Fisheries Information Summary System (FISS). Available at: http://habitat.rhq.pac.dfo-mpo.gc.ca/fiss/dcf01.cfm Accessed: March 2010.

Environment Canada. 2012. Metal Mining Guidance Document for Aquatics Effects Monitoring.

Hallam Knight Piésold Ltd. 1995. Dublin Gulch Project, Preliminary Baseline Fisheries Study Proposal. Prepared for Department of Fisheries and Oceans Canada. 8 pp.

Hallam Knight Piésold Ltd. 1996. New Millennium Mining Ltd., Dublin Gulch Project, 1996 Fisheries Survey. Prepared for Department of Fisheries and Oceans Canada. 12 pp.

JDS Energy and Mining Inc. (JDS). 2016. NI 43-101 Feasibility Study Technical Report for the Eagle Project, Yukon Territory, Canada. Prepared for Victoria Gold Corp., published September 12, 2016: Vancouver, BC.

Knight Piésold Ltd. 2013. *Hydrology Baseline Data Summary*. Prepared for Victoria Gold Corp. published August 30, 2013: Vancouver, BC.

Lorax Environmental. 2014. *Eagle Gold Hydrology Baseline Report*. Prepared for Victoria Gold Corp. published December 15, 2016.

Lorax Environmental. 2016. *Eagle Gold Hydrology Baseline Report*. Prepared for Victoria Gold Corp. published December 15, 2016.

Madrone Environmental Services Ltd. 2006. Dublin Gulch Project Gap Analysis: Environmental Baseline Information. Prepared for Strata Gold Corporation. 32 pp.

Stantec Consulting Ltd. 2010. Eagle Gold Project: Environmental Baseline Report – Fish and Fish Habitat. Prepared for Victoria Gold Corporation, Vancouver, BC.

Stantec Consulting Ltd. 2012. *Environmental Baseline Data Report: Hydrology 2011 Update*. Prepared for Victoria Gold Corp. published June 2012: Burnaby, BC.

Stantec Consulting Ltd. 2011. Baseline Environmental Report: Water Quality and Aquatic Biota. Prepared for Victoria Gold Corp. Project # 1231-10377.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A

Assessment, Licence and Permit Requirements for Annual Reporting

THIS PAGE INTENTIONALLY LEFT BLANK

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
QZ14-041	8		The Licensee shall apply the relevant procedures in the Spill Contingency Plan. The Licensee shall review the Spill Contingency Plan annually and shall provide a summary of that review, including any revisions to the plan, as a component of the annual report	Section 3.8
QZ14-041	10		The Licensee shall include a summary of all spills or unauthorized discharges that occurred during the year reported, as part of the annual report	Section 3.8
QZ14-041	16		The Licensee shall submit an Annual Report to the Board not later than March 31 of each year starting in 2017. The reporting period for the Annual Reports shall be from the effective date of this licence until December 31, 2016 for the first report, and from January I to December 31 of each year for all subsequent reports. The report shall include the information required by the Regulation, but not necessarily limited to:	All
QZ14-041	16	a	A description of the water use and waste deposition carried out during the year reported including but not limited to: i. detailed data on the volume of water (including measurements) collected at, conveyed through, transferred between, or released to the environment from the Engineered Structures and any water source used by the project (groundwater wells, water courses); ii. variation of the water volume inventories in water storage facilities (HLF, water storage ponds, sediment control ponds); iii. records of fluid management within the HLF including irrigation completed, process water recovered, any leakage into the leakage detection and recovery system (LDRS), quality and quantity of water collected within the foundation drainage systems, variation of fluid levels in the in heap pond, and records of any water accumulation in or discharge to the Events Pond;	n/a
QZ14-041	16	b	An annual construction report for each Engineered Structure built or modified in the reporting year;	n/a
QZ14-041	16	c	A summary report, reviewed and stamped by a Professional Engineer, on the performance	n/a

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
			of Engineered Structures in service during the reporting year including but not limited to: i. Any operational deficiencies or failures to achieve operational requirements; ii. records of any leakage into the LDRS of the HLF; iii. a detailed record of any major maintenance work carried out including but not limited to; 1. any work required to physically stabilize structures; 2. reporting on ice or snow accumulation and removal conducted within water conveyance channels; 3. reporting on sediment removal from sediment control ponds or water management ponds; 4. repair of any damaged liner or armouring materials; and 5. repair or replacement of any damaged or faulty monitoring or control instrumentation or equipment; iv. Plans to conduct major maintenance work for the following year; v. Status report on any backup equipment and supplies for emergency management of the HLF (generators, pumps, fuel caches. etc.) including records of exercising such equipment;	
QZ14-041	16	d	A summary of mining and production activities concluded in the reporting year including but not limited to: i. the mass/volume of excavation from the Eagle Zone Pit; ii. the mass/volume and nature of materials placed in WRSA's including location of any overburden placed in WRSA's; iii. the monthly mass/volume of ore in storage in the 100 day ore stockpile; iv. the mass/volume and end of year configuration of ore lifts placed in HLF with the identification of any	n/a, see Section 2.0

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
			final benches or slopes as may have been achieved during the year; v. records on the management of excavated overburden including ice rich overburden; vi. records of ore properties for ore placed on the heap (summary of gradation and other characteristic properties as may be collected) and records of any of agglomeration conducted; vii. report on metallurgical performance of the FILE; viii. analysis of whether Mine Plan activities completed in the reporting year are consistent with the Mine Plan and analysis of the effect of any deviations from the plan including but not limited to: 1. changes to the pit excavation designs (slopes, volumes) and indication of whether a change to the expected volume of waste rock to be removed has been identified: 2. changes to construction of WRSAs; 3. deviations in production rates for mining and processing of ore: 4. changes to heap loading, ore density and porosity, and irrigation schedules;	
QZ14-041		e	Records of monitoring conducted as part of the EMSAMP including but not limited to: i. summaries of all data generated as a result of the monitoring requirements of this licence: ii. analysis and interpretation of collected data by a qualified individual or firm and a discussion of any variances from baseline conditions, from the previous years' data, or from expected performance, or variances from expected conditions; iii. results and interpretations of QA/QC Programs completed as part of monitoring or part of construction;	Section 3.0
QZ14-041		f	Reporting on monitoring according to Cyanide Management Plan;	n/a, see Section 3 .7

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
QZ14-041		g	A description of reclamation or reclamation research activities carried out during the year and commentary on whether the annual activities are consistent with the schedule of the RCP; and	Section 5.0
QZ14-041		h	Any other reports which are required by this licence	All
QZ14-041	17		The Licensee shall provide to the Board one unbound, single-sided, paper copy of all reports required by this licence. All reports must be reproducible by standard photocopier.	All
QZ14-041	18		The Licensee shall upload electronic copies of all reports required by this licence to the Yukon Water Board's online licensing registry, Waterline. Electronic copies shall be submitted in one of the following formats: MS Word. MS Excel, or Adobe .pdf format. Water quality results uploaded to Waterline must be presented in MS Excel.	All
QZ14-041	56		Where site conditions require Minor Modifications to submitted final designs during construction, the modifications shall be approved by a Professional Engineer and a record of the modification along with the rationale for the modification shall be submitted to the Board with a copy to the Inspector as part of the annual construction report for the affected Engineered Structure	n/a
QZ14-041	57	a	For all Engineered Structures authorized by this Licence, the Licensee shall produce a construction report detailing the construction of the infrastructure. The construction report shall include: As-built drawings of completed structures;	n/a
QZ14-041	57	b	Results of quality control and quality assurance activities associated with the completed works;	Section 2.6
QZ14-041	57	c	Records of any minor or substantive modifications from submitted final designs; and	n/a
QZ14-041	57	d	Certification by a Professional Engineer that the completed works have been constructed in compliance with final designs and construction specifications inclusive of any approved minor or substantive modifications and in compliance with any relevant terms of this licence	n/a
QZ14-041	58		The construction report in clause 57 shall be submitted annually with the annual report required by this licence and shall include all	n/a

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
			structures completed during the year covered by the annual report.	
QZ14-041	105		The Licensee shall comply with the monitoring programs and studies required by this licence and, unless otherwise specified, shall submit the data that is compiled as a result of these programs and studies as a component of the required annual reports	Section 3.0
QZ14-041	111		The Licensee shall comply with the EMSAMP and Schedules I and 2 of this Licence. The findings of the programs included in the EMSAMP, including any recommendations, shall be submitted as part of the Annual Report. Any changes should be submitted to the Board.	Section 3.0
QZ14-041	112		The Licensee shall update the EMSAMP to reflect the continuation of the collection of baseline data until the initiation of the Development Phase of the Project.	Section 3.0
QZ14-041	113	a	Baseline data to be collected shall include: Meteorological data by the Camp and Potato Hills climate stations;	Section 3.1
QZ14-041	113	b	Flow monitoring at stations identified in Table 2.2-I of Exhibit 1.13.1	Section 3.0 and 3.2
QZ14-041	113	c	Sampling and monitoring of field barrels at the project site; and	Section 3.3
QZ14-041	113	d	Snow courses.	Section 3.1
QZ14-041	123	a	Adaptive Management Plan: The Licensee shall include in the updated EMSAMP updates to the Adaptive Management Program (AMP) to include, but not be limited to: The effluent discharge standards identified in this licence;	n/a
QZ14-041	123	b	Updated receiving water quality thresholds for Haggart Creek at W4 and W29 based on the Haggart Creek WQOs;	n/a
QZ14-041	123	c	The revised water quantity thresholds for reduction of flow in Haggart Creek as proposed in Exhibit 1.2.3.1 for open water (36%) and Exhibit 6.1 for November to April (15%);	n/a
QZ14-041	123	d	The AMP for the monitoring of thiocyanate and cyanate at W4 and W29;	n/a
QZ14-041	123	e	Incorporation of trend analysis in the assessment component of the AMP;	n/a
QZ14-041	123	f	Monthly review and reporting of the results of the AMP assessments in the Monthly Reports;	n/a

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
QZ14-041	123	g	An annual review of the AMP which shall include: i. A summary of the monthly reviews; ii. Assessment of the adequacy and appropriateness of the various components of the AMP (thresholds, indicator and monitoring requirements); and iii. Recommendations for modifications.	n/a
QZ14-041	123	h	Any other revisions necessary for compliance with this licence.	n/a
QZ14-041	124	a	Metal Mining Effluent Regulations Monitoring Programs: The Licensee shall conduct the following Environmental Effects Monitoring Studies in accordance with MMER Schedule 5: Effluent and Water Quality Monitoring Studies; and	n/a
QZ14-041	124	b	Biological Monitoring Studies.	n/a
QZ14-041	125		The results of these studies and programs in clause 124 shall be submitted to the Board as part of the Annual Report along with any additional studies or revisions to studies required under the MMER.	n/a
QZ14-041	130		A summary of activities carried out under any approved plan shall be submitted to the Board as part of the annual report.	Section 3.0, 4.0 and 5.0
QZ14-041	132		Cyanide Management Plan: The Licensee shall submit to the Board for Review and Approval, an updated CMP which includes an annual independent third-party audit, consistent with the ICMC, of the cyanide management plan and its execution.	n/a, see Section 3.7
QZ14-041	133		Storage and use of cyanide at the site must not occur until receipt of notice of approval of the updated CMP from the Board.	n/a, see Section 3.7
QZ14-041	157	a	Surface Water Balance and Water Quality Models Updates: The Licensee shall submit to the Board updated Surface Water Balance and Water Quality Models as part of each Annual Report. The updated models shall include, but not be limited to, the following: Updated site data collected as per the EMSAMP;	Section 3.0
QZ14-041	157	b	Updated input from any updates to the HLF Water Balance Model; and	n/a
QZ14-041	157	c	Updated predictions for operations and closure including discussion of any variances	n/a

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
			identified and implications on site water management	
QZ14-041	178	f	Reclamation and Closure Research Program The Licensee shall submit to the Board, an update to the Reclamation and Closure Research Program provided in Exhibit 1.7.1, Section 10 with the RCP updates described in clause 171. The updated plan shall be implemented once approved and must include, but not necessarily be limited to, the following: Annual reporting on research activities.	Section 5.0
QZ14-041	190		The Licensee shall report in the annual report on whether, based on information available at the time of report including actual progress on execution of the Mine Plan and the best judgement of mine management, the current liability for closure of the mine exceeds or does not exceed the security held at the end of the year for which the annual report has been prepared.	Section 5.0
QML-0011	13.9		On or before March 31st of each year of the term of this License, the Licensee must submit an annual report, in writing, in accordance with Schedule D and any written direction of the Director, covering the period of January 1 to December 31 of the prior year.	All
QML-0011	Schedule C	2.4	**Waste Management**: "Solid Waste and Hazardous Materials Management Plan, Version 2014-01" dated May 2014 and prepared by StrataGold Corporation. Subject to the following conditions: (a) an update to the Solid Waste and Hazardous Materials Management Plan must be provided in the 2016 Annual Report, this updated plan must include the following information i. an update to the permit and disposal requirements consistent with the *Environment Act* and regulations.	Section 3.7
QML-0011	Schedule C	2.5	**Spill Contingency**: "Spill Response Plan, Version 2014-01" dated June 2014 and prepared by StrataGold Corporation. Subject to the following conditions: (a) an update to the Spill Contingency Plan must be provided in the 2016 Annual	Section 3.8

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
			Report, this updated plan must include the following information i. an update to section 2.2 and Appendix C of the Plan to include all reportable thresholds for special wastes substances consistent with section 3(1)(b) of the Special Waste Regulations; ii. spill response steps for each category of material that may be spilled; and iii. an update to the reporting requirements to include the requirement to report all spills on site.	
QML-0011	Schedule C	3.1	**Dust Control:** "Dust Control Plan, Version 2013-01" dated September 2013. Subject to the following conditions: (a) an update to the Dust Control Plan must be provided in the 2016 Annual Report, this updated plan must include the following information i. an update to the permit requirements consistent with the Environment Act and regulations.	Section 3.1
QML-0011	Schedule D, **Site Activities**	a	a summary of construction activities associated with the Undertaking;	Section 2.2
QML-0011	Schedule D, **Site Activities**	b	a summary of mining activities;	Section 2.3
QML-0011	Schedule D, **Site Activities**	c	a summary of proposed development and production for the coming year;	Section 2.4
QML-0011	Schedule D, **Site Activities**	d	a map showing the status of all structures, works, and installations associated with the Undertaking;	Figure 2-2
QML-0011	Schedule D, **Site Activities**	e	the total amount of ore and waste removed from the open pit for the year and for the life of the Undertaking;	n/a, see Section 2.3.1
QML-0011	Schedule D, **Site Activities**	f	the total amount of gold produced and removed from the undertaking;	n/a, see Section 2.3.1

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
QML-0011	Schedule D, **Site Activities**	g	the total amount of waste rock removed from the Undertaking and deposited into each deposit location;	n/a, see Section 2.3.1
QML-0011	Schedule D, **Site Activities**	h	the total amount of waste rock stored in each waste rock storage facility;	n/a, see Section 2.3.1
QML-0011	Schedule D, **Site Activities**	i	details respecting any action taken as a result of the recommendations made by the engineer in relation to the inspection referred to in 13.2 of QML-0011;	n/a
QML-0011	Schedule D, **Site Activities**	j	a summary of any update to estimates of ore reserves and the life of the mine, including reserve category, tonnage and grade;	Section 2.3.3
QML-0011	Schedule D, **Site Activities**	k	the total amount and the average grade of ore stockpiled;	n/a
QML-0011	Schedule D, **Site Activities**	l	the remaining reserve life of the mine;	Section 2.3.3
QML-0011	Schedule D, **Site Activities**	m	results and interpretation from all QA/QC programs for the site;	See Appendices
QML-0011	Schedule D, **Site Activities**	n	a summary of heap leach facility construction including: i. the total amount and the average head grade of ore placed on the heap leach pad for the year and the life of the Undertaking; ii. the mass/volume and end of year configuration of ore lifts placed in the heap leach facility with the identification of any final benches or slopes achieved during the year; iii. the records of ore properties for ore placed on the heap and records of any of agglomeration conducted; and iv. report on metallurgical performance of the heap leach facility	n/a
QML-0011	Schedule D, **Environmental Monitoring**	a	a summary of the programs undertaken for environmental monitoring and surveillance as outlined in the Environmental Monitoring, Surveillance and Adaptive Management Plan and the Wildlife Protection Plan, including an	Section 3.0

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
			analysis of these data and any action taken or adaptive management strategies implemented to monitor or address any changes in environmental performance;	
QML-0011	Schedule D, **Environmental Monitoring**	b	a summary of operating procedures for cyanide-related tasks and their implementation, including the review of proposed process and operational changes and modifications deemed necessary for potential impacts on personnel health and safety and the incorporation of personnel protection measures;	n/a
QML-0011	Schedule D, **Environmental Monitoring**	c	a summary of all safety measures taken (signs, etc.) to identify the presences of cyanide to all personnel;	n/a
QML-0011	Schedule D, **Environmental Monitoring**	d	a summary of all tests and calibration records for HCN monitoring equipment;	n/a
QML-0011	Schedule D, **Environmental Monitoring**	e	a summary of the results of the waste rock quality assurance/quality control monitoring for the past year;	n/a
QML-0011	Schedule D, **Environmental Monitoring**	f	a summary of invasive plants that have been identified on site and measures taken to control or remove invasive plants;	n/a
QML-0011	Schedule D, **Environmental Monitoring**	g	a summary of ambient air quality monitoring and modelling (which includes emissions related to the gold recovery process) and mitigation measures taken;	n/a, see Section 3.1
QML-0011	Schedule D, **Environmental Monitoring**	h	a summary of spills and accidents that occurred at the site and measures taken respond to any spills or accidents;	Section 3.8
QML-0011	Schedule D, **Environmental Monitoring**	i	a summary of the level of traffic, access control issues, wildlife incidents and other accidents, and any upgrade or maintenance work planned for the upcoming year;	Section 3.9
QML-0011	Schedule D, **Environmental Monitoring**	j	a summary of sound-levels associated with blasting activities;	n/a
QML-0011	Schedule D, **Environmental Monitoring**	k	a summary of any site improvements undertaken to address sediment and erosion control;	n/a, see Section 3.10
QML-0011	Schedule D, **Environmental Monitoring**	l	a summary and interpretation of humidity cell or other geochemical tests undertaken on materials on site, including a. geochemical characterization of the expanded open pit, including kinetic testing to predict metal leaching potential;	Section 3.3

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
			b. assumptions and conclusions of geochemical predictions and the effectiveness of mitigation measures; c. the segregation of waste rock based on metal leaching potential; and d. results of long-term column tests to study the effects to stability and permeability of the heap leach facility;	
QML-0011	Schedule D, **Environmental Monitoring**	m	a summary of cyanide release or exposure that occurred at the Undertaking, including: i) any hospitalization or fatality related to cyanide; ii) the nature of release and the response or remediation required; and iii) any exceedances to cyanide limits in permits or authorizations	n/a
QML-0011	Schedule D, **Physical Monitoring**	a	a summary of any heap leach, waste rock, or open pit stability incidents;	n/a
QML-0011	Schedule D, **Physical Monitoring**	b	a summary of data collected to date as part of the Physical Monitoring Program;	n/a, see section 4.0
QML-0011	Schedule D, **Physical Monitoring**	c	details of results, including data collected, for the Physical Monitoring Program;	n/a, see section 4.0
QML-0011	Schedule D, **Physical Monitoring**	d	a summary report on the performance of Engineered structures in service during the reporting year including but not limited to: a. any operational deficiencies or failures to achieve operational requirements; b. records of any leakage into the LDRS of the HLF; c. a detailed record of any major maintenance work carried out; d. plans to conduct major maintenance work for the following year; and e. status report on any backup equipment and supplies for emergency management of the heap leach facility including records of exercising such equipment.	n/a
QML-0011	Schedule D, **Reclamation and Closure**	a	any temporary closure or permanent closure that has occurred during the year;	n/a
QML-0011	Schedule D, **Reclamation and Closure**	b	a summary of activities related to care and maintenance of the Undertaking, including any temporary closure activities if applicable;	n/a

Document, License or Permit	Section/ Clause	Paragraph/ Sub-clause/	Requirement	Annual Report Section
QML-0011	Schedule D, **Reclamation and Closure**	c	a summary of progressive and ongoing reclamation activities;	n/a
QML-0011	Schedule D, **Reclamation and Closure**	d	a summary of proposed development and production and reclamation activities for the coming year; and.	Section 2.4
QML-0011	Schedule D, **Reclamation and Closure**	e	a summary of reclamation research and results	Section 5.0
QML-0011	Schedule D, **Socio-economic Monitoring**	a	a summary of action taken by the Licensee with respect to development and implementation of a joint committee that will confirm socio-economic indicators, reporting and responding to monitoring results.	n/a. see Section 6.0

APPENDIX B2

Preparatory Works, Construction, and As-Built Drawings and Reports - LDSP

THIS PAGE INTENTIONALLY LEFT BLANK

EAGLE GOLD PROJECT

LOWER DUBLIN SOUTH POND CONSTRUCTION REPORT

JULY 2017

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ATTACHMENTS

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT A

Letter of Assurance

THIS PAGE INTENTIONALLY LEFT BLANK

TETRA TECH

LETTER OF ASSURANCE

ISSUED FOR USE

Eagle Gold Mine

Project Name:	Eagle Gold Lower Dublin South Pond	**Date:**	January 31, 2018
Location:	Victoria Gold Mine, YT	**Page:**	1 of 1
		File:	704.TRN-WTRM03037

I hereby give assurance that:

- I am a Professional Engineer registered with Engineers Yukon, licensed to practice in the Yukon;
- I have utilized the standards of care, skill and diligence that, in accordance with the standards of my profession, are required of Professional Engineers in the Yukon Territory;
- I am the Engineer of Record (EoR) for the Eagle Gold Lower Dublin South Pond ("The Pond");
- The Pond was built according to the Issued for Construction (IFC) drawings;
- Minor modifications during construction of the facility were made, as documented in the Request for Information (RFI) Forms attached to this letter. I approved all minor modifications documented in the RFIs.
- The minor modifications documented in the RFIs will not impact the expected performance of the Lower Dublin South Pond.
- All Quality Assurance and Quality Controls during construction related to the geotechnical aspects of the project were conducted to my satisfaction.

PROFESSIONAL ENGINEER
YUKON TERRITORY
MAURICIO HERRERA

Mauricio Herrera, Ph.D., P.Eng.
Senior Hydrotechnical Engineer
Mauricio.Herrera@tetratech.com
604.608.8612`

ENGINEERS & GEOSCIENTISTS | OQM CERTIFIED

Tetra Tech Canada Inc.
Suite 1000 – 10th Floor, 885 Dunsmuir Street
Vancouver, BC V6C 1N5 CANADA
Tel 604.685.0275 Fax 604.684.6241

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT B

Record Drawings

THIS PAGE INTENTIONALLY LEFT BLANK

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE, YT

SITE LOCATION
SCALE: NTS

RECORD DRAWING

CLIENT		PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
StrataGold Corporation	TETRA TECH	WTRM03037-01	VANC	DH	MH	3	G1.00
		DATE	SHEET No.	DWN	APP	STATUS	
		January 29, 2018	of	JDM	MH	REC	

\\tt.local\eteLegacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [G1.00] January 29, 2018 - 1:29:23 pm (BY: MANG, JUSTIN)

INDEX OF DRAWINGS	
DWG No.	DESCRIPTION
G1.00	COVER SHEET
G1.01	DRAWING INDEX AND GENERAL NOTES
G1.04	BOREHOLE AND TEST PIT LOCATION PLAN
C1.01	LOWER DUBLIN SOUTH POND - PLAN
C1.02	LOWER DUBLIN SOUTH POND - PROFILES
C1.03	LOWER DUBLIN SOUTH POND - TYPICAL SECTIONS
C1.04	LOWER DUBLIN SOUTH POND - SPILLWAY PLAN AND PROFILE
C1.05	LOWER DUBLIN SOUTH POND - SECTIONS AND DETAILS
C1.06	LOWER DUBLIN SOUTH POND - LOW LEVEL OUTLET AND PUMPHOUSE

DESIGN CRITERIA:

1. DAM CLASSIFICATION: SIGNIFICANT
2. LOWER DUBLIN SOUTH POND CAPACITY (MINIMUM 24 HOUR RETENTION TIME): 1 IN 10 YEAR FLOOD.
3. MAIN DAM SPILLWAY: 1 IN 1000 YEAR FLOOD
4. COLLECTION DITCHES: 1 IN 10 YEAR FLOOD FOR CAPACITY, 1 IN 100 YEAR FLOOD FOR EROSION
5. CULVERT DOWNSTREAM OF THE DAM ($H_w/D=1.5$): 1 IN 1000 YEAR FLOOD
6. REST OF CULVERTS ($H_w/D-1.5$): 1 IN 200 YEAR FLOOD

HYDROLOGY:

1. RECENT PRECIPITATION DATA HAS BEEN REVIEWED AS PART OF THE DESIGN AND FOUND TO BE WITHIN THE NATURAL VARIABILITY.

DISCLAIMER

1. These record drawings have been compiled from as-built information provided to Tetra Tech by JDS Energy & Mining Inc. Tetra Tech assumes no responsibility for the accuracy of this information.

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

RECORD DRAWING

NUM	DATE	DWN	CKD	APR	DESCRIPTION
3	1/29/18	JDM	DH	MH	RECORD DRAWING
2	10/20/17	JDM	DH	MH	DESIGN CHANGE 002
1	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION
0	7/6/17	JDM	DH	MH	ISSUED FOR CONSTRUCTABILITY REVIEW

REVISIONS

PROFESSIONAL SEAL
PROFESSIONAL
Jan 29/18
YUKON
MAURICIO HERRERA
TERRITORY
ENGINEER

CLIENT
StrataGold Corporation

TETRA TECH

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

DRAWING INDEX AND GENERAL NOTES

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	3	G1.01
DATE	SHEET No.	DWN	APP	STATUS	
January 29, 2018	of	JDM	MH	REC	

\\tt.localtetra\Legacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [G1.01] January 29, 2018 - 4:02:25 pm (BY: MANG, JUSTIN)

TTBH17-06
TEST PIT 20
TEST PIT 22
TEST PIT 21
TTBH17-04
TTBH17-05
TEST PIT 19
TP-23
TTBH17-03
TP-24
TEST PIT 6
TEST PIT 7
TEST PIT 5
TEST PIT 8
TEST PIT 9
TTBH17-02
TEST PIT 3
TEST PIT 10
COLLECTION POND
FOREBAY
TEST PIT 4
TEST PIT 18
TEST PIT 16
TEST PIT 17
TEST PIT 13
TEST PIT 2
TEST PIT 15
TTBH17-01
TEST PIT 1
TEST PIT 14
TEST PIT 11
TEST PIT 12
OH-P

\\tt.local\eba\Legacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [G1.04] January 29, 2018 - 1:37:02 pm (BY: MANG, JUSTIN)

LEGEND

---------- Design Major Contours (2 m)

---------- Design Minor Contours (0.5 m)

SCALE 1:1000

10 0 10 20 40m

NOTES

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

RECORD DRAWING

NUM	DATE	DWN	CKD	APR	DESCRIPTION
2	1/29/18	JDM	DH	MH	RECORD DRAWING
1	10/10/17	JDM	DH	MH	ADDED TEST PIT LOCATIONS
0	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION

REVISIONS

PROFESSIONAL SEAL
PROFESSIONAL ENGINEER
YUKON TERRITORY
MAURICIO HERRERA
Jan 29/18

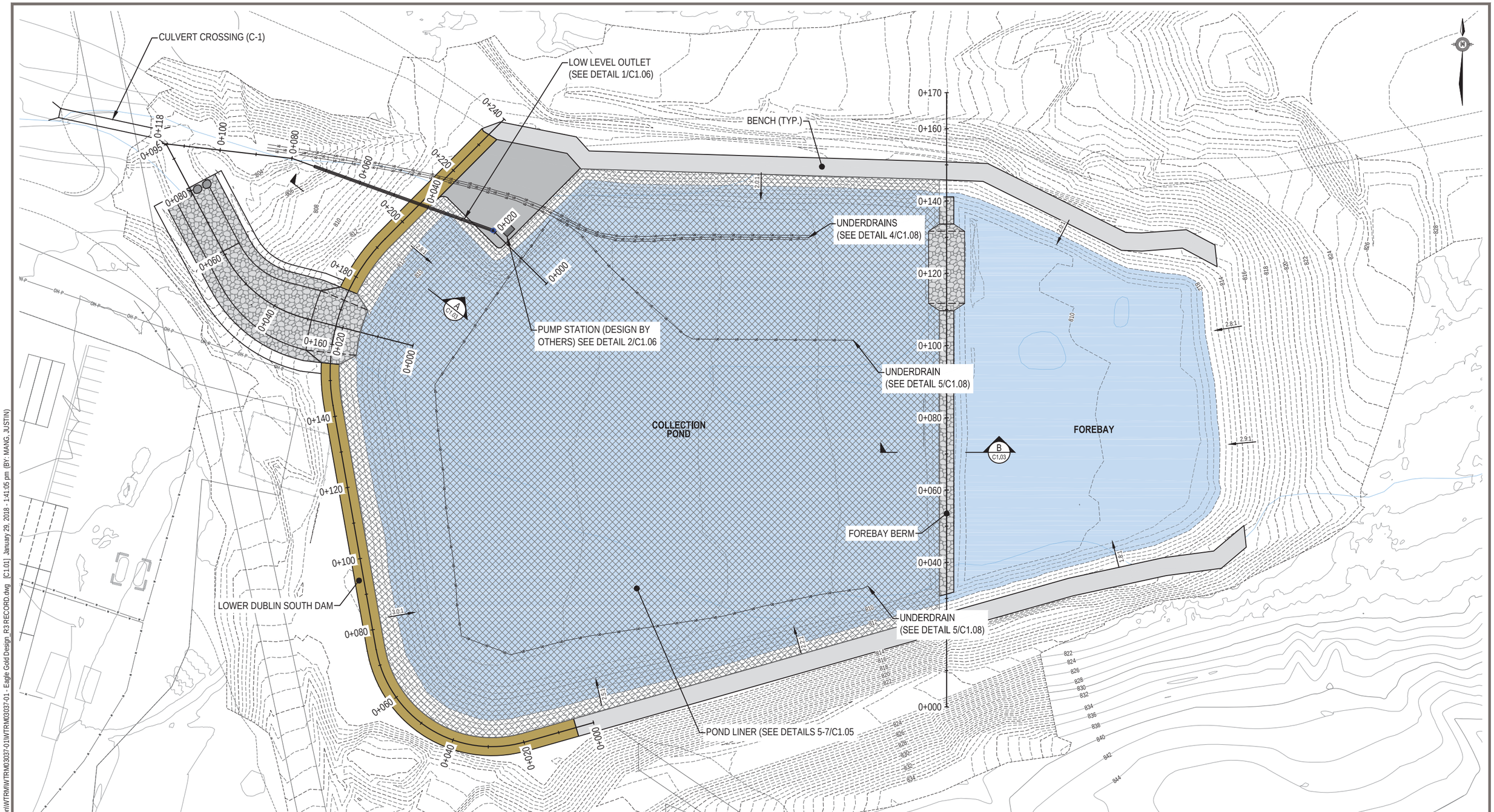
CLIENT
StrataGold Corporation

TETRA TECH

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

BOREHOLE AND TEST PIT LOCATION PLAN

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	2	G1.04
DATE	SHEET No.	DWN	APP	STATUS	
January 29, 2018	of	JDM	MH	REC	



LEGEND

---------- Design Major Contours (2 m)

---------- Design Minor Contours (0.5 m)

SCALE 1:1000

10 0 10 20 40m

NOTES

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

RECORD DRAWING

NUM	DATE	DWN	CKD	APR	DESCRIPTION
4	1/29/18	JDM	DH	MH	RECORD DRAWING
3	10/20/17	JDM	DH	MH	DESIGN CHANGE 002
2	9/29/17	JDM	DH	MH	DESIGN CHANGE 001
1	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION
0	7/6/17	JDM	DH	MH	ISSUED FOR CONSTRUCTABILITY REVIEW

REVISIONS

PROFESSIONAL SEAL
PROFESSIONAL ENGINEER
Jan 29/18
YUKON
MAURICIO HERRERA
TERRITORY

CLIENT
StrataGold Corporation

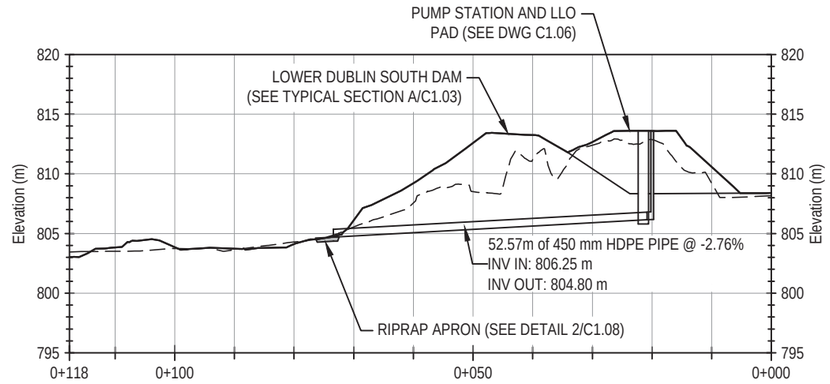
TETRA TECH

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

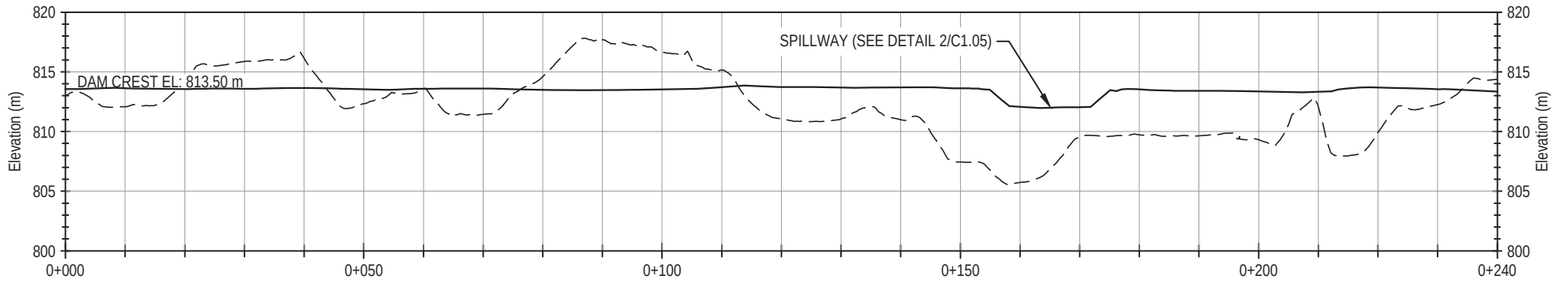
LOWER DUBLIN SOUTH POND PLAN

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	4	C1.01
DATE	SHEET No.	DWN	APP	STATUS	
January 29, 2018	of	JDM	MH	REC	

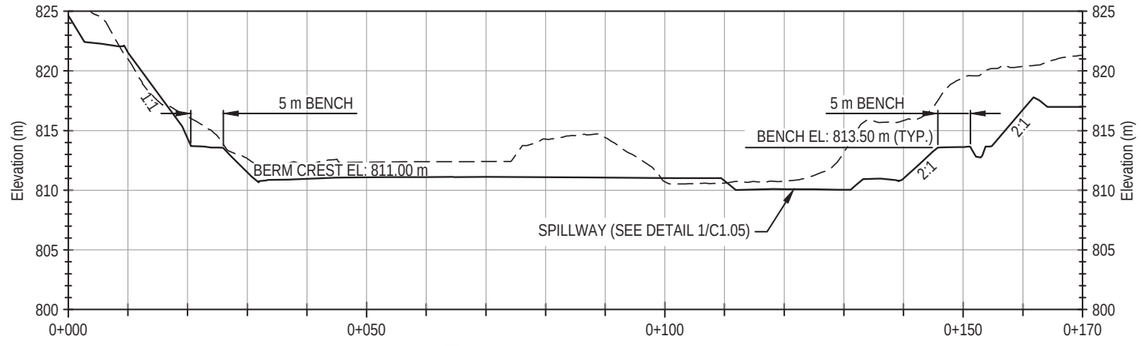
\\tt.local\eba\Legacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [C1.01] January 29, 2018 - 1:41:05 pm (BY: MANG, JUSTIN)



1 / C1.02 **LOW LEVEL OUTLET PROFILE**
SCALE: 1:1000 (HORIZ.) 1:500 (VERT)



2 / C1.02 **DAM CENTERLINE PROFILE**
SCALE: 1:1000 (HORIZ.) 1:500 (VERT)



3 / C1.02 **BERM CENTERLINE PROFILE**
SCALE: 1:1000 (HORIZ.) 1:500 (VERT)

NOTE:

1. PROFILE VIEWS ARE EXAGGERATED BY TWO TIMES VERTICALLY.

LEGEND

— — — — Existing Ground

———— Proposed Ground

NOTES

SCALE 1:1000

10 0 10 20 40m

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

RECORD DRAWING

NUM	DATE	DWN	CKD	APR	DESCRIPTION
4	1/29/18	JDM	DH	MH	RECORD DRAWING
3	10/20/17	JDM	DH	MH	DESIGN CHANGE 002
2	9/29/17	JDM	DH	MH	DESIGN CHANGE 001
1	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION
0	7/6/17	JDM	DH	MH	ISSUED FOR CONSTRUCTABILITY REVIEW

REVISIONS

PROFESSIONAL SEAL
PROFESSIONAL ENGINEER
YUKON TERRITORY
MAURICIO HERRERA
Jan 29/18

CLIENT
StrataGold Corporation

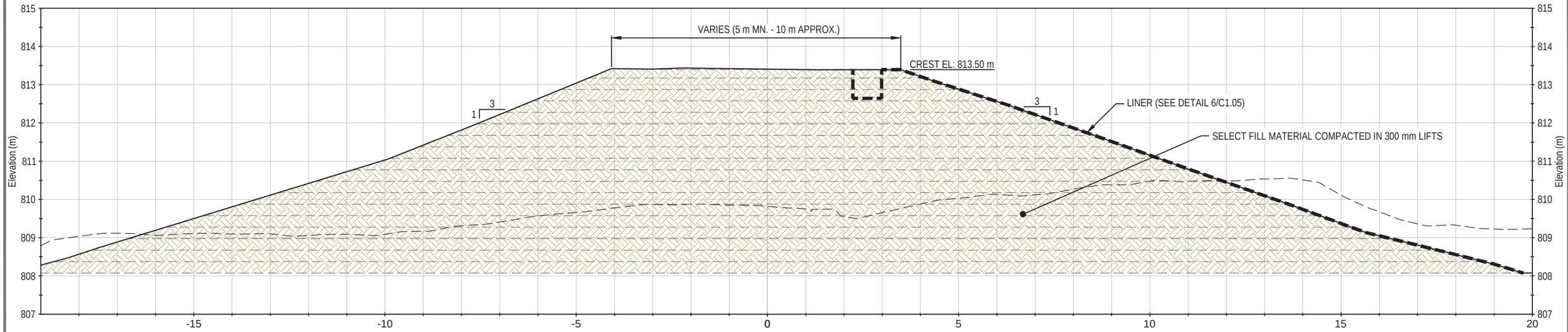
TETRA TECH

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

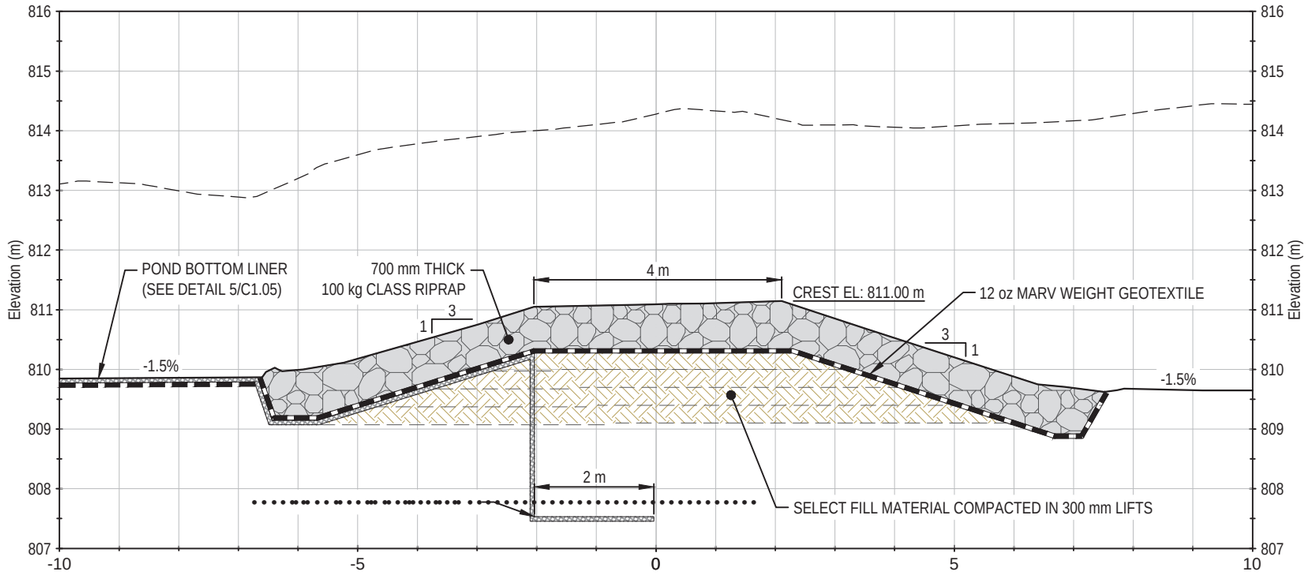
LOWER DUBLIN SOUTH POND PROFILES

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	4	C1.02
DATE	SHEET No.	DWN	APP	STATUS	
January 29, 2018	of	JDM	MH	REC	

\\tt.local\etba\Legacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [C1.02] January 29, 2018 - 1:49:12 pm (BY: MANG, JUSTIN)



A C1.03 TYPICAL DAM SECTION
SCALE: 1:100



B C1.03 TYPICAL FOREBAY EMBANKMENT SECTION
SCALE: 1:100

LEGEND

Existing Ground

Proposed Ground

SCALE 1:100

1 0 1 2 4m

NOTES

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

RECORD DRAWING

NUM	DATE	DWN	CKD	APR	DESCRIPTION
4	1/29/18	JDM	DH	MH	RECORD DRAWING
3	10/20/17	JDM	DH	MH	DESIGN CHANGE 002
2	9/29/17	JDM	DH	MH	DESIGN CHANGE 001
1	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION
0	7/6/17	JDM	DH	MH	ISSUED FOR CONSTRUCTABILITY REVIEW

REVISIONS

PROFESSIONAL SEAL
PROFESSIONAL ENGINEER
YUKON
MAURICIO HERRERA
TERRITORY
Jan 29/18

CLIENT
StrataGold Corporation

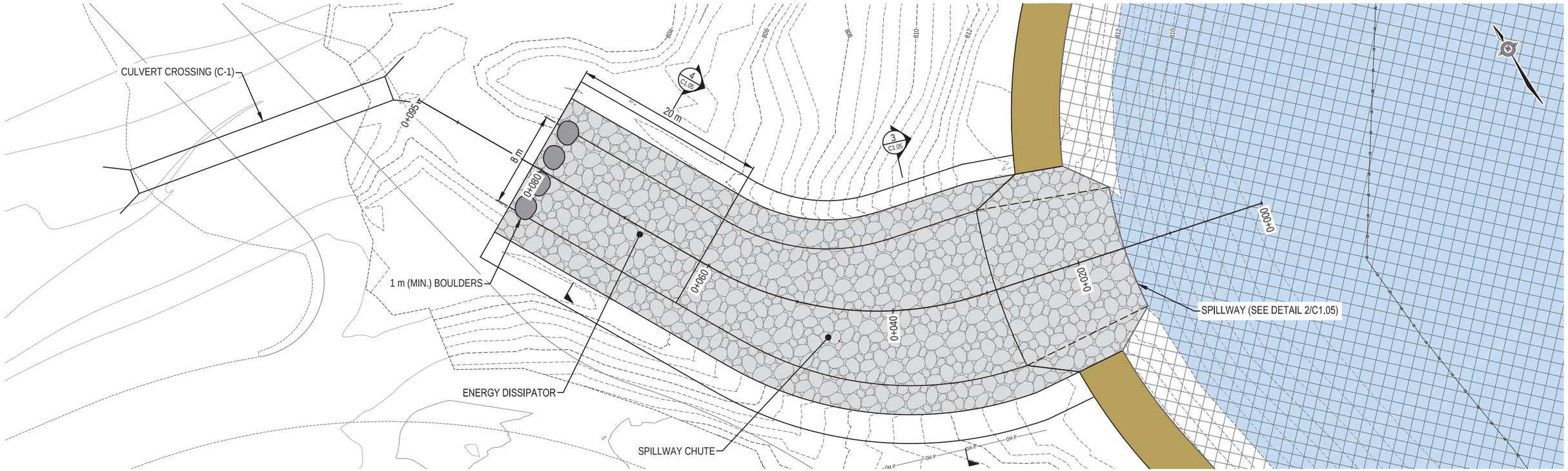
TETRA TECH

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

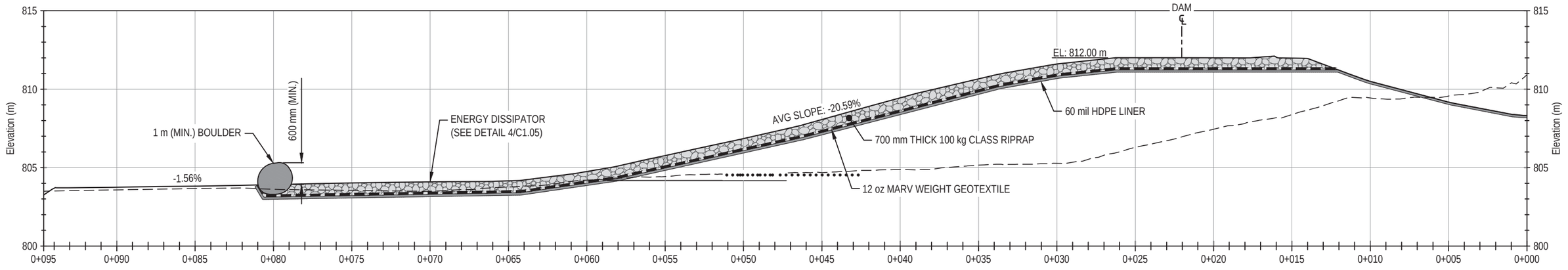
LOWER DUBLIN SOUTH POND
TYPICAL SECTIONS

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	4	C1.03
DATE	SHEET No.	DWN	APP	STATUS	
January 29, 2018	of	JDM	MH	REC	

\\tt.localtetra\Legacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [C1.03] January 29, 2018 - 3:46:46 pm (BY: MANG, JUSTIN)



PLAN
SCALE: 1:400



1 / C1.04 SPILLWAY PROFILE
SCALE: 1:250

LEGEND

Existing Ground

Proposed Ground

NOTES

SCALE AS SHOWN

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

ISSUED FOR CONSTRUCTION

NUM	DATE	DWN	CKD	APR	DESCRIPTION
4	1/29/18	JDM	DH	MH	RECORD DRAWING
3	10/20/17	JDM	DH	MH	DESIGN CHANGE 002
2	9/29/17	JDM	DH	MH	DESIGN CHANGE 001
1	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION
0	7/6/17	JDM	DH	MH	ISSUED FOR CONSTRUCTABILITY REVIEW

REVISIONS

PROFESSIONAL SEAL
PROFESSIONAL ENGINEER
Jan 29/18
YUKON
MAURICIO HERRERA
TERRITORY

CLIENT
StrataGold Corporation

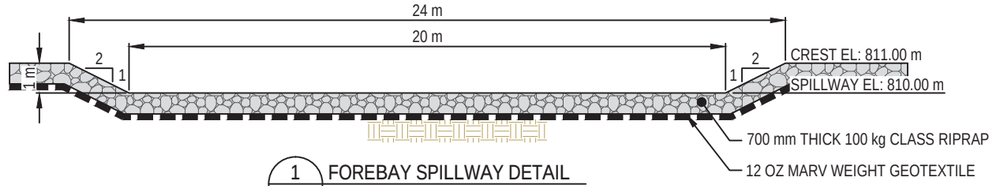
TETRA TECH

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

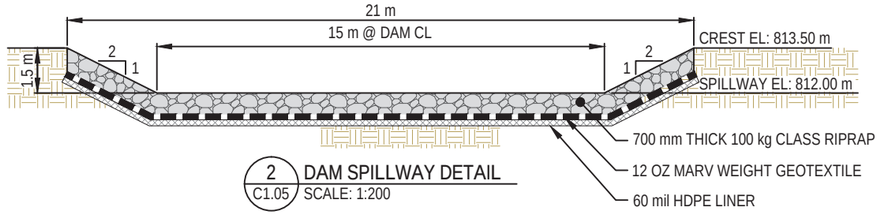
LOWER DUBLIN SOUTH POND
SPILLWAY PLAN AND PROFILE

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	4	C1.04
DATE	SHEET No.	DWN	APP	STATUS	
January 29, 2018	of	JDM	MH	REC	

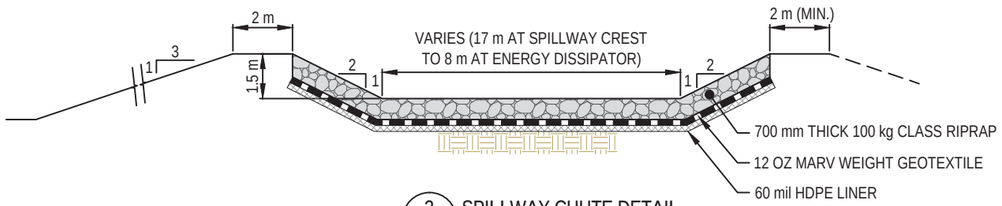
\\tt.local\eba\Legacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [C1.04] January 29, 2018 - 1:50:48 pm (BY: MANG, JUSTIN)



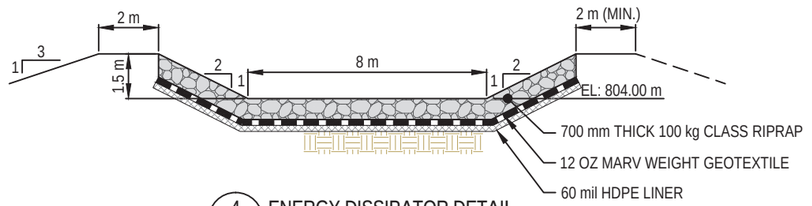
1 C1.05 FOREBAY SPILLWAY DETAIL
SCALE: 1:200



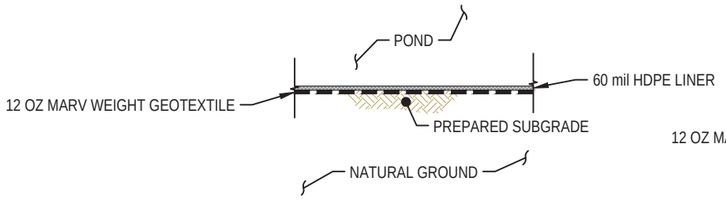
2 C1.05 DAM SPILLWAY DETAIL
SCALE: 1:200



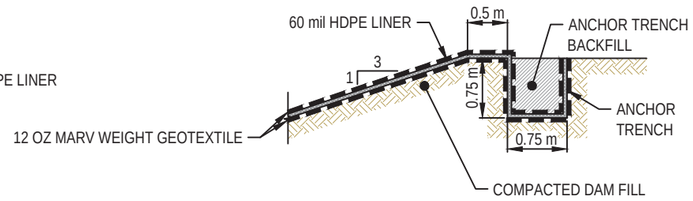
3 C1.05 SPILLWAY CHUTE DETAIL
SCALE: 1:200



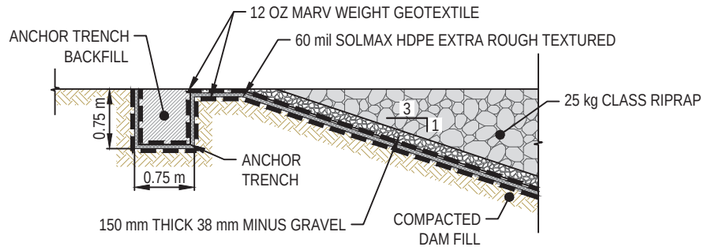
4 C1.05 ENERGY DISSIPATOR DETAIL
SCALE: 1:200



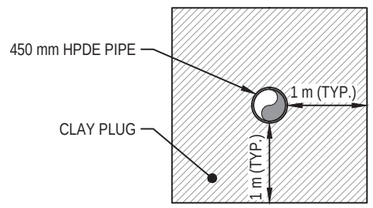
5 C1.05 POND BOTTOM LINER DETAIL
SCALE: NTS



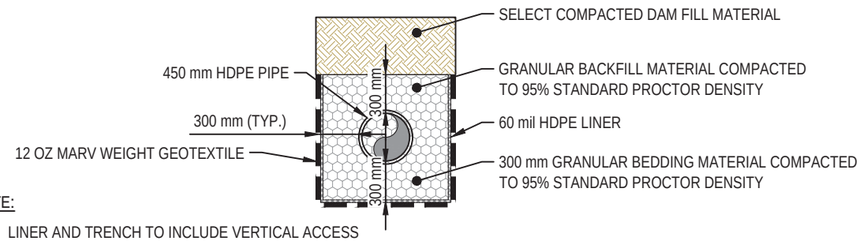
6 C1.05 POND LINER SLOPE AND ANCHOR DETAIL
SCALE: NTS



7 C1.05 PAD LINER DETAIL
SCALE: NTS



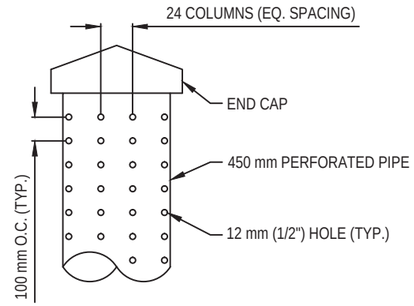
8 C1.05 CLAY PLUG DETAIL
SCALE: 1:75



NOTE:

1. LINER AND TRENCH TO INCLUDE VERTICAL ACCESS

9 C1.05 LLO TRENCH DETAIL
SCALE: 1:50



10 C1.05 PERFORATED PIPE DETAIL
SCALE: NTS

LEGEND

SCALE 1:200
2 0 2 4 8m

NOTES

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

RECORD DRAWING

NUM	DATE	DWN	CKD	APR	DESCRIPTION
4	1/29/18	JDM	DH	MH	RECORD DRAWING
3	10/20/17	JDM	DH	MH	DESIGN CHANGE 002
2	9/29/17	JDM	DH	MH	DESIGN CHANGE 001
1	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION
0	7/6/17	JDM	DH	MH	ISSUED FOR CONSTRUCTABILITY REVIEW

REVISIONS

PROFESSIONAL SEAL
PROFESSIONAL Jan 29/18 YUKON MAURICIO HERRERA TERRITORY ENGINEER

CLIENT
StrataGold Corporation

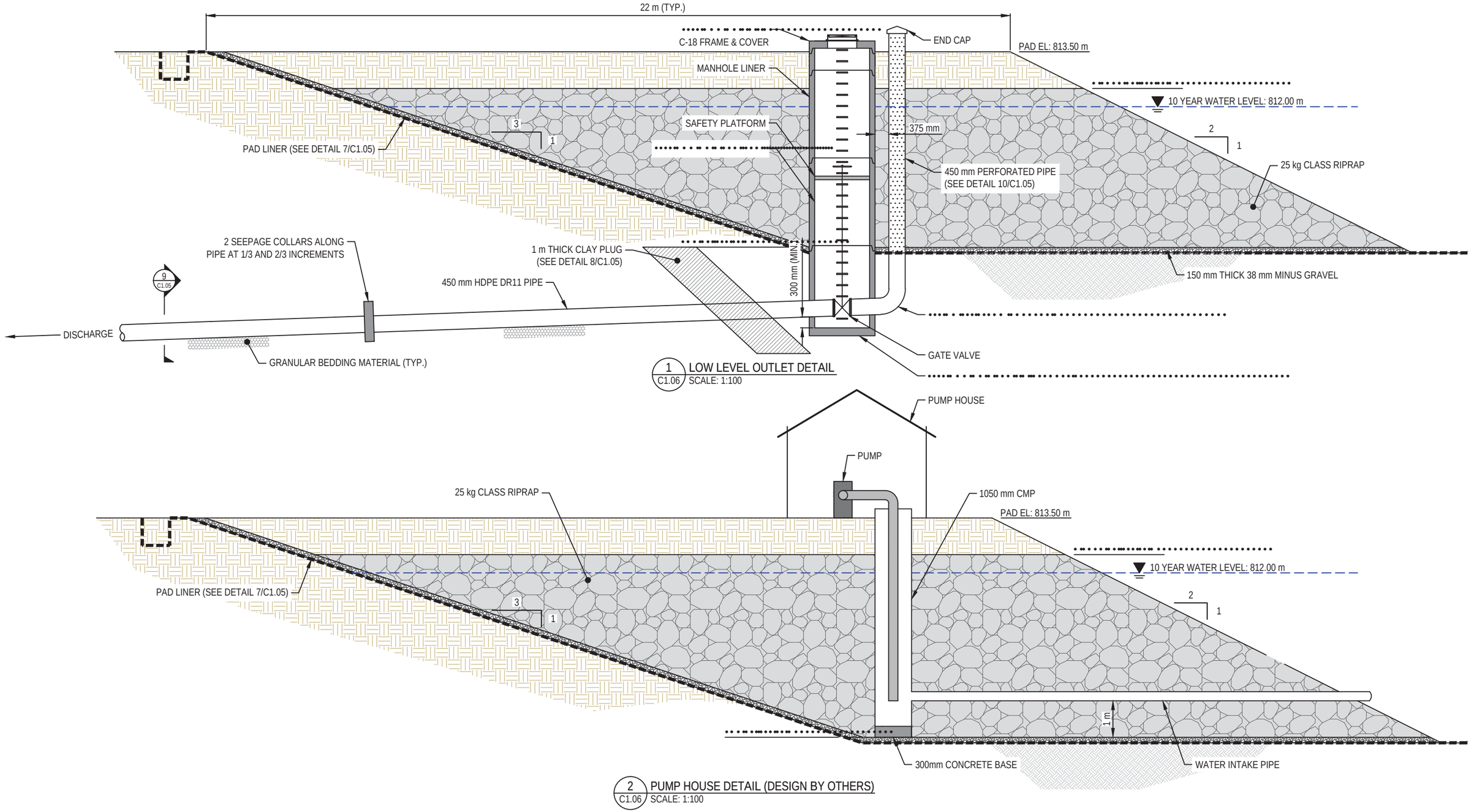
TETRA TECH

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

LOWER DUBLIN SOUTH POND
SECTIONS & DETAILS

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	4	C1.05
DATE	SHEET No.	DWN	APP	STATUS	
January 29, 2018	of	JDM	MH	REC	

\\tt.local\eLegacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [C1.05] January 29, 2018 - 3:58:49 pm (BY: MANG, JUSTIN)



LEGEND

SCALE 1:100

1 0 1 2 4m

NOTES

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

RECORD DRAWING

NUM	DATE	DWN	CKD	APR	DESCRIPTION
3	1/29/18	JDM	DH	MH	RECORD DRAWING
2	9/29/17	JDM	DH	MH	DESIGN CHANGE 001
1	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION
0	7/6/17	JDM	DH	MH	ISSUED FOR CONSTRUCTABILITY REVIEW

REVISIONS

PROFESSIONAL SEAL
PROFESSIONAL ENGINEER
Jan 29/18
YUKON TERRITORY
MAURICIO HERRERA

CLIENT
StrataGold Corporation

TETRA TECH

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

LOWER DUBLIN SOUTH POND
LOW LEVEL OUTLET AND PUMP HOUSE

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	3	C1.06
DATE	SHEET No.	DWN	APP	STATUS	
January 29, 2018	of	JDM	MH	REC	

\\tt.local\eball\Legacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R3 RECORD.dwg [C1.06] January 29, 2018 - 2:03:24 pm (BY: MANG, JUSTIN)

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT C

Request for Information Forms

THIS PAGE INTENTIONALLY LEFT BLANK

Request for Information - Site Master List

RFI No.	Contractor RFI No.	Contract No.	Location	Relevant Vendor (If Applicable)	Date of Submittal	RFI Topic (Info requested)	Project Response to RFI	Date Closed	Comments
CC205-RFI-001	COBALT-01	CC205	Water Management Pond	Cobalt	18-Aug-2017	Discharge and pump structures - constructability	Closed	7-Sep-2017	
CC205-RFI-002	COBALT-02	CC205	Culverts	Cobalt	27-Aug-2017	Clay plugs required at culvert ends	Closed	28-Aug-2017	Closed. Work completed
CC205-RFI-003	COBALT-03	CC205	Control Pond	Cobalt	15-Sep-2017	Pond Underdrain System	Closed	15-Sep-2017	
CC205-RFI-004	COBALT-04	CC205	CAR/Control Pond	Cobalt	15-Sep-2017	Culvert size and length confirmation	Closed	18-Sep-2017	
CC205-RFI-005	COBALT-05	CC205	Control Pond	Cobalt	15-Sep-2017	Confirmation of Bend on Overflow Outlet pipe	Closed	17-Sep-2017	
CC205-RFI-007	COBALT-07	CC205	Control Pond	Cobalt	16-Sep-2017	Underdrain Clarifiaction and Specs for Drain Rock	Closed	17-Sep-2017	
YG201-RFI-001	EPCM-RFI-003	YG201	Control Pond	EBA	26-Sep-2017	Clarification on Drawings & Specifications	Closed	27-Sep-2017	
YG201-RFI-002	EPCM-RFI-004	YG201	Control Pond	EBA	29-Sep-2017	Clay Deposits in the Pond Embankment	Closed	30-Sep-2017	Same a COBALT-06
CC205-RFI-006	COBALT-06	CC205	Control Pond	Cobalt	29-Sep-2017	Clay Deposits in the Pond Embankment	Closed	30-Sep-2017	
CC205-RFI-008	COBALT-08	CC205	Control Pond	Cobalt	30-Sep-2017	Clay Deposits in the Pond Embankment	Closed	1-Oct-2017	
CC205-RFI-009	COBALT-09	CC205	Control Pond	Cobalt	10-Oct-2017	EOR Approval of ITP	Closed		Not required to be signed
YG201-RFI-003	EPCM-RFI-005	YG201	Control Pond	EBA	14-Oct-2017	Geotextile around Underdrain Piping	Closed	15-Oct-2017	
YG201-RFI-004	EPCM-RFI-006	YG201	Control Pond	EBA	17-Oct-2017	Dam clay seam sub-excavation	Closed	19-Oct-2017	
YG201-RFI-005	EPCM-RFI-008	YG201	Control Pond	EBA	21-Oct-2017	Control Pond LLO Coordinates & Detail	Closed	22-Oct-2017	
YG201-RFI-006	EPCM-RFI-009	YG201	Control Pond	EBA	25-Oct-2017	Control Pond Details	Closed	25-Oct-2017	
YG201-RFI-007	EPCM-RFI-010	YG201	Control Pond	EBA	9-Nov-2017	Control Pond Jetty Riprap Design	Closed	10-Nov-2017	

REQUEST FOR INFORMATION	JDS RFI:	**CC205 RFI 1**
	Contractor RFI:	**COBALT-1**
	Site Location: Eagle Project	
	Date Submitted: Aug 18, 2017	

Subject:	**Project Zone/Area: Control Pond**
Contractor: Cobalt	**Station/Location: Discharge Outlet and Pump Station**
Attention: Engineering/Construction	**Discipline: Civil//Mechanical**

REQUEST

Related Drawings: **EBA – TetraTech drawing Package WTRM03037-01 - Eagle Gold Design_IFC R2** **Sheets C1.01, C1.02, C1.05, C1.06**	**Other Related Documents:**

Information Request/Description of Issue:
Further detail required on the pump station design, and discharge outlet.

1. **What kind of concrete bases for each structure**
2. **Length of each structure**
3. **How to construct the structures and how to install specified gate valve on the CSP manhole on discharge structure**
4. **The type of perforated pipe for inlet to discharge structure**
5. **Liner protection under the rip rap**

Proposed Corrective Action
The corrective action are some design changes to the outlet structures and the construction of each:

- **The pump outlet structure is to have:**
  - **Pre-cast concrete base, 1.5m diameter (or square), 400 mm depth, with a pre-manufactured inset ring (depression) to accept the 1050mm CSP and gasket to hold the CSP in place. A rub sheet of rubber, minimum of ¼" thick, or thicker (e.g. conveyor belting) will be placed under the concrete, on top of the pond liners. See attached sketch. The top of the CSP will be at elevation 813.65**
  - **A final lift of 1m deep general fill, 3m x 3m square, will be placed on 12 oz geotextile, on the rip rap (in place of current rip rap top 1m) around pump CSP structure.**
- **The pond outlet design change is as follows:**
  - **It is to be a pre-cast concrete manhole structure, 1.5m diameter (inside), with internal ladder rungs. The bottom of structure is to be at elevation 806m. The structure is 8 m tall. The sections to come with gaskets for sealing during assembly.**
  - **The bottom section of the manhole precast structure is to be manufacture with holes on each side to allow the 450mm HDPE pipe to be inserted on site, and grouted and sealed into place. Cobalt is to apply HDPE spiral weld bead on the 450 mm pipe where it is inserted in the holes, to secure it when grouting the pipe into place.**
  - **The precast concrete structure will penetrate the HDPE liner, and be sealed to the HDPE liner.**
  - **The bottom is to be a precast base specifically for 1.5m precast manhole (as per manufacturer standard), to be sealed to the precast manhole structure. The top is to be standard manhole lid.**
  - **The intake standpipe is 450mm diameter DR 17 HDPE Perforated Pipe.**
  - **The valve to be standard flanged 450mm knife gate for low pressure municipal water applications.**
- **On the top of the pond liner, a 150mm layer of general fill material (38mm minus) is to be placed before placing rip rap on the outlet structure pier.**

Type of Change: ☐ Owner Change ☒ Clarification/Info ☐ Field Change

	☐ Vendor Change	☒ Design Change	☐ Other		
Cost Impact:					
Schedule Impact:					
Requested by:	**Bruce MacLean**				
	Name	Signature		Date	

RESPONSE

☒ Approved ☐ Approved as noted ☐ Rejected as noted

Response:
The proposed corrective actions are to be implemented.

Contractor to use drawings provided with this RFI,

- **Outlet Structure Design RFI 1 CC205 Rev 1**
- **Pump Structure Design RFI 1 CC205**

Changes are approved by Mauricio Herrera, EBA-Tetra-Tech, as per email September 1, 2017

Answered by: Richard Boehnke P Eng		Sept. 7, 2017
Name	Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

Scanned by CamScanner

Hugh Coyle

From: Richard Boehnke
Sent: September-05-17 5:59 PM
To: Chris Copley; Calvin Goldschmidt
Subject: Fwd: Cobalt CC205 RFI 1 - Control Pond Outlet structures

In case I didn't send last Friday, below is initial acceptance from Mauricio on proposed outlet structures.

Also pipe all the way at 450mm

I'll follow up with EPG on pipe price for us in the morning.

Richard

Sent from my Samsung Galaxy smartphone.

-------- Original message --------
From: "Herrera, Mauricio" <Mauricio.Herrera@tetratech.com>
Date: 2017-09-01 7:16 AM (GMT-08:00)
To: Richard Boehnke <richardb@jdsmining.ca>
Subject: RE: Cobalt CC205 RFI 1 - Control Pond Outlet structures

Richard

As discussed I'm OK with the proposed changes as outlined in your email below. As I mentioned the outlet can be a 450 HDPE all the way, no need to have the 450 and then transition into a 600.

Regards,

Mauricio

From: Richard Boehnke [mailto:richardb@jdsmining.ca]
Sent: Friday, September 01, 2017 6:52 AM
To: Herrera, Mauricio <Mauricio.Herrera@tetratech.com>
Subject: FW: Cobalt CC205 RFI 1 - Control Pond Outlet structures

Good Morning Mauricio,

Can you please provide an email approving the attached design changes. We need to be sure that the outlet design is acceptable. I can also call you to discuss this morning if you have a few minutes.

Cheers,

Richard Boehnke P Eng
JDS Energy & Mining inc.
☏ Cell (250) 801-9474

From: Richard Boehnke
Sent: Tuesday, August 22, 2017 9:06 AM
To: 'Herrera, Mauricio' <Mauricio.Herrera@tetratech.com>
Subject: FW: Cobalt CC205 RFI 1 - Control Pond Outlet structures

Hi Mauricio,

Just as an FYI, I sent the attached and the below email to the contractor to price out the modifications. Unless you have any objections, we will be proceeding with the design as described here.

I also sent them a separate note clarifying that the bentonite plug will stay in the design.

Let me know if you have any questions or concerns. Looks like I am only available Thursday morning at 8 in Vancouver, if you want to discuss anything. I will be travelling all day tomorrow.

Richard Boehnke P Eng
JDS Energy & Mining inc.
☏ Cell (250) 801-9474

From: Richard Boehnke
Sent: Monday, August 21, 2017 1:52 PM
To: Bruce MacLean <macleanamericas@yahoo.ca>; harveymcintyre <harveymcintyre@gmail.com>; 'jon' <jon@cobaltconstruction.ca>; shaun <shaun@cobaltconstruction.ca>
Cc: Roman Bilobrowka <romanb@jdsmining.ca>; Jeff DePape <jdepape@jdsmining.ca>; Chris Copley <chrisc@jdsmining.ca>; Clint Abel <clinta@jdsmining.ca>
Subject: Cobalt CC205 RFI 1 - Control Pond Outlet structures

Bruce,

After the meeting we had last week, I prepared an RFI for you on the issues we discussed wrt to the control pond outlet structures from EBA-TetraTech design package, WTRM03037-01 - Eagle Gold Design_IFC R2.

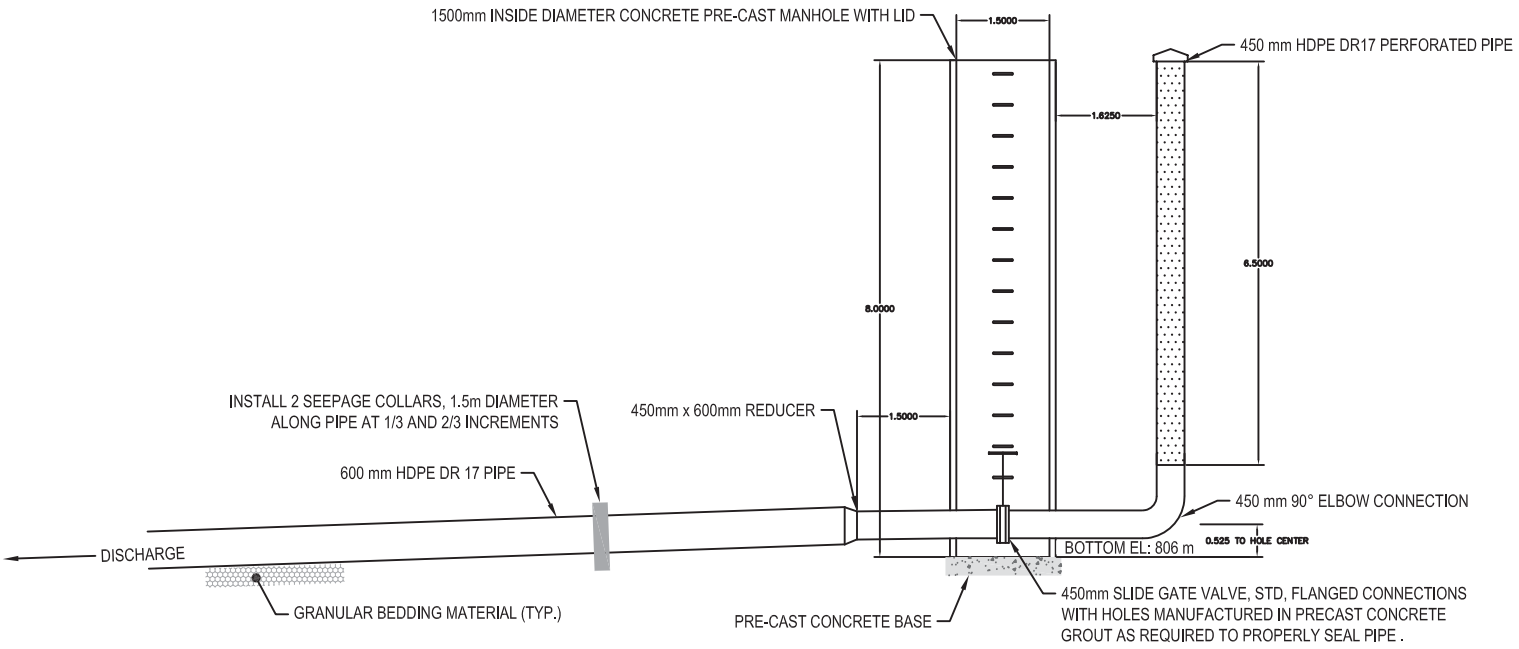
Please proceed to price and source out all the materials and installation for work for the clarifications and redesigns in the attached RFI and two sketches provided in the attached documents. ASAP. Then advise cost and schedule of items for construction.

Also, going forward for the work on this contract, please provide an RFI if there are and requests for information, clarifications or proposed design changes for any IFC or specific instructions provided to Cobalt for work here at the Victoria Gold site. I have also attached a blank RFI template for the project.

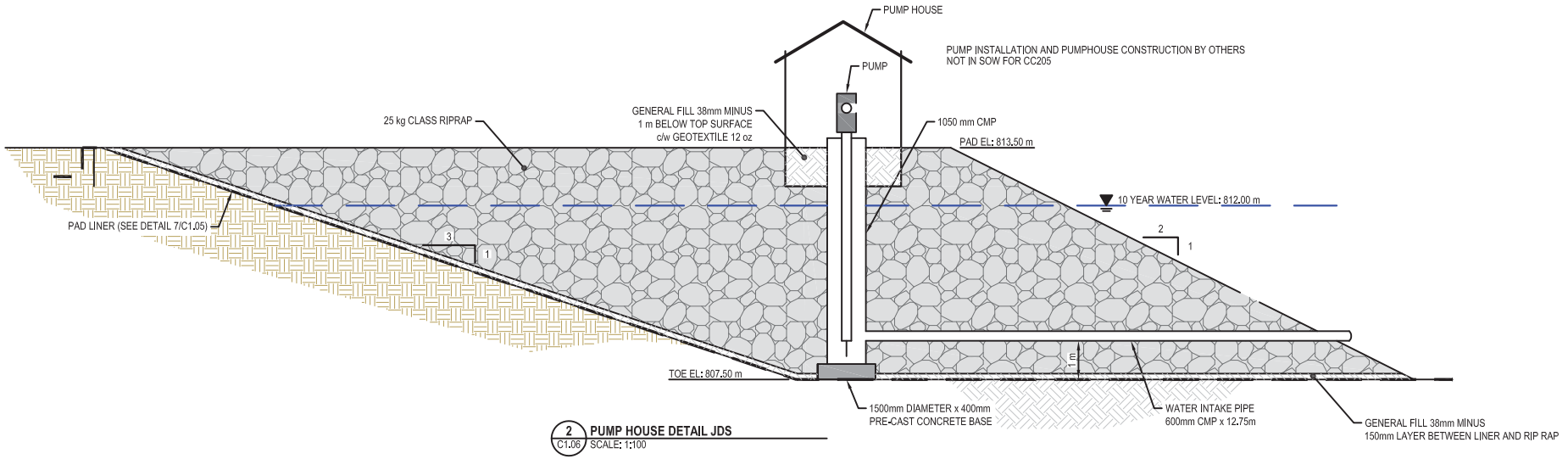
Let me know if you have any questions or require further clarifications.

Best regards,

Richard Boehnke, P.Eng.
Engineering Manager
JDS ENERGY & MINING INC.
Suite 900, 999 West Hastings St.
Vancouver, BC, V6C 2W2
email richardb@jdsmining.ca
office 604.558.6300
Canada cell 250.801.9474



JDS ENERGY & MINING INC.
VICTORIA GOLD - EAGLE PROJECT
RFI #1 CC205 COBALT
POND OUTLET STRUCTURE DETAILS
AUGUST 21, 2017
RICHARD BOEHNKE P ENG



2 / C1.06 **PUMP HOUSE DETAIL JDS**
SCALE: 1:100

JDS ENERGY & MINING INC.
VICTORIA GOLD - EAGLE PROJECT
RFI #1 CC205 COBALT
PUMP OUTLET STRUCTURE DETAILS
AUGUST 21, 2017
RICHARD BOEHNKE P ENG

REQUEST FOR INFORMATION

JDS RFI:	CC205 RFI 2
Contractor RFI:	COBALT - 02
Site Location:	EAGLEGOLD
Date Submitted:	AUG 27 2017

Subject: WATER MANAGEMENT PLAN	**Project Zone/Area:** TYPICAL CULVERT XING
Contractor: COBALT	**Station/Location:**
Attention: RICHARD BOEHNKE, CLINT ABEL	**Discipline:**

REQUEST

Related Drawings:
WATER MANAGEMENT PLAN C1.07 - 2

Other Related Documents:

Information Request/Description of Issue:
1 METER THICK CLAY PLUG (TYP). AS SHOWN – UPSTREAM AND DOWNSTREAM ON CULVERT CROSSING.
CLARIFICATION

QUESTION 1 : IF PLACED - IS THIS TO BE BENTONITE PLUGS

2: IS THIS REQUIRED?

Proposed Corrective Action

POSSIBLE DELETION AND JUST USE GEOTEXTILE AND RIPRAP AS SHOWN ON DRAWINGS. No – is required.

QUESTION 1 : IF PLACED - IS THIS TO BE BENTONITE PLUGS, clay or bentonite plugs are acceptable

2: IS THIS REQUIRED? yes

Type of Change:	☐	Owner Change	☒	Clarification/Info	☒	Field Change
	☐	Vendor Change	☒	Design Change	☐	Other
Cost Impact:	LESS BENTONITE REQUIRED AND TO INSTALL IN FIELD					
Schedule Impact:						

Requested by: BRUCE MacLEAN — AUG 27 2017

Name — Signature — Date

RESPONSE

☐ Approved ☒ Approved as noted ☐ Rejected as noted

Response:

Answered by: Richard Boehnke P Eng — 2017-8-28

Name — Signature — Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

Scanned by CamScanner

REQUEST FOR INFORMATION	JDS RFI:	
	Contractor RFI:	**COBALT- 3**
	Site Location:	
	Date Submitted:	

Subject: CONTROL POND	**Project Zone/Area:**
Contractor: COBALT CONSTRUCTION	**Station/Location:**
Attention:	**Discipline:**

REQUEST

Related Drawings: **Water management plan- Tetra Tech WTRM03037-01** **Sheets C1.01**	**Other Related Documents:**

Information Request/Description of Issue:

Water drainage system required below floor of pond (French Drain) within collection pond area and thru embankment area west to end area of spillway. Per discussion with Mauricio Herrera September 14 2017.
Will require survey layout, trenching and placing 100mm perforated pipe (4") within a geotextile lined and drain rock-fill trench.
Perforated pipe to be wrapped in geotextile.

Proposed Corrective Action

Cobalt to excavate trench's and place geotextile to enclose drain rock and perf. Pipe.
Proposed to place 3 lines of perforated pipe (100mm) approx. 0.5m apart in main East – West trench from Fore-Bay area (west side) to area near end of spillway. Proposed to place a single line of perforated pipe (100mm) in trench with drain rock along North inside of Collection Pond and then across (southerly) to connect with the East West lines. Trench's to be covered with compacted material above drain-rock wrap.
Cobalt to order all required pipe and geotextile to complete task asap after approval.

Approximately 910 lineal metres of perf. Pipe 100mm (4") corrugated & perforated DRAIN PIPE
Diameter and type of pipe subject to Engineer approval (Mauricio)

Approximately 8 Rolls of Geotextile 8 oz

Type of Change:	☐	Owner Change	☐	Clarification/Info	☒	Field Change
	☐	Vendor Change	☒	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: Bruce MacLean

Name Signature Date

RESPONSE

☐ Approved ☒ Approved as noted ☐ Rejected as noted

Response:
See attached drawing for proposed layout.
Trench needs to be lined and wrapped with geotextile (top covered).
Crushed rock must have no fines (clean). No punctures or tears to be allowed in geotextile to prevent entrance of fines.

At this time (9:30 AM 9/15/15) upstream diversion is not yet operating, but ok to proceed with 4 inch diameter assuming diversion will significantly reduce flows in the creek.

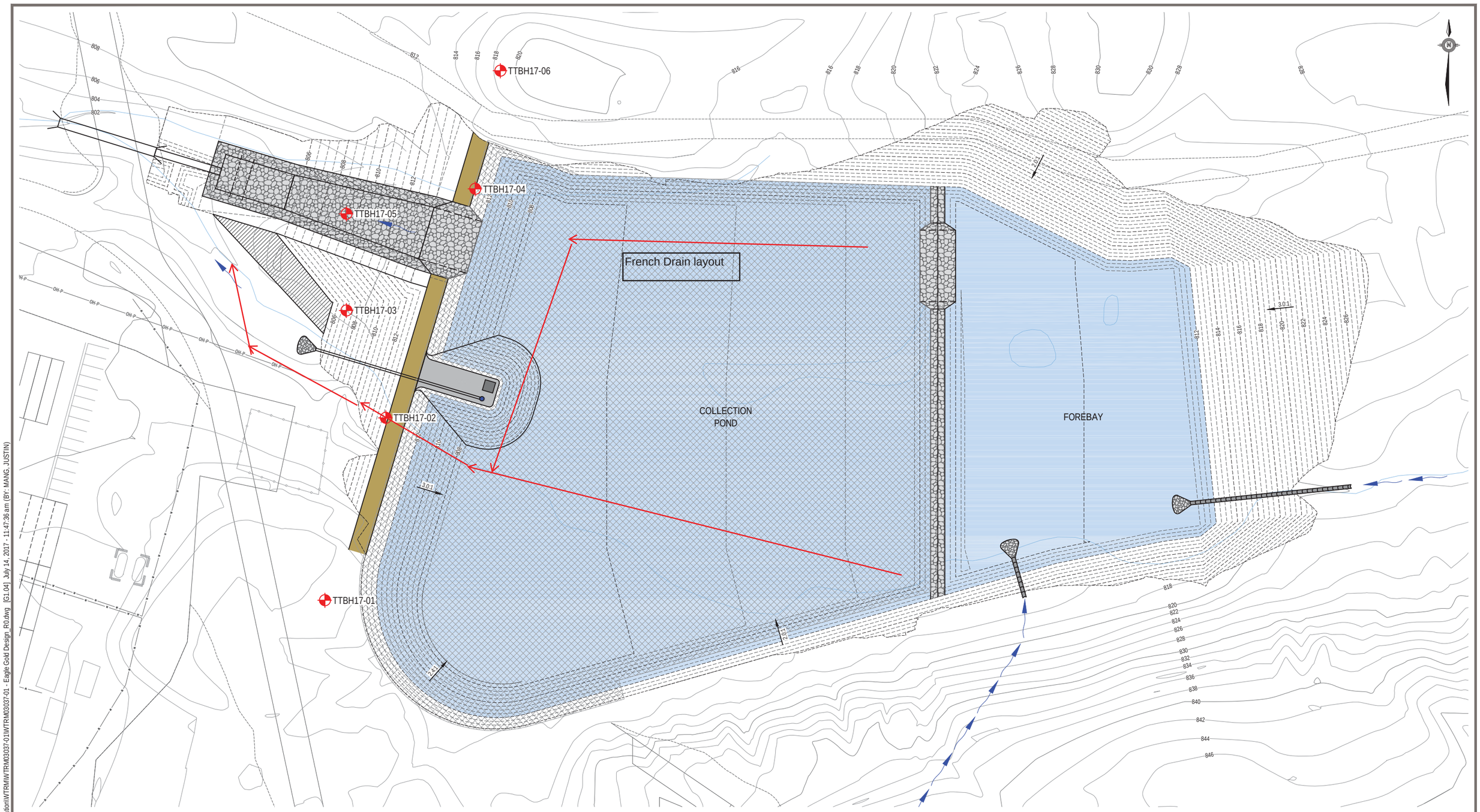
French drain is to deal primarily with groundwater baseflows. Surface water should be collected and pumped out.

French drain to discharge back to the creek approximately where shown in sketch, around elevation 803. Chase back up with slope 0.5%-1%.

Before placing lifts for the main dam. Fill material atop French drain, in trench segment under dam structure to be compacted as per Geotechnical Notes in sheet G1.02 in Tetra Tech's IFC drawings.

Answered by:		
Mauricio Herrera	MH	9/15/17

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.



LEGEND

---------- Design Major Contours (2 m)

---------- Design Minor Contours (0.5 m)

SCALE 1:1000

10 0 10 20 40m

NOTES

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date July 14/17
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

ISSUED FOR CONSTRUCTION

NUM	DATE	DWN	CKD	APR	DESCRIPTION
0	7/14/17	JDM	DH	MH	ISSUED FOR CONSTRUCTION

REVISIONS

Marianne Hansen P.ENG. (BC) July 14/2017 As Approved.

July 14, 2017

PROFESSIONAL SEAL

CLIENT

StrataGold Corporation

WATER MANAGEMENT PLAN
NELPCo EAGLE GOLD MINE , YT

BOREHOLE LOCATION PLAN

TETRA TECH EBA

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03037-01	VANC	DH	MH	0	G1.04
DATE	SHEET No.	DWN	APP	STATUS	
July 14, 2017	of	JDM	MH	IFC	

\\vt.local\eba\Legacy\Vancouver\Drafting\Transportation\WTRM\WTRM03037-01\WTRM03037-01 - Eagle Gold Design_R0.dwg [G1.04] July 14, 2017 - 11:47:36 am (BY: MANG, JUSTIN)

REQUEST FOR INFORMATION

JDS RFI:	
Contractor RFI:	**COBALT 4**
Site Location: C-1 AND C-8	
Date Submitted: SEPT 15 2017	

Subject: CULVERTS	**Project Zone/Area: CONTROL POND – SERVICE ROAD**
Contractor: COBALT	**Station/Location:**
Attention: CALVIN GOLDSCHMIDT	**Discipline:**

REQUEST

Related Drawings: **TETRA TECH WTRM03037 C-1.00**	**Other Related Documents:**

Information Request/Description of Issue:
Further to contract meeting of sept 14th

1. **ORDER AND INSTALL OF CULVERTS AT C-1 28m x 2200mm x 2 below spillway from control pond**
2. **ORDER AND INSTALL OF CULVERTS AT C-8 56m x 1200mm x2 junction of service road and crusher service road (below topsoil stockpile A.**

THESE AS PER THE CULVERT TABLE AS SHOWN ON C-1.00
CSP CULVERTS 14 GAUGE ALUMINIZED STEEL TYPE 2

Proposed Corrective Action

C-1 ORDER APPROVED AT MEETING. TO BE ORDERED FROM ATLANTIC INDUSTRIES

C-8 WAITING FOR CONFIRMATION OF FINAL CULVERT LENGTH FROM JDS PRIOR TO ORDER PLACEMENT

Type of Change:	☐	Owner Change	☒	Clarification/Info	☐	Field Change
	☐	Vendor Change	☒	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: BRUCE MACLEAN		**SEPTEMBER 14 2017**
Name	Signature	Date

RESPONSE

☐ Approved ☐ Approved as noted ☐ Rejected as noted

Response:
Contractor is instructed to supply their choice of the following:
C1 – 1 x 1500 mm CSP or 2 x 1200 mm CSP
C8 – 1 x 1000 mm CSP or 2 x 750 mm CSP. The total length of culvert to be 26m.

Contractor's choice is to be based on the least overall costs to supply, ship and install and must provide Owner brief description and cost analysis prior to placing the order.

Answered by:	**Calvin Goldschmidt**	**Sept 18, 2017**
Name	Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

Calvin Goldschmidt

From: Calvin Goldschmidt
Sent: Monday, September 18, 2017 3:23 PM
To: 'Herrera, Mauricio'
Subject: RE: Are you available to chat over the weekend?

Thanks Mauricio. Much appreciated. Will respond to Cobalt's RFI and copy you on the response.

Calvin.

From: Herrera, Mauricio [mailto:Mauricio.Herrera@tetratech.com]
Sent: Monday, September 18, 2017 3:20 PM
To: Calvin Goldschmidt
Subject: RE: Are you available to chat over the weekend?

Calvin
For C8 we can go with 2x750 mm or 1 x 1000 mm CSPs.

Mauricio Herrera, Ph.D.; P.Eng. | Senior Hydrotechnical Engineer
Direct **+1 (604) 608-8612** | Business **+1 (604) 685-0275** | Mobile **+1 (604) 764-1250** | Fax **+1 (604) 684-6241** |
Mauricio.Herrera@tetratech.com

Tetra Tech Canada | Complex World, Clear Solutions™ | Optional Operating Unit/Department
1000 | 10th FL, 885 Dunsmuir St., Vancouver, BC, V6C 1N5 | tetratech.com | tetratech.com

This message, including any attachments, may include privileged, confidential and/or inside information. Any distribution or use of this communication by anyone other than the intended recipient is strictly prohibited and may be unlawful. If you are not the intended recipient, please notify the sender by replying to this message and then delete it from your system.

Please consider the environment before printing. Read more

TETRA TECH

From: Herrera, Mauricio
Sent: Monday, September 18, 2017 2:06 PM
To: 'Calvin Goldschmidt' <Calving@jdsmining.ca>
Subject: RE: Are you available to chat over the weekend?

Calvin
For C1 we can go with one 1.5 m CSP or two 1.2 m CSP.

Working on C8 now.

Mauricio Herrera, Ph.D.; P.Eng. | Senior Hydrotechnical Engineer
Direct **+1 (604) 608-8612** | Business **+1 (604) 685-0275** | Mobile **+1 (604) 764-1250** | Fax **+1 (604) 684-6241** |
Mauricio.Herrera@tetratech.com

Tetra Tech Canada | Complex World, Clear Solutions™ | Optional Operating Unit/Department
1000 | 10th FL, 885 Dunsmuir St., Vancouver, BC, V6C 1N5 | tetratech.com | tetratech.com

This message, including any attachments, may include privileged, confidential and/or inside information. Any distribution or use of this communication by anyone other than the intended recipient is strictly prohibited and may be unlawful. If you are not the intended recipient, please notify the sender by replying to this message and then delete it from your system.

Please consider the environment before printing. Read more

TETRA TECH

From: Calvin Goldschmidt [mailto:Calving@jdsmining.ca]
Sent: Sunday, September 17, 2017 11:57 AM
To: Herrera, Mauricio <Mauricio.Herrera@tetratech.com>
Subject: RE: Are you available to chat over the weekend?

FYI, See attached what the discussion will be about. Basically challenging the design basis on the culverts.

The urgency is that we need to be able to place the culvert order on Monday.

If you would rather review and defer the discussion till Monday morning we can defer.

Thanks again Mauricio.

Calvin.

From: Herrera, Mauricio [mailto:Mauricio.Herrera@tetratech.com]
Sent: Sunday, September 17, 2017 10:25 AM
To: Calvin Goldschmidt
Subject: RE: Are you available to chat over the weekend?

4pm?

Sent from my Android phone using Symantec TouchDown (www.symantec.com)

-----Original Message-----
From: Calvin Goldschmidt [Calving@jdsmining.ca]
Received: Sunday, 17 Sep 2017, 7:27AM
To: Herrera, Mauricio [Mauricio.Herrera@tetratech.com]
Subject: RE: Are you available to chat over the weekend?

Morning sir,

At you leisure if you could spare the time sometime today please?

Thanks.

Calvin.

From: Herrera, Mauricio [mailto:Mauricio.Herrera@tetratech.com]
Sent: Saturday, September 16, 2017 1:33 PM
To: Calvin Goldschmidt
Subject: RE: Are you available to chat over the weekend?

Ok
In the meantime maybe in an email let me know what questions you do have

Sent from my Android phone using Symantec TouchDown (www.symantec.com)

-----Original Message-----
From: Calvin Goldschmidt [Calving@jdsmining.ca]
Received: Saturday, 16 Sep 2017, 1:29PM
To: Herrera, Mauricio [Mauricio.Herrera@tetratech.com]
Subject: Re: Are you available to chat over the weekend?

Ok. Maybe we can do it after the game instead and when convenient.

Calvin Goldschmidt
604-377-4522

From: Mauricio.Herrera@tetratech.com
Sent: September 16, 2017 1:19 PM
To: Calving@jdsmining.ca
Subject: RE: Are you available to chat over the weekend?

1:30 is fine I'll have about 20 min before my son's soccer game starts
604.764.1250

Sent from my Android phone using Symantec TouchDown (www.symantec.com)

-----Original Message-----
From: Calvin Goldschmidt [Calving@jdsmining.ca]
Received: Saturday, 16 Sep 2017, 12:51PM
To: Herrera, Mauricio [Mauricio.Herrera@tetratech.com]
Subject: Re: Are you available to chat over the weekend?

Let me know what time works. Does 1:30pm work? If you would rather wait, then no problem. Suggest an alternate time. I appreciate it's the weekend.

Calvin Goldschmidt
604-377-4522

From: Calving@jdsmining.ca
Sent: September 16, 2017 9:50 AM
To: Mauricio.Herrera@tetratech.com
Subject: RE: Are you available to chat over the weekend?

Culvert sizing. Need to order and don't understand the sizing. Not sure if this has been already discussed.

Let me get my thoughts together first.

Thanks.

Calvin.

From: Herrera, Mauricio [mailto:Mauricio.Herrera@tetratech.com]
Sent: Saturday, September 16, 2017 9:48 AM

To: Calvin Goldschmidt
Subject: RE: Are you available to chat over the weekend?

This afternoon ok?
What's up?

Sent from my Android phone using Symantec TouchDown (www.symantec.com)

-----Original Message-----
From: Calvin Goldschmidt [Calving@jdsmining.ca]
Received: Saturday, 16 Sep 2017, 9:31AM
To: Herrera, Mauricio [Mauricio.Herrera@tetratech.com]
Subject: Are you available to chat over the weekend?

Calvin Goldschmidt
Project Manager

JDS Energy & Mining Inc.

cell (604) 377-4522
email calving@jdsmining.ca
web jdsmining.ca

KELOWNA | VANCOUVER | WHITEHORSE | YELLOWKNIFE | TUCSON | HERMOSILLO

The content of this email is the confidential property of JDS Energy & Mining and should not be copied, modified, retransmitted, or used for any purpose except with JDS Energy & Mining's written authorization. If you are not the intended recipient please delete all copies and notify us immediately.

REQUEST FOR INFORMATION

JDS RFI:	
Contractor RFI:	**COBALT 5**
Site Location: EAGLEGOLD	
Date Submitted: SEPT 15 2017	

Subject: HDPE 450MM PIPE	**Project Zone/Area: CONTROL POND**
Contractor: COBALT	**Station/Location: LLO**
Attention: CALVIN GOLDSCHMIDT	**Discipline:**

REQUEST

Related Drawings: **TETRA TECH 03037-01 C1.06** **SJ-SS-JDS** **OUTLET STRUCTURE DESIGN RFI – 1 CC205 REV 1**	**Other Related Documents:**

Information Request/Description of Issue:
FURTHER DETAIL REQUIRED ON LLO HDPE PIPE FROM MANHOLE TO DISCHARGE.
LINE TO BE INSTALL AT 3.03% GRADE
NEED TO INSTALL A BEND IN 450mm LINE DOWNSTREAM SIDE OF MANHOLE.

REQUIRE THE DEGREE OF BEND

Proposed Corrective Action
PROPOSE TO FUSION IN PLACE A PRE- MADE BEND IN LINE.
SUPPLIER TO MAKE UP IN SHOP.

Type of Change:	☐	Owner Change	☐	Clarification/Info	☐	Field Change
	☐	Vendor Change	☒	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: BRUCE MACLEAN **SEPTEMBER 15 2017**

Name Signature Date

RESPONSE

☐ Approved ☐ Approved as noted ☐ Rejected as noted

Response:

JDS agree that a premanufactured bend is required as the wall thickness of the pipe will not allow the pipe to bend over the length of the discharge and cause stress at the connection to the valve inside the manhole.

JDS recommend that Cobalt select the angle required. Adjustments to where the bend is fused into the line can be made on site. Ie: the bend can be installed anywhere along the horizontal run provided that the invert of the outlet is per the design.

Answered by Calvin Goldschmidt Sept 17, 2017

Answered by:

Name Signature Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

REQUEST FOR INFORMATION

JDS RFI:	**CC 205 RFI 7**
Contractor RFI:	**COBALT -7**
Site Location: COLLECTION POND	
Date Submitted: SEPTEMBER 16 2017	

Subject: DRAIN ROCK	**Project Zone/Area: UNDER POND DRAINS**
Contractor: COBALT CONSTRUCTION	**Station/Location:**
Attention: CALVIN GOLDSCHMIDT	**Discipline:**

REQUEST

Related Drawings: **TETRA TECH WTRM03037-01 C1.01** **MAURICIO ALIGNMENT DRAWING AS SHOWN ON C1.01**	**Other Related Documents:**

Information Request/Description of Issue:

THE ROCK DRAINAGE EXCAVATION (FRENCH DRAIN) AS PROPOSED BY THE DESIGN ENGINEER (MAURICIO) FROM HIS NOTE ON RFI 3 REQUIRES CRUSHED ROCK WITH NO FINES. HE DIDN'T SPECIFY MAX ROCK SIZE ?
WHAT IS THE SOURCE OF THE DRAIN ROCK?

COBALT ESTIMATES BASED ON LINEAL DISTANCES FROM HIS DRAWING THAT IT WILL REQUIRE APPROX. 650m3 OF DRAIN ROCK TO COMPLETE THE DRAINS.

ESTIMATE THAT 910m OF 100mm PERFORATED PIPE WILL BE REQUIRED.

Proposed Corrective Action

REQUEST DECISION FROM JDS ON ORIGIN OF SUPPLY OF THIS DRAIN ROCK OR ALTERNATE? SIZE OF CRUSHED ROCK? APPROX. 45 -50 LOADS WITH ARTICULATING TRUCKS.
COBALT IS PROPOSING TO ORDER 100mm (4") PVC PERFORATED PIPE – 6m LENGTHS – BELL & SPIGOT TYPE, AS PER MEETING DISCUSSION WITH JDS.

Type of Change:	☐	Owner Change	☒	Clarification/Info	☐	Field Change
	☐	Vendor Change	☐	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: BRUCE MACLEAN		**SEPT. 16 2017**
Name	Signature	Date

RESPONSE

☐ Approved ☐ Approved as noted ☐ Rejected as noted

Response:
1) Drain rock will be supplied from the 20mm concrete aggregate stockpile located at Nuway Crushing site near 43km on the access road.

Answered by: Matt Coverdale	Matt Coverdale	**Sept 17,2017**
Name	Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense

REQUEST FOR INFORMATION

EPCM RFI No. **EPCM-RFI-003**	**Site Location:** Victoria Gold
Sub-Contractor RFI No.:	**Date Submitted:** 09/26/2017
Subject: Requesting design and specification clarifications	Project Zone/Area: Lower Dublin South Pond
Sub-contractor: Cobalt Construction	Station/Location: Control Pond
Attention: Mauricio Herrera	Discipline: Civil

REQUEST

Related Drawings:	**Other Related Documents:**
G1.02 C1.01 C1.03 C1.05 C1.06	

Information Request/Description of Issue:

1) G1.02 – Geotechnical Notes – Preparation – 8: Reference to Health & Safety Act for the Province of Alberta

2) G1.02 – Requesting lift thickness increase from 200mm loose fill lift as an estimated compacted 150mm is viewed as over conservative and will impact the construction schedule.

3) Clarification of prepared subgrade surface and who is responsible to sign off on prepared subgrade inspection

4) C1.01 -Clarification of collection pond/forebay crest elevation, crest width to tie in key trench; some areas from the asbuilt topo of original ground require areas of fill where the Tetratech design shows cut.

5) C1.03 – B/1.03 – Typical Forebay Embankment Section – Requesting HDPE liner tie in location separating the lined area of the Collection pond from the Forebay along the Forebay berm and spillway.

6) C1.03 – B/1.03 Typical Forebay Embankment Section does not match 1/C1.05 Forebay Spillway Detail. B/1.03 has crest marked at 811m and 1/C1.05 has crest marked at 812m and spillway top of rock elevation at 811m.

7) C1.05 – 7/C1.05 – Pad Liner Detail – Shows two layers of geotextile under the HDPE liner; unlike any other details

8) C1.06 - 1/1.06 – Low level outlet detail - Requesting detail for geotextile and HDPE liner tie in around manhole and perforated pipe.

9) Requesting hold point for Control Pond construction

Proposed Corrective Action

1) Update to Yukon Act references in drawings.

2) Increase lift thickness to 500mm loose fill lift.

3) Visual inspection by onsite Tetratech engineering representative and sign off on prepared subgrade before liner install. Surface will be rolled to push down any protruding rocks and any large rocks present will be removed to

provide sufficient prepared subgrade.

4) Establish 5m bench at the 813.5m elevation along top of collection pond to account for liner key in and access equipment access.

5) Provide detail of tie in point and location as there currently is none shown.

6) Clarify which elevation is correct for top of rock at the Forebay Berm (811m or 812m)

7) Remove second layer of geotextile liner from detail

8) Extend liner to 813.5m elevation to ensure seal around manhole, include fusing detail around perforated pipe to ensure all intake water is directed into the perforated pipe.

9) Specify hold points for the contractor to provide ITP's to be signed by the on Site Tetratech engineering representative.

Type of Change:	☐	Owner Change	☑	Clarification/Info	☐	Field Change
	☐	Vendor Change	☑	Design Change	☐	Other
Cost Impact:						
Schedule Impact:						

Requested by:	**Matt Coverdale**		**09/26/207**
	Name	Signature	Date

RESPONSE

☑ Approved ☐ Approved as noted ☐ Rejected as noted

Response:

Clarifications were provided and design drawings updated

Answered by:	Mauricio Herrera		09/27/2017
	Name	Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Sub-contractor's risk and expense.

REQUEST FOR INFORMATION

JDS RFI:	**EPCM-RFI-004**
Contractor RFI:	**COBALT 6**
Site Location: EAGLEGOLD	
Date Submitted: SEPT 29 2017	

Subject: Control Pond Material Excavation	**Project Zone/Area: Control Pond**
Contractor: Cobalt Construction	**Station/Location: Collection Pond**
Attention: Mauricio Herrera	**Discipline: Civil**

REQUEST

Related Drawings: **G1.04**	**Other Related Documents:** **Water Management Plan** **2017-09-29-TEST PIT LOCATIONS.csv** **Attached Pictures**

Information Request/Description of Issue:

During the excavation down to the collection pond floor on the southwest end, clay deposits have been encountered before reaching final grade and while excavating the under liner drain trench.

Four test pits were excavated to determine the depth of the clay seam.

Test Pit #1 located near the south west corner of the collection pond displayed a 2.5m thick seam of clay

Test Pit #2 located approximately 15m north east of Test Pit #1 showed continuous clay material down to the bottom of the test pit showing no sign of suitable material.

Test Pit #3 located approximately 35m north of Test Pit #3 showed continuous clay beginning 3m from the surface and was continuous to the bottom of the test pit.

Test Pit #4 located 35m west of Test Pit #3, down near the creek bed requiring a 0.5m cut to reach the bottom of the under liner trench displayed clay less than 0.1m below surface and was continuous to the bottom of the test pit.

Proposed Corrective Action

Propose to sub-excavate the clay material when it is encountered down to suitable ground if possible; approximately 1.5-2 meters below final grade, place a geogrid/geomembrane and backfill to final grade using suitable material.

If clay material is found above final grade of the pond floor and under liner drain trench, propose to sub-excavate 1.5m below final grade, place geotextile, and backfill using suitable material to provide a competent base for the pond floor and under liner drain.

Type of Change:	☐	Owner Change	☒	Clarification/Info	☐	Field Change	
	☐	Vendor Change	☐	Design Change	☐	Other	

Cost Impact:	
Schedule Impact:	

Requested by: Matt Coverdale — **SEPTEMBER 29 2017**

Name | Signature | Date

RESPONSE

☑ Approved ☐ Approved as noted ☐ Rejected as noted

Response:

Answered by: Mauricio Herrera — September 30, 2017

Name | Signature | Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

REQUEST FOR INFORMATION	JDS RFI:	**CC 205**
	Contractor RFI:	**COBALT 8**
	Site Location: Eagle Gold	
	Date Submitted: Sept 30 2017	

Subject: Clay Layer encountered in Control Pond	**Project Zone/Area: Control Pond**
Contractor: COBALT CONSTUCTION	**Station/Location: floor pond**
Attention: Calvin Goldschmidt	**Discipline:**

REQUEST

Related Drawings: **TETRA TECH WTRM 03037 C1.01**	**Other Related Documents:**

Information Request/Description of Issue:
Cobalt has encountered some wet clay layer at the floor elevation of collection pond.
This will not compact to meet spec. very wet.
4 Test Pits were dug to investigate problem and located by survey. These were inspected by Gus (Cobalt) and Matt Coverdale of JDS on Sept 29.
AREAS of concern: coordinates

TP 1	**7100796**	**458689.5**	**809.714**	**4.6m to bottom from survey notes - start of clay @ 2.8m from survey point**									
TP 2	**7100810**	**458715.8**	**808.883**	**3.3m**	**“**	**“**	**“**	**“**	**“**	**“**	**“**	**“**	**@ 2.0m**	**“**	**“**	**“**
TP 3	**7100846**	**458724**	**810.196**	**3.8m**	**“**	**“**	**“**	**“**	**“**	**“**	**“**	**“**	**@ 3.1m**	**“**	**“**	**“**
TP 4	**7100841**	**458691.9**	**806.393**						**“**	**“**	**“**	**@ 0.0m**	**“**	**“**	**“**

Proposed Corrective Action
Propose to excavate wet clay to approx. 1.5m below grade and re-.compact with suitable materials to 98% SSD Proctor.
Areas sub-excavated to be picked up by survey for location and quantity.

Type of Change:	☐	Owner Change	☒	Clarification/Info	☒	Field Change
	☐	Vendor Change	☐	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: Bruce MacLean - Cobalt		**September 30 2017**
Name	Signature	Date

RESPONSE

☐ Approved ☐ Approved as noted ☐ Rejected as noted

Response:

JDS requested Tetratech geotechnical engineer to make a site visit to complete further test pitting in the areas of concern.

Path forward to be provided by Tetratech after site visit.

Answered by:	**Matt Coverdale**	Matt Coverdale	**Oct 1, 2017**
Name		Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

REQUEST FOR INFORMATION	JDS RFI:	**CC- 205**
	Contractor RFI:	**COBALT - 9**
	Site Location: Victoria Gold	
	Date Submitted: Oct. 09 2017	

Subject: inspection test plan – control pond	**Project Zone/Area: CONTROL POND**
Contractor: COBALT CONSTRUCTION	**Station/Location:**
Attention:	**Discipline:**

REQUEST

Related Drawings: **WTRM03037-01 RIV 1 and REV 2 IFC**	**Other Related Documents:**

Information Request/Description of Issue:
Review and Approval of attached Inspection Test Plan for Control Pond – dated Oct. 08 2017 - by the Engineer of Record at TetraTech EBA.

Proposed Corrective Action
Review and approval of activities on attached ITP for use by Engineer of Record.

Type of Change:	☐	Owner Change	☒	Clarification/Info	☐	Field Change
	☐	Vendor Change	☐	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: B. MacLean – Cobalt Construction **Oct. 09 2017**

Name Signature Date

RESPONSE

☐ Approved ☐ Approved as noted ☐ Rejected as noted

Response:

Answered by:

Name Signature Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does

constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

REQUEST FOR INFORMATION

JDS RFI:	**EPCM-RFI-005**
Contractor RFI:	**EPCM-RFI-005**
Site Location: EAGLE GOLD	
Date Submitted: October 14 2017	

Subject: Control Pond – Underdrain System	**Project Zone/Area: Control Pond**
Contractor: Cobalt Construction	**Station/Location: Collection Pond**
Attention: Mauricio Herrera	**Discipline: Civil**

REQUEST

Related Drawings: **C1.08 – Detail 4 – Trench Drain Detail**	**Other Related Documents:**

Information Request/Description of Issue:

Drawing C.108, Detail #4 indicates that the underdrain piping needs to be wrapped in Geotextile.

Proposed Corrective Action

EPCM propose removing the requirement for geotextile wrap around the underdrain pipe as there is already geotextile wrap under around the "clear crush" underdrain backfill.

Type of Change:	☐	Owner Change	☐	Clarification/Info	☒ Field Change
	☐	Vendor Change	☐	Design Change	☐ Other
Cost Impact:					
Schedule Impact:					

Requested by: Calvin Goldschmidt	Calvin Goldschmidt	Digitally signed by Calvin Goldschmidt DN: cn=Calvin Goldschmidt, o=JDS Energy & Mining, ou=email, c=CA Date: 2017.10.14 18:49:27 -07'00'	**October 14 2017**
Name	Signature		Date

RESPONSE

☑ Approved ☒ Approved as noted ☐ Rejected as noted

Response:

Answered by:	MAURICIO HERRERA	Mauricio Herrera	OCT 15/2017
Name	Signature		Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

REQUEST FOR INFORMATION

JDS RFI:	**EPCM-RFI-006**
Contractor RFI:	
Site Location: EAGLE GOLD	
Date Submitted: October 18 2017	

Subject: Control Pond – Dam Construction	**Project Zone/Area: Control Pond**
Contractor: Pelly Construction	**Station/Location: Dam**
Attention: Mauricio Herrera	**Discipline: Civil**

REQUEST

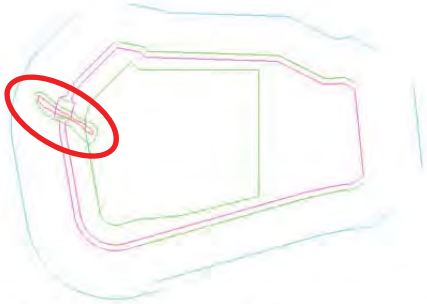
Related Drawings:	**Other Related Documents:** 20171018_CONTROLPOND_DAM_SUBEXCAVATION.dwg

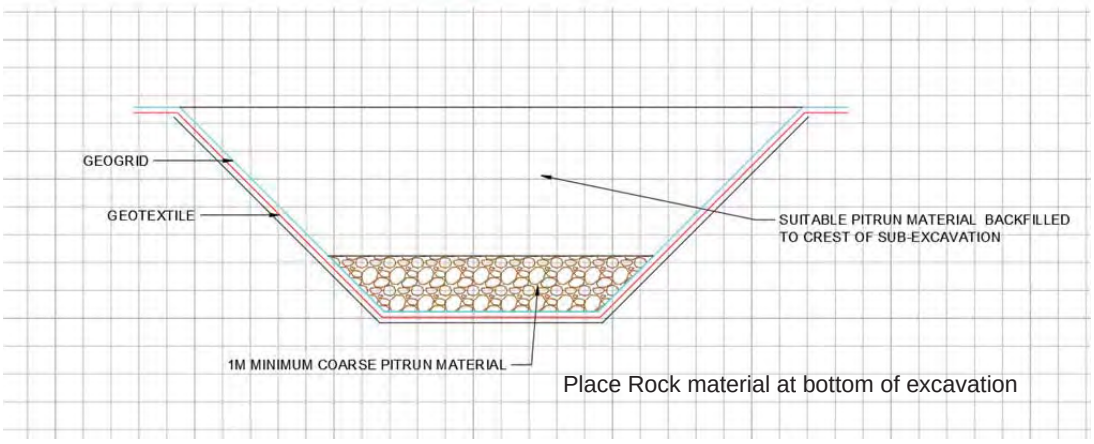
Information Request/Description of Issue:

A clay seam of material was identified under the spillway in the control pond dam; the sub-excavation reached approximately 5 m below design grade with no signs of stability improving. Survey of the excavation is attached.

Proposed Corrective Action

Propose to bridge the sub-excavation, materials will be placed in the following order: geotextile, geogrid, minimum of 1m coarse suitable material, capped with suitable backfill material to the crest of the sub-excavation.





Type of Change:	☐	Owner Change	☐	Clarification/Info	☒ Field Change
	☐	Vendor Change	☐	Design Change	☐ Other
Cost Impact:					
Schedule Impact:					

Requested by: Matt Coverdale		**October 18, 2017**
Name	Signature	Date

RESPONSE

☐ Approved ☑ Approved as noted ☐ Rejected as noted

Response: OK with the proposed concept. Prior to placing geogrid and geotextile, place a rock layer at bottom of excavation to displace soft material. Updates required as construction progresses to determine if modifications to concept are required.

Answered by:		10/19/17
Name	Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

Hugh Coyle

From: Buyck, James <James.Buyck@tetratech.com>
Sent: October-19-17 9:53 PM
To: Herrera, Mauricio; Matt Coverdale; Sinclair, Jennifer; Cowan, Chad; Patrick, Bob
Cc: Clint Abel; Calvin Goldschmidt; dan@pelly.net; shipeng@pelly.net; jason@pelly.net
Subject: RE: EPCM-RFI-006 - Control Pond Dam

There will be enough room on one end for sure and will attempt to proof roll all of it, if possible.

All for now,

J.

James Buyck | Senior Project Technologist - Nanaimo
Direct **(250) 756-2256 x246** | Fax **(250) 756-2686** | Mobile **(250) 802-6262** | James.Buyck@tetratech.com
Tetra Tech Canada Inc.

From: Herrera, Mauricio
Sent: Thursday, October 19, 2017 9:36 PM
To: MattC@jdsmining.ca; Sinclair, Jennifer <Jennifer.Sinclair@tetratech.com>; Cowan, Chad <Chad.Cowan@tetratech.com>; Patrick, Bob <Bob.Patrick@tetratech.com>; Buyck, James <James.Buyck@tetratech.com>
Cc: clinta@jdsmining.ca; Calving@jdsmining.ca; dan@pelly.net; shipeng@pelly.net; jason@pelly.net
Subject: RE: EPCM-RFI-006 - Control Pond Dam

Thank you James

After placing the 1m thick layer will there be enough width/access to do a proof roll? If yes please arrange to have it completed.

Sent from my Android phone using Symantec TouchDown (www.symantec.com)

-----Original Message-----
From: Buyck, James [James.Buyck@tetratech.com]
Received: Thursday, 19 Oct 2017, 6:28PM
To: Herrera, Mauricio [Mauricio.Herrera@tetratech.com]; Matt Coverdale [MattC@jdsmining.ca]; Sinclair, Jennifer [Jennifer.Sinclair@tetratech.com]; Cowan, Chad [Chad.Cowan@tetratech.com]; Patrick, Bob [Bob.Patrick@tetratech.com]
CC: Clint Abel [clinta@jdsmining.ca]; Calvin Goldschmidt [Calving@jdsmining.ca]; dan@pelly.net [dan@pelly.net]; Shipeng Zheng [shipeng@pelly.net]; Jason Abel [jason@pelly.net]
Subject: RE: EPCM-RFI-006 - Control Pond Dam

Everyone,

Placement of 200 to 600 mm diameter rock and attempting to push into the soft, saturated soil has proven to be not as effective as hoped.

When attempting to push the rock into the soft soil with the CAT 365 excavator the surrounding area lifts and remains unstable. Several methods of placement with minimal, medium and thicker lifts were attempted. It appears the soil is firm enough to resist complete penetration. While there is improvement, the area is still considered unstable.

-The plan is to now ensure rock is placed to completely covers the base and pushed into the soft base as much as possible.

The plan from there is to:
-Cover the rock with minimum 300 mm thick layer of import pit run gravel
-Place geotextile with 600 mm minimum overlap throughout excavation to crest of each embankment, as per previously RFI submitted by JDS;
-Place geogrid on top of geotextile edge to edge with no overlaps
-Place 1.0 m thick layer of pit run and compact to at least 98% SPMDD

It will not be possible to bench the (south side) slope opposite the north embankment the excavator is working from. It is preferable to leave the north embankment undisturbed as it appears solid and to to avoid causing a mess of the rock fill below.

The work is schedule to begin tomorrow morning. Any feedback would be appreciated.

All for now,

J.

James Buyck | Senior Project Technologist - Nanaimo
Direct **(250) 756-2256 x246** | Fax **(250) 756-2686** | Mobile **(250) 802-6262** | James.Buyck@tetratech.com
Tetra Tech Canada Inc.

From: Herrera, Mauricio
Sent: Thursday, October 19, 2017 3:25 PM
To: Matt Coverdale <MattC@jdsmining.ca>; Sinclair, Jennifer <Jennifer.Sinclair@tetratech.com>; Cowan, Chad <Chad.Cowan@tetratech.com>; Patrick, Bob <Bob.Patrick@tetratech.com>; Buyck, James <James.Buyck@tetratech.com>
Cc: Clint Abel <clinta@jdsmining.ca>; Calvin Goldschmidt <Calving@jdsmining.ca>; dan@pelly.net; Shipeng Zheng <shipeng@pelly.net>; Jason Abel <jason@pelly.net>
Subject: RE: EPCM-RFI-006 - Control Pond Dam

Response attached

Mauricio Herrera, Ph.D.; P.Eng. | Senior Hydrotechnical Engineer
Direct **+1 (604) 608-8612** | Business **+1 (604) 685-0275** | Mobile **+1 (604) 764-1250** | Fax **+1 (604) 684-6241** |
Mauricio.Herrera@tetratech.com

Tetra Tech Canada | Complex World, Clear Solutions™ | Optional Operating Unit/Department
1000 | 10th FL, 885 Dunsmuir St., Vancouver, BC, V6C 1N5 | tetratech.com | tetratech.com

This message, including any attachments, may include privileged, confidential and/or inside information. Any distribution or use of this communication by anyone other than the intended recipient is strictly prohibited and may be unlawful. If you are not the intended recipient, please notify the sender by replying to this message and then delete it from your system.

Please consider the environment before printing. Read more

TETRA TECH

From: Matt Coverdale [mailto:MattC@jdsmining.ca]
Sent: Wednesday, October 18, 2017 6:41 PM
To: Herrera, Mauricio <Mauricio.Herrera@tetratech.com>; Sinclair, Jennifer <Jennifer.Sinclair@tetratech.com>; Cowan, Chad <Chad.Cowan@tetratech.com>; Patrick, Bob <Bob.Patrick@tetratech.com>; Buyck, James <James.Buyck@tetratech.com>
Cc: Clint Abel <clinta@jdsmining.ca>; Calvin Goldschmidt <Calving@jdsmining.ca>; dan@pelly.net; Shipeng Zheng <shipeng@pelly.net>; Jason Abel <jason@pelly.net>
Subject: EPCM-RFI-006 - Control Pond Dam

Maurico,

Attached is an RFI concerning the clay seam encountered through the control pond dam as well as the survey data of the sub-excavation.

Please respond to our proposed approach ASAP.

Thanks,

Matt Coverdale
Mining Engineer EIT
JDS ENERGY & MINING INC.
Suite 900, 999 West Hastings St.
Vancouver, BC, V6C 2W2
email **mattc@jdsmining.ca**
office 604.558.6300
cell 604.209.0219

VANCOUVER | TORONTO | KELOWNA | YELLOWKNIFE | TUCSON | HERMOSILLO
The content of this email is the confidential property of JDS Energy & Mining and should not be copied, modified, retransmitted, or used for any purpose except with JDS Energy & Mining's written authorization. If you are not the intended recipient please delete all copies and notify us immediately.

REQUEST FOR INFORMATION

JDS RFI:	**EPCM-RFI-008**
Contractor RFI:	**YG201-RFI-005**
Site Location: EAGLE GOLD	
Date Submitted: October 21 2017	

Subject: Control Pond – Low Level Outlet	**Project Zone/Area:** Control Pond
Contractor: Pelly Construction	**Station/Location:** Low Level Outlet
Attention: Mauricio Herrera	**Discipline:** Civil

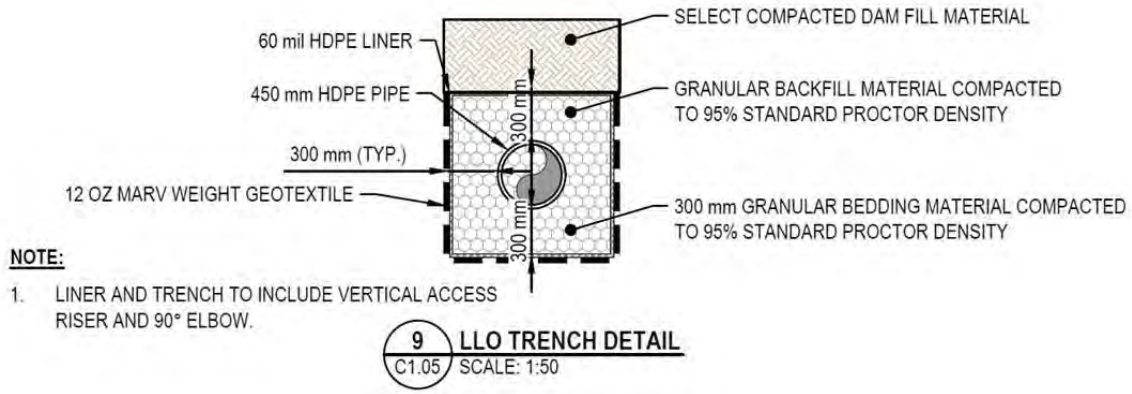
REQUEST

Related Drawings: C1.01 C1.05 – Detail 9 C1.06	**Other Related Documents:** LLO alignment

Information Request/Description of Issue:

1) Require clarification of the LLO trench detail concerning the 60mil HDPE Liner around the backfilled trench. Water seepage along the pipe is to be deterred by the clay plug and seepage collars.

2) There is only 48.5m of 450mm HDPE pipe on site, including the two seepage collars the total length of pipe is 50.5m.



Proposed Corrective Action

1) Remove HDPE liner from detail

2) Swap the pump station and LLO to shorten the length of the designed 56.44m of 450mm HDPE. The new alignment is attached and is 52.6m in length. The shortened length will result in a slight swale in the dam toe at the LLO outlet.

Type of Change:	☐	Owner Change	☒	Clarification/Info	☒	Field Change
	☐	Vendor Change	☐	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: Matt Coverdale	Matt Coverdale	**October 21, 2017**
Name	Signature	Date

RESPONSE

☐ Approved ☑ Approved as noted ☐ Rejected as noted

Response:

1) This change is not approved. The HDPE liner is required to prevent potential leakages under dam embankment from the low level outlet trench.

2) This change is approved. Tetra Tech will update the drawings to reflect the change

Answered by:	Mauricio Herrera	10/22/2107
Name	Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

REQUEST FOR INFORMATION

JDS RFI:	**EPCM-RFI-009**
Contractor RFI:	**YG201-RFI-006**
Site Location: EAGLE GOLD	
Date Submitted: October 25 2017	

Subject: Control Pond – Liner Details	**Project Zone/Area:** Control Pond
Contractor: Pelly Construction	**Station/Location:** Control Pond
Attention: Mauricio Herrera	**Discipline:** Civil

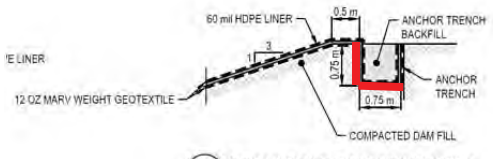
REQUEST

Related Drawings	**Other Related Documents:**

Information Request/Description of Issue:

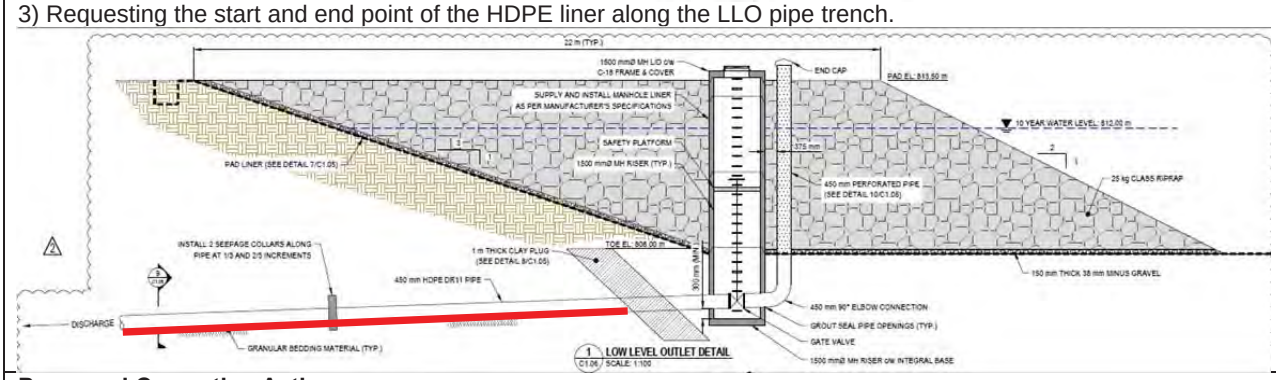
1) Requesting to remove control pond over-liner layer of geotextile; the non-goven geotextile does not have UV resistant properties and this layer along the slope will degrade eventually over time

2) Requesting to extend liner to bottom of anchor trench only, to allow water or moisture to drain away rather than be retained within the trench.



6 C1.05 POND LINER SLOPE AND ANCHOR DETAIL SCALE: NTS

3) Requesting the start and end point of the HDPE liner along the LLO pipe trench.



1 C1.05 LOW LEVEL OUTLET DETAIL SCALE: 1:100

Proposed Corrective Action

1) Remove over-liner layer of geotextile.
2) Extend liner down 0.75m and across 0.75m within the anchor trench.
3) Begin liner in LLO trench after bentonite plug and end at the discharge

Type of Change:	☐	Owner Change	☐	Clarification/Info	☐	Field Change
	☐	Vendor Change	☒	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: Matt Coverdale		**October 25, 2017**
Name	Signature	Date

RESPONSE

☑ Approved ☐ Approved as noted ☐ Rejected as noted

Response:
1) OK to remove layer of geotextile over liner
2) OK to change liner anchor detail as shown above
3) OK to start liner in LLO after bentonite

Answered by:		10/25/2017
Name	Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

REQUEST FOR INFORMATION

JDS RFI:	**EPCM-RFI-010**
Contractor RFI:	**YG201-RFI-007**
Site Location: EAGLE GOLD	
Date Submitted: November 09 2017	

Subject: Control Pond – Jetty riprap design	**Project Zone/Area:** Control Pond
Contractor: Pelly Construction	**Station/Location:** Control Pond
Attention: Mauricio Herrera	**Discipline:** Civil

REQUEST

Related Drawings	**Other Related Documents:**

Information Request/Description of Issue:

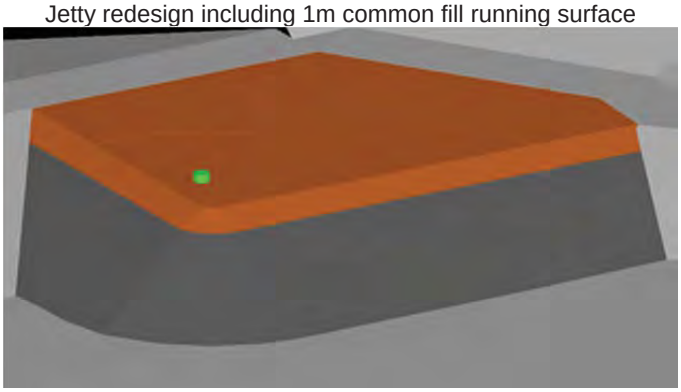
Requesting to extend Jetty to the North to increase the pad size for pump house access and constructability purposes. The extended Jetty will tie in with the north berm of the collection pond; using mostly common fill material to reduce riprap quantity.

Proposed Corrective Action

Proposing to reduce the riprap quantity from 1,700m3 to 950m3

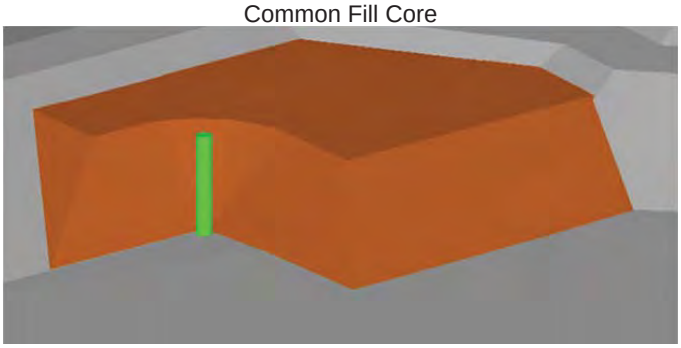
- Common fill material will be placed in the brown areas at the core of the Jetty and at the top 1m running surface.
- Riprap fill will be placed in the grey areas to allow water inflow to the perforated standpipe and 0.6m of riprap will be placed on the slopes of the common fill material; geotextile will be placed at the common fill/riprap interface.

Jetty redesign including 1m common fill running surface

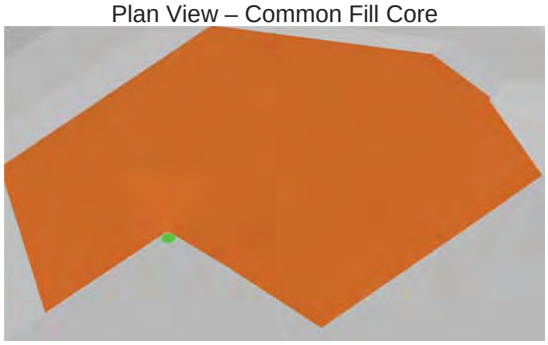


Jetty before installation of 1m running surface (812.5m)

Common Fill Core



Plan View – Common Fill Core



Type of Change:	☐	Owner Change	☐	Clarification/Info	☐	Field Change
	☐	Vendor Change	☒	Design Change	☐	Other

Cost Impact:	
Schedule Impact:	

Requested by: Matt Coverdale		**November 09, 2017**
Name	Signature	Date

RESPONSE

☑ Approved ☐ Approved as noted ☐ Rejected as noted

Response:

Answered by:	Mauricio Herrera		Nov. 10, 2017
	Name	Signature	Date

Note: Response to this RFI does not constitute authorization to perform a change to any Contract. The Requestor may proceed with the response only on the basis that the Requestor agrees that it is not a contract change. If the Requestor believes that the response does constitute a contract change, the Requestor shall immediately notify JDS. Work undertaken without JDS written authorization is at the Contractor's risk and expense.

ATTACHMENT D

Field Review Reports

THIS PAGE INTENTIONALLY LEFT BLANK

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin South Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRN03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**001**
Client:	**JDS Energy & Mining**			**Date:**	September 26, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Jamie Trainor	**Tetra Tech EBA Representative:**	Ryan Okkema (RO)
Sun and cloud	High 7°C				

Work undertaken:

1. Field review of west dam excavation and subgrade material

Testing:

1. None

Work (Passed/Failed):

1. N/A

Verbal discussions with Contractor and Others:

1. Discussed requirements for Tetra Tech sign off on project hold points and ITPs
2. Discussed requirements for subgrade conditions for liner overlay

Inspectors Remarks/Observations:

- Edges and corner of current excavation has large amount of +300mm stone, Middle of excavation looks reasonable for liner subgrade.

Site Recommendations Issued:

- Contractor to send RFI to JDS and Tetra Tech to clarify what the Contractor is responsible for in terms of ITP

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1
Excavation along west dam

Photo 2
Northwest corner of west dam excavation. Note material present in subgrade

Photo 3
Excavation of spoils in forebay area

Photo 4

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin South Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRN03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**002**
Client:	**JDS Energy & Mining**			**Date:**	September 27, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Jamie Trainor	**Tetra Tech EBA Representative:**	Ryan Okkema (RO)
Cloudy, Rain	High 6°C				

Work undertaken:

1. Field review of west dam excavation and subgrade material.

Testing:

1. None

Work (Passed/Failed):

1. N/A

Verbal discussions with Contractor and Others:

1. Discussed sourcing of native materials within the site to use for the West Dam and North Slope of pond.
2. Discussed the specs required for compaction and lift depths.
3. Discussed beginning compaction of North Slope, but proctor values have not yet been received from lab.

Inspectors Remarks/Observations:

- Native material located along CL of West Dam appears well graded gravel and sand with trace silt material, 30mm minus.
- Water is flowing into forebay berm footprint from an underground porous layer in North Slope.
- Grubbing and stripping completed along footprint of West Dam.
- Site conditions too wet to begin compaction, and proctor values are not available at this time.

Site Recommendations Issued:

- Contractor to wait for proctor values before beginning compaction, otherwise perform test strips. However site conditions have prevented any compaction efforts to begin.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1
East view of pond excavation.

Photo 2
East view of West Dam (in middle ground). Notice difference in material in dam footprint from left to right.

Photo 3
View of Northeast corner of pond. Contractor plans to push material down from crest of hill to build up the North slope between the crest and toe stake lines shown running along the cut edge of hill.

Photo 4
Native material present at midpoint of West Dam. Well graded, no cobble/boulders

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**003**
Client:	**JDS Energy & Mining**			**Date:**	October 14, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	James Buyck (JB)
Sun & cloud	High -1°C				

Work undertaken:

1. Field review of underdrain sub-excavation, filter fabric, perf piping, drain rock placement, and sub-excavation within the south end of the embankment.

Testing:

1. None

Work (Passed/Failed):

1. N/A

Verbal discussions with Contractor and Others:

1. Discussed work plan related to winter work and current work being performed with the west end of the South Pond with Clint Abel. Also discussed the preparation required by the contractor to cover and protect placed material with soil cover at the end of the day to prevent freezing and then removal the following day to continue construction.

Inspectors Remarks/Observations:

- Sub-excavation of soft, saturated clay/silt material within the area of the control pond being removed, as required.

Site Recommendations Issued:

- None

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Sub-excavation of underdrain area to subgrade at west end of Control Pond.

Photo 2: Placement of 20 mm minus drain rock in progress within underdrain area

PHOTOGRAPHS

Photo 3: View of sub-excavation within southwest area of embankment.

Photo 4 View looking west at in-progress sub-excavation of soft, saturated silt/clay material within southwest area of containment pond

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**004**
Client:	**JDS Energy & Mining**			**Date:**	October 15, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	James Buyck (JB)
Sun & cloud	Low: -7°C High: -1°C				

Work undertaken:

1. Field review of underdrain sub-excavation, filter fabric, perf piping and drain rock placement; sub-excavation within the south end of the embankment along with various locations within the east and south sides of the control pond.

Testing:

1. None

Work (Passed/Failed):

1. N/A

Verbal discussions with Contractor and Others:

1. On-going discussions on work plan, progress and construction methodology with C. Abel. General requirements of QC testing and reporting with C. Goldschmidt.

Inspectors Remarks/Observations:

- Continued sub-excavation within various areas of the control pond. Soft, saturated soils removed to firm subgrade base, as required.
- Although not photographed, the subgrade for the underdrain was observed by lifting the placed geotextile. It was noted that the soil comprised a mixture of sand/silt/gravels in a compact and damp to moist state. The stockpile from the excavation work observed to include cobbles and smaller boulder sized rocks throughout.
- Infiltration water being controlled with sumps and pumped out of the control pond area.

Site Recommendations Issued:

- None

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: View looking west from east end at partial excavation of control pond

Photo 2: Sub-excavation in progress with and near north end of spillway area of control pond.

PHOTOGRAPHS

Photo 3: Continued installation of perforated pipe for underdrain.

Photo 4: Continued sub-excavation within south end of control pond embankment area.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**005**
Client:	**JDS Energy & Mining**			**Date:**	October 16, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	James Buyck (JB)
Sun & cloud	Low: -9°C High: -1°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Sub-excavation and placement of filter fabric, perf piping and drain rock for underdrain;
2. Sub-excavation within the south end of the embankment along with locations within the east and south sides of the control pond.

Testing:

1. None

Work (Passed/Failed):

1. N/A

Verbal discussions with Contractor and Others:

1. Phone conversation held with M. Herrera, C. Copley; T. Thornton; C. Goldschmidt, and C. Abel present. Discussion included:
   - Progress of revised control pond design and site work, construction methodology and QC testing requirements for the sub-excavation work and planned backfill of the embankment fill area where soft, saturated clay encountered;
   - Planned 24-hour construction to bring sub-excavation to original design subgrade elevation to commence possibly Wednesday or Thursday. JB to monitor and report for M. Herrera to provide authorization prior to backfill placement.
   - JB to arrange with Whitehorse office for cross shift during 24-hour operations currently estimated to commence on Thursday.

Inspectors Remarks/Observations:

- Continued sloughing of soil occurring from the east wall of the excavation being completed to remove soft, saturated clay within the south dam area (Photo 1). The sloughing soil believed to be Placer tailings observed to comprise 1.5 m thick layer of sand overlying saturated silt/sand/clay soils;
- Sub-excavation within various other areas of the control pond continues with subgrade observed stable, as required. Rock and rough surfaces observed in various locations through the control pond.
- Continued water control efforts using sumps and pumping out of the control pond area;
- Continued installation of underdrain with no issues of concerns noted.

Site Recommendations Issued:

- Contractor will need to be prepared to address frozen soils prior to placement of backfill.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

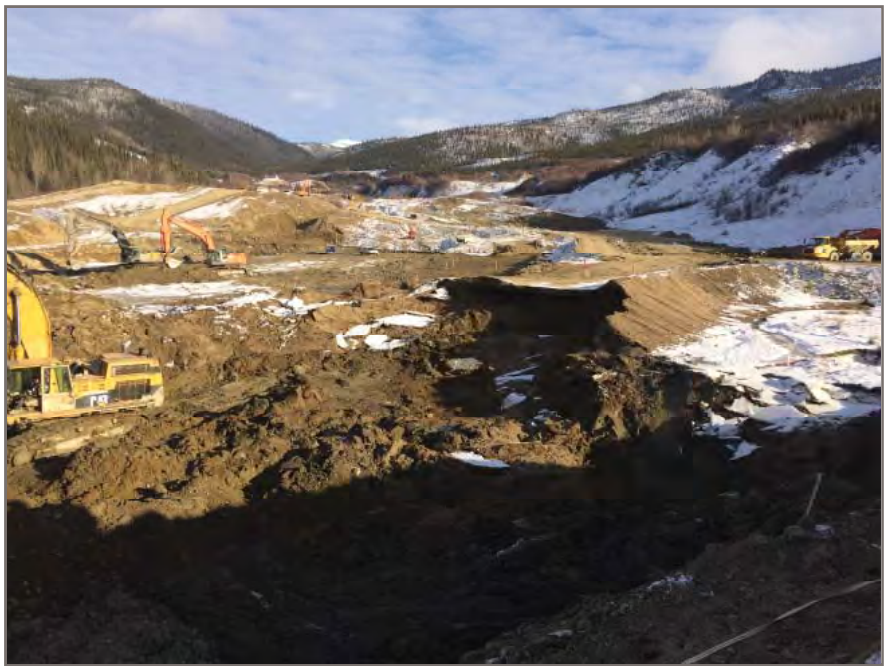


Photo 1: View of slough from east side of excavation within south dam area.

Photo 2: View looking south at sloughing soils from east wall of south dam excavation area.

PHOTOGRAPHS

Photo 3: Continued installation of perforated pipe for underdrain.

Photo 4: Excavation of underdrain

PHOTOGRAPHS

Photo 5: View looking west at sub-excavation in progress along south side of control pond.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**006**
Client:	**JDS Energy & Mining**			**Date:**	October 17, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	James Buyck (JB)
Sun & cloud	Low: -8°C High: -1°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Sub-excavation and placement of filter fabric, perf piping and drain rock for underdrain;
2. Sub-excavation within the south end of the control pond dam and along the south side of the control pond.

Testing:

1. None

Work (Passed/Failed):

1. N/A

Verbal discussions with Contractor and Others:

1. Phone conversation held with M. Herrera, C. Copley; T. Thornton; C. Goldschmidt, and C. Abel present. Discussion included:
   - Progress of revised control pond design and site work, construction methodology for the sub-excavation work and planned backfill of the embankment fill area where soft, saturated clay encountered;
   - Underdrain location and request for survey to be provided to M. Herrera;
   - JDS request to construct clay around low level outlet vertically as opposed to angled, as per Detail 1 on C1.06, approved by M.Herrera. Plug is to extend 1.0 m beyond pipe O.D;
   - JDS request to change key configuration in Forebay Embankment, as shown in Section B on C1.03, approved by M. Herrera;
   - Planned 24-hour construction to bring sub-excavation to original design subgrade elevation to commence possibly Wednesday or Thursday. JB to monitor and report for M. Herrera to provide authorization prior to backfill placement.
   - Discussions with C. Abel (JDS) and J. (Pelly) regarding stability of excavation base in the control dam area, as well, construction methodology, dewatering and backfill requirements. Determined excavation base still unstable and further excavation required.

Inspectors Remarks/Observations:

- Pumps used for water control in sump near Forebay failed during the night and water entered the excavation within the control pond dam area. More sloughing occurred as a result. Dewatered and sub-excavation completed to satisfaction.
- A soil buttress constructed against the toe of the east wall of the control pond dam area excavation used to hold back sloughing. These efforts observed to be working, as required.
- Contractor has excavated to about 4.8 m below design grade of dam subgrade elevation. Excavated base observed to be still unstable and continued excavation to possibly 2.0 m to 2.5 further estimated to be required based on a testpit completed in the area.
- Continued water control efforts using sumps and pumping out of the control pond area is working, as required;

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

- Continued construction of underdrains along the north side and through the center of the pond with no issues of concerns noted.

Site Recommendations Issued:

- Contractor will need to be prepared to potentially use geotextile in the excavated base and address frozen soils prior to placement of backfill.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

PHOTOGRAPHS

Photo 1: Continued slough from east side of excavation within south dam area.

Photo 2: View looking east at placement of buttress in progress against toe of east wall of excavation and base completed to about 4.5 m below design depth.

PHOTOGRAPHS

Photo 3: View looking west at partial excavation of soft, saturated soils within south end of control dam area.

Photo 4: View looking north at excavation of south end of control dam in progress.

PHOTOGRAPHS

Photo 5: View looking northeast at sub-excavation in progress along south side of control pond. Estimated depth at 4.5 m below design depth.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**007**
Client:	**JDS Energy & Mining**			**Date:**	October 18, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	James Buyck (JB)
Overcast	Low: -°C High: 1°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Sub-excavation within the south end of the lower Dublin control pond dam.
2. Control Strip testing of material proposed for backfill of control pond dam sub-excavation.

Testing:

1. Control Strip testing proposed backfill material for control pond dam sub-excavation.
2. The material observed to comprise Gravel, sandy, trace silt; cobbly with some smaller boulder sized particles throughout; mostly well-graded and in a damp state.

Work (Passed/Failed):

1. Results of control strip testing of pit run gravel to be submitted in a separate report, once reviewed.

Verbal discussions with Contractor and Others:

1. Discussions held with C. Abel, M. Cloverdale and J. Foster (Pelly) on how to proceed with the soft, saturated soil within the sub-excavation. A plan devised and forwarded to Tetra Tech team for consideration, discussion and ultimately authorized plan.

Inspectors Remarks/Observations:

- Continued dewatering and sub-excavation efforts throughout site;
- Contractor has excavated to about 4 to 5 mm below design grade of dam subgrade elevation. Excavated base observed to be still unstable and continued excavation to possibly 2.0 m to 2.5 further estimated to be required based on a testpit completed in the area.
- Continued water control efforts using sumps and pumping out of the control pond area is working, as required;
- Continued construction of underdrains along the north side and through the center of the pond with no issues of concerns noted.

Site Recommendations Issued:

- Contractor will need to be prepared to potentially place and push coarse rock into the soft, saturated soil of the sub-excavation; continue to dewater and deal with frozen soil.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: View looking east from west end of sub-excavation within south end of control pond dam.

Photo 2: View looking east from mid-point of sub-excavation within south end of control pond dam area.

PHOTOGRAPHS

Photo 3: View looking east at sub-excavation within area of the south control dam.

Photo 4: Material proposed for fill within the south control sub-excavation being prepared for control strip testing.

PHOTOGRAPHS

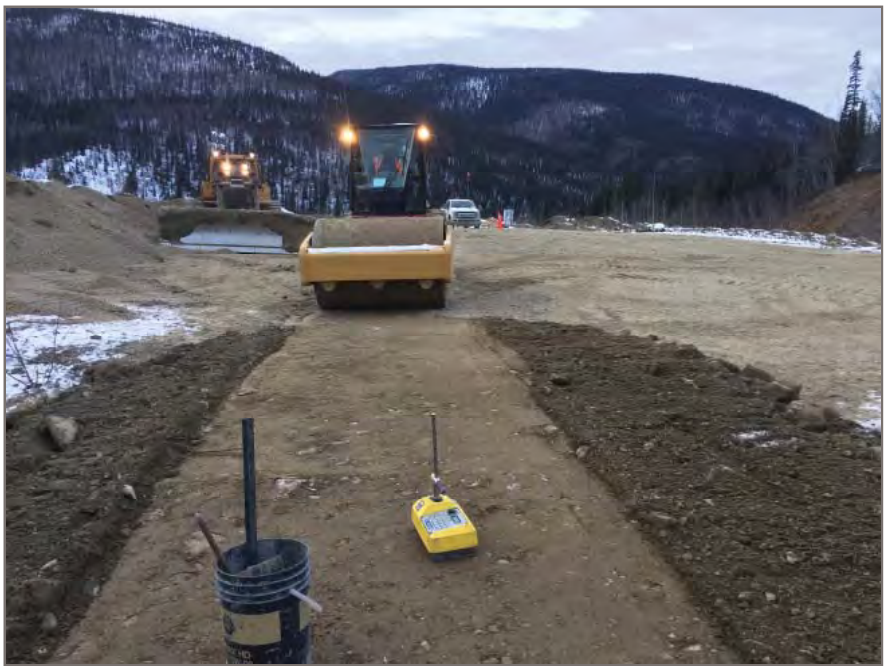


Photo 5: Control strip testing of material proposed for initial backfill of the south control dam sub-excavation.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**008**
Client:	**JDS Energy & Mining**			**Date:**	October 19, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	James Buyck (JB)
Overcast, light snow	Low: -8°C High: 1°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Sub-excavation within the south end of the lower Dublin control pond dam.
2. Control Strip testing of material proposed for backfill of control pond dam sub-excavation.

Testing:

1. Control Strip testing proposed backfill material for control pond dam sub-excavation.
2. The material observed to comprise Gravel, sandy, trace silt; cobbley with some smaller boulder sized particles throughout; mostly well-graded and in a damp state.

Work (Passed/Failed):

1. Results of control strip testing of pit run gravel to be submitted in a separate report, once reviewed.

Verbal discussions with Contractor and Others:

1. Discussions held with C. Abel, M. Cloverdale and J. Foster (Pelly) on how to proceed with the soft, saturated soil within the sub-excavation. A plan devised and forwarded to Tetra Tech team for consideration, discussion and ultimately authorized plan.
2. Phone conference with C. Cowan, A. Wallace, M. Herrera, B. Patrick, J. Buyck, C. Coverdale, C. Abel, J. Foster (Pelly). Plan to proceed with sub-excavation determined and to comprise using the CAT 365 excavator to push coarse 80 mm to 600 mm diameter into the soft subgrade. If successful in stabilizing the subgrade then using geotextile and geogrid not warranted.

Inspectors Remarks/Observations:

- Continued dewatering and sub-excavation efforts throughout site;
- Pushing the coarse rock in the soft subgrade of the excavation within the control pond dam area was not as successful as hoped. Plan is to proceed with placement of 300 mm of coarse pit run, covered with overlapped geotextile then geogrid. At least 1 m thick layer of coarse pit run to pad throughout the excavation area.
- Continued water control efforts using sumps and pumping out of the control pond area is working, as required;

Site Recommendations Issued:

- Proof roll required once the 1 m pit run layer placed within the sub-excavation area, as per M. Herrera request. A loaded tri-axel end dump to be used to completed this work. .

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Placement and pushing coarse rock into the soft base within the South Control Dam sub-excavation.

Photo 2: Attempting to push the rock into the subgrade with the cutting edge of the bucket.

PHOTOGRAPHS

Photo 3: Placement and pushing rock into the narrow section of the excavation in-progress.

Photo 4: CAT 265 excavator used to place and push coarse rock into soft subgrade of excavation area.

PHOTOGRAPHS

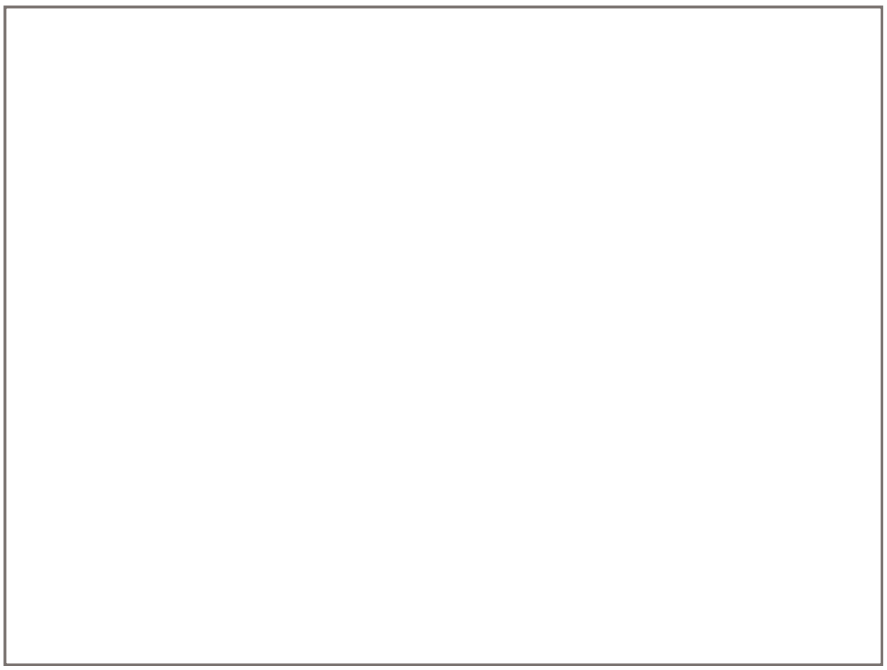


Photo 5: Control strip testing of material proposed for initial backfill of the south control dam sub-excavation.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**009**
Client:	**JDS Energy & Mining**			**Date:**	October 20, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	James Buyck (JB)
Overcast, light snow	Low: -4°C High: 1°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Placement of pit run, geotextile and geogrid throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Sub-excavation to design grades within Forebay area.

Testing:

1. None

Work (Passed/Failed):

1. None

Verbal discussions with Contractor and Others:

1. Site communication with C. Abel, M Coverdale and J. Foster (Pelly) related to placement of pit run over coarse rock pushed into soft, saturated soil, as well placement of geotextile and geogrid all with within the sub-excavation of the Lower Dublin South Dam of the control pond. Specific discussion held on placement of geogrid and subsequent backfill and importance of minimizing as much slack in the geotextile and geogrid as possible. Backfilling to be completed in a method that avoids the geotextile and geogrid to become slack and with gaps.
2. Discussion related to use of method spec for field density testing of material with C. Abel and M. Coverdale. Communicated with Tetra Team for feedback.

Inspectors Remarks/Observations:

- Continued dewatering and sub-excavation efforts throughout site;
- Placement of 300 mm thick layer of coarse pit run throughout sub-excavation area completed with no concerns noted.
- The previously placed coarse rock that was attempted to be pushed into the soft subgrade surveyed, as well the pit run placed today.
- The geotextile and geogrid placed throughout the entire sub-excavation area observed adequately overlapped, with minimal slack and adequately secured at the slope crests.
- At least 1.0 to 1.2 m thick layer of coarse pit run padded throughout the excavation area.
- Continued water control efforts using sumps and pumping out of the control pond area is working, as required;

Site Recommendations Issued:

- Proof roll required once the 1 m pit run layer placed within the sub-excavation area, as per M. Herrera request. A loaded tri-axel end dump to be used to completed this requirement.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: View looking northwest at 300 mm thick layer of pit run gravel placed within sub-excavation prior to geotextile and geogrid placement.

Photo 2: View looking east at 300 mm thick layer of pit run gravel placed within sub-excavation prior to geotextile and geogrid placement.

PHOTOGRAPHS

Photo 3: View from north embankment looking southwest at geotextile placed throughout sub-excavation.

Photo 4: View from north embankment looking south west at geogrid placed over geotextile.

PHOTOGRAPHS

Photo 5: View from west end looking east at geotextile and geogrid placed throughout sub-excavation.

Photo 6: View from south embankment looking northwest at pit run being padded throughout the west end of the sub-excavation.

PHOTOGRAPHS

Photo 7: View looking northwest at pit run gravel placement within west end of sub-excavtion.

Photo 8: Looking northwest at pit run gravel being padded into the west end of the sub-excavation.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**009NT**
Client:	**JDS Energy & Mining**			**Date:**	October 21, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Ryan Brown (RB)
Overcast, light snow	Low: -8°C High: -4°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Placement and compaction of four lifts observed adequate and confirmed with field density (compaction) testing.
- Contractor removed sluffed and frozen material off of south west bank before tying lift in. (Picture #3)
- Variability of material observed throughout shift. Minor organics, increases in fines and coarse pockets.
- Minor surface freezing observed. No more than 25mm throughout shift.
- Continued dewatering and sub-excavation efforts throughout site;

Site Recommendations Issued:

- Fifth lift started nearing end of shift. Adequate compaction not reached by end of shift. To be completed crossover shift.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Placement of bridge lift east side of excavation where underlying saturated material is located.

Photo 2: Compaction of bridge lift east side of excavation.

PHOTOGRAPHS

Photo 3: Removal of sluffed and frozen material in south west bank

Photo 4: Placement and compaction of pitrun within excavation

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**010**
Client:	**JDS Energy & Mining**			**Date:**	October 21, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	James Buyck (JB)
Overcast, light snow	Low: -8°C High: -4°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- About 25 mm thick layer of frozen materials bladed from the bridge lift placed yesterday observed adequately completed and acceptable for compaction (Photo 1) and proof roll. Proof roll completed with loaded tri-axel end dump observed with minimal deflections noted (Photo 2). Overall very stable base established.
- Two testpits excavated within the bridge lift to 0.6 to 0.8 m below surface and compaction testing performed. Results indicated adequate compaction; however as expected lower than test results taken at surface.
- Placement and compaction of subsequent three lifts observed adequate and confirmed with field density (compaction) testing.
- The sump used to dewater the sub-excavation filled with coarse rock pushed into the soft sub-grade as much as possible; capped with 300 mm thick pit run; covered with geotextile; and 1 m bridge placed and compacted.
- Continued dewatering and sub-excavation efforts throughout site;

Site Recommendations Issued:

- Depth of 1.2 m minimum and placement of geotextile throughout while extending to provide overlap of more excavation, backfill and geotextile anticipated. will be required excavation required and geotextile placement within unstable ground located within the entrance to the sub-excavation area. This location estimated to be within the toe area of the west side of the control dam structure.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Compaction of bridge lift in progress.

Photo 2: Proof-roll of bridge lift in–progress.

PHOTOGRAPHS

Photo 3: Field density testing in progress within testpit excavated into the bridge lift

Photo 4: Scarifying lift to ensure adequate bond to next lift in-pogress.

PHOTOGRAPHS

Photo 5: Bridge lift being extended into area previously used as sump that was located adjacent east side toe of south dam.

Photo 6: View from south embankment looking northwest at fill placement in-progress.

PHOTOGRAPHS

Photo 7: Entrance into fill area within west toe of dam where unstable material removed in preparation for geotextile placement

Photo 8: Coarse rock being pulled away from geotextile and geogrid lined excavation walls.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**011**
Client:	**JDS Energy & Mining**			**Date:**	October 22, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Arvin Linklater
Overcast, light snow	Low: -8°C High: -2°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Suspected weak subgrade from night shift required proof roll, performed by Arvin L and Clint A. (Photo 1) Proof roll showed very week sub grade, requested Contractor to test pit one location (Photo 2). Excavation through 900mm to 1.0m of placed material from night shift show unsuitable fill material not meeting contract spec for back-fill
- Subsequent material was rejected, Contractor was asked to remove 900mm of the unsuitable fill (Photo 3) and find a new source of material for back-fill
- Proof roll performed and passed by Arvin L and Clint A after excavation to competent ground (Photo 5).
- New sourced material placed spread and compacted
- Proof roll performed after one and a half hours of two single drum smooth drum packers on first placed lift exposes two large week spots.
- The week areas were excavated once more to 600mm, while excavating near south berm, the berm showed significant movement. The berm was exposed of fabric and geogrid and excavation into the side slope revealed over saturated material.
- After consultation with the client and contractor it was decided to remove the entire berm and replace with a more structurally durable material

Site Recommendations Issued:

- The removal of the soft spots with be lined with geogrid and backfilled, the remainder of the lift once at even grade will be lined with geogrid before the next lift placement
- The excavated berm bottom will require Filter Fabric and Geogrid and backfilled

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

PHOTOGRAPHS

Photo 1: Sub grade failure. Proof Roll performed showed heavy rut and roll

Photo 2: Test of material placed through night shift show organics and high clay content.

PHOTOGRAPHS

Photo 3: Unsuitable sub grade fill material excavated out

Photo 4: Performing proof roll.

PHOTOGRAPHS

Photo 5: New sourced material placed, spread and compacted.

Photo 6:

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**010NT**
Client:	**JDS Energy & Mining**			**Date:**	October 22, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Ryan Brown
Overcast, light snow	Low: -10°C High: -8°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Removal of unsuitable material near south berm.
2. Area north of excavation, within limits of dam cut to an elevation of 808.00m. Material placed north of excavation outside of dam footprint within control pond.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Removal of unsuitable material.
2. Material placed outside of limits of dam proof rolled.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Unsuitable material located within berm removed and sent to waste pile.
- Contractor removed saturated material out of south bank along excavation. Material sent to waste pile.
- Berm located to the north of the excavation cut down to an elevation of 808.00m.
- Cut material from north bank placed outside of damn footing within control pound proof rolled with CAT 740 rock truck.

Site Recommendations Issued:

- Day shift to install geogrid under excavated locations which contained saturated material.
- Suitable pitrun to be sourced for placement within berm.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Removal of unsuitable material within berm

Photo 2: Material removed from bank and straight walled.

PHOTOGRAPHS

Photo 3: Excess material located north of excavation being cut to 808.00m

Photo 4: CAT 740 tracking placed material

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

<table>
<tr><td>PROJECT:</td><td colspan="3">Lower Dublin Control Pond</td><td>EBA PROJECT NO.:
Task:</td><td>TRN.WTRM03037-01
001</td></tr>
<tr><td>Location:</td><td colspan="3">NELPCo Eagle Gold Mine, YT</td><td>REPORT NO.</td><td>012</td></tr>
<tr><td>Client:</td><td colspan="3">JDS Energy & Mining</td><td>Date:</td><td>October 23, 2017</td></tr>
<tr><td colspan="2">Weather</td><td rowspan="2">Client Rep.:</td><td rowspan="2">Calvin Goldschmidt
Roman Bilobrowka
Clint Abel</td><td rowspan="2">Tetra Tech EBA Representative:</td><td rowspan="2">Arvin Linklater</td></tr>
<tr><td>Overcast, light snow</td><td>Low: -11°C
High: -1°C</td></tr>
<tr><td colspan="4">Work undertaken:
Field review geotechnical work related to the following:
1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.</td><td colspan="2">Testing:
1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):
1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.</td></tr>
<tr><td colspan="6">Verbal discussions with Contractor and Others:
1.On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.</td></tr>
<tr><td colspan="6">Inspectors Remarks/Observations:
▪ Existing south berm excavated out to prior berm bottom elevation, berm bottom prepped, Filter Fabric and Geogrid installed
▪ Bridge lift of 400-500mm placed, spread and compacted. Cat 773 used as compaction on Bridge lift
▪ No deflection, rut or roll observed through each of two lifts placed on day shift
▪ Density tests all pass on density and moisture content as per contract spec</td></tr>
<tr><td colspan="6">Site Recommendations Issued:
▪ Keeping borrow material fresh, constant monitoring of backfill material
▪ Adequate lighting at borrow site through the night shift</td></tr>
</table>

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Excavator removes over saturated unsuitable berm material

Photo 2: Filter Fabric with Geogrid laid on bottom of berm

PHOTOGRAPHS

Photo 3: Geogrid placed on prior lift for support

Photo 4: Suitable backffill material placed on Geogrid

PHOTOGRAPHS

Photo 5: Cat 773 Rock Truck used for compaction

Photo 6: Second lift placed and spread

PHOTOGRAPHS

Photo 7: Packing second lift with Cat 773 rock Truck

Photo 8:

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

<table>
<tr><td>PROJECT:</td><td colspan="3">Lower Dublin Control Pond</td><td>EBA PROJECT NO.:
Task:</td><td>TRN.WTRM03037-01
001</td></tr>
<tr><td>Location:</td><td colspan="3">NELPCo Eagle Gold Mine, YT</td><td>REPORT NO.</td><td>011NT</td></tr>
<tr><td>Client:</td><td colspan="3">JDS Energy & Mining</td><td>Date:</td><td>October 23, 2017</td></tr>
<tr><td colspan="2">Weather</td><td rowspan="2">Client Rep.:</td><td rowspan="2">Calvin Goldschmidt
Roman Bilobrowka
Clint Abel</td><td rowspan="2">Tetra Tech EBA Representative:</td><td rowspan="2">Ryan Brown</td></tr>
<tr><td>Overcast, light snow</td><td>Low: -13°C
High: -10°C</td></tr>
<tr><td colspan="4">Work undertaken:
Field review geotechnical work related to the following:
1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.</td><td colspan="2">Testing:
1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):
1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.</td></tr>
<tr><td colspan="6">Verbal discussions with Contractor and Others:
1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.</td></tr>
<tr><td colspan="6">Inspectors Remarks/Observations:
▪ Placement and compaction of three lifts observed adequate and confirmed with field density (compaction) testing.
▪ Variability of material observed throughout shift. Increase in moisture content caused unstable surface in small area within second lift. Unstable material removed and replaced with suitable material. (Pictures #2 & #3)
▪ CAT 773D used for compaction.</td></tr>
<tr><td colspan="6">Site Recommendations Issued:
▪ Maintain placement of material with acceptable moisture content and fines.
▪ Day shift to confirm suitability of material placed.</td></tr>
</table>

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Loaded CAT 773D used for compaction

Photo 2: Unstable material located within Berm

PHOTOGRAPHS

Photo 3: Unstable material removed from berm

Photo 4: Placement of suitable pitrun within berm.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

<table>
<tr><td>PROJECT:</td><td colspan="3">Lower Dublin Control Pond</td><td>EBA PROJECT NO.:
Task:</td><td>TRN.WTRM03037-01
001</td></tr>
<tr><td>Location:</td><td colspan="3">NELPCo Eagle Gold Mine, YT</td><td>REPORT NO.</td><td>013</td></tr>
<tr><td>Client:</td><td colspan="3">JDS Energy & Mining</td><td>Date:</td><td>October 24, 2017</td></tr>
<tr><td colspan="2">Weather</td><td rowspan="2">Client Rep.:</td><td rowspan="2">Calvin Goldschmidt
Roman Bilobrowka
Clint Abel</td><td rowspan="2">Tetra Tech EBA Representative:</td><td rowspan="2">Arvin Linklater</td></tr>
<tr><td>Overcast, light snow</td><td>Low: -10°C
High: -3°C</td></tr>
<tr><td colspan="4">Work undertaken:
Field review geotechnical work related to the following:
1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.</td><td colspan="2">Testing:
1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):
1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.</td></tr>
<tr><td colspan="6">Verbal discussions with Contractor and Others:
1.On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.</td></tr>
<tr><td colspan="6">Inspectors Remarks/Observations:
▪ Contractor continues 400-500mm bridge lifts, placed, spread and compacted
▪ Material backfilled well graded gravel sand with silt, positive temperatures through the day
▪ No issues with rut and roll on lifts placed, compaction tests show constant densities and moisture content through all lifts placed
▪ Cat 773D used for compaction
▪ Lift thickness back to 300mm for subsequent lifts, Cat 773D to continue for compaction</td></tr>
<tr><td colspan="6">Site Recommendations Issued:
▪ Keeping borrow material fresh, constant monitoring of backfill material
▪ Adequate lighting at borrow site through the night shift</td></tr>
</table>

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: 400-500mm bridge lift spead

Photo 2: Backfill area ripped with removal of exiting snow removed before backfill

PHOTOGRAPHS

Photo 3: Cat 773D Rock Truck used for compaction of bridge lifts

Photo 4: Second lift placed with prior lift scarified prior to backfill

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**012NT**
Client:	**JDS Energy & Mining**			**Date:**	October 24, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Ryan Brown
Overcast, light snow	Low: -13°C High: -10°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Day shift unable to complete lift before end of shift. Night shift completed placement. During compaction of lift, rutting and unstable conditions were witnessed. Material was excavated and replaced with suitable material.
- Placement and compaction of two lifts observed adequate and confirmed with field density (compaction) testing.
- Variability of material observed throughout shift. Increase in moisture content caused unstable surface in small area within second lift. Unstable material removed and replaced with suitable material. (Pictures #2 & #3)
- CAT 773D used for compaction.
- As shift progressed material within borrow source deteriorated due to increase in moisture and clay content.
- Contractor and consultant dug many test pits to identify suitable fill material.

Site Recommendations Issued:

- Maintain placement of material with acceptable moisture and fines content.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Unstable material noted by dayshift

Photo 2: Unstable material removed

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**014**
Client:	**JDS Energy & Mining**			**Date:**	October 25, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Arvin Linklater
Overcast, light snow	Low: -15°C High: -6°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. No Density tests performed

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Contractor continues backfill placement of sub grade fill material, placed, spread and compacted
- First lift placed in a 600-700mm lift, requested contractor to cut lift back to 300mm
- Material backfilled well graded gravel sand with silt, positive temperatures of fill
- Backfill borrow sourced material changes to more silty higher moisture content, placed and packed with a Cat 773D Rock Truck resulting in rut and roll
- Lift of 300mm placed excavated out in 2 areas
- Contractor with myself explored other areas within borrow site, new area was located resulting in a suitable backfill material
- Production of the contractor recourses were focused on installation of a Man Hole and HDPE Pipe
- No further backfill placement continued through the day shift
- Effort to develop suitable borrow material and pipe installation resulted in lack of dam construction

Site Recommendations Issued:

- Keeping borrow material fresh, constant monitoring of backfill material
- Adequate lighting at borrow site through the night shift

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Positive temperature fill material placed and compacted with Cat 773D Rock Truck

Photo 2: Over-sized lift placed cut back to 300mm lift thickness before compacting

PHOTOGRAPHS

Photo 3: One of two soft spots excavated out due to excessive rut and roll

Photo 4: Cat 773D Rock Truck packs prior lift after excavation before continuing backfill

PHOTOGRAPHS

Photo 5: Packing replacement lift after excavation.

Photo 6: Packing with Cats 740B and 773 Rock Trucks on grade

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

<table>
<tr><td>PROJECT:</td><td colspan="3">Lower Dublin Control Pond</td><td>EBA PROJECT NO.:
Task:</td><td>TRN.WTRM03037-01
001</td></tr>
<tr><td>Location:</td><td colspan="3">NELPCo Eagle Gold Mine, YT</td><td>REPORT NO.</td><td>013NT</td></tr>
<tr><td>Client:</td><td colspan="3">JDS Energy & Mining</td><td>Date:</td><td>October 25, 2017</td></tr>
<tr><td colspan="2">Weather</td><td rowspan="2">Client Rep.:</td><td rowspan="2">Calvin Goldschmidt
Roman Bilobrowka
Clint Abel</td><td rowspan="2">Tetra Tech EBA Representative:</td><td rowspan="2">Ryan Brown</td></tr>
<tr><td>Overcast, light snow</td><td>Low: -13°C
High: -10°C</td></tr>
<tr><td colspan="4">Work undertaken:
Field review geotechnical work related to the following:
1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.</td><td colspan="2">Testing:
1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):
1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.</td></tr>
<tr><td colspan="6">Verbal discussions with Contractor and Others:
1.On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.</td></tr>
<tr><td colspan="6">Inspectors Remarks/Observations:
▪ Beginning of shift was spent removing bulk excess material from various locations on site by contractor.
▪ Day shift observed portion of previous lift unstable within sub-ex area. Recommended removal which night shift completed.
▪ Placement and compaction within excavated area observed adequate and confirmed with field density (compaction) testing.
▪ CAT 773D used for compaction.
▪ Borrow source produced material with variable moisture and fine contents
▪ Unstable areas removed and replaced with suitable material</td></tr>
<tr><td colspan="6">Site Recommendations Issued:
▪ Maintain placement of material with acceptable moisture and fines content.</td></tr>
</table>

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Placement of pit run within dam footprint

Photo 2: Removal of unstable material within berm

PHOTOGRAPHS

Photo 3: Compaction of material

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

<table>
<tr><td>PROJECT:</td><td colspan="3">Lower Dublin Control Pond</td><td>EBA PROJECT NO.:
Task:</td><td>TRN.WTRM03037-01
001</td></tr>
<tr><td>Location:</td><td colspan="3">NELPCo Eagle Gold Mine, YT</td><td>REPORT NO.</td><td>015</td></tr>
<tr><td>Client:</td><td colspan="3">JDS Energy & Mining</td><td>Date:</td><td>October 26, 2017</td></tr>
<tr><td colspan="2">Weather</td><td rowspan="2">Client Rep.:</td><td rowspan="2">Calvin Goldschmidt
Roman Bilobrowka
Clint Abel</td><td rowspan="2">Tetra Tech EBA Representative:</td><td rowspan="2">Arvin Linklater</td></tr>
<tr><td>Overcast</td><td>Low: -12°C
High: -6°C</td></tr>
<tr><td colspan="4">Work undertaken:
Field review geotechnical work related to the following:
1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.</td><td colspan="2">Testing:
1. Field density (compaction) testing of pit run placed within sub-excavation
Work (Passed/Failed):
1. No Density tests performed</td></tr>
<tr><td colspan="6">Verbal discussions with Contractor and Others:
1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.</td></tr>
<tr><td colspan="6">Inspectors Remarks/Observations:
▪ Pelly Construction placed HDPE liner within LLO (Low Level Outlet) trench as per design.
▪ Bedding Sand placed in 300mm lift to grade
▪ Man Hole (MH) installed into place
▪ HDPE 450mm Pipe placed into center line of trench to the center of the MH
▪ Backfill to commence on night shift
▪ No Backfill placement on the Dam through day shift due to LLO Pipe installation</td></tr>
<tr><td colspan="6">Site Recommendations Issued:
▪ Keeping borrow material fresh, constant monitoring of backfill material
▪ Adequate lighting at borrow site through night shift</td></tr>
</table>

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Liner installed to LLO Trench

Photo 2: Bedding Sand placed onto liner

PHOTOGRAPHS

Photo 3: Man Hole installed into place

Photo 4: HDPE 450mm Pipe moved to LLO Trench with one loader and two excavators

PHOTOGRAPHS

Photo 5: Positioning HDPE Pipe to Trench Bed with three excavators

Photo 6: Placing Pipe Invert into center of Man Hole

PHOTOGRAPHS

Photo 7: HDPE Pipe install complete and ready for Grout and backfill

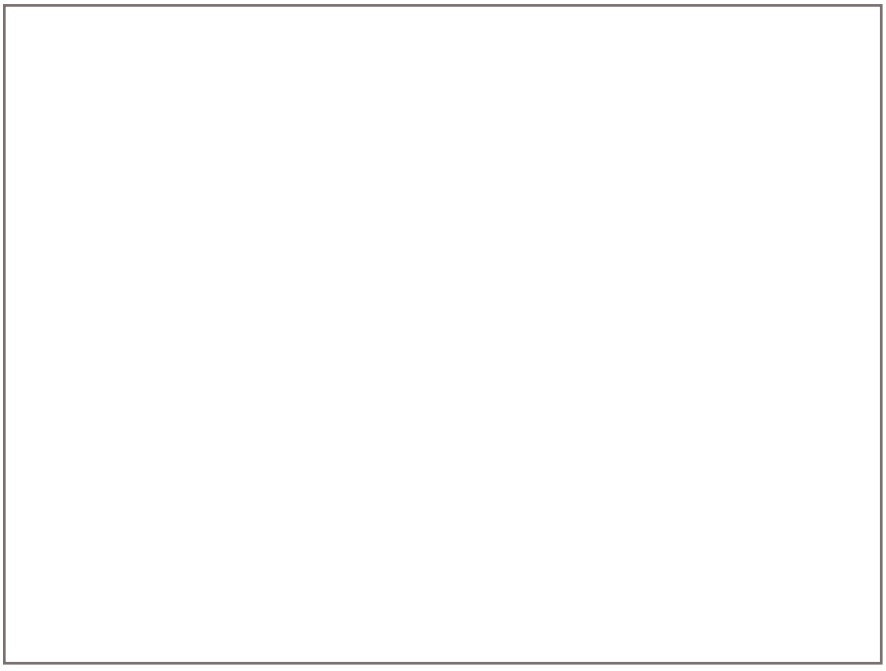


Photo 8:

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**014NT**
Client:	**JDS Energy & Mining**			**Date:**	October 26, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Ryan Brown (RB)
Overcast, light snow	Low: -4°C High: -2°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Placement and compaction of pit run and granular pipe bedding material within and adjacent to low level outlet south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Placement and compaction of granular pipe bedding material within trench for low level outlet for Lower Dublin control pond as per specifications.
- All granular pipe bedding material compacted to minimum of 95%. (see corresponding density report)
- Multiple lifts of pit run placed within pipe trench and within adjacent area. All pit run compacted to 98%.

Site Recommendations Issued:

- Day shift to continue placement of suitable pit run.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Placement of granular pipe bedding material.

Photo 2: Compaction of granular pipe bedding material.

PHOTOGRAPHS

Photo 3: Placement and compaction of pit run within pipe trench and adjacent area.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**016**
Client:	**JDS Energy & Mining**			**Date:**	October 27, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Arvin Linklater
Overcast Snow fall	Low: -6°C High: +1°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Pelly Construction continues placing sub grade material to Dam in 300mm lifts
- Sub grade lifts compacted with single smooth drum packer
- Sub grade placed and packed over LLO 450mm HDPE pipe
- Bedding Sand placed and compacted around Man Hole
- No issues with sub grade material, positive temperatures, density and moisture content all within contract spec

Site Recommendations Issued:

- Keeping borrow material fresh, constant monitoring of backfill material
- Adequate lighting at borrow site through night shift

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Backfilling sub grade material in LLO Pipe area after Pipe install

Photo 2: Single smooth drum packing sub grade fill

PHOTOGRAPHS

Photo 3: Cat D10T Dozer spreading backfill

Photo 4: Backfilling around Man Hole at LLO Pipe

PHOTOGRAPHS

Photo 5: Pelly continues backfilling throughout day shift

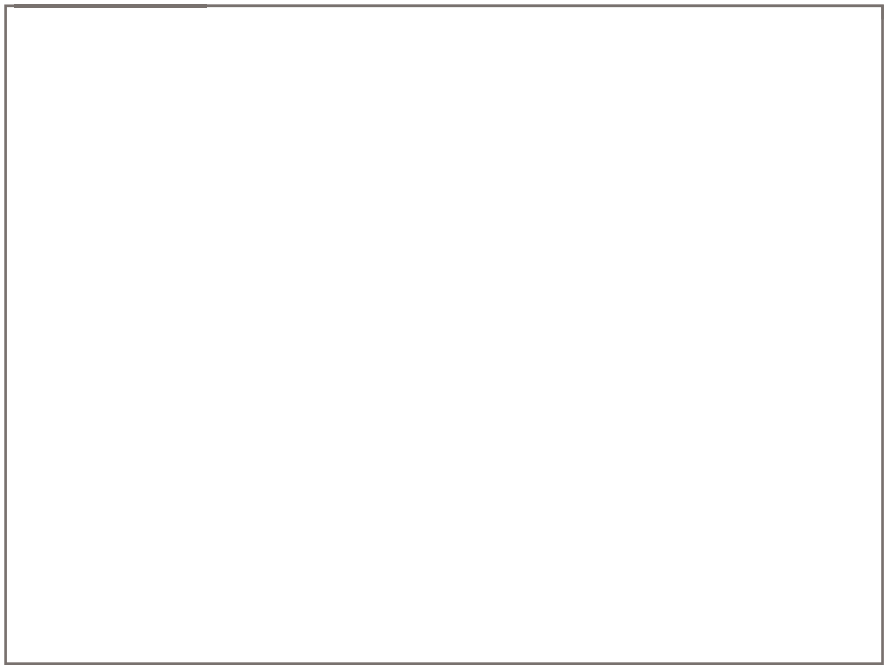


Photo 6: Placing Pipe Invert into center of Man Hole

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**015NT**
Client:	**JDS Energy & Mining**			**Date:**	October 27, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Ryan Okkema (RO)
Overcast, light snow	Low: -3°C High: -2°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Placement and compaction of pit run for south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run for south dam placement

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with Pelly Construction Site Superintendent J. Foster and packer operator relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Placement and compaction of pit run material for south dam sub layer as per specifications.
- All pit run material compacted to minimum of 98%. (see corresponding density report)
- 2 lifts placed within south dam area.

Site Recommendations Issued:

- Day shift to continue placement of suitable pit run.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Compaction of pit run on 808.7 m grade lift.

Photo 2: Placement of pit run base material for south dam on first lift.

PHOTOGRAPHS

Photo 3: Compaction of pit run on second lift at 809.0 m grade.

Photo 4: Placement and compaction of pit run.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**017DS**
Client:	**JDS Energy & Mining**			**Date:**	October 28, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Arvin Linklater
Overcast Snow fall	Low: -10°C High: +4°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Pelly Construction continues placing sub grade material to Dam in 300mm lifts
- Sub grade lifts compacted with single smooth drum packer
- All lifts placed packed and tested for density and moisture, all tests pass as per contract spec
- Two lifts completed on dayshift
- No issues with sub grade material, no visible rut or roll

Site Recommendations Issued:

- Keeping borrow material fresh, constant monitoring of backfill material
- Adequate lighting at borrow site through night shift

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Pelly continues backfill of South Dam of Lower Dublin Control Pond

Photo 2: Cat D10T dozer spreads sub grade material on floor of Dam

PHOTOGRAPHS

Photo 3: Rock truck placing fill on Dam, first lift on day shift

Photo 4: Spreading second lift of sub grade

PHOTOGRAPHS

Photo 5: Single smooth drum packer working on second lift

Photo 6: Progress from day shift on Dam. Elevation: 809.3

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

<table>
<tr><td>PROJECT:</td><td colspan="3">Lower Dublin Control Pond</td><td>EBA PROJECT NO.:
Task:</td><td>TRN.WTRM03037-01
001</td></tr>
<tr><td>Location:</td><td colspan="3">NELPCo Eagle Gold Mine, YT</td><td>REPORT NO.</td><td>016NT</td></tr>
<tr><td>Client:</td><td colspan="3">JDS Energy & Mining</td><td>Date:</td><td>October 28, 2017</td></tr>
<tr><td colspan="2">Weather</td><td rowspan="2">Client Rep.:</td><td rowspan="2">Calvin Goldschmidt
Roman Bilobrowka
Clint Abel</td><td rowspan="2">Tetra Tech EBA Representative:</td><td rowspan="2">Ryan Okkema (RO)</td></tr>
<tr><td>Clear</td><td>Low: -8°C
High: -6°C</td></tr>
<tr><td colspan="4">Work undertaken:
Field review geotechnical work related to the following:
1. Placement and compaction of pit run for south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.</td><td colspan="2">Testing:
1. Field density (compaction) testing of pit run for south dam placement

Work (Passed/Failed):
1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.</td></tr>
<tr><td colspan="6">Verbal discussions with Contractor and Others:
1. On-going communication with Pelly Construction Site Superintendent J. Foster and packer operator related to backfill placement and compaction requirements.
2. Begin using 2 packers to speed up compaction effort to prevent freezing of material</td></tr>
<tr><td colspan="6">Inspectors Remarks/Observations:
▪ Placement and compaction of pit run material for south dam sub layer as per specifications.
▪ All pit run material compacted to minimum of 98%. (see corresponding density report)
▪ 2.5 lifts placed within south dam area.</td></tr>
<tr><td colspan="6">Site Recommendations Issued:
▪ Day shift to continue placement of suitable pit run.</td></tr>
</table>

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Compaction and placement of pit run on 809.6 m grade lift.

Photo 2: Placement of pit run base material for south dam on first lift.

PHOTOGRAPHS

Photo 3: Compaction of pit run on second lift at 809.9 m grade.

Photo 4: Extent of dam embankment to date.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**018DS**
Client:	**JDS Energy & Mining**			**Date:**	October 29, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Arvin Linklater
Partly Cloudy	Low: -8°C High: +1°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Pelly Construction continues placing sub grade material to Dam in 300mm lifts
- Sub grade lifts compacted with 2-single smooth drum packer
- Backfill material moisture content rises, request dryer material, excavator moves to new area
- Material from new borrow area arrives with lower moisture content
- All lifts placed packed and tested for density and moisture, all tests pass as per contract spec
- Two lifts completed on dayshift
- No visible rut or roll or soft spots on lifts

Site Recommendations Issued:

- Keeping borrow material fresh, constant monitoring of backfill material for moisture content and clay content
- Adequate lighting at borrow and fill sites through night shift

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Pelly continues backfill of South Dam of Lower Dublin Control Pond

Photo 2: Cat D10T Dozer spreads sub grade fill material

PHOTOGRAPHS

Photo 3: 2-Single Smooth Drum packers working on pad

Photo 4: Dozer spreading second lift of sub grade

PHOTOGRAPHS

Photo 5: Moisture Density testing on sub grade fill

Photo 6: Progress from day shift on Dam fill complete at Elevation: 810.4

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**017NT**
Client:	**JDS Energy & Mining**			**Date:**	October 29, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Ryan Okkema (RO)
Cloudy, light snow	Low: -9°C High: -7°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Placement and compaction of pit run for south dam of Lower Dublin Control Pond.
2. Remediation of grade 810.7 lift was required.
3. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run for south dam placement

Work (Passed/Failed):

1. Initial placement of 810.7 lift failed compaction due to lift thickness and freezing.
2. Satisfactory compaction test results obtained after remediation.
3. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with Pelly Construction Site Superintendent J. Foster and packer operator related to backfill placement and compaction requirements.
2. Request to reduce thickness of initial lift.
3. Failure to reach compaction of lift at grade 810.7, asked for and received remediation efforts.

Inspectors Remarks/Observations:

- First lift placed too thick, requested and observed cutting down lift thickness.
- Removal and replacement of material after failed compaction and bearing tests.
- Placement and compaction of pit run material for south dam sub layer as per specifications after remediation.
- All pit run material compacted to minimum of 98%. (see corresponding density report)
- 0.5 lift placed and passed within south dam area.

Site Recommendations Issued:

- Day shift to continue placement of suitable pit run.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Stripping of insufficient lift material on East side of dam.

Photo 2: Replacement of material along stripped lift.

PHOTOGRAPHS

Photo 3: Compaction of placed material on 810.7m lift.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**019DS**
Client:	**JDS Energy & Mining**			**Date:**	October 30, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Arvin Linklater
Cloudy Heavy Snow Fall	Low: -9°C High: -6°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Pelly Construction continues placing subgrade material to Dam in 300mm lifts
- Notable rut and roll viewed at start of day shift, requested proof roll throughout whole of pad
- Two north south pads, one far west and one far east and a center soft spot were isolated, request to remove/replace 200mm of lift and re compact
- Re work of areas improved, however some rut and roll still exists with heavy truck traffic
- Subgrade lifts compacted with 2-single smooth drum packers
- Requested contractor to pack on Vibe for tow lifts followed by Static packing for remainder
- Suspect constant Vibe with packing adding to high moisture content at Density and Moisture testing
- All lifts placed packed and tested for density and moisture, all tests pass as per contract spec

Site Recommendations Issued:

- Keeping borrow material fresh, constant monitoring of backfill material for moisture and clay content
- Keeping lift thickness to 300mm
- Request less Vibratory packing with packers to elevate added moisture to surface while compacting
- Adequate lighting at borrow and fill sites through night shift

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Pelly continues backfill of South Dam of Lower Dublin Control Pond

Photo 2: Cat D10T Dozer spreads subgrade fill material from Cat 773 Rock Truck

PHOTOGRAPHS

Photo 3: 2-Single Smooth Drum packers working on pad with Cat D10T Dozer spreading subgrade fill

Photo 4: Dozer spreading second lift of subgrade

PHOTOGRAPHS

Photo 5: Progress from day shift on Dam fill complete at Elevation: 811.0

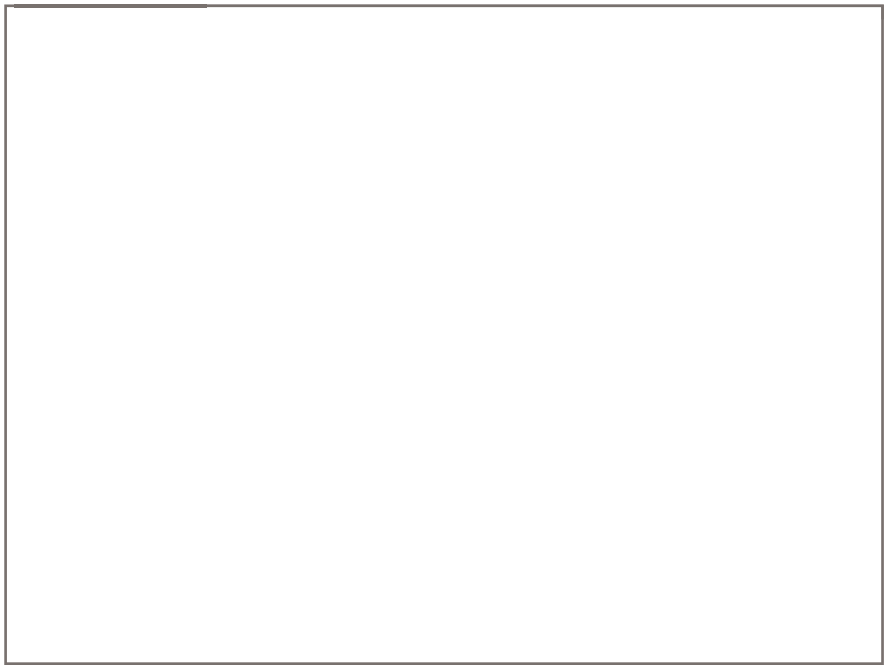


Photo 6:

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**018NT**
Client:	**JDS Energy & Mining**			**Date:**	October 30, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Ryan Okkema (RO)
Clear	Low: -10°C High: -8°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Placement and compaction of pit run for south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run for south dam placement

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with Pelly Construction Site Superintendent J. Foster and packer operator related to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Placement and compaction of pit run material for south dam sub layer as per specifications.
- Ensured lifts were kept at 300mm maximum.
- Continue using single vibratory packing pass followed by static packing for remainder as prescribed by dayshift.
- Subgrade lifts compacted with 2 smooth drum packers.
- Some rut and roll present on compacted backfill with heavy truck traffic.
- 2 lifts placed during night shift.
- All pit run material compacted to minimum of 98%. (see corresponding density report)

Site Recommendations Issued:

- Day shift to continue placement of suitable pit run.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Compaction and placement of pit run using a CAT 773 and D10T Dozer at grade 811.3m.

Photo 2: Compaction of pit run material using a smooth drum packer.

PHOTOGRAPHS

Photo 3: Extent of dam backfill at grade 811.3m, East side.

Photo 4: Extent of dam backfill at grade 811.3m, West side.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**020DS**
Client:	**JDS Energy & Mining**			**Date:**	October 31, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Arvin Linklater
Cloudy	Low: -7°C High: +1°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Pelly Construction continues placing subgrade material to Dam in 300mm lifts
- No notable rut and roll viewed at start of day shift from night shift production
- Subgrade fill material suitable with low moisture and low Clay content
- Subgrade lifts compacted with 2-single smooth drum packers
- Contractor continues to pack on Vibe for one pass followed by Static packing for remainder of compaction
- All lifts placed, compacted and tested for Density and Moisture, all tests pass as per contract spec

Site Recommendations Issued:

- Keeping borrow material fresh, constant monitoring of backfill material for temperature, moisture and clay content
- Keeping lift thickness to 300mm
- Request less Vibratory packing with packers to elevate added moisture to surface while compacting
- Adequate lighting at borrow and fill sites throughout night shift

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Pelly continues backfill of South Dam of Lower Dublin Control Pond

Photo 2: Cat D10T Dozer receives subgrade fill material from Cat 773 Rock Truck

PHOTOGRAPHS

Photo 3: 2-Single Smooth Drum packers compacting behind Cat D10T Dozer spreading subgrade fill

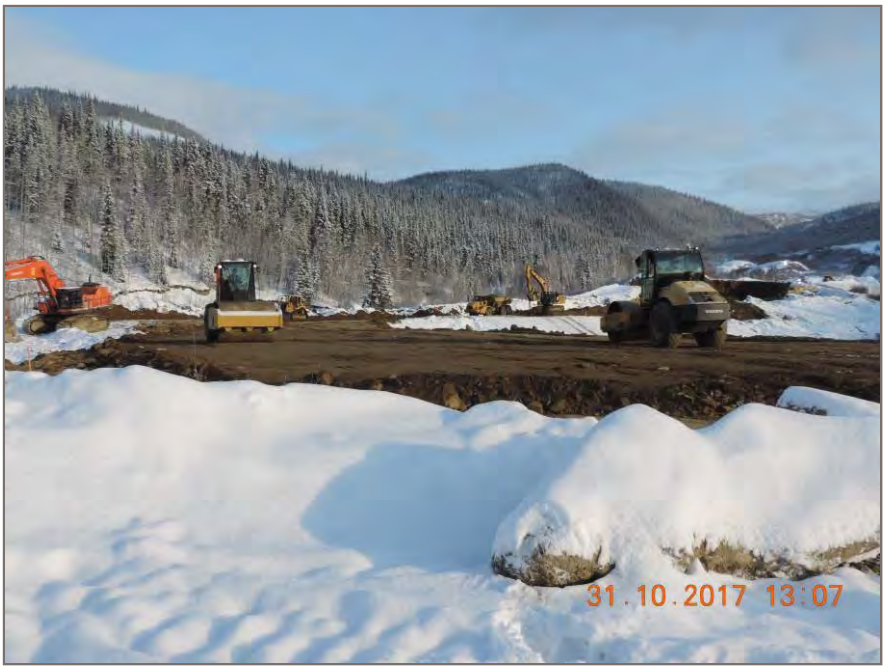


Photo 4: Packing on grade. Packers using Static packing. Elevation 811.9

PHOTOGRAPHS

Photo 5: Dozer back blading smooth fill lift for even compaction with packers

Photo 6: Progress from day shift on Dam fill complete at Elevation: 812.2

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**019NT**
Client:	**JDS Energy & Mining**			**Date:**	October 31, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Ryan Okkema (RO)
Clear	Low: -12°C High: -9°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Placement and compaction of pit run for south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run for south dam placement

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with Pelly Construction Site Superintendent J. Foster and packer operator related to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Placement and compaction of pit run material for south dam sub layer as per specifications.
- Ensured lifts were kept at 300mm maximum thickness.
- Using a single vibratory pass followed by static passes until compaction is met.
- Subgrade lifts compacted with a single smooth drum packer.
- Slight rut and roll present on compacted backfill with heavy truck traffic.
- 3 lifts placed during night shift.
- All pit run material compacted to minimum of 98%. (see corresponding density report)

Site Recommendations Issued:

- Day shift to continue placement of suitable pit run.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Compaction pit run using a smooth drum packer at grade 812.5m.

Photo 2: Placement of pit run material at grade 812.8m.

PHOTOGRAPHS

Photo 3: Placement of backfill material using a CAT 773 haul truck and D10T Dozer at grade 813.1m.

Photo 4: Initial placement of backfill at base of spill way.

TETRA TECH

DAILY FIELD REVIEW

ISSUED FOR REVIEW

PROJECT:	**Lower Dublin Control Pond**			**EBA PROJECT NO.: Task:**	**TRN.WTRM03037-01 001**
Location:	**NELPCo Eagle Gold Mine, YT**			**REPORT NO.**	**021DS**
Client:	**JDS Energy & Mining**			**Date:**	November 1, 2017
Weather		**Client Rep.:**	Calvin Goldschmidt Roman Bilobrowka Clint Abel	**Tetra Tech EBA Representative:**	Arvin Linklater
Cloudy	Low: -14°C High: -9°C				

Work undertaken:

Field review geotechnical work related to the following:

1. Scarifying, placement and compaction of pit run throughout sub-excavation within south dam of Lower Dublin Control Pond.
2. Field density (compaction) testing of placed fill materials.

Testing:

1. Field density (compaction) testing of pit run placed within sub-excavation

Work (Passed/Failed):

1. Satisfactory compaction test results obtained
2. Results of density testing to be provided in separate report.

Verbal discussions with Contractor and Others:

1. On-going communication with JDS site reps, C. Abel, M. Coverdale and Pelly Construction Site Superintendent J. Foster relating to backfill placement and compaction requirements.

Inspectors Remarks/Observations:

- Pelly Construction completes final lift on Dam. Elevation 813.5m
- All final tests pass on contract spec for Density and Moisture content
- Pelly Construction begins backfill placement on foundation of Spill Way
- Subgrade lifts at 300m placed, spread and compacted
- Cat D10T Dozer spreading material from two Rock Trucks and one Smooth Drum Packer compacting subgrade
- All lifts placed, compacted and tested for Density and Moisture, all tests pass as per contract spec

Site Recommendations Issued:

- Keeping borrow material fresh, constant monitoring of backfill material for temperature, moisture and clay content
- Keeping lift thickness to 300mm
- Request less Vibratory packing with packers to elevate added moisture to surface while compacting
- Adequate lighting at borrow and fill sites throughout night shift

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of JDS Energy & Mining and their agents. Tetra Tech Canada Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than JDS Energy & Mining or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse YT, Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

PHOTOGRAPHS

Photo 1: Pelly continues backfill of South Dam of Lower Dublin Control Pond

Photo 2: Cat D10T Dozer spreads subgrade fill on South Dam

PHOTOGRAPHS

Photo 3: 1-Single Smooth Drum packer works subgrade material on final lift Elevation: 813.5

Photo 4: First load of subgrade on foundation for Spill Way construction

PHOTOGRAPHS

Photo 5: Cat D10T Dozer spreading fill on Spill Way

Photo 6: Packer working fill on Spill Way

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 12 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -26 (*morning*) light snow -20 (*noon*) (*night*)

Description of Work Performed

Crew onsite for safety meeting 0700
Detail crew qualified extrusion welder 540 degrees for both temps.
Lance and Iain worked on welding and completing the penetration.
Mike, Jon, Donovan, Ewing crew worked on installing textile in seq 1&8.
when the textile was finished we qualified the wedge welded smooth smooth no problem, Mike pulled 2 panels in and when donovan went to wedge the wedge would move 1-2 meters and stop dead in its tracks, there is ice fog in the air, that combined with the cold weather is keeping us from properly fusing the material. All welding has stopped at this point, crew just setting up sandbags and rolls for tomorrow. We have tried all temperature and speed ranges for this material, in these conditions and cannot weld it at this time. Machines will be recalibrated/setup in the morning.

Penetrations are complete.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourette									
Total Hours	11.5	10.5	10.5	10.5	10.5	10.5									

Installation Production

Elapsed Calendar Days : 6

Elapsed Installation Days : 1

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	874.5	0	2300				
Cumulative	874.5	0	2300				

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	1	1	1	2	0	1	0.5	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	1000	0.25	5	30	2	5	0	0	0	0	0	0	0		
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley
JDS Energy & Mining
Dep. Proj. Manager
2018-01-31

Signature : Chad Messervey

LAYFIELD

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 13 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -22 (*morning*) Sun -18 (*noon*) (*night*)

Description of Work Performed

Crew moved sandbags from the sandpile where they were being built and stock piled them close to the pond, while waiting for the wedge w
All wedge welders have been reset and are working well, passing all trial testing, the crew continued deployment of liner in seq 1&8.
All detail work was completed behind the fusion crew.
QC testing was completed on the Seq 1.

Deployment crew started installing the geotextile overlay on seq 1, after the liner installation had been completed.
QC has 3 remaining APTs remaining on seq 8 to complete in the morning.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechne y	Mike Cantwel	Jon Hitchcoc	Donovan Halisheff	Lance Touret									
Total Hours	13	12	12	12	12	12									

Installation Production

Elapsed Calendar Days : 7

Elapsed Installation Days : 2

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Textile Overlay (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	1418	1418			1636		
Cumulative	2293	2293	2300		1636		

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	2	1	1	3	1	2	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved :

Signature : Chad Messervey

LAYFIELD

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 14 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -19 *morning* Sun -14 *noon* *night*

Description of Work Performed

Crew worked on installation of geotextile on seq 5 while waiting on the remaining air pressure tests to be completed on seq 8, when the air pressure testing was completed in seq 8 the crew completed the geotextile overlay. Seq 1&8 have been signed off and released to client. backfill of anchor trench and liner can commence at any time.
Crew continued to install liner in Seq 5 when this was completed they installed textile in seq 4&7. these areas were completed with geotextile underlay.

Crew set up equipment for liner deployment and fusion. Liner was started in seq 5 3 panels of liner were deployed on the floor and south slope. 3 panels were placed on the west slope. with the frost buildup and extra time and man power it was taking to clean the seams ahead of the wedge welders this was all that we could install today. Detail work needs to be completed before testing can commence.
Equipment was picked up and stored in warm up shack. Liner edges were ballasted with sandbags for the night.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourette									
Total Hours	12	11	11	11	11	11									

Installation Production

Elapsed Calendar Days : 7

Elapsed Installation Days : 3

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Textile overlay (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	2994	0	6498		664		
Cumulative	5287	2293	8798		2300		

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	1	0.5	0.5	2	1	0.5	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0.25	0	0	0	0	0	0	0.25	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley JDS Energy & Mining Dep. Proj. Manager 2018-01-31

Signature : Chad Messervey

LAYFIELD Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 15 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -26 (*morning*) overcast -22 light snow (*noon*, *night*)

Description of Work Performed

Crew continued on with liner installation on the west slope. Frost buildup on the liner slowed down production by 60%, entire crew was needed to clean the 2 seams being welded just ahead of the 2 wedge welders to allow for proper fusion.
Detail work and Air pressure testing was started on the liner section installed yesterday afternoon.
Liner deployment completed on the west slope, tie in seam (approx 200m) was prepared and welded connecting the slope panels to the floot panels. the tie in seam to seq 1 will be welded in the morning to allow the newly installed liner to cycle for 24 hours before attachment.
All liner scraps were cleaned up and placed in a pile on the floor, we cannot get our pickup in the pond at this time to collect it and throw it in dumpster. this will be done as soon as we have access across the East trench.

Detail and Air Pressure testing will continue on the liner in the morning as soon as weather conditions will allow.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourette									
Total Hours	12	11.5	11.5	11.5	11.5	11.5									

Installation Production

Elapsed Calendar Days : 8

Elapsed Installation Days : 4

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Textile Overlay (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	3491	2994					
Cumulative	8778	5287	8797		2300		

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	2	1	1	3	1	1	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	1	0	0	0	0	0	0	0.5	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley, JDS Energy & Mining, Dep. Proj. Manager, 2018-01-31

Signature : Chad Messervey

LAYFIELD

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 16 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -20 light snow (*morning*) Overcast -19 snow (*noon*) Snow (*night*)

Description of Work Performed

Crew installed 12 rolls of geotextile on the floor area, continuing east from where the textile left off in seq5.
crew switched over to liner deployment, it took a long time to get the rolls of liner staged in the pond for deployment to commence, transporting the rolls ate up a lot more time then expected. Once we staged 4 rolls we used the zoomboom and spreader bar to lay out 5 panels (3 weld seams) on the exposed textile. With all the snow that was coming down it took everyone to clean and weld the 3 seams that were layed out. Weather in the afternoon along with moving rolls decreased production. This did not leave any man power or time to bring more rolls into the pond for the mornings deployment. We will have to bring more rolls in in the morning.

Liner edges were ballasted at the end of the day, all tool were picked up and put in warm up shack.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourette									
Total Hours	13	12	12	12	11	12									

Installation Production

Elapsed Calendar Days : 9

Elapsed Installation Days : 5

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	2408	3491	4908				
Cumulative	11186	8778	13725				

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	1.5	0.5	1	2	1	0.5	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	1	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley, JDS Energy & Mining, Dep. Proj. Manager, 2018-01-31

Signature : Chad Messervey

LAYFIELD Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 17 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -17 snow (*morning*) Partial Cloud -15 snow (*noon*) (*night*)

Description of Work Performed

Crew was all set up to continue deployment on the pond floor where they had left off yesterday, Client asked if we could focus on the east ditch as they had it prepared. We brought the textile and liner for this section of the pond into the pond itself while Pellys were finishing getting the ditch read, While waiting I had Ewing crew load up all the liner scraps and dispose of them in the dumpsters. Textile was laid out and prepped while waiting for the ditch to be finished. At 1230 we were able to start the ditch liner. Textile was pulled into place by hand. liner was rolled out along side the trench, 2 panels wide and were fused together. Once these were fused we pulled them into place using a pickup truck and by having the guys spread out along the liner with clamps and pulling with the truck. Because of the changing contours of the ditch itself and it not being straight we could not get the liner to sit flat. It had to be sliced in the center and wrinkles pulled out and then fused back together. Liner edges no longer match up on the west side of the panel, this will require extra work once we reach this location with the liner from the pond floor.
While straightening liner using our pulling clamp a bolt sheared off on the latch, it is no longer useable until fixed. Will check with Blair tomorrow to see if he may have a way to get bolt out and possibly a new one that may fit.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourett									
Total Hours	12	11	11	11	11	11									

Installation Production

Elapsed Calendar Days : 10

Elapsed Installation Days : 6

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Textile overlay (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	1483		2352		1490		
Cumulative	12669	8778	16057		3790		

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	1	0	0.25	2	0.5	0	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley, JDS Energy & Mining, Dep. Proj. Manager, 2018-01-31

Signature : Chad Messervey

LAYFIELD Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey Date : Novermber 18 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904 Weather : overcast -26 *morning* Clear -24 *noon* *night*

Description of Work Performed

Crew continued on with the installation of geotextile and liner on the floor of the pond, attaching to the liner and textile on the west side of pond and continuing east.
Having a lot of trouble getting wedge welders Qualified and passing. even when they pass the Qualification we are having a lot of trouble fusing the plastic. they will weld a few meters then stop due to frost and ice build up on the liner. All 4 sides of the plastic are being cleaned in front of the welders and it did not matter, the welders just stop in the seam and drive wheels just spin.
We waited for it to get a bit colder after the sun went down and there was less humidity. the frost build up and the speed at which it formed was substantially slower, we had a lot more success welding at this time.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Touret									
Total Hours	12	11	11	11	11	11									

Installation Production

Elapsed Calendar Days : 11 Elapsed Installation Days : 7

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Textile overlay (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	3646	3891	2454				
Cumulative	16303	12669	18511		3790		

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2		1	1	1	2	1	1	3	1	1	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	1	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley JDS Energy & Mining Dep. Proj. Manager 2018-01-31 Signature : Chad Messervey

LAYFIELD

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 19 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -36/-46 *morning* Cloudy-36/-44 *noon* *night*

Description of Work Performed

Spoke to crew in the morning about concerns that the liner may be brittle at the current temperatures and to stay off of the liner all together.
It was too cold for liner installation and fusion today, Crew installed textile for the entire day, completing the textile underlay in the collection pond. Leisters had to be used to fuse textile it was too cold to use torch. it will just freeze up.
Warm up shack was placed in the pond for the crew to use.
Boom extension not able to function on zoom boom. will try to use skid steer for deployment, hopefully it can lift the rolls of liner and the spreader bar. I have concerns about stressing the liner past its breaking point if we pull it into place with machines and clamp. I think it is best to continue to use spreader bar and roll it out in place for as long as we can.
Tried to trim and weld tie in seam Seq 5 to seq 1 and the liner was so brittle that it shattered and ripped apart. This will have to be done another day then temperatures are warmer.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Touret									
Total Hours	11	10	10	10	10	10									

Installation Production

Elapsed Calendar Days : 12

Elapsed Installation Days : 8

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Textile overlay (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	0	0	9960		0		
Cumulative	16303	12669	28471		3790		

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	0	0	0	2	0	2	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley
JDS Energy & Mining
Dep. Proj. Manager
2018-01-31

Signature : Chad Messervey

LAYFIELD

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 20 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -36 (*morning*) Overcast -34 (*noon*) (*night*)

Description of Work Performed

Crew worked the entire day on Liner deployment and fusion.
With the zoom boom not able to extend the boom we had Marshall from Ewing use his excavator to pull the liner from the zoomboom up the slope. this saves a lot of time and manpower during the installation. I believe had we had to pull the liner up the slope by hand we may have only installed half the amount of liner that we actually did. It was a huge asset to have the use of the excavator for the day.
We tried to use the Bobcat to deploy the liner unfortunatly it is too small to lift the spreaderbar and a roll of plastic. we still had to use the zoomboom just being extra careful not to extend or retract the boom.
The extreme cold temperatures still causing minor problems with the welding equipment, fortunatly we were still able to get the seams fused together with minor issues. These were quickly corrected.
The remainder of the day went smoothly and we were able to get the majority of the floor installed.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Touret									
Total Hours	12	11	11	11	11	11									

Installation Production

Elapsed Calendar Days : 13

Elapsed Installation Days : 9

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	6241						
Cumulative	22544	12669	28471		3790		

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	2	0	1	2	0	1	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley, JDS Energy & Mining, Dep. Proj. Manager, 2018-01-31

Signature : Chad Messervey

LAYFIELD Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 21 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -36 (morning) cloudy -36 (noon) (night)

Description of Work Performed

Crew continued on the installation of the liner on the floor of the collection pond, it was extremly slow goinbg due to the cold temperatures, the wedge welders were having a difficult time welding the material as the plastic was so rigid and hard due to the cold that the drive wheels did not want to bite into the plastic to push the machine along. Due to this and the added frost build up added to the time it took to finish the liner on the floor of the pond.
During inspection, there was 1 seam that was fused together and according to specification is fine but does not meet Layfield QC standards and will be repaired tomorrow. Passes destructive sample 5 inner peels ok 4 outer peels ok with 20% peelon the 5th peel. Shears were ok 5/5.
2 rolls of plastic were loaded onto the deployment trailer with the plan of filling in the north slope as well, but one wedge welder broke due to the extreme cold conditions, and I am currently down to 1 welder until it gets repaired. Have 2 others that have broken due to cold conditions, that cannot be repaired.

Todays quantities need to be varified, and are subject to change.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourette									
Total Hours	11.5	10.5	10.5	10.5	10.5	10.5									

Installation Production

Elapsed Calendar Days : 14

Elapsed Installation Days : 10

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	1963						
Cumulative	24507	12669	28471		3790		

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	2	0	1	2	0	1	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley, JDS Energy & Mining, Dep. Proj. Manager, 2018-01-31

Signature : Chad Messervey

LAYFIELD

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 22 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Overcast -34 *morning* Cloudy light snow -26 *noon* *night*

Description of Work Performed

Crew worked on completing the installation of the liner in the collection pond.
Liner was installed along the north slope, connecting to the floor panels extending from the south.
One wedge welder was repaired as a backup in case its needed.
Tie in seam was welded between floor panels and slope panels.
Detail work continued today as warmer temperatures allowed for extrusion welding to continue.
Clean up was started from all the cut offs from the tie in seam and all the left over waste material created by having to tie in to the previously liner ditch. The two liners were on opposite angles and cutting and fitting the liners to match created a lot of extra waste that wouldn't have been necessary otherwise.

A spill tray for fuel tank was placed by Layfield in Location close to camp. 2 sections of liner had to be fused together. This was an extra, No QC package will be provided/required for this.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourett									
Total Hours	11.5	10.5	10.5	10.5	10.5	10.5									

Installation Production

Elapsed Calendar Days : 14

Elapsed Installation Days : 11

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	textile overlay (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	1470	2000	0				
Cumulative	26032	14669	26132	3790			

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	1	1	1	3	0	1	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	1	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley JDS Energy & Mining Dep. Proj. Manager 2018-01-31

Signature : Chad Messervey

LAYFIELD

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : Novemeber 23 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Clear -29 *morning* Clear -29 *noon* *night*

Description of Work Performed

Crew worked on detail and testing in the pond area, This is going extremly slow due to cold weather.
All remaining scrap has been cleaned out of the pond.
Geotextile has been rolled out and fabricated into prefab panels by Ewing, to help with the deployment in the spill way, as there is little to no access for deployment.
Testing and detail work approx 1/2 complete on Collection pond by end of day.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourette									
Total Hours	11.5	10.5	10.5	10.5	10.5	11									

Installation Production

Elapsed Calendar Days : 15

Elapsed Installation Days : 12

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date							
Cumulative	26032	14669	26132	3790			

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	0	2	1	4	1	3	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	3	0	0	0	0	0	0	2	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley
JDS Energy & Mining
Dep. Proj. Manager
2018-01-31

Signature : Chad Messervey

LAYFIELD
ENVIRONMENTAL SYSTEMS LTD.

DAILY FORCE ACCOUNT

Date: November 24 2017

Project: VGC Eagle Gold Collection Pond

Re: T&M Installation Daily Rate

LABOUR		Regular Time		Overtime		Amount
		Hrs.	Rate	Hrs.	Rate	
Chad Messervey	Supervisor					$0.00
Iain Konechny	Forman					$0.00
Mike Cantwell	Technician					$0.00
Jon Hitchcock	Technician					$0.00
Lance Tourett	Technician					$0.00
Donovan Halisheff	QC Technician					$0.00
						$0.00
					TOTAL	$0.00

Material - Supplies - Rental	Quantity	Unit Costs	Amount
CREWCAB	2		$0.00
Cargo Trailer	1		$0.00
Deployment Trailer	1		$0.00
			$0.00
			$0.00
			$0.00
			$0.00
			$0.00
			$0.00
			$0.00
			$0.00
		TOTAL Net	$0.00

Remarks, Layfield Crew working on installation of containment liner in Collection Pond

Customer/Client Representative

Signature

Clive Copley
JDS Energy & Mining
Dep. Proj. Manager
2018-01-31

DAILY COST SUMMARY	Amount
Material - Supplies - Rental	$0.00
Overhead and Fees	
Labour	$5,560.00
Total	**$5,560.00**

LAYFIELD

Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 25 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Clear -32 *morning* Clear -28 *noon* *night*

Description of Work Performed

Layfield crew continued with detail and testing on the collection pond, Having trouble with the air pressure tests passing, Due to the conditions that the liner was fused in this was to be expected, currently there are 6 seams that have not passed air pressure testing, the crew is working on tracking down the leaks, whiscjh is a matter of just blocking the air chanel in the center and eliminating half of the seam as a potential problem, this process is repeated. until the leak is located and repaired.

The remainder of the Layfield and Ewing crew continued the liner installation of the spill way, the Liner itself was completed. but the were only able to get 2 20m x 14m sections of textile installed before the end of the day, Clint asked that we stay late to complete the lower section of the spill way so pellys could start their backfill. this was completed.

Had 1 extrusion welder break down, not repairable, and 1 wedge welder break down, will be repaired if needed. the extreme cold, and welding hard brittle plastic is the likely cause. moisture getting into the electronics.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Touret									
Total Hours	13	12	12	12	12	12									

Installation Production

Elapsed Calendar Days : 17

Elapsed Installation Days : 14

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date	1058	4116		540			
Cumulative	28148	25785	28332	4330			

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	2	2	1	2	1	2	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	1	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley JDS Energy & Mining Dep. Proj. Manager 2018-01-31

Signature : Chad Messervey

LAYFIELD Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey

Date : November 26 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904

Weather : Clear -24 (*morning*) Clear -19 (*noon*) (*night*)

Description of Work Performed

Layfield crew continued to track leaks in the leaking wedge weld seams in the collection pond, all of the outer weld tracks are intact, there are no actual leaks through any of welded seams in the pond, all of the leaks are on the inner weld track, that is under the liner and more difficult to locate. the weld itself is intact on the outer side of weld track, it is the inner track that is leaking on all of the seams that will not pass air pressure testing. This most likely was caused by frost or snow being on the plastic during the welding process. One 30 meter section of weld will be cap stripped due to seam failure. this is the only one that has to be reconstructed so far.

Final seaming completed in spill way, textile overlay completed.

All remaining scrap liner materials have been collected, there is no empty dumpster to put it in, Ewing crew made a pile in the Layfield laydown.

Ewing crew was finished work with Layfield at 1200h

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Tourett									
Total Hours	11	10	10	10	10	10									

Installation Production

Elapsed Calendar Days : 18

Elapsed Installation Days : 15

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Textile Overlay (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date							
Cumulative	28148	25785	28332	4330			

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	1	1	1	3	1	2	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0.5	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(spool)	(lm)	(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Approved : Chris Copley
JDS Energy & Mining
Dep. Proj. Manager
2018-01-31

Signature : Chad Messervey

LAYFIELD Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey Date : November 27 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904 Weather : Snow, -20 *morning* Clear -21 *noon* *night*

Description of Work Performed

Layfield continued detail&testing, Had more success finding the leaks on the inner wedge track today, testing was progressing faster then previous days. Have 1.5 seams remaining on the floor to test and track tomorrow any leaks if found. Then the North slope will be completed. If everything goes well tomorrow will be the last full day on site.
4 Cap strips were installed on seam that leaks could not be located on.
Site clean up was started, Picking up any missed garbage, scrap, roll cores and properly disposing of them.
Demob preperations started, packing unneeded equipment and materials into the cargo trailer, Cleaning out sea can.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechney	Mike Cantwell	Jon Hitchcock	Donovan Halisheff	Lance Touret									
Total Hours	11	10	10	10	10	10									

Installation Production

Elapsed Calendar Days : 19 Elapsed Installation Days : 16

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date							
Cumulative	28148	25785	28332	4330			

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	1	1	1	2	1	2	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0.25	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(sp		(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Chris Copley
JDS Energy & Mining
Dep. Proj. Manager
2018-01-31

Approved : Signature : Chad Messervey

LAYFIELD Daily Installation Report

(revised Feb/08)

Supervisor : Chad Messervey Date : November 28 2017

Customer & Project Title : VGC Eagle Gold Collection Pond

Job Number : CT000904 Weather : Clear -20 (*morning*) Clear -20 (*noon*) (*night*)

Description of Work Performed

Crew completed work on the collection pond, all testing and detail work is now complete. The collection pond is 100% complete
All sandbags within the pond were moved to ballast loose textile edges around ripwrap so they dont float, any extra bags were moved to the toe of slope for ballast.
All garbage, scrap liner was cleaned up and disposed of.
Office trailer cleaned out.
Sea Can Cleaned out.
Equipment was cleaned and stored in cargo trailer for travel.
Equipment was loaded onto flatdeck and secured for travel.
Thurough truck inspection completed before road trip tomorrow.

Mobilization # :

Labour

Name	Chad Messervey	Iain Konenechne y	Mike Cantwel	Jon Hitchcoc	Donovan Halisheff	Lance Touret									
Total Hours	12	11	11	11	11	12									

Installation Production

Elapsed Calendar Days : 20 Elapsed Installation Days : 17

Material Production / Recap Info	Liner Installed (sq.m.) or (sq.ft.)	Liner Tested (sq.m.) or (sq.ft.)	Geotextile (sq.m.) or (sq.ft.)	Geonet (sq.m.) or (sq.ft.)	Other: (sq.m.) or (sq.ft.)	Wick Drain (ft) or (m)	Wick Drain # of wicks
Today's date		2363					
Cumulative	28148	28148	28332	4330			

Equipment

Type	Truck	Mileage	Flat Deck Trailer	Cargo Trailer	ATV	Wedge Welder	Extrusion Welder	Tensio-meter	Genset	Compres.	Leister	Hilti	Sewing Machine	Wick Machine	
Qty.	2	0	1	1	1	1	1	1	2	1	1	0	0	0	

Job Materials

Type	Sand Bags	Welding Rod	Batten Bar	Anchor Bolts	Caulking	Gasket	Banding	THF	Rags	Thread	Wick Plates	Wick Rebar	Wick Shoes	Wick Mandrel	
Qty.	0	0.5	0	0	0	0	0	0	1	0	0	0	0	0	
	(ea)	(spoo		(ea)	(tube)	(lm)	(lm)	(gal)	(box)	(spool)	(ea)	(ea)	(ea)	(ft)	

Chris Copley
JDS Energy & Mining
Dep. Proj. Manager
2018-01-31

Approved : Signature : Chad Messervey

ATTACHMENT E

Quality Control Inspection and Testing

THIS PAGE INTENTIONALLY LEFT BLANK

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond
QC Inspection & Testing
Project No.: TRN.WTRM03037-01
Client: JDS Energy & Mining
Attention: C. Goldschmidt/M. Coverdale
Contractor: Pelly Construction

Test Apparatus: Nuclear **Troxler No:** 65865
Specified Compaction: 95 % Std. Proctor Max. Dry Density
Specified Moisture (MC)**:** As Below
Temperature Air: ºC **Soil:** ºC
Date Tested: 2017/10/21 **By:** JSB
Construction Period: DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/21	**1** 300	Sub-Ex Area: Bridge lift 10 m west of Dam CL	804.6	2242	5.8	2252	6.0	**99.6**
"	**2** 300	Sub-Ex Area: Bridge lift near dam CL	804.3	2231	6.1	2252	6.0	**99.1**
"	**3** 300	Sub-Ex Area: Bridge lift 5 m east of dam CL	804.0	2232	5.8	2252	6.0	**99.1**
"	**4** 300	Sub-Ex Area: Testpit -0.6 m Depth 5 m west of dam CL	804.0	2225	6.8	2252	6.0	**98.8**
"	**5** 300	Sub-Ex Area: Testpit -0.8 m Depth 3 m east of dam CL	804.3	2196	6.6	2252	6.0	**97.5**
"	**6** 300	Sub-Ex Area: Sump located within east toe of dam	804.0	2201	6.0	2252	6.0	**97.7**
"	**7** 300	Sub-Ex Area: 10 m West of dam CL	804.8	2213	5.8	2252	6.0	**98.3**
"	**8** 300	Sub-Ex Area: Near dam CL	804.6	2243	7.4	2252	6.0	**99.6**
"	**9** 300	Sub-Ex Area: 5 m east of dam CL	804.5	2235	5.7	2252	6.0	**99.2**
"	**10** 300	Sub-Ex Area: 3 m east of dam CL	804.8	2222	5.0	2252	6.0	**98.7**
"	**11** 300	Sub-Ex Area: Near dam CL	804.9	2219	6.2	2252	6.0	**98.5**
"	**12** 300	Sub-Ex Area: 8 m west of dam CL	805.1	2215	6.3	2252	6.0	**98.4**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -8 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/21 **By:** RB

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill Below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/21	**1** 300	Sub-Ex: 2m E of E toe of dam	8.80	2209	6.0	2252	6.0	**98.1**
"	**2** 300	Sub-Ex: 20m W of E toe of dam	9.10	2211	6.2	2252	6.0	**98.2**
"	**3** 300	Sub-Ex: 20m W of E toe of dam	8.80	2250	6.2	2252	6.0	**99.9**
"	**4** 300	Sub-Ex: 5m E of E toe of dam	8.60	2226	6.2	2252	6.0	**98.8**
"	**5** 300	Sub-Ex: 25m W of E toe of dam	8.60	2213	6.5	2252	6.0	**98.3**
"	**6** 300	Sub-Ex: 10m E of E toe of dam	8.40	2211	5.5	2252	6.0	**98.2**
"	**7** 300	Sub-Ex: 15m W of E toe of dam	8.30	2217	6.8	2252	6.0	**98.4**
"	**8** 300	Sub-Ex: C/L of dam	8.10	2215	4.9	2252	6.0	**98.4**
"	**9** 300	Sub-Ex: 10m E of E toe of dam	8.10	2217	5.2	2252	6.0	**98.4**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM03037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** ºC **Soil:** ºC

Attention: C. Goldschmidt/M. Coverdale | **Date Tested:** 2017/10/23 **By:** A.Linklater

Contractor: Pelly Construction | **Construction Period:** DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/23	**1** 300	Sub-Ex Area: Bridge lift 6 m west of Dam CL	804.8	2226	4.6	2252	6.0	**98.8**
"	**2** 300	Sub-Ex Area: Bridge lift 4m west of dam CL	804.6	2235	4.7	2252	6.0	**99.2**
"	**3** 300	Sub-Ex Area: Bridge lift 6 m east of dam CL	805.2	2223	4.3	2252	6.0	**98.7**
"	**4** 300	Sub-Ex Area: Depth 5 m west of dam CL	805.0	2240	4.7	2252	6.0	**99.5**
"	**5** 300							
"	**6** 300							
"	**7** 300							
"	**8** 300							
"	**9** 300							
"	**10** 300							
"	**11** 300							
"	**12** 300							

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -12 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/23 **By:** RB

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill Below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/23	**1** 300	Sub-Ex: 2m E of E toe of dam	805.70	2329	3.5	2252	6.0	**103.4**
"	**2** 300	Sub-Ex: 25m W of E toe of dam	805.70	2219	3.9	2252	6.0	**98.5**
"	**3** 300	Sub-Ex: 25m W of E toe of dam	806.00	2242	3.4	2252	6.0	**99.6**
"	**4** 300	Sub-Ex: 1m W of E toe of dam	806.00	2225	5.1	2252	6.0	**98.8**
"	**5** 300	Sub-Ex: 20m W of E toe of dam	806.30	2213	6.5	2252	6.0	**98.3**
"	**6** 300	Sub-Ex: 2m W of E toe of dam	806.30	2215	3.4	2252	6.0	**98.4**
"	**7** 300	Sub-Ex: 2m W of E toe of dam	8.30	2217	6.8	2252	6.0	**98.4**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM03037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -10 ºC **Soil:** 3 ºC

Attention: C. Goldschmidt/M. Coverdale | **Date Tested:** 2017/10/24 **By:** A.Linklater

Contractor: Pelly Construction | **Construction Period:** DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/24	**1** 300	Sub-Ex Area: Bridge lift 6 m west of Dam CL	806.5	2244	5.3	2252	6.0	**99.6**
"	**2** 300	Sub-Ex Area: Bridge lift 9m west of dam CL	806.3	2235	5.6	2252	6.0	**99.2**
"	**3** 300	Sub-Ex Area: Bridge lift 29 m east of dam CL	806.4	2225	5.2	2252	6.0	**98.8**
"	**4** 300	Sub-Ex Area: Depth 23 m west of dam CL	806.4	2259	5.4	2252	6.0	**100.3**
"	**5** 300	Sub-Ex Area: Depth 8 m west of dam CL	806.8	2240	5.9	2252	6.0	**99.5**
"	**6** 300	Sub-Ex Area: Depth 7 m west of dam CL	806.8	2237	4.7	2252	6.0	**99.3**
"	**7** 300							
"	**8** 300							
"	**9** 300							
"	**10** 300							
"	**11** 300							
"	**12** 300							

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -12 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/24 **By:** RB

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill Below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/24	**1** 300	Sub-Ex: 2m E of E toe of dam, 5m S of N limit of Sub-ex	807.30	2274	4.4	2252	6.0	**101.0**
"	**2** 300	Sub-Ex: 2m E of E toe of dam, 10m N of N limit of Sub-ex	807.30	2243	5.2	2252	6.0	**99.6**
"	**3** 300	Sub-Ex: 20m W of E toe of dam, 5m N of N limit of Sub-ex	807.30	2211	6.0	2252	6.0	**98.2**
"	**4** 300	Sub-Ex: 20m W of E toe of dam, 5m S of N limit of Sub-ex	807.30	2295	5.1	2252	6.0	**101.9**
"	**5** 300	Sub-Ex: 5m E of E toe of dam, 1m N of N limit of Sub-ex	807.60	2218	4.0	2252	6.0	**98.5**
"	**6** 300	Sub-Ex: 25m E of E toe of dam, 10m N of N limit of Sub-ex	807.60	2206	3.7	2252	6.0	**98.0**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -8 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/26 **By:** RB

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%), 20mm Crush (2185@7%)

Material Usage/Zone: Low level control pound outlet, Pipe and trench backfill

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/26	**13** 300	25m W of Manhole within trench	806.70	2227	5.2	2252	6.0	**98.9**
"	**14** 300	10m W of Manhole within trench	807.10	2242	4.3	2252	6.0	**99.6**
"	**15** 300	30m W of Manhole, 4m N of pipe C/L	807.00	2219	4.7	2252	7.0	**98.5**
"	**16** 300	10m W of Manhole within trench	807.40	2276	4.9	2252	7.0	**101.1**
	17 300	35m W of Manhole, 5m N of pipe C/L	807.30	2221	4.6	2252	7.0	**98.6**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -8 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/26 **By:** RB

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%), 20mm Crush (2185@7%)

Material Usage/Zone: Low level control pound outlet, Pipe and trench backfill

Date yyyy/mm/dd	**Test No.** / Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/26	**1** / 300	12m W of Manhole within trench	806.30	2127	4.4	2185	7.0	**97.3**
"	**2** / 300	24m W of Manhole within trench	805.80	2112	4.8	2185	7.0	**96.7**
"	**3** / 300	36m W of Manhole within trench	805.30	2101	5.2	2185	7.0	**96.2**
"	**4** / 300	12m W of Manhole within trench	806.60	2107	5.1	2185	7.0	**96.4**
	5 / 300	24m W of Manhole within trench	806.10	2138	4.2	2185	7.0	**97.8**
	6 / 300	36m W of Manhole within trench	805.60	2097	4.0	2185	7.0	**96.0**
	7 / 300	45m W of Manhole, 5m N of C/L of pipe	805.10	2209	4.6	2252	6.0	**98.1**
	8 / 300	50m W of Manhole, 5m N of C/L of pipe	805.40	2234	4.2	2252	6.0	**99.2**
	9 / 300	35m W of Manhole, 5m N of C/L of pipe	805.70	2211	5.0	2252	6.0	**98.2**
	10 / 300	12m W of Manhole within trench	806.90	2104	4.6	2185		**96.3**
	11 / 300	24m W of Manhole within trench	806.40	2093	4.4	2185		**95.8**
	12 / 300	36m W of Manhole within trench	805.90	2086	4.9	2185		**95.5**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM03037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -1 ºC **Soil:** 4 ºC

Attention: C. Goldschmidt/M. Coverdale | **Date Tested:** 2017/10/27 **By:** A.Linklater

Contractor: Pelly Construction | **Construction Period:** DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/27	**1** 250	Sub-Ex Area: 7m North of LLO Trench CL	807.8	2211	4.6	2252	6.0	**98.2**
"	**2** 250	Sub-Ex Area: 5m South of LLO Trench CL	807.8	2223	5.8	2252	6.0	**98.7**
"	**3** 250	Sub-Ex Area: 6m North of LLO Trench CL	808.1	2231	4.7	2252	6.0	**99.1**
"	**4** 250	Sub-Ex Area: 3m North of LLO Trench CL	808.1	2234	5.1	2252	6.0	**99.2**
"	**5** 250	Sub-Ex Area: 23m South of LLO Trench CL	808.4	2227	4.6	2252	6.0	**98.9**
"	**6** 250	Sub-Ex Area: 14m South of LLO Trench CL	808.4	2243	5.0	2252	6.0	**99.6**
"	**7** 250							
"	**8** 250							
"	**9** 250							
"	**10** 250							
"	**11** 250							
"	**12** 250							

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM03037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** 4 ºC **Soil:** 4 ºC

Attention: C. Goldschmidt/M. Coverdale | **Date Tested:** 2017/10/28 **By:** A.Linklater

Contractor: Pelly Construction | **Construction Period:** DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/28	**1** 250	Sub-Ex Area: 22m South of LLO Trench CL	809.0	2245	3.5	2252	6.0	**99.7**
"	**2** 250	Sub-Ex Area: 31m South of LLO Trench CL	809.3	2234	3.4	2252	6.0	**99.2**
"	**3** 250	Sub-Ex Area: 18m South of LLO Trench CL	809.3	2220	3.7	2252	6.0	**98.6**
"	**4** 250	Sub-Ex Area: 38m South of LLO Trench CL	809.3	2263	3.4	2252	6.0	**100.5**
"	**5** 250	Sub-Ex Area: 4m South of LLO Trench CL	809.3	2218	5.6	2252	6.0	**98.5**
"	**6** 250	Sub-Ex Area: 15m South of LLO Trench CL	809.3	2243	5.6	2252	6.0	**99.6**
"	**7** 250							
"	**8** 250							
"	**9** 250							
"	**10** 250							
"	**11** 250							
"	**12** 250							

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -3 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/28 **By:** RO

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill Below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/28	**1** 250	2m N of LLO pipe CL	808.70	2239	3.5	2252	6.0	**99.4**
"	**2** 250	Sub-Ex: 20m W of E toe of dam	808.70	2210	3.9	2252	6.0	**98.1**
"	**3** 250	Sub-Ex: 20m W of E toe of dam	808.70	2219	4.1	2252	6.0	**98.5**
"	**4** 250	Sub-Ex: 5m E of E toe of dam	808.70	2210	3.2	2252	6.0	**98.1**
"	**5** 250	Sub-Ex: 25m W of E toe of dam	808.70	2252	5.5	2252	6.0	**100.0**
"	**6** 250	Sub-Ex: 10m E of E toe of dam	808.70	2207	3.7	2252	6.0	**98.0**
"	**7** 250	Sub-Ex: 15m W of E toe of dam	809.00	2211	3.8	2252	6.0	**98.2**
"	**8** 250	Sub-Ex: C/L of dam	809.00	2234	3.6	2252	6.0	**99.2**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM03037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** 1 ºC **Soil:** 5 ºC

Attention: C. Goldschmidt/M. Coverdale | **Date Tested:** 2017/10/29 **By:** A.Linklater

Contractor: Pelly Construction | **Construction Period:** DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/29	**1** 250	Sub-Ex Area: 21m South of LLO Trench CL	809.8	2251	4.4	2252	6.0	**100.0**
"	**2** 250	Sub-Ex Area: 48m South of LLO Trench CL	809.8	2220	6.2	2252	6.0	**98.6**
"	**3** 250	Sub-Ex Area: 15m South of LLO Trench CL	809.8	2257	5.5	2252	6.0	**100.2**
"	**4** 250	Sub-Ex Area: 29m South of LLO Trench CL	809.8	2230	5.9	2252	6.0	**99.0**
"	**5** 250	Sub-Ex Area: 12m South of LLO Trench CL	810.1	2242	5.8	2252	6.0	**99.6**
"	**6** 250	Sub-Ex Area: 31m South of LLO Trench CL	810.1	2245	5.8	2252	6.0	**99.7**
"	**7** 250	Sub-Ex Area: 16m South of LLO Trench CL	810.1	2238	4.9	2252	6.0	**99.4**
"	**8** 250	Sub-Ex Area: 42m South of LLO Trench CL	810.4	2247	5.3	2252	6.0	**99.8**
"	**9** 250	Sub-Ex Area: 15m South of LLO Trench CL	810.4	2225	5.4	2252	6.0	**98.8**
"	**10** 250							
"	**11** 250							
"	**12** 250							

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -8 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/29 **By:** RO

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill North of South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/29	**1** 250	30 m S of LLO pipe CL, E side	810.70	2213	5.5	2252	6.0	**98.3**
"	**2** 250	1m S of LLO pipe CL, E side	810.70	2251	4.9	2252	6.0	**100.0**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM03037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -6 ºC **Soil:** 3 ºC

Attention: C. Goldschmidt/M. Coverdale | **Date Tested:** 2017/10/30 **By:** A.Linklater

Contractor: Pelly Construction | **Construction Period:** DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam

Date yyyy/mm/dd	**Test No.** / Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/30	**1** / 250	Sub-Ex Area: 18m South of LLO Trench CL	810.4	2264	5.7	2252	6.0	**100.5**
"	**2** / 250	Sub-Ex Area: 37m South of LLO Trench CL	810.4	2217	5.2	2252	6.0	**98.4**
"	**3** / 250	Sub-Ex Area: 46m South of LLO Trench CL	810.4	2232	6.2	2252	6.0	**99.1**
"	**4** / 250	Sub-Ex Area: 27m South of LLO Trench CL	810.4	2239	4.5	2252	6.0	**99.4**
"	**5** / 250	Sub-Ex Area: 52m South of LLO Trench CL	810.7	2214	5.9	2252	6.0	**98.3**
"	**6** / 250	Sub-Ex Area: 10m South of LLO Trench CL	810.7	2226	6.4	2252	6.0	**98.8**
"	**7** / 250	Sub-Ex Area: 44m South of LLO Trench CL	810.7	2212	6.1	2252	6.0	**98.2**
"	**8** / 250	Sub-Ex Area: 49m South of LLO Trench CL	810.7	2211	6.6	2252	6.0	**98.2**
"	**9** / 250	Sub-Ex Area: 7m South of LLO Trench CL	810.7	2222	6.1	2252	6.0	**98.7**
"	**10** / 250	Sub-Ex Area: 18m South of LLO Trench CL	810.7	2227	6.3	2252	6.0	**98.9**
"	**11** / 250	Sub-Ex Area: 49m South of LLO Trench CL	811.0	2262	6.1	2252	6.0	**100.4**
"	**12** / 250	Sub-Ex Area: 23m South of LLO Trench CL	811.0	2258	6.2	2252	6.0	**100.3**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -10 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/30 **By:** RO

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill North of South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/30	**1** 250	36 m S of LLO pipe CL, W side	811.00	2212	5.5	2252	6.0	**98.2**
"	**2** 250	3m S of LLO pipe CL, W side	811.00	2217	5.1	2252	6.0	**98.4**
"	**3** 250	12m S of LLO pipe CL, E side	811.30	2268	4.1	2252	6.0	**100.7**
2017/10/31	**4** 250	38m S of LLO pipe CL, E side	811.30	2249	5.6	2252	6.0	**99.9**
"	**5** 250	2m N of LLO pipe CL, W side	811.30	2231	5.4	2252	6.0	**99.1**
"	**6** 250	40m S of LLO pipe CL,W side	811.30	2225	5.2	2252	6.0	**98.8**
"	**7** 250	16m S of LLO pipe CL, E side	811.60	2254	5.7	2252	6.0	**100.1**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM03037-01 | **Specified Moisture** (MC)**:** As Below

Client: JDS Energy & Mining | **Temperature** **Air:** 1 ºC **Soil:** 4 ºC

Attention: C. Goldschmidt/M. Coverdale | **Date Tested:** 2017/10/31 **By:** A.Linklater

Contractor: Pelly Construction | **Construction Period:** DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/31	**1** 250	Sub-Ex Area: 52m South of LLO Trench CL	811.6	2243	5.1	2252	6.0	**99.6**
"	**2** 250	Sub-Ex Area: 40m South of LLO Trench CL	811.9	2270	4.7	2252	6.0	**100.8**
"	**3** 250	Sub-Ex Area: 28m South of LLO Trench CL	811.9	2213	6.1	2252	6.0	**98.3**
"	**4** 250	Sub-Ex Area: 14m South of LLO Trench CL	811.9	2244	4.7	2252	6.0	**99.6**
"	**5** 250	Sub-Ex Area: 48m South of LLO Trench CL	812.2	2265	4.5	2252	6.0	**100.6**
"	**6** 250							
"	**7** 250							
"	**8** 250							
"	**9** 250							
"	**10** 250							
"	**11** 250							
"	**12** 250							

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM3037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -12 ºC **Soil:** 1 ºC

Attention: C.Goldschmidt/M.Coverdale | **Date Tested:** 2017/10/31 **By:** RO

Contractor: Pelly Construction | **Construction Period:** Nightshift

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill North of South Control Dam

Date yyyy/mm/dd	**Test No.** Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/10/31	**1** 250	42 m S of LLO pipe CL	812.20	2223	5.0	2252	6.0	**98.7**
"	**2** 250	5m S of LLO pipe CL	812.50	2255	4.8	2252	6.0	**100.1**
"	**3** 250	24m S of LLO pipe CL	812.50	2227	4.6	2252	6.0	**98.9**
"	**4** 250	44m S of LLO pipe CL	812.50	2269	5.2	2252	6.0	**100.8**
2017/11/01	**5** 250	3m N of LLO pipe CL	812.80	2210	5.4	2252	6.0	**98.1**
"	**6** 250	15m S of LLO pipe CL	812.80	2283	5.9	2252	6.0	**101.4**
"	**7** 250	37m S of LLO pipe CL	812.80	2263	5.1	2252	6.0	**100.5**
"	**8** 250	4m S of LLO pipe CL	813.10	2232	4.2	2252	6.0	**99.1**
"	**9** 250	26m S of LLO pipe CL	813.10	2255	4.8	2252	6.0	**100.1**
"	**10** 250	34m S of LLO pipe CL	813.10	2248	4.5	2252	6.0	**99.8**

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

TETRA TECH

COMPACTION DENSITY TEST SUMMARY REPORT

ASTM Designation D6938

Project: Lower Dublin Control Pond | **Test Apparatus:** Nuclear | **Troxler No:** 65865

QC Inspection & Testing | **Specified Compaction:** 98 % Std. Proctor Max. Dry Density

Project No.: TRN.WTRM03037-01 | **Specified Moisture** (MC): As Below

Client: JDS Energy & Mining | **Temperature** **Air:** -9 ºC **Soil:** 4 ºC

Attention: C. Goldschmidt/M. Coverdale | **Date Tested:** 2017/11/01 **By:** A.Linklater

Contractor: Pelly Construction | **Construction Period:** DAYSHIFT

Soil Description: Pit run (2252@6%)

Material Usage/Zone: Common fill below South Control Dam/Spill Way

Date yyyy/mm/dd	**Test No.** / Probe (mm)	**Location:**	Depth to Grade (m)	Dry Density (kg/m³)	MC %	Max. Dry Density	Opt. MC %	Comp % SPD
2017/11/01	**1** / 250	Sub-Ex Area: 17m South of LLO Trench CL	813.5	2243	4.8	2252	6.0	**99.6**
"	**2** / 250	Sub-Ex Area: 46m South of LLO Trench CL	813.5	2211	5.2	2252	6.0	**98.2**
"	**3** / 250	Sub-Ex Area: 4m North of CL on Spill Way	904.0	2234	5.2	2252	6.0	**99.2**
"	**4** / 250	Sub-Ex Area: 2m South of CL on Spill Way	805.6	2227	5.2	2252	6.0	**98.9**
"	**5** / 250	Sub-Ex Area: 3m North of CL on Spill Way	806.1	2244	4.5	2252	6.0	**99.6**
"	**6** / 250	Sub-Ex Area: 1m North of CL on Spill Way	807.7	2221	6.1	2252	6.0	**98.6**
2017/11/02	**7** / 250	Sub-Ex Area: 5m North of CL on Spill Way	809.5	2217	4.5	2252	6.0	**98.4**
2017/11/02	**8** / 250	Sub-Ex Area: CL on Spill Way	810.1	2231	5.2	2252	6.0	**99.1**
"	**9** / 250							
"	**10** / 250							
"	**11** / 250							
"	**12** / 250							

Remarks: Refer to corresponding daily FRR for specifics of testing

Copies:

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech EBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech EBA. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech EBA will provide it upon written request.

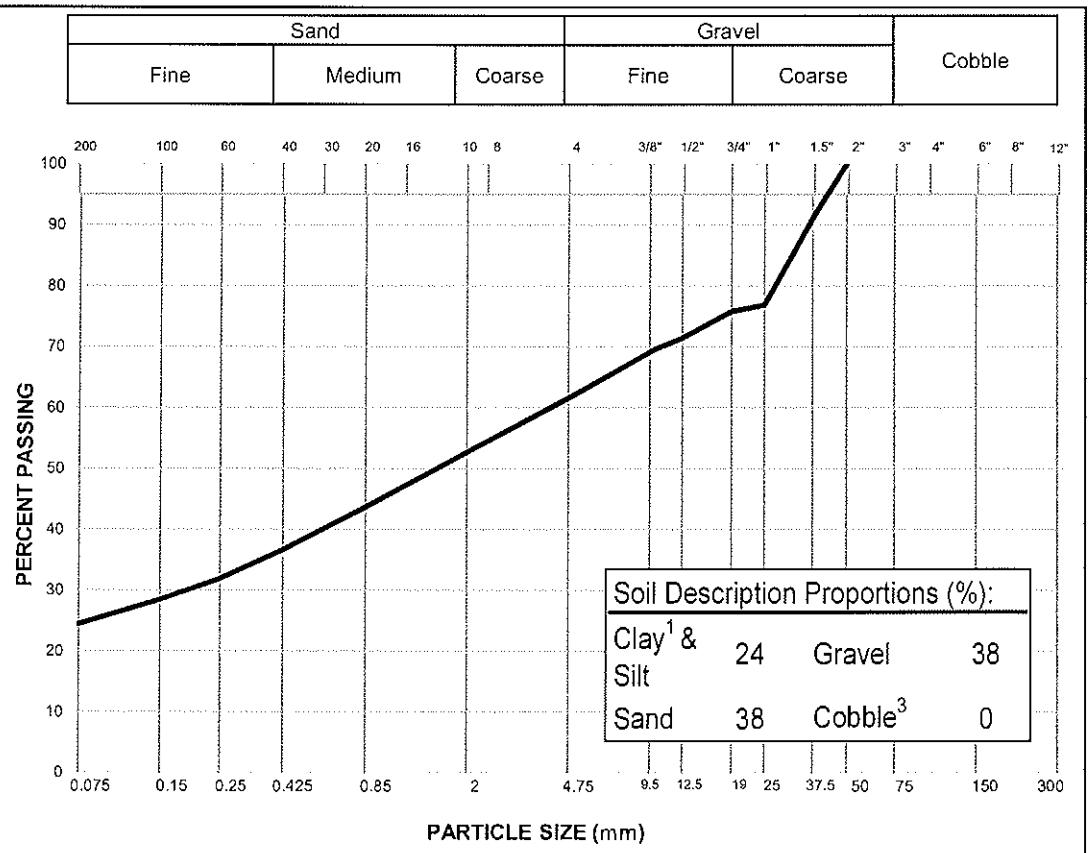
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA01
Project No.:	ENG.WARC03235-03	Material Type:	-
Site:	Dublin Gulch, YT	Sample Loc.:	Containment Pond Berm
Client:	JDS Energy & Mining (Strata Gold)	Sample Depth:	-
Client Rep.:	Calvin Goldschmidt	Sampling Method:	Grab
Date Tested:	September 26, 2017 By: AMT	Date sampled:	-
Soil Description[2]:	GRAVEL and SAND - silty	Sampled By:	-
		USC Classification:	Cu: #N/A
Moisture Content:	6.4%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	100
38	92
25	77
19	76
12.5	71
10	70
5	62
2	53
0.85	44
0.425	37
0.25	32
0.15	28
0.075	24.4



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to Tt WM4400 description protocols

[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: _____ P.Eng.

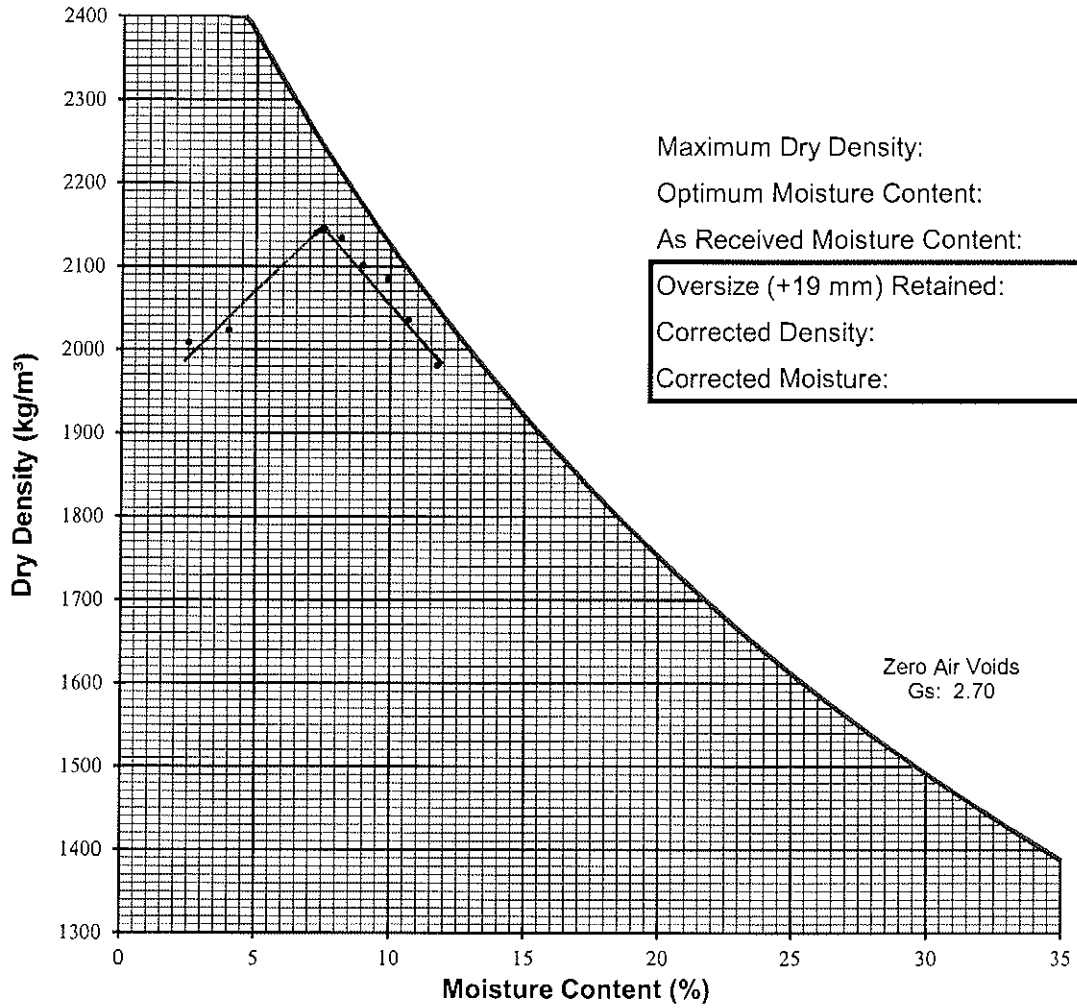
Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 Standard

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA01
Client:	JDS Energy & Mining (Strata Gold)	Sampled By:	-
Attention:	Calvin Goldschmidt	Sample Date:	-
Project No.:	ENG.WARC03235-03	Test Date:	September 22, 2017
Description:	GRAVEL and SAND - silty	Preparation:	Moist
Source:	Containment Pond Berm	Compaction:	Manual



Maximum Dry Density:	**2145**	kg/m³
Optimum Moisture Content:	**7.5**	%
As Received Moisture Content:	**6.4**	%
Oversize (+19 mm) Retained:	**25**	%
Corrected Density:	**2252**	%
Corrected Moisture:	**5.9**	%

Remarks: -

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

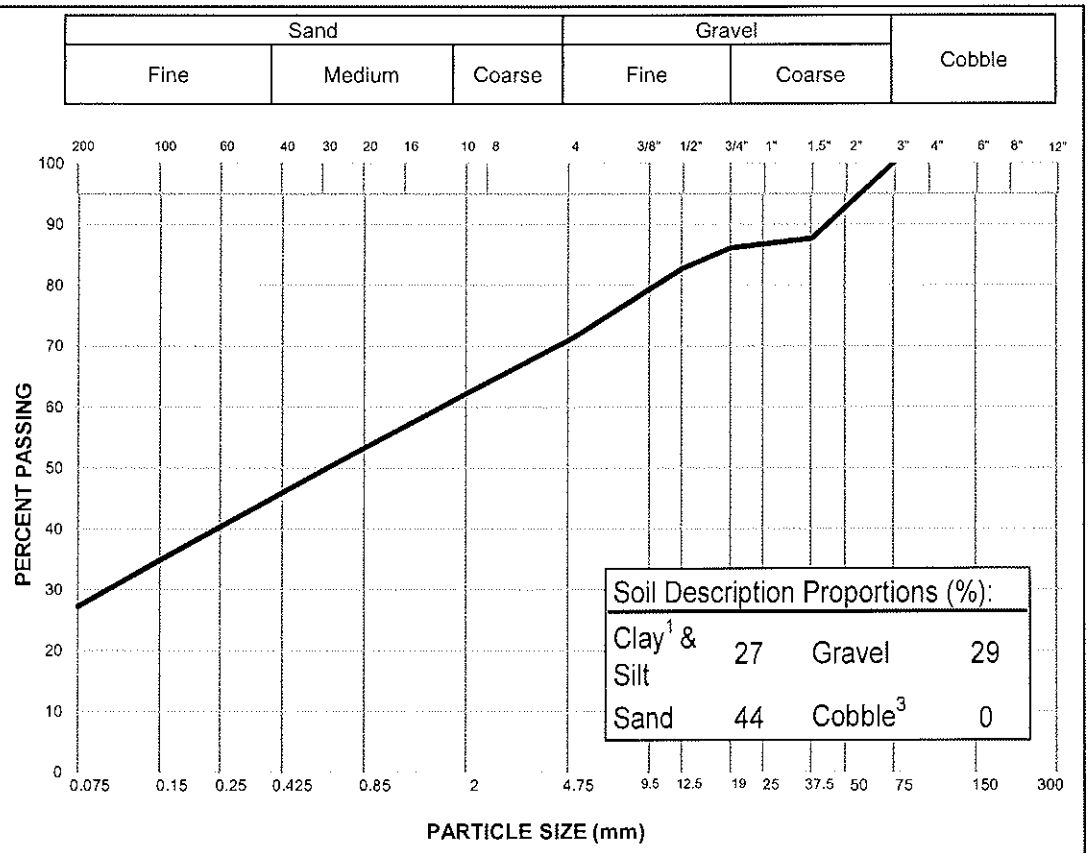
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA02
Project No.:	ENG.WARC03235-03	Material Type:	-
Site:	Dublin Gulch, YT	Sample Loc.:	Containment Pond Berm
Client:	JDS Energy & Mining (Strata Gold)	Sample Depth:	-
Client Rep.:	Calvin Goldschmidt	Sampling Method:	Grab
Date Tested:	September 26, 2017 By: AMT	Date sampled:	-
Soil Description[2]:	SAND - gravelly, silty	Sampled By:	-
		USC Classification:	Cu: #N/A
Moisture Content:	8.7%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	100
50	
38	88
25	
19	86
12.5	83
10	80
5	71
2	62
0.85	53
0.425	46
0.25	40
0.15	35
0.075	27.2



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: _____ P.Eng.

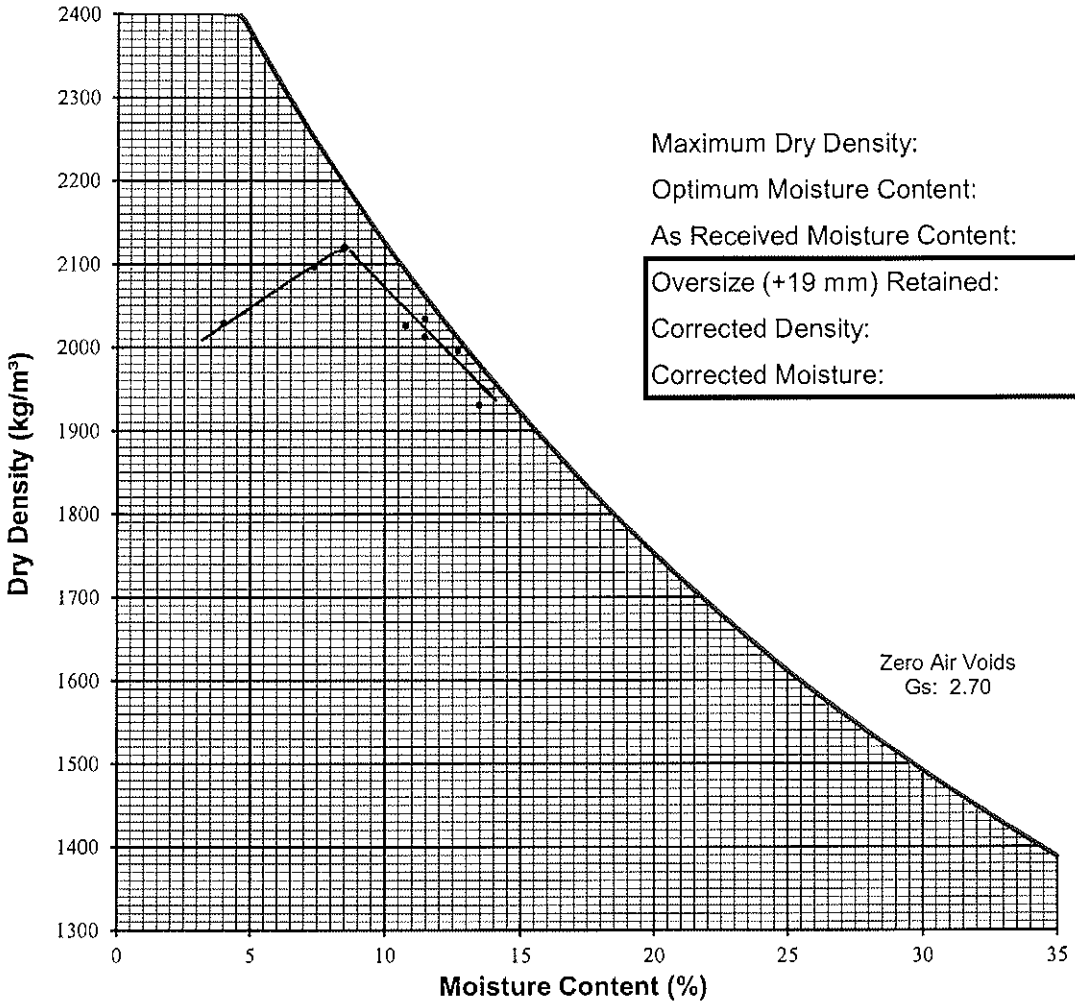
Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 Standard

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA02
Client:	JDS Energy & Mining (Strata Gold)	Sampled By:	-
Attention:	Calvin Goldschmidt	Sample Date:	-
Project No.:	ENG.WARC03235-03	Test Date:	September 22, 2017
Description:	SAND - gravelly, silty	Preparation:	Moist
Source:	Containment Pond Berm	Compaction:	Manual



Maximum Dry Density:	**2120**	kg/m³
Optimum Moisture Content:	**8.5**	%
As Received Moisture Content:	**6.4**	%
Oversize (+19 mm) Retained:	**15**	%
Corrected Density:	**2186**	%
Corrected Moisture:	**7.4**	%

Remarks: -

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

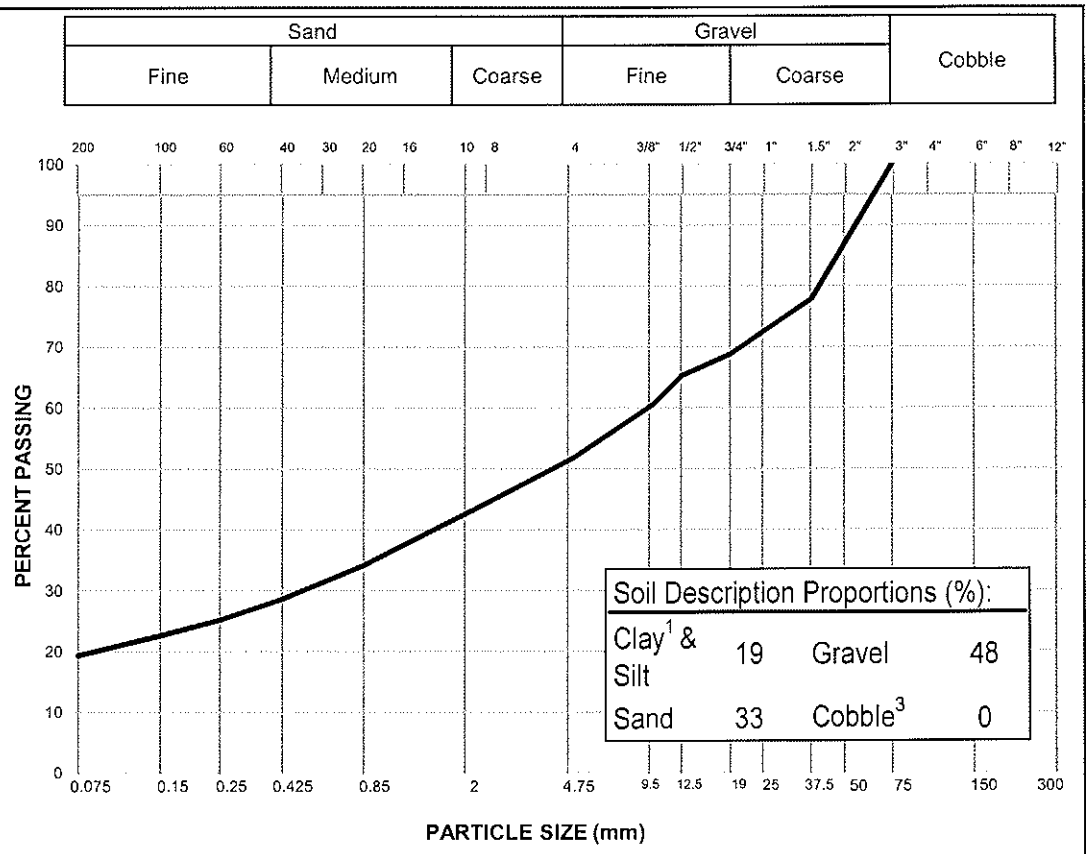
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA03
Project No.:	ENG.WARC03235-03	Material Type:	-
Site:	Dublin Gulch, YT	Sample Loc.:	Containment Pond Berm
Client:	JDS Energy & Mining (Strata Gold)	Sample Depth:	-
Client Rep.:	Calvin Goldschmidt	Sampling Method:	Grab
Date Tested:	September 26, 2017 By: AMT	Date sampled:	-
Soil Description[2]:	GRAVEL - sandy, some silt	Sampled By:	-
		USC Classification:	Cu: #N/A
Moisture Content:	6.5%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	100
50	
38	78
25	
19	69
12.5	65
10	61
5	52
2	43
0.85	34
0.425	29
0.25	25
0.15	23
0.075	19.3



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: _____ P.Eng.

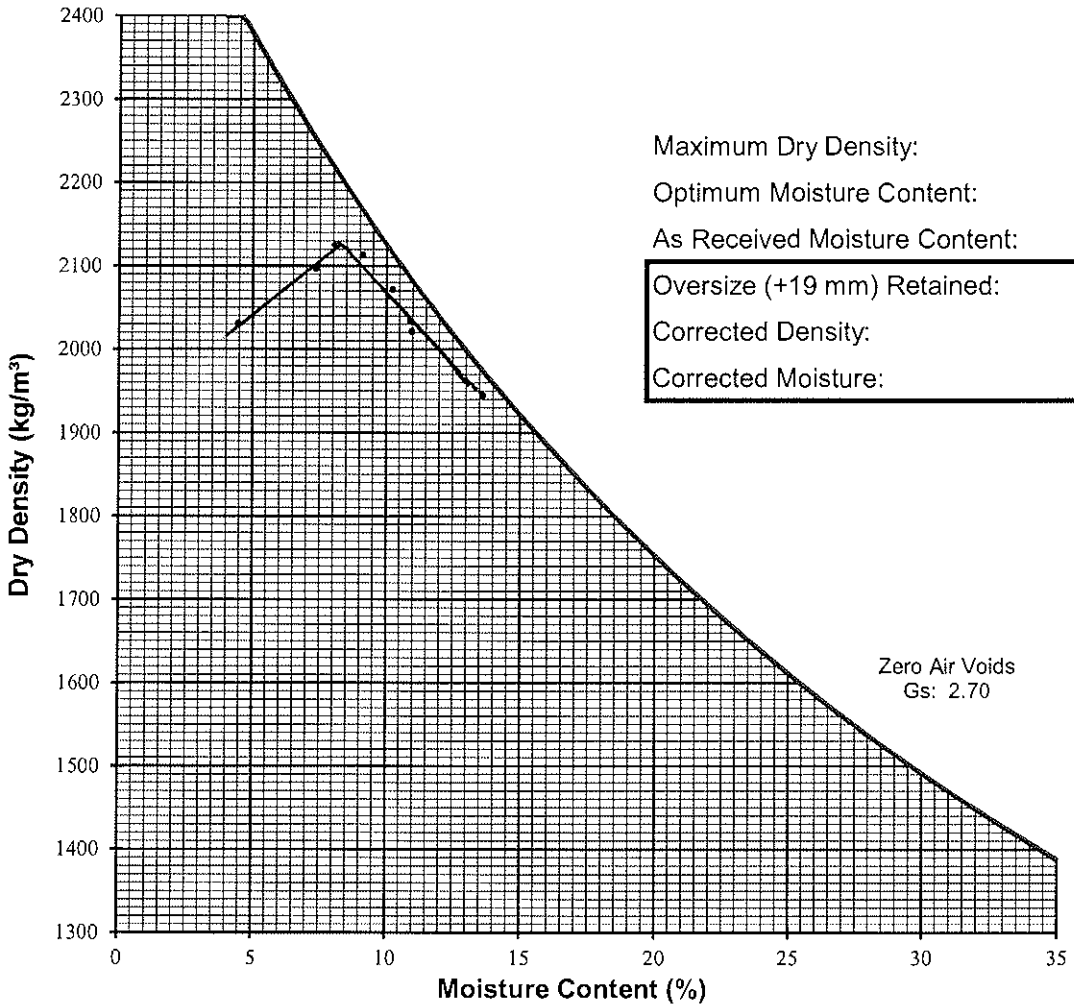
Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 Standard

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA03
Client:	JDS Energy & Mining (Strata Gold)	Sampled By:	-
Attention:	Calvin Goldschmidt	Sample Date:	-
Project No.:	ENG.WARC03235-03	Test Date:	September 22, 2017
Description:	GRAVEL - sandy, some silt	Preparation:	Moist
Source:	Containment Pond Berm	Compaction:	Manual



Maximum Dry Density:	**2125**	kg/m³
Optimum Moisture Content:	**8.1**	%
As Received Moisture Content:	**6.5**	%
Oversize (+19 mm) Retained:	**30**	%
Corrected Density:	**2259**	%
Corrected Moisture:	**6.0**	%

Remarks: -

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

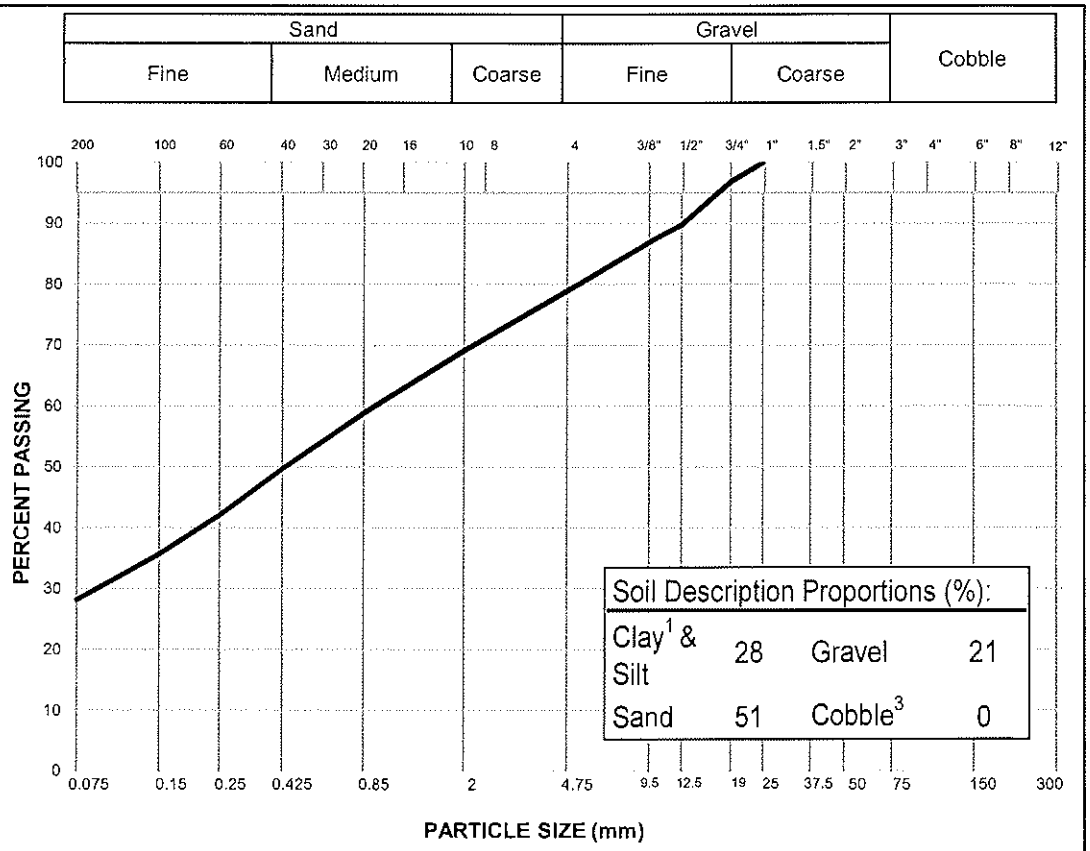
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA04
Project No.:	ENG.WARC03235-03	Material Type:	-
Site:	Dublin Gulch, YT	Sample Loc.:	Containment Pond Berm
Client:	JDS Energy & Mining (Strata Gold)	Sample Depth:	-
Client Rep.:	Calvin Goldschmidt	Sampling Method:	Grab
Date Tested:	September 26, 2017 By: AMT	Date sampled:	-
Soil Description[2]:	SAND - silty, gravelly	Sampled By:	-
		USC Classification:	Cu: #N/A
Moisture Content:	8.8%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	100
19	97
12.5	90
10	88
5	79
2	69
0.85	59
0.425	50
0.25	42
0.15	36
0.075	28.2



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to Tt WM4400 description protocols

[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: _____ P.Eng.

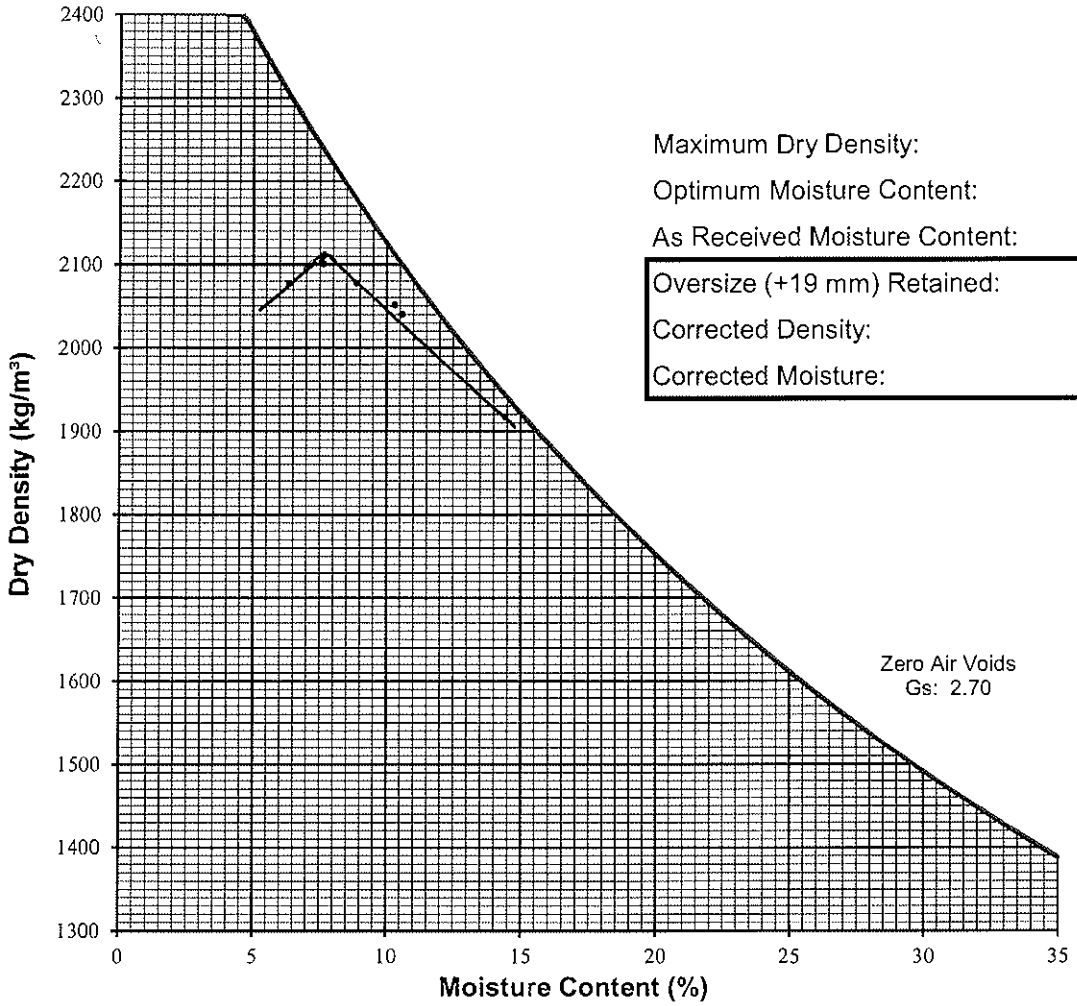
Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 Standard

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA04
Client:	JDS Energy & Mining (Strata Gold)	Sampled By:	-
Attention:	Calvin Goldschmidt	Sample Date:	-
Project No.:	ENG.WARC03235-03	Test Date:	September 22, 2017
Description:	SAND - silty, gravelly	Preparation:	Moist
Source:	Containment Pond Berm	Compaction:	Manual



Maximum Dry Density:	**2110**	kg/m³
Optimum Moisture Content:	**7.6**	%
As Received Moisture Content:	**8.8**	%
Oversize (+19 mm) Retained:	**5**	%
Corrected Density:	**2132**	%
Corrected Moisture:	**7.3**	%

Remarks: -

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

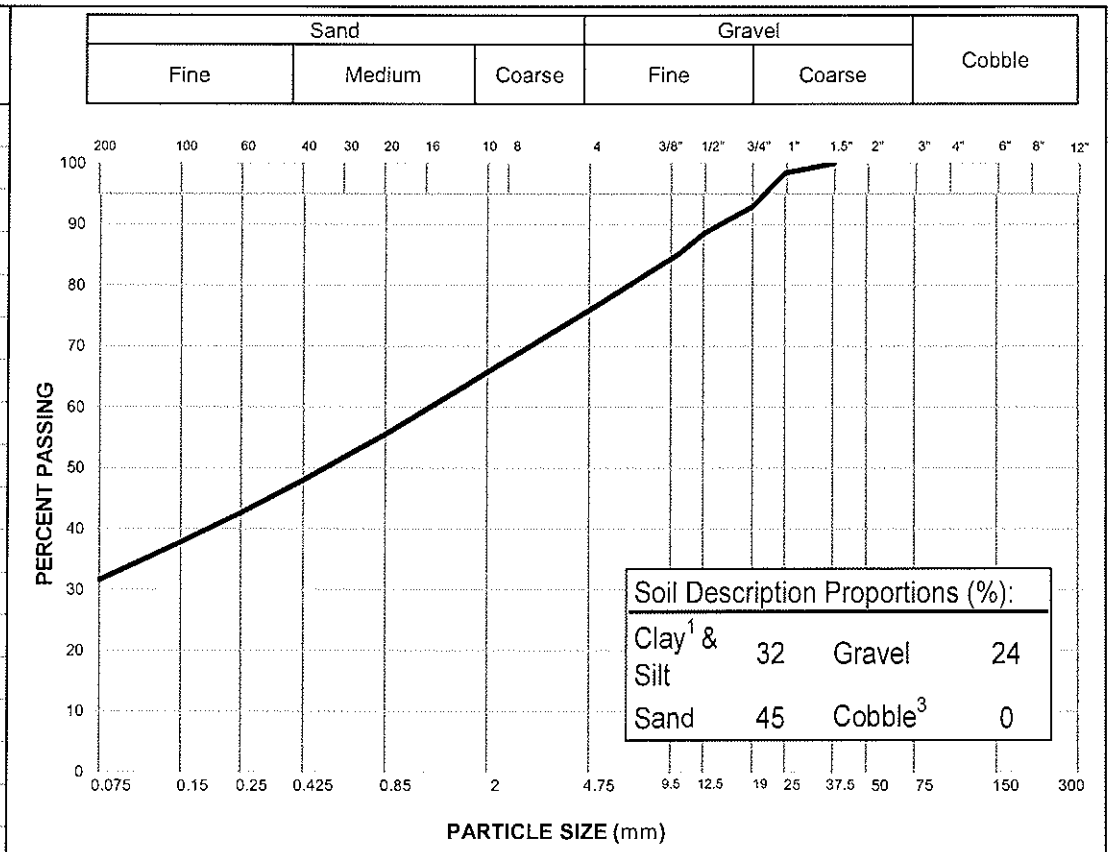
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA05
Project No.:	ENG.WARC03235-03	Material Type:	-
Site:	Dublin Gulch, YT	Sample Loc.:	Containment Pond Berm
Client:	JDS Energy & Mining (Strata Gold)	Sample Depth:	-
Client Rep.:	Calvin Goldschmidt	Sampling Method:	Grab
Date Tested:	September 26, 2017 By: AMT	Date sampled:	-
Soil Description[2]:	SAND - silty, gravelly	Sampled By:	-
		USC Classification:	Cu: #N/A
Moisture Content:	7.5%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	100
25	98
19	93
12.5	88
10	85
5	76
2	66
0.85	56
0.425	48
0.25	43
0.15	38
0.075	31.6



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to Tt WM4400 description protocols

[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: _____ P.Eng.

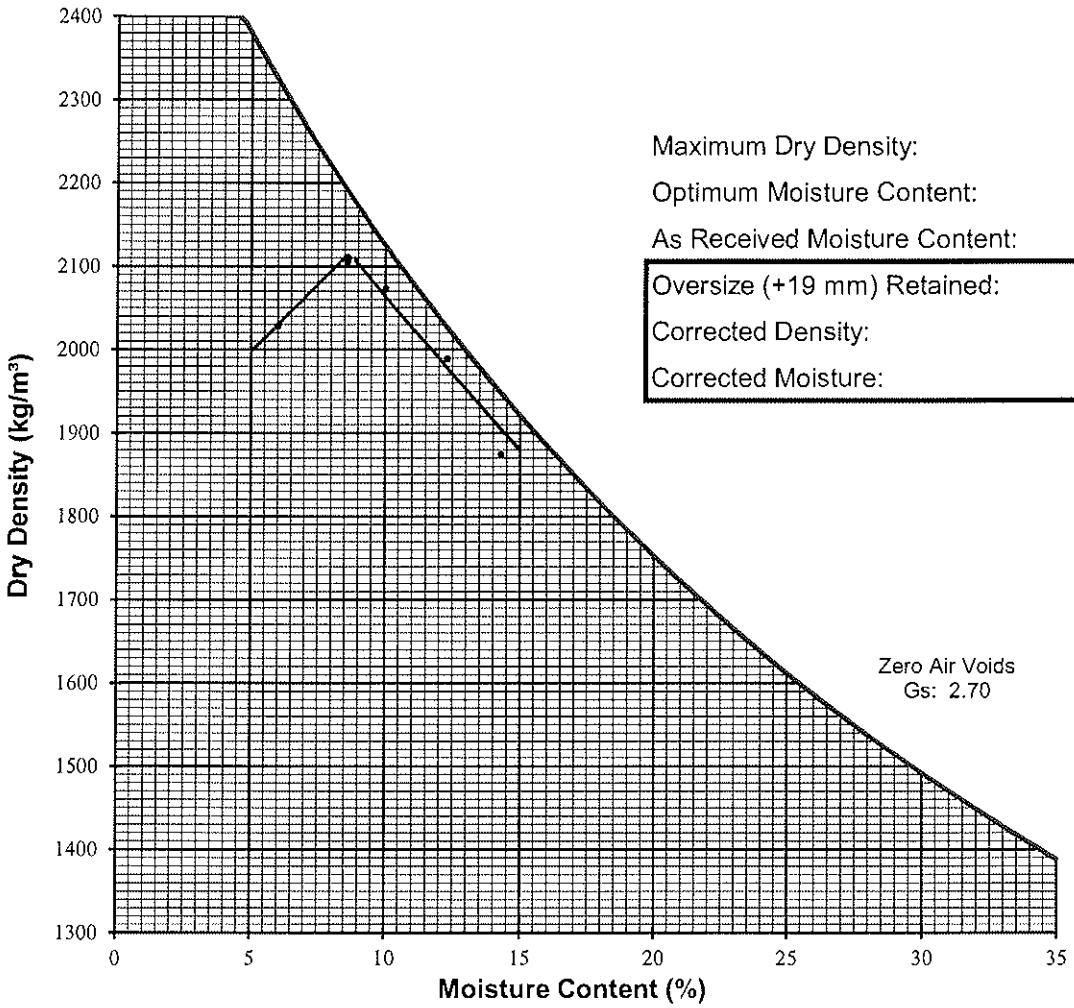
Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 Standard

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA05
Client:	JDS Energy & Mining (Strata Gold)	Sampled By:	-
Attention:	Calvin Goldschmidt	Sample Date:	-
Project No.:	ENG.WARC03235-03	Test Date:	September 22, 2017
Description:	SAND - silty, gravelly	Preparation:	Moist
Source:	Containment Pond Berm	Compaction:	Manual



Maximum Dry Density:	**2110**	kg/m³
Optimum Moisture Content:	**8.6**	%
As Received Moisture Content:	**7.5**	%
Oversize (+19 mm) Retained:	**10**	%
Corrected Density:	**2154**	%
Corrected Moisture:	**7.8**	%

Remarks: -

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

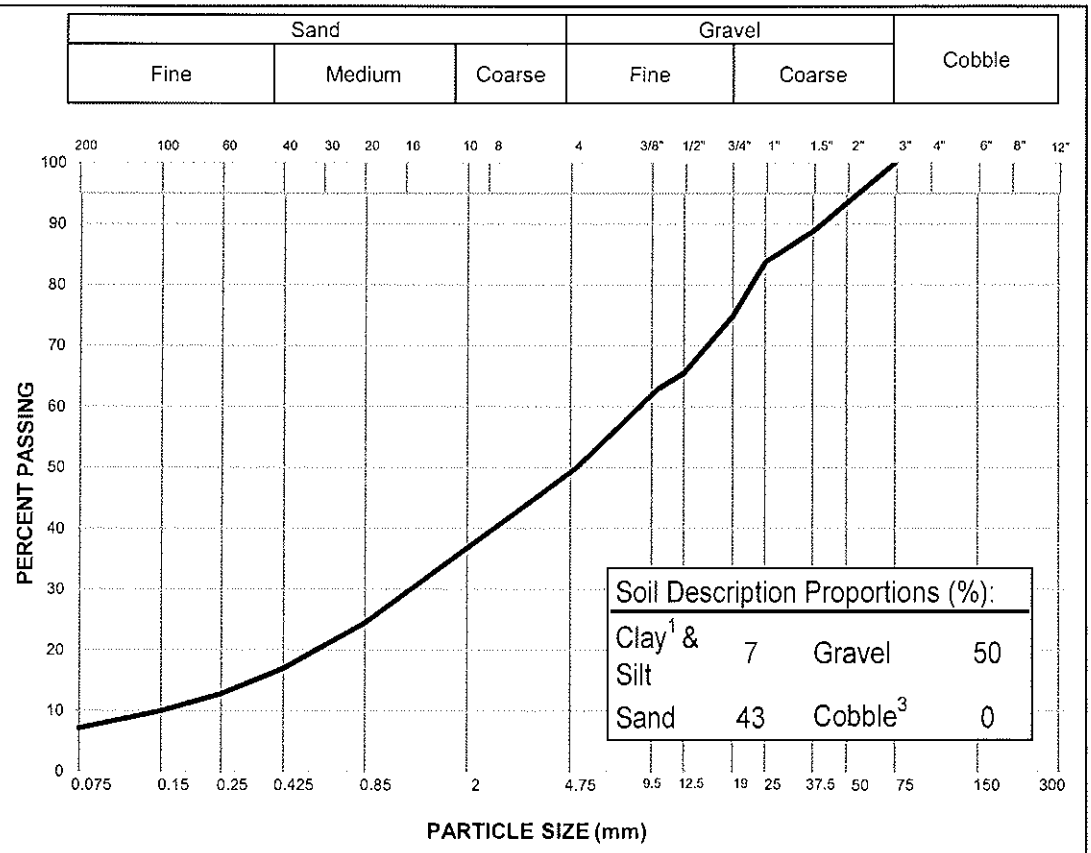
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA06
Project No.:	ENG.WARC03235-03	Material Type:	-
Site:	Dublin Gulch, YT	Sample Loc.:	Containment Pond Berm
Client:	JDS Energy & Mining (Strata Gold)	Sample Depth:	-
Client Rep.:	Calvin Goldschmidt	Sampling Method:	Grab
Date Tested:	September 26, 2017 By: AMT	Date sampled:	-
Soil Description[2]:	GRAVEL - sandy, trace silt	Sampled By:	-
		USC Classification:	Cu: 58.6
Moisture Content:	6.4%		Cc: 1.4

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	100
50	
38	89
25	84
19	75
12.5	66
10	63
5	50
2	37
0.85	24
0.425	17
0.25	13
0.15	10
0.075	7.1



Notes:
[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to Tt WM4400 description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification:

Remarks:

Reviewed By: _____ P.Eng.

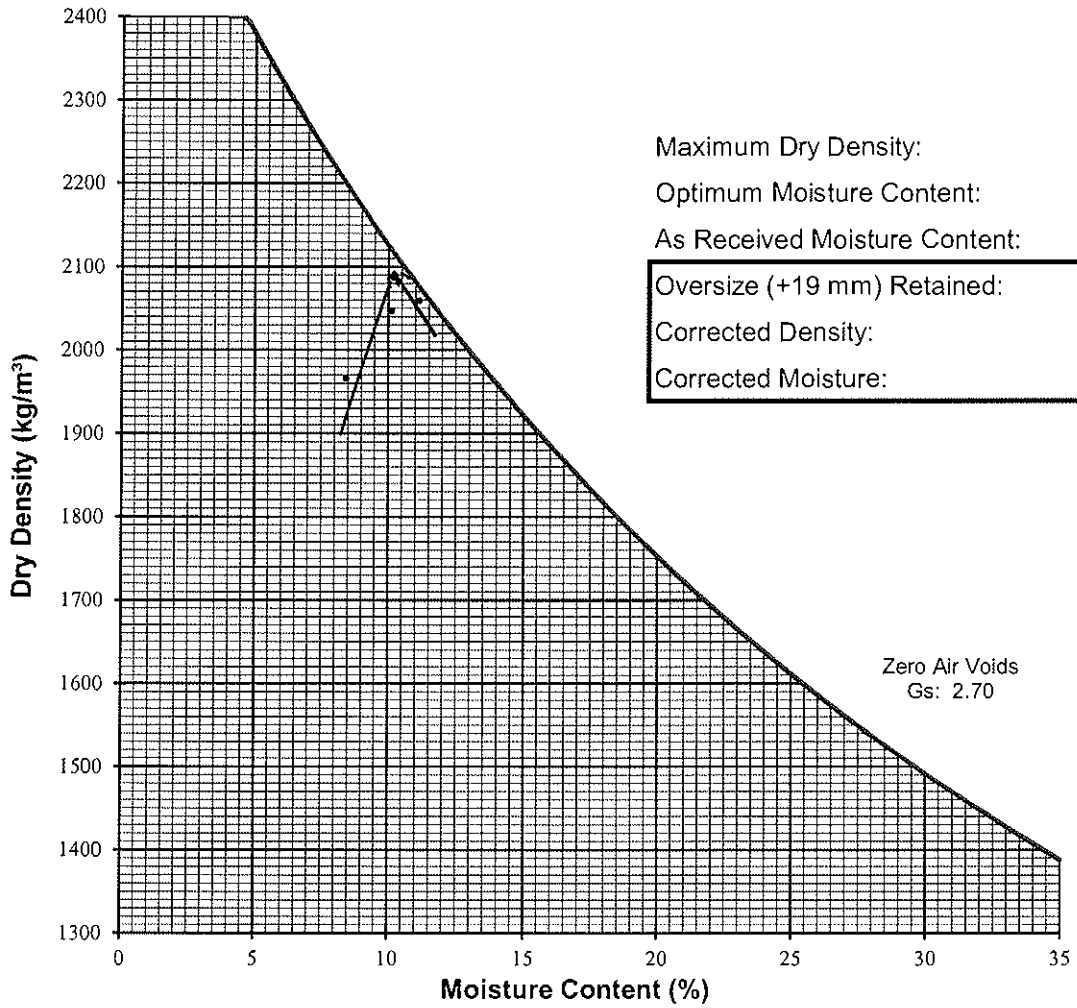
Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 Standard

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA06
Client:	JDS Energy & Mining (Strata Gold)	Sampled By:	-
Attention:	Calvin Goldschmidt	Sample Date:	-
Project No.:	ENG.WARC03235-03	Test Date:	September 25, 2017
Description:	GRAVEL - sandy, trace to some silt	Preparation:	Moist
Source:	Containment Pond Berm	Compaction:	Manual



Maximum Dry Density:	**2090**	kg/m³
Optimum Moisture Content:	**10.2**	%
As Received Moisture Content:	**6.4**	%
Oversize (+19 mm) Retained:	**25**	%
Corrected Density:	**2207**	%
Corrected Moisture:	**7.9**	%

Remarks: -

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

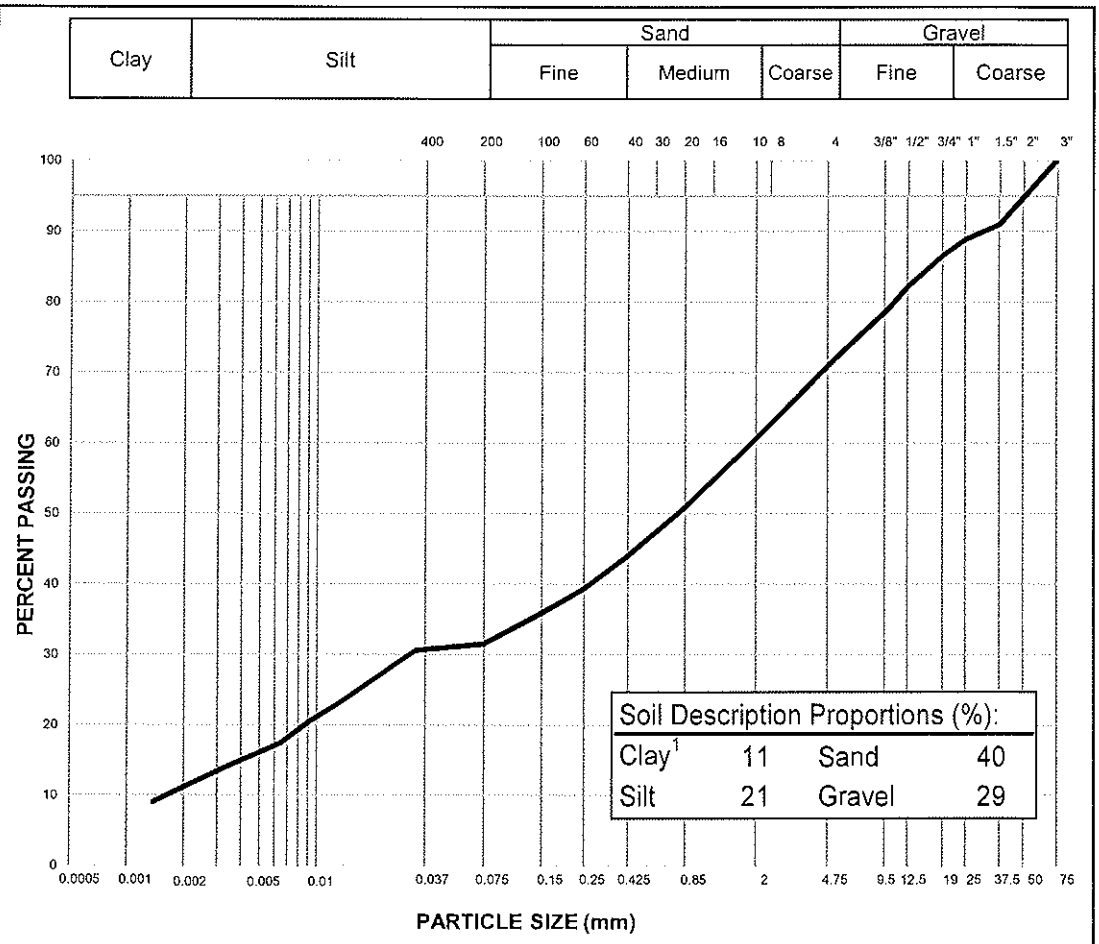
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA07
Project No.:	ENG.WARC03235-03	Material Type:	-
Site:	Dublin Gulch, YT	Sample Loc.:	Containment Pont Berm
Client:	JDS Energy & Mining (Strata Gold)	Sample Depth:	-
Client Rep.:	Calvin Goldschmidt	Sampling Method:	Grab
Date Tested:	September 26, 2017 By: AMT	Date sampled:	-
Soil Description[2]:	SAND - gravelly, silty, some clay	Sampled By:	-
		USC Classification:	Cu: 1094.9
Moisture Content:	11.8%		Cc: 0.3

Particle Size (mm)	Percent Passing
75	100
50	
38	91
25	89
19	87
12.5	82
10	79
5	71
2	61
0.85	51
0.425	44
0.25	39
0.15	36
0.075	31.5
0.0331	30.6
0.0213	27.0
0.0126	22.8
0.0090	20.4
0.0065	17.4
0.0032	13.8
0.0014	9.0



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to EBA description protocols

Specification:

Remarks:

Reviewed By: _____ P.Eng.

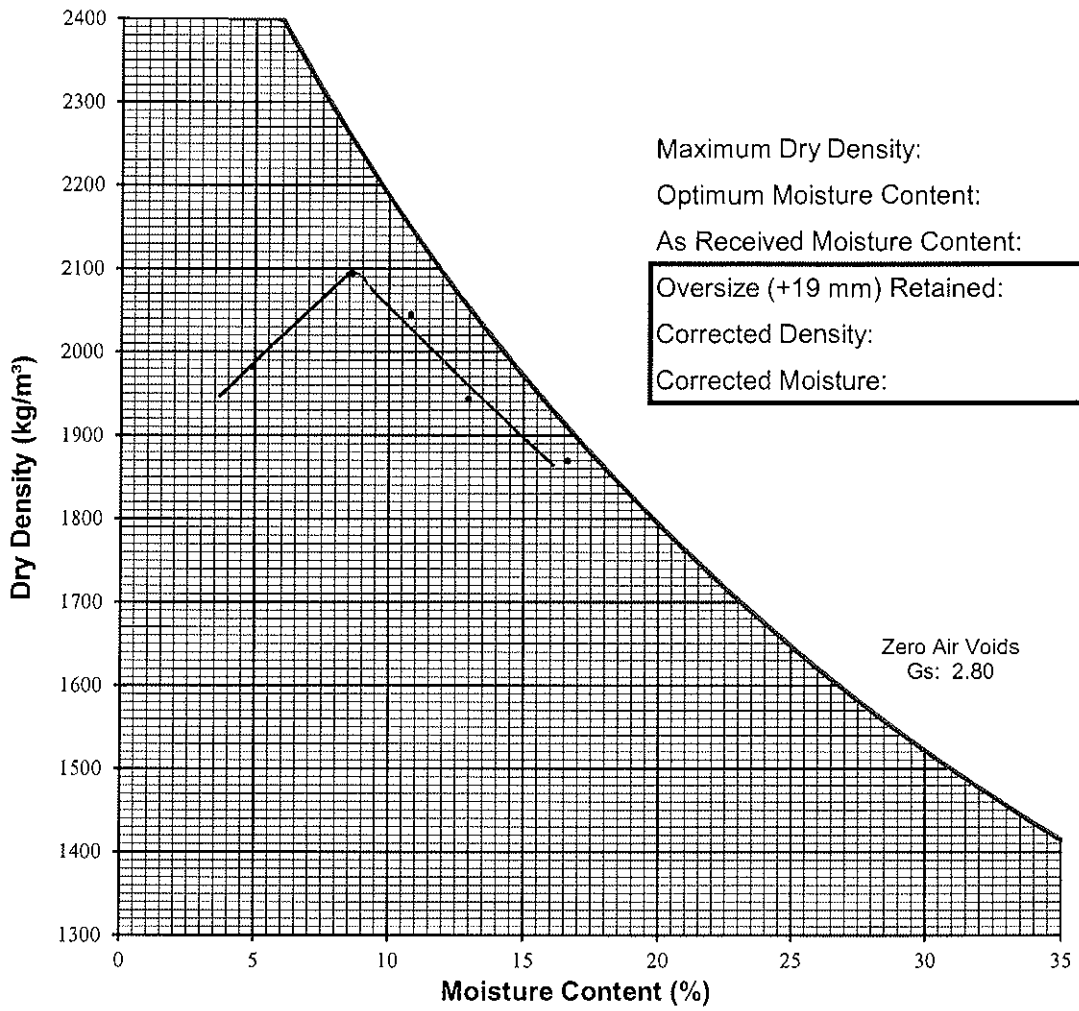
Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 Standard

Project:	Eagle Gold Project - QC Testing	Sample No.:	SA07
Client:	JDS Energy & Mining (Strata Gold)	Sampled By:	-
Attention:	Calvin Goldschmidt	Sample Date:	-
Project No.:	ENG.WARC03235-03	Test Date:	September 25, 2017
Description:	SAND - gravelly, silty, some clay	Preparation:	Moist
Source:	Containment Pond Berm	Compaction:	Manual



Maximum Dry Density:	**2095**	kg/m³
Optimum Moisture Content:	**8.6**	%
As Received Moisture Content:	**11.8**	%
Oversize (+19 mm) Retained:	**15**	%
Corrected Density:	**2163**	%
Corrected Moisture:	**7.5**	%

Remarks: -

Reviewed By: _____ C.E.T.

Data presented hereon is for the sole use of the stipulated client. Tetra Tech is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of Tetra Tech. The testing services reported herein have been performed to recognized industry standards, unless noted. No other warranty is made. These data do not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, Tetra Tech will provide it upon written request.

TETRA TECH

LAYFIELD Canada

Project Completion QA/QC Package
for

StrataGold Corporation
Eagle Gold Project

Control Pond Liner

Mayo, YT

Supply and Install of HDPE 60mil Textured

Prepared By: Sujay Ramganesh

Reviewed By: Fred Cross

Date Submitted: December 20th, 2017

Layfield Canada Ltd.

Table of Contents

for

StrataGold Corporation
Eagle Gold Project

Control Pond
Mayo, YT

New Construction

LAYFIELD
ENVIRONMENTAL CONTAINMENT

CERTIFICATE OF SUBGRADE SURFACE INSPECTION

PROJECT NAME: VGC Eagle Gold Collection Pond
PROJECT NUMBER: CT000904
OWNER/CONTRACTOR: Victoria Gold Corporation
LOCATION: VGC Eagle Gold Mine, YT

I, the undersigned, a duly appointed representative of Layfield Canada Ltd. (Layfield), have visually observed the subgrade surface described below, and:

☑ *found it to be an Acceptable surface on which to install geomembrane; OR*
☐ *found it to be an Unacceptable surface on which to install geomembrane*

Area Inspected (☑Partial or ☐Complete): Seg 108 area.
Dimensions of Subgrade Inspection: Approx 2197.6 m2.
Anchor Trench Dimensions: 0.75m x 0.75m.
Comments: Subgrade Frozen, in Good condition, Bare, No ice or snow.

This certification is based on observations of the surface of the subgrade only. No subterranean inspections or tests have been performed by Layfield and Layfield makes no representations or warranties regarding conditions which may exist below the surface of the subgrade. Layfield accepts no responsibility for conformance of the subgrade to this project's specifications.

The subgrade inspected on this date refers to its present condition. Any changes in the subgrade condition that result from the effects of inclement weather and/or other forces beyond the control of Layfield and remedial work to correct the resulting deficiencies, will be the direct responsibility of the General Contractor.

LAYFIELD REPRESENTATIVE:

Date: 11/11/17
Signature:
Name: Chad Messervey
Title: Project Supervisor.

OWNERS REPRESENTATIVE:

I, the undersigned, a duly appointed representative of the Owner, hereby understand the subgrade surface inspection described above and authorize Layfield to proceed with deployment of geosynthetics on the subgrade provided.

Date: 11/11/17
Signature:
Name:
Title: QA/QC Tech
Company: Tetra Tech

LAYFIELD
ENVIRONMENTAL CONTAINMENT

CERTIFICATE OF SUBGRADE SURFACE INSPECTION

PROJECT NAME: VGC Eagle Gold Collection Pond.
PROJECT NUMBER: CT000904
OWNER/CONTRACTOR: Victoria Gold Coporation
LOCATION: VGC Eagle Gold Mine, YT

I, the undersigned, a duly appointed representative of Layfield Canada Ltd. (Layfield), have visually observed the subgrade surface described below, and:

☑ *found it to be an Acceptable surface on which to install geomembrane; OR*
☐ *found it to be an Unacceptable surface on which to install geomembrane*

Area Inspected (☑Partial or ☐Complete): Collection Pond Prepared area.
Dimensions of Subgrade Inspection: Prepared area on Seq 3, 4, 5, 6, 7
Anchor Trench Dimensions: 0.75m x 0.75m.
Comments: Layfield has inspected and accepted area that has been Prepared in collection Pond.

This certification is based on observations of the surface of the subgrade only. No subterranean inspections or tests have been performed by Layfield and Layfield makes no representations or warranties regarding conditions which may exist below the surface of the subgrade. Layfield accepts no responsibility for conformance of the subgrade to this project's specifications.

The subgrade inspected on this date refers to its present condition. Any changes in the subgrade condition that result from the effects of inclement weather and/or other forces beyond the control of Layfield and remedial work to correct the resulting deficiencies, will be the direct responsibility of the General Contractor.

LAYFIELD REPRESENTATIVE:

Date: 11/13/17
Signature:
Name: Chad Messervey
Title: Project Supervisor

OWNERS REPRESENTATIVE:

I, the undersigned, a duly appointed representative of the Owner, hereby understand the subgrade surface inspection described above and authorize Layfield to proceed with deployment of geosynthetics on the subgrade provided.

Date: 11/13/17
Signature:
Name: Arvin Mukhatar
Title: QA/QC REP
Company: TETRA TECH

LAYFIELD
ENVIRONMENTAL CONTAINMENT

CERTIFICATE OF SUBGRADE SURFACE INSPECTION

PROJECT NAME: VGC Eagle Gold Mine Collection Pond.
PROJECT NUMBER: CT000904
OWNER/CONTRACTOR: Victoria Gold Corporation
LOCATION: VGC Eagle Gold Mine, YT

I, the undersigned, a duly appointed representative of Layfield Canada Ltd. (Layfield), have visually observed the subgrade surface described below, and:

☑ *found it to be an Acceptable surface on which to install geomembrane; OR*
☐ *found it to be an Unacceptable surface on which to install geomembrane*

Area Inspected (☐Partial or ☑Complete): Collection Pond.
Dimensions of Subgrade Inspection: 26100 m2
Anchor Trench Dimensions: 0.5m x 0.75m
Comments: This includes already accepted areas

This certification is based on observations of the surface of the subgrade only. No subterranean inspections or tests have been performed by Layfield and Layfield makes no representations or warranties regarding conditions which may exist below the surface of the subgrade. Layfield accepts no responsibility for conformance of the subgrade to this project's specifications.

The subgrade inspected on this date refers to its present condition. Any changes in the subgrade condition that result from the effects of inclement weather and/or other forces beyond the control of Layfield and remedial work to correct the resulting deficiencies, will be the direct responsibility of the General Contractor.

LAYFIELD REPRESENTATIVE:

Date: 11/17/17
Signature:
Name: Chad Messervey
Title: Project Supervisor

OWNERS REPRESENTATIVE:

I, the undersigned, a duly appointed representative of the Owner, hereby understand the subgrade surface inspection described above and authorize Layfield to proceed with deployment of geosynthetics on the subgrade provided.

Date: 17-NOV-2017
Signature:
Name: CHRIS CORLEY
Title: PROJECT MANAGER
Company: JDS EGM

LAYFIELD
ENVIRONMENTAL CONTAINMENT

CERTIFICATE OF SUBGRADE SURFACE INSPECTION

PROJECT NAME: VGC Eagle Gold Mine Collection Pond Spill way
PROJECT NUMBER: CT000904
OWNER/CONTRACTOR: Victoria Gold Corporation
LOCATION: VGC Eagle Gold Mine, YT

I, the undersigned, a duly appointed representative of Layfield Canada Ltd. (Layfield), have visually observed the subgrade surface described below, and:

☑ *found it to be an Acceptable surface on which to install geomembrane; OR*

☐ *found it to be an Unacceptable surface on which to install geomembrane*

Area Inspected (☐Partial or ☑Complete): Spill way
Dimensions of Subgrade Inspection: Approx 2000m²
Anchor Trench Dimensions: N/A
Comments: No Anchor Trench.

This certification is based on observations of the surface of the subgrade only. No subterranean inspections or tests have been performed by Layfield and Layfield makes no representations or warranties regarding conditions which may exist below the surface of the subgrade. Layfield accepts no responsibility for conformance of the subgrade to this project's specifications.

The subgrade inspected on this date refers to its present condition. Any changes in the subgrade condition that result from the effects of inclement weather and/or other forces beyond the control of Layfield and remedial work to correct the resulting deficiencies, will be the direct responsibility of the General Contractor.

LAYFIELD REPRESENTATIVE:

Date: 11/25/17
Signature:
Name: Chad Messervey
Title: Project Supervisor

OWNERS REPRESENTATIVE:

I, the undersigned, a duly appointed representative of the Owner, hereby understand the subgrade surface inspection described above and authorize Layfield to proceed with deployment of geosynthetics on the subgrade provided.

Date: 25-NOV-17
Signature:
Name: CHRIS COPLEN
Title: PROJECT MANAGER
Company: JDS E&M

INVENTORY LOG

PROJECT NUMBER: CT000904
PROJECT TITLE: VGC Eagle Gold Collection Pond
DATE OF INVENTORY: 2017/11/11
PRODUCT TYPE: 60mil HDPE DST
MATERIAL MANUFACTURER: Layfield

#	ROLL NUMBER	MATERIAL DIMENSIONS			REMARKS
		THICKNESS	LENGTH (m)	WIDTH (m)	
1	E0005975-015	60mil	164.5	6.8	
2	E0005975-016	60mil	164.5	6.8	
3	E0006196-001	60mil	164.5	6.8	
4	E0006196-004	60mil	164.5	6.8	
5	E0006196-005	60mil	164.5	6.8	
6	E0006196-008	60mil	164.5	6.8	
7	E0006196-009	60mil	164.5	6.8	
8	E0006196-010	60mil	164.5	6.8	
9	E0006196-013	60mil	164.5	6.8	
10	E0006196-014	60mil	164.5	6.8	
11	E0006196-017	60mil	164.5	6.8	
12	E0006196-018	60mil	164.5	6.8	
13	E0006196-020	60mil	164.5	6.8	
14	E0006196-021	60mil	164.5	6.8	
15	E0006196-022	60mil	164.5	6.8	
16	E0006196-024	60mil	164.5	6.8	
17	E0006196-025	60mil	164.5	6.8	
18	E0006196-026	60mil	164.5	6.8	
19	E0006196-027	60mil	164.5	6.8	
20	E0006197-001	60mil	91.8	6.8	
21	E0006916-007	60mil	164.5	6.8	
22	E0006916-023	60mil	164.5	6.8	
23					
24					
25					
26					
27					
28					
29					
30					

TOTAL PAGE AREA: 24114.84 m^2

QC TECH: Lance Tourett
SUPERVISOR: Chad Messervey
SUBMISSION DATE: December 4 2017

INVENTORY LOG

PROJECT NUMBER	CT000904
PROJECT TITLE	VGC Eagle Gold Collection Pond
DATE OF INVENTORY	2017/11/11
PRODUCT TYPE	60MIL HDPE EDST
MATERIAL MANUFACTURER	Layfield

#	ROLL NUMBER	MATERIAL DIMENSIONS			REMARKS
		THICKNESS	LENGTH (m)	WIDTH (m)	
1	E0006197-002	60mil	164.5	6.8	Rough TEX
2	E0006197-003	60mil	164.5	6.8	Rough TEX
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

TOTAL PAGE AREA 2237.2 m^2

QC TECH	Lance Tourett
SUPERVISOR	Chad Messervey
SUBMISSION DATE	December 4 2017
SHEET NUMBER	2 of 7

INVENTORY LOG

PROJECT NUMBER	CT000904
PROJECT TITLE	VGC Eagle Gold Collection Pond
DATE OF INVENTORY	2017/11/11
PRODUCT TYPE	60mil HDPE SST
MATERIAL MANUFACTURER	Layfield

#	ROLL NUMBER	MATERIAL DIMENSIONS			REMARKS
		THICKNESS	LENGTH (m)	WIDTH (m)	
1	E0005761-012	60mil	164.5	6.8	
2	E0005761-019	60mil	164.5	6.8	
3	E0005761-021	60mil	164.5	6.8	
4	E0005761-024	60mil	164.5	6.8	
5	E0005761-029	60mil	164.5	6.8	
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

TOTAL PAGE AREA 5593 m^2

QC TECH	Lance Tourett
SUPERVISOR	Chad Messervey
SUBMISSION DATE	December 4 2017
SHEET NUMBER	3 of 7

INVENTORY LOG

PROJECT NUMBER: CT000904
PROJECT TITLE: VGC Eagle Gold Collection Pond
DATE OF INVENTORY: 2017/11/11
PRODUCT TYPE: LP12 GEOTEXTILE
MATERIAL MANUFACTURER: Layfield

#	ROLL NUMBER	MATERIAL DIMENSIONS			REMARKS
		THICKNESS	LENGTH (m)	WIDTH (m)	
1	030591659	12 oz	91	4.57	
2	030607124	12 oz	91	4.57	
3	030607125	12 oz	91	4.57	
4	030607126	12 oz	91	4.57	
5	050410677	12 oz	91	4.57	
6	050410703	12 oz	91	4.57	
7	050440306	12 oz	91	4.57	
8	050440321	12 oz	91	4.57	
9	050440322	12 oz	91	4.57	
10	050440323	12 oz	91	4.57	
11	050440337	12 oz	91	4.57	
12	050440338	12 oz	91	4.57	
13	050440339	12 oz	91	4.57	
14	050441068	12 oz	91	4.57	
15	050441120	12 oz	91	4.57	
16	050441222	12 oz	91	4.57	
17	050441223	12 oz	91	4.57	
18	050441224	12 oz	91	4.57	
19	050441225	12 oz	91	4.57	
20	050441226	12 oz	91	4.57	
21	050441227	12 oz	91	4.57	
22	050441230	12 oz	91	4.57	
23	050441232	12 oz	91	4.57	
24	050441238	12 oz	91	4.57	
25	050441239	12 oz	91	4.57	
26	050441240	12 oz	91	4.57	
27	050441245	12 oz	91	4.57	
28	050441246	12 oz	91	4.57	
29	050441247	12 oz	91	4.57	
30	050441249	12 oz	91	4.57	

TOTAL PAGE AREA: 12476.1 m^2

QC TECH: Lance Tourett
SUPERVISOR: Chad Messervey
SUBMISSION DATE: December 4 2017

INVENTORY LOG

PROJECT NUMBER: CT000904
PROJECT TITLE: VGC Eagle Gold Collection Pond
DATE OF INVENTORY: 2017/11/11
PRODUCT TYPE: LP12 GEOTEXTILE
MATERIAL MANUFACTURER: Layfield

#	ROLL NUMBER	MATERIAL DIMENSIONS			REMARKS
		THICKNESS	LENGTH (m)	WIDTH (m)	
1	050441250	12 oz	91	4.57	
2	050441252	12 oz	91	4.57	
3	050441256	12 oz	91	4.57	
4	050441260	12 oz	91	4.57	
5	050441261	12 oz	91	4.57	
6	050441262	12 oz	91	4.57	
7	050441263	12 oz	91	4.57	
8	050441264	12 oz	91	4.57	
9	050441265	12 oz	91	4.57	
10	050441267	12 oz	91	4.57	
11	050441268	12 oz	91	4.57	
12	050441269	12 oz	91	4.57	
13	050441270	12 oz	91	4.57	
14	050441271	12 oz	91	4.57	
15	050441272	12 oz	91	4.57	
16	050441273	12 oz	91	4.57	
17	050441274	12 oz	91	4.57	
18	050441275	12 oz	91	4.57	
19	050441276	12 oz	91	4.57	
20	050441280	12 oz	91	4.57	
21	050441281	12 oz	91	4.57	
22	050441282	12 oz	91	4.57	
23	050441283	12 oz	91	4.57	
24	050441284	12 oz	91	4.57	
25	050441285	12 oz	91	4.57	
26	050441286	12 oz	91	4.57	
27	050441287	12 oz	91	4.57	
28	050441288	12 oz	91	4.57	
29	050441289	12 oz	91	4.57	
30	050441291	12 oz	91	4.57	

TOTAL PAGE AREA: 12476.1 m^2

QC TECH: Lance Tourett
SUPERVISOR: Chad Messervey
SUBMISSION DATE: December 4 2017

INVENTORY LOG

PROJECT NUMBER: CT000904
PROJECT TITLE: VGC Eagle Gold Collection Pond
DATE OF INVENTORY: 2017/11/11
PRODUCT TYPE: LP12 GEOTEXTILE
MATERIAL MANUFACTURER: Layfield

#	ROLL NUMBER	MATERIAL DIMENSIONS			REMARKS
		THICKNESS	LENGTH (m)	WIDTH (m)	
1	050441293	12 oz	91	4.57	
2	050441294	12 oz	91	4.57	
3	050441295	12 oz	91	4.57	
4	050441296	12 oz	91	4.57	
5	050441297	12 oz	91	4.57	
6	050441298	12 oz	91	4.57	
7	050441298	12 oz	91	4.57	
8	050441299	12 oz	91	4.57	
9	050441300	12 oz	91	4.57	
10	050441302	12 oz	91	4.57	
11	050441303	12 oz	91	4.57	
12	050441307	12 oz	91	4.57	
13	050441308	12 oz	91	4.57	
14	050441309	12 oz	91	4.57	
15	050441310	12 oz	91	4.57	
16	050441310	12 oz	91	4.57	
17	050441311	12 oz	91	4.57	
18	050441315	12 oz	91	4.57	
19	050441316	12 oz	91	4.57	
20	050441317	12 oz	91	4.57	
21	050441318	12 oz	91	4.57	
22	050441319	12 oz	91	4.57	
23	050441320	12 oz	91	4.57	
24	050441322	12 oz	91	4.57	
25	050441323	12 oz	91	4.57	
26	050441324	12 oz	91	4.57	
27	050441328	12 oz	91	4.57	
28	050441329	12 oz	91	4.57	
29	050441330	12 oz	91	4.57	
30	050441331	12 oz	91	4.57	

TOTAL PAGE AREA: 12476.1 m^2

QC TECH: Lance Tourett
SUPERVISOR: Chad Messervey
SUBMISSION DATE: December 4 2017

INVENTORY LOG

PROJECT NUMBER: CT000904
PROJECT TITLE: VGC Eagle Gold Collection Pond
DATE OF INVENTORY: 2017/11/11
PRODUCT TYPE: LP12 GEOTEXTILE
MATERIAL MANUFACTURER: Layfield

#	ROLL NUMBER	MATERIAL DIMENSIONS			REMARKS
		THICKNESS	LENGTH (m)	WIDTH (m)	
1	050441332	12 oz	91	4.57	
2	050441334	12 oz	91	4.57	
3	050441335	12 oz	91	4.57	
4	050442057	12 oz	91	4.57	
5	050442058	12 oz	91	4.57	
6	050442059	12 oz	91	4.57	
7	070116604	12 oz	91	4.57	
8	810181847	12 oz	91	4.57	
9	J10235862	12 oz	91	4.57	
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

TOTAL PAGE AREA: 3742.83 m^2

QC TECH: Lance Tourett
SUPERVISOR: Chad Messervey
SUBMISSION DATE: December 4 2017

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 2017/12/11

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
1	E0006197-003	43.5	6.7	-24	Good	LT	Good
2	E0006197-003	43.5	6.7	-24	Good	LT	Good
3	E0006197-003	43.5	6.7	-24	Good	LT	Good

TOTAL PAGE AREA 874.35 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 1 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 13/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
4	E0006197-003	21.3	6.7	-18	Good	LT	Good
5	E0006197-003	12.3	6.7	-18	Good	LT	Good
6	E0006197-002	10.5	6.7	-18	Good	LT	Good
7	E0006197-002	43	6.7	-18	Good	LT	Good
8	E0006197-002	21	6.7	-18	Good	LT	Good
9	E0006197-002	10.1	6.7	-18	Good	LT	Good
10	E0006197-002	3.5	3	-18	Good	LT	Good
11	E0006197-002	12.3	6.7	-18	Good	LT	Good
12	E0006197-002	18.6	6.7	-18	Good	LT	Good
13	E0006197-002	20.2	6.7	-18	Good	LT	Good
14	E0006197-002	20.4	6.7	-18	Good	LT	Good
15	E0005761-029	20.4	6.7	-18	Good	LT	Good

TOTAL PAGE AREA 1418.17 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 2 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 14/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
16	E0005761-016	123.9	6.7	-15	Good	LT	Good
17	E0005761-016	46.2	6.7	-15	Good	LT	Good
18	E0005761-019	74.3	6.7	-15	Good	LT	Good
19	E0005761-016	12.3	6.7	-15	Good	LT	Good
20	E0005761-019	79.6	6.7	-19	Good	LT	Good
21	E0006196-024	30.2	6.7	-19	Good	LT	Good
22	E0006196-024	31.5	6.7	-19	Good	LT	Good
23	E0006196-024	31.5	6.7	-19	Good	LT	Good
24	E0006196-024	31.5	6.7	-19	Good	LT	Good

TOTAL PAGE AREA 3088.7 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 3 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 15/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
25	E0006196-024	31.5	6.7	-26	Good	LT	Good
26	E0006196-010	31.5	6.7	-26	Good	LT	Good
27	E0006196-010	30.5	6.7	-26	Good	LT	Good
28	E0006196-010	30	6.7	-26	Good	LT	Good
29	E0006196-010	29.7	6.7	-26	Good	LT	Good
30	E0006196-010	29.3	6.7	-26	Good	LT	Good
31	E0006196-027	29.3	6.7	-26	Good	LT	Good
32	E0006196-027	29.3	6.7	-26	Good	LT	Good
33	E0006196-027	29.2	6.7	-26	Good	LT	Good
34	E0006196-027	12	6.7	-26	Good	LT	Good
35	E0006196-027	24	6.7	-20	Good	LT	Good
36	E0006196-027	24	6.7	-20	Good	LT	Good
37	E0006196-027	21.3	6.7	-20	Good	LT	Good
38	E0006196-008	24.3	6.7	-20	Good	LT	Good
39	E0006196-008	17	14	-20	Good	LT	Good
40	E0006196-008	28.4	6.7	-20	Good	LT	Good
41	E0006196-008	22	6.7	-20	Good	LT	Good
42	E0006196-008	13.8	6.7	-20	Good	LT	Good
43	E0006196-008	3.5	2.7	-20	Good	LT	Good
44	E0006196-008	31.6	6.7	-20	Good	LT	Good

TOTAL PAGE AREA 3407.84 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 4 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 15/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
45	E0005761-012	30	6.7	-20	Good	LT	Good
46	E0006196-008	16.8	6.7	-20	Good	LT	Good
47	E0006196-008	3	2.5	-20	Good	LT	Good

TOTAL PAGE AREA 321.06 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 5 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 16/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
48	E0006197-001	98.1	6.7	-19	Good	LT	Good
49	E0006196-005	23.6	6.7	-19	Good	LT	Good
50	E0006196-005	123.5	6.7	-19	Good	LT	Good
51	E0006196-005	20	6.7	-19	Good	LT	Good
52	E0006196-025	100.5	6.7	-19	Good	LT	Good

TOTAL PAGE AREA 2450.19 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 6 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 17/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
53	E0005761-024	15	6.7	-17	Good	LT	Good
54	E0005761-024	51.7	6.7	-17	Good	LT	Good
55	E0005761-024	51.7	6.7	-17	Good	LT	Good
56	E0005761-029	51.5	6.7	-17	Good	LT	Good
57	E0005761-029	51.5	6.7	-17	Good	LT	Good

TOTAL PAGE AREA 1483.38 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 7 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 18/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
58	E0005761-029	14	6.7	-24	Good	LT	Good
59	E0006196-025	64.1	6.7	-24	Good	LT	Good
60	E0006196-013	62.1	6.7	-24	Good	LT	Good
61	E0006196-013	103.7	6.7	-24	Good	LT	Good
62	E0006196-017	25.5	6.7	-24	Good	LT	Good
63	E0006196-017	137.7	6.7	-24	Good	LT	Good
64	E0006196-021	137	6.7	-24	Good	LT	Good

TOTAL PAGE AREA 3645.47 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 8 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 20/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
65	E0005975-015	132	6.7	-31	Good	LT	Good
66	E0005975-015	34.4	6.7	-31	Good	LT	Good
67	E0006196-018	97	6.7	-31	Good	LT	Good
68	E0006196-018	69	6.7	-31	Good	LT	Good
69	E0006916-007	62	6.7	-30	Good	LT	Good
70	E0006916-007	5.7	6.7	-30	Good	LT	Good
71	E0006916-007	100	6.7	-30	Good	LT	Good
72	E0006196-009	25	6.7	-30	Good	LT	Good
73	E0006196-009	127.7	6.7	-30	Good	LT	Good
74	E0006196-009	11.7	6.7	-30	Good	LT	Good
75	E0006196-020	126.4	6.7	-29	Good	LT	Good
76	E0006196-020	51	6.7	-29	Good	LT	Good
77	E0006196-021	15	6.7	-29	Good	LT	Good
78	E0006196-021	13.2	6.7	-29	Good	LT	Good
79	E0006916-023	61.5	6.7	-30	Good	LT	Good

TOTAL PAGE AREA 6241.72 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 9 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 21/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
80	E0006916-023	101	6.7	-34	Good	LT	Good
81	E0006196-014	4	6.7	-34	Good	LT	Good
82	E0006196-014	41.7	6.7	-34	Good	LT	Good
83	E0006196-014	26.2	6.7	-34	Good	LT	Good
84	E0005761-024	48.4	6.7	-34	Good	LT	Good
85	E0005761-024	38.5	6.7	-34	Good	LT	Good
86	E0005761-024	9.5	2.3	-34	Good	LT	Good
87	E0005761-021	36.1	6.7	-34	Good	LT	Good
88	E0005761-021	10.2	1	-34	Good	LT	Good

TOTAL PAGE AREA 2014.58 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 10 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 22/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
89	E0005761-021	16	6.7	-29	Good	LT	Good
90	E0005761-021	16	6.7	-29	Good	LT	Good
91	E0005761-021	16.1	6.7	-29	Good	LT	Good
92	E0005761-021	16	6.7	-29	Good	LT	Good
93	E0005761-021	17	6.7	-29	Good	LT	Good
94	E0005761-021	17	6.7	-29	Good	LT	Good
95	E0005761-021	16.4	6.7	-29	Good	LT	Good
96	E0005761-029	16.4	6.7	-29	Good	LT	Good
97	E0006196-014	16	6.7	-29	Good	LT	Good
98	E0006196-014	15.8	6.7	-29	Good	LT	Good
99	E0006196-014	15.5	6.7	-29	Good	LT	Good
100	E0006196-014	15.5	6.7	-29	Good	LT	Good
101	E0006196-014	15	6.7	-29	Good	LT	Good
102	E0006196-014	15	4.8	-29	Good	LT	Good

TOTAL PAGE AREA 1470.29 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 11 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
DEPLOYMENT DATE 27/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
103	E0006196-004	6.6	1	-20	Good	LT	Good
104	E0006196-004	6.6	1	-20	Good	LT	Good
105	E0006196-004	6.6	1	-20	Good	LT	Good
106	E0006196-004	6.6	1	-20	Good	LT	Good
107	E0006196-004	3.1	1	-20	Good	LT	Good

TOTAL PAGE AREA 29.5 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 12 of 12

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE Victoria Gold Corporation Spillway
AREA / LAYER Primary
DEPLOYMENT DATE 25/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
1	E0006196-001	30	6	-25	GOOD	CM	GOOD
2	E0006196-001	10	6	-25	GOOD	CM	GOOD
3	E0006196-001	40	6.8	-25	GOOD	CM	GOOD
4	E0006196-001	45	6.8	-25	GOOD	CM	GOOD
5	E0006196-001	45	2	-25	GOOD	CM	GOOD
6	E0005761-012	25	6	-25	GOOD	CM	GOOD
7	E0005761-012	20	6	-25	GOOD	CM	GOOD

TOTAL PAGE AREA 1178 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 1 of 2

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NUMBER CT000904
PROJECT TITLE Victoria Gold Corporation Spillway
AREA / LAYER Primary
DEPLOYMENT DATE 26/11/2017

PANEL NUMBER	ROLL NUMBER	LENGTH (m)	WIDTH (m)	AIR TEMP °C	PANEL CONDITION	CHECKED BY	SUBGRADE CONDITION
8	E0005761-012	30	6	-22	GOOD	CM	GOOD
9	E0006196-004	30	6.8	-22	GOOD	CM	GOOD
10	E0006196-004	15	6	-22	GOOD	CM	GOOD
11	E0006196-004	15	6	-22	GOOD	CM	GOOD
12	E0006196-004	18	6.8	-22	GOOD	CM	GOOD

TOTAL PAGE AREA 686.4 m²

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 2 of 2

GEOMEMBRANE SEAM & TEST LOG

LAYFIELD

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond SEAM DATE 2017/12/11

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-056	1330	DH	-20	60.0%	454	145	138	148	123	140	126	124	141	139	129	180	172	177	176	177	CM	

WELD SEAMS									QC		AIR PRESSURE TEST (PSI)				VERIFY	
PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	TEST METH.	TEST DATE Y-M-D	TIME START	TIME END	PRESSURE START	PRESSURE END	PASS	QC TECH
1 / 2	NWeos	SEeos	1430	-20	DH	EC-WW-056	11.5		AP+PS	13/11/17	1610	1615	40	40	P	LT
1 / 2	NWeos	SEeos	1439	-20	DH	EC-WW-056	8.0		AP+PS	13/11/17	1608	1613	40	40	P	LT
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																

PAGE TOTAL 19.5

TEST METHOD: AL - AIR LANCE; AP - AIR PRESSURE; PS - POINT STRESS; ST - SPARK TEST; VB - EXTRUDED & VAC BOX

REMARKS:

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 1 of 19

LS-10-QF-004

www.layfieldcontainment.com

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 13/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-039	900	JH	-21	60.0%	454	135	156	132	135	146	127	118	132	125	134	195	170	193	192	170	CM	
2	EC-WW-054	1000	DH	-21	60.0%	454	130	115	146	115	122	113	156	136	143	147	182	169	171	178	165	CM	
3	EC-WW-039	1405	JH	-18	45.0%	454	157	110	121	148	149	115	132	122	126	134	168	178	179	183	180	LT	
4	EC-WW-054	1415	DH	-18	60.0%	454	128	118	124	141	119	127	144	128	144	130	176	183	184	187	180	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
2 / 3	Sweos	Neeos	1000	-20	DH	EC-WW-054	43.3		AP+PS	13/11/17	1528	1533	40	40	P	LT
4 / 5	Eeos	Weos	1130	-19	DH	EC-WW-039	3.0		AP+PS	13/11/17	1540	1545	40	40	P	LT
4 / 5	Eeos	Weos	1135	-19	DH	EC-WW-039	2.5		AP+PS	13/11/17	1550	1555	40	40	P	LT
5 / 6	Eeos	Weos	1140	-19	DH	EC-WW-039	6.7		AP+PS	13/11/17	1530	1535	40	40	P	LT
3 / 6	Sweos	NEeos	1145	-19	DH	EC-WW-054	10.5		AP+PS	13/11/17	1530	1535	40	40	P	LT
3 / 5	Sweos	Neeos	1150	-19	DH	EC-WW-054	7.2		AP+PS	13/11/17	1530	1535	40	40	P	LT
3 / 5	Neos	Seos	1150	-19	DH	EC-WW-054	5.1		AP+PS	13/11/17	1540	1545	40	40	P	LT
3 / 4	Sweos	NEeos	1155	-19	DH	EC-WW-054	21.7		AP+PS	13/11/17	1540	1545	40	40	P	LT
6 / 7	Sweos	NEeos	1345	-19	DH	EC-WW-054	10.5		AP+PS	13/11/17	1600	1605	40	40	P	LT
5 / 7	Sweos	NEeos	1350	-19	DH	EC-WW-054	12.3	DS-1	AP+PS	13/11/17	1600	1605	40	40	P	LT
4 / 7	Sweos	NEeos	1355	-19	DH	EC-WW-054	21.7		AP+PS	13/11/17	1550	1555	40	40	P	LT
7 / 8	Sweos	NEeos	1430	-19	DH	EC-WW-054	21.0		AP+PS	13/11/17	1745	1750	40	40	P	LT
1 / 2	NWeos	SEeos	1435	-22	DH	EC-WW-054	7.6		AP+PS	13/11/17	1520	1525	30	30	P	LT
8 / 9	Sweos	NEeos	1435	-19	DH	EC-WW-054	8.2		AP+PS	14/11/17	905	910	30	30	P	LT
8 / 9	SEeos	Nweos	1435	-19	DH	EC-WW-054	2.0		AP+PS	14/11/17	906	911	30	30	P	LT
10 / 11	Seos	Neos	1440	-19	DH	EC-WW-054	3.0		AP+PS	13/11/17	1810	1815	40	40	P	LT
1 / 2	NWeos	SEeos	1441	-20	DH	EC-WW-054	7.4		AP+PS	13/11/17	1511	1516	36	36	P	LT
1 / 2	NWeos	SEeos	1455	-20	DH	EC-WW-054	8.8		AP+PS	13/11/17	1511	1516	36	36	P	LT
11 / 12	Seos	Neos	1500	-19	DH	EC-WW-054	12.3		AP+PS	13/11/17	1800	1805	40	40	P	LT
12 / 13	Seos	Neos	1505	-19	DH	EC-WW-054	18.6		AP+PS	13/11/17	1745	1750	40	40	P	LT
						PAGE TOTAL	233.4									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 2 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 13/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
13 / 14	Seos	Neos	1509	-19	DH	EC-WW-054	20.4		AP+PS	13/11/17	1540	1545	36	36	P	LT
14 / 15	Seos	Neos	1550	-19	DH	EC-WW-054	20.4		AP+PS	13/11/17	1735	1740	40	40	P	LT
14 / 15	SEeos	Nweos	1550	-21	DH	EC-WW-054	2.9		AP+PS	13/11/17	1730	1735	40	40	P	LT
9 / 15	Eeos	Weos	1632	-21	JH	EC-WW-039	6.7		AP+PS	13/11/17	1730	1735	40	40	P	LT
9 / 14	Eeos	Weos	1637	-21	JH	EC-WW-039	2.8		AP+PS	13/11/17	1730	1735	40	40	P	LT
8 / 14	Eeos	Weos	1638	-21	JH	EC-WW-039	4.1		AP+PS	14/11/17	912	917	30	30	P	LT
8 / 13	Eeos	Weos	1640	-21	JH	EC-WW-039	5.8		AP+PS	14/11/17	900	905	30	30	P	LT
7 / 12	SEeos	NWeos	1643	-21	JH	EC-WW-039	2.1		AP+PS	14/11/17	912	917	30	30	P	LT
7 / 12	SEeos	Nweos	1643	-21	JH	EC-WW-039	8.0		AP+PS	13/11/17	1800	1805	40	40	P	LT
7 / 11	SEeos	Nweos	1647	-21	JH	EC-WW-039	10.1		AP+PS	13/11/17	1800	1805	40	40	P	LT
7 / 10	SEeos	Nweos	1651	-21	JH	EC-WW-039	3.7		AP+PS	13/11/17	1810	1815	40	40	P	LT
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							87.0									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 3 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 14/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-039	1500	CM	-19	60.0%	454	132	143	145	129	152	130	112	127	126	123	189	188	191	191	190	LT	
2	EC-WW-054	1500	DH	-19	60.0%	454	137	145	111	142	136	134	149	138	133	139	182	183	185	180	184	LT	
3	EC-WW-056	1500	DH	-19	60.0%	454	144	133	131	137	128	130	122	120	134	138	184	186	184	185	184	LT	
4	EC-WW-039	1500	CM	-19	60.0%	454	127	120	141	137	141	117	117	123	121	120	171	175	170	196	192	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
16 / 17	Neos	Seos	1530	-19	DH	EC-WW-054	37.2		AP+PS	15/11/17	1135	1140	40	40	P	LT
17 / 18	Weos	Eeos	1530	-19	CM	EC-WW-039	6.7		AP+PS	15/11/17	1135	1140	40	40	P	LT
16 / 18	Neos	Seos	1547	-19	DH	EC-WW-054	74.3		AP+PS	15/11/17	1135	1140	40	40	P	LT
19 / 20	Weos	Eeos	1642	-19	CM	EC-WW-039	6.7		AP+PS	16/11/17	1005	1010	40	40	P	LT
17 / 19	Neos	Seos	1700	-19	DH	EC-WW-056	12.4		AP+PS	15/11/17	1135	1140	40	40	P	LT
17 / 20	Neos	Seos	1708	-19	DH	EC-WW-056	22.1		AP+PS	15/11/17	1135	1140	40	40	P	LT
20 / 21	Eeos	Weos	1720	-19	CM	EC-WW-039	6.7		AP+PS	15/11/17	1152	1157	40	40	P	LT
18 / 20	Neos	Seos	1720	-19	DH	EC-WW-056	58.0		AP+PS	15/11/17	1147	1152	40	40	P	LT
22 / 23	Eeos	Weos	1740	-19	CM	EC-WW-039	31.5		AP+PS	15/11/17	1317	1322	40	40	p	LT
18 / 21	Neos	Seos	1750	-19	DH	EC-WW-056	30.2		AP+PS	15/11/17	1147	1152	40	40	P	LT
23 / 24	Eeos	Weos	1800	-19	CM	EC-WW-039	31.5	DS-2	AP+PS	15/11/17	1317	1322	40	40	p	LT
/																
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							317.3									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 4 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 15/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-039	800	CM	-26	60.0%	454	130	127	140	149	124	138	147	163	148	142	198	200	195	197	200	LT	
2	EC-WW-054	800	DH	-26	60.0%	454	127	126	146	140	119	147	137	141	147	133	197	191	196	200	198	LT	
3	EC-WW-039	810	CM	-26	45.0%	454	140	127	131	162	145	139	142	130	133	153	182	186	185	197	188	LT	
4	EC-WW-056	900	DH	-24	60.0%	454	112	132	123	124	125	147	124	141	135	141	192	196	178	199	197	LT	
5	EC-WW-056	1300	DH	-22	60.0%	454	117	120	108	120	116	144	126	130	119	137	179	176	181	179	174	LT	
6	EC-WW-039	1300	CM	-22	65.0%	454	117	121	118	130	121	126	116	131	126	126	177	177	177	175	173	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
24 / 25	Eeos	Weos	802	-26	DH	EC-WW-054	30.0		VB+PS	18/11/17	1455	1500	40	40	P	LT
25 / 26	Eeos	Weos	830	-26	DH	EC-WW-054	13.4		AP+PS	18/11/17	1306	1311	40	40	P	LT
27 / 28	Eeos	Weos	840	-26	CM	EC-WW-039	29.7		AP+PS	16/11/17	1300	1305	40	40	P	LT
25 / 26	Eeos	Weos	845	-26	DH	EC-WW-054	17.0		AP+PS	16/11/17	1306	1311	40	40	P	LT
28 / 29	Eeos	Weos	855	-26	CM	EC-WW-039	11.2		AP+PS	16/11/17	1145	1150	40	40	P	LT
28 / 29	Eeos	Weos	907	-26	CM	EC-WW-039	15.4		AP+PS	16/11/17	1152	1157	40	40	P	LT
29 / 30	Eeos	Weos	915	-26	CM	EC-WW-039	29.0		AP+PS	16/11/17	1145	1150	40	40	P	LT
26 / 27	Eeos	Weos	945	-26	CM	EC-WW-039	30.3		AP+PS	16/11/17	1300	1305	40	40	P	LT
31 / 32	Eeos	Weos	1055	-26	CM	EC-WW-039	29.0		AP+PS	16/11/17	1023	1028	40	40	P	LT
30 / 31	Eeos	Weos	1100	-26	DH	EC-WW-056	24.5		AP+PS	16/11/17	1115	1120	40	40	P	LT
34 / 35	Weos	Eeos	1100	-26	CM	EC-WW-039	5.0		AP+PS	16/11/17	1011	1016	40	40	P	LT
34 / 35	Weos	Eeos	1105	-26	CM	EC-WW-039	5.7		AP+PS	16/11/17	1011	1016	40	40	P	LT
30 / 31	Eeos	Weos	1118	-26	DH	EC-WW-056	4.5		AP+PS	16/11/17	1115	1120	40	40	P	LT
32 / 33	Eeos	Weos	1120	-26	DH	EC-WW-056	7.0		AP+PS	16/11/17	1011	1016	40	40	P	LT
32 / 33	Eeos	Weos	1125	-26	DH	EC-WW-056	22.0		AP+PS	16/11/17	1018	1023	40	40	P	LT
35 / 36	Eeos	Weos	1130	-26	CM	EC-WW-039	24.0		AP+PS	16/11/17	1005	1010	40	40	P	LT
38 / 39	Seos	Neos	1135	-26	CM	EC-WW-039	2.8		AP+PS	16/11/17	952	957	40	40	P	LT
38 / 39	Seos	Neos	1138	-26	CM	EC-WW-039	2.7		AP+PS	16/11/17	952	957	40	40	P	LT
33 / 35	Eeos	Weos	1145	-26	CM	EC-WW-039	14.0		AP+PS	16/11/17	1005	1010	40	40	P	LT
33 / 34	Eeos	Weos	1154	-26	CM	EC-WW-039	12.8		AP+PS	16/11/17	1011	1016	40	40	P	LT
						PAGE TOTAL	330.0									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED
PS - POINT STRESS | & VAC BOX

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 5 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 15/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
7	EC-WW-039	1500	CM	-23	40.0%	454	143	161	139	172	146	137	143	146	160	148	200	204	202	188	188	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
37 / 38	Seos	Neos	1330	-22	DH	EC-WW-056	23.5		AP+PS	16/11/17	940	945	40	40	P	LT
38 / 39	Seos	Neos	1330	-22	CM	EC-WW-039	8.2		AP+PS	16/11/17	950	955	40	40	P	LT
36 / 38	Eeos	Weos	1339	-22	CM	EC-WW-039	9.4		AP+PS	16/11/17	942	947	40	40	P	LT
36 / 39	Eeos	Weos	1408	-22	CM	EC-WW-039	14.0		AP+PS	16/11/17	950	955	40	40	P	LT
40 / 41	Neos	Seos	1410	-22	CM	EC-WW-039	8.6	DS-3	AP+PS	18/11/17	1600	1605	40	40	P	LT
22 / 44	Eeos	Weos	1415	-22	DH	EC-WW-056	31.5		AP+PS	16/11/17	1330	1335	40	40	P	LT
40 / 41	Neos	Seos	1416	-22	CM	EC-WW-039	9.5	DS-3	AP+PS	16/11/17	1340	1345	40	40	P	LT
41 / 42	Neos	Seos	1425	-22	CM	EC-WW-039	12.6		AP+PS	16/11/17	1356	1401	40	40	P	LT
21 / 40	Neos	Seos	1430	-22	DH	EC-WW-056	26.4		AP+PS	16/11/17	1333	1338	40	40	P	LT
42 / 43	Neos	Seos	1435	-22	CM	EC-WW-039	2.6		AP+PS	16/11/17	1402	1407	40	40	P	LT
45 / 46	Weos	Eeos	1530	-22	DH	EC-WW-056	15.8		AP+PS	16/11/17	1350	1355	40	40	P	LT
44 / 45	Weos	Eeos	1535	-22	CM	EC-WW-039	30.0		AP+PS	23/11/17	1000	1005	40	40	P	LT
46 / 47	Weos	Eeos	1545	-22	DH	EC-WW-056	2.5		AP+PS	16/11/17	1402	1407	40	40	P	LT
37 / 17	Eeos	Weos	1624	-22	CM	EC-WW-039	6.4		AP+PS	16/11/17	1410	1415	40	40	P	LT
19 / 38	Eeos	Weos	1630	-22	CM	EC-WW-039	2.8		AP+PS	16/11/17	940	945	40	40	P	LT
19 / 36	Eeos	Weos	1633	-22	CM	EC-WW-039	6.8		AP+PS	16/11/17	942	947	40	40	P	LT
19 / 25	Neos	Seos	1645	-22	CM	EC-WW-039	1.3		VB+PS	16/11/17					P	LT
19 / 33	Neos	Seos	1645	-22	CM	EC-WW-039	3.3		AP+PS	16/11/17	1005	1010	40	40	P	LT
20 / 33	Neos	Seos	1647	-22	CM	EC-WW-039	3.6		AP+PS	16/11/17	1011	1016	40	40	P	LT
20 / 32	Neos	Seos	1649	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1011	1016	40	40	P	LT
						PAGE TOTAL	225.5									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 6 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 15/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
20 / 31	Neos	Seos	1651	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1115	1120	40	40	P	LT
20 / 30	Neos	Seos	1654	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1115	1120	40	40	P	LT
20 / 29	Neos	Seos	1659	-22	CM	EC-WW-039	6.5		AP+PS	16/11/17	1145	1150	40	40	P	LT
20 / 28	Neos	Seos	1702	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1145	1150	40	40	P	LT
20 / 27	Neos	Seos	1705	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1300	1305	40	40	P	LT
20 / 27	Neos	Seos	1708	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1300	1305	40	40	P	LT
20 / 25	Neos	Seos	1711	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1306	1311	40	40	P	LT
20 / 24	Neos	Seos	1714	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1312	1317	40	40	P	LT
20 / 23	Neos	Seos	1717	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1317	1322	40	40	P	LT
20 / 22	Neos	Seos	1720	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1323	1328	40	40	P	LT
20 / 44	Neos	Seos	1723	-22	CM	EC-WW-039	2.9		AP+PS	16/11/17	1330	1335	40	40	P	LT
21 / 44	Neos	Seos	1725	-22	CM	EC-WW-039	1.8		AP+PS	16/11/17	1333	1338	40	40	P	LT
40 / 44	Neos	Sweos	1725	-22	CM	EC-WW-039	3.5		AP+PS	16/11/17	1334	1339	40	40	P	LT
40 / 45	Neos	Sweos	1730	-22	CM	EC-WW-039	4.8		AP+PS	16/11/17	1340	1345	40	40	P	LT
41 / 45	Neos	Sweos	1733	-22	CM	EC-WW-039	6.7		AP+PS	16/11/17	1340	1345	40	40	P	LT
41 / 46	Neos	Sweos	1737	-22	CM	EC-WW-039	2.1		AP+PS	16/11/17	1340	1345	40	40	P	LT
42 / 46	Neos	Sweos	1739	-22	CM	EC-WW-039	8.0		AP+PS	16/11/17	1356	1401	40	40	P	LT
/																
/																
/																
						PAGE TOTAL	96.6									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 7 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 16/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-039	800	DH	-20	60.0%	454	139	151	110	135	138	150	155	145	146	145	193	192	191	197	186	LT	
2	EC-WW-039	1400	IK	-21	60.0%	454	126	139	102	101	111	113	112	126	110	122	172	163	164	173	172	LT	
3	EC-WW-054	1400	DH	-21	60.0%	454	127	118	115	126	120	132	138	122	122	123	172	168	172	168	173	LT	
4	EC-WW-056	1530	CM	-21	60.0%	454	122	122	119	124	120	129	119	122	113	115	168	169	175	169	167	LT	
5	EC-WW-039	1600	IK	-21	40.0%	454	160	131	145	144	138	143	142	157	162	150	185	179	190	182	185	LT	
6	EC-WW-054	1800	DH	-21	60.0%	454	125	132	116	140	135	141	132	128	151	132	180	177	182	185	190	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
1 / 37	Neos	Seos	825	-20	DH	EC-WW-039	21.0		AP+PS	16/11/17	1410	1415	40	40	P	LT
1 / 17	Neos	Seos	832	-20	DH	EC-WW-039	5.1		AP+PS	16/11/17	1410	1415	40	40	P	LT
1 / 16	Neos	Seos	835	-20	DH	EC-WW-039	13.6		AP+PS	18/11/17	1330	1335	40	40	P	LT
48 / 49	Eeos	Weos	1645	-21	IK	EC-WW-039	6.7		AP+PS	18/11/17	1420	1425	40	40	P	LT
51 / 52	Eeos	Weos	1730	-21	IK	EC-WW-039	6.7		AP+PS	27/11/17	1625	1630	40	40	P	LT
49 / 50	Neos	Seos	1740	-21	IK	EC-WW-039	23.6		AP+PS	18/11/17	1420	1425	40	40	P	LT
50 / 51	Neos	Seos	1740	-21	CM	EC-WW-056	20.0		AP+PS	18/11/17	1416	1421	40	40	P	LT
16 / 48	Seos	Neos	1750	-21	DH	EC-WW-054	30.0	DS-4	AP+PS	27/11/17	1630	1635	40	40	P	LT
50 / 52	Neos	Seos	1756	-21	CM	EC-WW-056	100.5		AP+PS	27/11/17	1630	1635	40	40	P	LT
16 / 48	Seos	Neos	1759	-21	DH	EC-WW-054	61.5	DS-4	AP+PS	18/11/17	1410	1415	40	40	P	LT
48 / 50	Neos	Seos	1759	-21	IK	EC-WW-039	91.8		AP+PS	27/11/17	1655	1700	40	40	P	LT
16 / 49	Seos	Neos	1849	-21	DH	EC-WW-054	23.4		AP+PS	18/11/17	1410	1415	40	40	P	LT
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							403.9									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 8 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 17/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-039	1400	DH	-17	65.0%	454	127	129	117	124	124	115	117	120	137	127	180	177	178	179	178	LT	
2	EC-WW-039	1400	DH	-17	50.0%	454	132	144	119	101	142	143	135	117	150	148	193	183	176	176	185	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
55 / 57	Neos	Seos	1443	-19	DH	EC-WW-039	51.5		AP+PS	17/11/17	1512	1517	40	40	P	LT
54 / 56	Neos	Seos	1505	-19	DH	EC-WW-039	51.5		AP+PS	17/11/17	1530	1535	40	40	P	LT
56 / 57	Eeos	Weos	1700	-19	DH	EC-WW-039	6.5		AP+PS	18/11/17	940	945	40	40	P	LT
54 / 55	Eeos	Weos	1700	-19	DH	EC-WW-039	6.0		AP+PS	18/11/17	940	945	40	40	P	LT
53 / 55	Weos	Eeos	1757	-19	DH	EC-WW-039	4.9		AP+PS	18/11/17	950	955	40	40	P	LT
53 / 57	Weos	Eeos	1757	-19	DH	EC-WW-039	2.0		AP+PS	18/11/17	950	955	40	40	P	LT
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							122.4									

TEST METHOD
AL - AIR LANCE
AP - AIR PRESSURE
PS - POINT STRESS
ST - SPARK TEST
VB - EXTRUDED & VAC BOX

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 9 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 18/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-039	805	DH	-27	65.0%	454	130	142	104	146	125	137	144	132	144	152	182	178	179	186	180	LT	
2	EC-WW-039	830	DH	-27	50.0%	454	148	164	153	144	127	143	153	150	151	159	182	193	192	196	201	LT	
3	EC-WW-039	1300	DH	-27	40.0%	454	154	150	114	135	151	136	140	132	146	151	191	182	190	193	174	LT	
4	EC-WW-039	1320	DH	-27	65.0%	454	121	118	124	126	116	126	120	113	117	117	182	173	179	175	174	LT	
5	EC-WW-056	1635	CM	-27	75.0%	437	128	129	133	111	119	111	131	127	110	138	170	180	181	174	172	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
56 / 58	Eeos	Weos	900	-27	DH	EC-WW-039	3.7		AP+PS	18/11/17	1010	1015	40	40	P	LT
54 / 58	Eeos	Weos	900	-27	DH	EC-WW-039	1.2		VB+PS	18/11/17					P	LT
59 / 60	Weos	Eeos	945	-27	DH	EC-WW-039	6.7		AP+PS	25/11/17	1000	1005	40	40	P	LT
61 / 62	Weos	Eeos	1000	-27	DH	EC-WW-039	6.7		AP+PS	23/11/17	1110	1115	40	40	P	LT
51 / 59	Neos	Seos	1045	-27	DH	EC-WW-039	11.2		VB+PS	27/11/17					P	LT
51 / 59	Neos	Seos	1056	-27	DH	EC-WW-039	6.5		VB+PS	27/11/17					P	LT
52 / 59	Neos	Seos	1100	-27	DH	EC-WW-039	7.4		VB+PS	27/11/17					P	LT
52 / 59	Neos	Seos	1105	-27	DH	EC-WW-039	3.5		VB+PS	27/11/17					P	LT
52 / 59	Neos	Seos	1115	-27	DH	EC-WW-039	10.5		VB+PS	27/11/17					P	LT
52 / 59	Neos	Seos	1125	-27	DH	EC-WW-039	15.8		VB+PS	27/11/17					P	LT
52 / 60	Neos	Seos	1140	-27	DH	EC-WW-039	61.0	DS-5	AP+PS	26/11/17	1650	1655	40	40	P	LT
59 / 62	Neos	Seos	1500	-27	DH	EC-WW-039	20.7		AP+PS	23/11/17	930	935	40	40	P	LT
59 / 61	Neos	Seos	1515	-27	DH	EC-WW-039	43.6		AP+PS	23/11/17	1145	1150	40	40	P	LT
60 / 61	Neos	Seos	1545	-29	DH	EC-WW-039	61.0		AP+PS	26/11/17	1130	1135	40	40	P	LT
62 / 63	Neos	Seos	1630	-29	DH	EC-WW-039	26.0		AP+PS	20/11/17	1150	1155	40	40	P	LT
61 / 63	Neos	Seos	1645	-29	DH	EC-WW-039	103.5		AP+PS	26/11/17	1120	1125	40	40	P	LT
63 / 64	Neos	Seos	1710	-29	CM	EC-WW-056	137.0		AP+PS	20/11/17	1435	1440	40	40	P	LT
/																
/																
/																
PAGE TOTAL							526.0									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 10 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 20/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-039	900	DH	-31	65.0%	437	110	113	112	115	126	112	130	116	123	118	170	173	166	173	170	LT	
2	EC-WW-056	930	JH	-31	65.0%	437	116	108	127	132	118	120	121	115	123	124	163	167	174	168	170	LT	
3	EC-WW-056	930	JH	-31	40.0%	437	148	137	144	131	138	151	141	120	121	110	188	182	186	189	182	LT	
4	EC-WW-039	1300	DH	-29	67.0%	437	111	124	121	116	120	115	123	122	132	129	170	177	180	175	176	LT	
5	EC-WW-056	1330	JH	-29	65.0%	437	111	113	122	117	117	121	126	108	119	119	156	169	169	166	166	LT	
6	EC-WW-056	1330	JH	-29	40.0%	437	131	134	146	125	150	135	116	127	147	118	180	180	181	175	168	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
64 / 65	Seos	Neos	930	-31	DH	EC-WW-039	23.3		AP+PS	26/11/17	1120	1125	40	40	P	LT
64 / 65	Seos	Neos	945	-31	DH	EC-WW-039	108.8		AP+PS	26/11/17	1315	1320	40	40	P	LT
66 / 67	Weos	Eeos	1052	-31	JH	EC-WW-056	6.7		AP+PS	26/11/17	1110	1115	40	40	P	LT
65 / 67	Seos	Neos	1122	-31	JH	EC-WW-056	13.0		AP+PS	26/11/17	1300	1305	40	40	P	LT
65 / 67	Seos	Neos	1140	-31	JH	EC-WW-056	81.0		AP+PS	26/11/17	1330	1335	40	40	P	LT
65 / 66	Seos	Neos	1220	-30	JH	EC-WW-056	34.6		AP+PS	26/11/17	1150	1155	40	40	P	LT
67 / 68	Seos	Neos	1310	-30	DH	EC-WW-039	22.1		AP+PS	26/11/17	1440	1445	40	40	P	LT
68 / 69	Eeos	Weos	1330	-30	JH	EC-WW-056	6.7		AP+PS	26/11/17	1450	1455	40	40	P	LT
67 / 68	Seos	Neos	1330	-30	DH	EC-WW-039	43.5		AP+PS	26/11/17	1450	1455	40	40	P	LT
67 / 69	Seos	Neos	1355	-30	DH	EC-WW-039	28.4		AP+PS	26/11/17	1250	1255	40	40	P	LT
70 / 72	Eeos	Weos	1405	-29	JH	EC-WW-056	6.7		AP+PS	26/11/17	1636	1641	40	40	P	LT
66 / 69	Seos	Neos	1410	-29	DH	EC-WW-039	34.1		AP+PS	26/11/17	1425	1430	40	40	P	LT
71 / 72	Weos	Eeos	1425	-29	JH	EC-WW-056	6.7		AP+PS	26/11/17	1420	1425	40	40	P	LT
69 / 70	Neos	Seos	1445	-29	DH	EC-WW-039	3.5		AP+PS	2017/11/26	1636	1641	40	40	P	LT
72 / 69	Neos	Seos	1448	-29	DH	EC-WW-039	25.1		AP+PS	2017/11/26	1430	1435	40	40	P	LT
69 / 71	Neos	Seos	1503	-30	DH	EC-WW-039	31.5		AP+PS	25/11/17	1450	1455	40	40	P	LT
74 / 75	Weos	Eeos	1506	-30	JH	EC-WW-056	6.7		AP+PS	25/11/17	1431	1436	40	40	P	LT
70 / 73	Neos	Seos	1518	-30	JH	EC-WW-056	2.0		AP+PS	25/11/17	845	850	40	40	P	LT
72 / 73	Neos	Seos	1520	-30	JH	EC-WW-056	24.7		AP+PS	25/11/17	910	915	40	40	P	LT
68 / 71	Neos	Seos	1521	-30	DH	EC-WW-039	68.3	DS-7	AP+PS	25/11/17	1105	1110	40	40	P	LT
						PAGE TOTAL	577.4									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 11 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 20/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
7	EC-WW-039	1700	DH	-32	65.0%	437	115	121	123	116	119	121	137	128	140	145	182	188	187	175	175	LT	
8	EC-WW-056	1725	JH	-32	65.0%	437	131	132	125	127	130	116	119	117	125	130	191	190	188	185	190	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
71 / 73	Neos	Seos	1533	-30	JH	EC-WW-056	99.5		AP+PS	25/11/17	1455	1500	40	40	P	LT
73 / 74	Neos	Seos	1635	-32	DH	EC-WW-039	11.5		AP+PS	25/11/17	1300	1305	40	40	P	LT
73 / 75	Neos	Seos	1645	-32	DH	EC-WW-039	126.0		AP+PS	25/11/17	1635	1640	40	40	P	LT
76 / 78	Eeos	Weos	1647	-32	JH	EC-WW-056	6.7		AP+PS	25/11/17	1410	1415	40	40	P	LT
78 / 79	Eeos	Weos	1700	-32	JH	EC-WW-056	6.7		AP+PS	23/11/17	1400	1405	40	40	P	LT
74 / 79	Neos	Seos	1711	-32	JH	EC-WW-056	11.5		AP+PS	23/11/17	1641	1646	40	40	P	LT
75 / 79	Neos	Seos	1720	-32	JH	EC-WW-056	50.5		AP+PS	23/11/17	1410	1415	40	40	P	LT
76 / 77	Seos	Neos	1720	-32	DH	EC-WW-039	14.0		AP+PS	23/11/17	1400	1405	40	40	P	LT
75 / 78	Neos	Seos	1750	-32	JH	EC-WW-056	13.2		AP+PS	23/11/17	1641	1646	40	40	P	LT
75 / 76	Neos	Seos	1805	-32	JH	EC-WW-056	51.0		AP+PS	25/11/17	1635	1640	40	40	P	LT
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							390.6									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH: Lance Tourett
SUPERVISOR: Chad Messervey
SUBMISSION DATE: December 4 2017
SHEET NUMBER: 12 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 21/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-039	855	DH	-34	60.0%	437	121	123	120	141	137	125	126	135	142	100	175	174	186	163	181	LT	
2	EC-WW-056	900	JH	-34	60.0%	437	100	105	124	138	121	147	136	125	138	141	182	175	191	190	182	LT	
3	EC-WW-056	1255	JH	-34	60.0%	437	132	133	129	125	115	118	117	111	101	135	191	196	200	187	163	LT	
4	EC-WW-039	1255	DH	-34	60.0%	437	134	141	137	115	118	122	123	141	132	111	162	167	175	164	180	LT	
5	EC-WW-056	1545	JH	-34	60.0%	437	134	126	131	127	129	145	127	118	111	124	180	175	183	176	165	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
76 / 80	Seos	Neos	1015	-34	DH	EC-WW-039	36.2	DS-9	AP+PS	23/11/17	1626	1631	40	40	P	LT
78 / 80	Seos	Neos	1035	-34	DH	EC-WW-039	12.3		AP+PS	23/11/17	1400	1405	40	40	P	LT
79 / 80	Seos	Neos	1045	-34	DH	EC-WW-039	55.4		AP+PS	23/11/17	1400	1405	40	40	P	LT
80 / 81	Eeos	Weos	1048	-34	JH	EC-WW-056	6.7		AP+PS	23/11/17	1048	1053	40	40	P	LT
82 / 84	Eeos	Weos	1115	-34	JH	EC-WW-056	6.7		AP+PS	23/11/17	1322	1327	40	40	P	LT
79 / 81	Seos	Neos	1115	-34	DH	EC-WW-039	4.3		AP+PS	23/11/17	1042	1047	40	40	P	LT
80 / 82	Seos	Neos	1120	-34	DH	EC-WW-039	41.2		AP+PS	23/11/17	1626	1631	40	40	P	LT
80 / 84	Seos	Neos	1142	-34	DH	EC-WW-039	46.8		AP+PS	23/11/17	1331	1336	40	40	P	LT
86 / 87	Neos	Seos	1156	-34	JH	EC-WW-056	6.5		AP+PS	23/11/17	1100	1105	40	40	P	LT
81 / 84	Seos	Neos	1206	-34	DH	EC-WW-039	2.5		AP+PS	23/11/17	1048	1053	40	40	P	LT
83 / 85	Eeos	Weos	1300	-34	JH	EC-WW-056	6.7		AP+PS	23/11/17	1651	1656	40	40	P	LT
82 / 83	Seos	Neos	1330	-34	DH	EC-WW-039	16.5		AP+PS	23/11/17	1322	1327	40	40	P	LT
83 / 84	Seos	Neos	1340	-34	DH	EC-WW-039	8.8	DS-8	AP+PS	23/11/17	1331	1336	40	40	P	LT
85 / 87	Seos	Neos	1341	-34	JH	EC-WW-056	30.1		AP+PS	23/11/17	1100	1105	40	40	P	LT
84 / 85	Seos	Neos	1345	-34	DH	EC-WW-039	39.3		AP+PS	23/11/17	1052	1057	40	40	P	LT
85 / 86	Seos	Neos	1375	-34	JH	EC-WW-056	6.9		AP+PS	23/11/17	1315	1320	40	40	P	LT
53 / 88	Neos	Seos	1435	-34	JH	EC-WW-056	8.7		AP+PS	23/11/17	1619	1645	40	40	P	LT
53 / 77	Seos	Neos	1475	-34	JH	EC-WW-056	4.0		VB+PS	23/11/17					P	LT
77 / 86	Seos	Neos	1500	-34	JH	EC-WW-056	8.6		AP+PS	23/11/17	1619	1624	40	40	P	LT
57 / 80	Seos	Neos	1622	-34	JH	EC-WW-056	14.8		AP+PS	23/11/17	1619	1624	40	40	P	LT
						PAGE TOTAL	363.0									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 13 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 21/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
56 / 87	Neos	Seos	1640	-34	JH	EC-WW-056	37.1		AP+PS	23/11/17	1150	1155	40	40	P	LT
56 / 83	Neos	Seos	1700	-34	JH	EC-WW-056	4.1		AP+PS	23/11/17	1321	1326	40	40	P	LT
56 / 83	Neos	Seos	1705	-34	JH	EC-WW-056	4.0		AP+PS	23/11/17	1245	1250	40	40	P	LT
57 / 83	Neos	Seos	1708	-34	JH	EC-WW-056	18.6		AP+PS	23/11/17	1321	1326	40	40	P	LT
57 / 82	Neos	Seos	1718	-34	JH	EC-WW-056	25.0		AP+PS	23/11/17	1321	1326	40	40	P	LT
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							88.8									

TEST METHOD

AL - AIR LANCE	ST - SPARK TEST
AP - AIR PRESSURE	VB - EXTRUDED & VAC BOX
PS - POINT STRESS	

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 14 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 22/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-056	900	JH	-34	60.0%	437	128	132	122	120	126	138	141	131	136	131	194	191	188	184	192	LT	
2	EC-WW-056	1300	JH	-34	50.0%	437	110	127	148	120	129	123	122	123	135	137	155	177	176	172	171	LT	
3	EC-WW-039	1415	DH	-34	40.0%	437	128	130	143	145	132	130	129	119	114	135	197	191	187	194	188	LT	
4	EC-WW-039	1415	DH	-34	65.0%	437	122	131	130	134	140	126	136	139	140	138	191	191	184	191	187	LT	
5	EC-WW-056	1430	JH	-34	40.0%	437	138	151	141	151	137	129	133	126	141	124	187	195	175	197	192	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
15 / 89	Seos	Neos	1000	-34	JH	EC-WW-056	15.0		AP+PS	28/11/17	930	935	40	40	P	LT
89 / 90	Seos	Neos	1017	-34	JH	EC-WW-056	15.8		AP+PS	28/11/17	930	935	40	40	P	LT
90 / 91	Seos	Neos	1034	-34	JH	EC-WW-056	15.8		AP+PS	28/11/17	935	940	40	40	P	LT
91 / 92	Seos	Neos	1051	-34	JH	EC-WW-056	15.7		AP+PS	28/11/17	935	940	40	40	P	LT
92 / 93	Seos	Neos	1104	-34	JH	EC-WW-056	16.0		AP+PS	28/11/17	941	946	40	40	P	LT
93 / 94	Seos	Neos	1120	-34	JH	EC-WW-056	16.8		AP+PS	28/11/17	1400	1405	40	40	P	LT
94 / 95	Seos	Neos	1135	-34	JH	EC-WW-056	16.3		AP+PS	28/11/17	941	946	40	40	P	LT
95 / 96	Seos	Neos	1145	-34	JH	EC-WW-056	16.2		AP+PS	28/11/17	948	953	40	40	P	LT
96 / 97	Seos	Neos	1308	-34	JH	EC-WW-056	15.9		AP+PS	28/11/17	945	953	40	40	P	LT
97 / 98	Seos	Neos	1322	-34	JH	EC-WW-056	15.8		AP+PS	28/11/17	955	1000	40	40	P	LT
98 / 99	Seos	Neos	1336	-34	JH	EC-WW-056	15.5		AP+PS	28/11/17	955	1000	40	40	P	LT
99 / 100	Seos	Neos	1347	-34	JH	EC-WW-056	15.4		AP+PS	28/11/17	1001	1006	40	40	P	LT
77 / 82	Eeos	Weos	1400	-34	JH	EC-WW-056	6.7		AP+PS	25/11/17	1620	1625	40	40	P	LT
100 / 101	Seos	Neos	1403	-34	JH	EC-WW-056	15.0		AP+PS	28/11/17	1001	1006	40	40	P	LT
101 / 102	Seos	Neos	1415	-34	JH	EC-WW-056	14.7		AP+PS	28/11/17	1010	1015	40	40	P	LT
1 / 16	Weos	Eeos	1515	-34	JH	EC-WW-056	7.1		AP+PS	23/11/17	1410	1415	40	40	P	LT
2 / 49	Weos	Eeos	1519	-34	JH	EC-WW-056	6.4		AP+PS	23/11/17	1410	1415	40	40	P	LT
3 / 50	Weos	Eeos	1523	-34	JH	EC-WW-056	3.1		VB+PS	23/11/17					P	LT
3 / 50	Weos	Eeos	1525	-34	JH	EC-WW-056	2.7		AP+PS	23/11/17	1416	1421	40	40	P	LL
4 / 51	Weos	Eeos	1528	-34	JH	EC-WW-056	5.0		AP+PS	23/11/17	1422	1427	40	40	P	LT
						PAGE TOTAL	250.9									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 15 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 22/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
7 / 51	Weos	Eeos	1532	-34	JH	EC-WW-056	1.9		AP+PS	23/11/17	1428	1433	40	40	P	LT
7 / 59	Weos	Eeos	1534	-34	JH	EC-WW-056	4.0		AP+PS	23/11/17	1428	1433	40	40	P	LT
8 / 59	Weos	Eeos	1538	-34	JH	EC-WW-056	4.0		AP+PS	23/11/17	1650	1655	40	40	P	LT
8 / 62	Weos	Eeos	1540	-34	JH	EC-WW-056	2.3		AP+PS	23/11/17	1640	1645	40	40	P	LT
9 / 62	Weos	Eeos	1543	-34	JH	EC-WW-056	2.0		VB+PS	23/11/17					P	LT
9 / 62	Weos	Eeos	1544	-34	JH	EC-WW-056	5.1		AP+PS	23/11/17	1630	1635	40	40	P	LT
102 / 58	Seos	Neos	1628	-34	JH	EC-WW-056	14.7		AP+PS	28/11/17	1430	1435	40	40	P	LT
56 / 102	Eeos	Weos	1632	-34	JH	EC-WW-056	3.1		VB+PS	26/11/17					P	LT
56 / 101	Eeos	Weos	1639	-34	JH	EC-WW-056	1.0		VB+PS	26/11/17					P	LT
87 / 101	Eeos	Weos	1640	-34	JH	EC-WW-056	5.8		AP+PS	26/11/17	1106	1111	40	40	P	LT
87 / 100	Eeos	Weos	1644	-34	JH	EC-WW-056	1.0		AP+PS	26/11/17	1106	1111	40	40	P	LT
86 / 100	Eeos	Weos	1645	-34	JH	EC-WW-056	1.6		AP+PS	26/11/17	1100	1105	40	40	P	LT
85 / 100	Eeos	Weos	1646	-34	JH	EC-WW-056	4.3		AP+PS	26/11/17	1100	1105	40	40	P	LT
85 / 99	Eeos	Weos	1650	-34	JH	EC-WW-056	2.5		AP+PS	26/11/17	1052	1057	40	40	P	LT
84 / 99	Eeos	Weos	1653	-34	JH	EC-WW-056	4.1		AP+PS	26/11/17	1049	1054	40	40	P	LT
84 / 98	Eeos	Weos	1658	-34	JH	EC-WW-056	2.7		AP+PS	26/11/17	1048	1053	40	40	P	LT
81 / 98	Eeos	Weos	1700	-34	JH	EC-WW-056	4.1		AP+PS	26/11/17	1048	1053	40	40	P	LT
81 / 97	Eeos	Weos	1702	-34	JH	EC-WW-056	2.7		AP+PS	26/11/17	1042	1047	40	40	P	LT
79 / 97	Eeos	Weos	1704	-34	JH	EC-WW-056	4.0		AP+PS	26/11/17	1042	1047	40	40	P	LT
79 / 96	Eeos	Weos	1706	-34	JH	EC-WW-056	2.7		AP+PS	26/11/17	1036	1041	40	40	P	LT
						PAGE TOTAL	73.6									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 16 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 22/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
74 / 96	Eeos	Weos	1708	-34	JH	EC-WW-056	3.8		AP+PS	26/11/17	1048	1053	40	40	P	LT
74 / 95	Eeos	Weos	1710	-34	JH	EC-WW-056	3.0		AP+PS	26/11/17	1030	1035	40	40	P	LT
73 / 95	Eeos	Weos	1713	-34	JH	EC-WW-056	3.8		VB+PS	26/11/17					P	LT
73 / 94	Eeos	Weos	1715	-34	JH	EC-WW-056	3.2		AP+PS	26/11/17	1021	1026	40	40	P	LT
70 / 94	Eeos	Weos	1718	-34	JH	EC-WW-056	3.6		AP+PS	26/11/17	1021	1026	40	40	P	LT
70 / 93	Eeos	Weos	1720	-34	JH	EC-WW-056	3.3		VB+PS	26/11/17					P	LT
69 / 93	Eeos	Weos	1722	-34	JH	EC-WW-056	3.6		VB+PS	26/11/17					P	LT
69 / 92	Eeos	Weos	1725	-34	JH	EC-WW-056	3.4		AP+PS	26/11/17	1612	1617	40	40	P	LT
66 / 92	Eeos	Weos	1727	-34	JH	EC-WW-056	3.4		VB+PS	26/11/17					P	LT
66 / 91	Eeos	Weos	1730	-34	JH	EC-WW-056	3.7		AP+PS	26/11/17	1610	1615	40	40	P	LT
65 / 91	Eeos	Weos	1732	-34	JH	EC-WW-056	3.2		AP+PS	26/11/17	1610	1615	40	40	P	LT
65 / 90	Eeos	Weos	1734	-34	JH	EC-WW-056	3.9		AP+PS	26/11/17	1600	1605	40	40	P	LT
64 / 90	Eeos	Weos	1737	-34	JH	EC-WW-056	3.0		AP+PS	26/11/17	1600	1605	40	40	P	LT
64 / 89	Eeos	Weos	1740	-34	JH	EC-WW-056	4.9		AP+PS	26/11/17	1435	1440	40	40	P	LT
63 / 89	Eeos	Weos	1743	-34	JH	EC-WW-056	2.2		AP+PS	26/11/17	1435	1440	40	40	P	LT
/																
/																
/																
/																
/																
						PAGE TOTAL	52.0									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 17 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 26/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-054	1500	CM	-23	40.0%	443	109	129	121	130	139	144	147	142	142	147	160	161	162	170	158	LT	
2	EC-WW-054	1500	CM	-23	65.0%	437	151	152	106	138	119	120	120	126	129	120	155	149	157	174	145	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
106 / 107	Weos	Eeos	1500	-27	CM	EC-WW-054	1.0		VB+PS	28/11/17					P	LT
59 / 106	Neos	Seos	1515	-27	CM	EC-WW-054	6.6		AP+PS	28/11/17	1500	1505	40	40	P	LT
59 / 107	Neos	Seos	1520	-27	CM	EC-WW-054	3.1		AP+PS	28/11/17	1450	1455	40	40	P	LT
52 / 107	Seos	Neos	1600	-27	CM	EC-WW-054	3.1		AP+PS	28/11/17	1450	1455	40	40	P	LT
52 / 106	Seos	Neos	1603	-27	CM	EC-WW-054	6.6		AP+PS	28/11/17	1500	1505	40	40	P	LT
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							20.4									

TEST METHOD

AL - AIR LANCE	ST - SPARK TEST
AP - AIR PRESSURE	VB - EXTRUDED
PS - POINT STRESS	& VAC BOX

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 18 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE VGC Eagle Gold Collection Pond | SEAM DATE 27/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-054	800	DH	-22	40.0%	443	138	132	144	138	140	140	137	123	132	134	174	160	170	171	152	LT	
2	EC-WW-054	905	DH	-22	60.0%	443	143	136	163	137	183	121	129	137	137	143	192	193	183	179	193	LT	

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
59 / 103	Neos	Seos	840	-21	DH	EC-WW-054	6.6		AP+PS	28/11/17	1530	1535	40	40	P	LT
51 / 103	Seos	Neos	850	-21	DH	EC-WW-054	6.6		AP+PS	28/11/17	1530	1535	40	40	P	LT
59 / 104	Neos	Seos	930	-21	DH	EC-WW-054	6.6		AP+PS	28/11/17	1515	1520	40	40	P	LT
51 / 104	Seos	Neos	937	-21	DH	EC-WW-054	6.6		AP+PS	28/11/17	1515	1520	40	40	P	LT
59 / 105	Neos	Seos	1000	-21	DH	EC-WW-054	6.6		AP+PS	28/11/17	1506	1511	40	40	P	LT
52 / 105	Seos	Neos	1005	-21	DH	EC-WW-054	6.6		AP+PS	28/11/17	1506	1511	40	40	P	LT
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							39.6									

TEST METHOD
AL - AIR LANCE
AP - AIR PRESSURE
PS - POINT STRESS
ST - SPARK TEST
VB - EXTRUDED & VAC BOX

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 19 of 19

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE Victoria Gold Corporation Spillway | SEAM DATE 26/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS
1	EC-WW-056	1250	DH	-22	65.0%	437	129	125	124	114	115	131	116	121	132	120	171	175	169	170	162	LT	S/S
2	EC-WW-056	1255	DH	-22	40.0%	437	111	110	121	125	119	118	117	117	120	114	156	170	160	168	168	LT	T/T

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
8 / 12	N/A	N/A	0	-22	DH	EC-WW-056	0.0		PS	26/11/17					PASS	CM
9 / 12	N/A	N/A	0	-22	DH	EC-WW-056	0.0		PS	26/11/17					PASS	CM
11 / 12	N/A	N/A	0	-22	DH	EC-WW-056	0.0		PS	26/11/17					PASS	CM
1 / 2	EEOS	WEOS	1300	-22	DH	EC-WW-056	6.0		PS	26/11/17					PASS	CM
1 / 3	NEOS	SEOS	1305	-22	DH	EC-WW-056	30.0		PS	26/11/17					PASS	CM
2 / 3	NEOS	SEOS	1316	-22	DH	EC-WW-056	10.0		PS	26/11/17					PASS	CM
3 / 4	NEOS	SEOS	1325	-22	DH	EC-WW-056	40.0		PS	26/11/17					PASS	CM
4 / 5	NEOS	SEOS	1330	-22	DH	EC-WW-056	45.0		PS	26/11/17					PASS	CM
6 / 7	EEOS	WEOS	1335	-22	DH	EC-WW-056	6.0		PS	26/11/17					PASS	CM
5 / 6	NEOS	SEOS	1340	-22	DH	EC-WW-056	25.0		PS	26/11/17					PASS	CM
5 / 7	NEOS	SEOS	1345	-22	DH	EC-WW-056	20.0		PS	26/11/17					PASS	CM
8 / 9	NEOS	SEOS	1349	-22	DH	EC-WW-056	30.0		PS	26/11/17					PASS	CM
10 / 11	EEOS	WEOS	1359	-22	DH	EC-WW-056	6.0		PS	26/11/17					PASS	CM
9 / 10	NEOS	SEOS	1420	-22	DH	EC-WW-056	15.0		PS	26/11/17					PASS	CM
9 / 11	NEOS	SEOS	1425	-22	DH	EC-WW-056	15.0		PS	26/11/17					PASS	CM
2 / 8	EEOS	WEOS	1700	-22	DH	EC-WW-056	4.5		PS	26/11/17					PASS	CM
3 / 8	EEOS	WEOS	1703	-22	DH	EC-WW-056	4.0		PS	26/11/17					PASS	CM
3 / 9	EEOS	WEOS	1704	-22	DH	EC-WW-056	2.0		PS	26/11/17					PASS	CM
4 / 9	EEOS	WEOS	1706	-22	DH	EC-WW-056	6.0		PS	26/11/17					PASS	CM
4 / 10	EEOS	WEOS	1708	-22	DH	EC-WW-056	1.0		PS	26/11/17					PASS	CM
						PAGE TOTAL	265.5									

TEST METHOD
AL - AIR LANCE | ST - SPARK TEST
AP - AIR PRESSURE | VB - EXTRUDED & VAC BOX
PS - POINT STRESS

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 1 of 2

GEOMEMBRANE SEAM & TEST LOG

PROJECT NUMBER CT000904 | AREA / LAYER Primary
PROJECT TITLE Victoria Gold Corporation Spillway | SEAM DATE 26/11/2017

TRIAL SEAMS

#	MACHINE NUMBER	TIME	WELD TECH	AIR TEMP °C	SPEED	WEDGE TEMP °C	INSIDE PEEL (PPI)					OUTSIDE PEEL (PPI)					SHEAR (PPI)					CHK'D BY	LINER TO LINER TYPE AND REMARKS

WELD SEAMS

PANEL NUMBERS	SEAM SECTION FROM	SEAM SECTION TO	START TIME	AIR TEMP °C	WELD TECH	MACHINE NUMBER	WELD LENGTH	DESTRUCT NUMBER	QC TEST METH.	QC TEST DATE Y-M-D	AIR PRESSURE TEST (PSI) TIME START	TIME END	PRESSURE START	PRESSURE END	VERIFY PASS	VERIFY QC TECH
5 / 10	EEOS	WEOS	1710	-22	DH	EC-WW-056	1.0		PS	26/11/17					PASS	CM
7 / 10	EEOS	WEOS	1710	-22	DH	EC-WW-056	4.0		PS	26/11/17					PASS	CM
1 / CP	EEOS	WEOS	1735	-22	DH	EC-WW-056	6.0		PS	26/11/17					PASS	CM
3 / CP	EEOS	WEOS	1737	-22	DH	EC-WW-056	6.8		PS	26/11/17					PASS	CM
4 / CP	EEOS	WEOS	1739	-22	DH	EC-WW-056	6.8		PS	26/11/17					PASS	CM
5 / CP	EEOS	WEOS	1741	-22	DH	EC-WW-056	2.0		PS	26/11/17					PASS	CM
6 / CP	EEOS	WEOS	1741	-22	DH	EC-WW-056	6.0		PS	26/11/17					PASS	CM
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
/																
PAGE TOTAL							32.6									

TEST METHOD

AL - AIR LANCE	ST - SPARK TEST
AP - AIR PRESSURE	VB - EXTRUDED & VAC BOX
PS - POINT STRESS	

REMARKS:

QC TECH Lance Tourett
SUPERVISOR Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 2 of 2

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-011	2017/11/12	1100	IK	-24	282	276	96	122	94	122	93	194	200	179	217	202	CM	
2	EC-EX-011	2017/11/13	1300	IK	-18	282	276	114	110	93	107	99	178	193	183	197	196	LT	
3	EC-EX-011	2017/11/13	1655	IK	-20	282	276	101	115	111	127	99	180	184	177	186	180	LT	
4	EC-EX-027	2017/11/14	830	IK	-19	282	276	88	89	90	90	101	189	154	160	175	164	LT	
5																			
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
1A	4 /	20.3m S 3.3m E OF NWEOS 3/4	P	B	EC-EX-011	2017/11/12	1100	IK	-24	2017/11/13	VB+PS	LT
1B	4 /	1m SE OF 1A	P	B	EC-EX-011	2017/11/12	1130	IK	-24	2017/11/13	VB+PS	LT
1C	1 / 2	1m SE OF NWEOS	WR	P	EC-EX-027	2017/11/14	930	IK	-19	2017/11/14	VB+PS	LT
1D	1 / 2	18.5m SE OF 1C	WR	P	EC-EX-011	2017/11/13	1414	IK	-20	2017/11/13	VB+PS	LT
1E	1 / 2	7.6m SE OF 1D	WS	G+W	EC-EX-011	2017/11/13	1410	IK	-20	2017/11/13	VB+PS	LT
1F	1 / 2	7.4m SE OF 1E	WS	G+W	EC-EX-011	2017/11/13	1412	IK	-20	2017/11/13	VB+PS	LT
1G	2 / 3	1m SE OF NWEOS	WR	P	EC-EX-027	2017/11/14	940	IK	-19	2017/11/14	VB+PS	LT
1H	1 / 2	6.1m NW OF 1D	WR	G+W	EC-EX-011	2017/11/13	1420	IK	-20	2017/11/13	VB+PS	LT
1I	5 / 6	5,6 INT 3	T	G+W	EC-EX-011	2017/11/13	1357	IK	-20	2017/11/13	VB+PS	LT
1J	3 / 5	7m NW OF 1I	WS	P	EC-EX-011	2017/11/13	1402	IK	-20	2017/11/13	VB+PS	LT
1K	4 / 5	4,5 INT 3	T	G+W	EC-EX-011	2017/11/13	1405	IK	-20	2017/11/13	VB+PS	LT
1L	5 / 6	5,6 INT 7	T	G+W	EC-EX-011	2017/11/13	1400	IK	-20	2017/11/13	VB+PS	LT
1M	4 / 5	INT 7	DST+T	P	EC-EX-011	2017/11/13	1600	IK	-20	2017/11/13	VB+PS	LT
1N	14 / 15	14,15 INT 9	T	P	EC-EX-011	2017/11/13	1700	IK	-20	2017/11/13	VB+PS	LT
1O	8 / 9	8,9 INT 14	T	P	EC-EX-011	2017/11/13	1708	IK	-20	2017/11/13	VB+PS	LT
1P	13 / 14	13,14 INT 8	T	P	EC-EX-011	2017/11/13	1712	IK	-20	2017/11/13	VB+PS	LT
1Q	7 / 8	7,8 INT 13	T	G+W	EC-EX-011	2017/11/13	1715	IK	-20	2017/11/13	VB+PS	LT
1R	12 / 13	12,13 INT 7	T	G+W	EC-EX-011	2017/11/13	1716	IK	-20	2017/11/13	VB+PS	LT
1S	11 / 12	11,12 INT 7	T	P	EC-EX-011	2017/11/13	1718	IK	-20	2017/11/13	VB+PS	LT
1T	10 / 11	10,11 INT 7	T	G+W	EC-EX-011	2017/11/13	1718	IK	-20	2017/11/13	VB+PS	LT

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 1 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-011	2017/11/13	1300	IK	-18	282	276	114	110	93	107	99	178	193	183	197	196	LT	
2	EC-EX-011	2017/11/13	1655	IK	-20	282	276	101	115	111	127	99	180	184	177	186	180	LT	
3	EC-EX-027	2017/11/15	830	IK	-26	282	276	103	102	96	87	97	149	175	169	177	178	LT	
4	EC-EX-027	2017/11/15	1300	IK	-22	282	276	110	99	104	89	93	176	151	181	181	170	LT	
5	EC-EX-027	2017/11/16	800	IK	-20	282	276	91	94	84	83	101	153	172	166	174	169	LT	
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
2A	14 / 15	2.9m N OF 1N	WS	P	EC-EX-011	2017/11/13	1625	IK	-20	2017/11/13	VB+PS	LT
2B	7 / 12	3.0m NW OF 1R	WS	G+W	EC-EX-011	2017/11/13	1745	IK	-20	2017/11/13	VB+PS	LT
2C	8 / 9	8m SE OF 1O	WS	G+W	EC-EX-011	2017/11/13	1630	IK	-20	2017/11/13	VB+PS	LT
2D	1 / 37	1m SE OF Nweos	WR	P	EC-EX-027	2017/11/16	1010	IK	-21	2017/11/16	VB+PS	LT
2E	17 / 37	INT 1	T+WR	P	EC-EX-027	2017/11/16	1000	IK	-21	2017/11/16	VB+PS	LT
2F	16 / 17	INT 1	T	G+W	EC-EX-027	2017/11/15	1005	IK	-20	2017/11/16	VB+PS	LT
2G	17 / 18	INT 16	T	G+W	EC-EX-027	2017/11/15	1000	IK	-20	2017/11/16	VB+PS	LT
2H	19 / 20	INT 17	T	G+W	EC-EX-027	2017/11/15	1025	IK	-20	2017/11/16	VB+PS	LT
2I	17 / 18	INT 20	T	G+W	EC-EX-027	2017/11/15	1020	IK	-20	2017/11/16	VB+PS	LT
2J	20 / 21	INT 18	T	G+W	EC-EX-027	2017/11/15	830	IK	-20	2017/11/16	VB+PS	LT
2K	28 / 39	INT 36	T	G+W	EC-EX-027	2017/11/15	1500	IK	-20	2017/11/16	VB+PS	LT
2L	38 / 39	8.2m NW OF 2K	WS	P	EC-EX-027	2017/11/15	1445	IK	-20	2017/11/16	VB+PS	LT
2M	38 / 39	2.8m NW OF 2L	WS	P	EC-EX-027	2017/11/15	1440	IK	-20	2017/11/16	VB+PS	LT
2N	33 / 35	INT 33	T	G+W	EC-EX-027	2017/11/15	1410	IK	-20	2017/11/16	VB+PS	LT
2O	34 / 35	5m W OF 2N	WR	P	EC-EX-027	2017/11/15	1415	IK	-20	2017/11/16	VB+PS	LT
2P	32 / 33	7m W OF Eeos	WS	P	EC-EX-027	2017/11/15	1320	IK	-20	2017/11/16	VB+PS	LT
2Q	30 / 31	24.5m W OF Eeos	WS	P	EC-EX-027	2017/11/15	1330	IK	-20	2017/11/16	VB+PS	LT
2R	28 / 29	11m W OF Eeos	WR	P	EC-EX-027	2017/11/15	1040	IK	-20	2017/11/16	VB+PS	LT
2S	25 / 26	13.1m W OF Eeos	WR	P	EC-EX-027	2017/11/15	1050	IK	-20	2017/11/16	VB+PS	LT
2T	40 / 41	8.4m N OF Seos	WR	P	EC-EX-027	2017/11/15	1630	IK	-20	2017/11/16	VB+PS	LT

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 2 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-027	2017/11/16	800	IK	-20	282	276	91	94	84	83	101	153	172	166	174	169	LT	
2																			
3																			
4																			
5																			
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
3A	43 / 46	INT 42 & 47	T	G+W	EC-EX-027	2017/11/16	802	IK	-20	2017/11/16	VB+PS	LT
3B	42 / 41	INT 46	T	G+W	EC-EX-027	2017/11/16	804	IK	-20	2017/11/16	VB+PS	LT
3C	45 / 46	INT 1	T	G+W	EC-EX-027	2017/11/16	805	IK	-19	2017/11/16	VB+PS	LT
3D	40 / 41	INT 44	T	G+W	EC-EX-027	2017/11/16	807	IK	-19	2017/11/16	VB+PS	LT
3E	44 / 45	INT 40	T	G+W	EC-EX-027	2017/11/16	808	IK	-19	2017/11/16	VB+PS	LT
3F	540 / 44	INT 21	T	G+W	EC-EX-027	2017/11/16	810	IK	-19	2017/11/16	VB+PS	LT
3G	44 / 22	INT 20	T	G+W	EC-EX-027	2017/11/16	812	IK	-19	2017/11/16	VB+PS	LT
3H	22 / 23	INT 20	T	G+W	EC-EX-027	2017/11/16	812	IK	-19	2017/11/16	VB+PS	LT
3I	23 / 24	INT 20	T	G+W	EC-EX-027	2017/11/16	814	IK	-19	2017/11/16	VB+PS	LT
3J	24 / 25	INT 20	T	G+W	EC-EX-027	2017/11/16	845	IK	-19	2017/11/16	VB+PS	LT
3K	25 / 26	INT 20	T	G+W	EC-EX-027	2017/11/16	848	IK	-19	2017/11/16	VB+PS	LT
3L	26 / 27	INT 20	T	G+W	EC-EX-027	2017/11/16	850	IK	-19	2017/11/16	VB+PS	LT
3M	27 / 28	INT 20	T	G+W	EC-EX-027	2017/11/16	852	IK	-19	2017/11/16	VB+PS	LT
3N	28 / 29	INT 20	T	G+W	EC-EX-027	2017/11/16	855	IK	-19	2017/11/16	VB+PS	LT
3O	20 / 21	INT 44	T	G+W	EC-EX-027	2017/11/16	859	IK	-19	2017/11/16	VB+PS	LT
3P	29 / 30	INT 20	T	G+W	EC-EX-027	2017/11/16	900	IK	-19	2017/11/16	VB+PS	LT
3Q	30 / 31	INT 20	T	G+W	EC-EX-027	2017/11/16	901	IK	-19	2017/11/16	VB+PS	LT
3R	31 / 32	INT 20	T	G+W	EC-EX-027	2017/11/16	902	IK	-19	2017/11/16	VB+PS	LT
3S	32 / 33	INT 20	T	G+W	EC-EX-027	2017/11/16	905	IK	-19	2017/11/16	VB+PS	LT
3T	18 / 20	INT 33	T	G+W	EC-EX-027	2017/11/16	906	IK	-19	2017/11/16	VB+PS	LT

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 3 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-027	2017/11/16	800	IK	-20	282	276	91	94	84	83	101	153	172	166	174	169	LT	
2	EC-EX-027	2017/11/18	900	IK	-27	282	276	102	99	107	100	101	174	173	172	171	168	LT	
3	EC-EX-027	2017/11/18	1300	IK	-27	282	276	90	98	98	93	98	175	173	174	186	172	LT	
4	EC-EX-027	2017/11/21	900	DH	-34	282	276	90	87	99	104	99	175	181	172	189	191	LT	
5	EC-EX-027	2017/11/21	1245	DH	-34	282	276	87	85	80	91	90	186	195	200	204	201	LT	
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
4A	33 / 35	INT 19 & 36	T	G+W	EC-EX-027	2017/11/16	920	IK	-19	2017/11/16	VB+PS	LT
4B	36 / 38	INT 19	T	G+W	EC-EX-027	2017/11/16	925	IK	-19	2017/11/16	VB+PS	LT
4C	37 / 38	INT 17 & 19	T	G+W	EC-EX-027	2017/11/16	930	IK	-19	2017/11/16	VB+PS	LT
4D	24 / 25	1m OF OF Weos	WR	P	EC-EX-027	2017/11/16	1100	IK	-19	2017/11/16	VB+PS	LT
4E	53 / 55	INT OF 54 & 56	T	P	EC-EX-027	2017/11/18	920	IK	-27	2017/11/18	VB+PS	LT
4F	54 / 56	INT IF 57	T	G+W	EC-EX-027	2017/11/18	940	IK	-27	2017/11/18	VB+PS	LT
4G	53 / 55	INT OF 58	T	G+W	EC-EX-027	2017/11/18	1000	IK	-27	2017/11/18	VB+PS	LT
4H	1 / 16	INT OF 49	T	G+W	EC-EX-027	2017/11/18	1350	IK	-27	2017/11/18	VB+PS	LT
4I	48 / 49	INT OF 16	T	G+W	EC-EX-027	2017/11/18	1400	IK	-27	2017/11/18	VB+PS	LT
4J	48 / 49	INT OF 50	T	G+W	EC-EX-027	2017/11/18	1410	IK	-27	2017/11/18	VB+PS	LT
4K	1 / 2	INT of 16 & 49	T	G+W	EC-EX-027	2017/11/21	1100	DH	-33	2017/11/21	VB+PS	LT
4L	2 / 3	INT of 49 & 50	T	G+W	EC-EX-027	2017/11/21	1105	DH	-33	2017/11/21	VB+PS	LT
4M	3 / 4	INT of 50 & 51	T	G+W	EC-EX-027	2017/11/21	1110	DH	-33	2017/11/21	VB+PS	LT
4N	4 / 7	INT of 51	T	G+W	EC-EX-027	2017/11/21	1112	DH	-33	2017/11/21	VB+PS	LT
4O	51 / 59	INT of 7	T	G+W	EC-EX-027	2017/11/21	1115	DH	-33	2017/11/21	VB+PS	LT
4P	7 / 8	INT of 59	T	G+W	EC-EX-027	2017/11/21	1120	DH	-33	2017/11/21	VB+PS	LT
4Q	59 / 62	INT of 8	T	G+W	EC-EX-027	2017/11/21	1125	DH	-33	2017/11/21	VB+PS	LT
4R	8 / 9	INT of 62	T	G+W	EC-EX-027	2017/11/21	1130	DH	-33	2017/11/21	VB+PS	LT
4S	9 / 15	INT of 15 & 89	T	G+W	EC-EX-027	2017/11/21	1145	DH	-33	2017/11/21	VB+PS	LT
4T	58 / 102	INT of 56 & 87	T	G+W	EC-EX-027	2017/11/21	1200	DH	-33	2017/11/21	VB+PS	LT

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 4 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-027	2017/11/21	900	DH	-34	282	276	90	87	99	104	99	175	181	172	189	191	LT	
2	EC-EX-027	2017/11/21	1245	DH	-34	282	276	87	85	80	91	90	186	195	200	204	201	LT	
3																			
4																			
5																			
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
5A	100 / 101	INT of 87	T	G+W	EC-EX-027	2017/11/21	1236	DH	-33	2017/11/21	VB+PS	LT
5B	86 / 87	INT of 101	T	G+W	EC-EX-027	2017/11/21	1240	DH	-33	2017/11/21	VB+PS	LT
5C	85 / 86	INT of 100	T	G+W	EC-EX-027	2017/11/21	1241	DH	-33	2017/11/21	VB+PS	LT
5D	99 / 100	INT of 85	T	G+W	EC-EX-027	2017/11/21	1244	DH	-33	2017/11/21	VB+PS	LT
5E	84 / 85	INT of 99	T	G+W	EC-EX-027	2017/11/21	1250	DH	-33	2017/11/21	VB+PS	LT
5F	98 / 99	INT of 84	T	G+W	EC-EX-027	2017/11/21	1300	DH	-33	2017/11/21	VB+PS	LT
5G	81 / 84	INT of 98	T	G+W	EC-EX-027	2017/11/21	1305	DH	-33	2017/11/21	VB+PS	LT
5H	97 / 98	INT of 81	T	G+W	EC-EX-027	2017/11/21	1310	DH	-33	2017/11/21	VB+PS	LT
5I	79 / 81	INT of 97	T	G+W	EC-EX-027	2017/11/21	1312	DH	-33	2017/11/21	VB+PS	LT
5J	96 / 97	INT of 79	T	G+W	EC-EX-027	2017/11/21	1315	DH	-33	2017/11/21	VB+PS	LT
5K	74 / 79	INT of 96	T	G+W	EC-EX-027	2017/11/21	1318	DH	-33	2017/11/21	VB+PS	LT
5L	95 / 96	INT of 74	T	G+W	EC-EX-027	2017/11/21	1321	DH	-33	2017/11/21	VB+PS	LT
5M	73 / 74	INT of 95	T	G+W	EC-EX-027	2017/11/21	1325	DH	-33	2017/11/21	VB+PS	LT
5N	94 / 95	INT of 73	T	G+W	EC-EX-027	2017/11/21	1330	DH	-33	2017/11/21	VB+PS	LT
5O	70 / 73	INT of 94	T	G+W	EC-EX-027	2017/11/21	1335	DH	-33	2017/11/21	VB+PS	LT
5P	93 / 94	INT of 70	T	G+W	EC-EX-027	2017/11/21	1345	DH	-33	2017/11/21	VB+PS	LT
5Q	69 / 70	INT of 93	T	G+W	EC-EX-027	2017/11/21	1350	DH	-33	2017/11/21	VB+PS	LT
5R	92 / 93	INT of 69	T	G+W	EC-EX-027	2017/11/21	1355	DH	-33	2017/11/21	VB+PS	LT
5S	66 / 69	INT of 92	T	G+W	EC-EX-027	2017/11/21	1400	DH	-33	2017/11/21	VB+PS	LT
5T	91 / 92	INT of 66	T	G+W	EC-EX-027	2017/11/21	1405	DH	-33	2017/11/21	VB+PS	LT

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 5 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-027	2017/11/18	900	IK	-27	282	276	102	99	107	100	101	174	173	172	171	168	LT	
2	EC-EX-027	2017/11/18	1300	IK	-27	282	276	90	98	98	93	98	175	173	174	186	172	LT	
3	EC-EX-027	2017/11/21	900	DH	-34	282	276	90	87	99	104	99	175	181	172	189	191	LT	
4	EC-EX-027	2017/11/21	1245	DH	-34	282	276	87	85	80	91	90	186	195	200	204	201	LT	
5	EC-EX-011	2017/11/24	930	MC	-31	282	276	141	123	86	89	84	145	176	183	147	185	LT	
6	EC-EX-027	2017/11/24	1000	DH	-31	282	276	82	127	80	86	90	168	175	170	173	167	LT	

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
6A	65 / 66	INT of 91	T	G+W	EC-EX-027	2017/11/21	1410	DH	-33	2017/11/21	VB+PS	LT
6B	90 / 91	INT of 65	T	G+W	EC-EX-027	2017/11/21	1415	DH	-33	2017/11/21	VB+PS	LT
6C	64 / 65	INT of 90	T	G+W	EC-EX-027	2017/11/21	1420	DH	-33	2017/11/21	VB+PS	LT
6D	63 / 64	INT of 86	T	G+W	EC-EX-027	2017/11/21	1422	DH	-33	2017/11/21	VB+PS	LT
6E	16 / 48	30M N of Seos	VR + DS	P	EC-EX-027	2017/11/18	1125	IK	-27	2017/11/21	VB+PS	LT
6F	50 / 52	50M N of Seos	DST	P	EC-EX-011	2017/11/24	1000	MC	-31	2017/11/25	VB+PS	LT
6G	68 / 71	51.1M N of Seos	DST	P	EC-EX-011	2017/11/24	1015	MC	-31	2017/11/25	VB+PS	LT
6H	76 / 78	INT of 80	DST+T	P	EC-EX-011	2017/11/24	1025	MC	-31	2017/11/25	VB+PS	LT
6I	83 / 84	INT of 85	DST+T	P	EC-EX-011	2017/11/24	1040	MC	-31	2017/11/25	VB+PS	LT
6J	51 / 59	INT 103	T	G+W	EC-EX-027	2017/11/28	1130	IK	-19	2017/11/28	VB+PS	LT
6K	51 / 59	INT 103	T	G+W	EC-EX-027	2017/11/28	1140	IK	-19	2017/11/28	VB+PS	LT
6L	51 / 59	INT of 104	T	G+W	EC-EX-027	2017/11/28	1000	IK	-19	2017/11/28	VB+PS	LT
6M	51 / 59	INT of 104	T	G+W	EC-EX-027	2017/11/28	1035	IK	-19	2017/11/28	VB+PS	LT
6N	52 / 59	INT of 105	T	G+W	EC-EX-027	2017/11/28	1015	IK	-19	2017/11/28	VB+PS	LT
6O	52 / 59	INT of 105	T	G+W	EC-EX-027	2017/11/28	1100	IK	-19	2017/11/28	VB+PS	LT
6P	52 / 59	INT of 106	T	G+W	EC-EX-027	2017/11/28	1115	IK	-19	2017/11/28	VB+PS	LT
6Q	106 / 107	INT of 52	T	G+W	EC-EX-027	2017/11/28	1201	IK	-19	2017/11/28	VB+PS	LT
6R	106 / 107	INT of 59	T	G+W	EC-EX-027	2017/11/28	1145	IK	-19	2017/11/28	VB+PS	LT
6S	52 / 59	INT of 107	T	G+W	EC-EX-027	2017/11/28	1130	IK	-19	2017/11/28	VB+PS	LT
6T	51 / 52	INT of 59	T	G+W	EC-EX-027	2017/11/28	1035	IK	-19	2017/11/28	VB+PS	LT

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 6 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-027	2017/11/28	900	IK	-19	282	276	99	91	90	91	94	157	162	159	173	174	LT	
2																			
3																			
4																			
5																			
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
A	/											
B	/											
C	/											
D	/											
E	/											
F	/											
G	/											
H	/											
I	/											
J	/											
K	/											
L	/											
M	/											
N	/											
O	/											
P	/											
Q	/											
R	/											
S	/											
T	/											

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 7 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-011	2017/11/24	930	MC	-31	282	276	141	123	86	89	84	145	176	183	147	185	LT	
2	EC-EX-027	2017/11/24	1000	DH	-31	282	276	82	127	80	86	90	168	175	170	173	167	LT	
3	EC-EX-027	2017/11/26	830	JH	-23	282	276	104	94	113	95	101	187	201	183	204	190	LT	
4	EC-EX-027	2017/11/28	900	IK	-19	282	276	99	91	90	91	94	157	162	159	173	174	LT	
5																			
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
7A	51 / 52	INT of 50	T	G+W	EC-EX-027	2017/11/28	1038	IK	-19	2017/11/28	VB+PS	LT
7B	59 / 60	INT of 52	T	G+W	EC-EX-027	2017/11/28	1205	IK	-19	2017/11/28	VB+PS	LT
7C	59 / 60	INT of 61	T	G+W	EC-EX-011	2017/11/24	1000	MC	-31	2017/11/28	VB+PS	LT
7D	61 / 62	INT of 59	T	G+W	EC-EX-027	2017/11/26	900	JH	-29	2017/11/28	VB+PS	LT
7E	61 / 62	INT of 63	T	G+W	EC-EX-027	2017/11/26	905	JH	-29	2017/11/28	VB+PS	LT
7F	66 / 67	INT of 65	T	G+W	EC-EX-027	2017/11/26	915	JH	-29	2017/11/28	VB+PS	LT
7G	66 / 67	INT of 69	T	G+W	EC-EX-027	2017/11/26	915	JH	-29	2017/11/28	VB+PS	LT
7H	68 / 69	INT of 67	T	G+W	EC-EX-027	2017/11/26	920	JH	-29	2017/11/28	VB+PS	LT
7I	68 / 69	INT of 71	T	G+W	EC-EX-027	2017/11/26	923	JH	-29	2017/11/28	VB+PS	LT
7J	71 / 72	INT of 69	T	G+W	EC-EX-027	2017/11/26	930	JH	-29	2017/11/28	VB+PS	LT
7K	71 / 72	INT of 73	T	G+W	EC-EX-027	2017/11/26	934	JH	-29	2017/11/28	VB+PS	LT
7L	70 / 72	INT of 69	T	G+W	EC-EX-027	2017/11/26	940	JH	-29	2017/11/28	VB+PS	LT
7M	70 / 72	INT of 73	T	G+W	EC-EX-027	2017/11/26	940	JH	-29	2017/11/28	VB+PS	LT
7N	74 / 75	INT of 73	T	G+W	EC-EX-027	2017/11/26	1020	JH	-29	2017/11/28	VB+PS	LT
7O	74 / 75	INT of 79	T	G+W	EC-EX-027	2017/11/26	1022	JH	-29	2017/11/28	VB+PS	LT
7P	78 / 79	INT of 75	T	G+W	EC-EX-027	2017/11/26	1030	JH	-29	2017/11/28	VB+PS	LT
7Q	78 / 79	INT of 80	T	G+W	EC-EX-027	2017/11/26	1043	JH	-29	2017/11/28	VB+PS	LT
7R	76 / 78	INT of 75	T	G+W	EC-EX-027	2017/11/26	1045	JH	-29	2017/11/28	VB+PS	LT
7S	56 / 57	INT of 83 & 87	T	P	EC-EX-027	2017/11/24	1100	DH	-31	2017/11/28	VB+PS	LT
7T	77 / 80	INT of 76	T	G+W	EC-EX-011	2017/11/24	1100	MC	-31	2017/11/28	VB+PS	LT

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 8 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE VGC Eagle Gold Collection Pond

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-011	2017/11/24	930	MC	-31	282	276	141	123	86	89	84	145	176	183	147	185	LT	
2	EC-EX-027	2017/11/24	1000	DH	-31	282	276	82	127	80	86	90	168	175	170	173	167	LT	
3																			
4																			
5																			
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
8A	77 / 80	INT of 83	T	G+W	EC-EX-011	2017/11/24	1120	MC	-31	2017/11/28	VB+PS	LT
8B	53 / 88	INT of 77	T	G+W	EC-EX-011	2017/11/24	1130	MC	-31	2017/11/28	VB+PS	LT
8C	53 / 88	INT of 57	T	G+W	EC-EX-011	2017/11/24	1115	MC	-31	2017/11/28	VB+PS	LT
8D	82 / 84	INT of 80	T	G+W	EC-EX-027	2017/11/24	1100	DH	-31	2017/11/28	VB+PS	LT
8E	82 / 84	INT of 87	T	G+W	EC-EX-027	2017/11/24	1105	DH	-31	2017/11/28	VB+PS	LT
8F	85 / 86	INT of 87	T	G+W	EC-EX-027	2017/11/24	1130	DH	-31	2017/11/28	VB+PS	LT
8G	80 / 81	INT of 79	T	G+W	EC-EX-027	2017/11/24	1130	DH	-31	2017/11/28	VB+PS	LT
8H	80 / 81	INT of 84	T	G+W	EC-EX-027	2017/11/24	1145	DH	-31	2017/11/28	VB+PS	LT
8I	82 / 83	INT of 80	T	G+W	EC-EX-011	2017/11/24	1125	MC	-31	2017/11/28	VB+PS	LT
8J	57 / 82	INT of 88	T	G+W	EC-EX-011	2017/11/24	1117	MC	-31	2017/11/28	VB+PS	LT
	/											
	/											
	/											
	/											
	/											
	/											
	/											
	/											
	/											
	/											

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 9 of 9

GEOMEMBRANE DETAIL & TEST LOG

PROJECT NUMBER CT000904 AREA / LAYER Primary

PROJECT TITLE Victoria Gold Corporation Spillway

TRIAL SEAMS

#	MACHINE NUMBER	DATE YYYY-MM-DD	TIME	WELD TECH	AIR TEMP °C	PREHEAT TEMP °C	EXTRUDER TEMP °C	PEEL (PPI)					SHEAR (PPI)					CHK'D BY	REMARKS
1	EC-EX-027	2017/11/26	1700	MC	-22	276	279	109	99	101	105	104	156	161	168	159	160	LT	
2																			
3																			
4																			
5																			
6																			

DETAIL CODE	PANEL NUMBER(S)	LOCATION DESCRIPTION	DETAIL TYPE	REPAIR TYPE	MACHINE NUMBER	REPAIR DATE YYYY-MM-DD	START TIME	WELD TECH	AIR TEMP °C	TEST DATE YYYY-MM-DD	TEST METH.	QC TECH
1A	1 / 2	INT 3	T	G&W	EC-EX-027	2017/11/26	1720	MC	-22	2017/11/26	PS	CM
1B	6 / 7	INT 5	T	G&W	EC-EX-027	2017/11/26	1725	MC	-22	2017/11/26	PS	CM
1C	3 / 4	INT 9	T	G&W	EC-EX-027	2017/11/26	1730	MC	-22	2017/11/26	PS	CM
1D	5 / 7	5m NW of SEEOS	IO	P	EC-EX-027	2017/11/26	1740	MC	-22	2017/11/26	PS	CM
1E	9 / 10	9m NW of SEEOS	IO	G&W	EC-EX-027	2017/11/26	1745	MC	-22	2017/11/26	PS	CM
1F	10 / 11	INT 9	T	G&W	EC-EX-027	2017/11/26	1750	MC	-22	2017/11/26	PS	CM
1G	9 / 11	5m NW of SEEOS	IO	G&W	EC-EX-027	2017/11/26	1755	MC	-22	2017/11/26	PS	CM
1H	8 / 9	INT 12	T	G&W	EC-EX-027	2017/11/26	1800	MC	-22	2017/11/26	PS	CM
1I	9 / 10	INT 12	T	G&W	EC-EX-027	2017/11/26	1810	MC	-22	2017/11/26	PS	CM
1J	2 / 3	INT 8	T	G&W	EC-EX-027	2017/11/26	1815	MC	-22	2017/11/26	PS	CM
1K	9 / 10	INT 10	T	G&W	EC-EX-027	2017/11/26	1819	MC	-22	2017/11/26	PS	CM
1L	4 / 5	INT 10	T	G&W	EC-EX-027	2017/11/26	1830	MC	-22	2017/11/26	PS	CM
1M	5 / 7	INT 10	T	G&W	EC-EX-027	2017/11/26	1835	MC	-22	2017/11/26	PS	CM
1N	8 / 9	INT 3	T	G&W	EC-EX-027	2017/11/26	1840	MC	-22	2017/11/26	PS	CM
1O	1 / 3	INT Collection Pond 36	T	G&W	EC-EX-027	2017/11/26	1850	MC	-22	2017/11/26	PS	CM
1P	3 / 4	INT Collection Pond 35	T	G&W	EC-EX-027	2017/11/26	1855	MC	-22	2017/11/26	PS	CM
1Q	4 / 5	INT Collection Pond 35	T	G&W	EC-EX-027	2017/11/26	1900	MC	-22	2017/11/26	PS	CM
1R	5 / 6	INT Collection Pond 34	T	G&W	EC-EX-027	2017/11/26	1905	MC	-22	2017/11/26	PS	CM
1S	/											
1T	/											

DETAIL TYPE:

AD - ANIMAL DAMAGE	DS-# - DESTRUCT SAMPLE NUMBER	IO - INSUFFICIENT OVERLAP	T - THREE PANEL INTERSECTION
ATL - AIR TEST LEAK	EE - EARTHWORK EQUIPMENT DAMAGE	MD - MANUFACTURER/DELIVERY DAMAGE	VL - VACUUM TEST LEAK
BO - FUSION WELDER BURN	EXT - EXTENSION	P - PENETRATION	WR - WRINKLE
CR - CREASE	FM - FISHMOUTH	PT - PRESSURE TEST CUT	WS - WELDER RESTART
D - INSTALLATION DAMAGE	FS - FAILED SEAM LENGTH	SI - SOIL SURFACE IRREGULARITY	OTHER:

TEST METHOD:

AL - AIR LANCE	VB - VAC BOX
PS - POINT STRESS	ST - SPARK TEST

REPAIR TYPE:

G&W - GRIND & WELD	B - BOOT	P - PATCH
RS - RECONSTRUCTED SEAM	C - CAP	S - SKIRT
HAW - HOT AIR WELD		

REMARKS

QC TECH Lance Tourett

SUPERVISOR Chad Messervey

SUBMISSION DATE December 4 2017

SHEET NUMBER 1 of 1

GEOMEMBRANE DESTRUCT LOG

PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond
AREA / LAYER Primary
3RD PARTY N/A
ARCHIVE LAYFIELD ☑ OWNER ☑ ENGINEER ☑

DESTRUCT SAMPLE NUMBER	TYPE OF SEAM	PANEL NUMBERS	TEST DATE YYYY-MM-DD	TEST TEMP °C	INITIALS			INSIDE PEEL STRENGTH (PPI)					OUTSIDE PEEL STRENGTH (PPI)					SHEAR STRENGTH (PPI)				
SAMPLE LOCATION					3RD PARTY PRESENT	LAYFIELD PASS	3RD PARTY LAB PASS	LOCUS OF BREAK					LOCUS OF BREAK					LOCUS OF BREAK				
DS-1	SPF	5/7	2017/11/14	21	N/A	PASS	N/A	122	118	121	124	123	141	138	125	127	119	175	175	178	177	183
0.4m SE OF 4,5 INT 7								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
DS-2	SPF	23/24	2017/11/16	21	N/A	PASS	N/A	121	136	124	140	136	117	126	110	118	110	189	171	168	158	161
Weos AT Cutoff								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
DS-3	SPF	40/41	2017/11/16	21	N/A	PASS	N/A	124	137	122	138	126	129	112	113	108	115	184	171	176	168	172
Seos AT Cutoff								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
DS-4	SPF	16/48	2017/11/24	21	N/A	PASS	N/A	128	124	143	137	140	121	126	120	129	125	181	180	175	182	176
31m N of Seos								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
DS-5	SPF	52/60	2017/11/27	21	N/A	PASS	N/A	157	131	158	147	149	114	122	117	125	127	171	165	172	166	171
30M N of Seos								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
DS-6	SPF	64/64	2017/11/27	21	N/A	PASS	N/A	112	111	111	117	102	111	104	100	109	100	143	152	161	172	169
Seos AT Cutoff								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
DS-7	SPF	68/71	2017/11/24	21	N/A	PASS	N/A	113	125	128	109	127	122	118	118	134	115	170	171	166	172	170
15M N of Seos								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
DS-8	SPF	83/84	2017/11/24	21	N/A	PASS	N/A	141	144	136	137	123	132	121	124	131	137	174	177	179	181	177
0.4 M N of Seos								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1

TYPE OF SEAM:
SPF - SPLIT FUSION SOF - SOLID FUSION SLV - SOLVENT
EXT - EXTRUSION HAF - HOT AIR FUSION

QC TECH Lance Tourett
SUBMITTED BY Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 1 of 2

GEOMEMBRANE DESTRUCT LOG

LAYFIELD

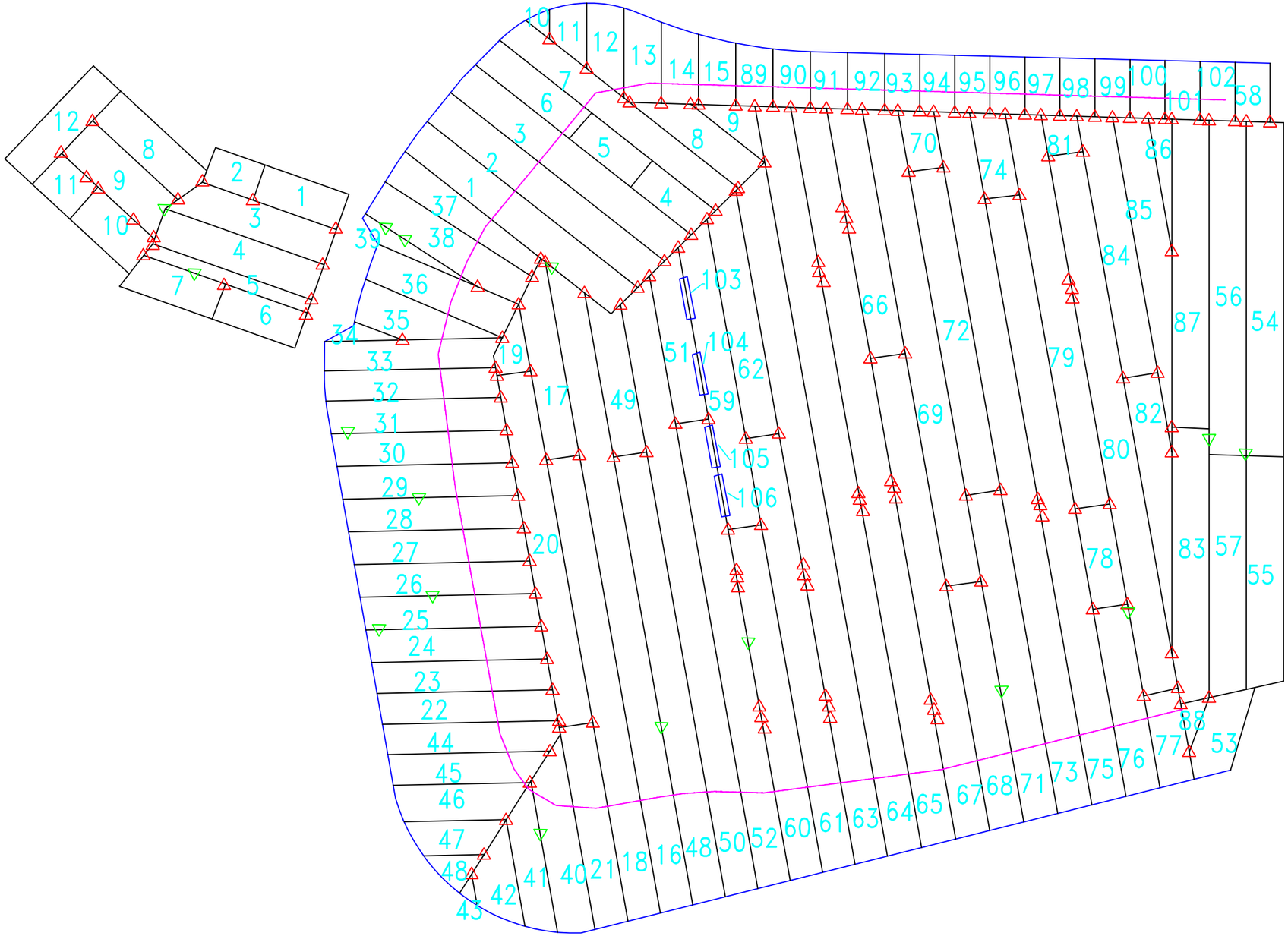
PROJECT NUMBER CT000904
PROJECT TITLE VGC Eagle Gold Collection Pond

AREA / LAYER Primary
3RD PARTY N/A
ARCHIVE LAYFIELD ☑ OWNER ☑ ENGINEER ☑

DESTRUCT SAMPLE NUMBER / SAMPLE LOCATION	TYPE OF SEAM	PANEL NUMBERS	TEST DATE YYYY-MM-DD	TEST TEMP °C	INITIALS: 3RD PARTY PRESENT	INITIALS: LAYFIELD PASS	INITIALS: 3RD PARTY LAB PASS	INSIDE PEEL STRENGTH (PPI) / LOCUS OF BREAK					OUTSIDE PEEL STRENGTH (PPI) / LOCUS OF BREAK					SHEAR STRENGTH (PPI) / LOCUS OF BREAK				
DS-9	SPF	76/80	2017/11/27	21	N/A	PASS	N/A	149	124	127	116	109	116	127	149	127	116	154	159	167	171	176
INT of 78								SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1
DS-																						
DS-																						
DS-																						
DS-																						
DS-																						
DS-																						
DS-																						

TYPE OF SEAM: SPF - SPLIT FUSION SOF - SOLID FUSION SLV - SOLVENT
EXT - EXTRUSION HAF - HOT AIR FUSION

QC TECH Lance Tourett
SUBMITTED BY Chad Messervey
SUBMISSION DATE December 4 2017
SHEET NUMBER 2 of 2



NOTES

LAYFIELD CANADA LTD.

STRATAGOLD CORPORATION
EAGLE GOLD- CONTROL POND
60MIL HDPE TEX-2
AS BUILT DRAWING
MAYO, YT

Quote No.	PROJECT No.
P10201	CT000904

DWG: 1 OF 1		SCALE: N.T.S.
DWN: CM	CHKD: SR	APP'D: SR
DATE: 12/20/17	REVISION: A	

B-SIZE

CONTROL POND & SPILLWAY - AS BUILT DWG

ANSI B Size Page (Horizontal)

LAYFIELD
ENVIRONMENTAL CONTAINMENT

CERTIFICATE OF FINAL INSPECTION AND ACCEPTANCE

PROJECT NAME: VGC Eagle Gold Collection Pond.
PROJECT NUMBER: CT000904 **DATE:** 11/14/17
OWNER: Victoria Gold Corporation
LOCATION: VGC Eagle Gold Mine, YT

Scope of Installation(s): THE WORK
Area/Layer: Primary (2293m²) Area Inspected: ☑ Partial or ☐ Complete
Dimensions: Layfield has completed Geomembrane Containment Liner Placement. in Seq 7 and 8 Installation consists of LP12 underlay, 1.0PE Tex-2 Extreme rough texture Liner and LP12 overlay. QC Testing completed. Work scope completed.

Part 1 – LAYFIELD CANADA LTD.

I, Chad Messervey, a duly appointed representative of Layfield Canada Ltd. (Layfield), have visually observed the installations (as outlined above), and have found the Work to be complete and free of defects and declare that the Work was completed in accordance with the project specifications, Layfield's QC program and the terms and conditions of the contract.

Layfield Representative:
Name: Chad Messervey
Title: Project Supervisor
Date: 11/14/17 **Signature:**

Part 2 – OWNER (or Representative)

I, Arvin Hinklater, a duly appointed representative of Tetra Tech, do hereby accept and receive the installation(s) described above, and confirm that the work has been completed in accordance with the project specifications and the terms and conditions of the contract.

I have evaluated and measured the work together with the Layfield representative, and agree that the measurements shown are both true and correct, and that the installation has met our approval.

Owners Representative:
Name: Arvin Hinklater
Title: QA/QC Rep
Company: Tetra Tech
Date: 11/14/17 **Signature:**

Comments: 2 Penetrations Completed in Seq 1

LAYFIELD
ENVIRONMENTAL CONTAINMENT

CERTIFICATE OF FINAL INSPECTION AND ACCEPTANCE

PROJECT NAME: VGC Eagle Gold Mine Collection Pond & Spillway
PROJECT NUMBER: CT000904 **DATE:** 11/28/17
OWNER: Victoria Gold Corporation
LOCATION: VGC Eagle Gold Mine YT

Scope of Installation(s): THE WORK
Area/Layer: Primary Area Inspected: ☐ Partial or ☑ Complete
Dimensions: Collection Pond 26062m2, Spill way 1864m2. Area includes Seq 1 & 8.
Layfield has completed its scope of work on the Collection Pond & Spill way

Part 1 – LAYFIELD CANADA LTD.

I, Chad Messervey, a duly appointed representative of Layfield Canada Ltd. (Layfield), have visually observed the installations (as outlined above), and have found the Work to be complete and free of defects and declare that the Work was completed in accordance with the project specifications, Layfield's QC program and the terms and conditions of the contract.

Layfield Representative:
Name: Chad Messervey
Title: Project Supervisor
Date: 11/28/17 **Signature:**

Part 2 – OWNER (or Representative)

I, CHRIS COPLEY, a duly appointed representative of JDS ENERGY & MINING, do hereby accept and receive the installation(s) described above, and confirm that the work has been completed in accordance with the project specifications and the terms and conditions of the contract.

I have evaluated and measured the work together with the Layfield representative, and agree that the measurements shown are both true and correct, and that the installation has met our approval.

Owners Representative:
Name: CHRIS COPLEY
Title: PROJECT MANAGER
Company: JDS ENERGY & MINING
Date: 7-DEC-2017 **Signature:**

Comments: Destructive Samples were taken every 500m as per Specs, Confirmed By Client.

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006196		
Start Date	9/12/2017	**Customer Name**	9/12/2017
Req Delivery Date	9/12/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	42
		Qty Manufactured	31045.163 FT

Inspection #	27475	**Job**	E0006196	**Status**	Active	**Result**	Undetermined
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/6/2017	**Completion Date**	
Notes							

Serial	Result	Roll Length ft	Roll Weight - Net lbs	Sheet Width (270 in +/- 2 in)	Roll Area m2	Thickness - Average ASTM D5994 (57 mil to 63 mil)	Thickness - Minimum ASTM D5994 (54 mil to 66 mil)
607270060-E0006196-001	Pass	540	4141	271.00	1128.76254180602	60.24	58.6
607270060-E0006196-004	Pass	540	4131	270.25	1128.76254180602	61.52	60.3
607270060-E0006196-005	Pass	540	4106	270.00	1128.76254180602	61.75	59.6
607270060-E0006196-007	Pass	540	4036	270.25	1128.76254180602	60.42	57.6
607270060-E0006196-008	Pass	540	4026	271.00	1128.76254180602	59.97	57.5
607270060-E0006196-009	Pass	540	4041	270.75	1128.76254180602	60.4	58.3
607270060-E0006196-010	Pass	540	4041	270.75	1128.76254180602	60.43	57.4
607270060-E0006196-013	Pass	540	4046	270.50	1128.76254180602	60.21	57.4
607270060-E0006196-014	Pass	540	4051	270.50	1128.76254180602	60.8	59.2
607270060-E0006196-017	Pass	540	4041	269.00	1128.76254180602	59.83	57.4
607270060-E0006196-018	Pass	540	4036	269.25	1128.76254180602	59.61	57.2
607270060-E0006196-020	Pass	540	4031	270.50	1128.76254180602	59.75	57.2
607270060-E0006196-021	Pass	540	4031	270.75	1128.76254180602	60.58	58.3
607270060-E0006196-022	Pass	540	4026	271.00	1128.76254180602	60.25	57.4
607270060-E0006196-023	Pass	540	4041	270.75	1128.76254180602	60.1	57.3
607270060-E0006196-024	Pass	540	4051	270.50	1128.76254180602	60.22	57.4
607270060-E0006196-025	Pass	540	4051	270.50	1128.76254180602	60.23	57.3

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006196		
Start Date	9/12/2017	**Customer Name**	9/12/2017
Req Delivery Date	9/12/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	42
		Qty Manufactured	31045.163 FT

Inspection #	27475	**Job**	E0006196	**Status**	Active	**Result**	Undetermined
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/6/2017	**Completion Date**	
Notes							

Serial	Asperity - Printed Average ASTM D7466 (18 mil to 30 mil)	Asperity - Unprinted Average ASTM D7466 (18 mil to 30 mil)	Strength at Yield - MD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)	Elongation at Yield - MD Average ASTM D6693 IV (12 % to 20 %)	Strength at Break - MD Average ASTM D6693 IV (90 lbs/in to 250 lbs/in)	Elongation at Break MD Average ASTM D6693 IV (250 % to 1000 %)	Strength at Yield - TD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)
607270060-E0006196-001	20.75	23.35	182.5	16	212.4	520.6	170.86
607270060-E0006196-004	20	19.95	182.5	16	212.4	520.6	170.86
607270060-E0006196-005	19.7	20.35	182.5	16	212.4	520.6	170.86
607270060-E0006196-007	19.85	20.1	157.14	18.2	212.24	571	163.54
607270060-E0006196-008	19.75	23.4	157.14	18.2	212.24	571	163.54
607270060-E0006196-009	19.9	20.35	157.14	18.2	212.24	571	163.54
607270060-E0006196-010	22.05	18.65	157.14	18.2	212.24	571	163.54
607270060-E0006196-013	21.9	21.85	175.98	16.6	206.36	488.8	177.44
607270060-E0006196-014	25.45	22.41	175.98	16.6	206.36	488.8	177.44
607270060-E0006196-017	20.4	20	158.1	17.2	188.68	499.4	170
607270060-E0006196-018	21.35	18.8	158.1	17.2	188.68	499.4	170
607270060-E0006196-020	19.25	18.3	158.1	17.2	188.68	499.4	170
607270060-E0006196-021	23.6	20.85	169.8	15.8	197.96	486	179.74
607270060-E0006196-022	24.65	20.8	169.8	15.8	197.96	486	179.74
607270060-E0006196-023	24.6	20.85	169.8	15.8	197.96	486	179.74
607270060-E0006196-024	23.85	21.55	169.8	15.8	197.96	486	179.74
607270060-E0006196-025	23	22.6	169.8	15.8	197.96	486	179.74

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006196		
Start Date	9/12/2017	**Customer Name**	9/12/2017
Req Delivery Date	9/12/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	42
		Qty Manufactured	31045.163 FT

Inspection #	27475	**Job**	E0006196	**Status**	Active	**Result**	Undetermined
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/6/2017	**Completion Date**	
Notes							

Serial	Elongation at Yield TD Average ASTM D6693 IV (12 % to 20 %)	Strength at Break - TD Average ASTM D6693 IV (90 lbs/in to 250 lbs/in)	Elongation at Break TD Average ASTM D6693 IV (250 % to 1000 %)	Tear Strength - MD Average ASTM D1004 (42 lbs to 80 lbs)	Tear Strength - TD Average ASTM D1004 (42 lbs to 80 lbs)	Puncture Strength - Average ASTM D4833 (90 lbs to 175 lbs)	Carbon Black Content ASTM D4218 (2 % to 3 %)
607270060-E0006196-001	17	222.8	518	56.4	58.4	122	2.70
607270060-E0006196-004	17	222.8	518	56.4	58.4	122	2.70
607270060-E0006196-005	17	222.8	518	56.4	58.4	122	2.70
607270060-E0006196-007	18	224.1	610.8	56.4	58.4	122	2.70
607270060-E0006196-008	18	224.1	610.8	56.4	58.4	122	2.70
607270060-E0006196-009	18	224.1	610.8	56.4	58.4	122	2.70
607270060-E0006196-010	18	224.1	610.8	56.4	58.4	122	2.70
607270060-E0006196-013	14.8	230.02	574.6	59	60.2	125.2	2.79
607270060-E0006196-014	14.8	230.02	574.6	59	60.2	125.2	2.79
607270060-E0006196-017	16.6	191.74	500.6	59	60.2	125.2	2.46
607270060-E0006196-018	16.6	191.74	500.6	59	60.2	125.2	2.46
607270060-E0006196-020	16.6	191.74	500.6	59	60.2	125.2	2.46
607270060-E0006196-021	16.4	196.1	444.4	57	58.8	126.8	2.38
607270060-E0006196-022	16.4	196.1	444.4	57	58.8	126.8	2.38
607270060-E0006196-023	16.4	196.1	444.4	57	58.8	126.8	2.38
607270060-E0006196-024	16.4	196.1	444.4	57	58.8	126.8	2.38
607270060-E0006196-025	16.4	196.1	444.4	57	58.8	126.8	2.38

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006196		
Start Date	9/12/2017	**Customer Name**	9/12/2017
Req Delivery Date	9/12/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	42
		Qty Manufactured	31045.163 FT

Inspection #	27475	**Job**	E0006196	**Status**	Active	**Result**	Undetermined
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/6/2017	**Completion Date**	
Notes							

Serial	Density ASTM D1505 (0.94 g/cc to 0.96 g/cc)	Carbon Black Dispersion ASTM D5596	OIT - High Pressure ASTM D5885
607270060-E0006196-001	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-004	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-005	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-007	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-008	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-009	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-010	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-013	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-014	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-017	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-018	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-020	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-021	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-022	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-023	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-024	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0006196-025	0.946	>= 9 in Category 1 or 2	Pass > 400 mins

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006196		
Start Date	9/12/2017	**Customer Name**	9/12/2017
Req Delivery Date	9/12/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	42
		Qty Manufactured	31045.163 FT

Inspection #	27475	**Job**	E0006196	**Status**	Active	**Result**	Undetermined
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/6/2017	**Completion Date**	
Notes							

Serial	Result	Roll Length ft	Roll Weight - Net lbs	Sheet Width (270 in +/- 2 in)	Roll Area m2	Thickness - Average ASTM D5994 (57 mil to 63 mil)	Thickness - Minimum ASTM D5994 (54 mil to 66 mil)
607270060-E0006196-026	Pass	540	4046	270.50	1128.76254180602	60.72	58.3
607270060-e0006196-027	Pass	540	4041	270.75	1128.76254180602	60.29	54.9

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006196		
Start Date	9/12/2017	**Customer Name**	9/12/2017
Req Delivery Date	9/12/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	42
		Qty Manufactured	31045.163 FT

Inspection #	27475	**Job**	E0006196	**Status**	Active	**Result**	Undetermined
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/6/2017	**Completion Date**	
Notes							

Serial	Asperity - Printed Average ASTM D7466 (18 mil to 30 mil)	Asperity - Unprinted Average ASTM D7466 (18 mil to 30 mil)	Strength at Yield - MD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)	Elongation at Yield - MD Average ASTM D6693 IV (12 % to 20 %)	Strength at Break - MD Average ASTM D6693 IV (90 lbs/in to 250 lbs/in)	Elongation at Break MD Average ASTM D6693 IV (250 % to 1000 %)	Strength at Yield - TD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)
607270060-E0006196-026	24.5	20.85	177.44	16.2	203.96	486.2	185.66
607270060-e0006196-027	18.55	21.85	177.44	16.2	203.96	486.2	185.66

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006196		
Start Date	9/12/2017	**Customer Name**	9/12/2017
Req Delivery Date	9/12/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	42
		Qty Manufactured	31045.163 FT

Inspection #	27475	**Job**	E0006196	**Status**	Active	**Result**	Undetermined
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/6/2017	**Completion Date**	
Notes							

Serial	Elongation at Yield TD Average ASTM D6693 IV (12 % to 20 %)	Strength at Break - TD Average ASTM D6693 IV (90 lbs/in to 250 lbs/in)	Elongation at Break TD Average ASTM D6693 IV (250 % to 1000 %)	Tear Strength - MD Average ASTM D1004 (42 lbs to 80 lbs)	Tear Strength - TD Average ASTM D1004 (42 lbs to 80 lbs)	Puncture Strength - Average ASTM D4833 (90 lbs to 175 lbs)	Carbon Black Content ASTM D4218 (2 % to 3 %)
607270060-E0006196-026	16.4	206.72	464.8	57	58.8	126.8	2.48
607270060-e0006196-027	16.4	206.72	464.8	57	58.8	126.8	2.48

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006196		
Start Date	9/12/2017	**Customer Name**	9/12/2017
Req Delivery Date	9/12/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	42
		Qty Manufactured	31045.163 FT

Inspection #	27475	**Job**	E0006196	**Status**	Active	**Result**	Undetermined
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/6/2017	**Completion Date**	
Notes							

Serial	Density ASTM D1505 (0.94 g/cc to 0.96 g/cc)	Carbon Black Dispersion ASTM D5596	OIT - High Pressure ASTM D5885
607270060-E0006196-026	0.946	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-e0006196-027	0.946	>= 9 in Category 1 or 2	Pass > 400 mins

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006197		
Start Date	9/13/2017	**Customer Name**	9/13/2017
Req Delivery Date	9/13/2017	**Job Description**	HDPE 270"X540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	41
		Qty Manufactured	2892.978 FT

Inspection #	27533	**Job**	E0006197	**Status**	Active	**Result**	Pass
Stock Code	607X270060	HDPE 270"X540' 60MIL SE TEX-2		**Inspection Date**	9/14/2017	**Completion Date**	
Notes							

Serial	Result	Roll Length (540 ft +/- 0 ft)	Roll Weight - Net lbs	Sheet Width (270 in +/- 2 in)	Roll Area m2	Thickness - Average ASTM D5994 (57 mil to 63 mil)	Thickness - Minimum ASTM D5994 (56 mil to 66 mil)
607x270060-e0006197-002	Pass	540	4331	269.75	1128.76254180602	59.66	57
607x270060-e0006197-003	Pass	540	4341	269.75	1128.76254180602	59.03	56.4

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006197		
Start Date	9/13/2017	**Customer Name**	9/13/2017
Req Delivery Date	9/13/2017	**Job Description**	HDPE 270"X540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	41
		Qty Manufactured	2892.978 FT

Inspection #	27533	**Job**	E0006197	**Status**	Active	**Result**	Pass
Stock Code	607X270060	HDPE 270"X540' 60MIL SE TEX-2		**Inspection Date**	9/14/2017	**Completion Date**	
Notes							

Serial	Asperity - Printed Average ASTM D7466 (28 mil to 35 mil)	Asperity - Unprinted Average ASTM D7466 (28 mil to 35 mil)	Strength at Yield - MD Average ASTM D6693 IV (135 lbs/in to 200 lbs/in)	Elongation at Yield - MD Average ASTM D6693 IV (13 % to 20 %)	Strength at Break - MD Average ASTM D6693 IV (135 lbs/in to 250 lbs/in)	Elongation at Break MD Average ASTM D6693 IV (150 % to 800 %)	Strength at Yield - TD Average ASTM D6693 IV (135 lbs/in to 200 lbs/in)
607x270060-e0006197-002	34.2	32.2	169.72	15.8	176.24	333	170.24
607x270060-e0006197-003	34.6	30.1	169.72	15.8	176.24	333	170.24

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006197		
Start Date	9/13/2017	**Customer Name**	9/13/2017
Req Delivery Date	9/13/2017	**Job Description**	HDPE 270"X540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	41
		Qty Manufactured	2892.978 FT

Inspection #	27533	**Job**	E0006197	**Status**	Active	**Result**	Pass
Stock Code	607X270060	HDPE 270"X540' 60MIL SE TEX-2		**Inspection Date**	9/14/2017	**Completion Date**	
Notes							

Serial	Elongation at Yield TD Average ASTM D6693 IV (13 % to 20 %)	Strength at Break - TD Average ASTM D6693 IV (135 lbs/in to 250 lbs/in)	Elongation at Break TD Average ASTM D6693 IV (150 % to 800 %)	Tear Strength - MD Average ASTM D1004 (45 lbs to 80 lbs)	Tear Strength - TD Average ASTM D1004 (45 lbs to 80 lbs)	Puncture Strength - Average ASTM D4833 (121 lbs to 175 lbs)	Carbon Black Content ASTM D4218 (2 % to 3 %)
607x270060-e0006197-002	14.8	170.5	247	55	58.2	128.2	2.82
607x270060-e0006197-003	14.8	170.5	247	55	58.2	128.2	2.82

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006197		
Start Date	9/13/2017	**Customer Name**	9/13/2017
Req Delivery Date	9/13/2017	**Job Description**	HDPE 270"X540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	41
		Qty Manufactured	2892.978 FT

Inspection #	27533	**Job**	E0006197	**Status**	Active	**Result**	Pass
Stock Code	607X270060	HDPE 270"X540' 60MIL SE TEX-2		**Inspection Date**	9/14/2017	**Completion Date**	
Notes							

Serial	Density ASTM D1505 (0.94 g/cc to 0.96 g/cc)	Carbon Black Dispersion ASTM D5596	OIT - High Pressure ASTM D5885
607x270060-e0006197-002	0.945	>= 9 in Category 1 or 2	Pass > 400 mins
607x270060-e0006197-003	0.945	>= 9 in Category 1 or 2	Pass > 400 mins

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006197		
Start Date	9/13/2017	**Customer Name**	9/13/2017
Req Delivery Date	9/13/2017	**Job Description**	HDPE 270"X540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	41
		Qty Manufactured	2892.978 FT

Inspection #	27533	**Job**	E0006197	**Status**	Active	**Result**	Pass
Stock Code	607X270060	HDPE 270"X540' 60MIL SE TEX-2		**Inspection Date**	9/14/2017	**Completion Date**	
Notes							

Serial	Result	Roll Length (540 ft +/- 0 ft)	Roll Weight - Net lbs	Sheet Width (270 in +/- 2 in)	Roll Area m2	Thickness - Average ASTM D5994 (57 mil to 63 mil)	Thickness - Minimum ASTM D5994 (56 mil to 66 mil)
607x270060-e0006197-001	Pass	380	2406	270.25	794.314381270903	60.16	56

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006197		
Start Date	9/13/2017	**Customer Name**	9/13/2017
Req Delivery Date	9/13/2017	**Job Description**	HDPE 270"X540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	41
		Qty Manufactured	2892.978 FT

Inspection #	27533	**Job**	E0006197	**Status**	Active	**Result**	Pass
Stock Code	607X270060	HDPE 270"X540' 60MIL SE TEX-2		**Inspection Date**	9/14/2017	**Completion Date**	
Notes							

Serial	Asperity - Printed Average ASTM D7466 (28 mil to 35 mil)	Asperity - Unprinted Average ASTM D7466 (28 mil to 35 mil)	Strength at Yield - MD Average ASTM D6693 IV (135 lbs/in to 200 lbs/in)	Elongation at Yield - MD Average ASTM D6693 IV (13 % to 20 %)	Strength at Break - MD Average ASTM D6693 IV (135 lbs/in to 250 lbs/in)	Elongation at Break MD Average ASTM D6693 IV (150 % to 800 %)	Strength at Yield - TD Average ASTM D6693 IV (135 lbs/in to 200 lbs/in)
607x270060-e0006197-001	33.4	31.7	169.72	15.8	176.24	333	170.24

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006197		
Start Date	9/13/2017	**Customer Name**	9/13/2017
Req Delivery Date	9/13/2017	**Job Description**	HDPE 270"X540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	41
		Qty Manufactured	2892.978 FT

Inspection #	27533	**Job**	E0006197	**Status**	Active	**Result**	Pass
Stock Code	607X270060	HDPE 270"X540' 60MIL SE TEX-2		**Inspection Date**	9/14/2017	**Completion Date**	
Notes							

Serial	Elongation at Yield TD Average ASTM D6693 IV (13 % to 20 %)	Strength at Break - TD Average ASTM D6693 IV (135 lbs/in to 250 lbs/in)	Elongation at Break TD Average ASTM D6693 IV (150 % to 800 %)	Tear Strength - MD Average ASTM D1004 (45 lbs to 80 lbs)	Tear Strength - TD Average ASTM D1004 (45 lbs to 80 lbs)	Puncture Strength - Average ASTM D4833 (121 lbs to 175 lbs)	Carbon Black Content ASTM D4218 (2 % to 3 %)
607x270060-e0006197-001	14.8	170.5	247	55	58.2	128.2	2.82

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0006197		
Start Date	9/13/2017	**Customer Name**	9/13/2017
Req Delivery Date	9/13/2017	**Job Description**	HDPE 270"X540' 60MIL SE TEX-2
Completion Date	9/15/2017	**Warehouse**	41
		Qty Manufactured	2892.978 FT

Inspection #	27533	**Job**	E0006197	**Status**	Active	**Result**	Pass
Stock Code	607X270060	HDPE 270"X540' 60MIL SE TEX-2		**Inspection Date**	9/14/2017	**Completion Date**	
Notes							

Serial	Density ASTM D1505 (0.94 g/cc to 0.96 g/cc)	Carbon Black Dispersion ASTM D5596	OIT - High Pressure ASTM D5885
607x270060-e0006197-001	0.945	>= 9 in Category 1 or 2	Pass > 400 mins

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005975		
Start Date	10/8/2017	**Customer Name**	LAYFIELD GEO EDMONTON - 321802
Req Delivery Date	10/8/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Close Date		**Warehouse**	42
		Qty Manufactured	8640 FT

Inspection #	27033	**Job**	E0005975	**Status**	Active	**Result**	Pass
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/8/2017	**Completion Date**	10/8/2017
Notes							

Serial	Result	Roll Length ft	Roll Weight - Net lbs	Sheet Width (270 in +/- 2 in)	Roll Area m2	Thickness - Average ASTM D5994 (57 mil to 63 mil)	Thickness - Minimum ASTM D5994 (54 mil to 66 mil)
607270060-E0005975-015	Pass	540	4031	271.00	1128.76254180602	61.12	58.6
607270060-E0005975-016	Pass	540	4026	270.75	1128.76254180602	61.09	58.6

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005975		
Start Date	10/8/2017	**Customer Name**	LAYFIELD GEO EDMONTON - 321802
Req Delivery Date	10/8/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Close Date		**Warehouse**	42
		Qty Manufactured	8640 FT

Inspection #	27033	**Job**	E0005975	**Status**	Active	**Result**	Pass
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/8/2017	**Completion Date**	10/8/2017
Notes							

Serial	Asperity - Printed Average ASTM D7466 (18 mil to 30 mil)	Asperity - Unprinted Average ASTM D7466 (18 mil to 30 mil)	Strength at Yield - MD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)	Elongation at Yield - MD Average ASTM D6693 IV (12 % to 20 %)	Strength at Break - MD Average ASTM D6693 IV (90 lbs/in to 250 lbs/in)	Elongation at Break MD Average ASTM D6693 IV (250 % to 1000 %)	Strength at Yield - TD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)
607270060-E0005975-015	23.95	25.6	160.8	18	183.18	488.8	168.72
607270060-E0005975-016	24.05	23.15	163.48	17	182.08	442.2	164.4

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005975		
Start Date	10/8/2017	**Customer Name**	LAYFIELD GEO EDMONTON - 321802
Req Delivery Date	10/8/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Close Date		**Warehouse**	42
		Qty Manufactured	8640 FT

Inspection #	27033	**Job**	E0005975	**Status**	Active	**Result**	Pass
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/8/2017	**Completion Date**	10/8/2017
Notes							

Serial	Elongation at Yield TD Average ASTM D6693 IV (12 % to 20 %)	Strength at Break - TD Average ASTM D6693 IV (90 lbs/in to 250 lbs/in)	Elongation at Break TD Average ASTM D6693 IV (250 % to 1000 %)	Tear Strength - MD Average ASTM D1004 (42 lbs to 80 lbs)	Tear Strength - TD Average ASTM D1004 (42 lbs to 80 lbs)	Puncture Strength - Average ASTM D4833 (90 lbs to 175 lbs)	Carbon Black Content ASTM D4218 (2 % to 3 %)
607270060-E0005975-015	16.6	175.6	399.8	53.4	55.6	130	2.46
607270060-E0005975-016	16.6	140.4	319	53.4	55.6	130	2.82

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005975		
Start Date	10/8/2017	**Customer Name**	LAYFIELD GEO EDMONTON - 321802
Req Delivery Date	10/8/2017	**Job Description**	HDPE 270"x540' 60MIL SE TEX-2
Close Date		**Warehouse**	42
		Qty Manufactured	8640 FT

Inspection #	27033	**Job**	E0005975	**Status**	Active	**Result**	Pass
Stock Code	607270060	HDPE 270"x540' 60MIL SE TEX-2		**Inspection Date**	9/8/2017	**Completion Date**	10/8/2017
Notes							

Serial	Density ASTM D1505 (0.94 g/cc to 0.96 g/cc)	Carbon Black Dispersion ASTM D5596	OIT - High Pressure ASTM D5885
607270060-E0005975-015	0.945	>= 9 in Category 1 or 2	Pass > 400 mins
607270060-E0005975-016	0.945	>= 9 in Category 1 or 2	Pass > 400 mins

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005761		
Start Date	28/07/2017	**Customer Name**	28/07/2017
Req Delivery Date	30/07/2017	**Job Description**	HDPE 270"x560' 60MIL SE TEX-1
Completion Date	31/07/2017	**Warehouse**	42
		Qty Manufactured	35117.07 FT

Inspection #	26473	**Job**	E0005761	**Status**	Active	**Result**	Pass
Stock Code	606270060	HDPE 270"x560' 60MIL SE TEX-1		**Inspection Date**	27/07/2017	**Completion Date**	
Notes							

Serial	Result	Time/Date	Core width (273 in +/- 0 in)	Roll Length (560 ft +/- 10 ft)	Roll Weight - Net (3919 lbs +/- 392 lbs)	Sheet Width (270 in +/- 2 in)	Roll Area m2
606270060-E0005761-012	Pass	29 Jul 2017 12:00 AM	273.00	560	4041.18	270.3	1170.56856187291
606270060-E0005761-019	Pass	29 Jul 2017 2:30 PM	272.90	560	4056.18	270.0	1170.56856187291
606270060-E0005761-021	Pass	29 Jul 2017 6:10 PM	272.90	560	4051.18	269.5	1170.56856187291
606270060-e0005761-024	Pass	29 Jul 2017 12:00 AM	272.75	560	4031.18	270.0	1170.56856187291

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005761		
Start Date	28/07/2017	**Customer Name**	28/07/2017
Req Delivery Date	30/07/2017	**Job Description**	HDPE 270"x560' 60MIL SE TEX-1
Completion Date	31/07/2017	**Warehouse**	42
		Qty Manufactured	35117.07 FT

Inspection #	26473	**Job**	E0005761	**Status**	Active	**Result**	Pass
Stock Code	606270060	HDPE 270"x560' 60MIL SE TEX-1		**Inspection Date**	27/07/2017	**Completion Date**	
Notes							

Serial	Thickness - Average ASTM D5994 (57 mil to 63 mil)	Thickness - Minimum ASTM D5994 (54 mils to 66 mils)	Asperity - Printed Average ASTM D7466 (18 mil to 30 mil)	Strength at Yield - MD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)	Elongation at Yield - MD Average ASTM D6693 IV (12 % to 25 %)	Strength at Break - MD Average ASTM D6693 IV (90 lbs/in to 275 lbs/in)	Elongation at Break - MD Average ASTM D6693 IV (100 % to 700 %)
606270060-E0005761-012	60.16	57.6	25.95	171.1	17	176	413.4
606270060-E0005761-019	59.4	57.4	22.1	154.84	18.4	182.36	511.2
606270060-E0005761-021	59.67	58	21	154.16	19.4	176.96	482
606270060-e0005761-024	59.95	58.6	20.65	154.16	19.4	176.96	482

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005761		
Start Date	28/07/2017	**Customer Name**	28/07/2017
Req Delivery Date	30/07/2017	**Job Description**	HDPE 270"x560' 60MIL SE TEX-1
Completion Date	31/07/2017	**Warehouse**	42
		Qty Manufactured	35117.07 FT

Inspection #	26473	**Job**	E0005761	**Status**	Active	**Result**	Pass
Stock Code	606270060	HDPE 270"x560' 60MIL SE TEX-1		**Inspection Date**	27/07/2017	**Completion Date**	
Notes							

Serial	Strength at Yield - TD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)	Elongation at Yield - TD Average ASTM D6693 IV (12 % to 25 %)	Strength at Break - TD Average ASTM D6693 IV (90 lbs/in to 275 lbs/in)	Elongation at Break - TD Average ASTM D6693 IV (100 % to 700 %)	Tear Strength - MD Average ASTM D1004 (42 lbs to 80 lbs)	Tear Strength - TD Average ASTM D1004 (42 lbs to 80 lbs)	Puncture Strength - Average ASTM D4833 (90 lbs to 180 lbs)
606270060-E0005761-012	172.68	16.4	182.26	491.6	55	55.6	135.2
606270060-E0005761-019	160.54	18.2	191.78	562	55	55.6	135.2
606270060-E0005761-021	158.5	18.2	188.02	551.4	50.4	52.8	112.8
606270060-e0005761-024	158.5	18.2	188.02	551.4	50.4	52.8	112.8

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005761		
Start Date	28/07/2017	**Customer Name**	28/07/2017
Req Delivery Date	30/07/2017	**Job Description**	HDPE 270"x560' 60MIL SE TEX-1
Completion Date	31/07/2017	**Warehouse**	42
		Qty Manufactured	35117.07 FT

Inspection #	26473	**Job**	E0005761	**Status**	Active	**Result**	Pass
Stock Code	606270060	HDPE 270"x560' 60MIL SE TEX-1		**Inspection Date**	27/07/2017	**Completion Date**	
Notes							

Serial	Carbon Black Content ASTM D4218 (2 % to 3 %)	Density ASTM D1505 (0.94 g/cc to 0.96 g/cc)	Carbon Black Dispersion ASTM D5596	OIT - High Pressure ASTM D5885
606270060-E0005761-012	2.51	0.950	>= 9 in Category 1 or 2	Pass > 400 mins
606270060-E0005761-019	2.56	0.950	>= 9 in Category 1 or 2	Pass > 400 mins
606270060-E0005761-021	2.59	0.950	>= 9 in Category 1 or 2	Pass > 400 mins
606270060-e0005761-024	2.59	0.950	>= 9 in Category 1 or 2	Pass > 400 mins

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005761		
Start Date	28/07/2017	**Customer Name**	28/07/2017
Req Delivery Date	30/07/2017	**Job Description**	HDPE 270"x560' 60MIL SE TEX-1
Completion Date	31/07/2017	**Warehouse**	42
		Qty Manufactured	35117.07 FT

Inspection #	26473	**Job**	E0005761	**Status**	Active	**Result**	Pass
Stock Code	606270060	HDPE 270"x560' 60MIL SE TEX-1		**Inspection Date**	27/07/2017	**Completion Date**	
Notes							

Serial	Result	Time/Date	Core width (273 in +/- 0 in)	Roll Length (560 ft +/- 10 ft)	Roll Weight - Net (3919 lbs +/- 392 lbs)	Sheet Width (270 in +/- 2 in)	Roll Area m2
606270060-E0005761-029	Pass	30 Jul 2017 2:40 PM	272.80	560	4061.18	269.3	1170.56856187291

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005761		
Start Date	28/07/2017	**Customer Name**	28/07/2017
Req Delivery Date	30/07/2017	**Job Description**	HDPE 270"x560' 60MIL SE TEX-1
Completion Date	31/07/2017	**Warehouse**	42
		Qty Manufactured	35117.07 FT

Inspection #	26473	**Job**	E0005761	**Status**	Active	**Result**	Pass
Stock Code	606270060	HDPE 270"x560' 60MIL SE TEX-1		**Inspection Date**	27/07/2017	**Completion Date**	
Notes							

Serial	Thickness - Average ASTM D5994 (57 mil to 63 mil)	Thickness - Minimum ASTM D5994 (54 mils to 66 mils)	Asperity - Printed Average ASTM D7466 (18 mil to 30 mil)	Strength at Yield - MD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)	Elongation at Yield - MD Average ASTM D6693 IV (12 % to 25 %)	Strength at Break - MD Average ASTM D6693 IV (90 lbs/in to 275 lbs/in)	Elongation at Break - MD Average ASTM D6693 IV (100 % to 700 %)
606270060-E0005761-029	59.94	58	19.25	158.96	18.4	185.9	501.4

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005761		
Start Date	28/07/2017	**Customer Name**	28/07/2017
Req Delivery Date	30/07/2017	**Job Description**	HDPE 270"x560' 60MIL SE TEX-1
Completion Date	31/07/2017	**Warehouse**	42
		Qty Manufactured	35117.07 FT

Inspection #	26473	**Job**	E0005761	**Status**	Active	**Result**	Pass
Stock Code	606270060	HDPE 270"x560' 60MIL SE TEX-1		**Inspection Date**	27/07/2017	**Completion Date**	
Notes							

Serial	Strength at Yield - TD Average ASTM D6693 IV (126 lbs/in to 200 lbs/in)	Elongation at Yield - TD Average ASTM D6693 IV (12 % to 25 %)	Strength at Break - TD Average ASTM D6693 IV (90 lbs/in to 275 lbs/in)	Elongation at Break - TD Average ASTM D6693 IV (100 % to 700 %)	Tear Strength - MD Average ASTM D1004 (42 lbs to 80 lbs)	Tear Strength - TD Average ASTM D1004 (42 lbs to 80 lbs)	Puncture Strength - Average ASTM D4833 (90 lbs to 180 lbs)
606270060-E0005761-029	156.94	17.6	185.72	536.8	50.4	52.8	112.8

LAYFIELD Leaders in Film & Geosynthetic Technology

Mill Certification Report

Job #	E0005761		
Start Date	28/07/2017	**Customer Name**	28/07/2017
Req Delivery Date	30/07/2017	**Job Description**	HDPE 270"x560' 60MIL SE TEX-1
Completion Date	31/07/2017	**Warehouse**	42
		Qty Manufactured	35117.07 FT

Inspection #	26473	**Job**	E0005761	**Status**	Active	**Result**	Pass
Stock Code	606270060	HDPE 270"x560' 60MIL SE TEX-1		**Inspection Date**	27/07/2017	**Completion Date**	
Notes							

Serial	Carbon Black Content ASTM D4218 (2 % to 3 %)	Density ASTM D1505 (0.94 g/cc to 0.96 g/cc)	Carbon Black Dispersion ASTM D5596	OIT - High Pressure ASTM D5885
606270060-E0005761-029	2.36	0.950	>= 9 in Category 1 or 2	Pass > 400 mins

SKAPS Industries (Nonwoven Division)
335, Athena Drive
Athens, GA 30601 (U.S.A.)
Phone (706) 354-3700 Fax (706) 354-3737
E-mail: contact@skaps.com

Sales Office:
Engineered Synthetic Product Inc.
Phone: (770)564-1857
Fax: (770)564-1818

September 6, 2017
Layfield Canada Ltd.
17720 - 129 Avenue NW
Edmonton, AB, T5V 0C4
PO : E30453
BOL : 060249

Dear Sir/Madam:

This is to certify that SKAPS GT112 (Layfield LP 12) is a high quality needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, randomly networked to form a high strength dimensionally stable fabric. SKAPS GT112 (Layfield LP 12) resists ultraviolet deterioration, rotting, biological degradation. The fabric is inert to commonly encountered soil chemicals. Polypropylene is stable within a pH range of 2 to 13. SKAPS GT112 (Layfield LP 12) conforms to the property values listed below:

PROPERTY	TEST METHOD	UNITS	M.A.R.V. Minimum Average Roll Value
Grab Tensile	ASTM D 4632	lbs (kN)	300 (1.33)
Grab Elongation	ASTM D 4632	%	50
Trapezoidal Tear	ASTM D 4533	lbs (kN)	115 (0.51)
CBR Puncture	ASTM D 6241	lbs (kN)	850 (3.78)
Permittivity*	ASTM D 4491	sec^{-1}	1.00
Water Flow*	ASTM D 4491	$gpm/ft^2(l/min/m^2)$	75 (3056)
AOS*	ASTM D 4751	US Sieve (mm)	100 (0.15)
UV Resistance	ASTM D 4355	%/hrs	70/500

Notes:
* At the time of manufacturing. Handling may change these properties.

KOUROSH SABZEVARI
QUALITY CONTROL MANAGER

Product : GT112-180 (Layfield LP 12)

ROLL # ASTM METHOD UNITS TARGET	MD TENSILE D4632 lbs. 300	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 300	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 115	XMD TRAP D4533 lbs 115	CBR PUNCTURE D6241 lbs. 850	AOS D4751 US Sieve 100	WATER FLOW D4491 gpm/ft2 75	PERMITTIVITY D4491 sec-1 1.00
050441222	311	82	370	104	115	154	1006	100	86	1.15
050441223	311	82	370	104	115	154	1006	100	86	1.15
050441224	311	82	370	104	115	154	1006	100	86	1.15
050441225	311	82	370	104	115	154	1006	100	86	1.15
050441226	311	82	370	104	115	154	1006	100	86	1.15
050441227	311	82	370	104	115	154	1006	100	86	1.15
050441229	311	82	370	104	115	154	1006	100	86	1.15
050441230	311	82	370	104	115	154	1006	100	86	1.15
050441231	311	82	370	104	115	154	1006	100	86	1.15
050441232	311	82	370	104	115	154	1006	100	86	1.15
050441238	311	82	370	104	115	154	1006	100	86	1.15
050441239	311	82	370	104	115	154	1006	100	86	1.15
050441240	311	82	370	104	115	154	1006	100	86	1.15
050441244	311	82	370	104	115	154	1006	100	86	1.15
050441245	311	82	370	104	115	154	1006	100	86	1.15
050441246	311	82	370	104	115	154	1006	100	86	1.15
050441247	311	82	370	104	115	154	1006	100	86	1.15
050441248	339	83	387	101	123	170	983	100	86	1.15
050441249	339	83	387	101	123	170	983	100	86	1.15
050441250	339	83	387	101	123	170	983	100	86	1.15
050441251	339	83	387	101	123	170	983	100	86	1.15
050441252	339	83	387	101	123	170	983	100	86	1.15
050441253	339	83	387	101	123	170	983	100	86	1.15
050441254	339	83	387	101	123	170	983	100	86	1.15
050441255	339	83	387	101	123	170	983	100	86	1.15
050441262	339	83	387	101	123	170	983	100	86	1.15
050441263	339	83	387	101	123	170	983	100	86	1.15
050441264	339	83	387	101	123	170	983	100	86	1.15
050441265	339	83	387	101	123	170	983	100	86	1.15
050441266	339	83	387	101	123	170	983	100	86	1.15
050441267	339	83	387	101	123	170	983	100	86	1.15
050441268	339	83	387	101	123	170	983	100	86	1.15
050441269	339	83	387	101	123	170	983	100	86	1.15
050441270	339	83	387	101	123	170	983	100	86	1.15
050441271	339	83	387	101	123	170	983	100	86	1.15
050441272	304	83	369	107	157	226	1052	100	86	1.15

* All values are MARV.

Product : GT112-180 (Layfield LP 12)

ROLL # ASTM METHOD UNITS TARGET	MD TENSILE D4632 lbs. 300	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 300	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 115	XMD TRAP D4533 lbs 115	CBR PUNCTURE D6241 lbs. 850	AOS D4751 US Sieve 100	WATER FLOW D4491 gpm/ft2 75	PERMITTIVITY D4491 sec-1 1.00
050441273	304	83	369	107	157	226	1052	100	86	1.15
050441274	304	83	369	107	157	226	1052	100	86	1.15
050441275	304	83	369	107	157	226	1052	100	86	1.15
050441276	304	83	369	107	157	226	1052	100	86	1.15
050441277	304	83	369	107	157	226	1052	100	86	1.15
050441278	304	83	369	107	157	226	1052	100	86	1.15
050441279	304	83	369	107	157	226	1052	100	86	1.15
050441280	304	83	369	107	157	226	1052	100	86	1.15
050441281	304	83	369	107	157	226	1052	100	86	1.15
050441282	304	83	369	107	157	226	1052	100	86	1.15
050441283	304	83	369	107	157	226	1052	100	86	1.15
050441284	304	83	369	107	157	226	1052	100	86	1.15
050441285	304	83	369	107	157	226	1052	100	86	1.15
050441286	304	83	369	107	157	226	1052	100	86	1.15
050441287	304	83	369	107	157	226	1052	100	86	1.15
050441288	304	83	369	107	157	226	1052	100	86	1.15
050441289	304	83	369	107	157	226	1052	100	86	1.15
050441290	304	83	369	107	157	226	1052	100	86	1.15
050441291	304	83	369	107	157	226	1052	100	86	1.15
050441292	304	83	369	107	157	226	1052	100	86	1.15
050441293	304	83	369	107	157	226	1052	100	86	1.15
050441294	304	83	369	107	157	226	1052	100	86	1.15
050441295	304	83	369	107	157	226	1052	100	86	1.15
050441296	314	87	360	107	179	203	944	100	86	1.15
050441297	314	87	360	107	179	203	944	100	86	1.15
050441298	314	87	360	107	179	203	944	100	86	1.15
050441299	314	87	360	107	179	203	944	100	86	1.15
050441300	314	87	360	107	179	203	944	100	86	1.15
050441301	314	87	360	107	179	203	944	100	86	1.15
050441302	314	87	360	107	179	203	944	100	86	1.15
050441303	314	87	360	107	179	203	944	100	86	1.15
050441305	314	87	360	107	179	203	944	100	86	1.15
050441306	314	87	360	107	179	203	944	100	86	1.15
050441308	314	87	360	107	179	203	944	100	86	1.15
050441309	314	87	360	107	179	203	944	100	86	1.15
050441310	314	87	360	107	179	203	944	100	86	1.15

* All values are MARV.

Product : GT112-180 (Layfield LP 12)

ROLL # ASTM METHOD UNITS TARGET	MD TENSILE D4632 lbs. 300	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 300	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 115	XMD TRAP D4533 lbs 115	CBR PUNCTURE D6241 lbs. 850	AOS D4751 US Sieve 100	WATER FLOW D4491 gpm/ft2 75	PERMITTIVITY D4491 sec-1 1.00
050441315	314	87	360	107	179	203	944	100	86	1.15
050441316	314	87	360	107	179	203	944	100	86	1.15
050441317	314	87	360	107	179	203	944	100	86	1.15
050441318	314	87	360	107	179	203	944	100	86	1.15
050441319	314	87	360	107	179	203	944	100	86	1.15
050441320	350	90	398	116	158	195	1018	100	86	1.15
050441321	350	90	398	116	158	195	1018	100	86	1.15
050441322	350	90	398	116	158	195	1018	100	86	1.15
050441323	350	90	398	116	158	195	1018	100	86	1.15
050441324	350	90	398	116	158	195	1018	100	86	1.15
050441328	350	90	398	116	158	195	1018	100	86	1.15
050441329	350	90	398	116	158	195	1018	100	86	1.15
050441330	350	90	398	116	158	195	1018	100	86	1.15
050441331	350	90	398	116	158	195	1018	100	86	1.15
050441332	350	90	398	116	158	195	1018	100	86	1.15
050441333	350	90	398	116	158	195	1018	100	86	1.15
050441334	350	90	398	116	158	195	1018	100	86	1.15
050441335	350	90	398	116	158	195	1018	100	86	1.15

* All values are MARV.

SKAPS Industries (Nonwoven Division)
335, Athena Drive
Athens, GA 30601 (U.S.A.)
Phone (706) 354-3700 Fax (706) 354-3737
E-mail: contact@skaps.com

Sales Office:
Engineered Synthetic Product Inc.
Phone: (770)564-1857
Fax: (770)564-1818

September 7, 2017
Layfield Canada Ltd.
17720 - 129 Avenue NW
Edmonton, AB, T5V 0C4
PO : E30453
BOL : 060286

Dear Sir/Madam:

This is to certify that SKAPS GT112 (Layfield LP 12) is a high quality needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, randomly networked to form a high strength dimensionally stable fabric. SKAPS GT112 (Layfield LP 12) resists ultraviolet deterioration, rotting, biological degradation. The fabric is inert to commonly encountered soil chemicals. Polypropylene is stable within a pH range of 2 to 13. SKAPS GT112 (Layfield LP 12) conforms to the property values listed below:

PROPERTY	TEST METHOD	UNITS	M.A.R.V. Minimum Average Roll Value
Grab Tensile	ASTM D 4632	lbs (kN)	300 (1.33)
Grab Elongation	ASTM D 4632	%	50
Trapezoidal Tear	ASTM D 4533	lbs (kN)	115 (0.51)
CBR Puncture	ASTM D 6241	lbs (kN)	850 (3.78)
Permittivity*	ASTM D 4491	sec^{-1}	1.00
Water Flow*	ASTM D 4491	$gpm/ft^2(l/min/m^2)$	75 (3056)
AOS*	ASTM D 4751	US Sieve (mm)	100 (0.15)
UV Resistance	ASTM D 4355	%/hrs	70/500

Notes:
* At the time of manufacturing. Handling may change these properties.

KOUROSH SABZEVARI
QUALITY CONTROL MANAGER

Product : GT112-180 (Layfield LP 12)

ROLL # ASTM METHOD UNITS TARGET	MD TENSILE D4632 lbs. 300	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 300	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 115	XMD TRAP D4533 lbs 115	CBR PUNCTURE D6241 lbs. 850	AOS D4751 US Sieve 100	WATER FLOW D4491 gpm/ft2 75	PERMITTIVITY D4491 sec-1 1.00
810181847	351	83	503	91	146	214	1150	100	76	1.01
030591601	384	70	312	88	127	138	1008	100	91	1.21
030591606	384	70	312	88	127	138	1008	100	91	1.21
030591617	349	70	346	94	130	137	974	100	91	1.21
030591619	349	70	346	94	130	137	974	100	91	1.21
030591659	376	71	314	92	130	146	1021	100	76	1.02
030591660	376	71	314	92	130	146	1021	100	76	1.02
030607124	311	60	318	69	125	131	882	100	78	1.04
030607125	311	60	318	69	125	131	882	100	78	1.04
030607126	311	60	318	69	125	131	882	100	78	1.04
030607575	314	57	329	65	123	136	874	100	85	1.14
050410595	350	81	387	114	161	197	1033	100	105	1.40
050410605	345	86	397	109	149	203	979	100	105	1.40
050410609	345	86	397	109	149	203	979	100	105	1.40
050410615	345	86	397	109	149	203	979	100	105	1.40
050410639	330	82	387	114	139	196	1022	100	105	1.40
050410657	417	88	412	104	146	208	1293	100	87	1.16
050410664	417	88	412	104	146	208	1293	100	87	1.16
050410677	417	88	412	104	146	208	1293	100	87	1.16
050410680	417	88	412	104	146	208	1293	100	87	1.16
050410681	417	88	412	104	146	208	1293	100	87	1.16
050410703	370	80	331	97	139	208	1436	100	87	1.16
050410704	370	80	331	97	139	208	1436	100	87	1.16
050410714	340	78	344	125	121	141	1214	100	76	1.02
050410722	340	78	344	125	121	141	1214	100	76	1.02
050410733	340	78	344	125	121	141	1214	100	76	1.02
050410734	340	78	344	125	121	141	1214	100	76	1.02
050410737	340	78	344	125	121	141	1214	100	76	1.02
050410739	340	78	344	125	121	141	1214	100	76	1.02
050440321	325	64	348	81	123	129	945	100	91	1.22
050440322	325	64	348	81	123	129	945	100	91	1.22
050440323	325	64	348	81	123	129	945	100	91	1.22
050440337	325	64	348	81	123	129	945	100	91	1.22
050440338	325	64	348	81	123	129	945	100	91	1.22
050440339	325	64	348	81	123	129	945	100	91	1.22
050440358	323	83	374	104	116	162	991	100	91	1.22

* All values are MARV.

Product : GT112-180 (Layfield LP 12)

ROLL # ASTM METHOD UNITS TARGET	MD TENSILE D4632 lbs. 300	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 300	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 115	XMD TRAP D4533 lbs 115	CBR PUNCTURE D6241 lbs. 850	AOS D4751 US Sieve 100	WATER FLOW D4491 gpm/ft2 75	PERMITTIVITY D4491 sec-1 1.00
050440359	323	83	374	104	116	162	991	100	91	1.22
050440360	323	83	374	104	116	162	991	100	91	1.22
050440367	323	83	374	104	116	162	991	100	91	1.22
050440368	323	83	374	104	116	162	991	100	91	1.22
050440369	323	83	374	104	116	162	991	100	91	1.22
050440370	323	83	374	104	116	162	991	100	91	1.22
050440371	323	83	374	104	116	162	991	100	91	1.22
050440374	345	88	421	108	132	165	1079	100	91	1.22
050440398	332	85	375	108	145	210	1045	100	91	1.22
050440399	332	85	375	108	145	210	1045	100	91	1.22
050440400	332	85	375	108	145	210	1045	100	91	1.22
050440417	332	85	375	108	145	210	1045	100	91	1.22
050440418	332	85	375	108	145	210	1045	100	91	1.22
050440419	332	85	375	108	145	210	1045	100	91	1.22
050441228	311	82	370	104	115	154	1006	100	86	1.15
050441233	311	82	370	104	115	154	1006	100	86	1.15
050441234	311	82	370	104	115	154	1006	100	86	1.15
050441235	311	82	370	104	115	154	1006	100	86	1.15
050441236	311	82	370	104	115	154	1006	100	86	1.15
050441237	311	82	370	104	115	154	1006	100	86	1.15
050441241	311	82	370	104	115	154	1006	100	86	1.15
050441242	311	82	370	104	115	154	1006	100	86	1.15
050441243	311	82	370	104	115	154	1006	100	86	1.15
050441256	339	83	387	101	123	170	983	100	86	1.15
050441257	339	83	387	101	123	170	983	100	86	1.15
050441258	339	83	387	101	123	170	983	100	86	1.15
050441259	339	83	387	101	123	170	983	100	86	1.15
050441260	339	83	387	101	123	170	983	100	86	1.15
050441261	339	83	387	101	123	170	983	100	86	1.15
050441304	314	87	360	107	179	203	944	100	86	1.15
050441307	314	87	360	107	179	203	944	100	86	1.15
050441311	314	87	360	107	179	203	944	100	86	1.15
050441312	314	87	360	107	179	203	944	100	86	1.15
050441313	314	87	360	107	179	203	944	100	86	1.15
050441314	314	87	360	107	179	203	944	100	86	1.15
050441325	350	90	398	116	158	195	1018	100	86	1.15

* All values are MARV.

Product : GT112-180 (Layfield LP 12)

ROLL # ASTM METHOD UNITS TARGET	MD TENSILE D4632 lbs. 300	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 300	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 115	XMD TRAP D4533 lbs 115	CBR PUNCTURE D6241 lbs. 850	AOS D4751 US Sieve 100	WATER FLOW D4491 gpm/ft2 75	PERMITTIVITY D4491 sec-1 1.00
050441326	350	90	398	116	158	195	1018	100	86	1.15
050441327	350	90	398	116	158	195	1018	100	86	1.15
050442047	352	88	415	109	134	157	1039	100	101	1.35
050442049	352	88	415	109	134	157	1039	100	101	1.35
050442050	352	88	415	109	134	157	1039	100	101	1.35
050442057	352	88	415	109	134	157	1039	100	101	1.35
050442058	352	88	415	109	134	157	1039	100	101	1.35
050442059	352	88	415	109	134	157	1039	100	101	1.35
050442080	383	79	405	98	181	254	1082	100	101	1.35
050442081	383	79	405	98	181	254	1082	100	101	1.35
050442082	383	79	405	98	181	254	1082	100	101	1.35
050442179	368	70	345	100	158	180	1057	100	135	1.80
050442180	368	70	345	100	158	180	1057	100	135	1.80
050442181	368	70	345	100	158	180	1057	100	135	1.80
050442188	368	70	345	100	158	180	1057	100	135	1.80
050442189	368	70	345	100	158	180	1057	100	135	1.80
050442190	368	70	345	100	158	180	1057	100	135	1.80
070116604	308	61	315	66	120	129	866	100	85	1.14

* All values are MARV.

LAYFIELD CANADA LTD.
17720 – 129 Avenue NW Edmonton, Alberta T5V 0C4 Canada
Phone: (780) 453-6731
Fax: (780) 452-9495
Toll Free: 1 800 840-2884
Web: www.layfieldgroup.com
E-Mail: edm@layfieldgroup.com

INSTALLATION WARRANTY

Layfield Reference No. : (Job #) CT000904

LAYFIELD CANADA LTD. (LAYFIELD) hereby warrants to Strata Gold Corporation; (the Customer) that the work performed by LAYFIELD on the Installation described as Control Pond Liner will:

1. Meet the field seam specifications set out in the contract between LAYFIELD and the Customer (as amended by LAYFIELD's quotation), all workmanship to meet the requirements of LAYFIELD's Field Installation Quality Assurance program, and be free of defects at the time of completion of the Installation; and

2. Be free of installation defects from the date of the completion of the Installation (November 28, 2017), for a period of One year so long as the completed Installation is used for the purposes and in the manner for which the Installation was designed.

Should damage or defects within the scope of the aforesaid warranties occur, LAYFIELD shall repair the damage or defects, PROVIDED THAT the area to be repaired must first be made ready by the Customer and be in a clean, dry, unencumbered condition, free from all water, soil, sludge, residuals, and liquids of any kind.

To enable LAYFIELD to investigate and determine the cause of any alleged damage or defect, notice and details of any claim hereunder must be presented in writing to LAYFIELD within thirty (30) days after the alleged damage or defect was first noticed or observed. Failure to provide such notice and details shall invalidate all warranties provided hereunder.

The liability of LAYFIELD under the aforesaid warranties are subject to the following conditions:

a. LAYFIELD's only obligation shall be to repair or replace any defective workmanship and in no event shall LAYFIELD be liable for any amount in excess of the cost of the Installation;

b. No allowance will be made for repairs, replacements or alterations made by the Customer unless with the prior written consent of LAYFIELD;

c. The warranties hereunder extend only to the Customer and are not transferable;

d. The warranties hereunder shall not apply to any damage or defects resulting from misuse, mechanical abuse by machinery, equipment or persons, excessive pressures or stresses, exposure of the completed Installation of harmful chemicals, unusual weather conditions, casualty catastrophe such as (but not limited to) earthquake, flood, hail, tornado, or any other act of God;

e. Under no circumstances shall LAYFIELD be liable for any special, direct, indirect, or consequential damages including the loss of use of the Installation howsoever caused;

f. The warranties hereunder are given in lieu of all other warranties, express, implied, statutory, or otherwise, and the Customer expressly waives all other warranties and claims whatsoever except those specifically given herein, and the Customer acknowledges that the warranties hereunder are accepted in preference to and to the exclusion of any or all other warranties; and

g. An Installation Warranty will not be provided for lining projects unless the installation is completed by LAYFIELD personnel or designated LAYFIELD subcontractors.

LAYFIELD CANADA LTD.

Fred Cross, Senior Construction Manager

LAYFIELD CANADA LTD.

Greg Van Petten, Estimating Manager

APPENDIX D

Eagle Gold Water Quality and Water Balance Model Update Report

THIS PAGE INTENTIONALLY LEFT BLANK

StrataGold Corporation

Eagle Gold Project

2018 Water Quality Model Update Report

Project No. A445-1
4 April 2018

Prepared by:
Lorax Environmental Services Ltd.
Vancouver, BC

LORAX ENVIRONMENTAL

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1. Introduction

1.1 Project Description

The Eagle Gold Project (the Project) is owned by StrataGold Corporation, a wholly owned subsidiary of the Victoria Gold Corp. (the "Company"). The Project is located in the Central Yukon Territory, approximately 350 km north of Whitehorse and approximately 45 km north of Mayo. Much of the mine site lies within the Dublin Gulch watershed, a tributary that reports to Haggart Creek, and which then flows to the South McQuesten River. Ultimately, the South McQuesten River joins the Stewart River, which flows west to its eventual confluence with the Yukon River.

A Type A Water Use License (QZ14-041) was issued on December 3rd, 2015 to allow the construction, operation and closure of the Project, an open pit heap leach gold mine in central Yukon. Water Use License QZ14-041 has specific conditions related to water balance and water quality modeling updates for the Eagle Gold Project. Specifically:

> *The Licensee shall submit to the Board updated Surface Water Balance and Water Quality Models as part of each Annual Report. The updated models shall include, but not be limited to, the following:*
>
> *a. Updated site data collected as per the EMSAMP;*
> *b. Updated input from any updates to the HLF Water Balance Model; and*
> *c. Updated predictions for operations and closure including discussion of any variances identified and implications on site water management.*

The Eagle Gold Mine water balance and water quality model (WBQM) was updated in January 2018, following changes to the water management plan and water management assumptions around the heap leach facility.

1.2 Scope of Report

The Eagle Gold WBWQM is a GoldSim-based integrated water balance and quality model that was originally developed in two parts. The initial water balance model design was led by Knight-Piesold (KP) who used a runoff-based approach to determine natural and mine-impacted runoff from the catchments that comprise the Eagle mine site. Precipitation was back-calculated from runoff where a precipitation input was required. KP also integrated the Excel-based monthly heap leach facility (HLF) water balance model provided by the Mines Group. The water quality component was developed by Lorax Environmental Services Ltd. (Lorax) and integrated within the WBM to combine source concentrations of potential contaminants of concern with contact and non-contact flows to track contaminant loading throughout the mine site and into the receiving waters of Haggart Creek. The

culmination of both these efforts was the 2014 water quality model used in support of Stratagold's Type A Water Use License Application submitted in August 2014 (Appendix 28 Water Quality Model Report).

This report presents an update of the Eagle Gold water balance model (WBM) and water quality model (WQM) that fully integrates the following:

- Revisions to the water management plan as described in: *Eagle Gold Project Construction and Operations Water Management Plan*. Version 2107-01. July 2017;
- Revisions to the heap leach facility water balance modeling as described in: *Water Balance Modeling for the Eagle Gold Mine Proposed Heap Leach Pad Facility, Final Design*. Report prepared by The Mines Group, January 2018;
- Baseline climate and hydrology data collected since 2007 and inclusive of data collected in 2016 and 2017;
- Updated baseline surface water quality monitoring data collected from 2007 to 2017 prior to initiation of construction in August 2017; and
- Geochemical source term data collected from active field bins of waste rock and leached ore materials, with consideration of data collected up through end of 2017 ice-free season.

Following this introduction, Section 2 presents the updated input parameters and assumptions used to update the water balance and water quality models. Section 3 presents a summary of the results of the updated models.

2. Model Inputs and Assumptions

2.1 Water Balance Model Inputs and Assumptions

For the purposes of this update, the Goldsim model structure, parameterization and assumptions are largely unchanged from those presented in the previous water balance model report submitted in support of the WUL application (Knight Piésold, 2014), with some exceptions, as described below.

2.1.1 Hydro-meteorological Updates

Following the issuance of WUL QZ14-041, the collection of baseline climate and streamflow data has continued at the Project site. This additional data has been incorporated into the site monitoring records, and the results are presented in the climate and hydrology baseline reports (Lorax 2016a, 2016b, 2018a and 2018b). These data were analyzed in conjunction with regional climate and streamflow records to estimate the necessary input parameters for use in the updated WBM. A summary of the updated values of interest is presented in Table 2.1-1, along with the previous estimates derived by Knight Piésold (2013). These estimates are considered representative of the reference elevation of 1,125 m asl, which is the mid-point of the Haggart Creek below Dublin Gulch hydrometric station (W4; 76.9 km^2), which contains the proposed Project footprint.

Overall, the incorporation of additional baseline climate data and updated synthetic precipitation and runoff estimates have resulted in minimal changes to the understanding of the Project site water balance. As in the previous WBM, annual runoff at the W4 hydrometric station is assumed to represent the effective precipitation at the Project site, and forms the primary driver of the WBM. The summary of the changes relevant to the WBM parameterization is as follows:

- Mean annual precipitation (MAP) at the 1,125 m elevation has decreased by 6%, from 500 mm to 472 mm;
- Mean annual runoff (MAR) for the W4 hydrometric station has increased by 7% from 230 mm to 247 mm;
- The annual orographic precipitation gradient has decreased from +10%/100 m for to +7%/100 m; and
- The monthly distribution of annual runoff used to distribute the MAR value for W4 has changed slightly, as outlined in Table 2.1-2.

Table 2.1-1:
Comparison of 2014 and updated 2017 runoff and precipitation estimates at the Eagle Gold Project site

Knight Piésold Hydrometeorology Report (2013)									
Parameter	**Camp (782 m)**			**1125 m**			**Potato Hills (1420 m)**		
	Annual	Oct-Apr (SWE)	May-Sept (Rain)	Annual	Oct-Apr (SWE)	May-Sept (Rain)	Annual	Oct-Apr (SWE)	May-Sept (Rain)
Potential Evapotranspiration (mm)	439	--	439	--	--		335	--	335
Mean Precipitation (mm)	357	205	152	500	310	190	652	432	220
Mean Annual Runoff (W4; mm)	--	--	--	230	--	--	--	--	--
Lorax Hydrometeorology Report (2017a)									
Potential Evapotranspiration (mm)	483	--	382	380	--	344	305	--	309
Mean Precipitation (mm)	375	160	214	472	227	245	581	306	275
Mean Annual Runoff (W4; mm)	--	--	--	247	--	--	--	--	--

Table 2.1-2:
Comparison of 2014 and updated 2017 monthly runoff distributions for the Eagle Gold Project site

Month	**2014 values**		**2017 values**	
	Distribution	**Precipitation (mm)**	**Distribution**	**Precipitation (mm)**
JAN	2%	3.6	3%	6.5
FEB	1%	2.8	2%	5.4
MAR	1%	3.0	2%	5.7
APR	2%	4.8	3%	8.4
MAY	30%	69.6	24%	60.5
JUN	21%	48.0	17%	41.1
JUL	12%	27.3	11%	28.4
AUG	10%	23.9	10%	23.9
SEP	10%	23.2	10%	24.2
OCT	6%	13.1	8%	20.7
NOV	3%	6.9	6%	14.0
DEC	2%	4.9	3%	8.2
Total		231		247

Overall, the changes listed above result in minor alterations to the WBM inputs. Winter flows in the larger drainages tend to be higher than previous estimates, and freshet magnitudes are slightly lower.

Additional site monitoring confirms that winter flows within the smaller (and higher elevation) drainages at the Project site are lower relative to those measured at W4, and thus the multiplier of 0.1 for these drainages was carried forward in the WBM update.

The updated annual runoff volumes are higher overall in the larger basins, with the increases ranging from 2% to 10% above the values used in the 2014 WBM (Table 2.1-3). However, the slight increase in the updated winter flow estimates for the smaller basins that are modified by the winter low flow factor, in concert with the slight reductions in freshet volumes, has resulted in small decreases in annual runoff for the Stewart Gulch (W26) and the Eagle Pup drainages, on the order of -4% and -2%, respectively. Annual runoff for Suttles Gulch has increased slightly by 2%, and runoff from Platinum Gulch remains effectively unchanged.

Table 2.1-3:
Comparison of 2014 and 2017 updated monthly runoff distributions

Basin	Elevation (m)	Area (km^2)	2014 Annual Runoff (mm)	2017 Annual Runoff (mm)	% change MAR from 2014 WBM
Upper Dublin Gulch (W1)	1303	6.8	274	279	2%
Stewart Gulch (W26)[1]	1183	1.3	219	212	-4%
Haggart Ck u/s Dublin Gulch (W22)	1113	66.8	228	245	7%
Haggart Ck d/s Dublin Gulch (W4)	1125	76.9	231	247	7%
Ann Gulch	1029	0.89	211	231	10%
Eagle Pup[1]	1116	8.88	206	202	-2%
Suttles Gulch[1]	994	0.22	183	186	2%
Platinum Gulch[1]	1070	0.77	197	196	0%
Haggart Ck (btwn W29 and W5)	1091	0.68	224	241	8%
Lynx Ck u/s Haggart Ck (W6)	1049	100.9	215	235	9%

Note:
[1]The runoff presented for these nodes was modified by the winter low flow factor of 0.1.

All other climatic and streamflow inputs and assumptions remain unchanged from the previous WBM version.

2.1.1.1 2018 Validation of Water Balance Model Inputs

Following the update of the baseline streamflow time-series to include data collected in 2016 and 2017, a verification exercise was conducted to ensure that the water balance model inputs were still adequately representing site conditions. As outlined in Section

2.1.1, the model inputs are scaled from the W4 synthetic monthly runoff series, with the winter runoff for the high-elevation sub-basins scaled further by a factor of 0.1 to account for the limited groundwater contributions to winter baseflows.

In most cases, the measured streamflow records cover the open water season from May to October, with May generally showing incomplete data due to extensive channel icing conditions. Therefore, depending on the availability of data for May at each station, it is expected that the measured runoff will be less than the model input. The winter flow data for November to April, where available, are based on monthly averages of manual measurements that are made concurrent with the water quality sampling trips.

Figures 2.1-1 to 2.1-6 present the results of the verification exercise and compare measured and model runoff from key locations within the Haggart Creek, Dublin Gulch and Lynx Creek catchments. Overall, the measured monthly runoff and model input match well, with the modelled runoff ranging from 7% less, to 12% more than the measured data on an annual basis. At the monthly scale, modeled June runoff is consistently higher than measured runoff for all nodes, while summer runoff is slightly underpredicted by the model, relative to the available measurements. Where sufficient winter streamflow measurements are available (*e.g.*, W22, W4), the model inputs track the measurements closely (Figure 2.1-1 and Figure 2.2-2). One notable exception is W27, where the measured discharges for March and April are significantly higher than the model inputs (Figure 2.1-4). However, as only five measurements are available for these two months (in total), there is insufficient information available at this stage to update or modify the current model inputs.

Given that the measured record spans from 7 to 10 years, and that many of the monthly averages calculated from this record are based on incomplete records, the long-term synthetic streamflow records upon which the water balance model is based are thought to best represent the long-term average runoff conditions at site. Accordingly, no changes to the runoff inputs to the water balance model are necessary at this time.

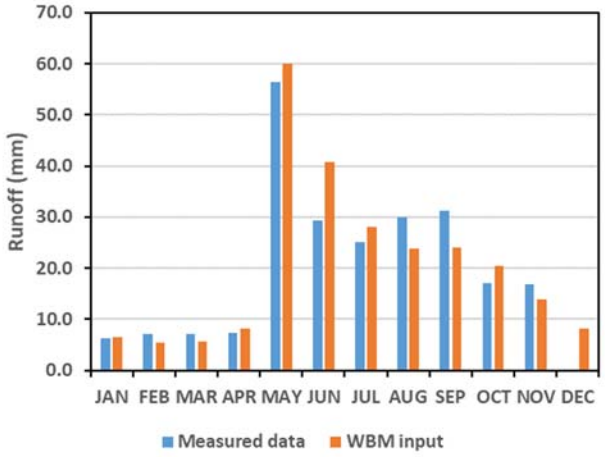


Figure 2.1-1: Measured and modeled runoff for the W22 station (Haggart Creek upstream of Dublin Gulch).

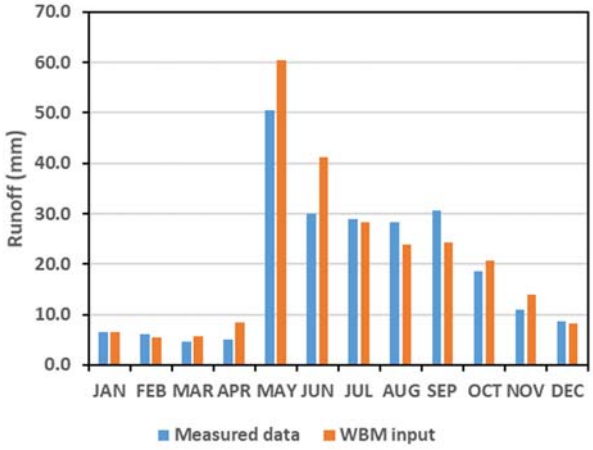


Figure 2.1-2: Measured and modeled runoff for the W4 station (Haggart Creek downstream of Dublin Gulch).

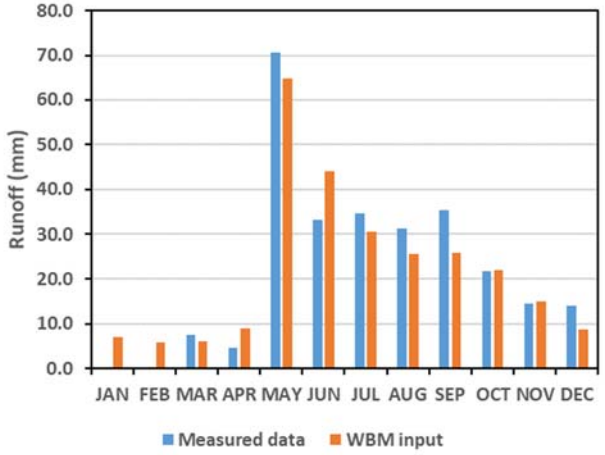


Figure 2.1-3: Measured and modeled runoff for the W1 station (Upper Dublin Gulch).

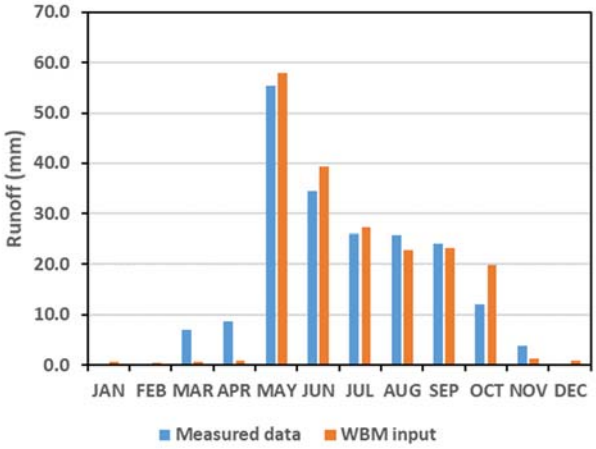


Figure 2.1-4: Measured and modeled runoff for the W27 station (Haggart Creek downstream of Dublin Gulch).

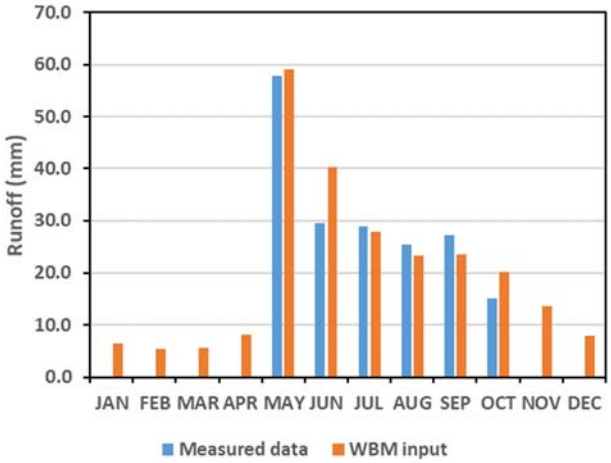


Figure 2.1-5: Measured and modeled runoff for the W5 station (Haggart Creek (immediately upstream of confluence with Lynx Creek).

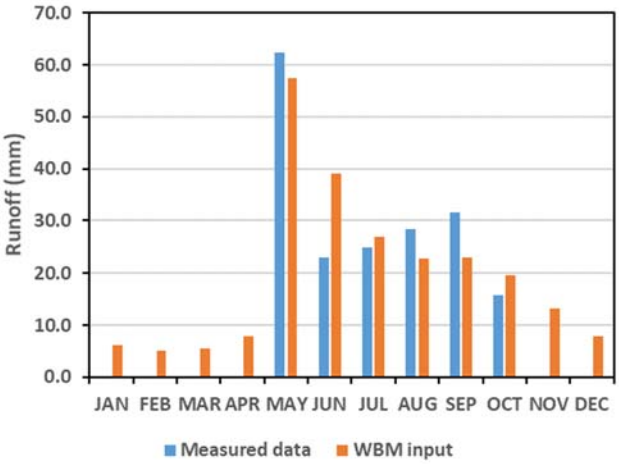


Figure 2.1-6: Measured and modeled runoff for the W6 station (Lynx Creek upstream of Haggart Creek).

2.1.2 Heap Leach Facility Water Balance Model Updates

The GoldSim HLF model required updates to accommodate the following changes described in: *Water Balance Modeling for the Eagle Gold Mine Proposed Heap Leach Pad Facility, Final Design*. Report prepared by The Mines Group, January 2018:

1. Decreased total ore tonnages and volume (from 92 Mt to 86 Mt) comprising an additional year of stacking at a monthly average of 29,500 tonnes per day for 12 months/year.

2. Maximum In-Heap sump storage of 120,095 m^3 and maximum event pond storage of 299,851 m^3.

3. Change in start date of liner placement to March Yr 1 (previously assumed at May Yr 1);

4. Implementation of a discharge cap (20 L/s) to the event pond during draindown; and

5. Updated HLF seepage rates from the Mines Group at the end of draindown as the post-closure seepage rate in the Goldsim model.

All other inputs, assumptions and parameterizations for the HLF WBM were carried forward from the previous iterations.

2.2 Water Quality Model Inputs and Assumptions

The Eagle Gold Project water quality model (WQM) is a mass-conserving mixing model that predicts water quality for 38 parameters at key monitoring and compliance points in the receiving waters affected by mine activity. The model was designed on the GoldSim® platform and utilizes a GoldSim® water balance model (WBM). As described in Section 2.1, the WBM has been updated to reflect additional data collected in 2016 to 2017. Both the WBM and the WQM use a monthly time-step for 50 years, spanning the construction phase, operations, closure and several years into post-closure. Below is a brief description of water quality model inputs including seepage contact water source terms, Mine Water Treatment Plant (MWTP) and Passive Treatment Systems (PTS) effluent discharge requirements and background water quality for non-contact flows.

2.2.1 Seepage Contact Water

Contact water comes from the following sources:

- Waste rock storage facilities in Eagle Pup and Platinum Gulch;
- Pit wall runoff and pit-wall depressurization wells that report to pit;
- Heap leach facility (during post-operations and drain-down only); and

- Runoff-seepage from developed and undeveloped portions of the project footprint.

Input source concentrations for all contact waters are the same as described in *Eagle Gold Geochemical Source Term Predictions – Model Description and Results* (Lorax 2014b) and in *Eagle Gold Project – Water Quality Model* (Lorax 2014a). As part of the 2018 WQM update, the geochemical source terms used as inputs in Lorax (2014a) were assessed in light of the updated data collection. The geochemistry of field bin leachates collected throughout 2017 were reviewed, and the potential effect on the additional data on the source term model was assessed. Upon completion of this review it was determined that the source term model results prepared for the Eagle Gold WUL in 2014 (Lorax 2014b) are still valid and do not currently require updating as a result of more recent field bin data collected in 2017. The rationale for this conclusion is due to the following reasons:

- The field bin leachate data were only directly used in the source term model to calculate a "first flush" value representing the effect of the initial flush of easily soluble species. These values were calculated based on the 75th percentile value in the first year of field bin data. Hence, the values used for this approach have not changed since the last model iteration;
- Overall, the trends observed in field bin leachates over time were used qualitatively for model validation purposes. While variable, these trends have not changed sufficiently to warrant a re-run of the source term model.

2.2.2 MWTP and PTS Effluent Quality Standards

Effluent quality standards were developed during the Water Use License application process for the MWTP during operations and PTS for the closure phase. The effluent quality standards for each component are utilized in the model representing treatment flows and chemistry.

Table 2.2-1:
MWTP Water Quality Used in Model

Parameter	*MWTP Effluent Quality Standards (mg/L)*
pH	6.5 to 8
TSS	15
Cl	250
SO_4	1850
Nitrate-N	19.5
Nitrite-N	0.12
NH_3-N	7.5
CN_{WAD}	0.03
Al (diss)	0.4
Sb	0.13
As	0.053
Cd	0.00125
Cu	0.026
Co	0.026
Fe	6.4
Pb	0.05
Hg	0.00008
Mn	7.7
Mo	0.45
Ni	0.5
Se	0.025
Ag	0.01
U	0.09
Zn	0.23

Table 2.2-2:
Eagle Pup (EG) and Platinum Gulch (PG) PTS Water Quality Used in Model

Parameter	*WRSA PTS Effluent Quality Standards (mg/L)*
pH	6.5 to 8
TSS	15
Cl	250
SO_4	2000
Nitrate-N	30
Nitrite-N	0.3
NH_3-N	13
CN_{WAD}	not applicable
Al (diss)	0.5
Sb	0.2
As	0.085
Cd	0.001
Cu	0.02
Co	0.05
Fe	5
Pb	0.03
Hg	0.00015
Mn	5
Mo	0.5
Ni	0.2
Se	0.04
Ag	0.02
U	0.15
Zn	0.05

Table 2.2-3:
Heap Leach Facility (HLF) PTS Water Quality Used in Model

Parameter	*HLF PTS Effluent Quality Standards (mg/L)*
pH	6.5 to 8
TSS	15
Cl	250
SO_4	2000
Nitrate-N	40
Nitrite-N	0.3
NH_3-N	18
CN_{WAD}	0.09
Al (diss)	1
Sb	0.2
As	0.085
Cd	0.003
Cu	0.07
Co	0.08
Fe	15
Pb	0.12
Hg	0.00015
Mn	10
Mo	0.8
Ni	0.5
Se	0.04
Ag	0.02
U	0.2
Zn	0.3

2.2.3 **Background Water Quality Inputs**

Background flows and water quality from runoff (e.g. non-contact water) and background receiving environment water chemistry are fully characterized and included in the model. Baseline water quality data collected from project area streams from 2007 and including data collected in 2016 to August 2017, prior to construction, have been incorporated into the water quality baseline dataset.

2.2.4 **Modeling Approach**

Flows from background sources and mine facilities are taken directly from the WBM, with the exception of the seepage from the waste rock facilities. As with 14WQM, infiltration through the waste rock is provided to the WQM; the model then uses a function that attenuates the flow within the waste rock pile in a manner consistent with observed waste rock seepage hydrographs from other sites.

Water quality parameters tracked by the model are listed in Table 2.2-4. Each parameter is treated as a conservative tracer which is mixed at model nodes (confluences) by the following equation:

$$C_r = \frac{\sum_i Q_i C_i}{\sum_i Q_i}$$

where C_r is the resultant concentration, $Q_i$are the source flows into the mixing point and $C_i$are the concentrations associated with the source flows. The only exceptions to this flow-weighted instantaneous mixing scheme are for the Lower Dublin South Pond (LDSP) and for the open pit lake which are represented by constituent transport flow cells in GoldSim. The water quality for each of these two facilities is handled slightly differently during operations and draindown/closure:

1. During operations, the water quality of both the LDSP and the open pit (drained via sump from a small holding pond) are assumed to be the same as those of their respective flow-weighted source flows (this is to ensure there is no load delay to the receiver, which can occur in GoldSim flow cells that quickly fill and drain).
2. During post-operations (draindown, closure) the LDSP and open pit lake accumulate and release contaminant load relatively slowly, and their water qualities are determined by the finite volume flow cell concentration (not the input concentration as before).

This difference in methodology has a very small impact in the particular case of the LDSP; it simply reduces artificial spikes in concentration during operations which are artifacts of the filling/draining activities of the pond, and ensures loading is sent to the receiving environment consistent with how flow/loading arrives at the pond.

Table 2.2-4:
Eagle Gold Project Water Quality Model Parameters

Parameter	Cont'd	Cont'd
NH_4	Al	Mn
Cl	Sb	Hg
F	As	Mo
NO_3	Ba	Ni
NO_2	B	K
N	Cd	Se
P	Ca	Si
SO_4	Cr	Ag
WADCN	Co	Na
	Cu	Tl
	Fe	U
	Pb	V
	Mg	Zn

As previously indicated, the WQM simulates 50 years of mine life, beginning in operation and ending several years into post-closure. The model time step is monthly, and the three principal mine periods for reporting are:

1. Operations (Phase 1 through Phase 5 corresponding to mine –years 1 to 12) with LDSP treated in the MWTP; in Phase 5 the heap is rinsed during cyanide destruction;
2. Early Closure (Phase 6 corresponding to mine -years 13 to 20): LDSP decommissioned and the heap drain-down is controlled with the MTWP operating to treat heap seepage. Eagle Pup WRSA and Platinum Gulch WRSA are passively treated before discharge to receiving waters;
3. Late Closure (Years 20+): Waste rock and heap seepages are passively treated before discharge to receiving waters.

Source terms were developed for the 75th percentile and median cases. To remain conservative, the discussion is based on the results of the 75th percentile source terms coupled with the median WBM flow scenario.

Water quality from mine discharge during operations is driven by the contact water reporting to the Lower Dublin South Pond. Contact water from the Eagle Pup and Platinum Gulch WRSAs, the temporary ore stockpile, and the sump water from the open pit all report to the LDSP at some point during operations. Excess water from the LDSP is treated through the MWTP to meet the discharge criteria in Table 2.2-1 and discharged to Haggart Creek upstream of W4 (Figure 2.2-1).

After the LDSP is decommissioned (year 12), both the Eagle Pup and Platinum Gulch waste rock seeps are treated by passive systems to meet the discharge criteria in Table 2.2-2. During this time period, HLF drain-down water reports to the MWTP and is treated to meet discharge criteria in Table 2.2-1.

The late closure period begins with the decommissioning of the MWTP and the full application of passive treatment for all contact mine waters (year 20+). At this time, the HLF has little excess water to drain, and post-closure monthly discharge is driven largely by infiltration. After year 20, the HLF seep is treated solely through a PTS to values indicated in Table 2.2-3.

The WQM provides monthly predictions of water quality at key locations in Haggart Creek, namely:

- W4 in Haggart Creek just downstream of the chief compliance point (i.e., MWTP discharge);
- W29 in Haggart Creek downstream of all project influences; and
- W23 in Haggart Creek, immediately downstream of the confluence with Lynx Creek.

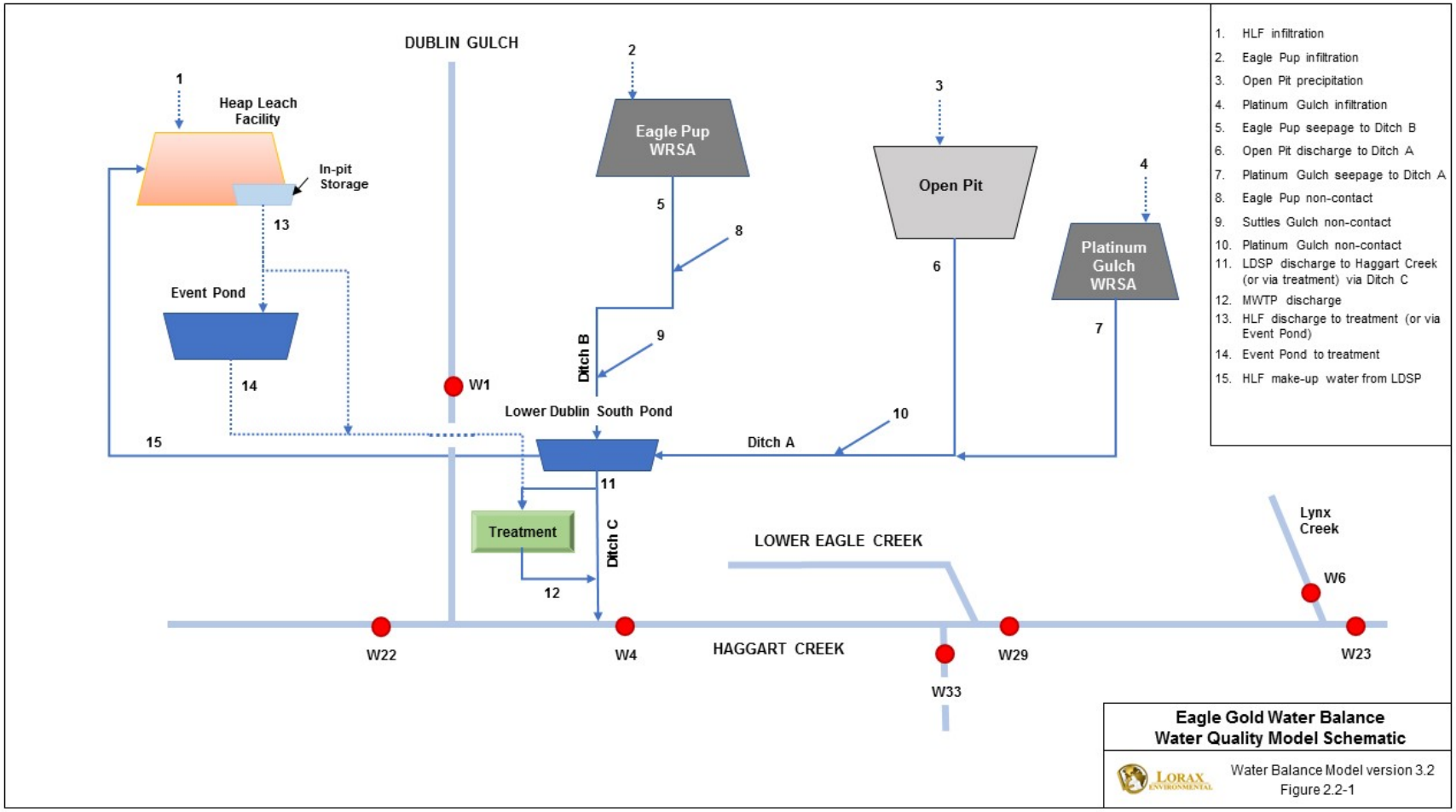


Figure 2.2-1: Eagle Gold Water Balance and Water Quality Model Schematic

3. Results and Discussion

The results of the 18WQM update are presented in this section. Results are presented in downstream order for the three Haggart Creek receiving environment stations (W4), (W29) and (W23), for the main parameters of interest, namely As and Se. Time-series of all predicted parameters are provided in Appendix A of this report and all raw output data is provided in Appendix B (electronically).

3.1 Station W4 – Haggart Creek

Station W4 in Haggart Creek is located just downstream of the chief compliance location for the Eagle Gold project (i.e., discharge via Ditch C from the MWTP). Water quality objectives for W4 were developed during the licensing process and stipulated within QZ14-041 (Table 3.1-1).

Table 3.1-1:
Water Quality Objectives for Haggart Creek at W4

Parameter List		WQ Objectives at W4
Dissolved Parameters	SO_4	309
	Cl	150
	Nitrate-N	3
	Nitrite-N	0.02
	NH_3-N	1.13
	CN_{WAD}	0.005
	Al (diss)	0.1
Total Metalloids and Metals	Sb	0.02
	As	0.0085
	Cd	0.000197
	Cu	0.005
	Co	0.004
	Fe	1.0
	Pb	0.0077
	Hg	0.00002
	Mn	1.17
	Mo	0.073
	Ni	0.116
	Se	0.002
	Ag	0.0015
	U	0.015
	Zn	0.038

All values as mg/L

Figure 3.1-1 summarizes the updated 2018 water quality model predictions for As at W4 in Haggart Creek. The updated model predicts peak As concentrations at W4 of approximately 0.008 mg/L that occur typically in the higher flow periods of May to July during HLF draindown. Corresponding peak As values during the winter low flow months are approximately 0.0065 mg/L during this same period.

Post closure As concentrations (Yr 23 onwards) are predicted to be on the order of 0.0067 mg/L with winter low flow peak concentrations of approximately 0.005 mg/L (Figure 3.1-1).

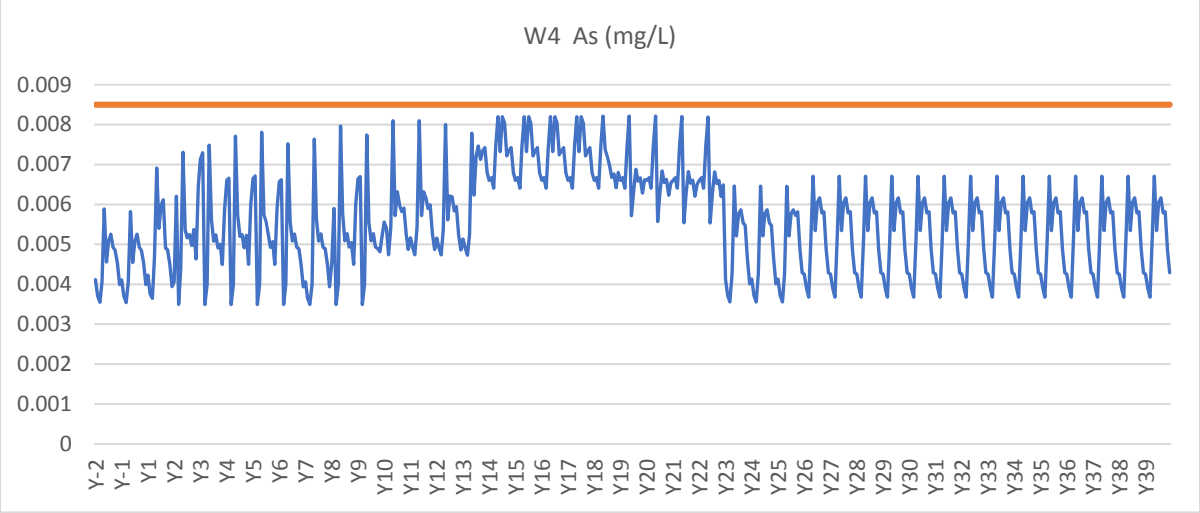


Figure 3.1-1: Predictions for Total As at W4 in Haggart Creek for 18WQM. Water Quality Objective denoted by Red line.

Similar results are observed for Se at W4 in Haggart Creek (Figure 3.1-2). During early operations, Se treatment is not necessary and predicted concentrations are driven by the background concentrations in Haggart Creek. The primary source of Se is associated with the HLF. Once treatment of the HLF is required, Se concentrations increase at station W4. Updated predictions indicate that Se concentrations are highest during the HLF draindown period and peak concentrations are predicted to be roughly 0.0018 mg/L. However, throughout the remainder of the life of mine, Se concentrations are predicted to be well below water quality objectives at W4. During post-closure, peak Se concentrations are predicted to be only approximately 0.0007 mg/L.

Table 3.1-2 summarizes the maximum 18WQM predicted concentrations for all parameters at W4 in Haggart Creek. As illustrated, all parameters are predicted to be below their respective water quality objective. No suggested changes to proposed site water management strategies are therefore warranted as a result of the modeling updates. 18WQM output for all parameters can be found in Appendix A and Appendix B.

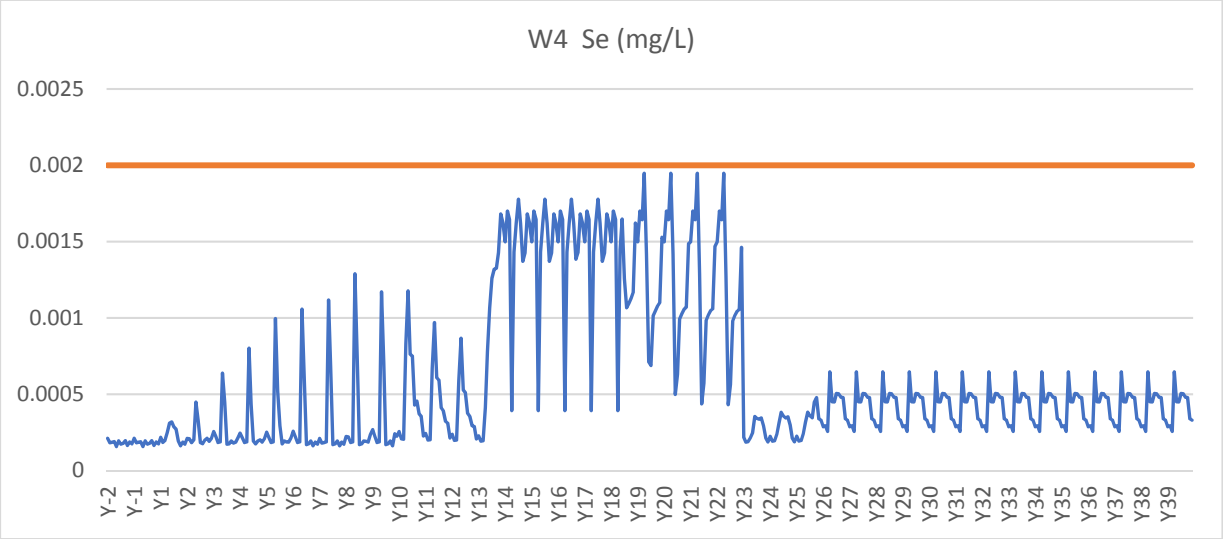


Figure 3.1-2: Predictions for Total Se at W4 in Haggart Creek for 18WQM. Water Quality Objective denoted by Red line.

Table 3.1-2:
Maximum 17WQM Predicted Concentrations Compared to Water Quality Objectives at W4 for Haggart Creek

Parameter List		Maximum Predicted Concentration at W4	WQ Objectives at W4
Dissolved Parameters	SO_4	114	309
	Cl	1.7	150
	Nitrate-N	1.5	3
	Nitrite-N	0.008	0.02
	NH_3-N	0.13	1.13
	CN_{WAD}	0.0026	0.005
	Al (diss)	0.144	0.1
Total Metalloids and Metals	Sb	0.009	0.02
	As	0.008	0.0085
	Cd	0.00008	0.000197
	Cu	0.003	0.005
	Co	0.0008	0.004
	Fe	0.38	1.0
	Pb	0.0036	0.0077
	Hg	0.000015	0.00002
	Mn	0.097	1.17
	Mo	0.002	0.073
	Ni	0.0034	0.116
	Se	0.0019	0.002
	Ag	0.00011	0.0015
	U	0.007	0.015
	Zn	0.0087	0.038

All values as mg/L

3.2 Station W29 – Haggart Creek

18WQM output is graphically presented in Figure 3.2-1 for As at station W29 in Haggart Creek. Peak As concentrations at W29 are predicted to be slightly lower as compared to station W4 during the operation and draindown period (e.g. Yr 1 to Yr 22) and well below the water quality objective. Peak As concentrations for this period are approximately 0.007 mg/L and occur during the higher flow month of May. During post closure, additional As loadings occur to Haggart Creek from the open pit overflow and Platinum Gulch PTS resulting in higher peak As concentrations as compared to W4 of approximately 0.008 mg/L (Figure 3.2-1).

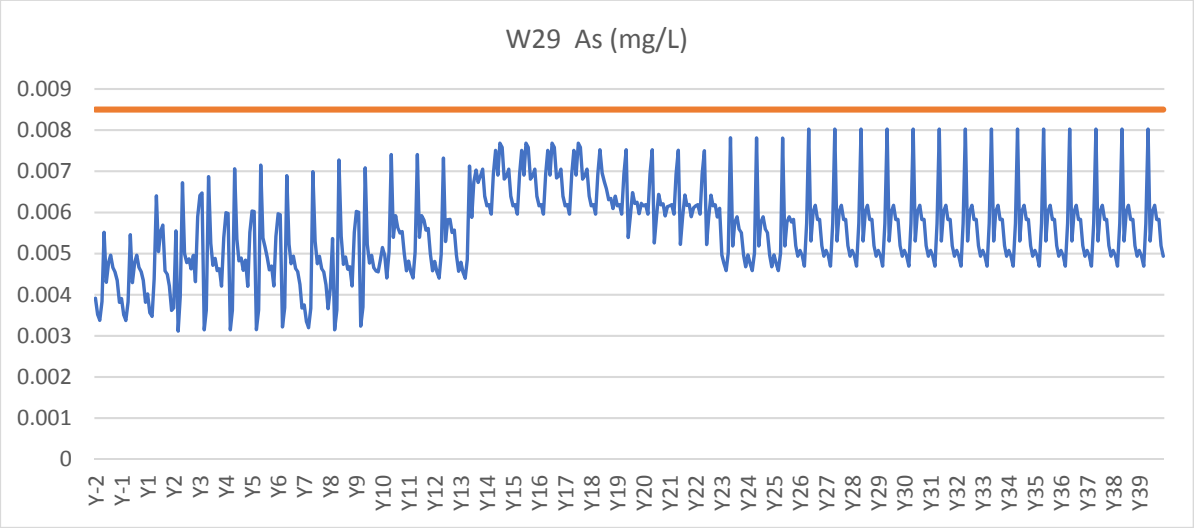


Figure 3.2-1: Predictions for Total As at W29 in Haggart Creek for 18WQM. Water Quality Objective denoted by Red line.

Unlike As, the predicted total Se concentrations at W29 are similar to predicted concentrations at station W4 in Haggart Creek. The primary reason for this is that background Se in all catchments at the project site is very low (less than 0.0003 mg/L) and the most significant Se loading source is the HLF which discharges into Haggart Creek above W4 either from the WTP or discharge from the HLF PTS. Much smaller loadings of Se originate from the waste rock storage facilities or open pit overflow.

Full excel output data for all parameters modeled at station W29 is presented in Appendix B.

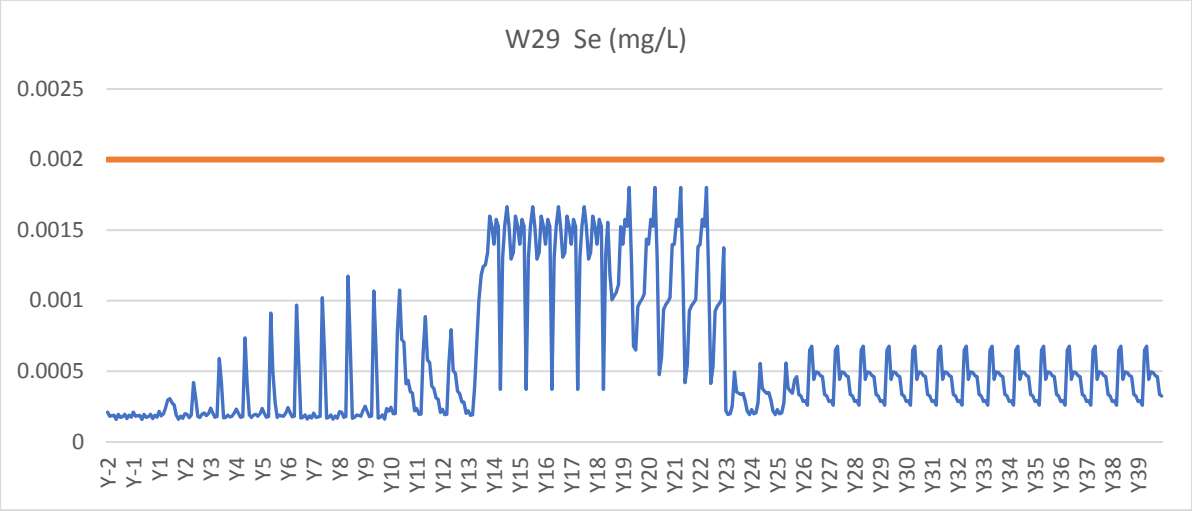


Figure 3.2-2: Predictions for Total Se at W29 in Haggart Creek for 18WQM. Water Quality Objective denoted by Red line.

3.3 Station W23 – Far-Field Haggart Creek

18WQM predictions for total As at W23 in Haggart Creek are graphically presented in Figure 3.3-1. Unlike stations more proximal to the Eagle Mine in Haggart Creek (e.g. W4 and W29), predicted peak As concentrations at W23 are less variable throughout the life of mine period. For example, peak As concentrations during the operations and draindown period are approximately 0.0072 mg/L and peak As concentrations during the post closure period are roughly 0.0074 mg/L. The less variable As concentrations at W23 are a result of the natural background As loadings from Lynx Creek that enter Haggart Creek immediately upstream of W23.

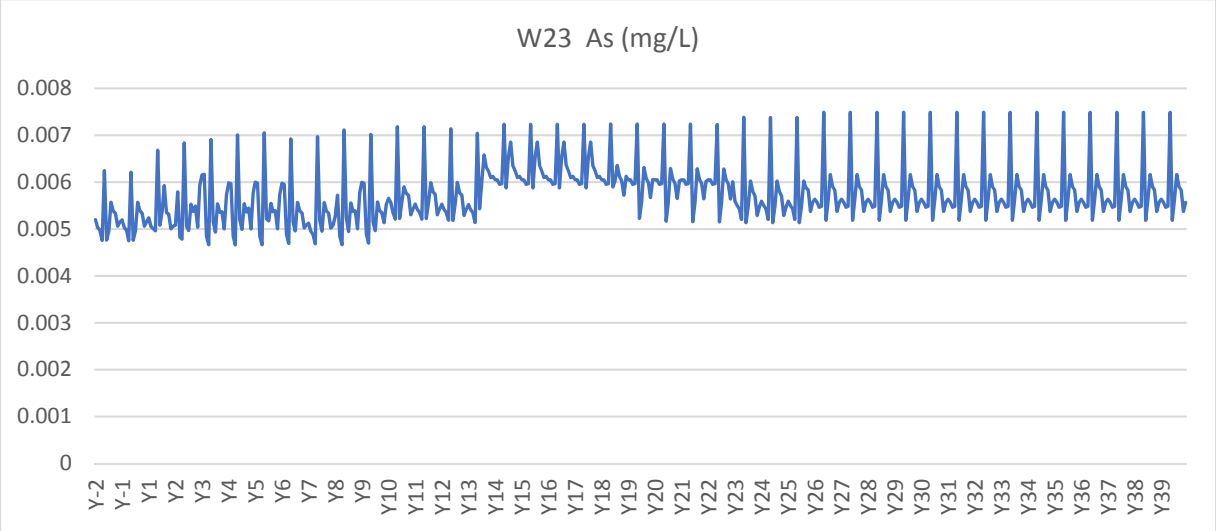


Figure 3.3-1: Predictions for Total As at W23 in Haggart Creek for 18WQM.

Water quality predictions for total Se at W23 are presented in Figure 3.3-2. Maximum predicted total Se concentrations in 18WQM are slightly above 0.001 mg/L and occur during the HLF draindown. Post closure total Se concentration predictions are slightly greater than 0.0005 mg/L (Appendix B). All predicted concentrations are well below the water quality objective for Se of 0.002 mg/L

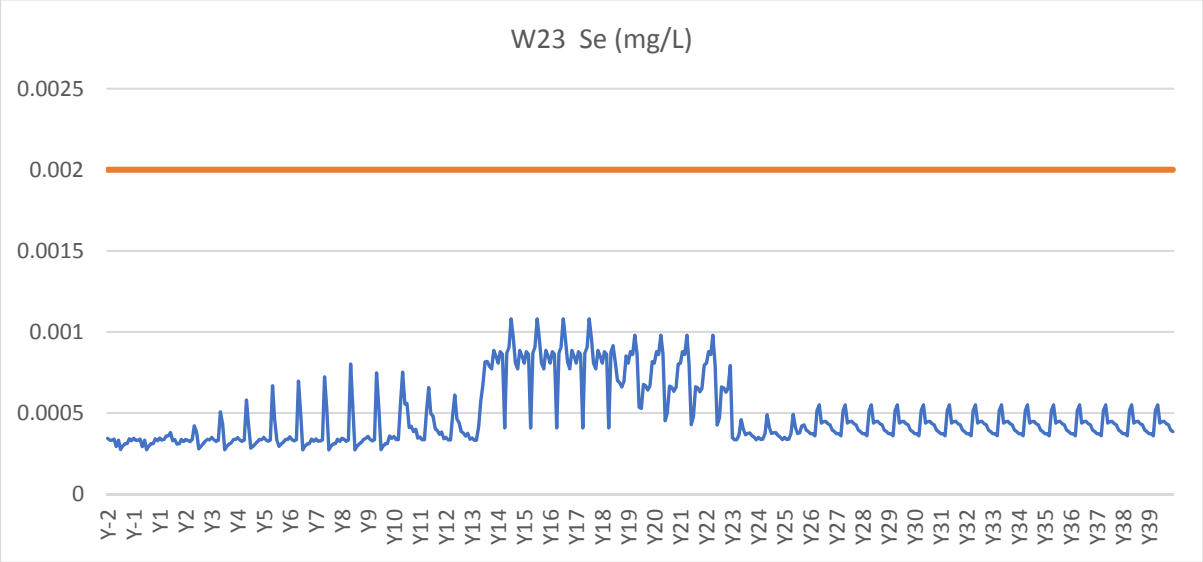


Figure 3.3-2: Predictions for Total Se at W23 in Haggart Creek for 18WQM.

4. Closure

We trust that this report meets your expectations. Please contact the undersigned with any questions or comments.

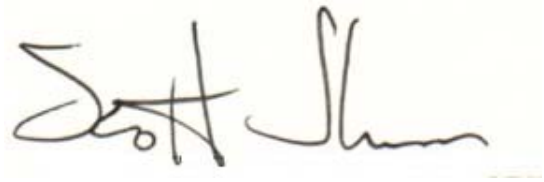
Sincerely,

LORAX ENVIRONMENTAL SERVICES LTD.

Prepared by:

David Flather, M.Sc.
Principal

Scott Tinis, Ph.D.
Senior Numerical Modeller



Scott Jackson, M.Sc., P.Geo.
Hydrologist

References

Knight Piésold Ltd. 2013. *Victoria Gold Corp., Eagle Gold Project – Hydro-meteorology Report. VA101-290/6-8*, prepared by Knight Piésold Ltd. (Vancouver, BC) for Victoria Gold Corp., August 2013.

Knight Piésold Ltd. 2014. *Surface Water Balance Model Report*. Report Prepared for Victoria Gold Corporation.

Lorax 2014a. *Eagle Gold Geochemical Source Term Predictions – Model Description and Results*. Report Prepared for Victoria Gold Corporation.

Lorax 2014b. *Eagle Gold Project – Water Quality Objectives for the Receiving Environment in Support of WUL Application*. Memorandum to Steve Wilbur Victoria Gold Corporation.

Lorax 2014c. *Eagle Gold Project – Proposed Effluent Quality Standards in Support of WUL Application*. Memorandum to Steve Wilbur Victoria Gold Corporation.

Lorax Environmental Service Ltd. 2014d. *Eagle Gold Project – Water Quality Model*. Report Prepared for Victoria Gold Corporation. July 2014.

Lorax Environmental Services Ltd. 2016a. *Victoria Gold Corp. Eagle Gold Project – Climate Baseline Report.* A413-1, prepared by Lorax Environmental Services Ltd. (Vancouver, BC) for Victoria Gold Corp., October 2016.

Lorax Environmental Services Ltd. 2016b. *Victoria Gold Corp. Eagle Gold Project – Hydrology Baseline Report*. A413-2, prepared by Lorax Environmental Services Ltd. (Vancouver, BC) for Victoria Gold Corp., December 2016.

Lorax Environmental Services Ltd. 2017a. *Victoria Gold Corp. Eagle Gold Project – Hydrometeorology Report*. A413-3, prepared by Lorax Environmental Services Ltd. (Vancouver, BC) for Victoria Gold Corp., March 2017.

Lorax Environmental Services Ltd. 2017b. *Victoria Gold Corp. Eagle Gold Project – Baseline Water Quality Report (2016 Update).* A413-5, prepared by Lorax Environmental Services Ltd. (Vancouver, BC) for Victoria Gold Corp., March 2017.

Lorax Environmental Services Ltd. 2017c. *Eagle Gold Mine – Update on Geochemical Source Terms*. Memorandum to Steve Wilbur Victoria Gold Corporation.

The Mines Group. 2018. *Water Balance Modeling for the Eagle Gold Mine Proposed Heap Leach Pad Facility, Final Design*. Report prepared by The Mines Group, January 2018

Stratagold Corporation. 2017. *Eagle Gold Project Construction and Operations Water Management Plan. Version 2107-01. July 2017*

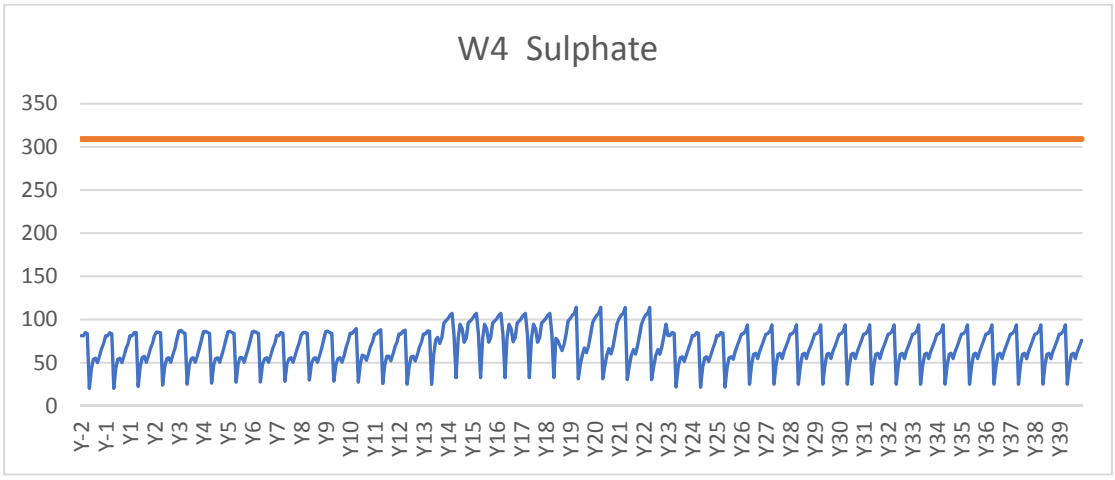
Appendix A: Water Quality Model Plots for all Parameters

A.1. Haggart Creek below Dublin Gulch (W4) – Water Quality Predictions

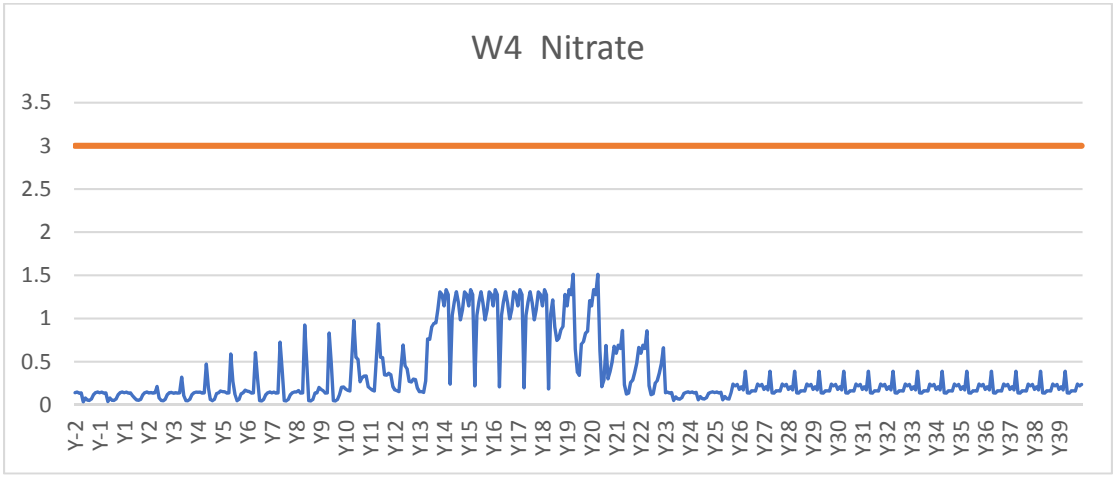
A.2. Haggart Creek below Eagle Creek (W29) – Water Quality Predictions

A.3. Haggart Creek below Lynx Creek (W23) – Water Quality Predictions

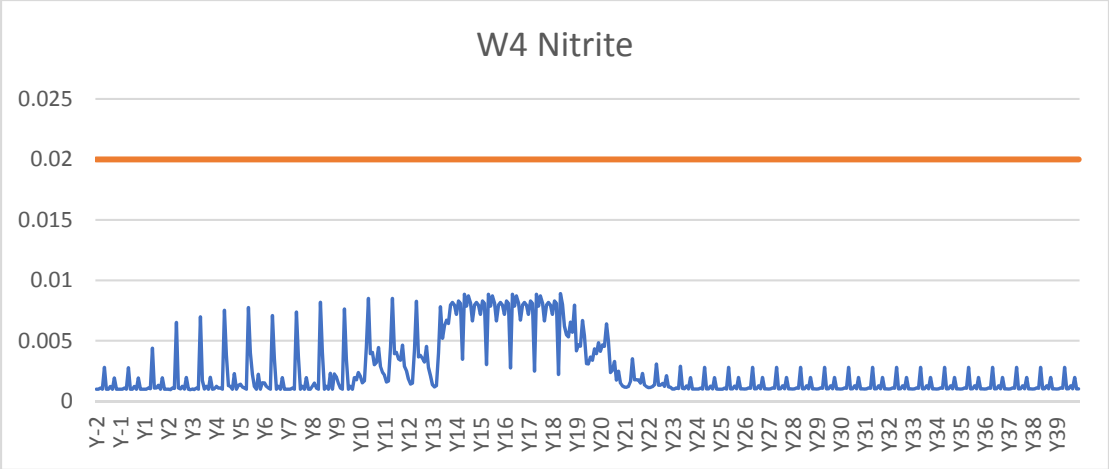
A.1. Haggart Creek below Dublin Gulch (W4) – Water Quality Predictions



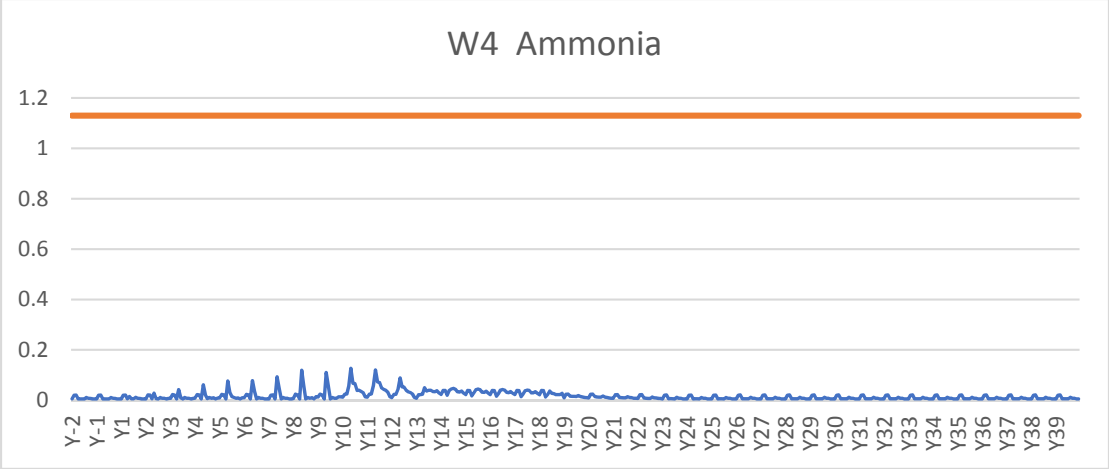
A.1-1: Time series of predicted sulphate concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



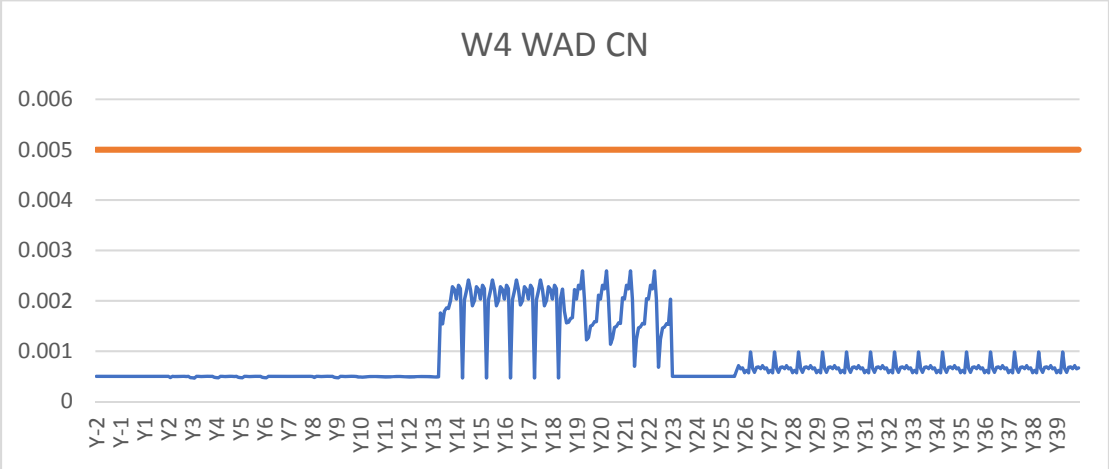
A.1-2: Time series of predicted nitrate concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



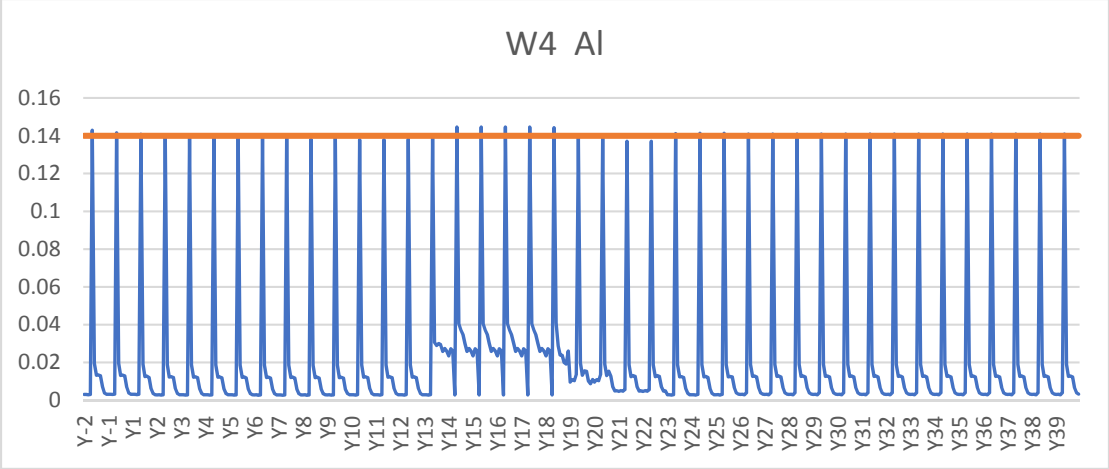
A.1-3: Time series of predicted nitrite concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



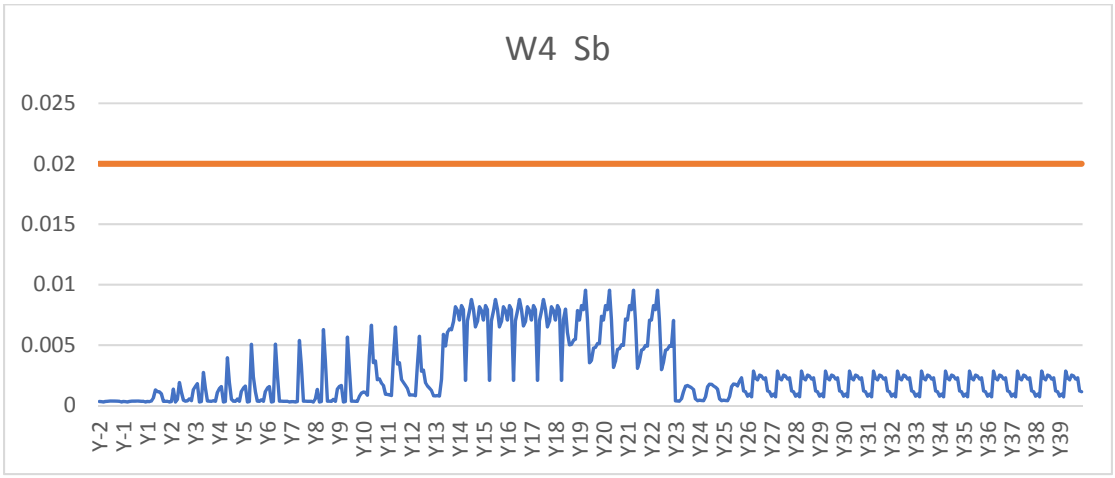
A.1-4: Time series of predicted ammonia concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



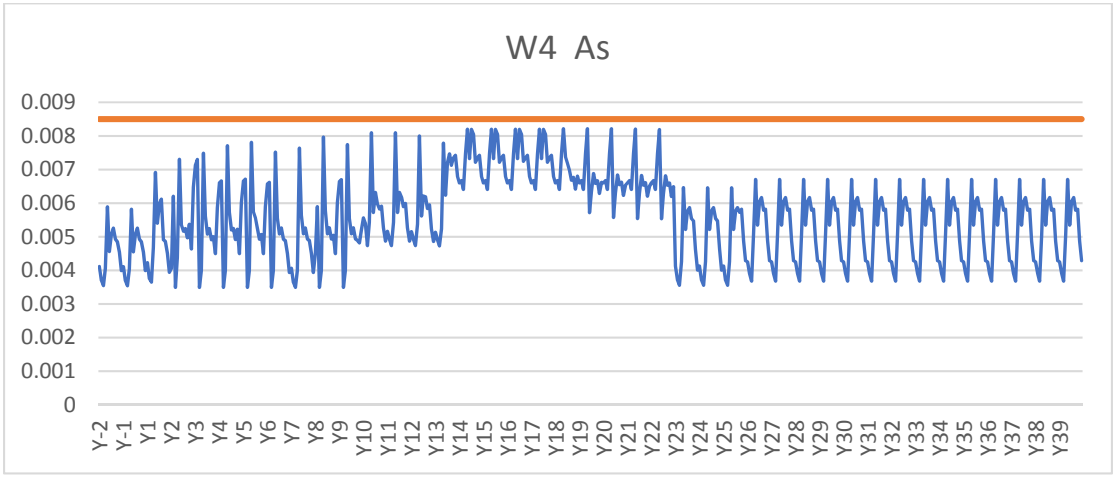
A.1-5: Time series of predicted WAD-CN concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



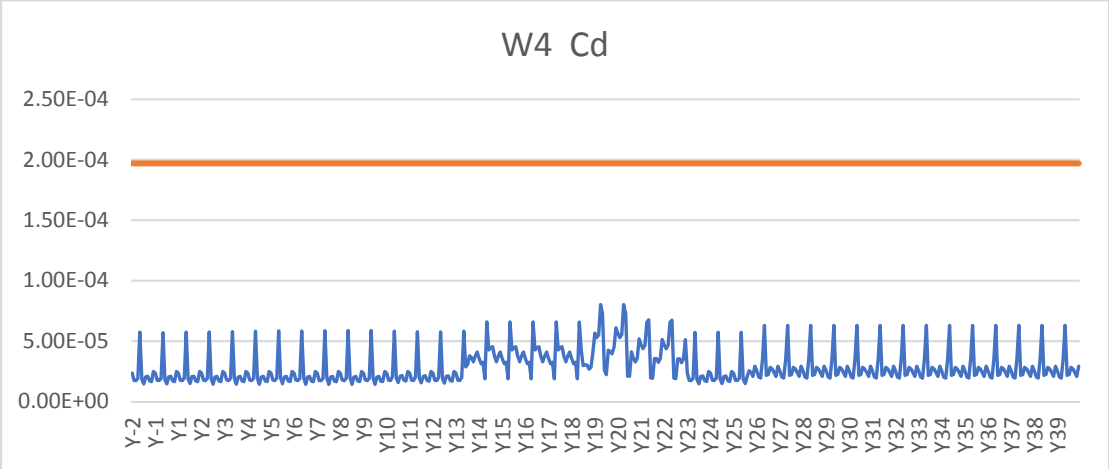
A.1-6: Time series of predicted aluminum concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



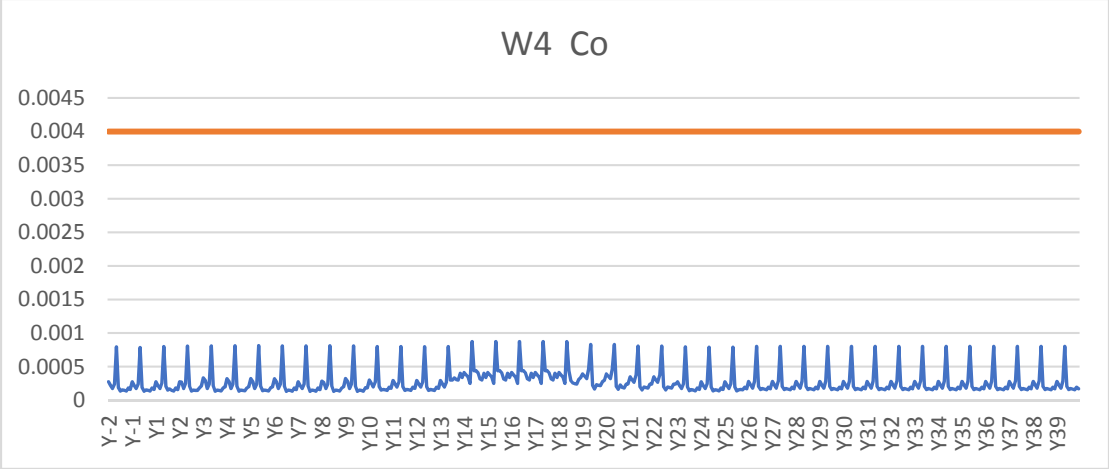
A.1-7: Time series of predicted antimony concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



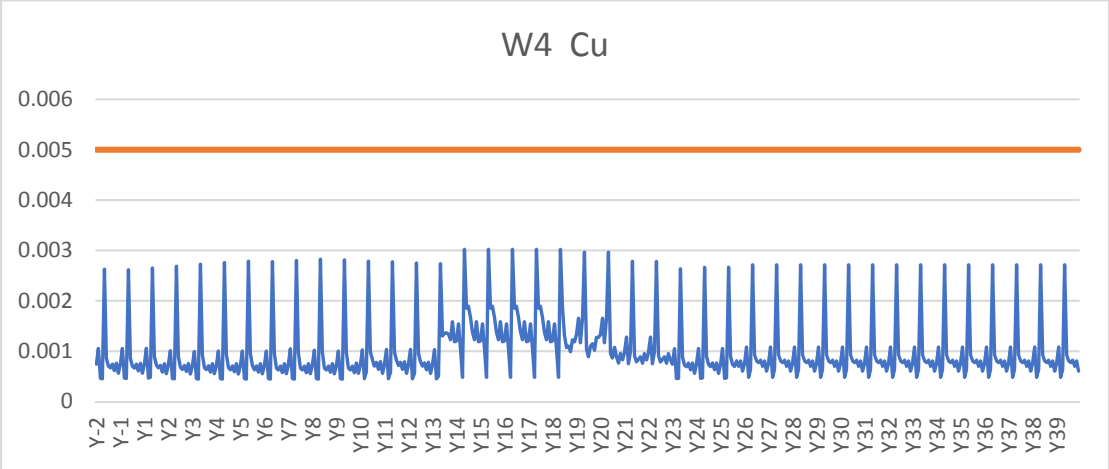
A.1-8: Time series of predicted arsenic concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



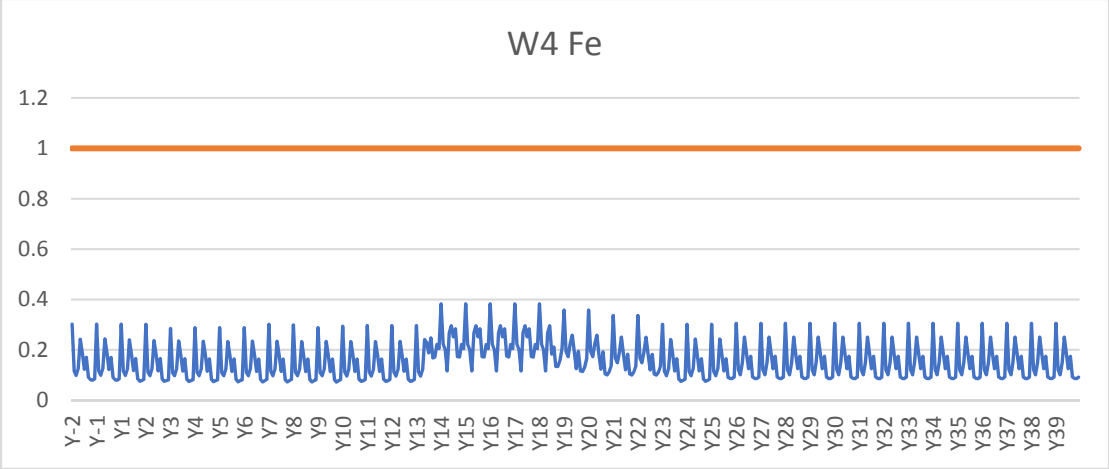
A.1-9: Time series of predicted cadmium concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



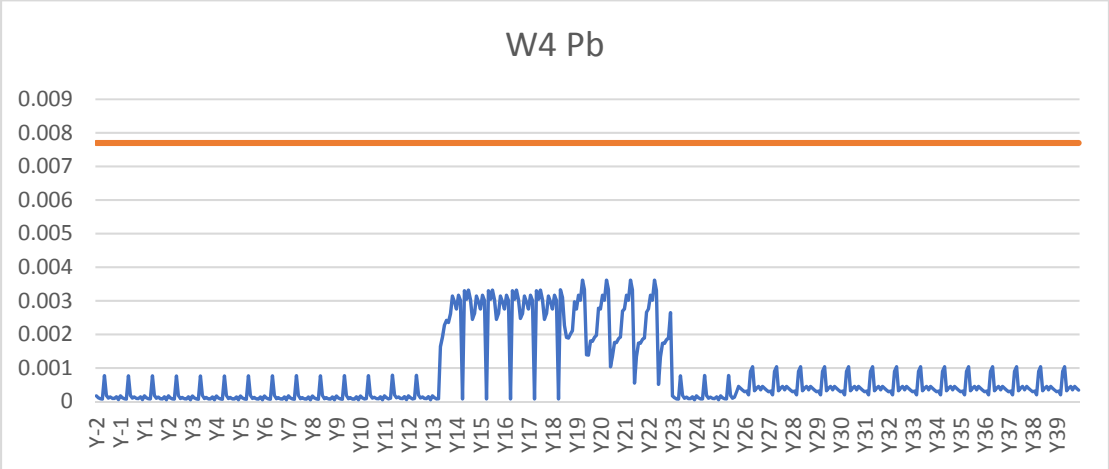
A.1-10: Time series of predicted cobalt concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



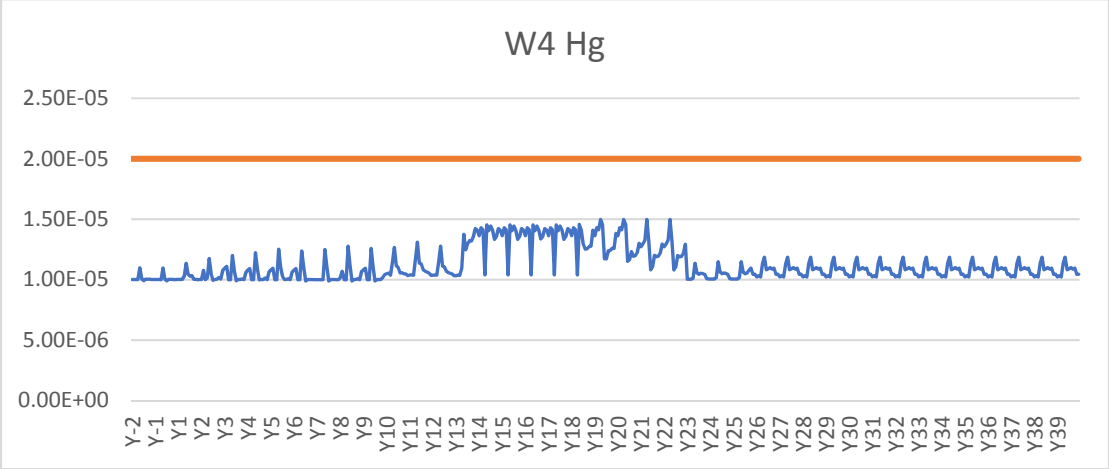
A.1-11: Time series of predicted copper concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



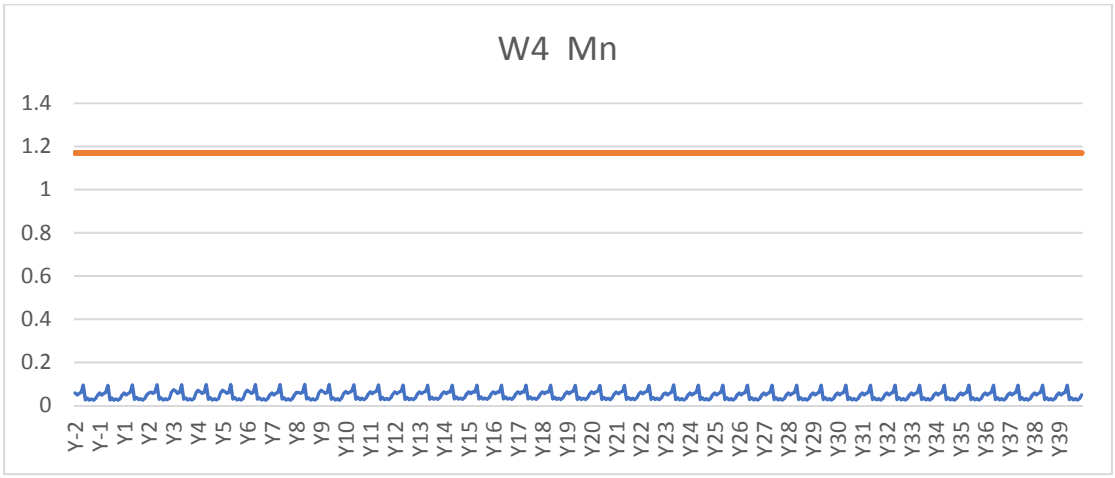
A.1-12: Time series of predicted iron concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



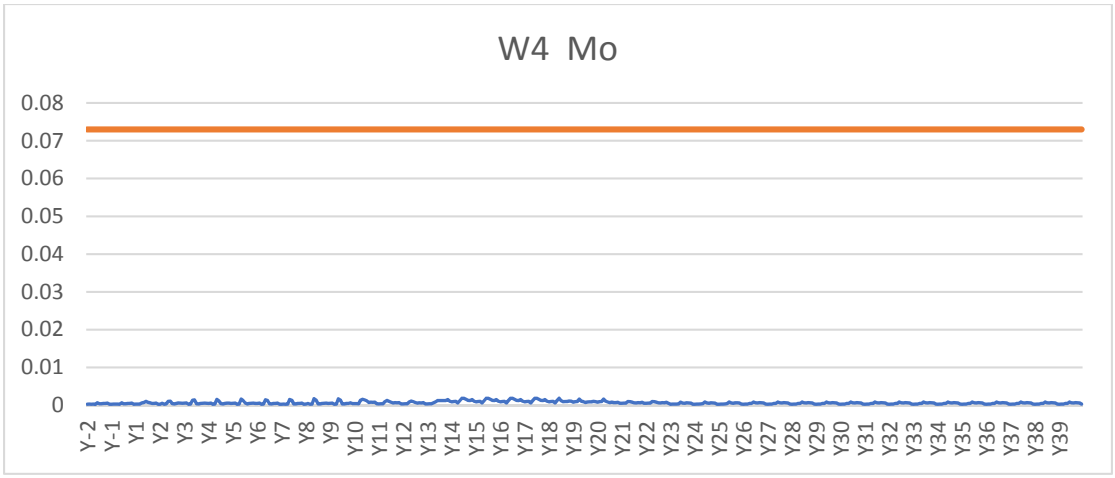
A.1-13: Time series of predicted lead concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



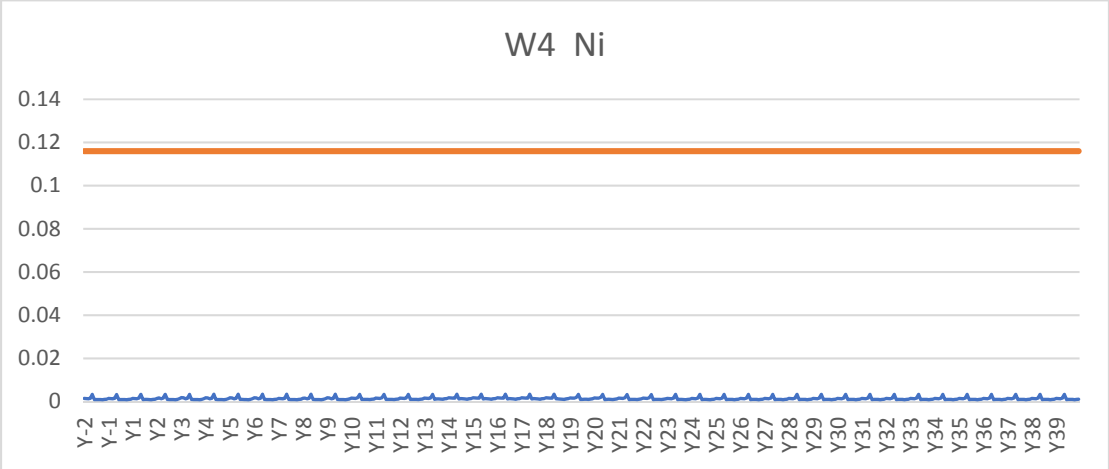
A.1-14: Time series of predicted mercury concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



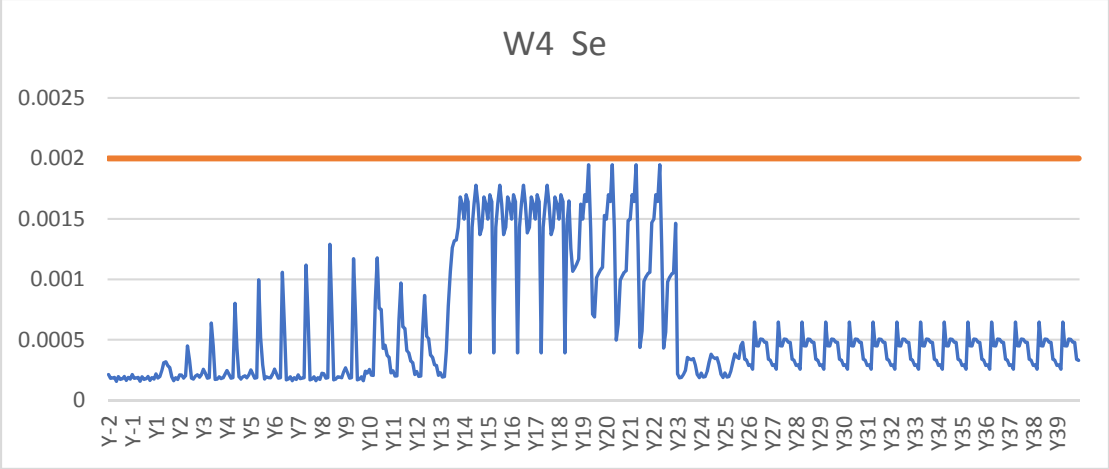
A.1-15: Time series of predicted manganese concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



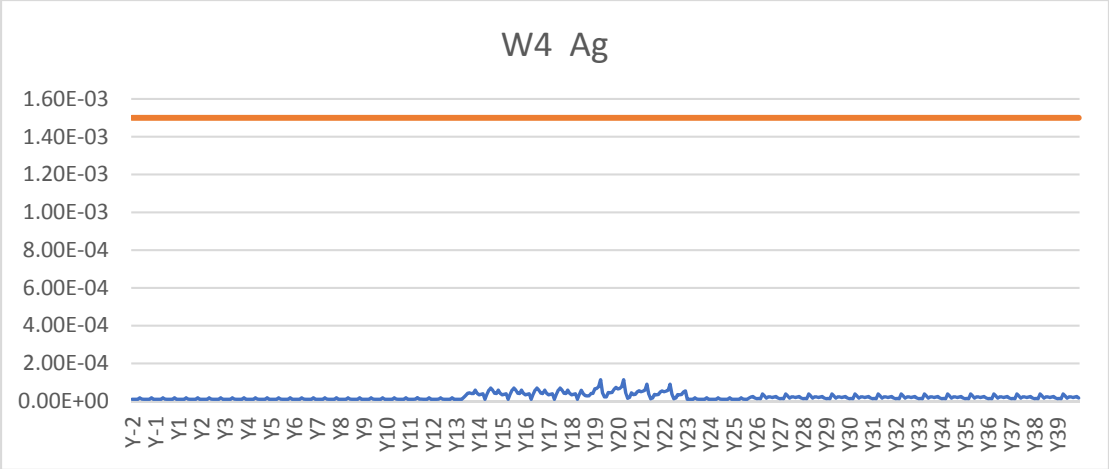
A.1-16: Time series of predicted molybdenum concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



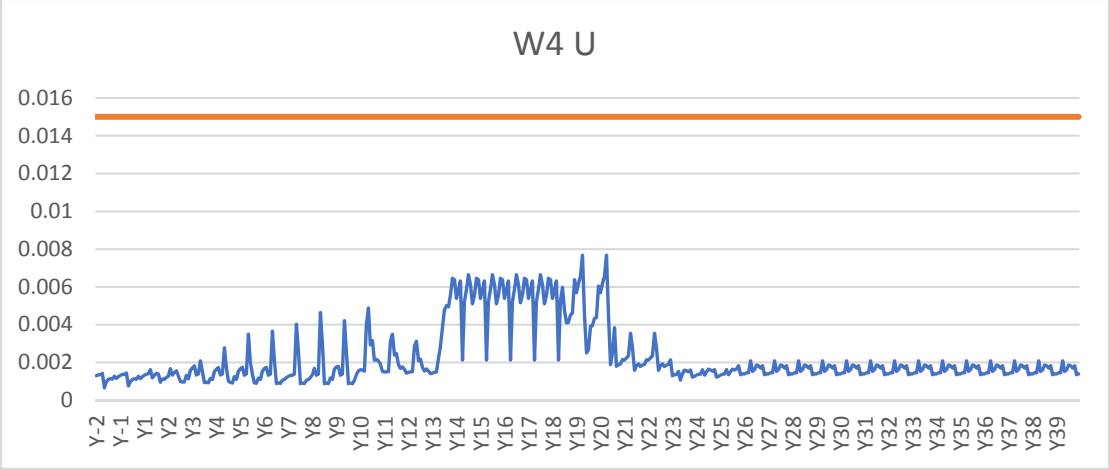
A.1-17: Time series of predicted nickel concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



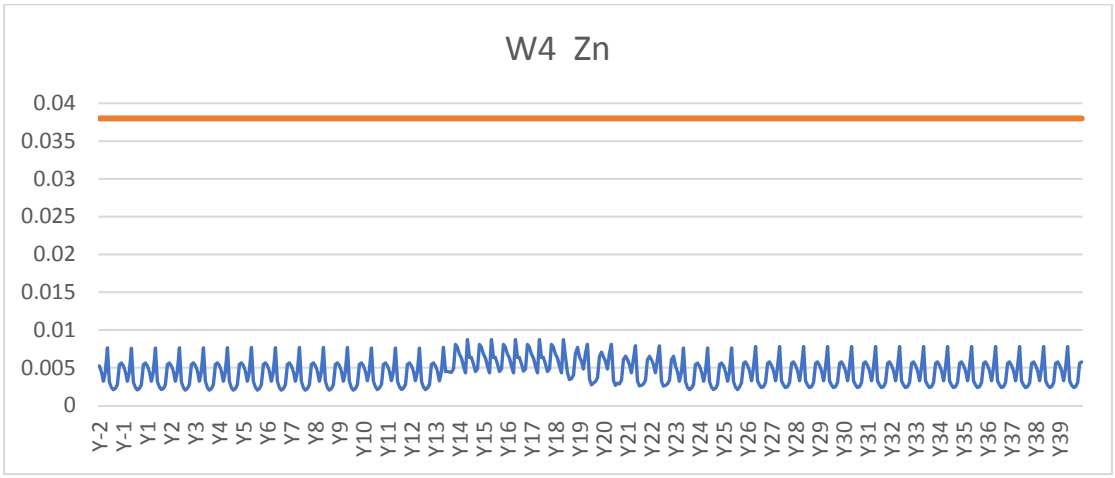
A.1-18: Time series of predicted selenium concentrations (mg/L) for W4. Water Quality Objective is shown by red line.



A.1-19: Time series of predicted silver concentrations (mg/L) for W4. Water Quality Objective is shown by red line.

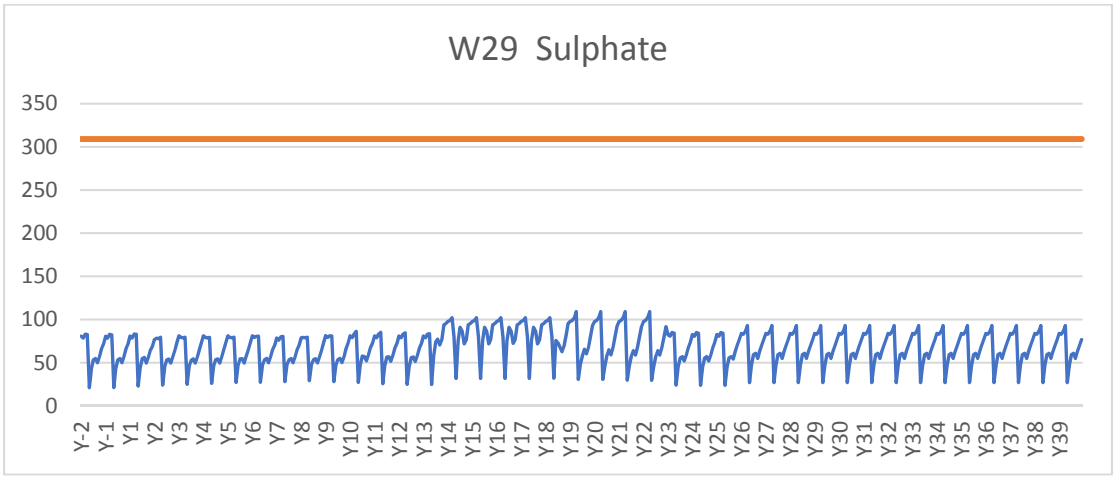


A.1-20: Time series of predicted uranium concentrations (mg/L) for W4. Water Quality Objective is shown by red line.

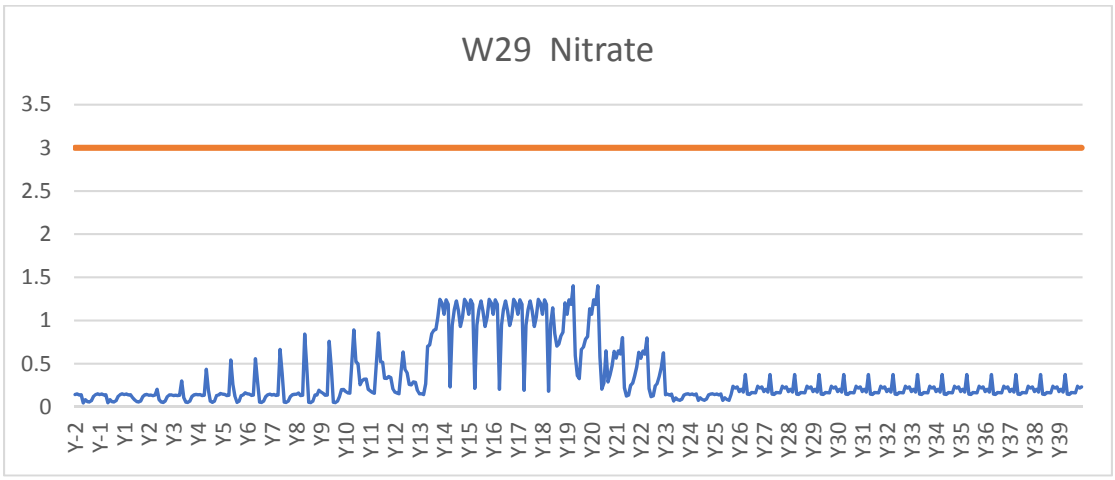


A.1-21: Time series of predicted zinc concentrations (mg/L) for W4. Water Quality Objective is shown by red line.

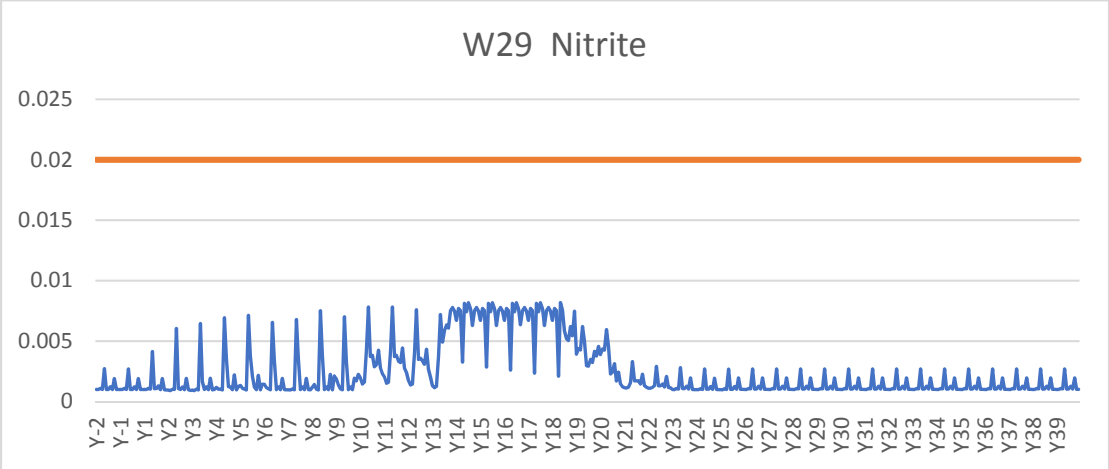
A.2. Haggart Creek below Eagle Creek (W29) – Water Quality Predictions



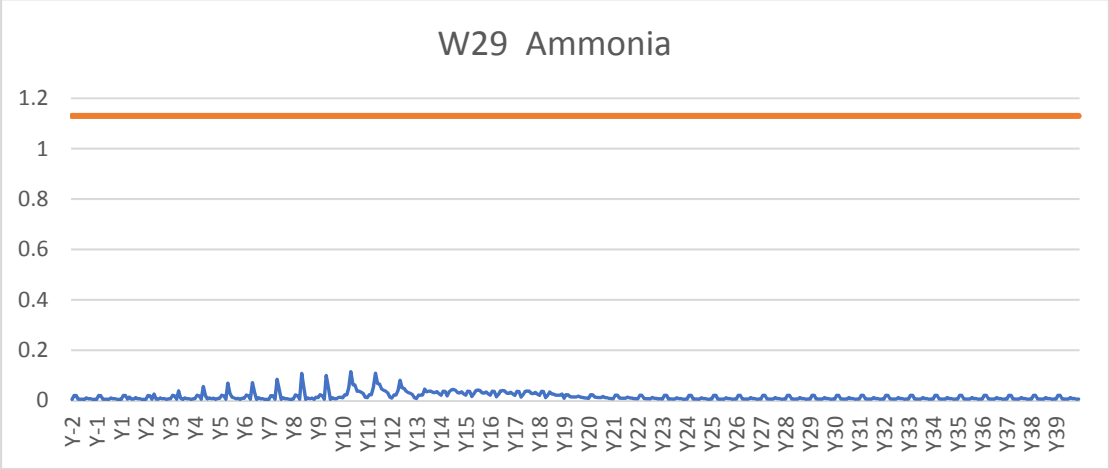
A.2-1: Time series of predicted sulphate concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



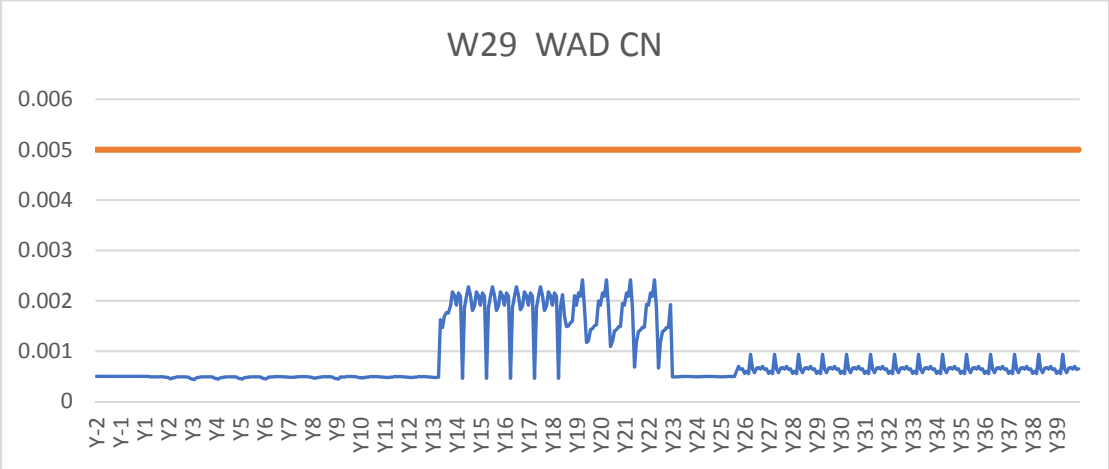
A.2-2: Time series of predicted nitrate concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



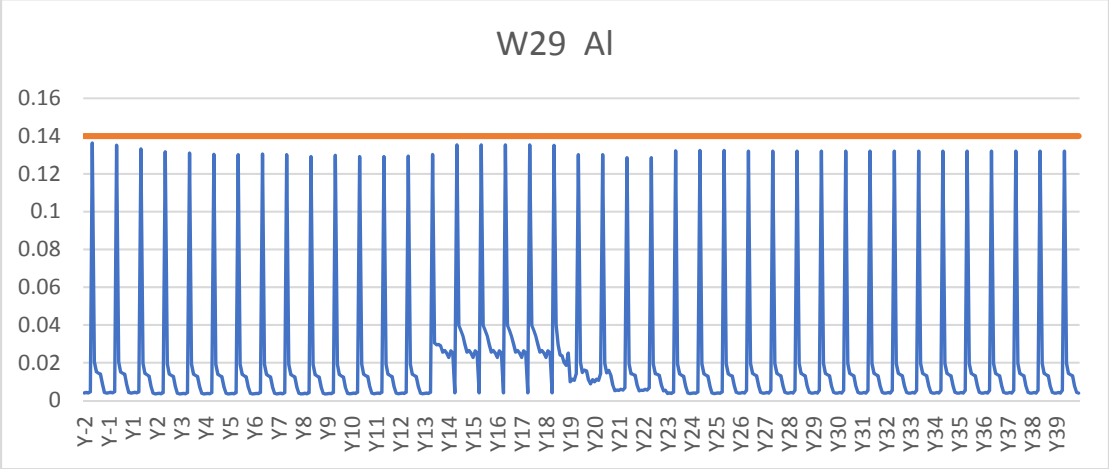
A.2-3: Time series of predicted nitrite concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



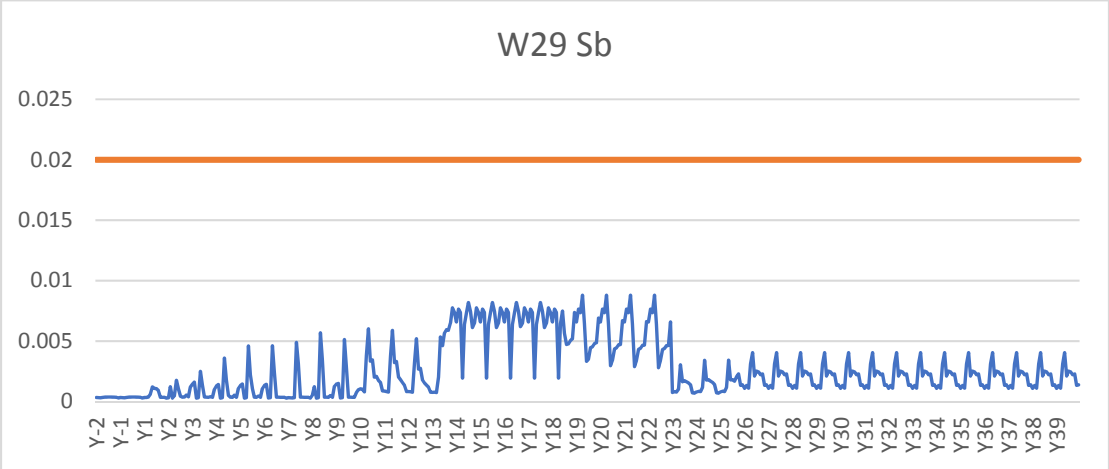
A.2-4: Time series of predicted ammonia concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



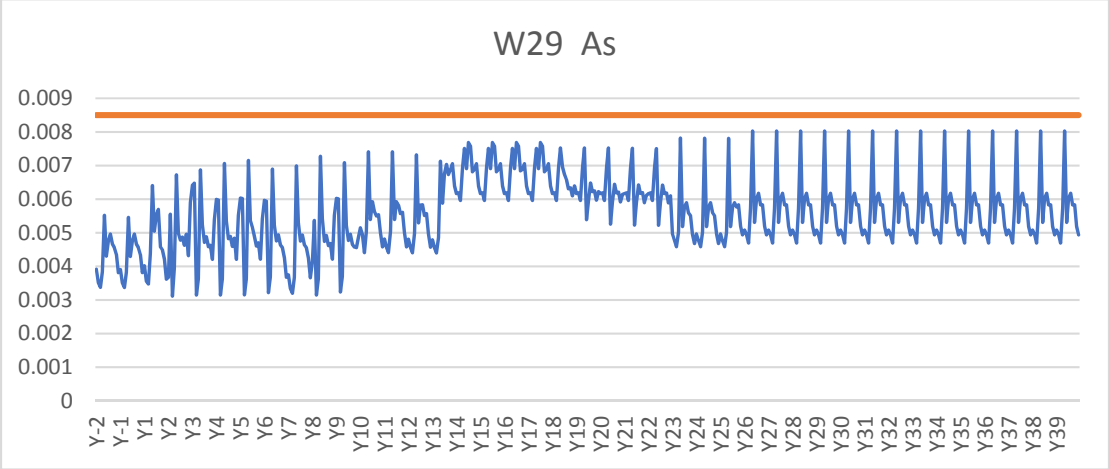
A.2-5: Time series of predicted WAD-CN concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



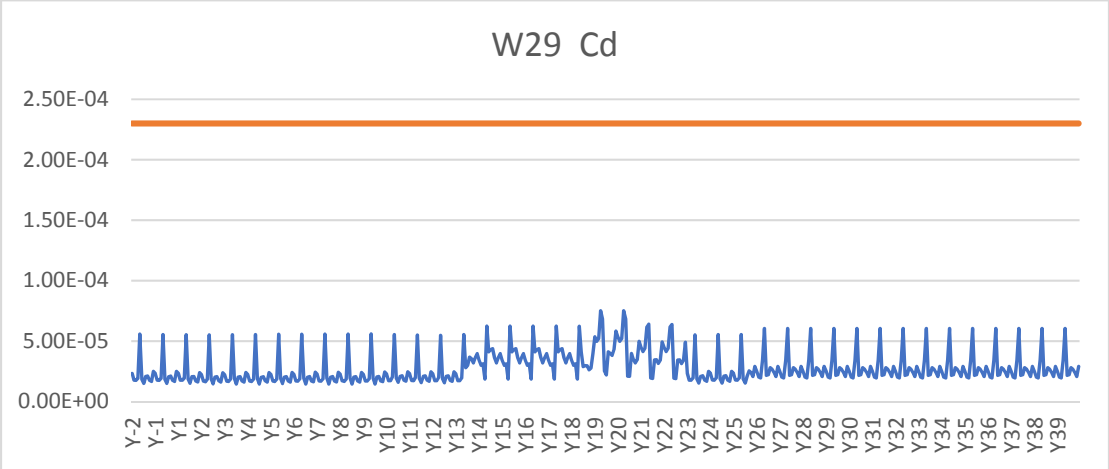
A.2-6: Time series of predicted aluminum concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



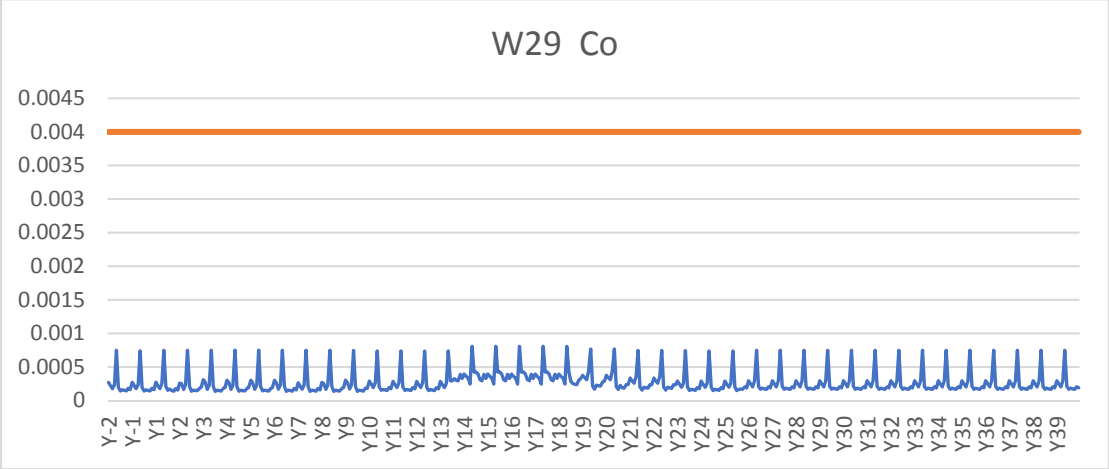
A.2-7: Time series of predicted antimony concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



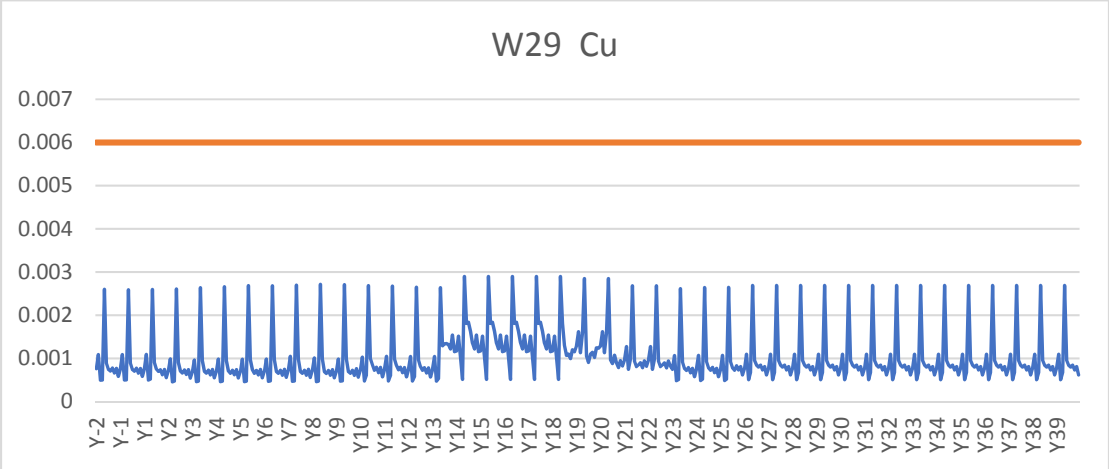
A.2-8: Time series of predicted arsenic concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



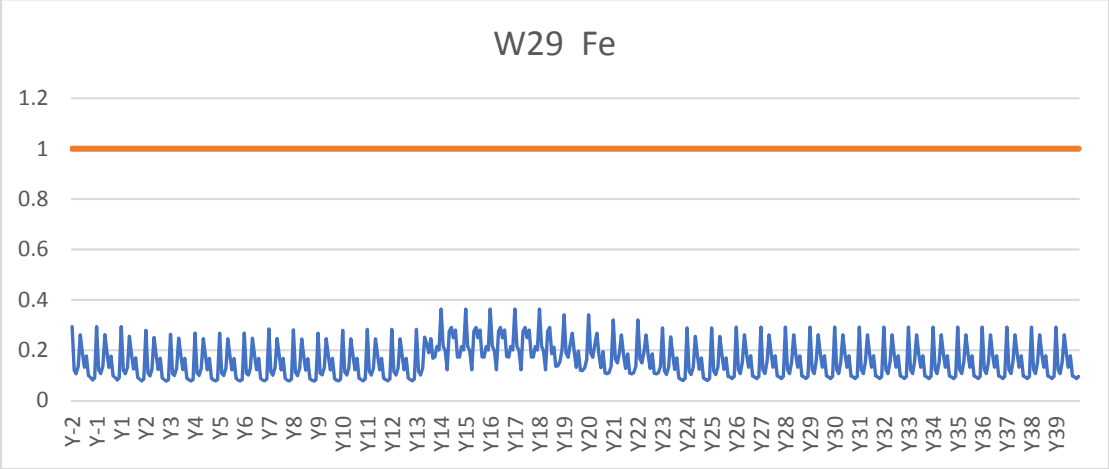
A.2-9: Time series of predicted cadmium concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



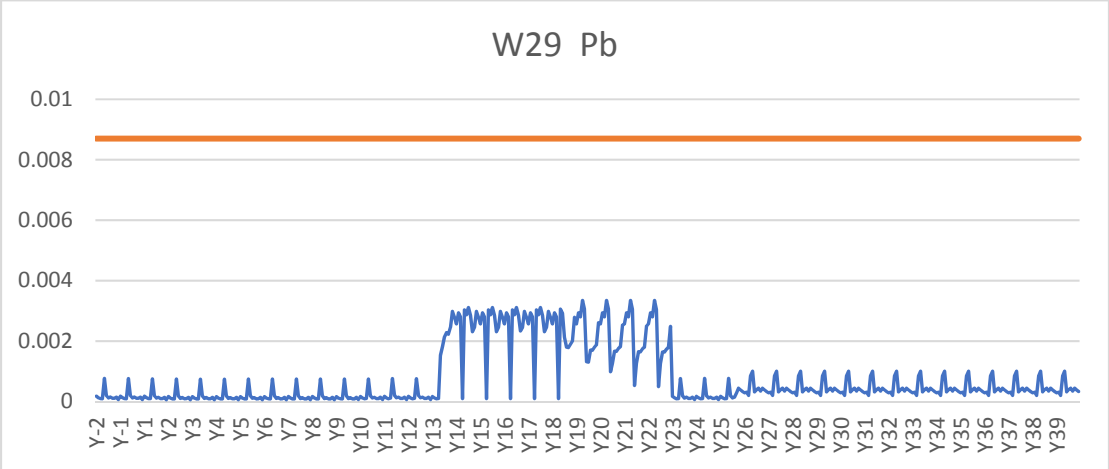
A.2-10: Time series of predicted cobalt concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



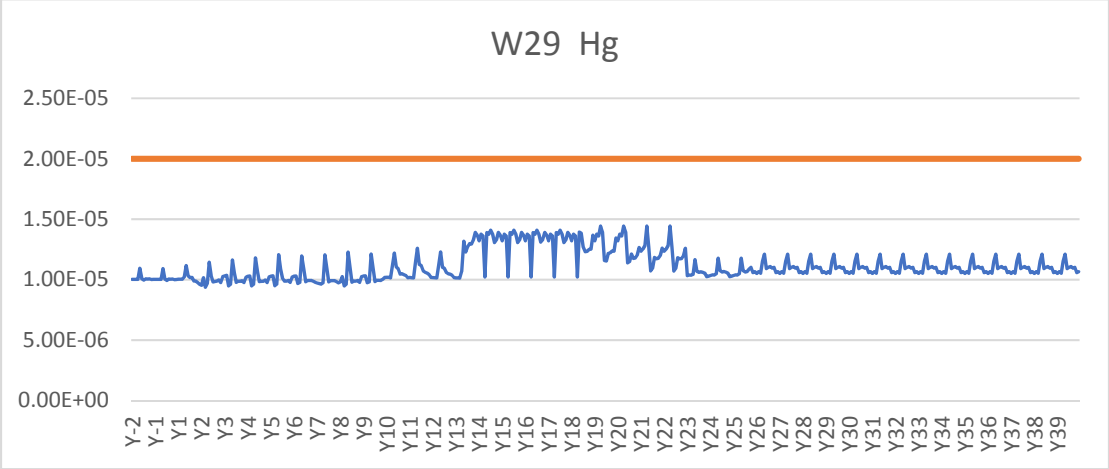
A.2-11: Time series of predicted copper concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



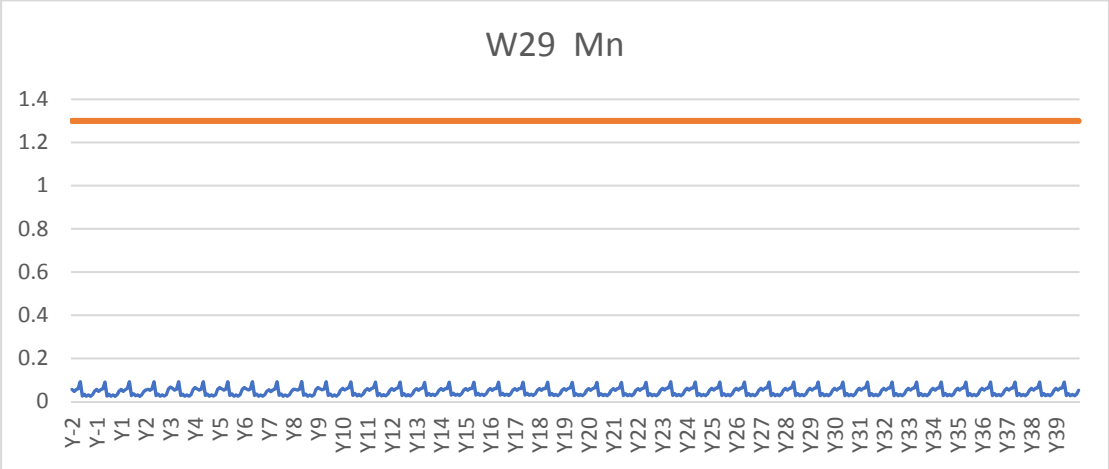
A.2-12: Time series of predicted iron concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



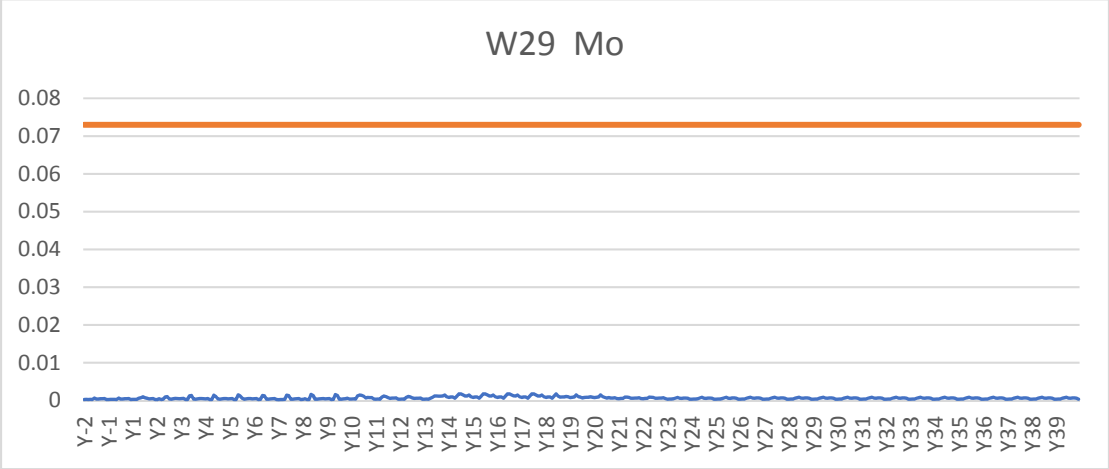
A.2-13: Time series of predicted lead concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



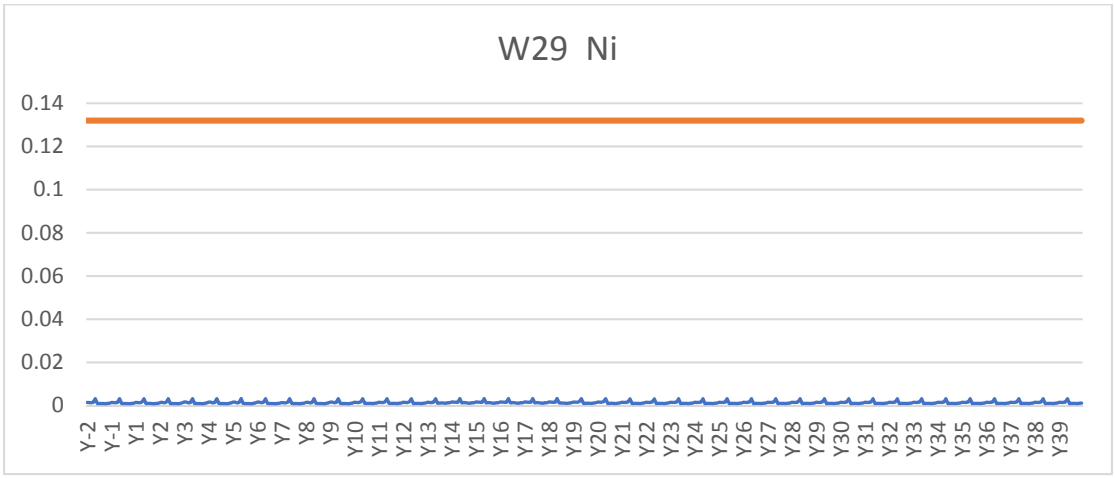
A.2-14: Time series of predicted mercury concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



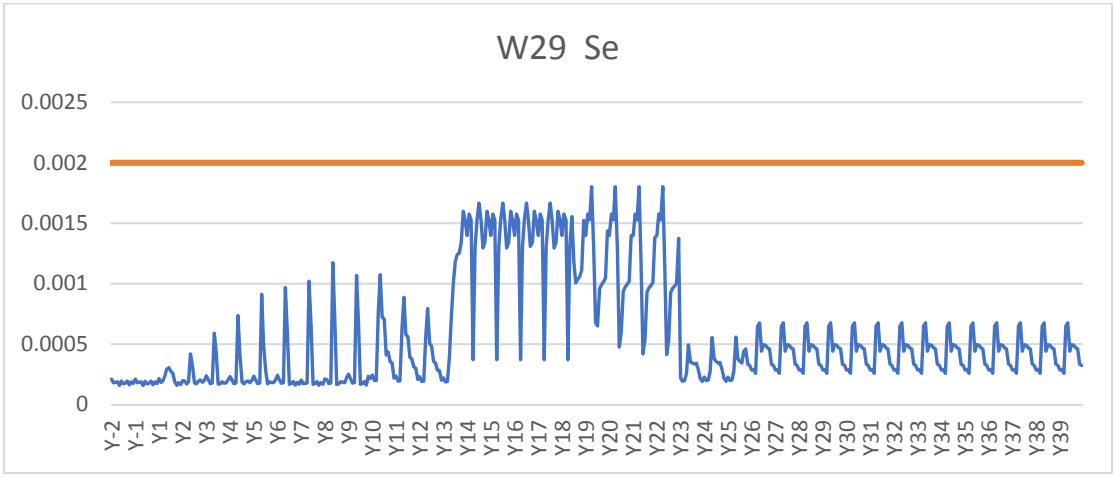
A.2-15: Time series of predicted manganese concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



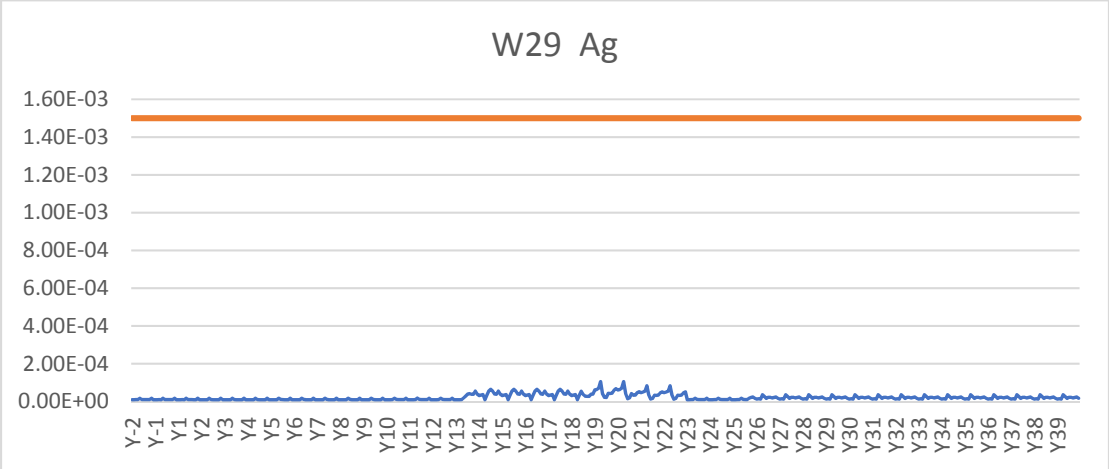
A.2-16: Time series of predicted molybdenum concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



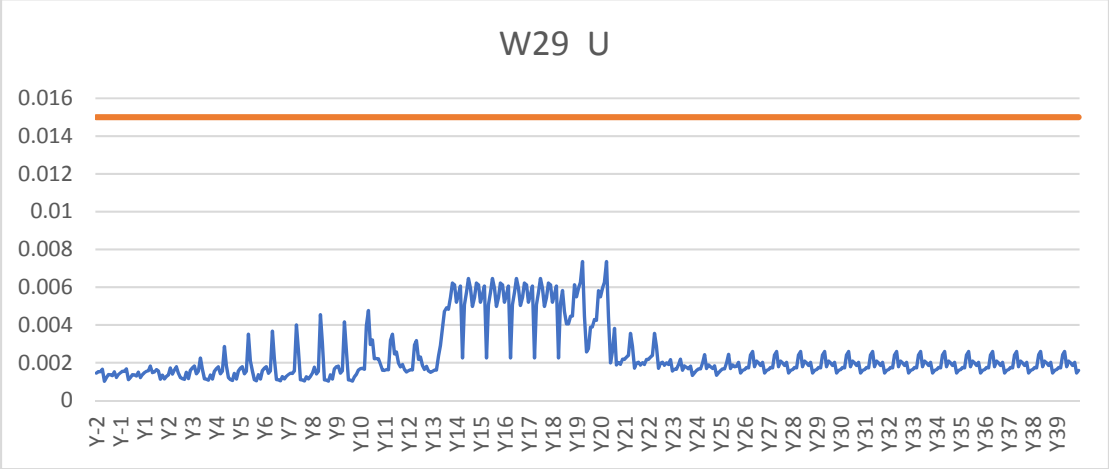
A.2-17: Time series of predicted nickel concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



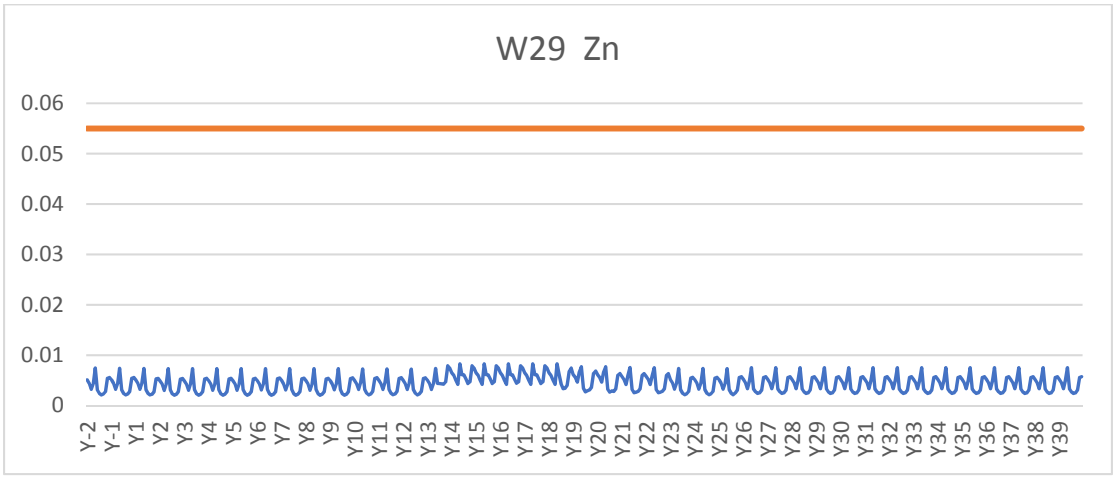
A.2-18: Time series of predicted selenium concentrations (mg/L) for W29. Water Quality Objective is shown by red line.



A.2-19: Time series of predicted silver concentrations (mg/L) for W29. Water Quality Objective is shown by red line.

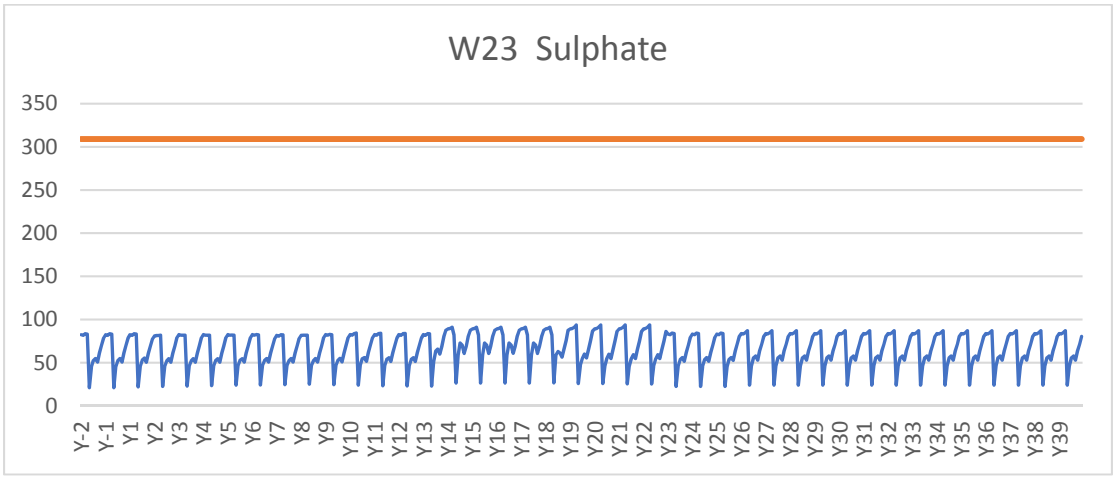


A.2-20: Time series of predicted uranium concentrations (mg/L) for W29. Water Quality Objective is shown by red line.

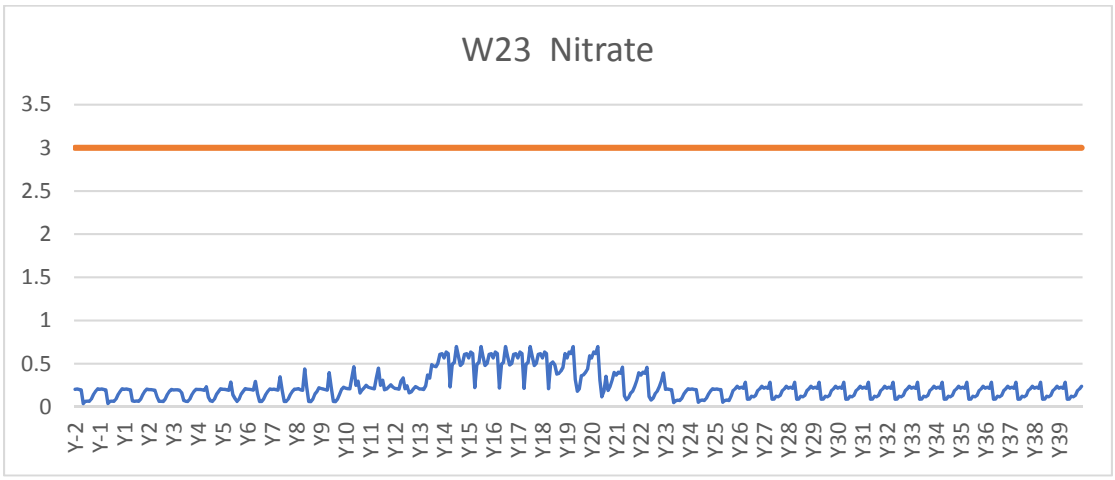


A.2-21: Time series of predicted zinc concentrations (mg/L) for W29. Water Quality Objective is shown by red line.

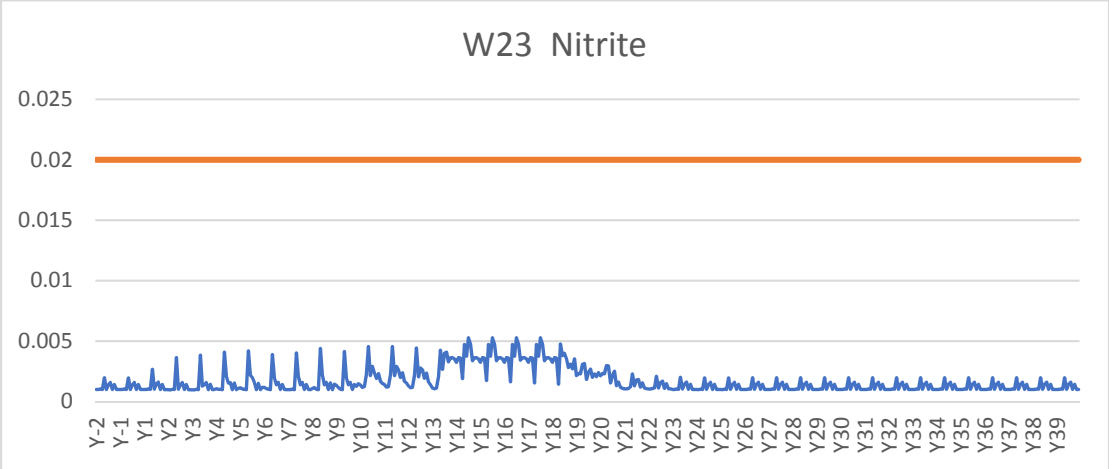
A.3. Haggart Creek below Lynx Creek (W23) – Water Quality Predictions



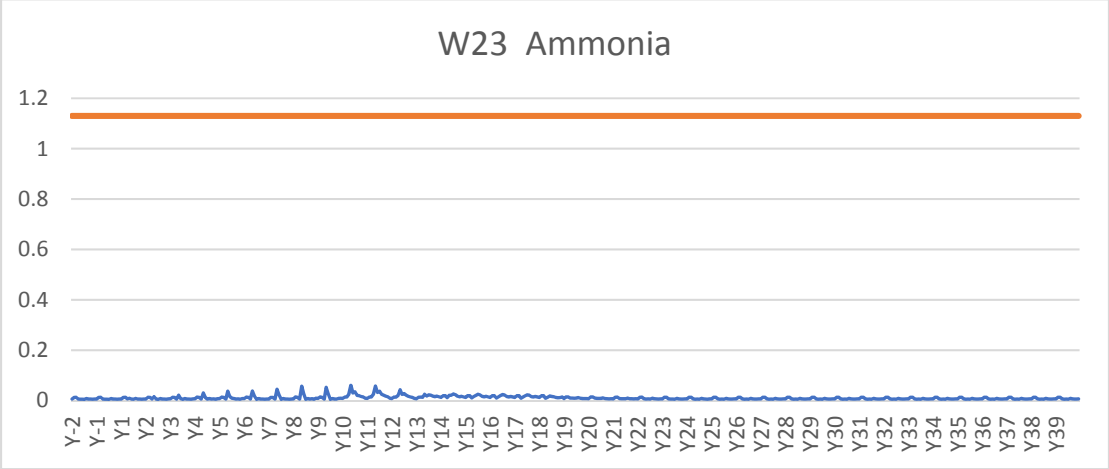
A.3-1: Time series of predicted sulphate concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



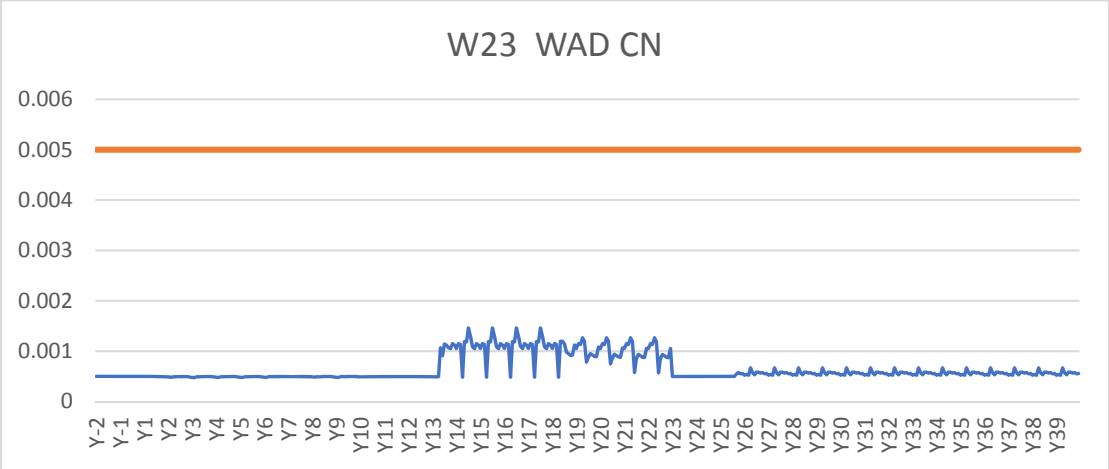
A.3-2: Time series of predicted nitrate concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



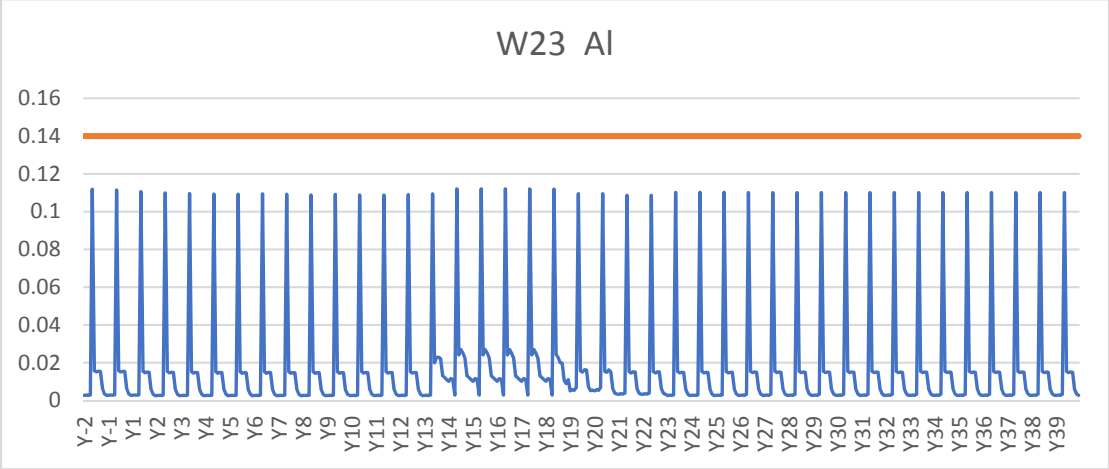
A.3-3: Time series of predicted nitrite concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



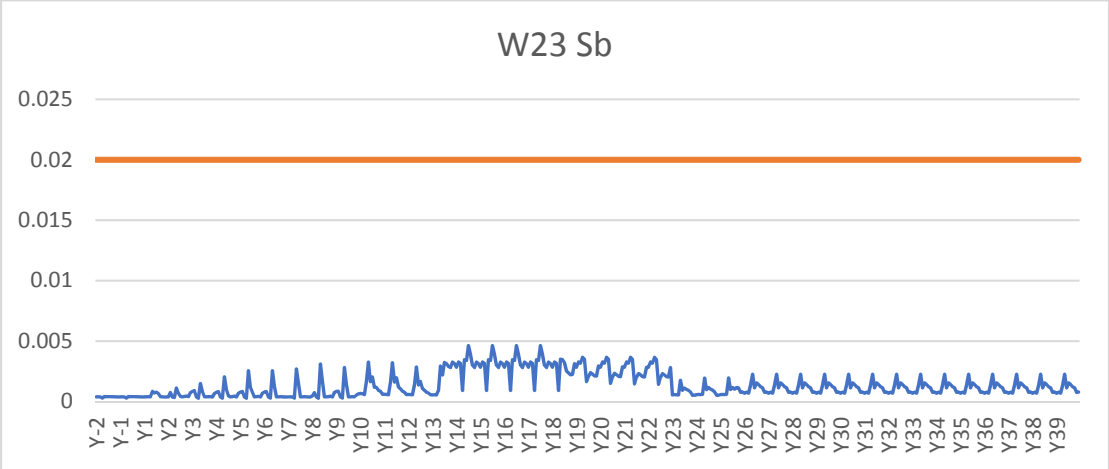
A.3-4: Time series of predicted ammonia concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



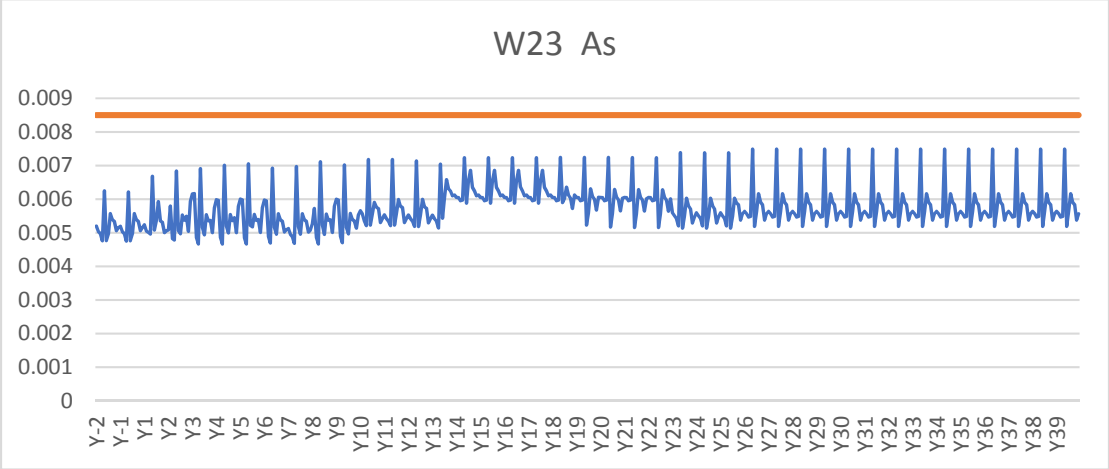
A.3-5: Time series of predicted WAD-CN concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



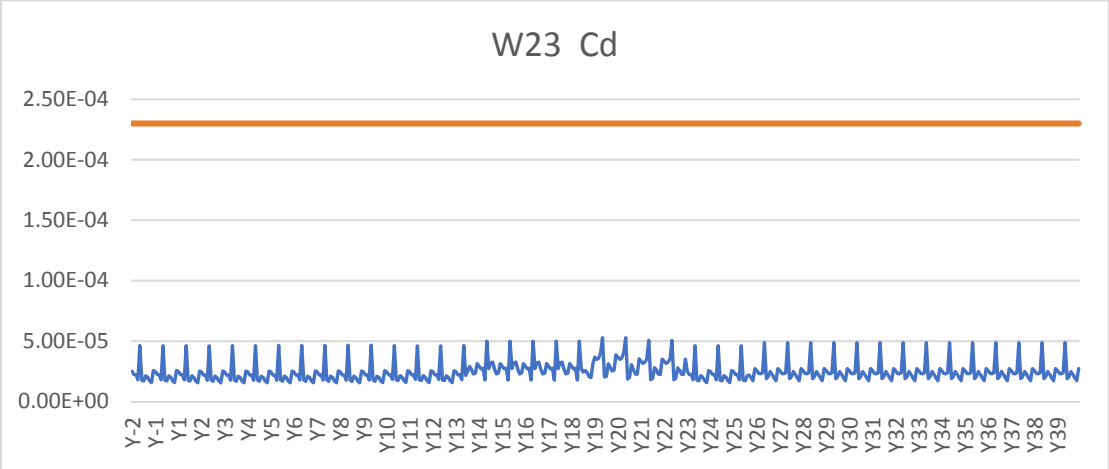
A.3-6: Time series of predicted aluminum concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



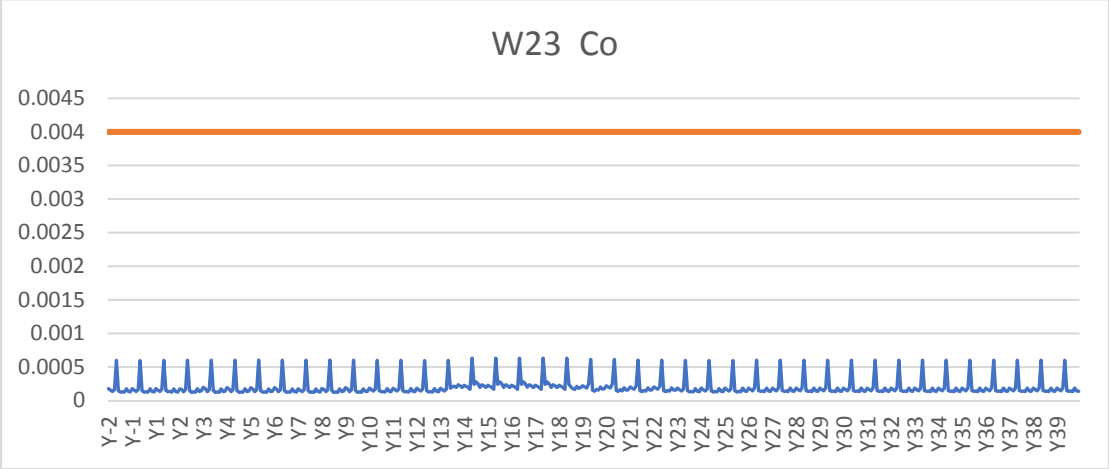
A.3-7: Time series of predicted antimony concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



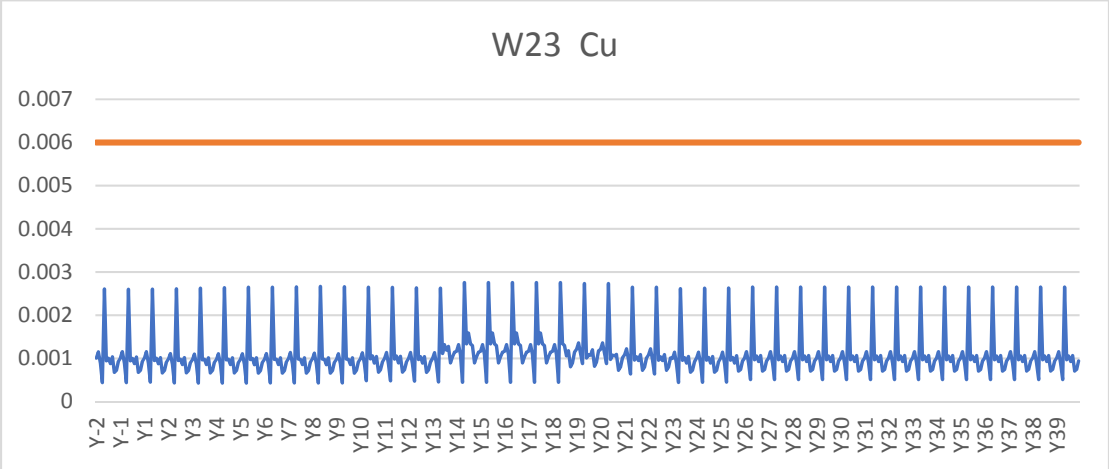
A.3-8: Time series of predicted arsenic concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



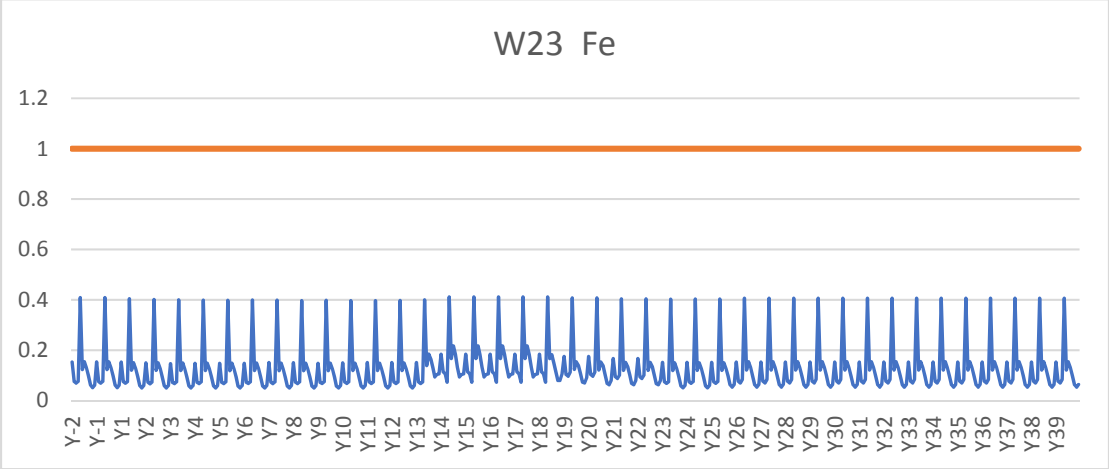
A.3-9: Time series of predicted cadmium concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



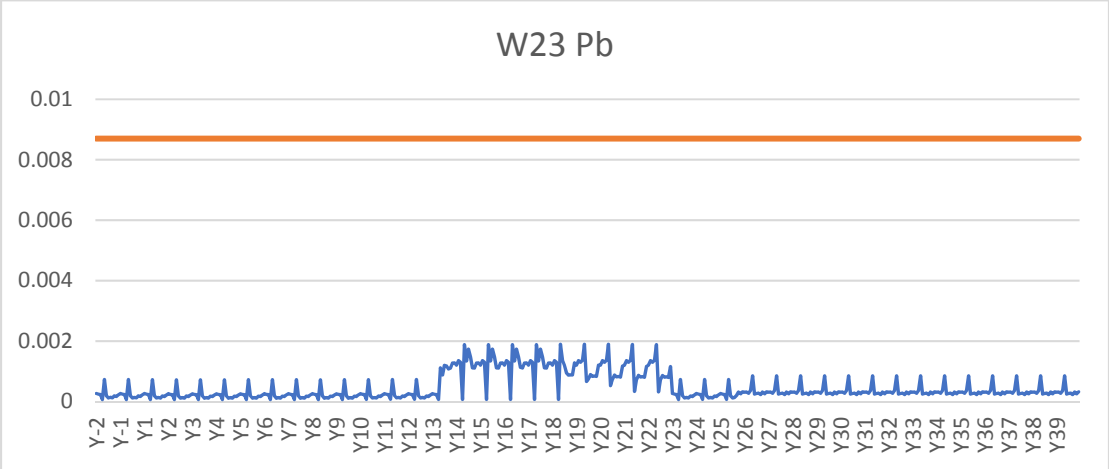
A.3-10: Time series of predicted cobalt concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



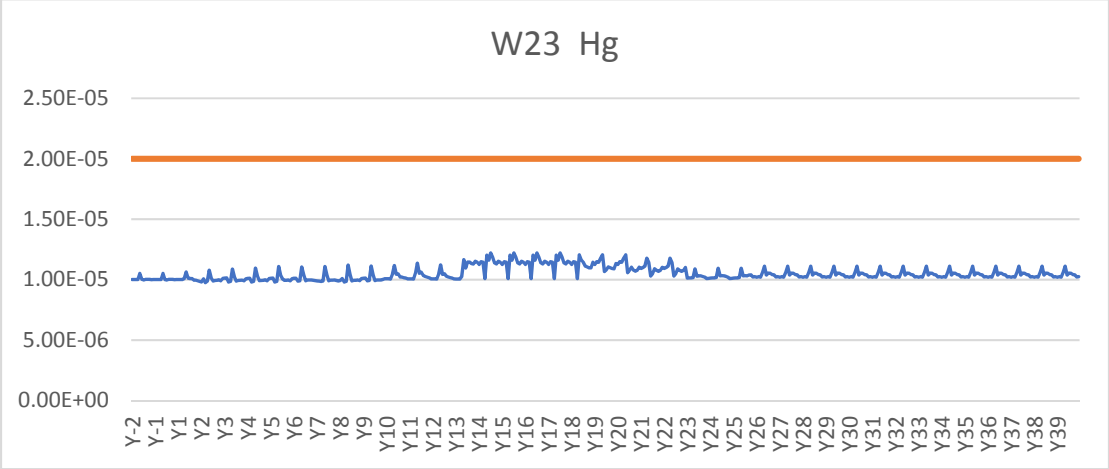
A.3-11: Time series of predicted copper concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



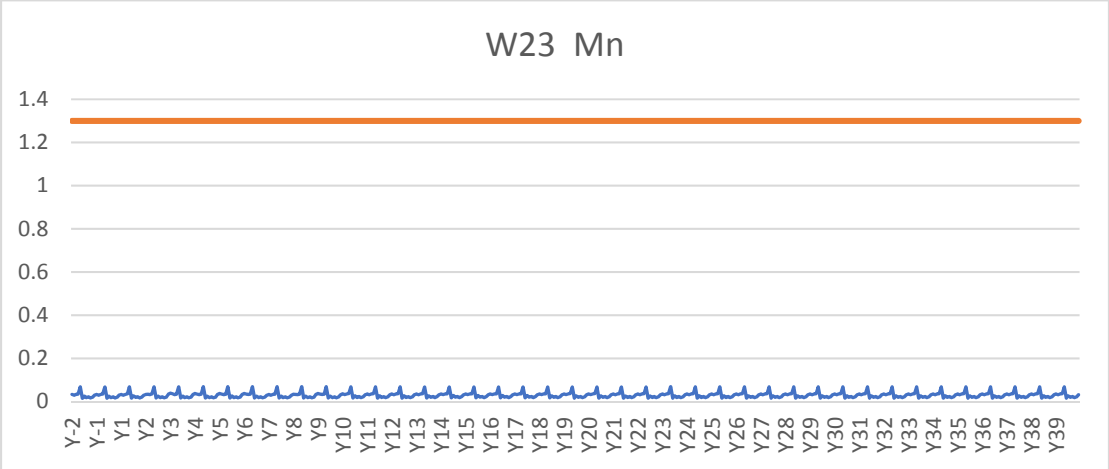
A.3-12: Time series of predicted iron concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



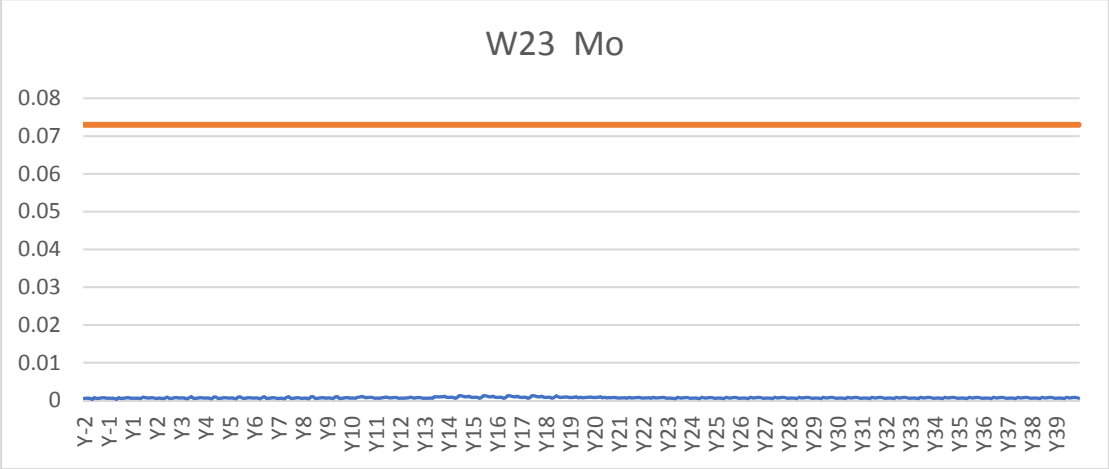
A.3-13: Time series of predicted lead concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



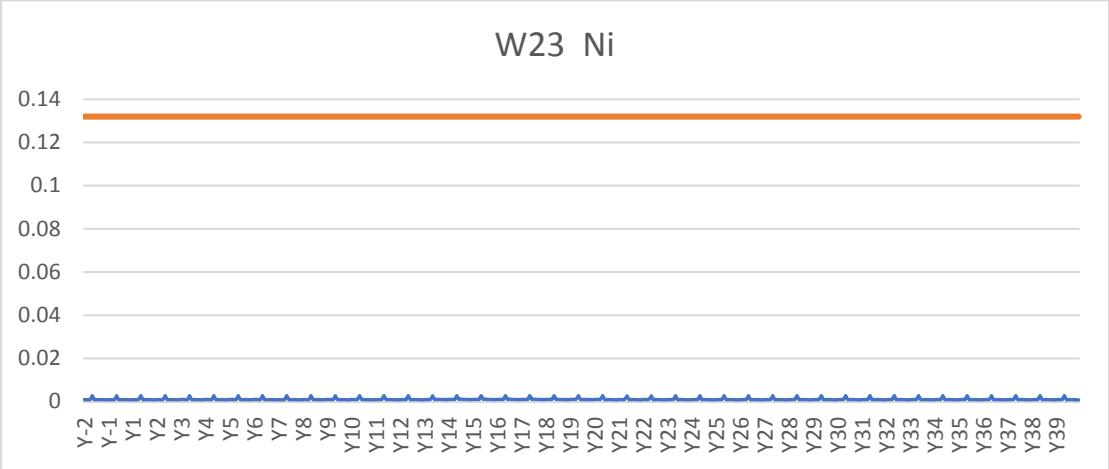
A.3-14: Time series of predicted mercury concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



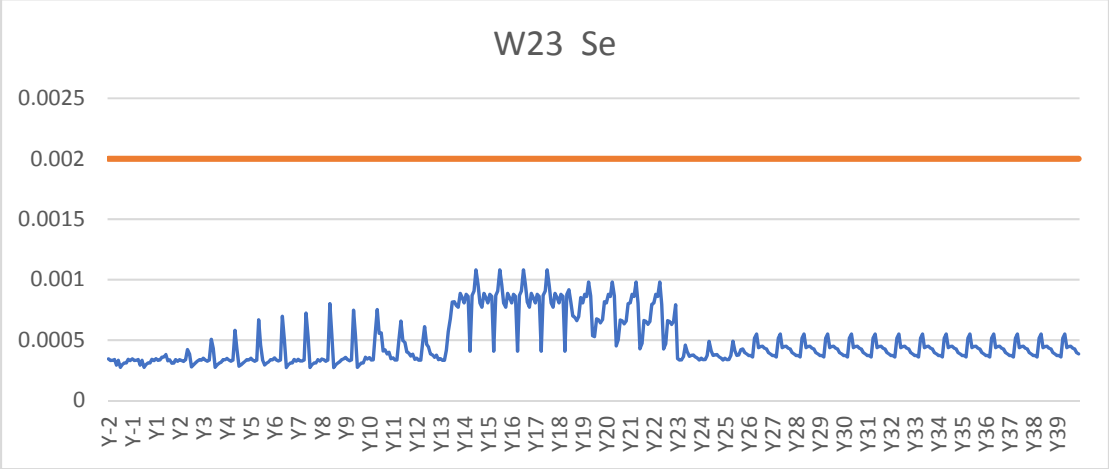
A.3-15: Time series of predicted manganese concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



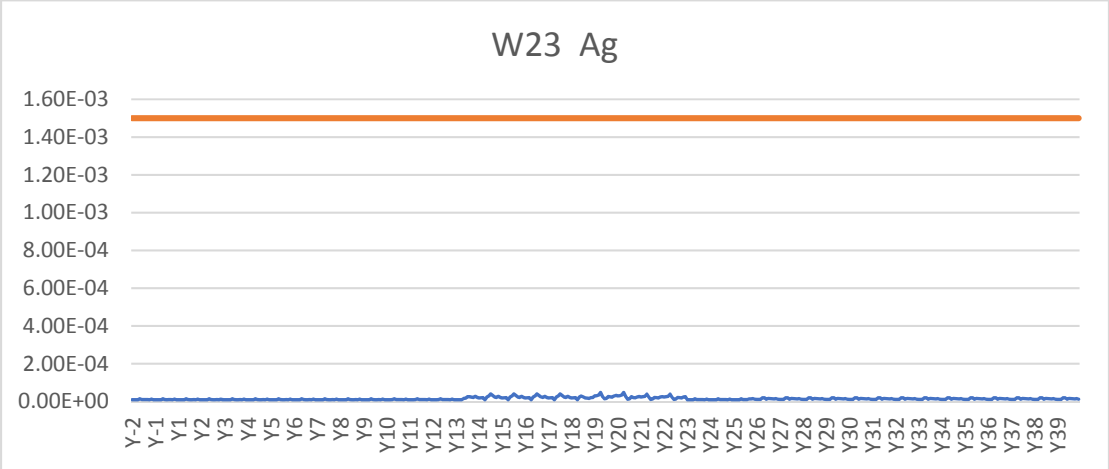
A.3-16: Time series of predicted molybdenum concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



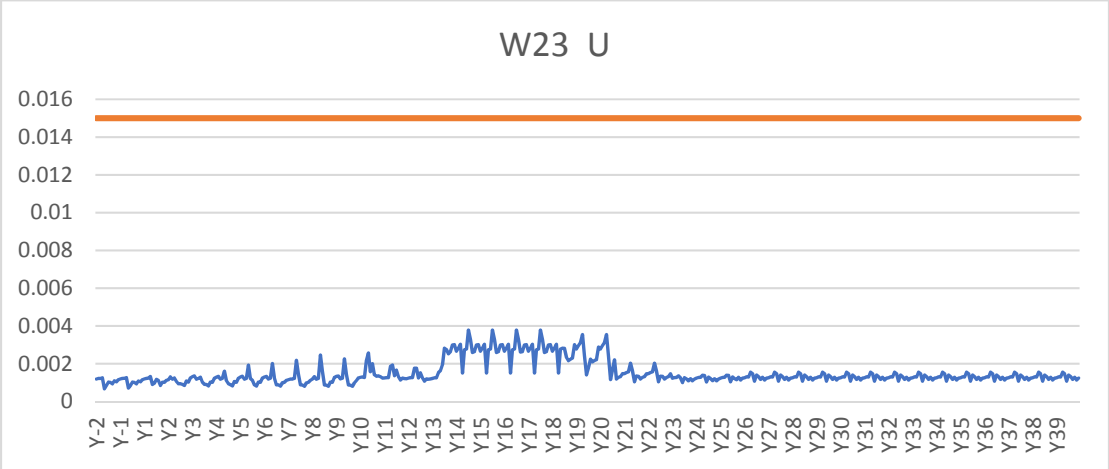
A.3-17: Time series of predicted nickel concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



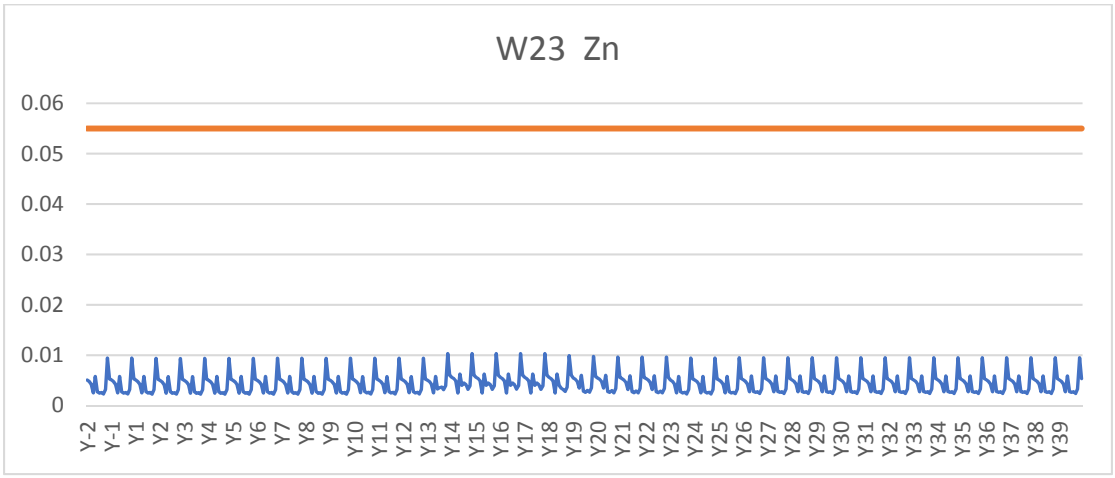
A.3-18: Time series of predicted selenium concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



A.3-19: Time series of predicted silver concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



A.3-20: Time series of predicted uranium concentrations (mg/L) for W23. Water Quality Objective is shown by red line.



A.3-21: Time series of predicted zinc concentrations (mg/L) for W23. Water Quality Objective is shown by red line.

Appendix B: Water Quality Model Output for all Parameters

Provided electronically

APPENDIX E

Water Balance Modeling for the Eagle Gold Mine Proposed Heap Leach Pad Facility

THIS PAGE INTENTIONALLY LEFT BLANK

Water Balance Modeling for the Eagle Gold Mine Proposed Heap Leach Pad Facility, Final Design

Prepared for:

Strata Gold Corporation
Vancouver B.C., Canada

Prepared by:

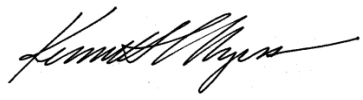
1325 Airmotive Way, Suite 175u
Reno, Nevada 89502
775-322-7622

Project No. 167301
January 26, 2018

Water Balance Modeling for the Eagle Gold Mine Proposed Heap Leach Pad Facility, Final Design

The following documents have been prepared by The MINES Group, Inc. under the professional supervision of the engineer whose signature appears hereon.

The findings are presented within the limits described by the client, and prepared in accordance with generally accepted professional engineering principles and practices. No other warranties either express or implied are made.



_____

Kenneth L. Myers, P.E.
Principal

Table of Contents

List of Tables

List of Figures

1 EXECUTIVE SUMMARY

An updated operational water balance model has been developed for the proposed heap leach facility (HLF) at the Eagle Gold Project (Project) site in the Yukon Territory, Canada, with the primary objectives of evaluating HLF pad performance in terms of predicting: 1) makeup water demands, and 2) the potential for maintaining a desired level of available pond storage volume. Two (2) different types of water balance models were used: a deterministic model (using a chain of single valued input parameters to produce a series of single valued results) and a stochastic model (probability based). In the stochastic model the single valued input parameters were replaced with probability distributions derived from the computed statistics of the meteoric observations (in this case the monthly mean and variance or its square root, the standard deviation). A Monte Carlo procedure was then used to propagate the uncertainty through the model by sampling all of the input parameter distributions and compiling output distributions for specific results of interest.

A 12 year meteoric record was originally used for the modeling of the effective operational facility life. The updated model involves optimized ore volumes based on the issued for construction HLF design. The model includes 1 year for construction, 9+ years of normal operations (including ore stacking at approximately 39,154 tonnes per day for 275 days of the year), an assumed 2 years of extended gold extraction after the cessation of ore stacking, and an additional 2 years to represent rinsing and the initiation of draindown.The last two (2) years of the weather record (representing average or typical conditions) were repeated to accommodate the last phase (Phase 5) addressing rinsing and draindown. The actual duration of extended gold extraction will depend on when the level of gold recovery becomes uneconomic, and similarly, the actual duration of draindown will depend on the pace of reclamation activities and the rate of pumping of solution to treatment. The draindown process beyond what is depicted in the water balance model is further examined using a separate but linked spreadsheet based model that simulates the unsaturated flow conditions in the heap.

A three (3) year dry period and a three (3) year wet period were taken from the 68-year site synthetic weather record developed by Lorax (2017) using site and regional data and included within the 12 year synthetic meteoric mine life record. That portion of the record not involved in the wet or dry sequences are near the mean precipitation levels with moderate variability. Inclusion of the wet and dry periods in the deterministic record assure that the potential impact of historically observed variations in precipitation were represented by the model and included in the expected operating range. The order in which they were included is of relatively little consequence. However, to preserve conservatism, the dry sequence was placed early in the record (when the lined surface area was smaller and the annual amount of water recruited lower) and the wet sequence later in the record (when the lined surface area was greater amplifying the impact of more precipitation). This record will be referred to as Meteoric Record Number 1. As a check on the expected performance of the HLF during normal operations, two (2) additional meteoric records were extracted from the full site synthetic weather record. Meteoric Record Number 2 represents a period of average precipitation with moderate variability. Meteoric Record Number 3 represents a wetter period with high variability.

Air temperature was included in the site synthetic meteoric record, as it is a major factor in the climate of the site influencing the fluctuations and phases of meteoric water. Given the far north latitude of the site and the predominance of sub-freezing temperatures from October through April each year, a very large percentage of the precipitation at site occurs as snow. The accumulation of water as the snow water equivalent (SWE) in a growing snowpack over the

winter months has a major impact on the hydrology of the site by storing water from October through early April, then rapidly releasing that stored water over the months of April and May. The water balance model controls the accumulation of SWE in the snowpack as a function of precipitation and temperature using a monthly series of snowpack factors. Similarly, the evaporation data provided in the Lorax (2017) site synthetic record was included; for the coldest months with mean monthly temperatures below freezing and the presence of a snowpack, the potential evaporative loss was replaced with a sublimation loss assumed to be 20% of the monthly precipitation (Lorax 2017). For use in stochastic modeling, descriptive statistics were developed for the compiled monthly values from the 68-year synthetic meteoric record.

The deterministic model uses the synthetic precipitation record, number of days of precipitation, temperature, and the synthetic evaporation time history for the same time period to track system storage and makeup water demand on a monthly basis, compute a single value for all variables and provide results for each month in the record. Similarly the stochastic model substitutes probability distributions for the discrete monthly rainfall, temperature, and evaporation values and samples the distributions based on the observed statistical parameters (monthly mean and standard deviation). Then the model compiles new probability distributions for the results of interest.

The first deterministic scenario examines the dry/wet meteoric record with no mitigation of seasonal accumulation of water in the pond system. The adsorption of solution by new ore prevents any excessive accumulation of water in the pond system during normal leaching operations. However, once ore stacking ends in operational year 9, the substantial ore wetting loss component is no longer a factor and solution begins to accumulate within the pond system in response to the addition of meteoric water.

The model demonstrates that by pumping solution at a rate of 6 l/s to treatment beginning in operational year 9 at the end of ore stacking was sufficient to control the seasonal accumulation of water in the ponds and maintain the desired available storage volume with no uncontrolled discharge from the pond system. Substituting the Average Precipitation with Moderate Variability meteoric record also showed no tendency for significant seasonal accumulation within ponds, maintenance of the desired available storage volume, and no uncontrolled discharge from the pond system. Similarly, substituting the Wetter Precipitation with High Variability meteoric record also showed no tendency for significant seasonal accumulation within ponds, maintenance of the desired available storage volume, and no uncontrolled discharge from the pond system.

Therefore, the final deterministic water balance model configuration for the HLF includes pumping of solution to treatment at a rate of 6 l/s beginning in June of operational year 9 once ore stacking operations have ceased.

Deterministic results show that normal operating volumes in the sump and event pond remain low during normal operations due to the dominance of ore wetting in system losses. Once ore stacking ceases and the ore wetting loss component is lost, the system continues to recruit meteoric water such that some solution management is required (e.g., increasing pumping rate and dynamic storage, pumping to treatment, etc.) to prevent excessive seasonal accumulation of water. The pond levels increase during Phase 4 as irrigation for gold production continues, while no additional ore is being delivered to soak up water. During normal operations, the ponds maintain the desired available storage volume and when any water is in the events pond, the levels are substantially below the spillway. Makeup water demand declines over the operating life of the facility having a typical demand of about 60,000 m^3 to 70,000 m^3 per month and maximums of about 80,000 m^3 +/- per month during Phase 1. There is a modest decrease in Phase 2 as the lined

footprint increases and water begins to accumulate in the system. Typical values fall to between 30,000 m^3 and 50,000 m^3 and maximums are on the order of 60,000 m^3 +/-. Makeup water demand continues to decline into Phase 3. Typical values fall to about 30,000 m^3 to 40,000 $m^3$and maximums are on the order of 50,000 m^3 +/-.The percentage of time that the makeup water demand is zero increases with later phases as the lined footprint increases and more captured meteoric water is available.

Stochastic modeling results show that makeup water demand during Phase 1 will typically range from about 65,000 m^3 to 80,000 m^3 per month during the warmer months and about 50,000 m^3 to 60,000 m^3 during the cooler months. The exception is the spring freshet period, typically occurring in the month of May, where a sudden influx of water from snowmelt substantially reduces the outside makeup water demand. The reduction in makeup water demand steadily increases with each phase due to the associated increase in the lined footprint of the HLF. Outside makeup water demand drops to zero during Phase 4 and Phase 5 due to the accumulation of water in the system following the termination of ore stacking and the elimination of ore wetting losses and the expectation that no fresh water from outside the system will be used in the rinsing process. The other matter of interest in stochastic modeling involves the volume of water stored within the pond system and the ability to maintain the desired available storage capacity. As mentioned in the section on deterministic modeling, the desired available storage volume varies as a function of the lined footprint of the heap leach pad and therefore varies by phase.

The desired available storage volume is defined as the total pond capacity minus the volume of water in storage within the pond system at any given point in time. The results show there is essentially no risk of encroaching on the minimum desired available storage volume during Phase 1, Phase 2, or Phase 3 (normal operations). There is a small risk of encroachment (0.2%) during the freshet month (May) in Phase 3. Phase 1 through Phase 3 are similar in that the strong ore wetting demand keep ponds relatively empty and facilitate a quick recovery even from strong freshet inflows. During Phase 4 ore stacking ends and the water demand associated with the wetting of fresh ore is lost. The strong annual influx of water associated with the freshet in May is now slow to recover and water begins to accumulate in the system. Pumping to treatment is now the dominant mechanism for controlling seasonal accumulation of water. On average the month of May maintains the desired available storage volume of about 203,000 m^3 and the most common value (the mode) is on the order of 210,000 m^3, well above the minimum of 181,900 m^3. However, there are circumstances that could occur which would encroach upon the minimum desired available storage volume and those circumstances are expected to occur about 5.7% of the time without any mitigation (e.g., pumping to treatment, increasing the volume in dynamic storage, etc.). Assuming pumping to treatment at a rate of at least 6 L/s from June through December, the accumulated water volume would steadily decrease and reduce the associated probability of a shortfall in the desired available storage from a probability of 2.5% in June to a probability of 0.5% in September climbing back slightly to 1.7% in December.

The risks addressed by the pond design criteria are not the same as the risks characterized by a stochastic analysis. Whether the empty pond systems have the capacity to store a 24 hr PMP event or a 100 yr 24 hr (1% probability) storm plus 72 hrs of draindown from an associated power outage, these are all short duration, one to three day events that present no practical option other than to “catch” the volume of the event within the pond system without overtopping and spilling. However, the risk characterized by the stochastic analysis addresses a combination or sequence of events that occur over an extended period of time. Most of the time they will not simply appear without warning, but will be seen developing over time allowing the effects of these event sequences to be mitigated either before they encroach upon the desired available storage or shortly after a shortfall becomes evident. This is particularly true of a climate environment like

that of the Eagle Mine where the greatest risk is associated with the spring snowmelt or freshet event. The snowpack responsible for this event can be seen developing over a period of at least four (4) or five (5) months. The SWE of the snowpack can be measured and monitored over the period from October through April so that the subsequent snowmelt event in May can be predicted with a high degree of certainty and prepared for well ahead of time.

Of interest is not simply the probability of experiencing a shortfall in the desired available storage volume, but also the ability to manage the risk and recover from the shortfall in a reasonable amount of time (typically within 30 days). There are multiple ways of managing the overtopping risk and desired available storage volume. In some cases increasing the rate of solution pumped to treatment can eliminate the shortfall. In other cases, an increase in the application pumping rate and associated area under leach can empty ponds very quickly by putting more water into dynamic storage. The stochastic model was designed to evaluate mitigation options for correcting a shortfall in storage. When a shortfall is triggered the model computes the treatment rate required to eliminate the shortfall over a 30 day period, and also computes the required increase in pumping rate/area under leach as a percentage of the base pumping rate/area under leach required to eliminate the shortfall over a 30 day period.

The stochastic model was also utilized to perform sensitivity analyses. Of interest is the sensitivity of results to assumptions regarding the porosity of the ore in the heap sump and the magnitude of sublimation as a percentage of the monthly precipitation. All variates (input distributions) are considered in the ranking (precipitation, evaporation, temperature, porosity and sublimation), 98 variates in total. The variate producing the largest range of variation is ranked number one, the second largest number 2, and so on. The baseline is a measure of central tendency among all variates (essentially a global mean). The % impact is calculated by subtracting the minimum observation in the range from the maximum observation in the range and dividing that difference by the baseline value. During Phase 3 the potential impact of effective porosity assumptions consistently ranks very high (ranking number 1 in all but the months of May, June, and July where it ranks 4, 3, and 2 respectively). This is because the large ore wetting loss component during normal operations offsets precipitation impacts. The impact of porosity assumptions on storage capacity is purely physical and consistently on the order of 9% to 10%. During Phase 4 the offsetting impact of ore wetting loss is gone and precipitation impacts dominate driving the impact of porosity to a rank of 2 or 3 during the colder months (when precipitation is largely stored in the snowpack) or to a rank of 6 or more during the warmer months when precipitation impacts are more direct and immediate. During Phase 3 the potential impact of assumptions on sublimation are modest during the coldest months (ranking 2 to 4 with an impact on the order of 1% to 3%) and virtually non-existent as the weather warms with the ranking going to 10 or more. During Phase 4 the effect of sublimation on the net impact of precipitation and in particular the amount of precipitation accumulating in the snowpack over the colder period makes sublimation rank high in the coldest months (consistently ranking 1) but with the ranking changing rapidly as the weather warms going to 2 in May and June and to 4 by September. However, the potential impact remains significant over the course of the entire year through its effect on the snowpack and freshet volume (the impact during the freshet in May is almost 20% but remains in the teens most of the year and increasing even further at the end of the year to about 25% in November and December). It should be noted that the baseline level of desired available storage volume remains well above the minimum requirement of 181,890 m^3 for all of Phase 3 and Phase 4 regardless of any potential impacts from assumptions regarding either porosity or sublimation.

Once all gold production has ceased and the proposed cyanide neutralization and rinsing of the HLF is finished, the post closure heap will be allowed to dewater and drain. The draindown

process is an unsaturated flow process that is controlled by the soil water retention characteristics of the ore. The rate of flow during draindown is a function of the unsaturated hydraulic conductivity which is in turn a function of the moisture content of the ore. As the ore drains the moisture content decreases and the effective unsaturated hydraulic conductivity declines as well leading to an exponentially declining flow rate curve. There are two (2) distinctly different areas of the HLF that will behave differently during the draindown period. The first area is the column of ore below the area under leach which will have an elevated moisture content relative to the adjacent unirrigated ore. The elevated moisture allows the leach column to drain at a faster rate than the unirrigated ore. At some point in time the moisture content of the leach column will essentially equal the moisture content of the unirrigated ore and there will be no measureable difference in the draindown rate anywhere across the heap.

It is not practical nor advantageous to simply turn off the pumps and allow the heap to just drain as a very large volume of water would report quickly to the ponds, filling and overtopping them. Therefore, the model assumes that pumping of process solution will continue at a declining rate until such time as the water content in the active leach column approaches the water content in the unirrigated ore, or the potential draindown volume remaining would not fill the ponds but would be captured in the pond system and still provide sufficient capacity to capture and store the design events (i.e., 1% probability (100 yr) 24 hr storm and a short-term drain-down). At that point the pumps could be turned off while allowing the heap to continue to drain until it reaches a meta-stable equilibrium with the level of meteoric water that continues to enter the pad year after year. The rate at which the water is diverted to treatment will control the time required for the leach column to reach the moisture content of the unirrigated ore and also the time required to reach equilibrium with the meteoric precipitation regime. The draindown model predicts that continuing the treatment rate of 4 l/s would result in an elapsed time of 10.8 years before pumping could be stopped and 12.6 years before the leach column fully dewaters. It is more likely however, due to cost considerations, that a higher treatment pumping rate would be used to minimize the duration of the draindown period. For example, while the actual pumping rate would be determined based on several factors, doubling the treatment rate would approximately halve the time to when pumping was not necessary.

2 Introduction and Project Description

The Eagle Gold Project (Project) is located in the Yukon Territory of northwestern Canada at an elevation of approximately 1,000 masl, in mountainous topography. The climate in this region is characterized by short warm, periodically wet summers and long cold, periodically snowy winters. Annual precipitation is approximately 450 mm, occurring mainly in the summer and fall months, from May to November. Runoff is characterized by a substantial snowmelt period that typically peaks in the month of May. The project involves the construction and operation of a heap leaching facility (HLF) for the extraction of disseminated gold from a low-grade ore. The heap leaching process involves the management of a large volume of weak cyanide solution, and considerations of water balance are of considerable importance to the successful operation of the facility.

3 Heap Leach Pad Operational Water Balance

Heap leaching involves the dissolving of precious metals contained in a low-grade ore using the application and circulation of a weak cyanide solution through the ore. An operational water balance model has been developed for the proposed HLF at the Project site. The model provides output to evaluate meteoric (weather) impacts on the facility design and to predict the fresh water demand during operations, and the subsequent post mining rinsing and initial draindown period. A linked spreadsheet model simulates the long-term draindown period.

3.1 Water Balance Concept

The water balance model for a heap leach pad operation is essentially a water budget that tracks all of the water entering and leaving the lined containment system. Sources of water entering the system include pore water delivered with the ore, precipitation falling as rain or snow, and any fresh water (makeup water) added to the system from outside the lined limits of the pad. System losses are a bit more complicated and include three basic categories of loss.

- Evaporative losses
- Losses to surface tension
- Extraction losses

In general, evaporative losses include the solution application system (2% to 3% volume loss for sprinklers or about a 0.5% loss for drip emitters), “lake” or “pond” evaporation from the free water surface in any of the process ponds (e.g., pregnant, intermediate, or barren) or event ponds, and potential evaporation from any wetted soil surfaces (primarily the portion of the ore heap under active leach, and potentially any portion of the ore after rainfall events). It should be noted that measured evaporation at weather stations is typically “pan” evaporation or the loss from a Class A pan device. The pan is very shallow relative to a typical pond environment and has exposed sides that are capable of transferring more heat to the water than the earthen banks of a pond. Therefore the evaporation from a typical lake or pond is less than that measured in a typical pan device and is reduced by a factor on the order of 0.70 to 0.75. To calculate the volume evaporated from pond surfaces, the surface area of each pond must be known at a particular point in time. Therefore, all sources of new water added to the system must be routed within the system and the net increase that must go into storage allocated to the various ponds. To avoid “circular references” and a mathematically in-determinant condition, a consistent point in time must be selected for reconciliation. In the case of our water balance model, this is the end of each month.

Since the process ponds are actually tanks in the process plant and the in-heap pond is at the lined base of the ore stack (i.e., covered by ore), evaporative losses are determined by computing the volume stored in the events pond only at the end of the prior month, calculating the depth and area of each pond, and using that calculated surface area to calculate the volume of lake evaporation from pond. Then applying the calculated change in volume along with all other losses and additions, a new volume is computed for the end of the current month. This allows a new depth and area to be calculated and the process repeats itself.

Evaporative losses on soil surfaces must be handled differently, as there is no well-defined free water surface. The evaporative loss will be limited by one of two factors:

1. the maximum "potential" evaporation, or the greatest depth (volume per unit area) that could be evaporated under the weather conditions for that month given an unlimited supply of water, or
2. the maximum amount of water available.

In the case of an operating heap leach pad, the area under active leach is assumed to be continuously wetted by sprinklers or emitters with a limitless supply of water. Therefore, the full potential depth of evapotranspiration is applied to that area. Outside of the area under active leach, the ore surface is assumed to be dry, except for that fraction of the month's rainfall events that coated the soil particles or infiltrated into the soil and did not run off. This volume of water is assumed to be available during that month for evapotranspiration. Any portion of the infiltrated water volume that is not lost to evapotranspiration during the same month is assumed to be beyond the reach of evapotranspiration in the following month and is routed into the solution collection system along with the other applied solution. Therefore, during months where evaporation/evapotranspiration greatly exceeds rainfall, rain events generally add nothing to the water volume stored in the system. However, during months where rainfall greatly exceeds evaporation/ evapotranspiration, a significant volume of water may be added to storage.

Environments like the Project site where snowfall is a substantial part of the precipitation regime create a special case. During much of the year, a snowpack will exist on the surface of the HLF which will significantly hinder evaporative loss, but create a new opportunity for "sublimation" loss (which is a phase change where water goes directly from the solid phase to the gas phase without passing through a liquid state).

Losses to surface tension involve changes in the water content of the ore during operations. The ore is not delivered to the heap leach pad in a truly dry condition, but rather contains some relatively small amount of moisture in the pore spaces that is held in place by surface tension. This delivered water content is typically less than the "specific retention" of the ore. The specific retention is a threshold moisture content that marks the position on the soil water characteristic curve where the soil begins refusing to release its water to gravity (i.e., below that moisture content it simply will not readily drain). Therefore for ore to release the applied solution carrying the dissolved precious metals to the solution collection system, it is necessary to raise the moisture content of the soil to a level above the specific retention. For example, if the delivered moisture content of the ore is at 8% moisture by weight and the specific retention of the ore is 10% by weight, then the difference of 2% is "soaked up" by the ore upon first wetting and is considered for all practical purposes to be a volume of water that is locked up in storage in the ore and held indefinitely against gravity. However, even at the specific retention moisture content, the ore will not pass the applied solution on to the solution collection system. Unsaturated hydraulic conductivity of the ore is a function of the moisture content. The moisture content of the ore must be increased to a level that allows the water to be passed through the ore at the same rate that it is

being applied so that the system is in equilibrium or in balance. If for example this operating moisture content were 14% by weight, then an additional 4% (14% minus the specific retention of 10%) would be required to bring the ore under active leach into equilibrium. Once an area is no longer actively being leached (i.e., no new solution is being applied), then the ore would drain back down to its specific retention moisture content and release the 4% difference back into the solution collection system. The water balance model tracks these changes in moisture content in the ore and accounts for the addition and subtraction of water volume in the system.

Once all additions and losses to the volume of water stored in the system have been estimated and accounted for at the end of the month, the model evaluates whether or not there is sufficient water available in storage to maintain the solution application rate for the next month.

Heap leach pads are designed as fully lined containment systems. Solutions that are not stored within the ore itself as described in the earlier paragraphs, are routed through the system and stored in various lined ponds. Permit requirements for this Project dictate that the total lined capacity of pond system store the volume of water associated with the Probable Maximum Precipitation (PMP). During operations it is necessary to maintain the ability to store a specific design storm event (typically the 100 yr 24 hr or 1% probability storm), plus a specified period of solution draindown accompanying a power outage, (typically 24 hrs of draindown), plus a volume associated with freeboard in the ponds (in our case 0.0 m of depth in the in-heap pond or sump, and 0.5 m of depth in the lined open pond). However, should extreme events encroach upon the desired available storage capacity of the system, then the excess must be extracted from the system (e.g., pumping the solution to treatment, pumping more to dynamic storage, etc.). The water balance model computes any excess volume detected in the system and routes that volume into a phantom pond that is labeled "treatment and discharge". This allows the model to estimate both the frequency and size of events that could exceed the design capacity of the pond storage and require extraction of water and a reduction in storage through the treatment and discharge of solutions.

Figure 1 shows a schematic of the heap leach pad with respect to water balance. Using the ore heap as a control volume, the following equation may be written:

$$SC = SA + Pi - Es - Ed - (Wo - Wi) + Wd$$

Where:

SA = Water available for solution application
SC = Solution Collection
P = Precipitation
Pi = The infiltration component of precipitation
Es = Evapotranspiration from soil
Ed = Evaporative losses from sprinklers/emitters (the distribution system)
(Wo – Wi) = Water captured in the ore from the difference in initial and operating water contents
Wd = Water returned from the ore (operating moisture minus specific retention)

Then using the lined ponds as a control volume, the water balance equation can be written as follows:

$$0 = SC + Pr - Ep - D - SA + \Delta S + M$$

Where:

Pr = The runoff component of precipitation
Ep = Evaporation from ponds
D = Discharge out of the system
M = Makeup water
ΔS = The change in storage in the system

Rearranging the terms to isolate the two (2) unknowns (makeup water and change in storage) yields:

$$M + \Delta S = SA - SC + D + Ep - Pr$$

The water balance model uses this equation to track the water available in storage and then calculates the outside makeup water required for each monthly period. The term [SA – SC] defines the net changes in water content in the ore stack area while the term [D + Ep – Pr] defines the net changes in water stored in the ponds.

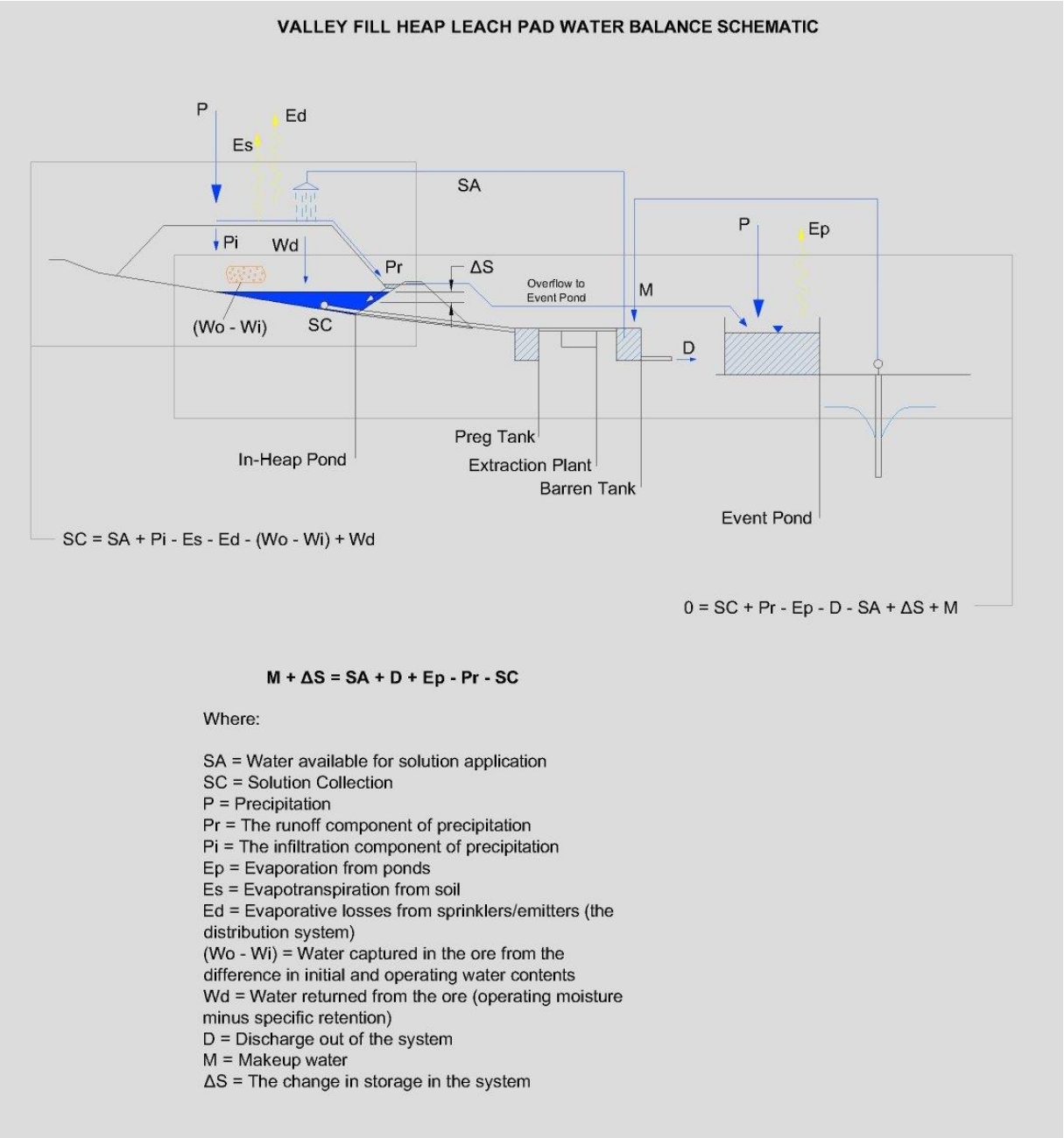
Another way to look at the water balance is to expand the SC parameter and rearrange the equation to get the following:

$$M + \Delta S = Es + Ed + Ep - (Pi + Pr) + (Wo - Wi) + Wd + D$$

[Es + Ed + Ep] represents all the evaporative losses in the system;
[Pi + Pr] represents all the gains in the system due to precipitation;
[(Wo – Wi) + Wd] represents the net impact of changes in pore water content in the ore;
and D is simply the volume of water physically removed from the system for treatment.

As long as water is available in storage in the system, it will be allocated for use in processing the ore in future months. ΔS increases and decreases in response to precipitation and the demand for processing water and M is zero. However, once the storage in the ponds falls to operational minimums, the model assumes that the ponds are not capable of supplying the demand and any shortfall in supply is made up as “outside makeup water” (M) or freshwater from outside the lined system, introduced into the lined system to meet the processing water demand.

Figure 1 – Heap Leach Pad Water Balance Schematic



3.2 Stochastic vs. Deterministic Models

There are two (2) different classifications of water balance model that can be used to evaluate heap leach pad performance and makeup water requirements. A deterministic model uses a chain of single valued input parameters to produce a series of single valued results. The weather data (which is the primary input) is often derived from some portion of an existing historic record or may consist of a synthetic record generated using the statistical summaries of the historic record. The potential range of variability can only be evaluated in a general sense over the full time

history of the model. However, it is useful in characterizing the range of variability one could expect during the "normal" course of operations.

In a stochastic model, the single valued input parameters are replaced with probability distributions derived from the computed statistics of the observations (in this case the monthly mean and variance or its square root, the standard deviation). Precipitation distributions are assumed to be Gamma distributed (i.e., there can be no negative values permitted in the sampling since a negative precipitation has no meaning). Shape and scale parameters for the Gamma distributions are computed as a function of the mean and standard deviation. A Monte Carlo procedure is then used to propagate the uncertainty through the model by sampling all of the input parameter distributions and compiling output distributions for all the results of interest. In this way results are also probability distributions that permit exceedance probabilities to be associated with each event or outcome. For example, the probability of exceeding a particular makeup water flow rate during the month of October during Phase 3 of the heap leach pad operation can be quantified from the results of the stochastic model. Probability distributions in hydrology are often highly skewed distributions, such that the mean or average result may not be the most frequently observed result (i.e., the mean and mode of the distribution do not coincide). Stochastic model results can be very useful in setting system design criteria, quantifying risk, and developing methodologies for managing risk during operations.

3.3 Weather Data

The primary inputs required for the HLF water balance model are the monthly precipitation totals, the monthly number of days of precipitation, the mean monthly temperature, the monthly total for lake evaporation, the monthly total for potential evapotranspiration from soil surfaces, and the monthly total for sublimation during the colder months of the year. Meteoric data has been collected and analyzed by Lorax Environmental (Lorax) and has been published in a report entitled "*Eagle Gold, Hydrometeorology Report*" dated 13 March 2017.

3.3.1 PRECIPITATION

Two (2) sources of precipitation and temperature information are available. These include site-specific observations from the Project site having a record length of 6 to 10 years (Camp and Potato Hill stations with some missing observations), and observations from regional climate stations including the Keno Hill, Klondike, Elsa, Mayo A, Stewart Crossing, and McQuestin regional stations having record lengths of 8, 44, 41, 68[1], 45, and 28 years respectively. Although the mean values for monthly precipitation and temperature at the Project site are likely to be reasonably close and stable after 6+ years, the measure of variance will be substantially better at the regional stations due to the longer record lengths. Therefore, for purposes of deterministic modeling, a site synthetic precipitation record was developed by Lorax using a combination of the site specific record and the Mayo A data to represent the expected precipitation history at the Project site. The purpose of developing a synthetic weather record for the projected life of the HLF was to permit the development of a deterministic model that would produce a reasonable estimate of the range of values for makeup water demand, pond storage, and so on during normal operations and to verify the reasonableness of the model prior to stochastic analysis. The Lorax

[1] The 1948 to 2015 period of the Mayo record was selected from the longer 1925 to 2015 record due to its more complete record.

site synthetic record spans a period from 1948 through 2015 (a duration of 68 years). Precipitation was found to correlate strongly to elevation (see Figure 2, from Lorax, 2017). Therefore, a synthetic record was developed for three (3) different elevations including the Camp station elevation (728 m), the Potato Hills station elevation (1420 m), and a Midpoint elevation (1125 m). The Midpoint elevation is more representative of most of the mine infrastructure on the site, including the HLF. A plot of the % of annual precipitation for each of the onsite and regional observation stations is shown in Figure 3 (Lorax, 2017).

Figure 2 – Correlation of Mean Annual Precipitation and Elevation for Site and Regional Stations (Lorax, 2017)

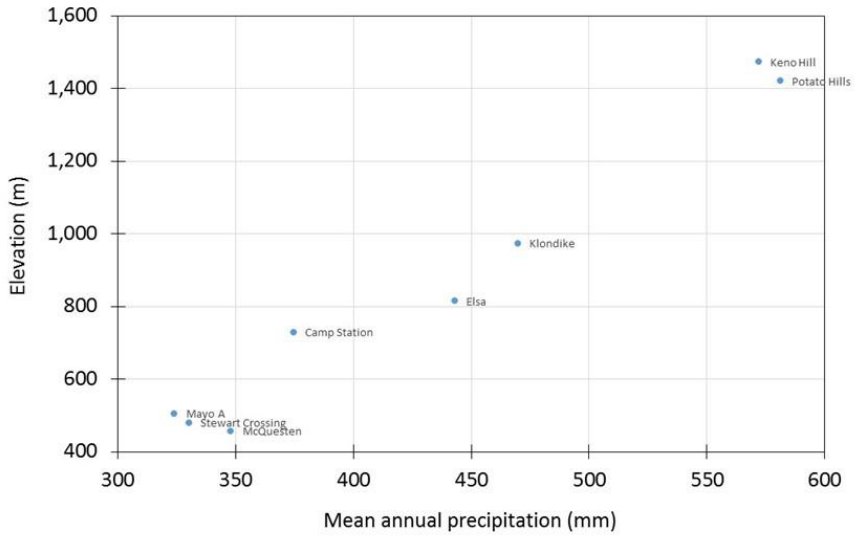
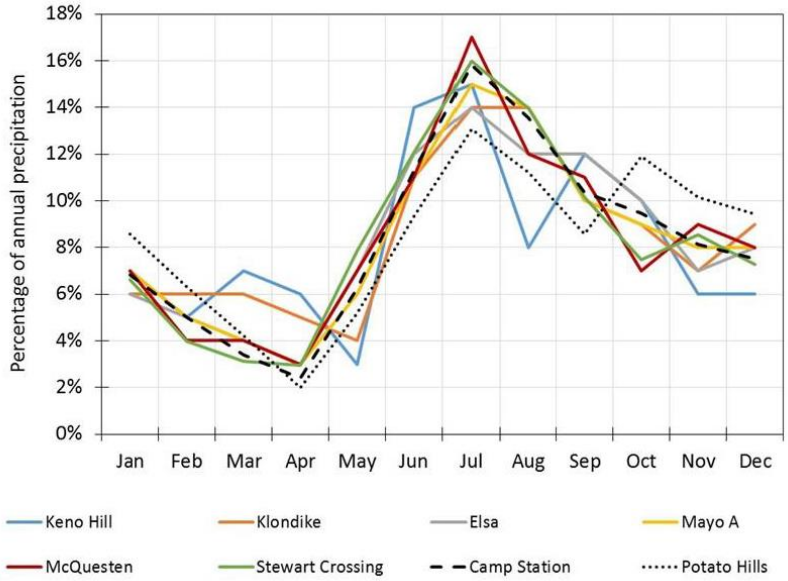


Figure 3 - % of Annual Precipitation from Observation Stations (Lorax, 2017)



The site synthetic record includes daily values for precipitation, evaporation, and temperature. This daily record was compiled into a monthly record for precipitation, number of days with precipitation, evaporation, and temperature. The full monthly record for precipitation is shown in Figure 4. The data was further compiled into an annual site synthetic record and a 3-point centered moving average was added to help disclose extended dry periods and wet periods within the record (see Figure 5).

The HLF requires a 12 year meteoric record for the modeling of effective operational facility life. This includes 1 year for construction, 8 years of normal operations (including ore stacking), an assumed 2 years of extended gold extraction after the cessation of ore stacking, and an additional 1 years to represent the initiation of draindown and closure. The actual duration of extended gold extraction will depend on when the level of gold recovery becomes uneconomic, and similarly, the actual duration of draindown will depend on the pace of reclamation activities and the rate of pumping of solution to treatment.

A three (3) year dry period and a three (3) year wet period taken from the site synthetic weather record and included within the 12 year synthetic mine life record (see Figure 6). The dry sequence (1950 through 1952) represents the lowest three consecutive precipitation years in the record, while the wet sequence (1963 through 1965) represents the highest three consecutive precipitation years in the record. Inclusion of these wet and dry periods in the deterministic record assure that the potential impact of historically observed variations in precipitation will be resolved by the model and included in the normal operating range. The order in which they are included is of relatively little consequence. However, in order to preserve conservatism, the dry sequence was placed early in the record (when the lined surface area was smaller and the annual amount of water recruited lower) and the wet sequence later in the record (when the lined surface area was greater amplifying the impact of more precipitation). This record will be referred to as Meteoric Record Number 1.

As a check on the expected performance of the HLF during normal operations, two (2) additional meteoric records were extracted from the full site synthetic weather record. Meteoric Record Number 2 represents a period of average precipitation with moderate variability. Meteoric Record Number 3 represents a wetter period with high variability and contains the two highest annual precipitation years in the 68 year record (although the high variability does not assure that this record provides the greatest cumulative precipitation volume). The sequence of years extracted for each design meteoric record is shown in Table 1 and comparative plots are shown in Figure 6 through Figure 8. Each year in the sequence also brings in corresponding parameters for days with precipitation, evaporation, and temperature. Due to the need to represent a 12-year period from the synthetic record, typical dry, average and wet year scenarios which are singular cannot be applied. These are more appropriately evaluated in the stochastic analysis, which represent these conditions within a probability function.

In order to provide an adequate record length to address the changes in the optimized HLF design, the design meteoric record was extended to 14 years by simply repeating the last two years in the record. The two year extension does not impact the period of normal operations but covers only the post operations period and the initiation of draindown.

Table 1 – Annual Sequences Extracted from Site Synthetic Meteoric Record

Operational Year	Meteoric Record #1	Meteoric Record #2	Meteoric Record #3
	Dry/Wet Sequence	Average Precipitation with Moderate Variability	Wetter Precipitation with High Variability
-1	1950	1980	2000
1	1951	1981	2001
2	1952	1982	2002
3	1956	1983	2003
4	1963	1984	2004
5	1964	1985	2005
6	1965	1986	2006
7	1989	1987	2007
8	1990	1988	2008
9	1991	1989	2009
10	1992	1990	2010
11	1993	1991	2011
12	1992	1990	2010
13	1993	1991	2011

Figure 4 – Site Synthetic Precipitation Record Compiled from Lorax Data

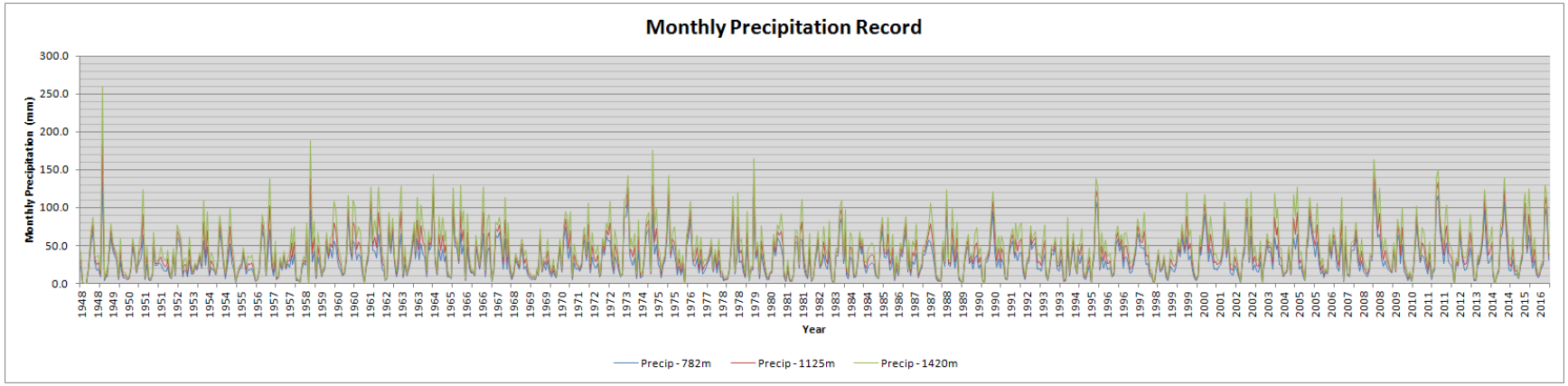


Figure 5 - – Annual Site Synthetic Precipitation History for the Eagle Gold Project Site

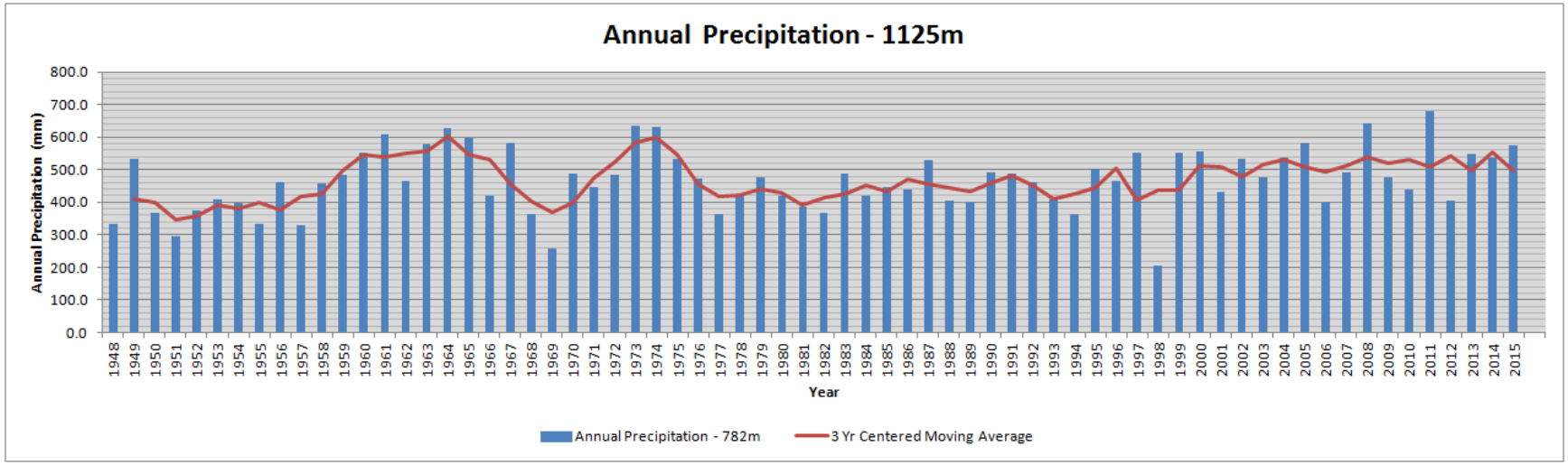


Figure 6 – Meteoric Record Number 1

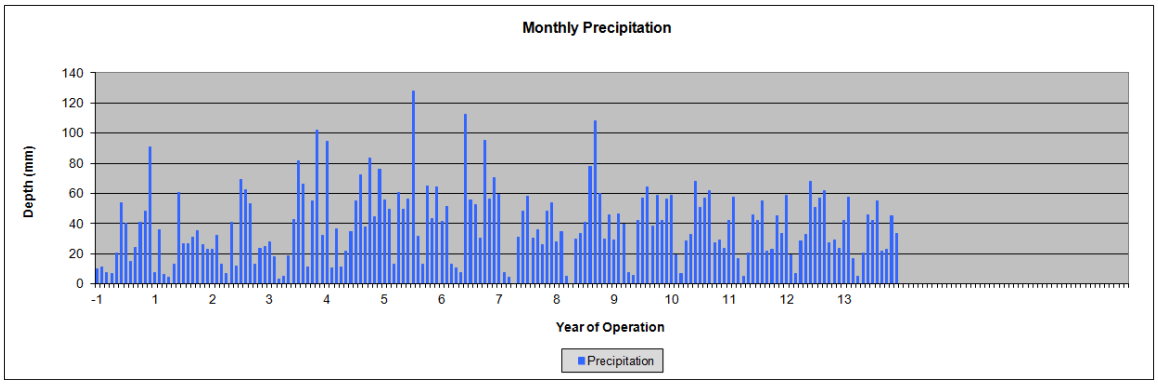


Figure 7 – Meteoric record Number 2

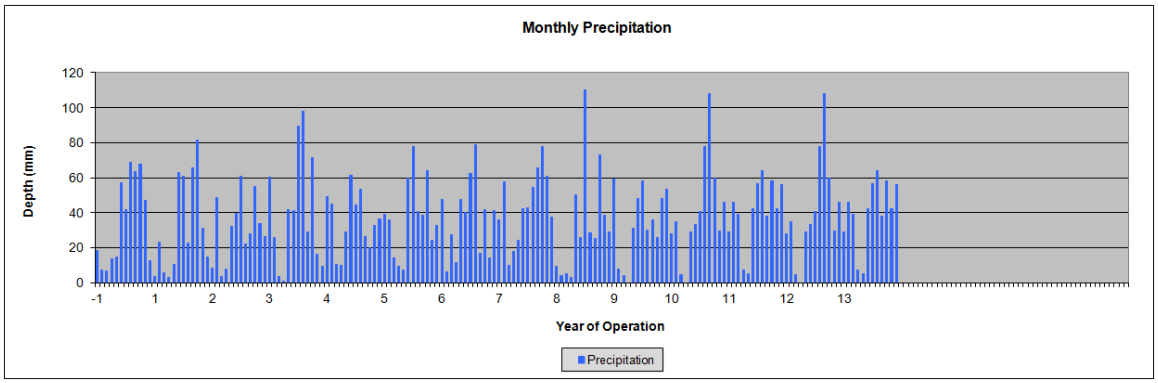
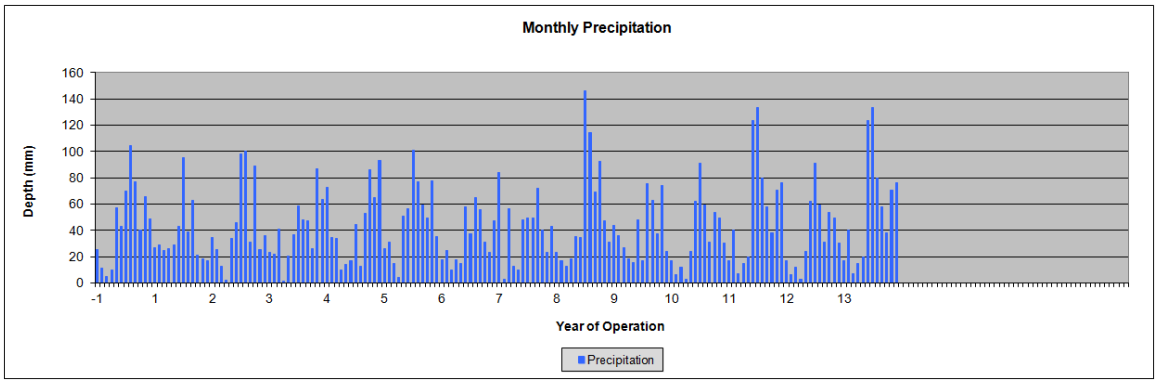


Figure 8 – Meteoric Record Number 3



For use in stochastic modeling, descriptive statistics were developed for the compiled monthly values in the full site synthetic meteoric record (68 years of record) and the resulting values for precipitation are presented in Table 2. A plot of the mean monthly precipitation is shown in Figure 9. The number of days of precipitation is shown in Table 3. A plot of the number of days of precipitation per month is also shown in Figure 10.

Table 2 – Summary of Site Synthetic Mean Monthly Precipitation

Month	Mean Precipitation (mm)	Standard Deviation (mm)	Maximum (mm)	Minimum (mm)
Jan	36.08	28.39	190.72	3.82
Feb	27.49	17.01	67.68	0.57
Mar	18.25	14.49	69.78	0.00
Apr	10.50	9.86	60.85	0.00
May	25.58	12.89	57.16	5.36
Jun	46.85	22.08	123.87	11.35
Jul	67.14	31.97	146.97	16.59
Aug	58.22	28.82	126.30	12.76
Sep	43.77	21.09	110.48	0.00
Oct	51.35	28.86	138.03	7.46
Nov	43.76	19.83	101.71	5.74
Dec	40.39	21.40	93.49	9.37
Annual	**471.20**	**90.91**	**653.50**	**215.15**

Table 3 – Site Synthetic Mean Number of Days of Precipitation

Month	Mean Number of Days of Precipitation	Standard Deviation	Maximum	Minimum
Jan	9.58	3.79	18	2
Feb	8.35	3.74	20	1
Mar	6.14	3.47	16	0
Apr	5.03	3.12	14	0
May	8.67	3.35	18	1
Jun	11.87	3.36	22	6
Jul	14.41	4.41	27	4
Aug	13.30	4.35	21	3
Sep	11.62	3.87	21	0
Oct	11.63	4.68	25	2
Nov	11.66	3.62	22	4
Dec	11.40	3.91	25	4
Annual	**123.47**	**19.72**	**160**	**71**

Figure 9 – Mean Monthly Precipitation

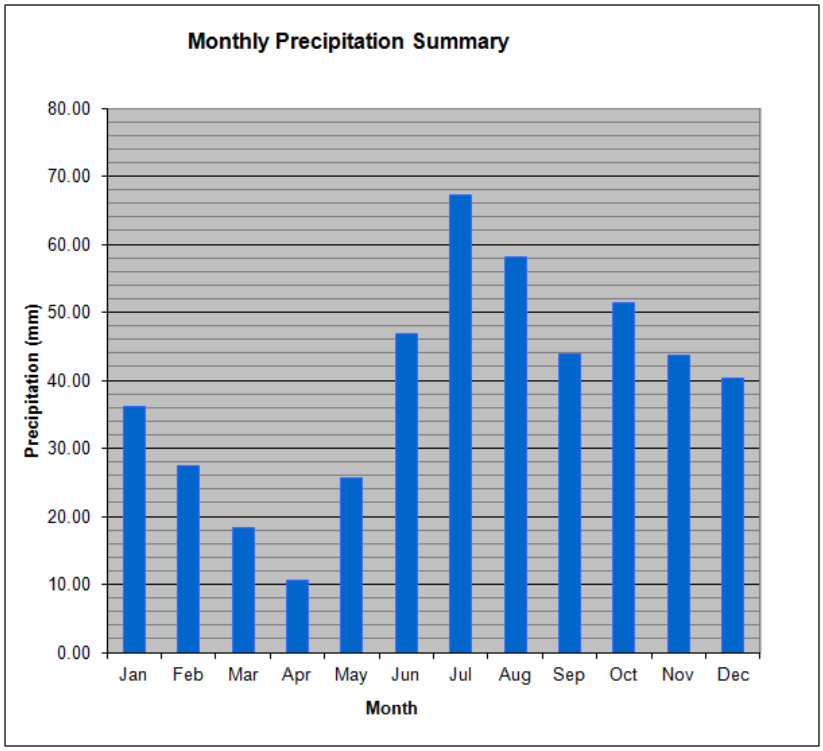
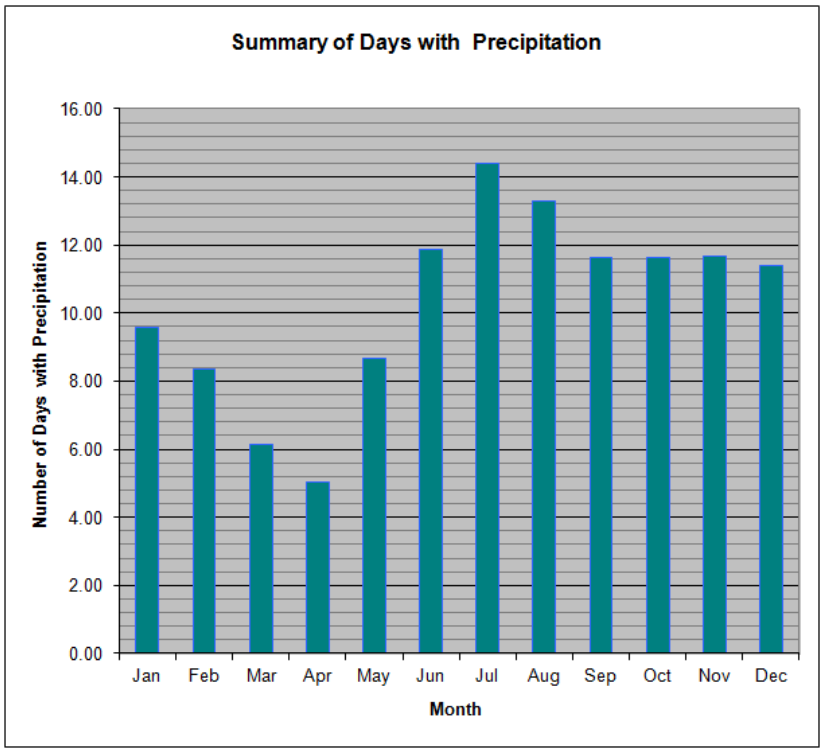


Figure 10 – Mean Number of Days with Precipitation



3.3.2 TEMPERATURE

Air temperature is a major factor in the climate of the site and the behavior of the meteoric water source. The following passage is extracted from the Lorax hydrometeorology report.

> "Overall, these data show that during the months of March to October inclusive, a standard lapse rate applies, with temperatures decreasing with rising elevation, and are cooler at the upper station, on average (see Figure 2-2; lower panel for July). However, during the winter months of November to February, temperature inversions are common in the region, with temperatures being cooler on average in the valley bottom than at the height of land.
>
> The spring/summer lapse rate returned by regional data is consistent with the saturated adiabatic lapse rate of -5.0°C/1,000 m. Such cooling temperatures with elevation are likely drivers for the increased frequency of precipitation at higher elevations during the summer months, when a larger portion of the annual precipitation falls. The winter lapse rate for the region shows variability by month but consistency overall with the general approximation reported by Wahl *et al.* (1987), which suggest winter temperature inversion lapse rates on the order of 3-5°C/1,000 m of elevation gain."

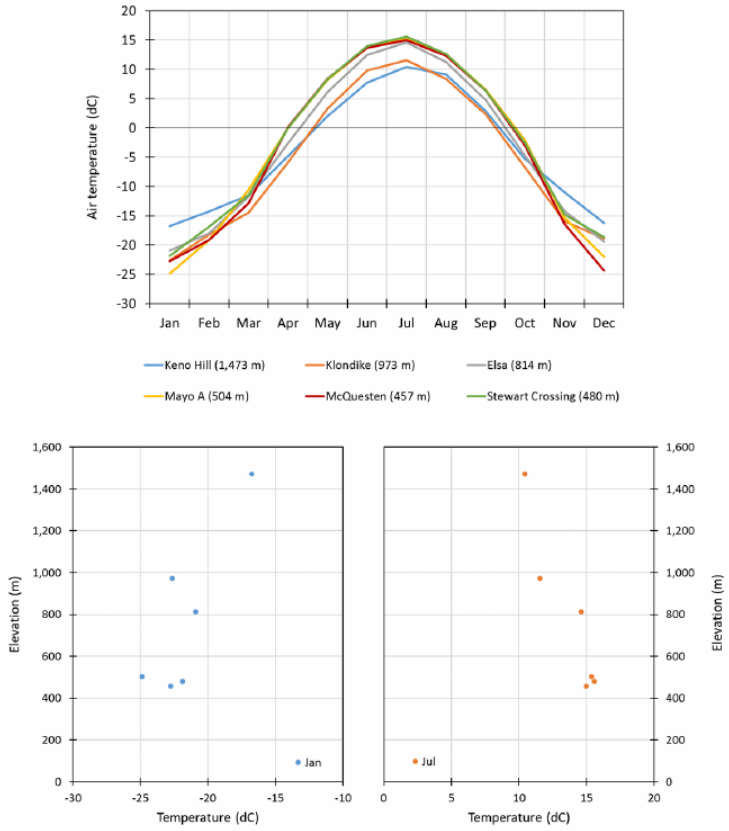


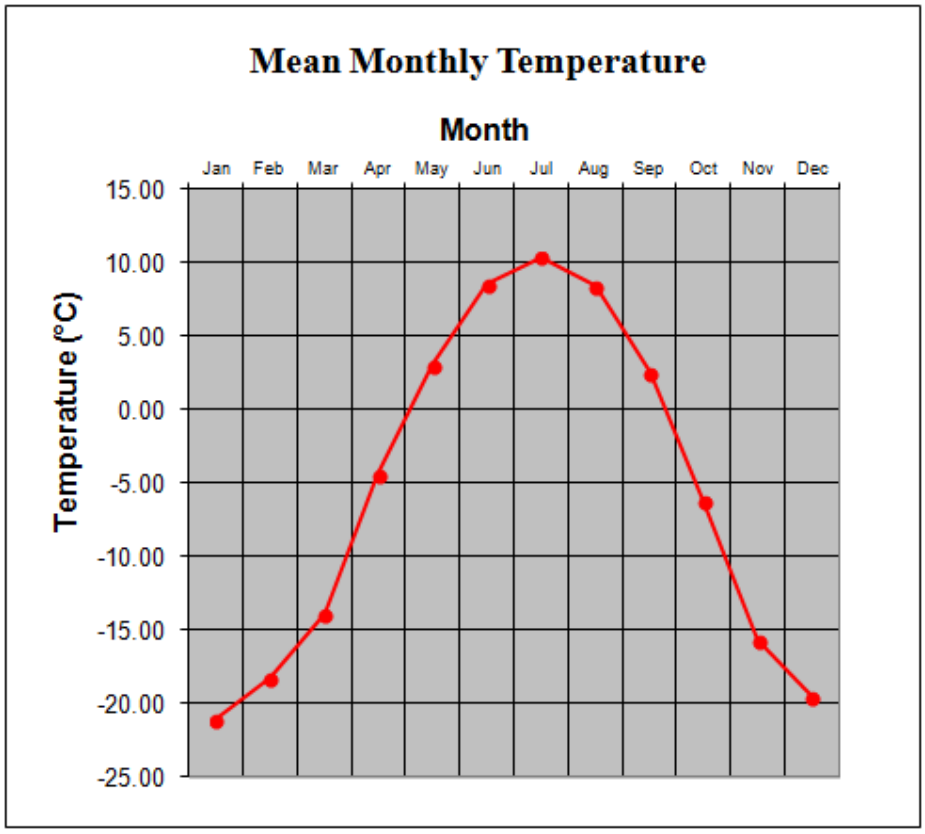
Figure 2-2: Regional air temperature data. The upper panel shows average monthly air temperature signatures for regional climate stations from Table 2-4. The lower panel shows the relationship between air temperature and elevation for January (left) and July (right).

For use in stochastic modeling, descriptive statistics were developed for the compiled monthly values from the 68-year site synthetic meteoric record and the resulting values for temperature are presented in Table 4. A plot of the mean monthly temperature is shown in Figure 11.

Table 4 - Site Synthetic Mean Monthly Temperature

Month	Mean Monthly Temperature (°C)	Standard Deviation (°C)
Jan	-21.06	6.11
Feb	-18.23	4.69
Mar	-13.91	3.47
Apr	-4.43	2.99
May	2.99	1.28
Jun	8.57	1.09
Jul	10.42	0.79
Aug	8.44	1.16
Sep	2.57	1.28
Oct	-6.24	2.78
Nov	-15.72	4.89
Dec	-19.51	4.99
Annual	**-5.42**	**1.52**

Figure 11 – Mean Monthly Temperature



3.3.3 POTENTIAL EVAPORATION

Observations of evaporation are not available for the Project site or any of the regional stations. In order to provide consistency with assumptions made by others for the Project Site, for months where the mean monthly temperature is less than or equal to 0°C, it was assumed that losses will consist of sublimation only at a rate of 20% of the precipitation for that month. For months where the mean monthly temperature exceeds 0°C, the potential evaporation is estimated based on temperature and other climatic factors. The following passage is extracted from the Lorax hydrometeorology report.

> "As described in Lorax (2016a) 15-minute potential evaporation rates were computed for the Camp station using available climate and the Ref-ET calculator - a compiled, standalone computer program that calculates reference evapotranspiration (ASCE, 2005). For the period of available record (Jan 2013 to Apr 2016), a 15-minute climate input file was prepared for the Eagle Gold site. The input variables required by Ref-ET are: maximum air temperature, minimum air temperature, relative humidity, incoming solar radiation, atmospheric pressure and wind speed.
>
> From the assembled climate inputs, Ref-ET returned potential evaporation (PE) computations for an array of evaporation models (*e.g.*, Penman-Monteith model, Priestley-Taylor formulation), which were aggregated to daily time-step. Presented in Table 2-13 (monthly tabulations) are resulting outputs from Ref-ET for months March to October for the site at 1125 masl. May to end-September PE estimates for the Camp station are also reported in Table 2-13 and are estimated to total 380 mm over this period. In terms of monthly magnitudes of PE, highest monthly rates of PE are expected in May, June, July and August of each year.
>
> These estimates were used as the basis for the time-series of evaporation estimates that were developed for the synthetic climate record."

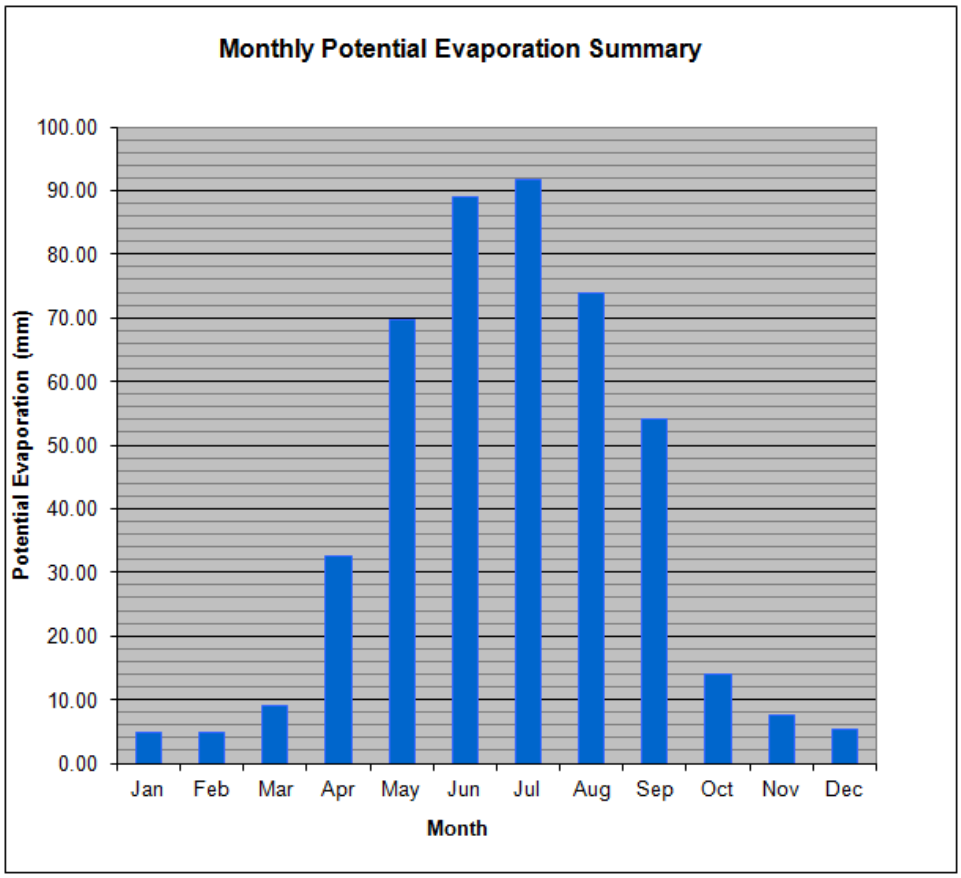
For use in stochastic modeling, descriptive statistics were developed for the compiled values in the full site synthetic meteoric record and the resulting values for potential are presented in Table 5. A plot of the mean monthly potential evaporation is shown in Figure 12.

Table 5 – Site Synthetic Mean Monthly Potential Evaporation

Month	Potential Evaporation (mm)	Standard Deviation (mm)	Maximum (mm)	Minimum (mm)
Jan	---	---	---	---
Feb	---	---	---	---
Mar	---	---	---	---
Apr	32.46	7.47	49.22	17.04
May	69.69	9.87	101.38	50.30
Jun	89.03	9.24	120.02	63.03
Jul	91.78	5.77	106.94	79.97
Aug	73.80	11.13	101.34	50.12
Sep	54.15	7.65	70.77	29.48
Oct	14.09	4.18	29.23	8.61
Nov	---	---	---	---
Dec	---	---	---	---

Note: when mean monthly temperature is less than or equal to 0° C, the snowpack yields zero evaporation, and losses will only consist of sublimation at a rate 20% of precipitation for that month.

Figure 12 – Mean Monthly Potential Evaporation



Note: when mean monthly temperature is less than or equal to 0° C, the snowpack yields zero evaporation, and losses will only consist of sublimation at a rate 20% of precipitation for that month.

3.3.4 SNOWFALL

Given the far north latitude of the site and the predominance of sub-freezing temperatures from October through April each year, a very large percentage of the precipitation at site occurs as snow. The accumulation of water as the snow water equivalent (SWE) in a growing snowpack over the winter months has a major impact on the hydrology of the site by storing water from October through March or early April, then rapidly releasing that stored water over the months of April and May. The water balance model controls the accumulation of SWE in the snowpack as a function of precipitation and temperature using a monthly series of snowpack factors.

The water balance model estimates the monthly rainfall and snowmelt volume using five (5) columns in the spreadsheet that do the following:

- The first column determines the effective number of days with either snowmelt or precipitation. If the mean monthly temperature is above 0°C, then it is assumed that snowmelt is contributing to the total precipitation depth for a maximum of 15 days. Since the model uses an SCS type excess precipitation model to estimate rainfall runoff and infiltration, limiting the number of days to 15 has the effect of increasing the volume attributed to runoff and is the rough equivalent of going from antecedent moisture condition II to antecedent moisture condition III (since during a month with nearly continuous melt there is essentially no time for the soil to drain and dry out between events).
- The second column tracks the cumulative water year precipitation beginning in October.
- The third column tracks the cumulative water year evaporation/sublimation beginning in October.
- SWE in the snowpack is estimated as the larger of the following:
    - (Last month's SWE) + (Current month's precipitation) x
        - If mean monthly temperature >0°C then 0
        - If mean monthly temperature <-3°C then 0.4
        - Else 0.2
    - Or (Monthly snowpack factor) x (Cumulative Water Year Precip – Cumulative Water Year Evaporation/Sublimation)
- Rain + Melt = The larger of:
    - (Current month's precipitation) – (Current month's SWE – Last month's SWE)
    - Or 0

The Lorax hydrometeorological report contains information on the development and dissipation of the snowpack at the Camp observation site. Our monthly snowpack factors were selected to mimic as closely as possible the behavior observed at site (the snowpack growing rapidly from October through December, leveling out from January through March, and declining rapidly from April through May - see Figure 13). The snowpack factors provide a stabilizing influence on the snowpack. Changes in snowpack are allowed to vary in response to precipitation and temperature at each time step. However, the use of the snowpack factors prevent any wild fluctuations by setting a minimum or floor level during the accumulation phase and by throttling the maximum melt rate during the depletion phase. Snowpack factors can be visualized as the minimum amount of SWE stored in the snowpack as a percentage of the cumulative precipitation occurring during the water year to date. The snowpack algorithms affect the routing and the timing of the winter

precipitation, but they have no impact on the net water balance. Factors utilized are shown in Table 6.

Figure 13 – Development and Dissipation of Snowpack at Camp Station (Lorax, 2017)

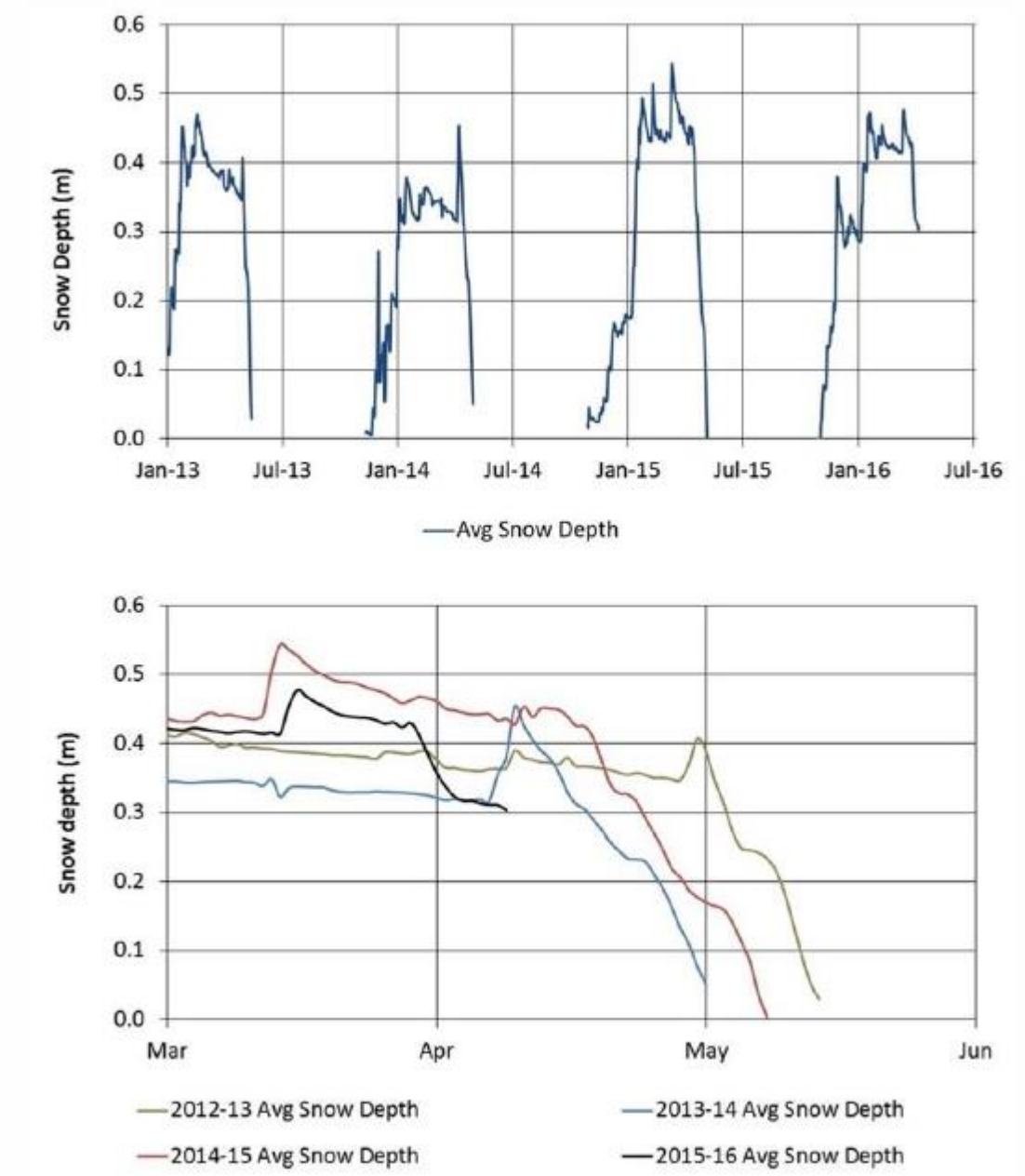


Table 6 – Monthly Snowpack Factors

Month	Snowpack Factor
Oct	1.0%
Nov	28.0%
Dec	42.0%
Jan	81.0%
Feb	85.0%
Mar	81.0%
Apr	51.0%
May	2.0%
Jun	0.0%
Jul	0.0%
Aug	0.0%
Sep	0.0%

Note: the snowpack factor reflects the remaining proportion of the accumulated SWE in the snowpack at the end of each month.

3.4 Input Parameter Assumptions

In addition to the weather data discussed in the earlier sections, there are a number of other key input parameters required for operation of the water balance model. These key parameters are summarized as follows:

- Initial moisture content of the ore = 5.84% by weight (5.0% from the Pit blended with 7.93% from a stockpile) [2]
- Specific retention of the ore = 8.6% by weight [2]
- Active leaching moisture content (operating moisture content) = 13.3% by weight [2]
- Solution application rate = 7 liters/hr/m^2 [2]
- Ore density (unit weight) = 1.72 tonnes/m^3 [2]
- Lift height = 10 m
- Sprinkler/emitter evaporative losses = 0.5% [3] (goes to 0% under snow cover)
- Distribution of daily rainfall (% of the rain days in a month with precipitation < X) [4]
    - 10 mm – cumulative probability less than = 91.89%
    - 25 mm – cumulative probability less than = 99.36%
    - 50 mm – cumulative probability less than = 99.99%
- SCS Curve Number (for the partitioning of runoff and infiltration) [2]
    - Ore – CN = 70
    - Liner – CN = 99
    - Reclaimed surface – CN = 91
- Ore production rate = approx. 29,500 tonnes per day year 1, then approx. 39,154 tonnes per day (stacked 9 months out of the year) [1]
- Total pumping rate [1]
    - Startup through Phase 3 = 1,500,000 liters per hr
    - Area under leach = 1,500,000 l/hr / 7 l/hr/m^2 = 214,286 m^2
- Maximum pond storage volumes [2]
    - Pregnant pond = Tank (volume not significant)

[2] From project design reports and technical memoranda by Wardrop, Knight Piesold, and Tetra Tech
[3] Engineering judgment and experience on past projects
[4] Based on analysis of the synthetic precipitation record

    - Barren pond = Tank (volume not significant)
    - In-Heap Sump = 120,095 m^3 (at elevation of spillway invert to the event pond, that is, with no freeboard left)
    - Event Pond 1 = 299,851 m^3 (at elevation of spillway invert, that is, with no freeboard left)
- Design 24 hr Extreme Precipitation Events
    - 100 yr, 24 hr storm (1% probability) = 54 mm (Lorax 2017)
    - 24 hr PMP (Probable Maximum Precipitation) = 256 mm (Knight-Piesold 2013)

For the sprinkler/emitter evaporative losses, the losses are only considered in the model during periods when mean temperature is above freezing. During periods when the mean temperature is below freezing the emitters will be buried within the ore stack and covered by a snowpack and the model assumes no evaporative losses.

3.5 Model Results

The deterministic model uses the synthetic precipitation record, number of days of precipitation, temperature, and the synthetic evaporation time history for the same time period to track system storage and makeup water demand on a monthly basis, to compute a single value for all variables and results for each month in the record. Similarly the stochastic model substitutes probability distributions for the discrete monthly rainfall, temperature, and evaporation values and samples the distributions based on the observed statistical parameters (monthly mean and standard deviation). Then the model compiles new probability distributions for the results of interest. Results of both models are summarized below.

3.5.1 DETERMINISTIC RESULTS

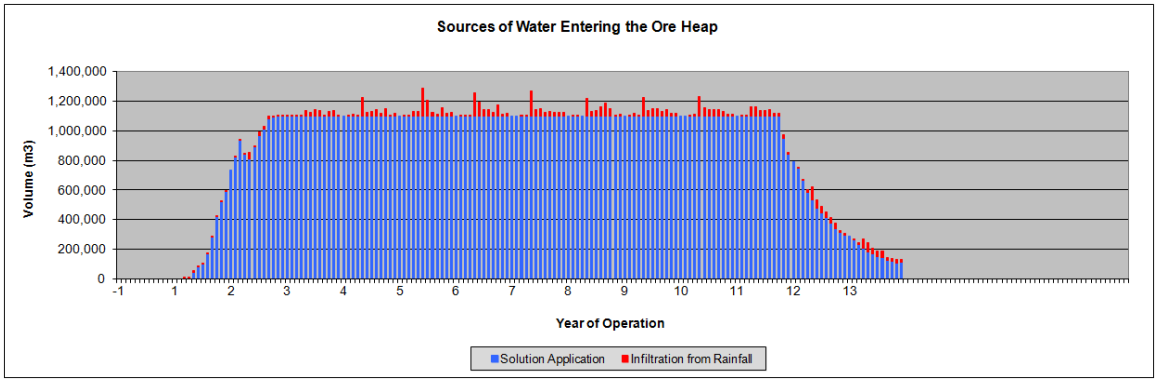
The deterministic water balance model is intended to determine the criteria to be used for normal operations and establish an appropriate configuration for the operation prior to examining the risk associated with extreme upset conditions using the stochastic model. As described earlier in the section on weather there were three (3) meteoric records considered to establish the expected normal operating range including the dry/wet scenario, mean precipitation with moderate variability, and a wetter precipitation sequence with high variability.

The water balance model covers the period of leach pad operation that includes startup and Phase 1 through Phase 5 (see below) which includes two (2) years of post-mining leaching and up to two (2) years of rinsing. Site preparation and construction activities are assumed to begin in the summer of operational year -1 (2018). Liner placement and ore stacking begins in operational year 1 (2019) and continues through operational year 9 (2027). Operations effectively end with the termination of gold production in operational year 11 (October of 2029). Upon completion of active leaching operations, solution management will be required until such time as the closure cover is established and clean runoff is diverted off the facility. Once the solution draindown rate falls to a level that can be safely and passively contained in the pond system, active solution management can cease (i.e., no pumping). The water balance model simulates up to the initial draindown period, and therefore results are presented only through the end of 2029 with an arbitrary rinsing period continuing into closure. A separate draindown model was used to simulate the full draindown process and is described in Section 5. Since information from a draindown model is available for the rinsing and draindown period, the expected changes in

pumping rate during the draindown/closure process were used in the later portion of the water balance model that represents the initiation of Phase 5 (see Figure 14).
Construction/Operations Phases for the HLF are as follows:

- Phase 1 — March of Yr 1 (2019) through February of Yr 3 (2021)
- Phase 2 – Northward expansion of the HLF footprint – March of Yr 3 (2021) through April of Yr 5 (2023)
- Phase 3 – Northeastward expansion of the HLF footprint – May of Yr 5 (2023) through September of Yr 9 (2027)
- Phase 4 – Termination of mining and ore production, but continued irrigation of the ore stack for gold production – October of Yr 9 (2027) through October of Yr 11 (2029)
- Phase 5 – Termination of gold production, rinsing, and initial draindown – November of Yr 11 (2029) on through closure

Figure 14 – Water Entering the Ore Heap Showing Pumping Rate Decline in Phase 5



The initial pond design criteria assure that the empty pond system is sufficient to store the runoff volume associated with the PMP event. The water balance model then tracks the volume available during operations for storage using a criteria that includes the full volume of the 100 year 24 hr storm falling on the total lined surface of the heap leach footprint and the lined external ponds, plus the volume associated with 72 hours of draindown (e.g., during a power outage), plus freeboard consisting of 0.0 m on the heap sump and 0.5 m on the external ponds. This desired available storage volume varies with changes in the lined footprint over time as well as with any changes in the solution pumping rate.

The first deterministic scenario examines the dry/wet meteoric record with no mitigation of seasonal accumulation of water in the pond system. The adsorption of solution by new ore prevents any excessive accumulation of water in the pond system during normal leaching operations (see Figure 15). Once ore stacking ends in operational year 9, the substantial ore wetting loss component is no longer a factor and solution begins to accumulate within the pond system in response to the addition of meteoric water (see Figure 16). Without implementing any solution management, the accumulation would continue until the desired available storage is depleted by operational year 11 (see Figure 17), and the events pond could experience an uncontrolled discharge of solution (see Figure 18).

Figure 15 – Significant Losses

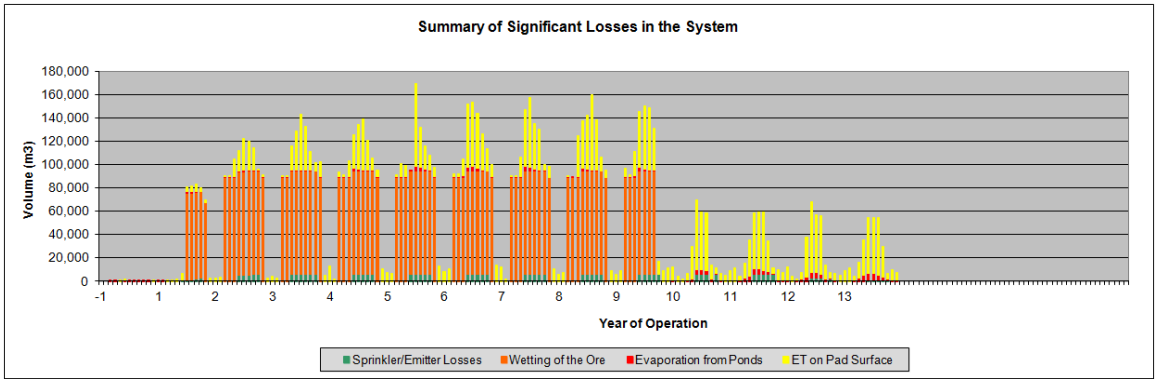


Figure 16 – Water in Event Ponds

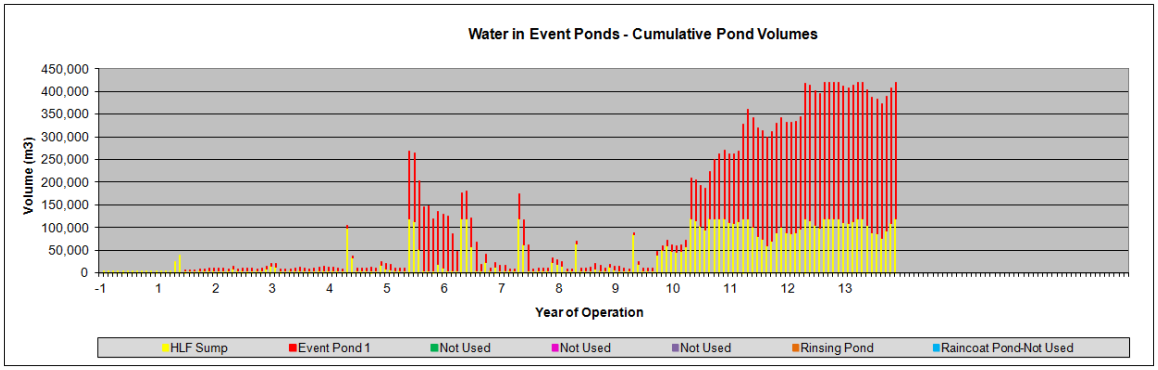


Figure 17 – Desired Available Storage Without Mitigation

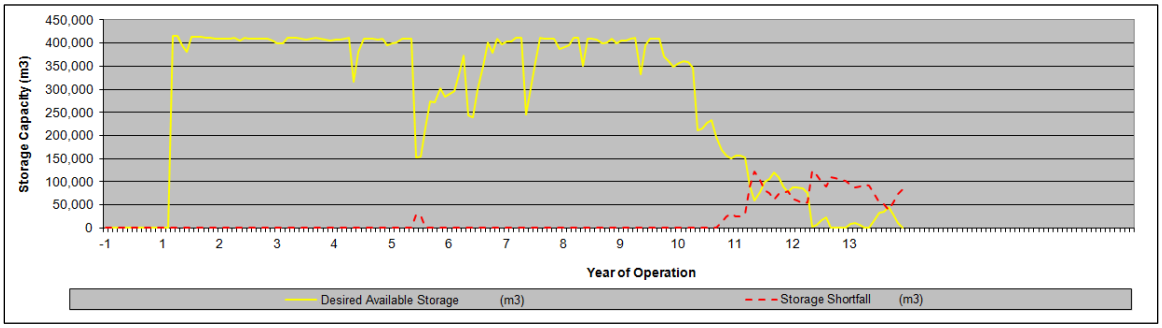
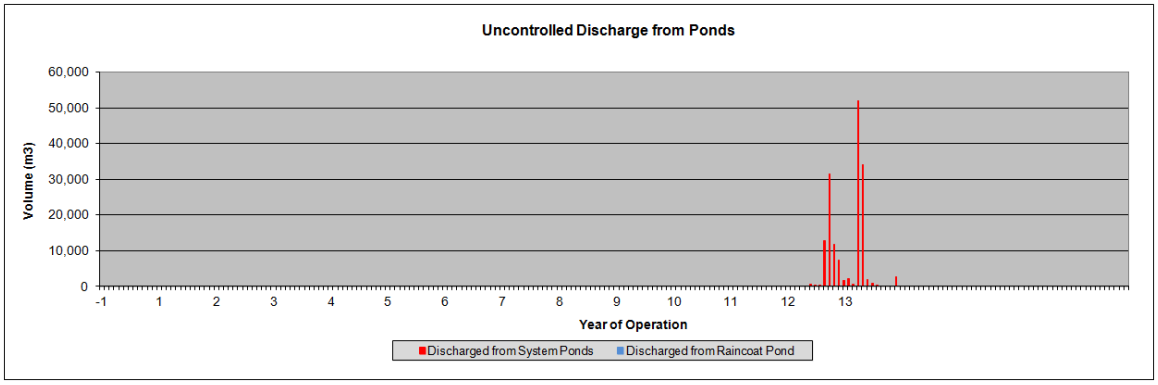


Figure 18 – Uncontrolled Discharge from the Ponds, Without Mitigation



However, the model shows that beginning the pumping of solution to treatment in operational year 9 at the end of ore stacking using a rate of 6 l/s is sufficient to control the seasonal accumulation of water in the ponds (see Figure 19) and maintain the desired availablestorage volume (see Figure 20) with no expected uncontrolled discharge from the pond system (see Figure 21).

Figure 19 – Water in Sump and Event Pond

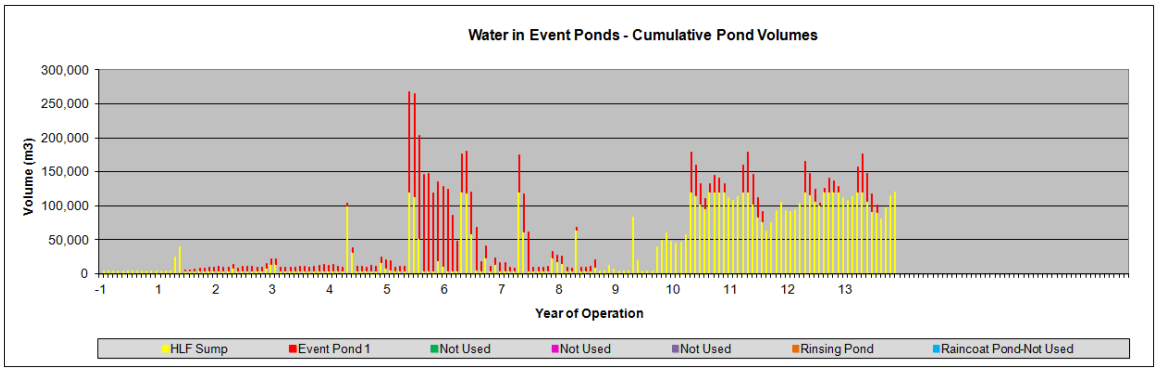


Figure 20 – Desired Available Storage

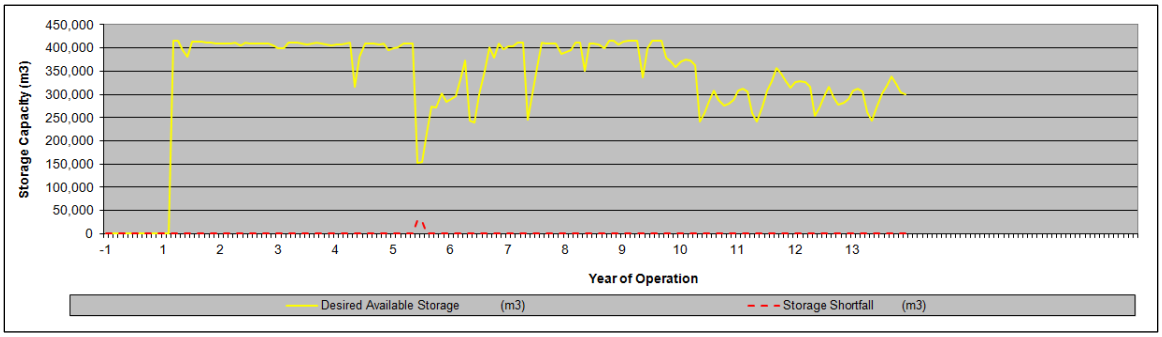
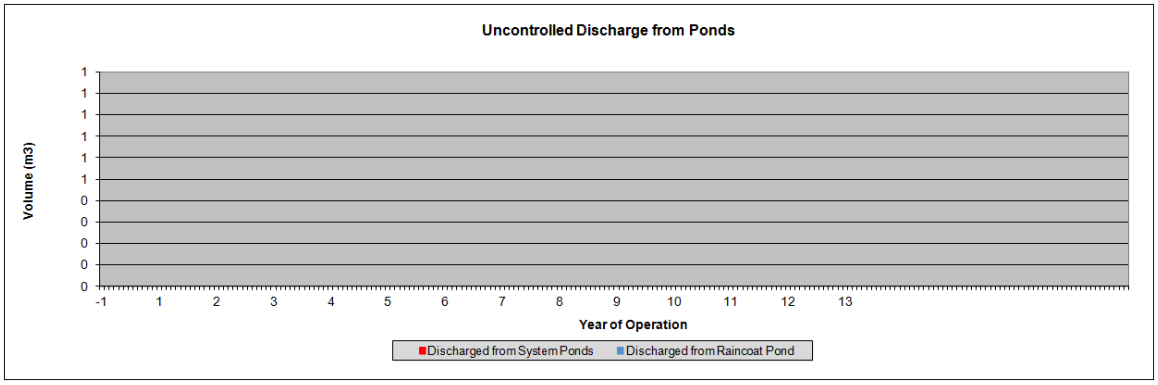


Figure 21 - Uncontrolled Discharge from the Ponds, With Mitigation



Substituting the Average Precipitation with Moderate Variability meteoric record also showed no tendency for significant seasonal accumulation within ponds, maintenance of the desired available storage volume, and no uncontrolled discharge from the pond system.

Similarly, substituting the Wetter Precipitation with High Variability meteoric record showed no tendency toward seasonal accumulation of water after ore stacking operations ceased using the rate of pumping to treatment from operational year 9 onward of 6 l/s. This treatment rate was again sufficient to control the seasonal accumulation of water in the ponds (see Figure 22) and maintain the desired available storage volume (see Figure 23) with no expected uncontrolled discharge from the pond system (see Figure 24).

Figure 22 – Water in Event Ponds

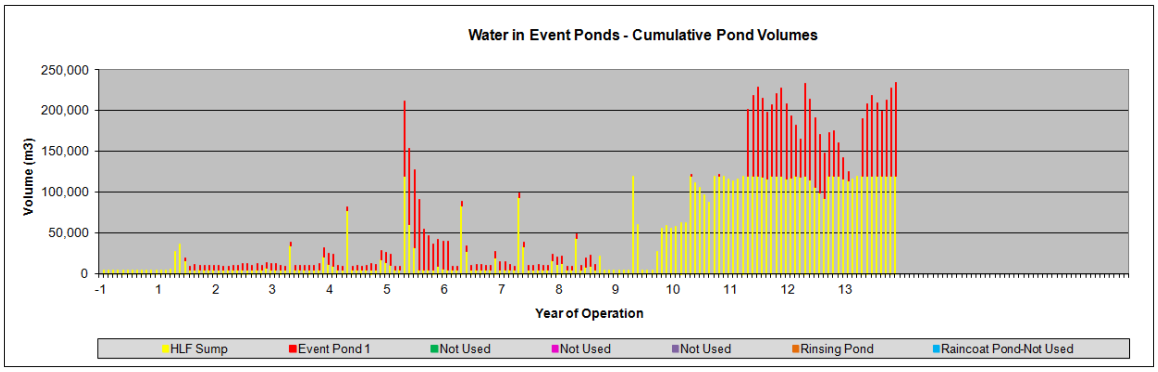


Figure 23 – Desired Available Storage

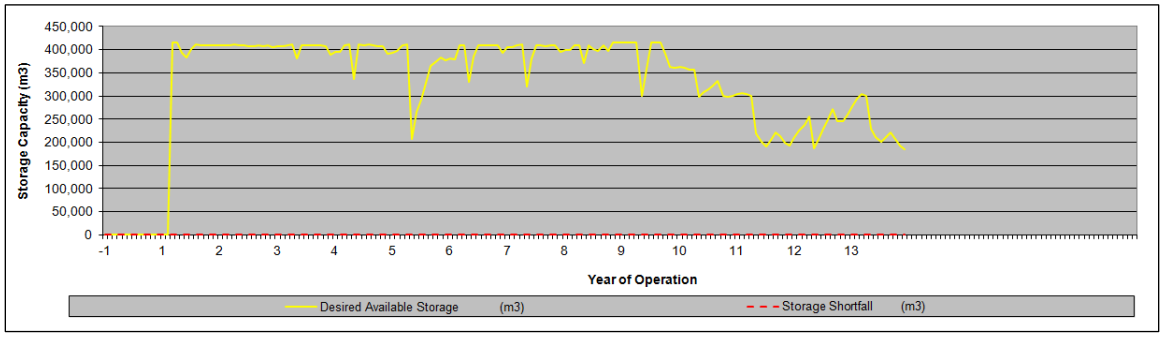
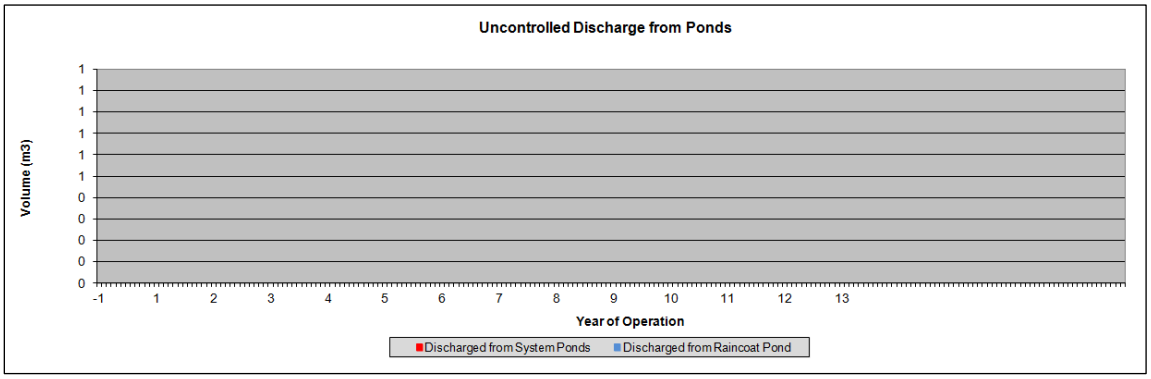


Figure 24 - Uncontrolled Discharge from the Ponds



Therefore, the final deterministic water balance model configuration for the HLF includes pumping of solution to treatment at a rate of at least 6 l/s beginning in October of operational year 9 once ore stacking operations have ceased. Table 7 shows a summary of the deterministic results for this model configuration.

Results show that normal operating volumes in the event pond remain low during normal operations due to the dominance of ore wetting in system losses. Once ore stacking ceases and the ore wetting loss component is lost, the system recruits more and more meteoric water and pumping to treatment becomes necessary to prevent excessive seasonal accumulation of water. This same set of scenarios could also develop during a temporary closure once ore stacking ceases as discussed in Section 5. The event pond levels peak during Phase 4 as irrigation for gold production continues, but no additional ore is being delivered and therefore the wetting of new ore no longer soaks up any water. The event pond levels during normal operations maintain an the desired available storage volume and do not approach the level that would begin to spill into the environment.

Table 7 - Results Summary from Deterministic Model – Dry/Wet Design Sequence

Parameter	Phase	Max	Mean	Min
Water in Stored in Ponds (m3)	**1**	39,563	12,400	4757
	2	104,680	17,184	9454
	3	267,857	59,719	4757
	4	179,389	105,911	40,251
	5	176,782	119,551	81,211
Runoff from Reclaimed Areas (m3/month)	**1**	0	0	0
	2	0	0	0
	3	22,729	1220	0
	4	39,820	2322	0
	5	37,469	2281	0
Outside Makeup Water (m3/month)	**1**	82,815	37,776	0
	2	61,980	26,652	0
	3	55,705	11,658	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/s)	**1**	31.5	14.4	0
	2	23.6	10.1	0
	3	21.2	4.4	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/tonne of ore)	**1**	79.7	33.5	0
	2	52.0	22.3	0
	3	46.8	9.8	0
	4	0	0	0
	5	0	0	0
% of Time Makeup Water Demand is Zero	**1**	---	27.3%	---
	2	---	26.9%	---
	3	---	64.3%	---
	4	---	100%	---
	5	---	100%	---

Note: 6 Liters/Second Pumping to Treatment Beginning in Yr 9 at End of Ore Stacking Operations

Makeup water demand declines over the operating life of the facility having a typical demand of about 60,000 m^3 to 70,000 m^3 per month and maximums of about 80,000 m^3 +/- per month during Phase 1. There is a modest decrease in Phase 2 as the lined footprint increases and water begins to accumulate in the system. Typical values fall to between 30,000 m^3 and 50,000 m^3 and maximums are on the order of 60,000 m^3 +/-. Makeup water demand continues to decline into Phase 3. Typical values fall to about 30,000 m^3 to 40,000 $m^3$and maximums are on the order of 50,000 m^3 +/-.The percentage of time that the makeup water demand is zero increases with later phases as the lined footprint increases and more captured meteoric water is available.

A complete set of summary tables and graphical summaries for the deterministic scenarios considered are provided in Appendix A.

3.5.2 STOCHASTIC RESULTS

Rather than an historic weather record intended to depict normal operating conditions (the deterministic model), the stochastic model is intended to look at extreme or upset conditions and to quantify the risk of experiencing those upset conditions. As discussed earlier, the stochastic model produces results that are actually probability distributions. These distributions show not just a single value, but the entire range of possible values for each parameter of interest. With regard to the HLF for the Project, the primary concern is the makeup water requirement for each month, and the frequency with which process solution storage encroaches upon the desired available storage capacity. Just as in the deterministic case, makeup water requirements can be characterized in different ways (as a monthly volume, a flow rate, a water demand per tonne, or a daily usage). For purposes of the discussion of stochastic model results, the makeup water requirement is discussed in terms of monthly usage (m^3 per month).

Stochastic models use a Monte Carlo sampling procedure to sample input distributions and generate output distributions. In a classic Monte Carlo procedure a random number generator is used to sample distributions and a minimum of about 3000 iterations (samples) are required to get good definition in the tails or extreme limits of the distribution. Other sampling algorithms such as Latin Hypercube, are available to obtain good resolution within the tails of the distributions with fewer samples (as little as 1000 iterations). However, to assure thorough resolution of distribution tails, the stochastic model for the HLF uses Latin Hypercube sampling and 5000 iterations.

Stochastic modeling generates an enormous volume of calculated results (literally many millions of calculations). Therefore, in reporting and interpreting results, it is important to simplify and focus on representative windows of time over the operating history. Since the primary concern is the behavior during each individual month during the year, a full calendar year of results was extracted from various portions of the modeled operating history to represent each major phase of leach pad construction/operation. Table 8 shows the selected windows in time.

Table 8 – Representative Time Windows for Presentation of Stochastic Model Results

Phase	Representative Year	Operational Year
Phase 1	2019	2
Phase 2	2021	4
Phase 3	2023	6
Phase 4	2026	9
Phase 5	2029	12

Figure 25 shows a "box and whiskers" plot of result summaries for each month of the time period listed in Table 8. The box and whiskers plot provides a sort of snapshot of the individual probability distributions. Each box (the red band) represents the middle 50% of the distribution (25^{th} percentile to the 75^{th} percentile) while the whiskers (the thin line) bracket 90% of the distribution (the 5^{th} percentile to the 95^{th} percentile). The dashed white line in the red box is the mean. When there is no box, it means the 25^{th} percentile to 75^{th} percentile range contains values of zero.

Several things become evident from an examination of the box and whiskers plot (see Figure 25). Makeup water demand during Phase 1 will typically range from about 65,000 m^3 to 80,000 m^3

per month during the warmer months and about 50,000 m^3 to 60,000 m^3 during the cooler months. The exception is the spring freshet period, typically occurring in the month of May, where a sudden influx of water from snowmelt substantially reduces the outside makeup water demand. The reduction in makeup water demand steadily increases with each phase due to the associated increase in the lined footprint of the HLF. Outside makeup water demand drops to zero during Phase 4 and Phase 5 due to the accumulation of water in the system following the termination of ore stacking and the elimination of ore wetting losses and the expectation that no fresh water from outside the system will be used in the rinsing process. A more detailed box and whiskers plot for each individual phase is provided in Figure 26 through Figure 30.

Figure 25 – Box & Whiskers Plot for Stochastic Makeup Water Requirement Results

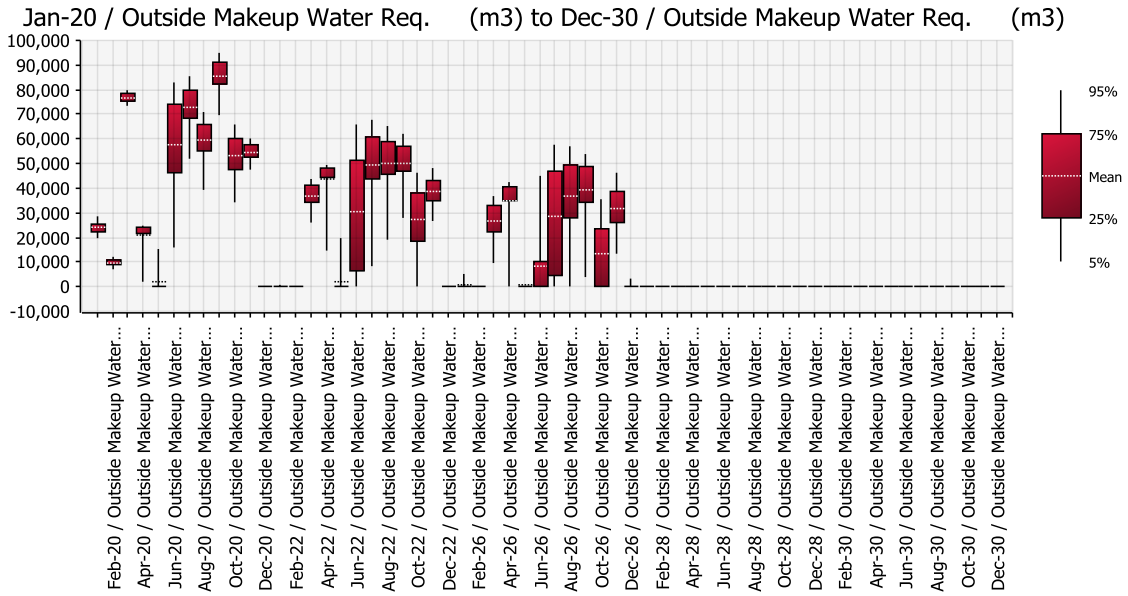


Figure 26 - Box & Whiskers Plot for Phase 1 Makeup Water

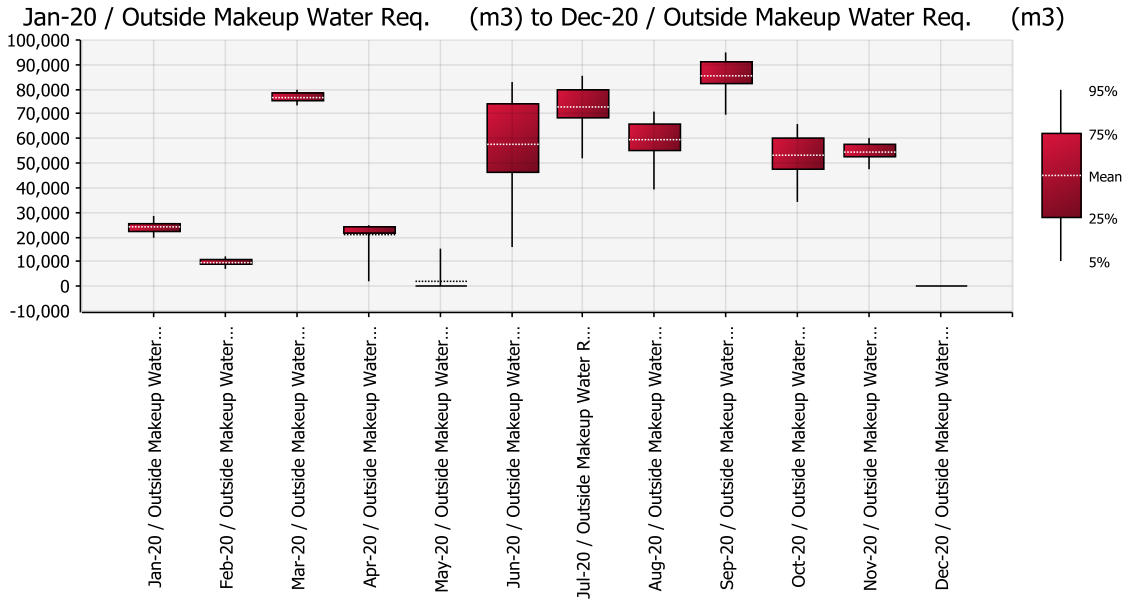


Figure 27 - Box & Whiskers Plot for Phase 2 Makeup Water

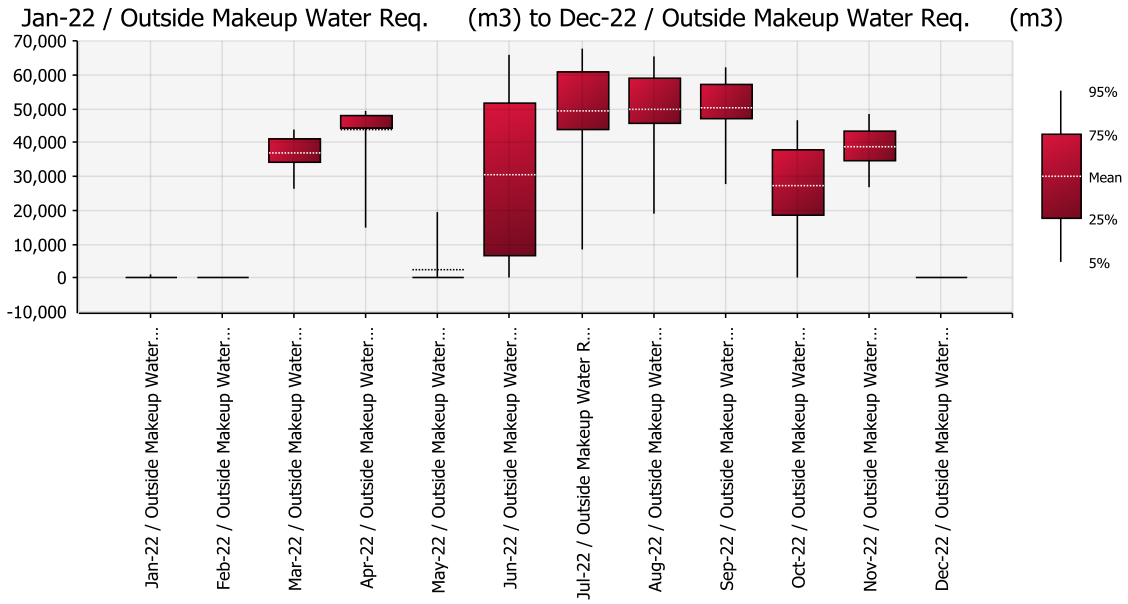


Figure 28 - Box & Whiskers Plot for Phase 3 Makeup Water

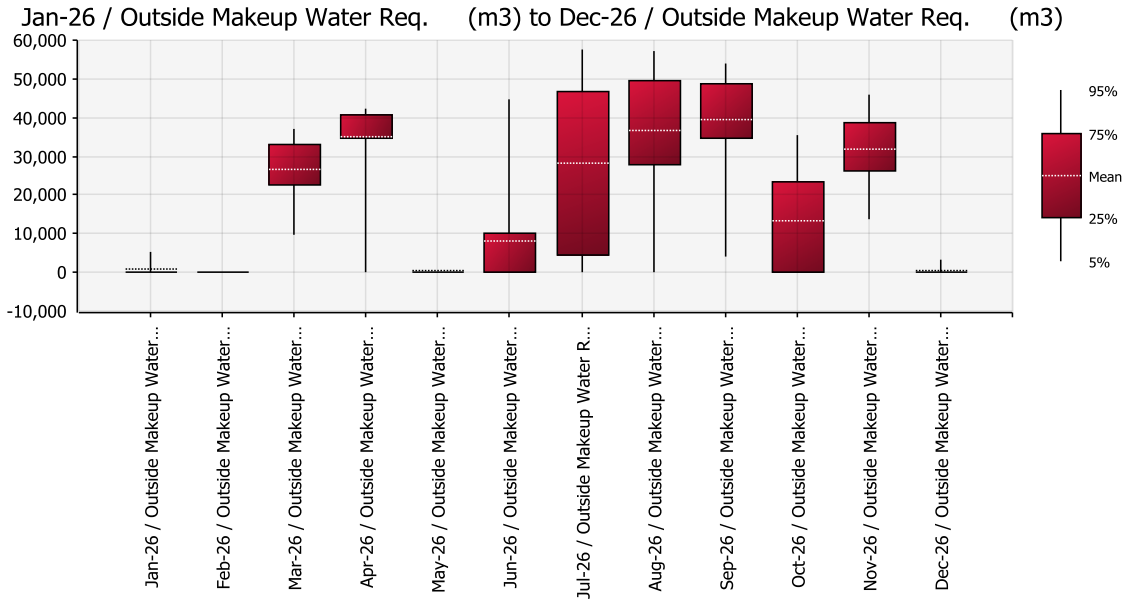


Figure 29 - Box & Whiskers Plot for Phase 4 Makeup Water

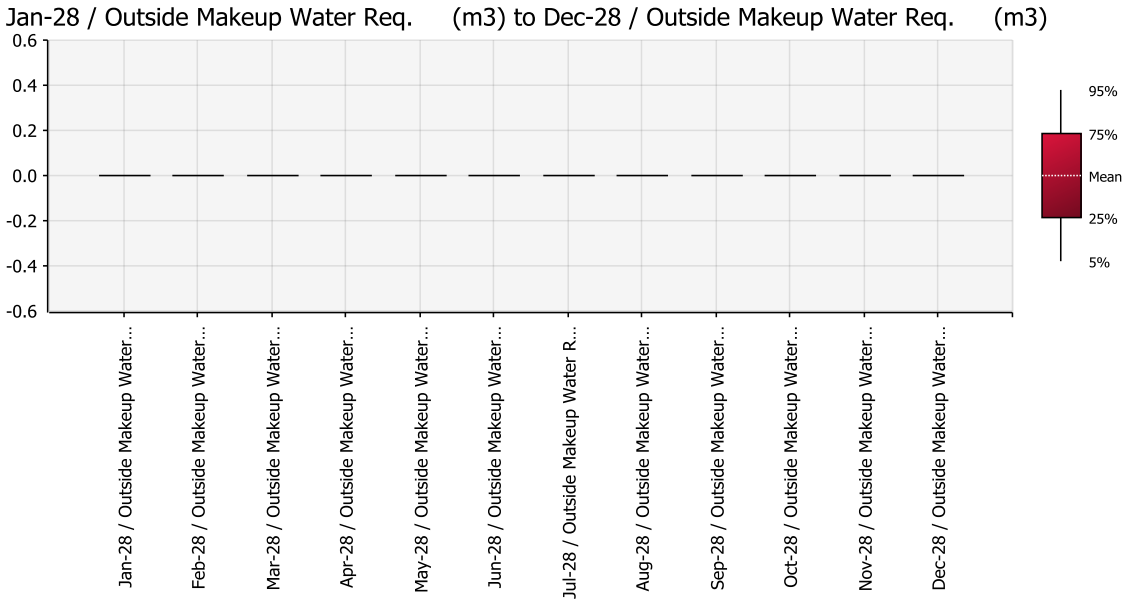
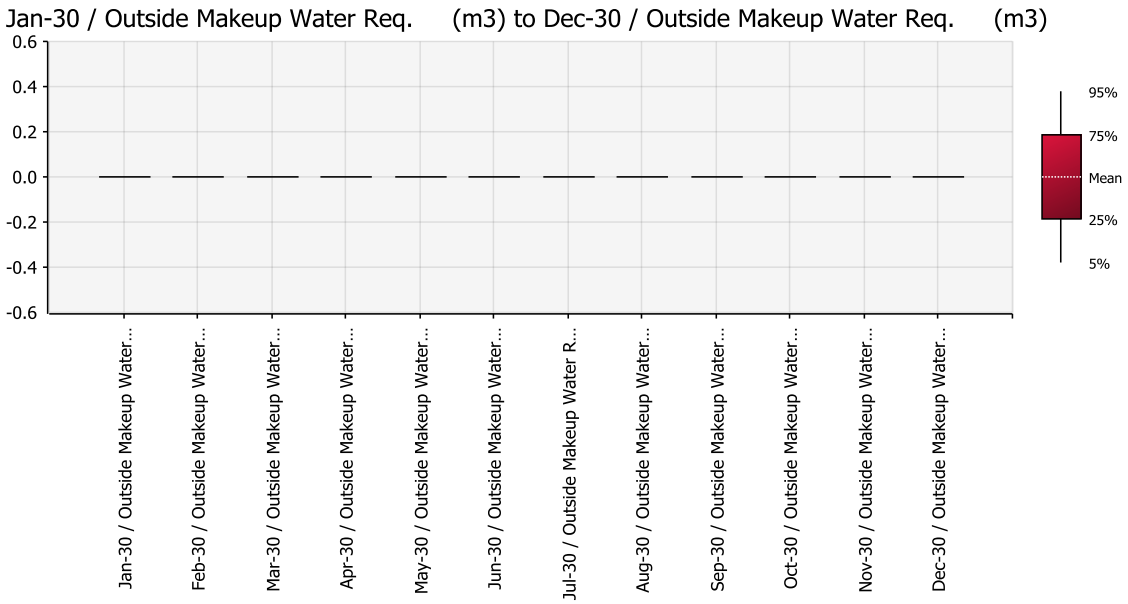


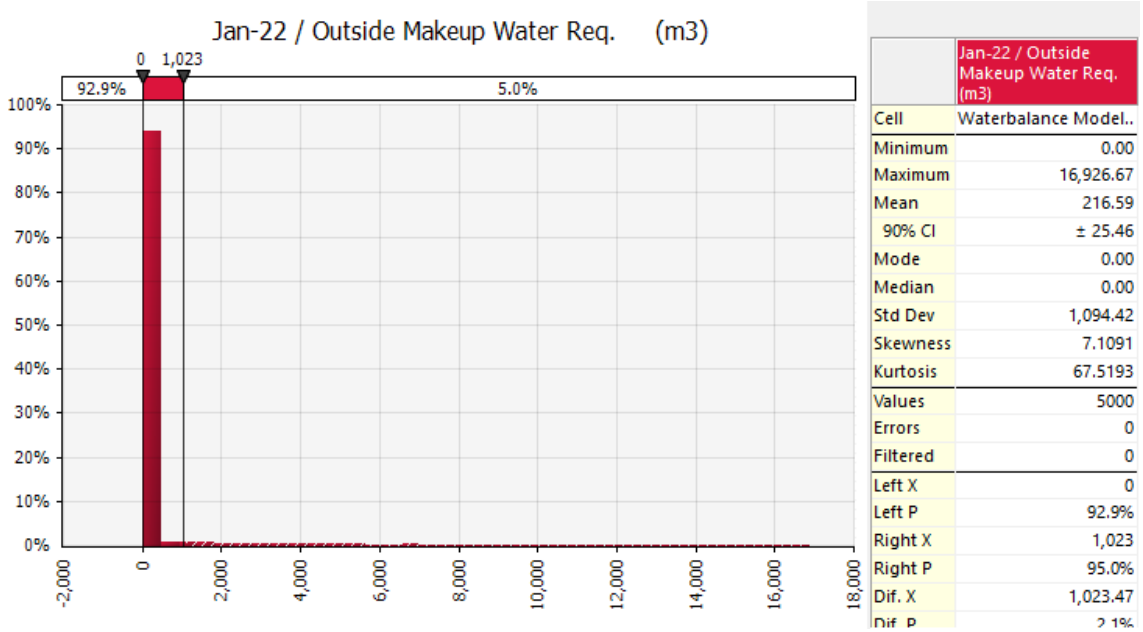
Figure 30 - Box & Whiskers Plot for Phase 5 Makeup Water



The next 12 charts (Figure 31 through Figure 42) show the monthly probability distributions for makeup water demand in m^3 per month for a typical calendar year (in this case for the Phase 2 pad in operational year 4 or 2021). Although it is apparent from the earlier discussion that the makeup water demand varies over time, an examination of one calendar year of monthly distributions will be sufficient to illustrate the typical character of each individual month.

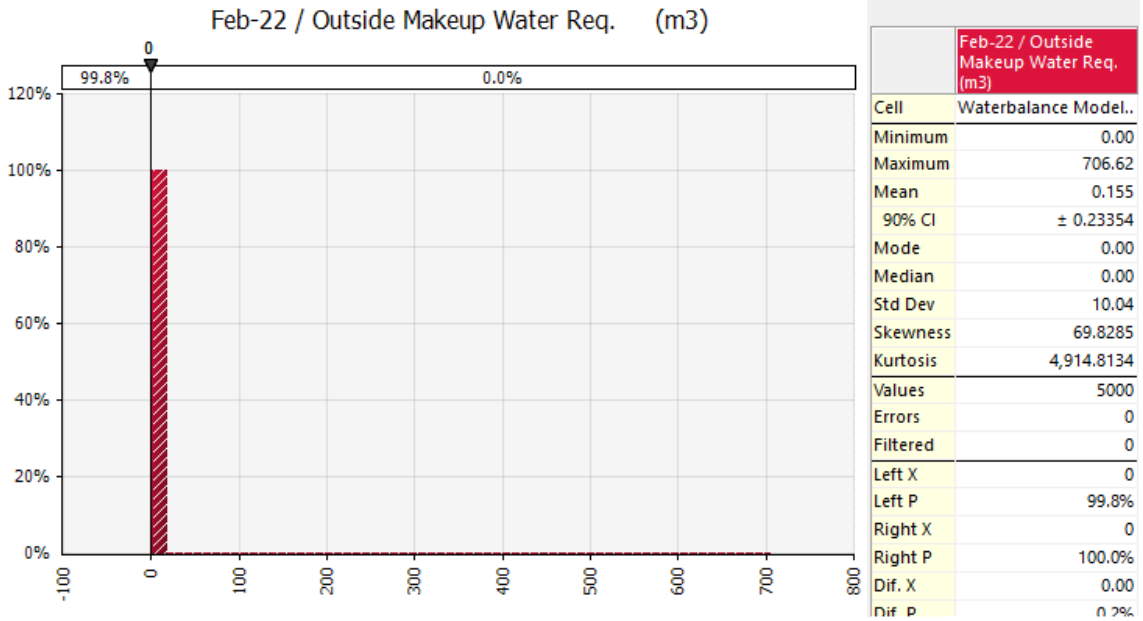
The distributions for January and February are very similar with the vast majority of events showing zero demand (about 93% of the time in January and nearly 100% of the time in February) and the frequency of non-zero demand events low (95% of the time in January the outside makeup water demand will be less than 1023 m^3 and for February, less than 1 m^3). This is primarily driven by the condition that no ore will be stacked on the heap during the months of December, January, and February.

Figure 31 – Probability Distribution for Phase 2 in January



	Jan-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	16,926.67
Mean	216.59
90% CI	± 25.46
Mode	0.00
Median	0.00
Std Dev	1,094.42
Skewness	7.1091
Kurtosis	67.5193
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	92.9%
Right X	1,023
Right P	95.0%
Dif. X	1,023.47
Dif. P	2.1%

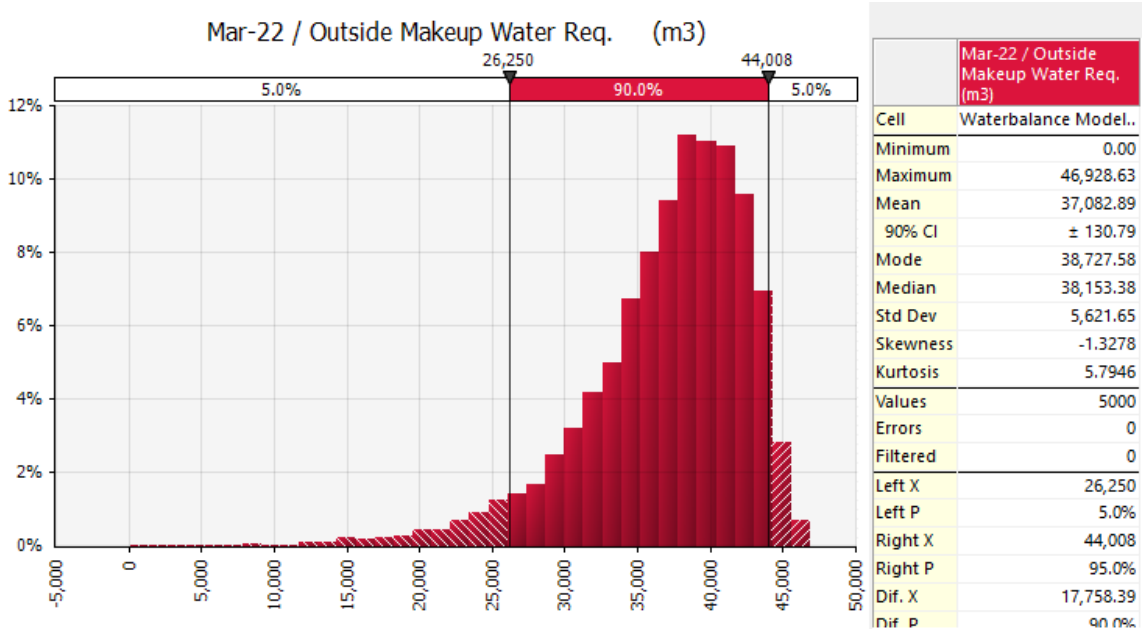
Figure 32 - Probability Distribution for Phase 2 in February



	Feb-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	706.62
Mean	0.155
90% CI	± 0.23354
Mode	0.00
Median	0.00
Std Dev	10.04
Skewness	69.8285
Kurtosis	4,914.8134
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	99.8%
Right X	0
Right P	100.0%
Dif. X	0.00
Dif. P	0.2%

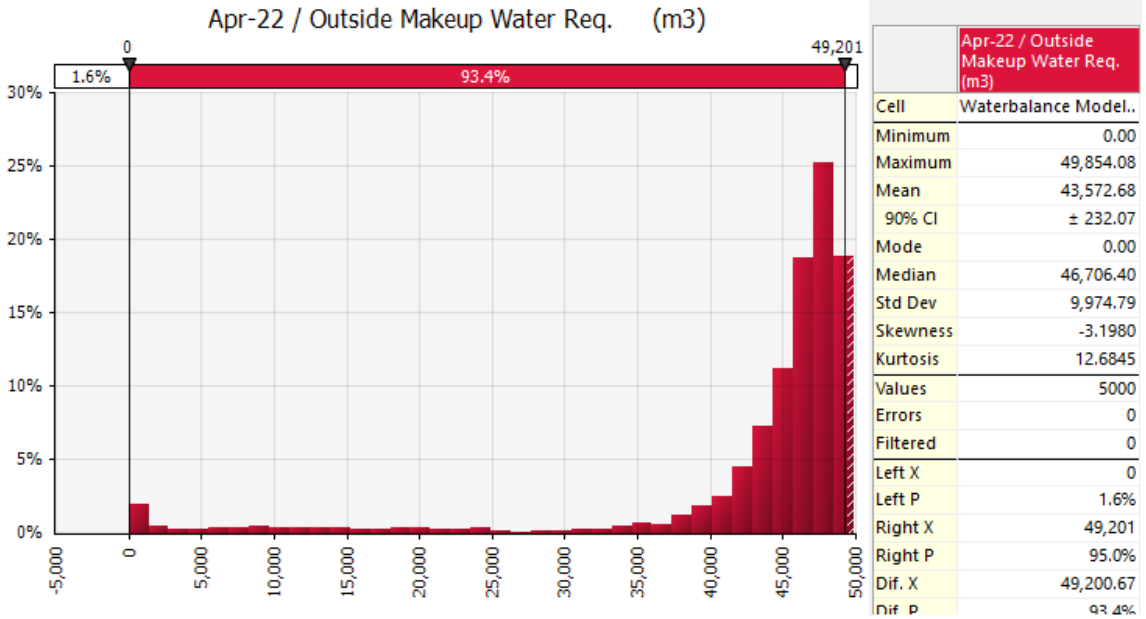
Makeup Water Demand changes significantly in March and April due to the resumption of ore stacking and the demand created by wetting of the fresh ore and the mean increasing from essentially 0 to 37,000 m^3 +/-. The mode or most frequently observed non-zero value increases to a value in the range of 38,000 m^3 to 42,000 m^3.

Figure 33 - Probability Distribution for Phase 2 in March



	Mar-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	46,928.63
Mean	37,082.89
90% CI	± 130.79
Mode	38,727.58
Median	38,153.38
Std Dev	5,621.65
Skewness	-1.3278
Kurtosis	5.7946
Values	5000
Errors	0
Filtered	0
Left X	26,250
Left P	5.0%
Right X	44,008
Right P	95.0%
Dif. X	17,758.39
Dif. P	90.0%

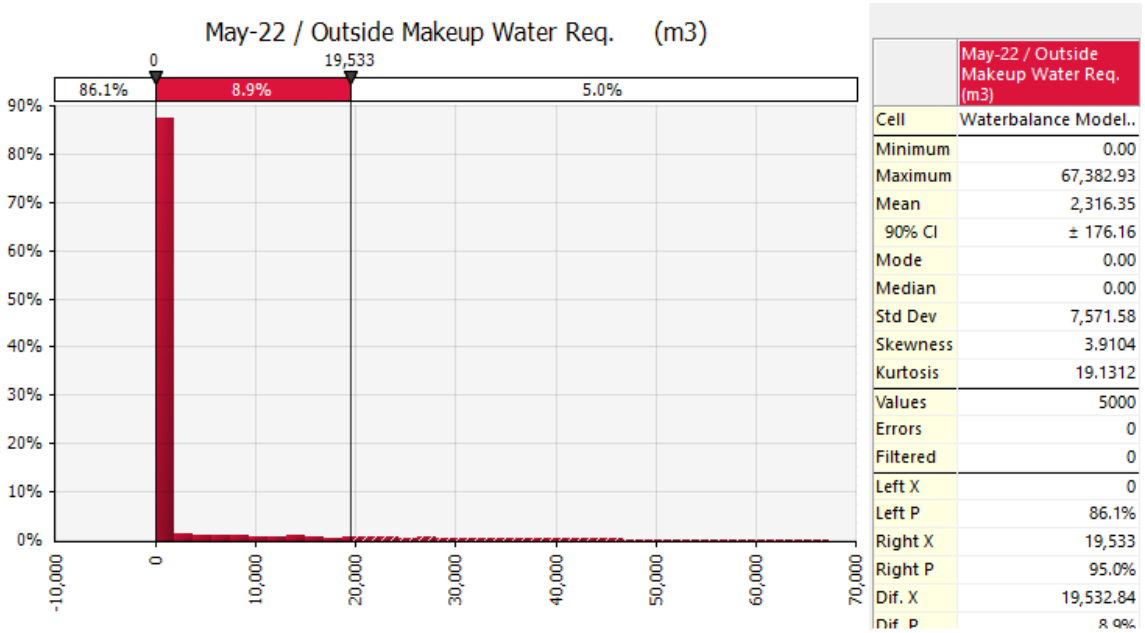
Figure 34 - Probability Distribution for Phase 2 in April



	Apr-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	49,854.08
Mean	43,572.68
90% CI	± 232.07
Mode	0.00
Median	46,706.40
Std Dev	9,974.79
Skewness	-3.1980
Kurtosis	12.6845
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	1.6%
Right X	49,201
Right P	95.0%
Dif. X	49,200.67
Dif. P	93.4%

The month of May, which is dominated by snowmelt, shows a zero makeup water demand about 86% of the time, and the mean demand is on the order of 2300 m^3.

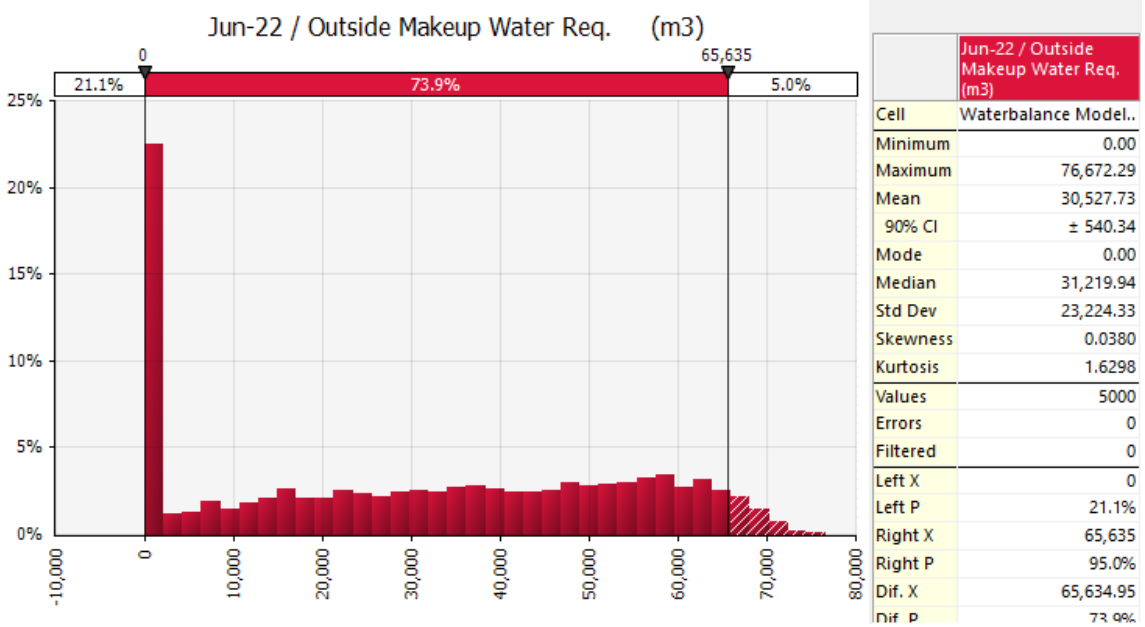
Figure 35 - Probability Distribution for Phase 2 in May



	May-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	67,382.93
Mean	2,316.35
90% CI	± 176.16
Mode	0.00
Median	0.00
Std Dev	7,571.58
Skewness	3.9104
Kurtosis	19.1312
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	86.1%
Right X	19,533
Right P	95.0%
Dif. X	19,532.84
Dif. P	8.9%

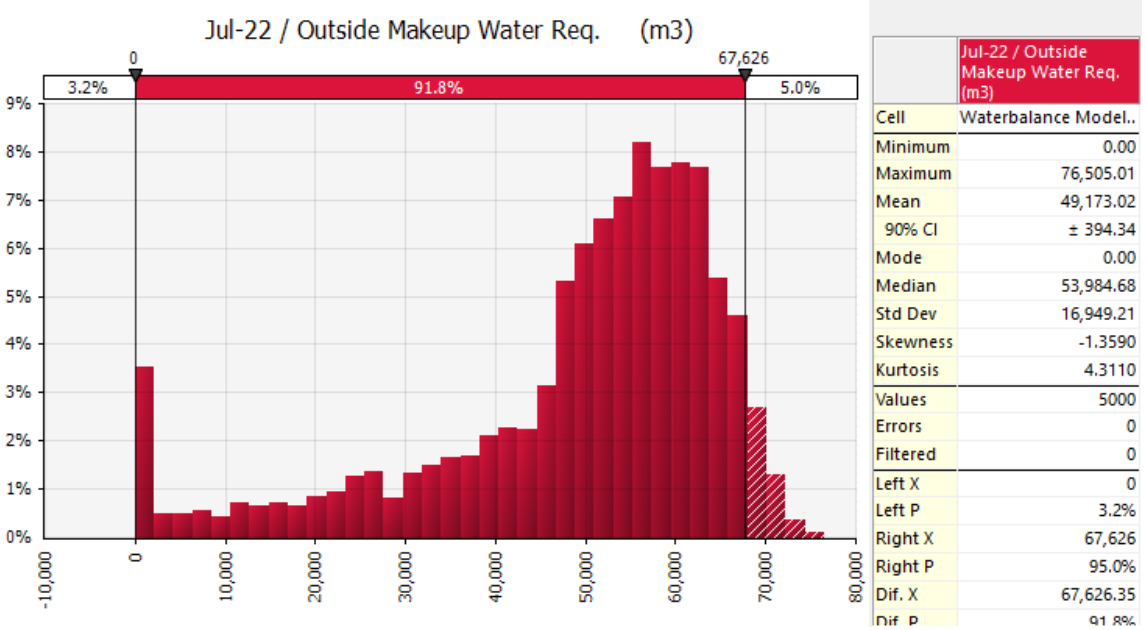
By June the summertime makeup water demand pattern is beginning to form, and the volume of water from the May snowmelt is rapidly being consumed by the large ore wetting demand combined with the large summertime evaporative demands. The frequency of high makeup water demand continues to increase and the frequency of zero makeup water demand continues to decrease from June through September.

Figure 36 - Probability Distribution for Phase 2 in June



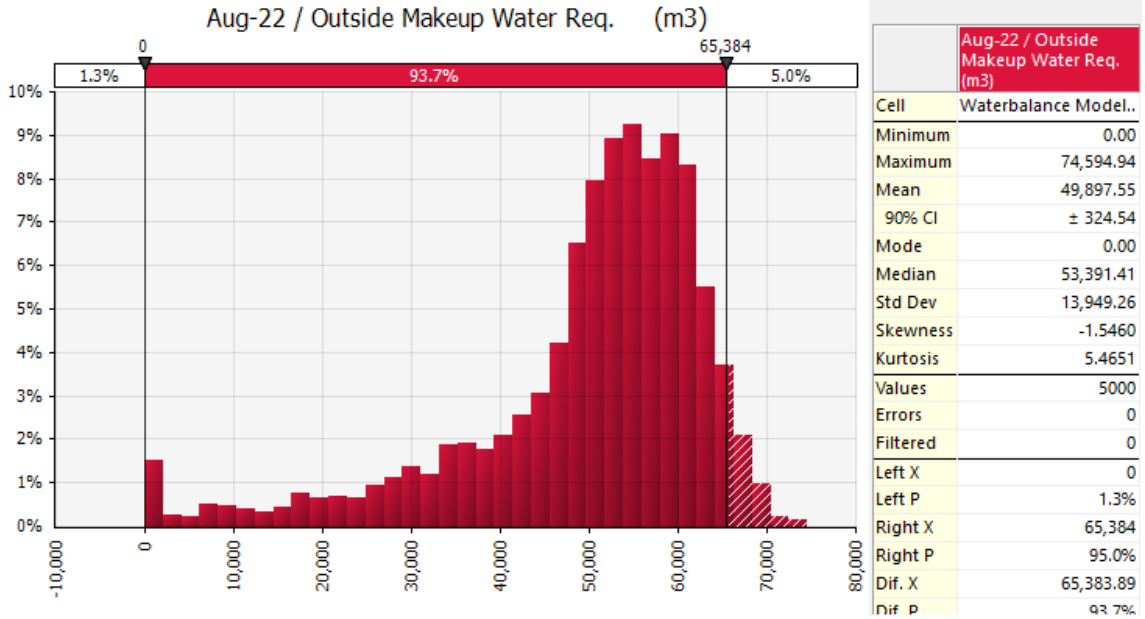
	Jun-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	76,672.29
Mean	30,527.73
90% CI	± 540.34
Mode	0.00
Median	31,219.94
Std Dev	23,224.33
Skewness	0.0380
Kurtosis	1.6298
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	21.1%
Right X	65,635
Right P	95.0%
Dif. X	65,634.95
Dif. P	73.9%

Figure 37 - Probability Distribution for Phase 2 in July



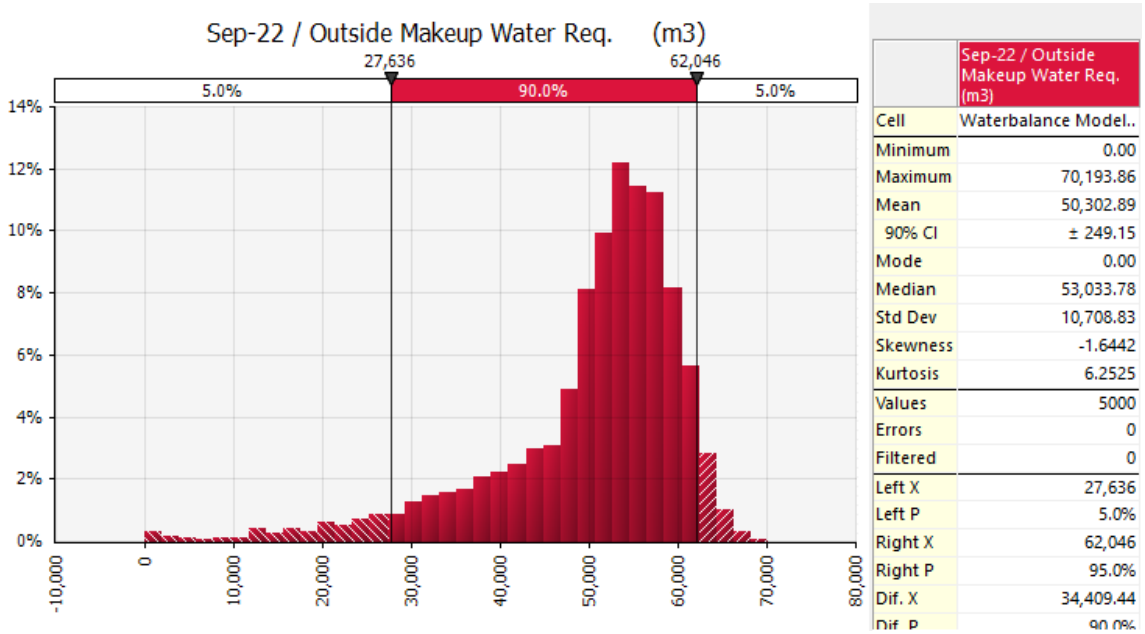
	Jul-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	76,505.01
Mean	49,173.02
90% CI	± 394.34
Mode	0.00
Median	53,984.68
Std Dev	16,949.21
Skewness	-1.3590
Kurtosis	4.3110
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	3.2%
Right X	67,626
Right P	95.0%
Dif. X	67,626.35
Dif. P	91.8%

Figure 38 - Probability Distribution for Phase 2 in August



	Aug-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	74,594.94
Mean	49,897.55
90% CI	± 324.54
Mode	0.00
Median	53,391.41
Std Dev	13,949.26
Skewness	-1.5460
Kurtosis	5.4651
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	1.3%
Right X	65,384
Right P	95.0%
Dif. X	65,383.89
Dif. P	93.7%

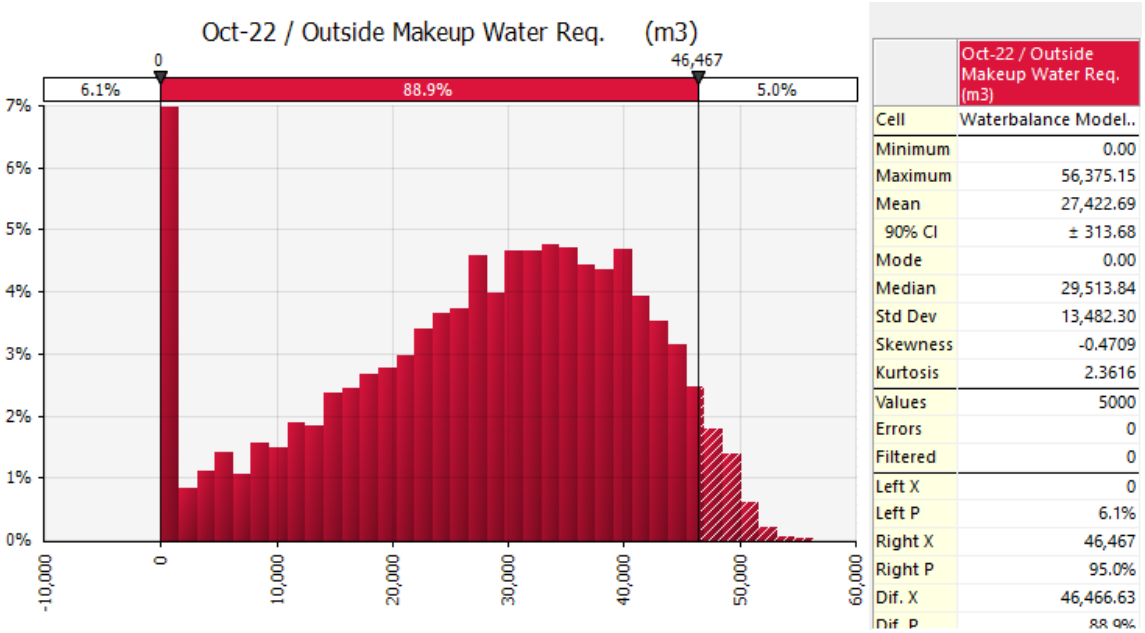
Figure 39 - Probability Distribution for Phase 2 in September



	Sep-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	70,193.86
Mean	50,302.89
90% CI	± 249.15
Mode	0.00
Median	53,033.78
Std Dev	10,708.83
Skewness	-1.6442
Kurtosis	6.2525
Values	5000
Errors	0
Filtered	0
Left X	27,636
Left P	5.0%
Right X	62,046
Right P	95.0%
Dif. X	34,409.44
Dif. P	90.0%

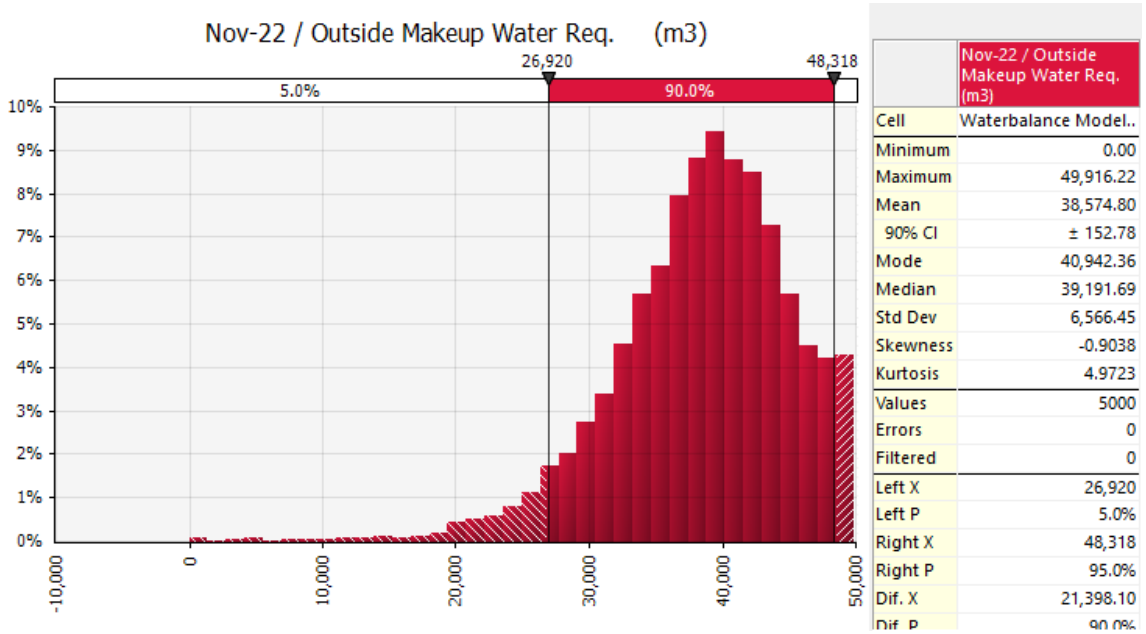
By October and November the ore wetting demand remains constant but the evaporative demand is beginning to wane as temperatures begin to regularly fall below freezing again.

Figure 40 - Probability Distribution for Phase 2 in October



	Oct-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	56,375.15
Mean	27,422.69
90% CI	± 313.68
Mode	0.00
Median	29,513.84
Std Dev	13,482.30
Skewness	-0.4709
Kurtosis	2.3616
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	6.1%
Right X	46,467
Right P	95.0%
Dif. X	46,466.63
Dif. P	88.9%

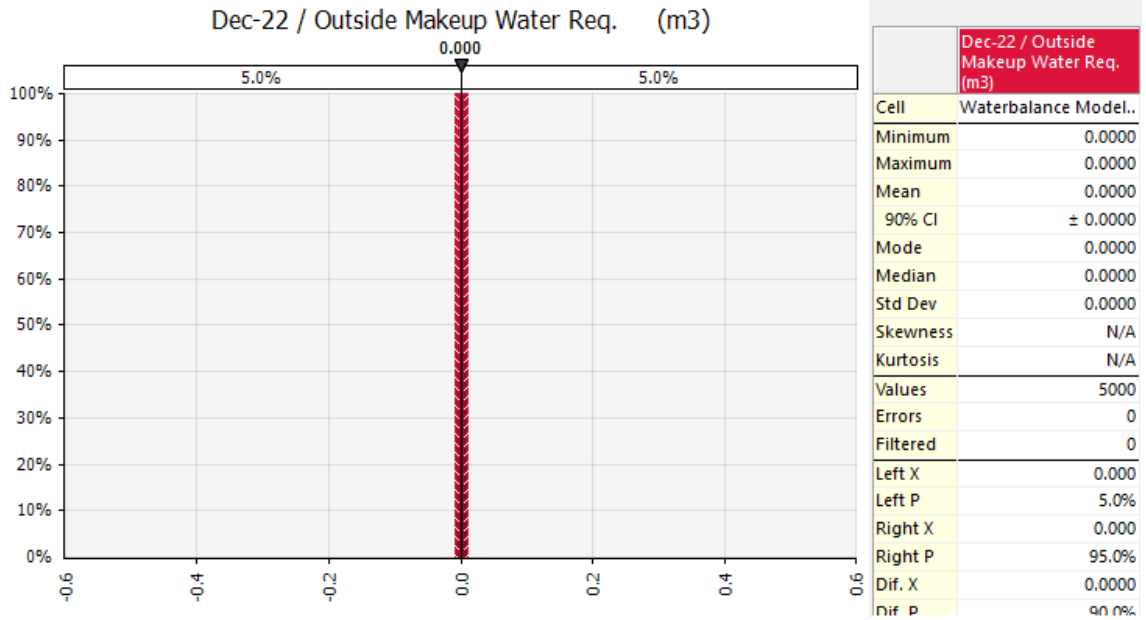
Figure 41 - Probability Distribution for Phase 2 in November



	Nov-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	49,916.22
Mean	38,574.80
90% CI	± 152.78
Mode	40,942.36
Median	39,191.69
Std Dev	6,566.45
Skewness	-0.9038
Kurtosis	4.9723
Values	5000
Errors	0
Filtered	0
Left X	26,920
Left P	5.0%
Right X	48,318
Right P	95.0%
Dif. X	21,398.10
Dif. P	90.0%

The December pattern is essentially the same as January and February, zero 100% of the time.

Figure 42 - Probability Distribution for Phase 2 in December



	Dec-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.0000
Maximum	0.0000
Mean	0.0000
90% CI	± 0.0000
Mode	0.0000
Median	0.0000
Std Dev	0.0000
Skewness	N/A
Kurtosis	N/A
Values	5000
Errors	0
Filtered	0
Left X	0.000
Left P	5.0%
Right X	0.000
Right P	95.0%
Dif. X	0.0000
Dif. P	90.0%

Table 9 – Stochastic Modeling Results for Outside Makeup Water Demand (m^3/Month)

Phase	Month	Max	95% <	Mean	5% <	Min	%Zero
1	**Jan**	41,256	28,718	23,868	19,919	1398	---
1	**Feb**	14,886	12,206	9880	7378	954	---
1	**Mar**	80,540	79,483	76,814	73,285	69,358	---
1	**Apr**	25,491	24,896	21,246	1698	0	4.4%
1	**May**	40,494	15,146	1832	0	0	83.7%
1	**Jun**	92,106	82,811	57,904	16,137	0	1.7%
1	**Jul**	91,900	85,344	72,631	51,652	0	---
1	**Aug**	79,017	71,193	59,249	39,136	0	---
1	**Sep**	102,472	95,026	85,556	69,463	34,486	---
1	**Oct**	70,709	65,788	53,040	34,028	0	---
1	**Nov**	61,653	60,484	54,713	47,375	33,699	---
1	**Dec**	0	0	0	0	0	100%
2	**Jan**	16,927	1023	217	0	0	92.9%
2	**Feb**	707	---	0.2	0	0	99.8%
2	**Mar**	46,929	44,008	37,083	26,250	0	---
2	**Apr**	49,854	49,201	43,573	14,786	0	1.6%
2	**May**	67,383	19,533	2316	0	0	86.1%
2	**Jun**	76,672	65,635	30,528	0	0	21.1%
2	**Jul**	76,505	67,626	49,173	8200	0	3.2%
2	**Aug**	74,595	65,384	49,898	18,803	0	1.3%
2	**Sep**	70,194	62,046	50,303	27,636	0	---
2	**Oct**	56,375	46,467	27,423	0	0	6.1%
2	**Nov**	49,916	48,318	38,575	26,920	0	---
2	**Dec**	0	0	0	0	0	100%
3	**Jan**	26,409	5151	662	0	0	87.4%
3	**Feb**	3681	---	7	0	0	99.2%
3	**Mar**	40,685	36,902	26,619	9658	0	1.6%
3	**Apr**	43,046	42,181	35,062	0	0	6.5%
3	**May**	48,615	---	542	0	0	96.8%
3	**Jun**	66,127	44,896	8034	0	0	65.3%
3	**Jul**	66,814	57,420	28,296	0	0	22.2%
3	**Aug**	69385	56,995	36,821	0	0	10.3%
3	**Sep**	61,334	54,036	39,422	4071	0	4.1%
3	**Oct**	47,948	35,621	13,350	0	0	29.3%
3	**Nov**	51,378	46,039	31,774	13,686	0	0.9%
3	**Dec**	7465	3245	429	0	0	82.3%

The other matter of interest in stochastic modeling involves the volume of water stored within the pond system and the ability to maintain the desired available storage capacity. As mentioned in the section on deterministic modeling, the desired available storage varies as a function of the lined footprint of the heap leach pad and therefore varies by phase. Table 10 shows the desired available storage volume by phase.

Table 10 – Desired Available Storage Volume by Phase

Phase	Volume of the 100 Yr 24 Hr (1%) Storm (m^3) [1]	72 Hr Draindown Volume (m^3) [2]	Freeboard (m^3) [3]	Total Desired Available Storage Volume (m3)
1	25,246	108,000	19,578	152,824
2	37,607	108,000	19,578	165,185
3	54,312	108,000	19,578	181,890
4	54,312	108,000	19,578	181,890
5	54,312	108,000	19,578	181,890

1- Based on a 100 Yr 24 Hr (1%) storm rainfall depth of 54 mm
2 – Based on a solution pumping rate of 1,500,000 liters/hr
3 – Based on a pond depth freeboard of 0.0 m in the in-heap sump and 0.5 m in the event ponds

Figure 43 shows a box and whiskers plot over the Phase 1 through Phase 5 time period (note that the Y axis scale varies with each plot). The desired available storage volume is defined as the total pond capacity minus the volume of water in storage within the pond system at any given point in time. The results show there is essentially no risk of encroaching on the desired available storage volume during Phase 1, Phase 2, or Phase 3 (normal operations). There is a small risk of encroachment (1.9%) during the freshet month (May) in Phase 3. Figure 44 through Figure 48 provide a more detailed look at a representative calendar year for Phase 1 through Phase 5. Phase 1 through Phase 3 are similar in that the strong ore wetting demand keep ponds relatively empty and facilitate a quick recovery even from strong freshet inflows.

Figure 43 – Box and Whiskers Plot for Desired Available Storage

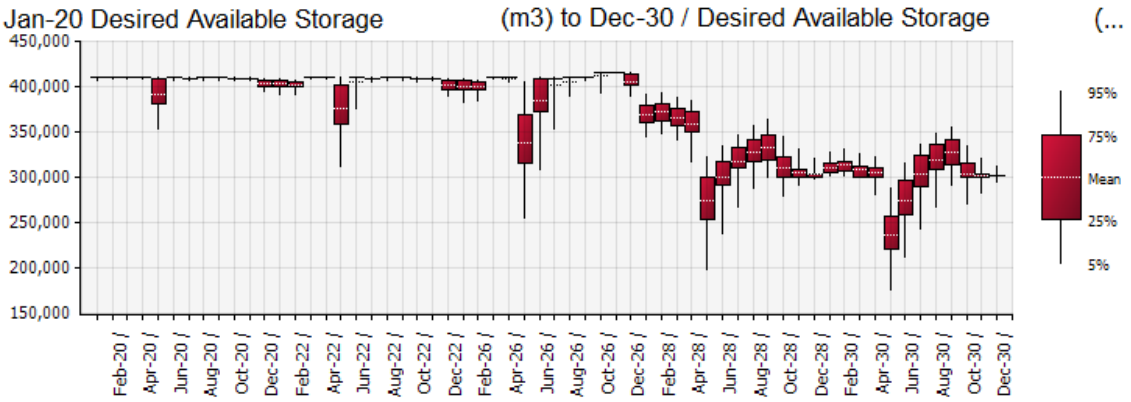


Figure 44 - Box and Whiskers Plot for Phase 1 Desired Available Storage

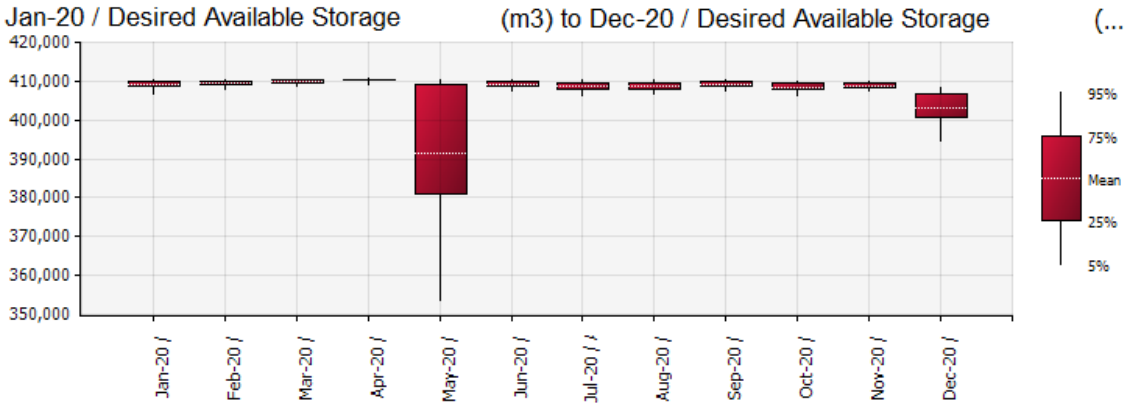


Figure 45 - Box and Whiskers Plot for Phase 2 Desired Available Storage

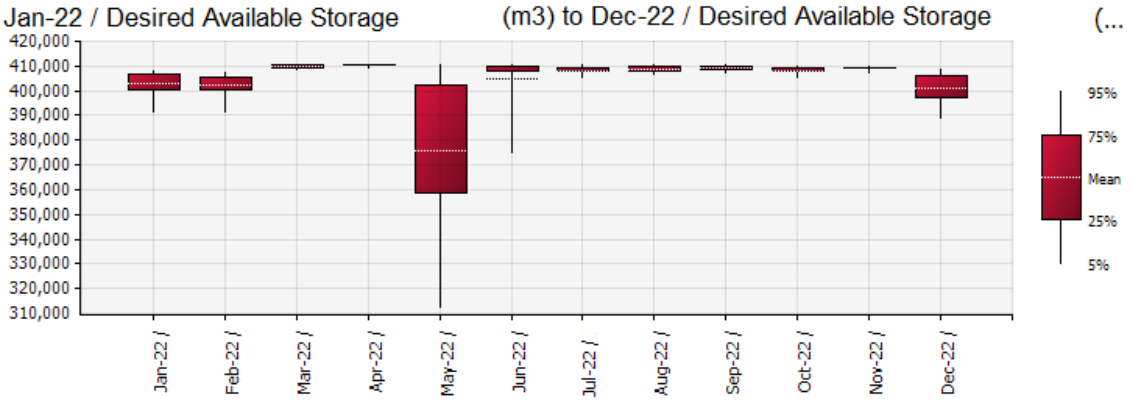
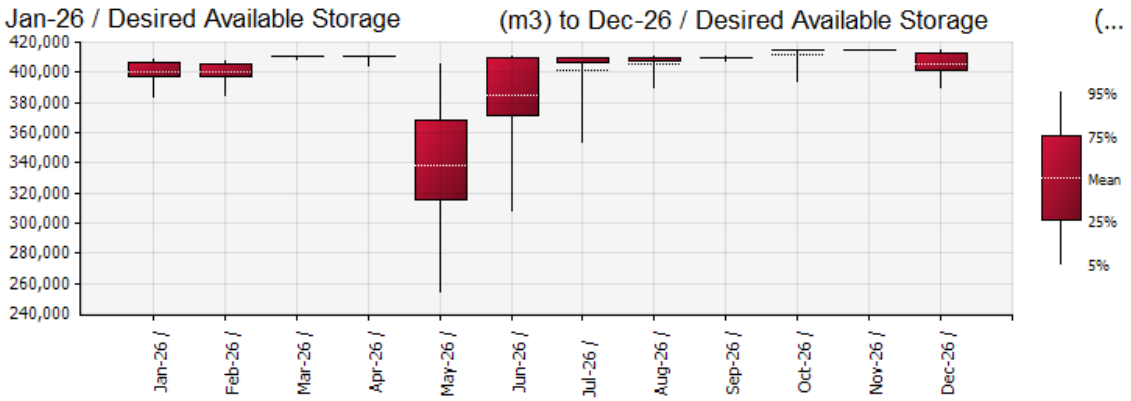


Figure 46 - Box and Whiskers Plot for Phase 3 Desired Available Storage



During Phase 4 ore stacking ends and the water demand associated with the wetting of fresh ore is lost. The strong annual influx of water associated with the freshet in May is now slow to recover and water begins to accumulate in the system. Pumping to treatment is now the dominant mechanism for controlling seasonal accumulation of water.

Figure 47 - Box and Whiskers Plot for Phase 4 Desired Available Storage

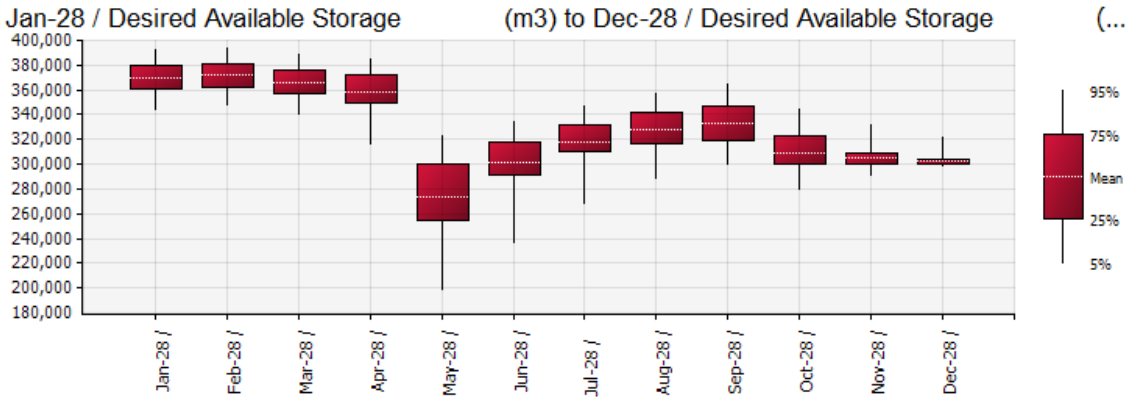
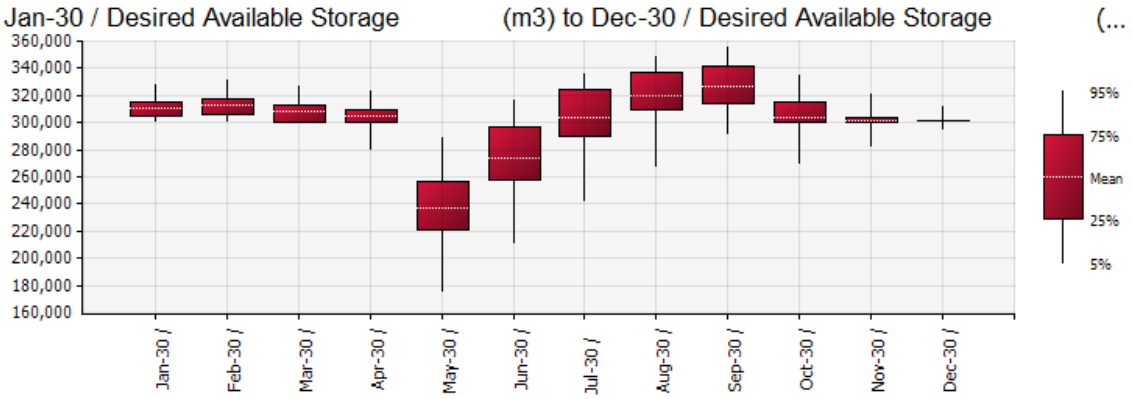


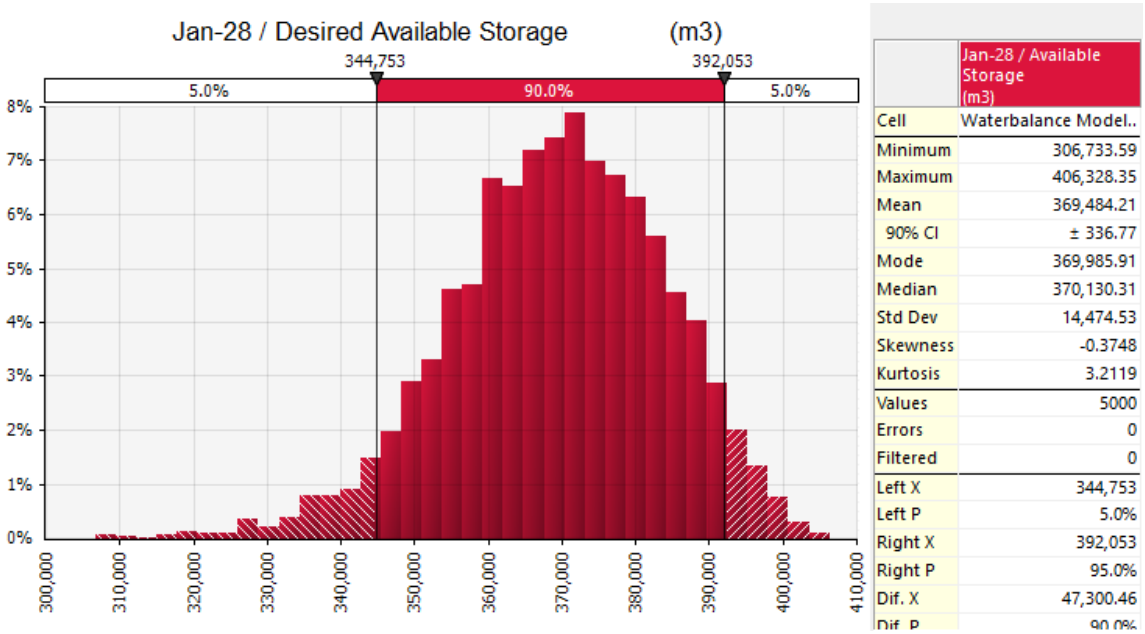
Figure 48 - Box and Whiskers Plot for Phase 5 Desired Available Storage



The next 12 charts (Figure 49 through Figure 60) show the monthly probability distributions for the desired available storage for a typical calendar year (in this case for the Phase 4 pad in operational year 9). Earlier phases (Phase 1 through Phase 3) show essentially a 0% probability of a shortfall in the desired available storage (with the exception of the month of May in Phase 3 where the probability of a shortfall is 1.9%). Distributions for Phase 4 and Phase 5 are similar although shortfalls for Phase 5 are somewhat larger. A complete presentation of the graphic results of stochastic modeling for the desired available storage for all phases is found in Appendix B.

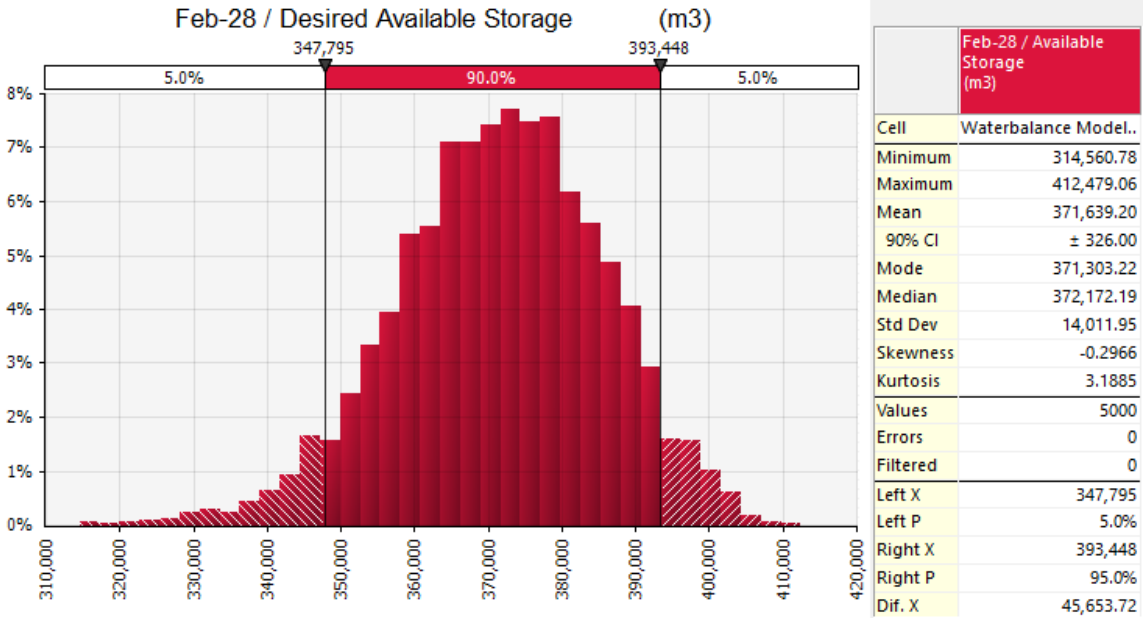
The distributions for January through April are very similar with all of these distributions showing minimum values that far exceed the minimum required Phase 4 the desired available storage of 181,900 m^3 resulting in a 0% probability of falling short of the desired amount (see Figure 49 through Figure 52).

Figure 49 – Desired Available Storage, Phase 4, January



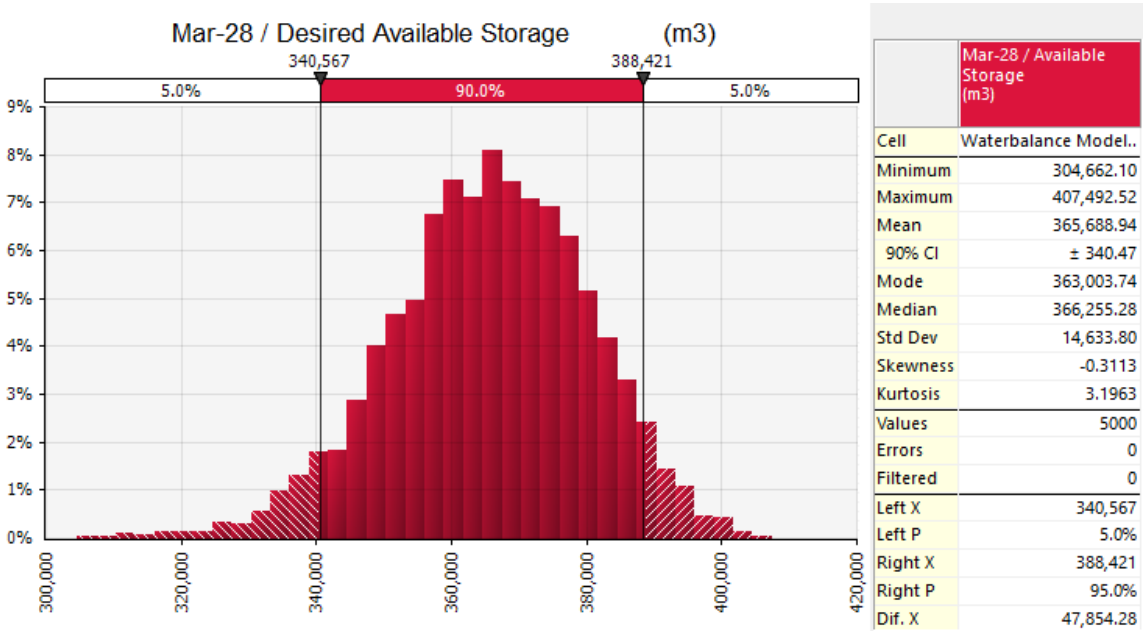
	Jan-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	306,733.59
Maximum	406,328.35
Mean	369,484.21
90% CI	± 336.77
Mode	369,985.91
Median	370,130.31
Std Dev	14,474.53
Skewness	-0.3748
Kurtosis	3.2119
Values	5000
Errors	0
Filtered	0
Left X	344,753
Left P	5.0%
Right X	392,053
Right P	95.0%
Dif. X	47,300.46
Dif. P	90.0%

Figure 50 – Desired Available Storage, Phase 4, February



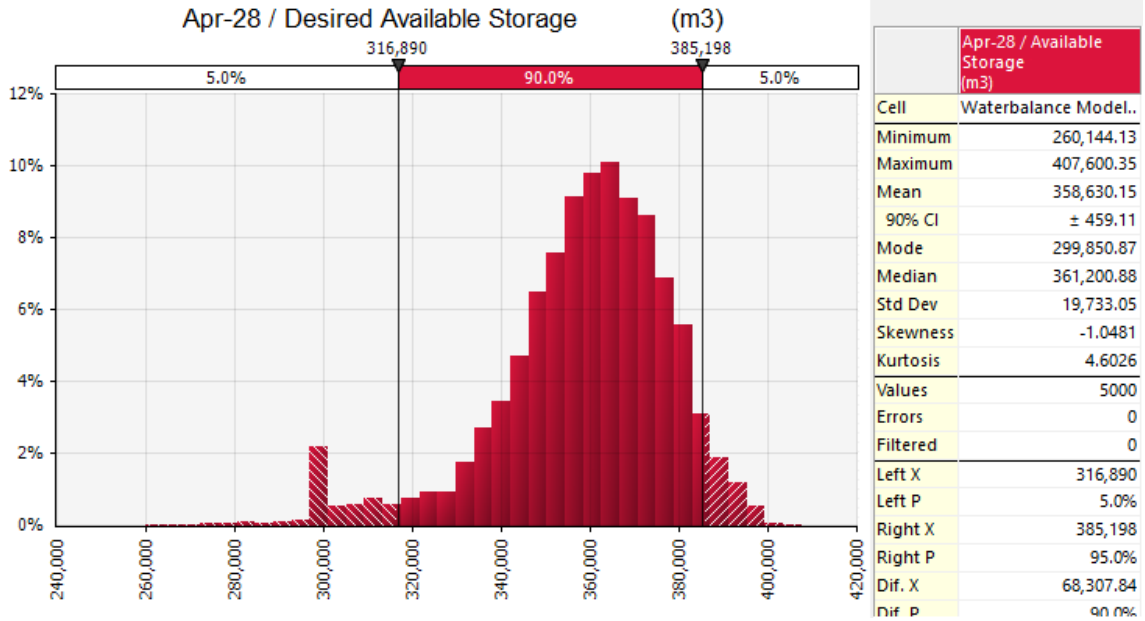
	Feb-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	314,560.78
Maximum	412,479.06
Mean	371,639.20
90% CI	± 326.00
Mode	371,303.22
Median	372,172.19
Std Dev	14,011.95
Skewness	-0.2966
Kurtosis	3.1885
Values	5000
Errors	0
Filtered	0
Left X	347,795
Left P	5.0%
Right X	393,448
Right P	95.0%
Dif. X	45,653.72

Figure 51 – Desired Available Storage, Phase 4, March



	Mar-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	304,662.10
Maximum	407,492.52
Mean	365,688.94
90% CI	± 340.47
Mode	363,003.74
Median	366,255.28
Std Dev	14,633.80
Skewness	-0.3113
Kurtosis	3.1963
Values	5000
Errors	0
Filtered	0
Left X	340,567
Left P	5.0%
Right X	388,421
Right P	95.0%
Dif. X	47,854.28

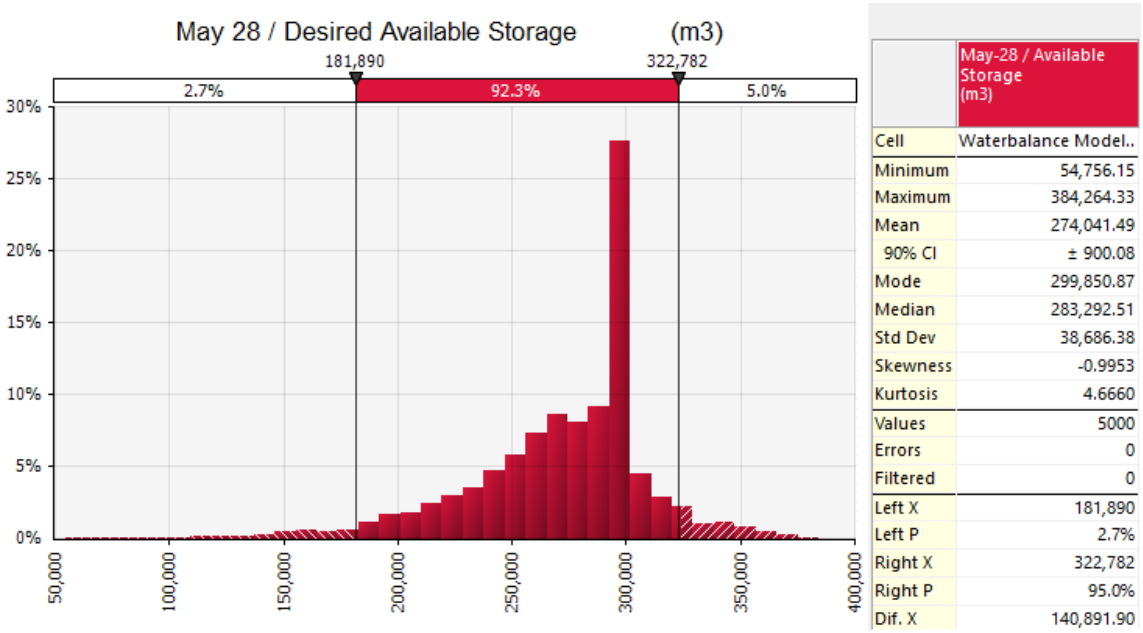
Figure 52 – Desired Available Storage, Phase 4, April



	Apr-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	260,144.13
Maximum	407,600.35
Mean	358,630.15
90% CI	± 459.11
Mode	299,850.87
Median	361,200.88
Std Dev	19,733.05
Skewness	-1.0481
Kurtosis	4.6026
Values	5000
Errors	0
Filtered	0
Left X	316,890
Left P	5.0%
Right X	385,198
Right P	95.0%
Dif. X	68,307.84
Dif. P	90.0%

On average the month of May maintains the desired available storage volume of about 203,000 m^3 and the most common value (the mode) is on the order of 210,000 m^3, well above the minimum of 181,900 m^3. However, there are circumstances that could occur which would encroach upon the desired available storage volume and those circumstances are expected to occur about 2.7% of the time (see Figure 53).

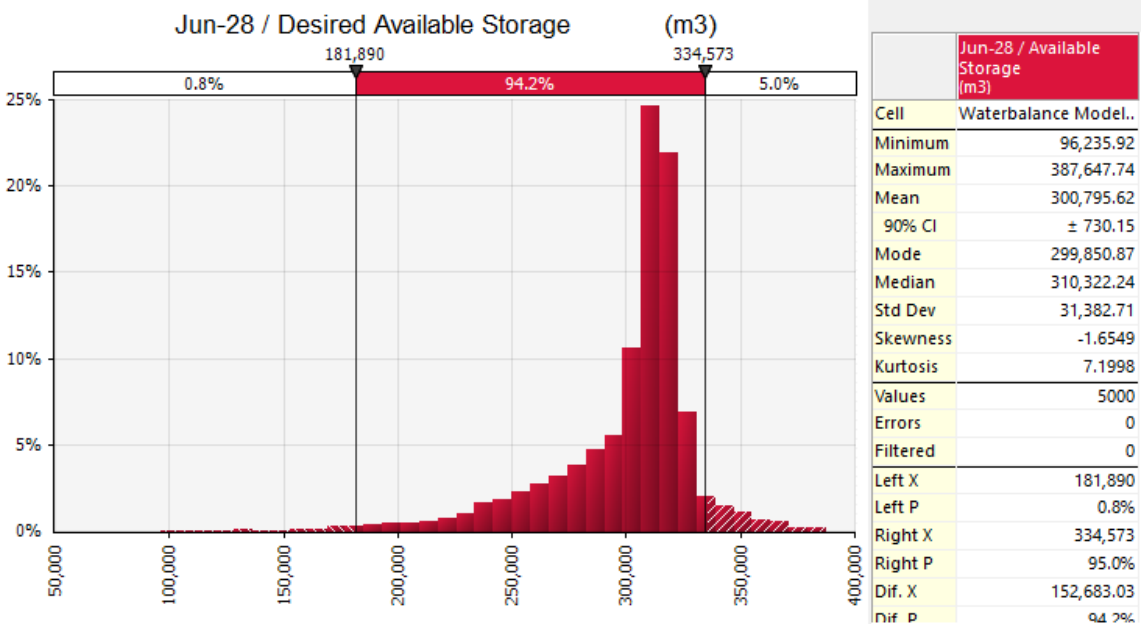
Figure 53 – Desired Available Storage, Phase 4, May



	May-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	54,756.15
Maximum	384,264.33
Mean	274,041.49
90% CI	± 900.08
Mode	299,850.87
Median	283,292.51
Std Dev	38,686.38
Skewness	-0.9953
Kurtosis	4.6660
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	2.7%
Right X	322,782
Right P	95.0%
Dif. X	140,891.90

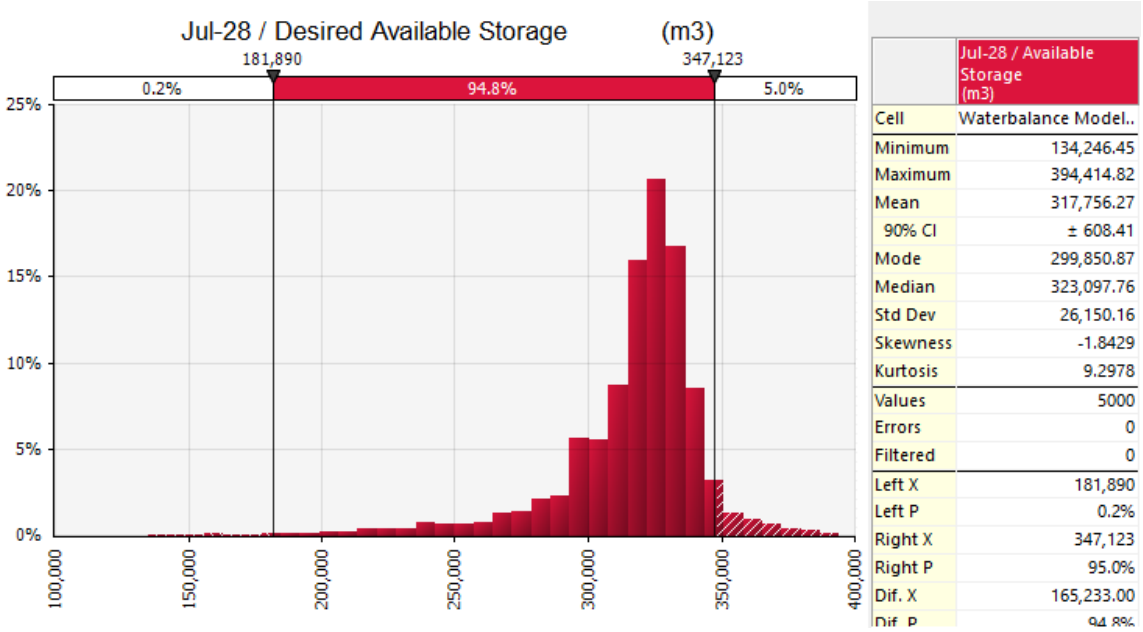
From June through December pumping to treatment steadily reduces the accumulated water volume and reduces the associated probability of a shortfall in the desired available storage from a probability of 0.8% in June to a probability less than 0.1% in October (see Figure 54 through Figure 60).

Figure 54 – Desired Available Storage, Phase 4, June



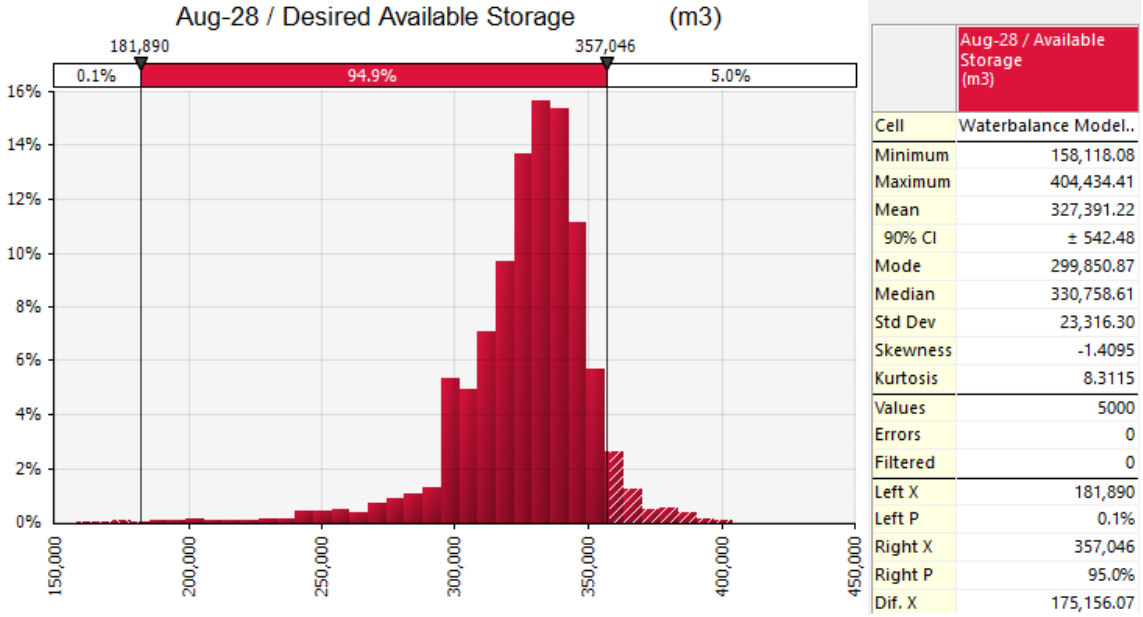
	Jun-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	96,235.92
Maximum	387,647.74
Mean	300,795.62
90% CI	± 730.15
Mode	299,850.87
Median	310,322.24
Std Dev	31,382.71
Skewness	-1.6549
Kurtosis	7.1998
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.8%
Right X	334,573
Right P	95.0%
Dif. X	152,683.03
Dif. P	94.2%

Figure 55 – Desired Available Storage, Phase 4, July



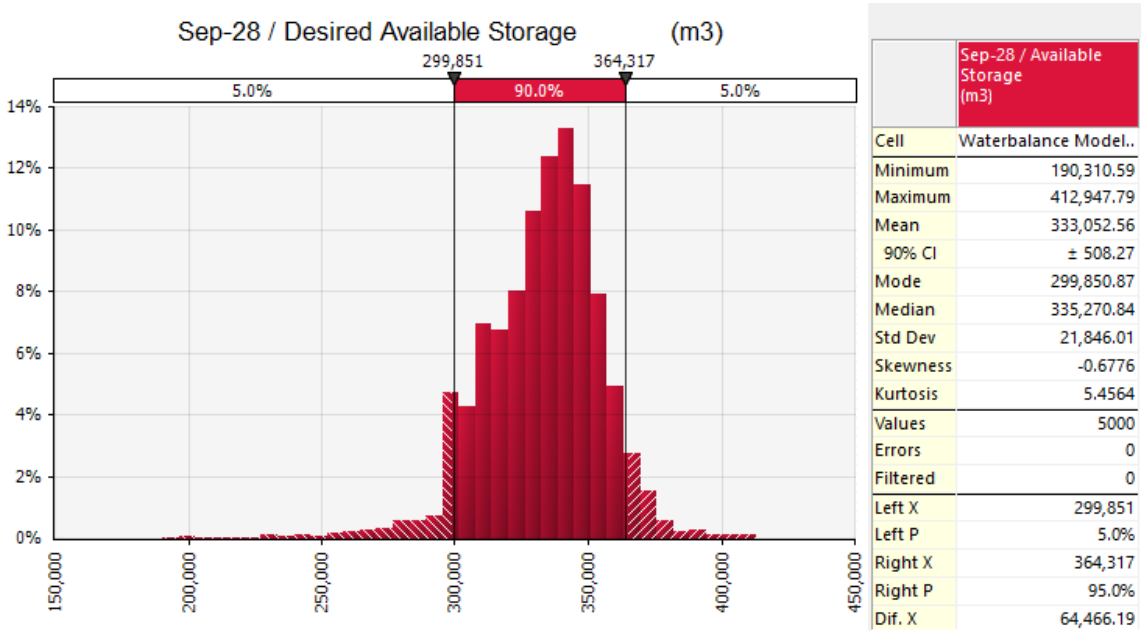
	Jul-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	134,246.45
Maximum	394,414.82
Mean	317,756.27
90% CI	± 608.41
Mode	299,850.87
Median	323,097.76
Std Dev	26,150.16
Skewness	-1.8429
Kurtosis	9.2978
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.2%
Right X	347,123
Right P	95.0%
Dif. X	165,233.00
Dif. P	94.8%

Figure 56 – Desired Available Storage, Phase 4, August



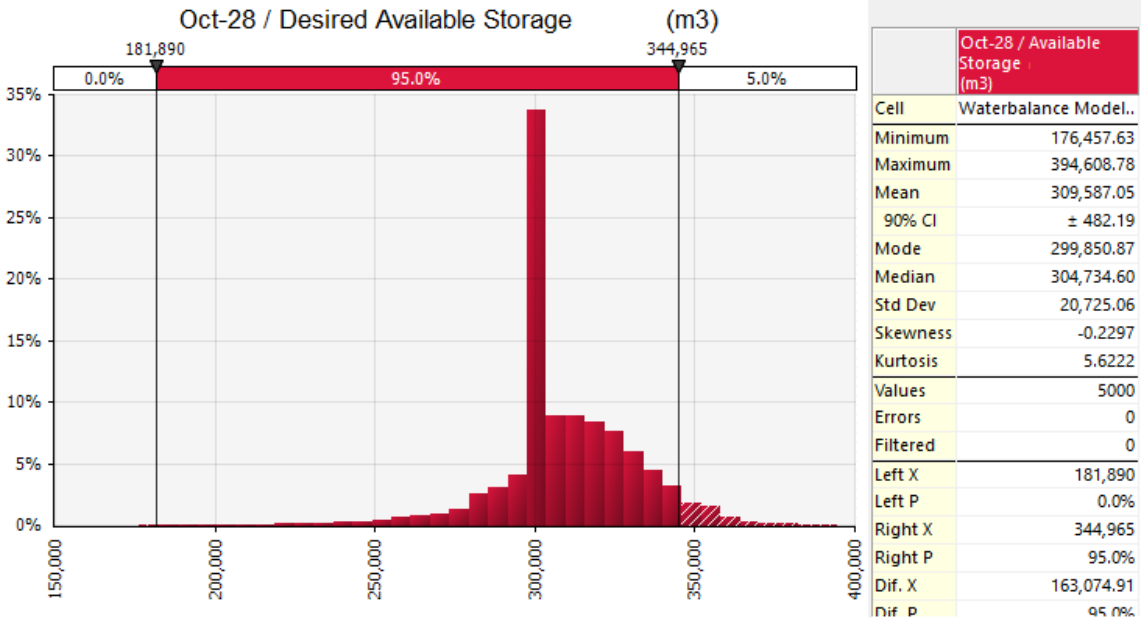
	Aug-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	158,118.08
Maximum	404,434.41
Mean	327,391.22
90% CI	± 542.48
Mode	299,850.87
Median	330,758.61
Std Dev	23,316.30
Skewness	-1.4095
Kurtosis	8.3115
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.1%
Right X	357,046
Right P	95.0%
Dif. X	175,156.07

Figure 57 – Desired Available Storage, Phase 4, September



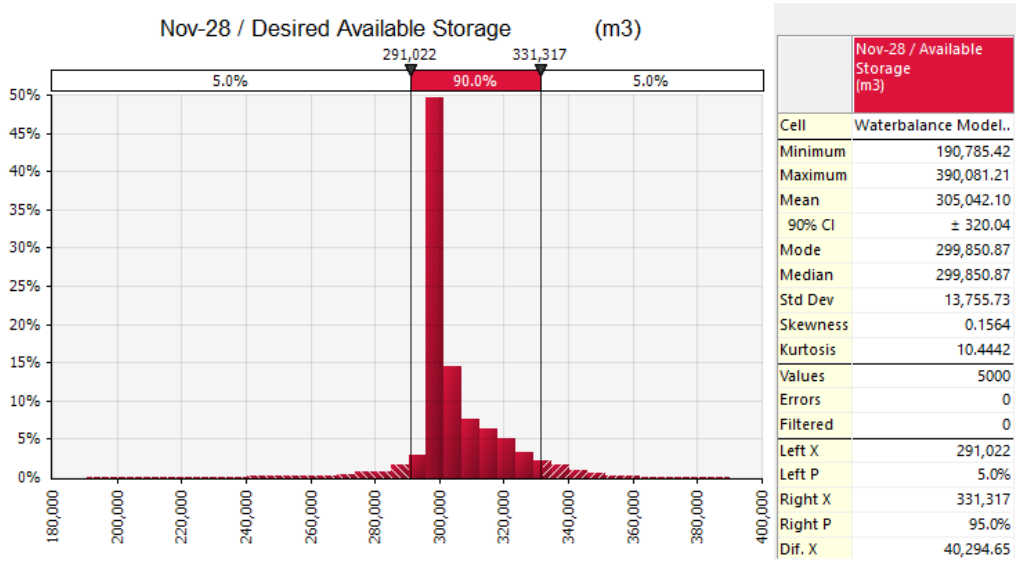
	Sep-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	190,310.59
Maximum	412,947.79
Mean	333,052.56
90% CI	± 508.27
Mode	299,850.87
Median	335,270.84
Std Dev	21,846.01
Skewness	-0.6776
Kurtosis	5.4564
Values	5000
Errors	0
Filtered	0
Left X	299,851
Left P	5.0%
Right X	364,317
Right P	95.0%
Dif. X	64,466.19

Figure 58 – Desired Available Storage, Phase 4, October



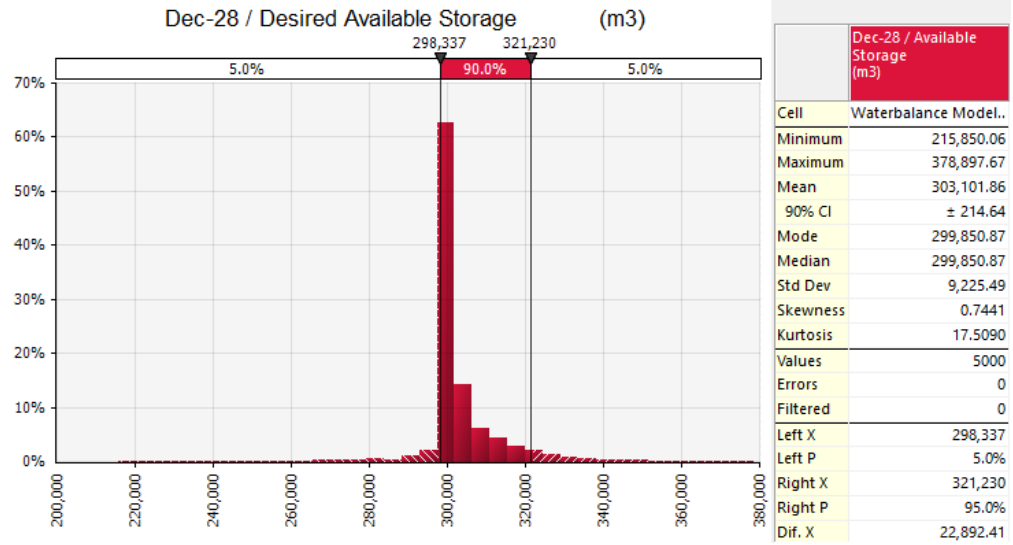
	Oct-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	176,457.63
Maximum	394,608.78
Mean	309,587.05
90% CI	± 482.19
Mode	299,850.87
Median	304,734.60
Std Dev	20,725.06
Skewness	-0.2297
Kurtosis	5.6222
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.0%
Right X	344,965
Right P	95.0%
Dif. X	163,074.91
Dif. P	95.0%

Figure 59 – Desired Available Storage, Phase 4, November



	Nov-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	190,785.42
Maximum	390,081.21
Mean	305,042.10
90% CI	± 320.04
Mode	299,850.87
Median	299,850.87
Std Dev	13,755.73
Skewness	0.1564
Kurtosis	10.4442
Values	5000
Errors	0
Filtered	0
Left X	291,022
Left P	5.0%
Right X	331,317
Right P	95.0%
Dif. X	40,294.65

Figure 60 – Desired Available Storage, Phase 4, December



	Dec-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	215,850.06
Maximum	378,897.67
Mean	303,101.86
90% CI	± 214.64
Mode	299,850.87
Median	299,850.87
Std Dev	9,225.49
Skewness	0.7441
Kurtosis	17.5090
Values	5000
Errors	0
Filtered	0
Left X	298,337
Left P	5.0%
Right X	321,230
Right P	95.0%
Dif. X	22,892.41

3.6 Risk Management and Mitigation

The risk associated with exceeding pond design criteria is not the same as the risk characterized by a stochastic analysis. Whether there is a pond systems capacity to store a 24 hr PMP event or a 100 yr 24 hr (1% probability) storm plus 72 hrs of draindown from an associated power outage, these are all short duration events that present no practical option other than to "catch" the volume of the event within the pond system without overtopping and spilling. The risk characterized by the stochastic analysis results from a combination or sequence of events over an extended period of time. Most of the time they will not simply appear without warning, but will be seen developing over time allowing the effects of these event sequences to be mitigated either

before reaching the desired available storage or shortly after a shortfall becomes evident. This is particularly true of a climate environment like that of the Eagle Mine where the greatest risk is associated with the spring snowmelt or freshet event. The snowpack responsible for this event can be seen developing over a period of four (4) or five (5) months. The SWE of the snowpack can be measured and monitored over the period from October through April so that the subsequent snowmelt event in May can be predicted with a high degree of certainty and prepared for well ahead of time.

Of interest is not simply the probability of experiencing a shortfall in storage, but also the ability to manage the risk and recover from the shortfall in a reasonable amount of time (typically within 30 days). There are multiple ways of managing an overtopping risk and retaining the desired available storage volume. In most cases, for small shortfalls increasing the pumping rate and irrigated area can eliminate the shortfall. For large shortfalls a combination of increasing the application pumping rate and irrigated area plus sending some water to treatment can empty ponds very quickly. Another potential method of mitigation would involve reduction of the snowpack. Given that the winter configuration will bury drip emitters 1 m below the surface and that no ore will be placed from December through February, it may be possible to safely remove a portion of a large snowpack without significant risk of contacting cyanide solution.

When mitigating a shortfall in storage by placing solution into dynamic storage, there are limitations on the volume that can be removed. A practical limitation is the potential maximum increase in pumping rate (i.e., capacity of back-up pumps) combined with the effective area under leach. Assuming hypothetically backup pumping equivalent to 25% of normal capacity (i.e., using all five pumps instead of four and re-pressurizing previously used emitter lines), would temporarily increase the area under leach by 25%). Using the design pumping rate of 1,500,000 liters/hr and the design application rate of 7 liters/hr/m^2 the maximum volume of water that can be pumped from the ponds over a 30 day period is 270,000 m^3, which is greater than the Phase 3 PMP volume. While this is theoretically limited by available stack height, mean stack will continue to increase over the mine life, and the greater the stack height beneath the area under leach the more water can be placed in dynamic storage.

The stochastic model was designed to evaluate mitigation options for correcting a shortfall in available storage. For normal operations (Phases 1 through 3), when a shortfall is triggered the model computes the required increase in pumping rate/area under leach as a percentage of the base pumping rate/area under leach required to eliminate the shortfall over a 30 day period. For rinsing and draindown (Phases 3 and 4), the model computes the treatment rate required to eliminate the shortfall over a 30 day period. Table 11 and Table 12 summarize the results of the stochastic modeling by month over all five (5) Phases. The tables provide:

- probability of experiencing a shortfall in the desired available storage volume,
- maximum pumping rate increase required to recover the shortfall in 30 days,
- maximum treatment rate required to recover the shortfall in 30 days,
- probability of a discharge from the pond system (if no mitigation is applied), and
- estimated volume that could be released (if no mitigation is applied).

Both the deterministic and the stochastic analyses show a minimal risk of encroachment on the desired available storage volume during the first three (3) phases. Therefore it is possible to manage seasonal accumulations using normal allocations to makeup water demand or minor changes to pumping rate. However, during post operations, when no new ore is being added, using and adjusting the treatment rate is a more viable mitigation.

Table 11 – Summary of Stochastic Water Balance Results for Maintaining the Desired Available Storage during Operations

Phase	Month	Probability of a Shortfall in Desired Available Storage (%)	Maximum Pumping Rate Increase to Recover Shortfall (%)	Probability of Uncontrolled Discharge (%)	Expected Volume Released Without Mitigation (m^3)
1	**Jan**	0%	---	0%	---
1	**Feb**	0%	---	0%	---
1	**Mar**	0%	---	0%	---
1	**Apr**	0%	---	0%	---
1	**May**	0%	---	0%	---
1	**Jun**	0%	---	0%	---
1	**Jul**	0%	---	0%	---
1	**Aug**	0%	---	0%	---
1	**Sep**	0%	---	0%	---
1	**Oct**	0%	---	0%	---
1	**Nov**	0%	---	0%	---
1	**Dec**	0%	---	0%	---
2	**Jan**	0%	---	0%	---
2	**Feb**	0%	---	0%	---
2	**Mar**	0%	---	0%	---
2	**Apr**	0%	---	0%	---
2	**May**	0%	---	0%	---
2	**Jun**	0%	---	0%	---
2	**Jul**	0%	---	0%	---
2	**Aug**	0%	---	0%	---
2	**Sep**	0%	---	0%	---
2	**Oct**	0%	---	0%	---
2	**Nov**	0%	---	0%	---
2	**Dec**	0%	---	0%	---
3	**Jan**	0%	---	0%	---
3	**Feb**	0%	---	0%	---
3	**Mar**	0%	---	0%	---
3	**Apr**	0%	---	0%	---
3	**May**	0.2%	8.3%	0%	---
3	**Jun**	<0.1%	1.3%	0%	---
3	**Jul**	0%	---	0%	---
3	**Aug**	0%	---	0%	---
3	**Sep**	0%	---	0%	---
3	**Oct**	0%	---	0%	---
3	**Nov**	0%	---	0%	---
3	**Dec**	0%	---	0%	---

Table 12 – Summary of Stochastic Water Balance Results for Maintaining the Desired Available Storage during Rinsing and Draindown

Phase	Month	Probability of a Shortfall inDesired Available Storage (%)	Maximum Pumping Rate Increase to Recover Shortfall (%)	Maximum Treatment Rate Required to Recover Shortfall (l/s)	Probability of Uncontrolled Discharge (%)	Expected Volume Released Without Mitigation (m^3)
4	**Jan**	0.0%	---	---	0%	---
4	**Feb**	0.0%	---	---	0%	---
4	**Mar**	0.0%	---	---	0%	---
4	**Apr**	0.0%	---	---	0%	---
4	**May**	2.7%	12.0%	49.0	0%	---
4	**Jun**	0.8%	8.1%	33.0	0%	---
4	**Jul**	0.2%	4.5%	18.4	0%	---
4	**Aug**	0.1%	2.2%	9.2	0%	---
4	**Sep**	0%	---	---	0%	---
4	**Oct**	<0.1%	---	---	0%	---
4	**Nov**	0%	---	---	0%	---
4	**Dec**	0%	---	---	0%	---
5	**Jan**	0%	---	---	0%	---
5	**Feb**	0%	---	---	0%	---
5	**Mar**	0%	---	---	0%	---
5	**Apr**	0%	---	---	0%	---
5	**May**	6.0%	5.5%	22.6	0%	---
5	**Jun**	1.0%	1.4%	5.8	0%	---
5	**Jul**	0.1%	0.6%	2.3	0%	---
5	**Aug**	<0.1%	---	---	0%	---
5	**Sep**	0%	---	---	0%	---
5	**Oct**	<0.1%	---	---	0%	---
5	**Nov**	0%	---	---	0%	---
5	**Dec**	0%	---	---	0%	---

Finally, it is important to note that the stochastic model results for the HLF provided in this report represents a standalone model, independent of any other facilities at the mine site. This model is being incorporated into a site-wide stochastic water balance model (GoldSim Model) that will consider the capacities and impacts of other storage facilities, treatment facilities, and so on, optimize their design, to reduce exceedance probabilities further.

4 Sensitivity Analyses

The stochastic model was also utilized to perform sensitivity analyses. The stochastic version is most appropriate because, by its very nature, it covers a wide range of variation and simultaneously considers the relative influence of all the random variates included in the model. Of interest is the sensitivity of results to assumptions regarding the porosity of the ore in the heap sump and the magnitude of sublimation as a percentage of the monthly precipitation. Porosity was considered to be a surrogate for moisture as they are almost certainly correlated (if the porosity of a material changed, the moisture would change as well). For the purpose of sensitivity modeling the input distributions were limited to the two most critical phases (Phase 3 and Phase 4) over operational years 6 through 9. This was done to conservatively focus on the impact of the two (2) parameters of interest (porosity and sublimation). If the full time history is sampled precipitation sequences tend to dominate, not just over adjacent months, but sometimes over multiple years and the rank of the impact of changes in porosity and sublimation is driven lower, often not even appearing in the top ten factors.

There is insufficient data on either porosity or sublimation to assign a representative probability distribution describing how the parameters might be expected to vary or be represented statistically in distributions. Therefore in accordance with the principle of maximum entropy (Harr, 1987) the uniform distribution was selected to represent both porosity and sublimation. This means that if only a range of possible values is known or assumed, then the uniform distribution assumes that every value in the range has an equal probability of occurrence. The assumed range of possible values for effective porosity was 0.1567 to 0.2773. The assumed range of possible values for sublimation was 10% to 40% of the monthly precipitation.

Results of sensitivity analyses are shown graphically in a series of "tornado graphs" (see Appendix D) and also summarized in Table 13 which shows the rank of the parameter and the amount of variability observed as a percentage of the baseline value. All variates (input distributions) are considered in the ranking (precipitation, evaporation, temperature, moisture content, porosity and sublimation), 98 variates in total. The variate producing the largest range of variation is ranked number one, the second largest number 2, and so on. The baseline is a measure of central tendency among all variates (essentially a global mean). The % impact is calculated by subtracting the minimum observation in the range from the maximum observation in the range and dividing that difference by the baseline value.

Table 13– Summary of Sensitivity Analysis Results on Desired Available Storage

Phase	Month	Porosity		Sublimation		Baseline
		Rank	Impact (%)	Rank	Impact (%)	
3	**Jan**	1	8.9%	2	1.4%	359,748
3	**Feb**	1	8.9%	2	2.9%	360,209
3	**Mar**	1	11.6%	10	0.3%	363,961
3	**Apr**	1	8.8%	>10	---	363,144
3	**May**	4	10.0%	>10	---	279,950
3	**Jun**	3	11.4%	>10	---	333,878
3	**Jul**	2	10.0%	>10	---	355,089
3	**Aug**	1	9.2%	>10	---	360,272
3	**Sep**	1	9.0%	>10	---	362,476
3	**Oct**	1	8.9%	5	0.9%	359,064
3	**Nov**	1	8.9%	>10	---	362,519

3	Dec	1	9.2%	4	2.5%	353,637
Phase	**Month**	**Porosity**		**Sublimation**		**Baseline**
		Rank	**Impact (%)**	**Rank**	**Impact (%)**	
4	**Jan**	2	8.0%	1	11.9%	327,856
4	**Feb**	2	7.8%	1	13.5%	331,258
4	**Mar**	2	7.6%	1	14.4%	326,622
4	**Apr**	3	7.6%	1	14.6%	320,816
4	**May**	5	10.4%	2	19.3%	220,966
4	**Jun**	6	9.9%	2	17.2%	245,624
4	**Jul**	7	9.6%	3	16.4%	264,398
4	**Aug**	6	9.6%	4	15.3%	279,232
4	**Sep**	7	9.2%	4	14.2%	292,773
4	**Oct**	8	9.4%	2	19.3%	274,317
4	**Nov**	>10	---	1	25.2%	272,100
4	**Dec**	>10	---	1	24.9%	272,835

During Phase 3 the potential impact of effective porosity assumptions consistently ranks very high (ranking number 1 in all but the months of May, June, and July where it ranks 4, 3, and 2 respectively). This is because the large ore wetting loss component during normal operations offsets precipitation impacts. The impact of porosity assumptions on storage capacity is purely physical and consistently on the order of 9% to 10%. During Phase 4 the offsetting impact of ore wetting loss is gone and precipitation impacts dominate driving the impact of porosity to a rank of 2 or 3 during the colder months (when precipitation is largely stored in the snowpack) or to a rank of 6 or more during the warmer months when precipitation impacts are more direct and immediate.

During Phase 3 the potential impact of assumptions on sublimation are modest during the coldest months (ranking 2 to 4 with a impact on the order of 1% to 3%) and virtually non-existent as the weather warms with the ranking going to 10 or more. During Phase 4 the effect of sublimation on the net impact of precipitation and in particular the amount of precipitation accumulating in the snowpack over the colder period makes sublimation rank high in the coldest months (consistently ranking 1) but with the ranking changing rapidly as the weather warms going to 2 in May and June and to 4 by September. However, the potential impact remains significant over the course of the entire year through its effect on the snowpack and freshet volume (the impact during the freshet in May is almost 20% but remains in the teens most of the year and increasing even further at the end of the year to about 25% in November and December).

It should be noted that the baseline level of the desired available storage volume remains well above the minimum requirement of 181,890 m^3 for all of Phase 3 and Phase 4 regardless of any potential impacts from assumptions regarding either porosity or sublimation.

5 Temporary Five Year Closure Scenarios

This section provides an evaluation using the HLF Water Balance Model of the impact of a five year temporary closure period at the end of each development phase for the HLF. This evaluation was conducted largely in response to the Water Use License (WUL) QZ14-041 condition #144 that states: *The updated HLF model shall explicitly consider each phase of the HLF and a five year period of temporary closure occurring at each phase of the HLF*.

The results of the evaluation are illustrated in a series of figures that depict the first 16 years of

mine life for: 1) significant water losses to the system, 2) expected water accumulations to the system, and 3) the desired available storage volume. Desired available storage volume is defined as the capacity to contain the runoff from a 100-yr 24-hr storm event plus 72 hrs of draindown from a concurrent power outage, plus 0 m of freeboard in the In-Heap Pond and 0.5 m of freeboard in the Events Pond. For the purpose of completing the temporary closure analyses, the 12 year meteoric record was extended to 16 years by simply repeating the last four years of record.

This analysis examined how to maintain the desired available storage by considering changes in pumping rate and dynamic storage or pumping to treatment. In actual operations, other potential means of mitigation would be used, including the application of raincoats to prevent precipitation from infiltrating into the heap, construction of additional pond storage capacity, diversion of clean water off of as yet unused liner surfaces, or efforts to reduce snow loads.

The first group of figures shows the timing and effect on water losses to the system during each temporary closure period for each phase. The most obvious impact during any temporary closure is the loss of the wetting of new ore. Over a five year temporary closure period, infiltrated precipitation will accumulate within the pond system. When ore delivery and stacking resume, pond volumes quickly reduce back to pre-closure levels. The Phase 3 scenario is unique because ore delivery and stacking does not resume. Based on standard mining practices, it would take an unusual set of circumstances to continue to irrigate the existing ore stack for five years before going into final closure (in all likelihood a cessation of active mining of two to three years at the end of mine life would be adequate for a company to determine that final closure be instituted), however the case was still evaluated as per WUL condition #144.

Each case looked at each of the three different meteoric records used in the deterministic model of the HLF Water Balance Model, all of which contain precipitation sequences that are representative of observed climate variability in the region. Record No. 1 is the typical design case which embeds a dry cycle in the early phases of the HLF and a wet cycle in the latter phases. Record No. 2 is a sequence that is typical of near mean level precipitation with only moderate variation. Record No. 3 is a sequence that is typical of a wet level of precipitation with high variation. In evaluating the potential impact of a five year temporary closure, the worst case from any one of the three precipitation records was used to characterize the potential impact.

For the Phase 1 scenario, the routine water management strategy associated with normal operations is adequate for the typical, expected precipitation cycle, but during a 5 year temporary closure additional efforts are needed to prevent substantial water accumulation in the pond system by the end of five years during the freshet and following a wetter annual cycle. These efforts would include deploying raincoats over large areas of the heap surface, removing snow or increasing dynamic storage slightly. These measures would be sufficient to minimize or prevent water accumulation during Phase 1. In the unlikely case that no active water management efforts were used, as shown in Table 14 below, a very small pump to treatment rate on the order of 2 l/s could be used to control seasonal water accumulation most years with an estimated maximum rate on the order of 6 l/s following the exceptionally wet years.

For the Phase 2 scenario, the routine water management strategy associated with normal operations is adequate for the typical, expected precipitation cycle, but due to the contribution of a larger heap pad surface area additional efforts are needed to prevent substantial water accumulation in the pond system during the freshet following a wetter annual cycle. Thus, as shown in Table 14 below, absent any other water management mitigation (e.g., deploying raincoats, snow removal, increasing dynamic storage, etc.), pump to treatment rates on the order

of 5 l/s would be needed to control seasonal water accumulation most years and an estimated maximum rate on the order of 37 l/s would be needed following the exceptionally wet years.

For the Phase 3 scenario, due to the contribution of an even larger heap pad area, in addition to routine water management strategies associated with normal operations, additional efforts would be needed for any of the considered meteoric records. Meteoric water would begin to accumulate within the pond system over the duration of the temporary shutdown. Absent any other water management mitigation, by increasing the base pumping to treatment rate to 5 l/s substantially reduces the amount of encroachment into the desired available storage volume, but still does not handle the wetter years with a larger freshet volume. An estimated maximum rate on the order of 42 l/s would be needed following exceptionally wet years.

The basic challenge is that for Phases 2 and 3, due to the loss from ore wetting and absent any active water management mitigation, one particularly strong freshet year could use a substantial portion of pond capacity; thus a substantial increase in the treatment rate would be needed to retain pond capacity. While pumping to treatment is a viable mitigation, in all likelihood, a combination of mitigations (e.g., raincoats, snowmelt management, increasing dynamic storage, etc.) would be employed to maintain the desired available storage capacity.

Table 14 shows a summary of the findings by phase and lists both the maximum pumping rate increase (increasing dynamic storage) and the maximum treatment rate required to restore the system to have the desired available storage capacity. The treatment rates shown include a basic treatment rate to address seasonal accumulation and an additional temporary maximum treatment rate to address the freshet surge. As noted above, Table 14 assumes no other mitigation methods are applied.

Table 14 - Modeled Basic and Maximum Treatment Rate Increases by the End of Year Five of Temporary Closure Assuming No Other Action is Taken

Phase #	Req'd Pumping Rate Increase (%)		Req'd Treatment Rate (l/s)	
	Basic Rate Increase (%)	Max. Rate Increase (%)	Basic Treatment Rate (l/s)	Max. Treatment Rate (l/s)
Phase 1	1.3%	3.7%	2	6
Phase 2	2%*	16%*	5	37
Phase 3	2%**	11%**	5	42

* - Mean stack height (= total ore volume/total heap pad area) expected to be about 39 m

** - Mean stack height expected to be about 55 m

5.1 Phase 1:

The removal of the ore wetting component during the five year temporary closure period at the end of Phase 1 substantially reduces the volume of water that would otherwise be diverted into dynamic storage within the ore stack (see Figure 61), allowing infiltrated precipitation to accumulate within the pond system. Water begins to accumulate within the pond system (see Figure 2) and the desired available storage volume begins to decline (see Figure 62). By operational year 5 the available storage volume declines below the desired capacity. Pumping water to treatment at a rate of 2 l/s would maintain the desired available storage volume for all but the brief, post freshet period in year 7 (see Figure 64 and Figure 65). During the period when the desired available storage volume cannot be recovered within a 30 day period by maintaining the 2

l/s pumping rate, a brief period of additional pumping at a maximum rate on the order of 6 l/s (or an equivalent pumping rate increase of 3.7%) would be needed.

Figure 61 – Significant Losses during Temporary 5 Yr Closure for Phase 1

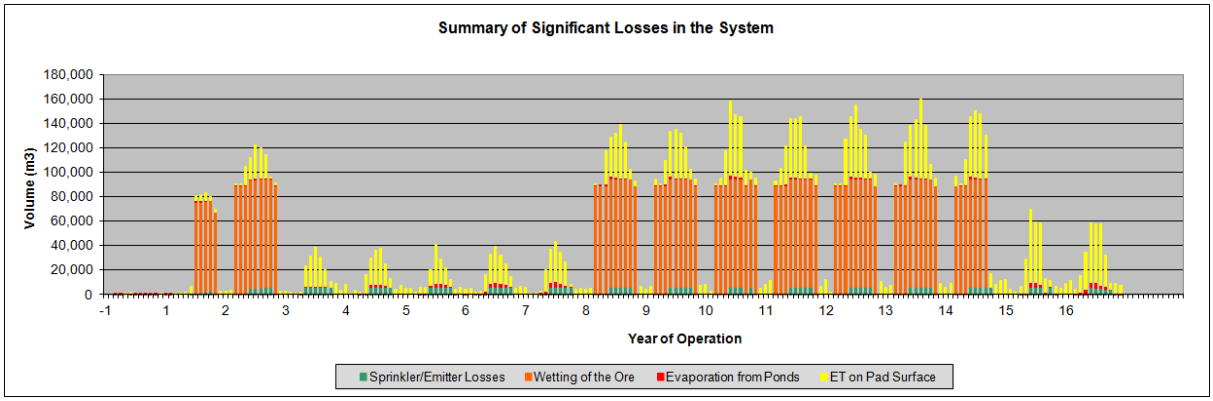


Figure 62 – Expected Seasonal Water Accumulation from Normal Operations, Phase 1

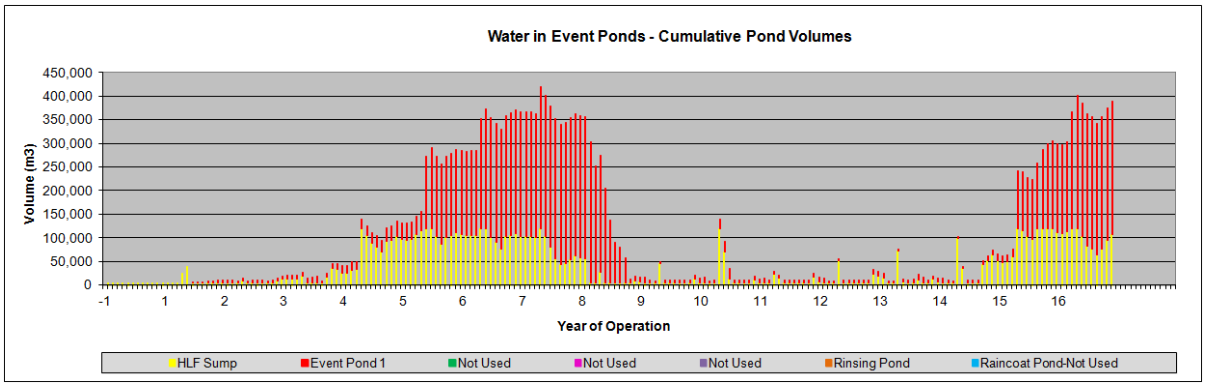


Figure 63 – Desired Available Storage Capacity from Normal Operations, Phase 1

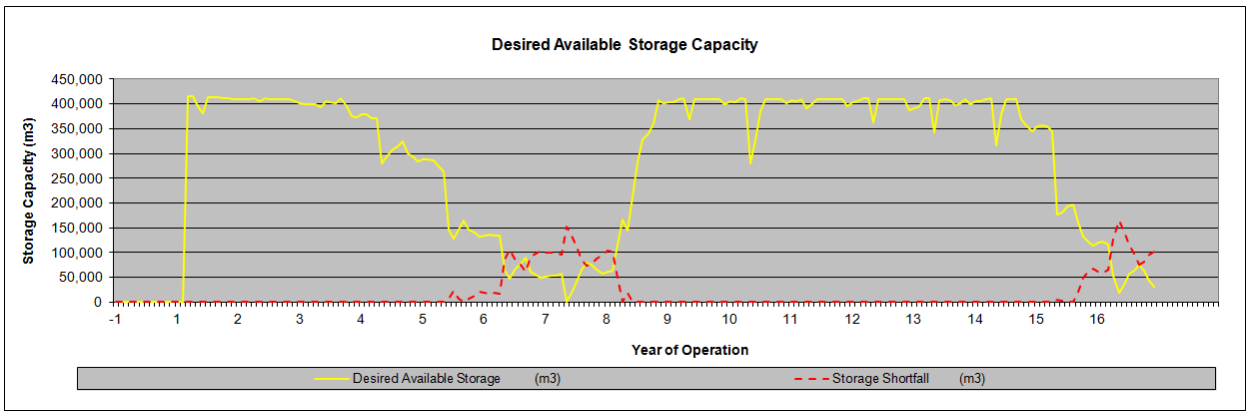


Figure 64 - Impact on Seasonal Water Accumulation from Pumping to Treatment at 2 l/s, Phase 1

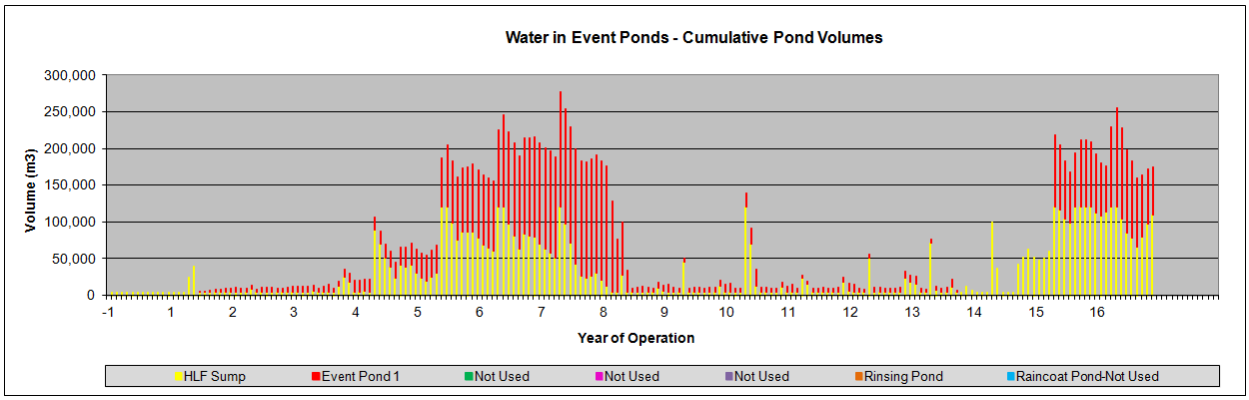
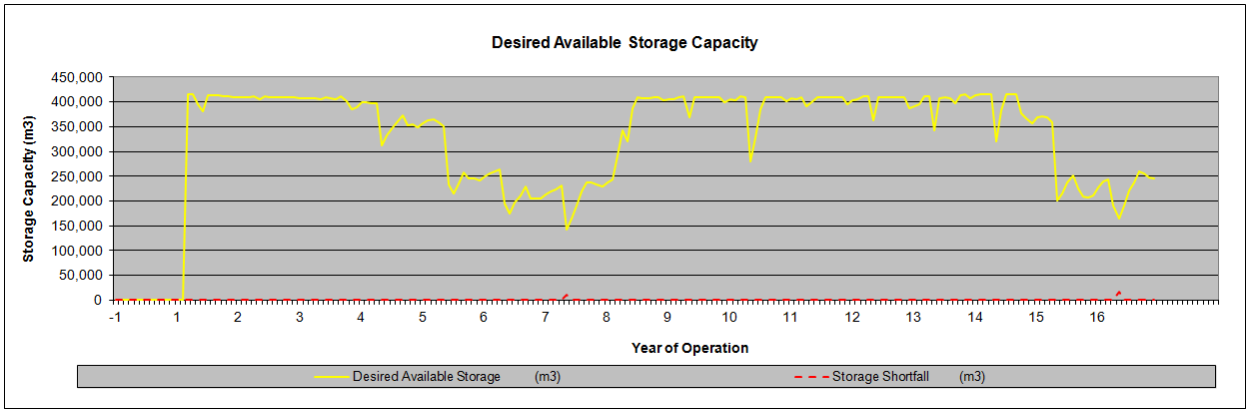


Figure 65 - Desired Available Storage Capacity from Pumping to Treatment at 2 l/s, Phase 1



5.2 Phase 2:

The removal of the ore wetting component during the five year temporary closure period at the end of Phase 2 substantially reduces the volume of water that would otherwise be diverted into dynamic storage within the ore stack (see Figure 66), allowing infiltrated precipitation to accumulate within the pond system. As water accumulates (see Figure 67) the desired available storage volume declines (see Figure 68). By operational year 5 the available storage volume declines below the desired capacity. Pumping water to treatment at a rate of 5 l/s would maintain the desired available storage volume for all but the brief, post freshet period (see Figure 69 and Figure 70). During those periods when the desired available storage volume cannot be recovered within a 30 day period by maintaining the 5 l/s pumping rate, a brief period of additional pumping at a maximum rate on the order of 37 l/s (or an equivalent pumping rate increase of 16%) would be needed.

Figure 66 - Significant Losses during Temporary 5 Yr Closure for Phase 2

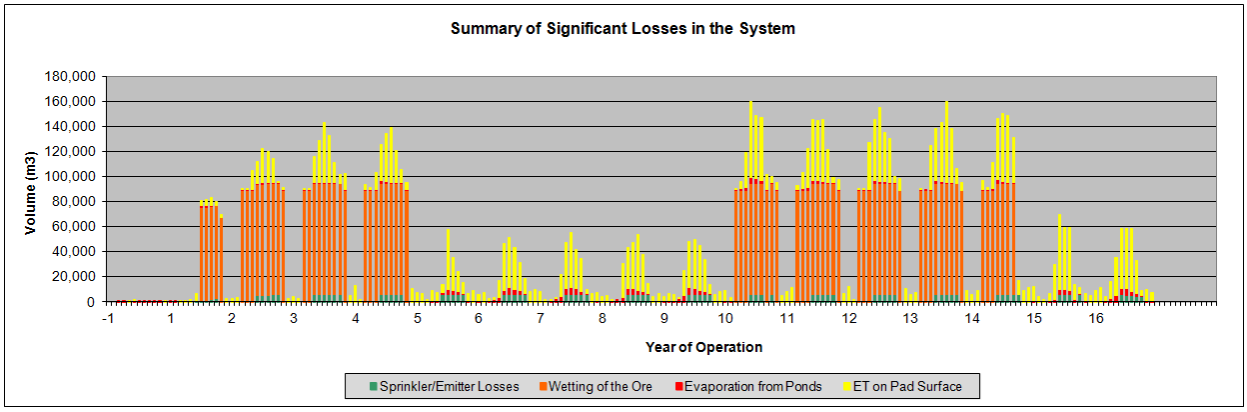


Figure 67 - Expected Seasonal Water Accumulation from Normal Operations, Phase 2

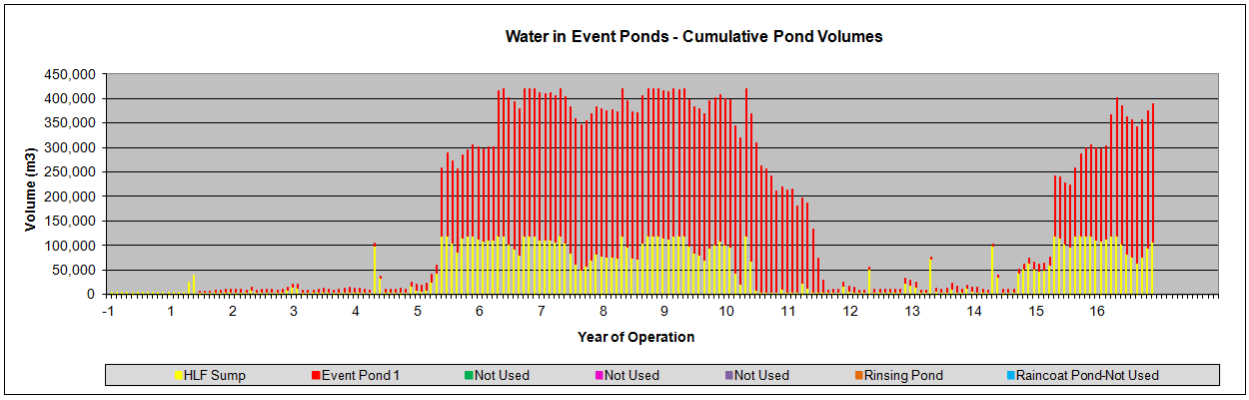


Figure 68 – Desired Available Storage Capacity from Normal Operations, Phase 2

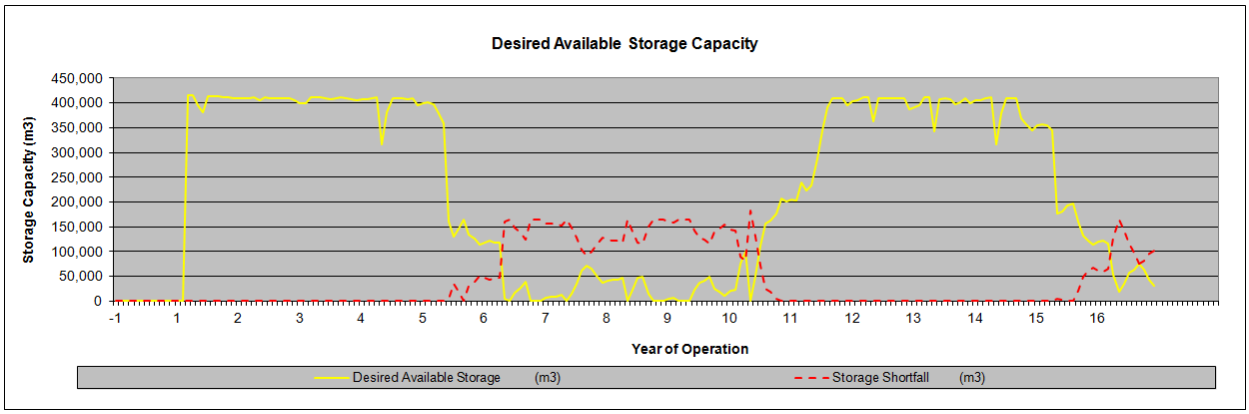


Figure 69 – Impact on Seasonal Water Accumulation from Pumping to Treatment at 5 l/s, Phase 2

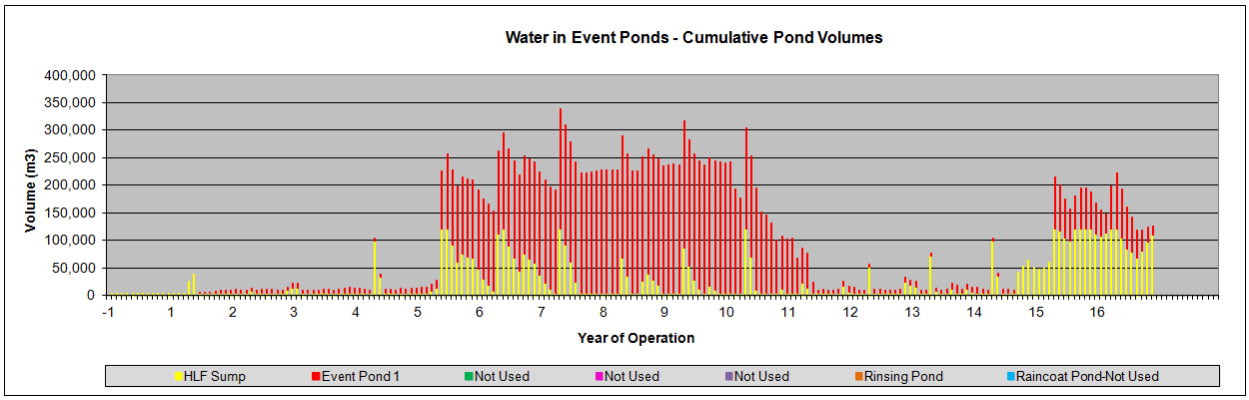
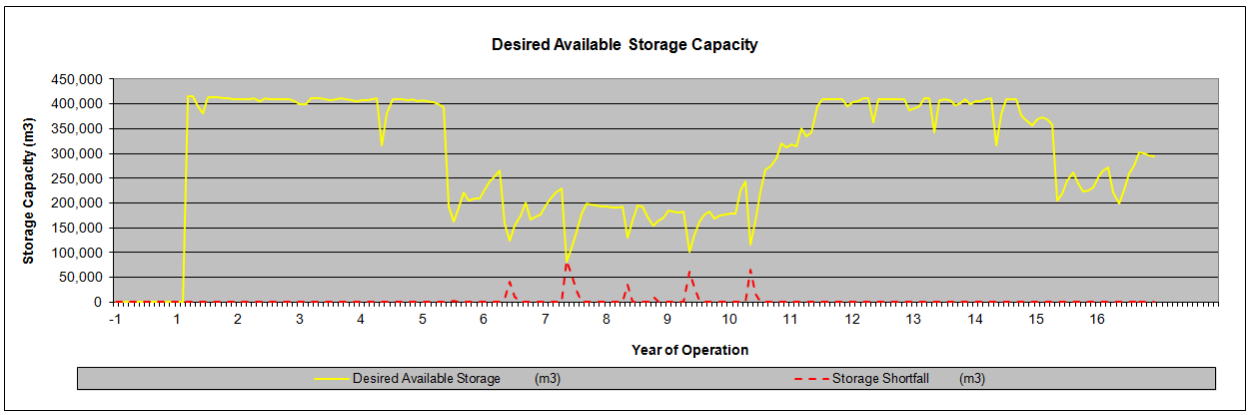


Figure 70 - Desired Available Storage Capacity from Pumping to Treatment at 5 l/s, Phase 2



5.3 Phase 3:

The removal of the ore wetting component during the five year temporary closure period at the end of Phase 3 substantially reduces the volume of water that would otherwise be diverted into dynamic storage within the ore stack (see Figure 71), allowing infiltrated precipitation to accumulate within the pond system. As water accumulates (see Figure 72) the desired available storage volume declines (see Figure 73). By operational year 10 the available storage volume declines below the desired capacity. Pumping water to treatment at a rate of 5 l/s would maintain the desired available storage volume for all but the last three (3) years, but then accumulation encroaches upon the desired available storage volume (see Figure 74 and Figure 75). During those periods when the desired available storage volume cannot be recovered within a 30 day period by maintaining the 5 l/s pumping rate, a brief period of additional pumping at a maximum rate on the order of 42 l/s (or an equivalent pumping rate increase of 11%) would be necessary to recover that volume.

Figure 71 - Significant Losses during Temporary 5 Yr Closure for Phase 3

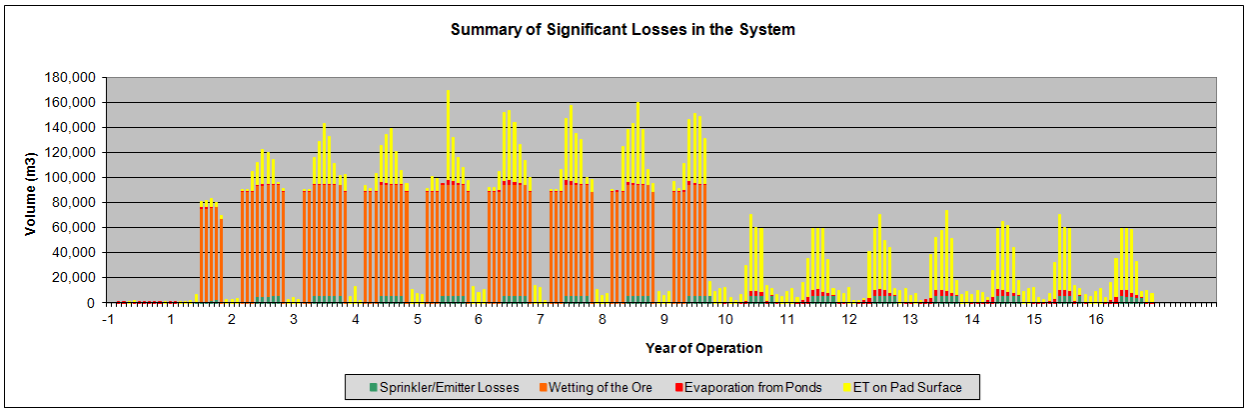


Figure 72 - Expected Seasonal Water Accumulation from Normal Operations, Phase 3

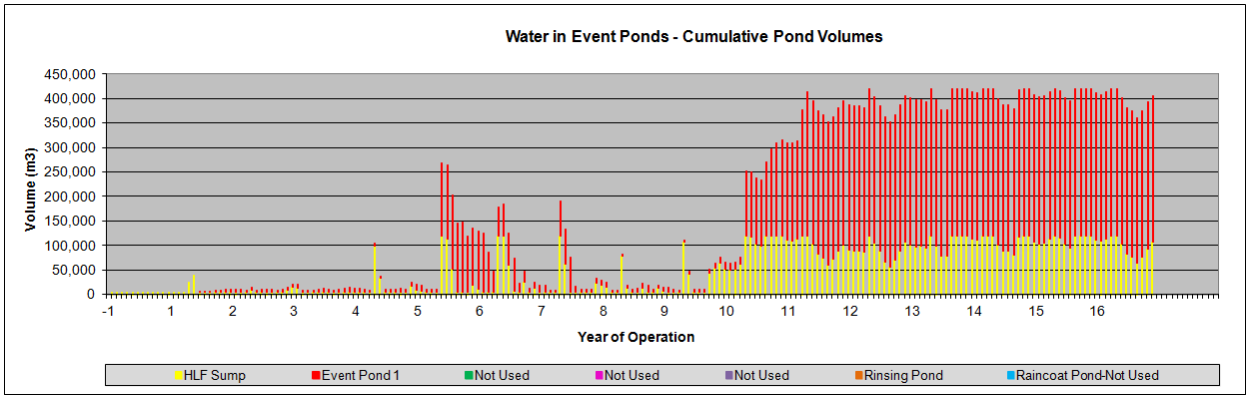


Figure 73 – Desired Available Storage Capacity from Normal Operations, Phase 3

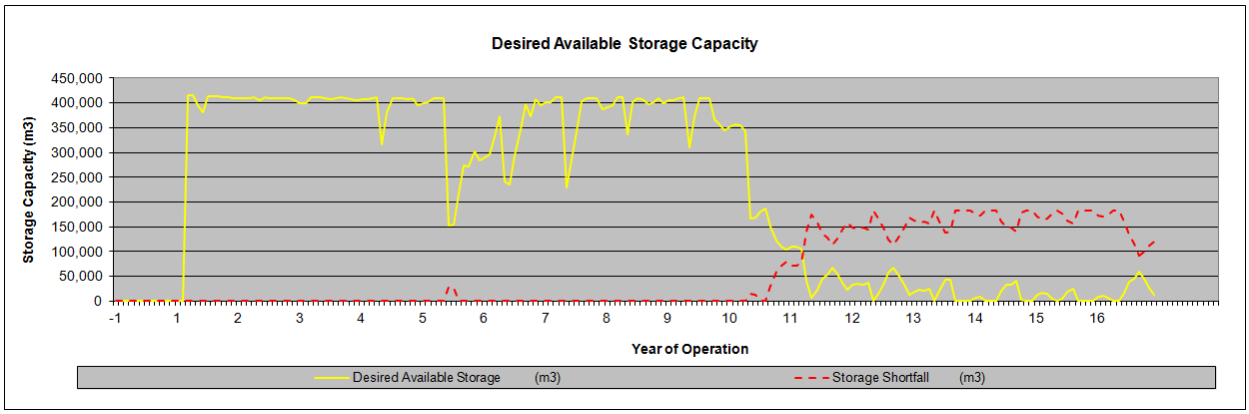


Figure 74 - Impact on Seasonal Water Accumulation from Pumping to Treatment at 5 l/s, Phase 3

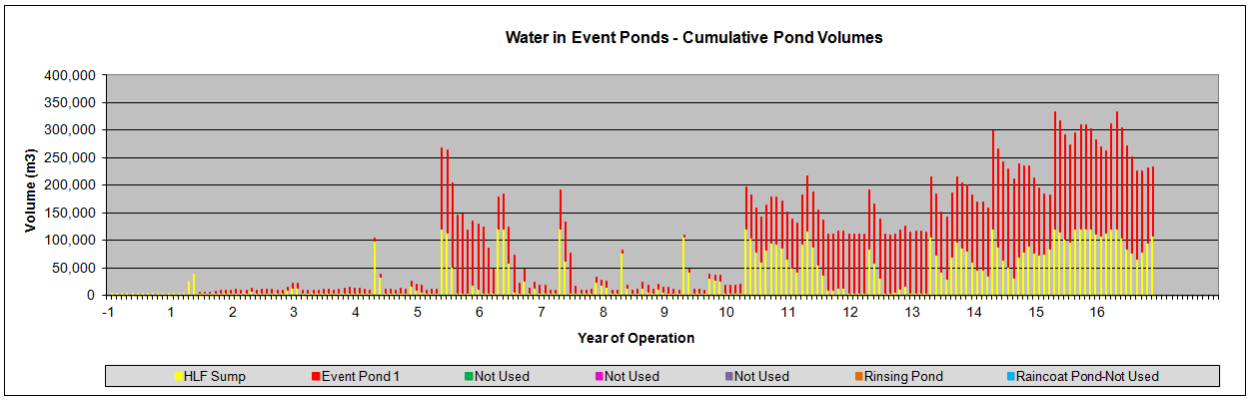
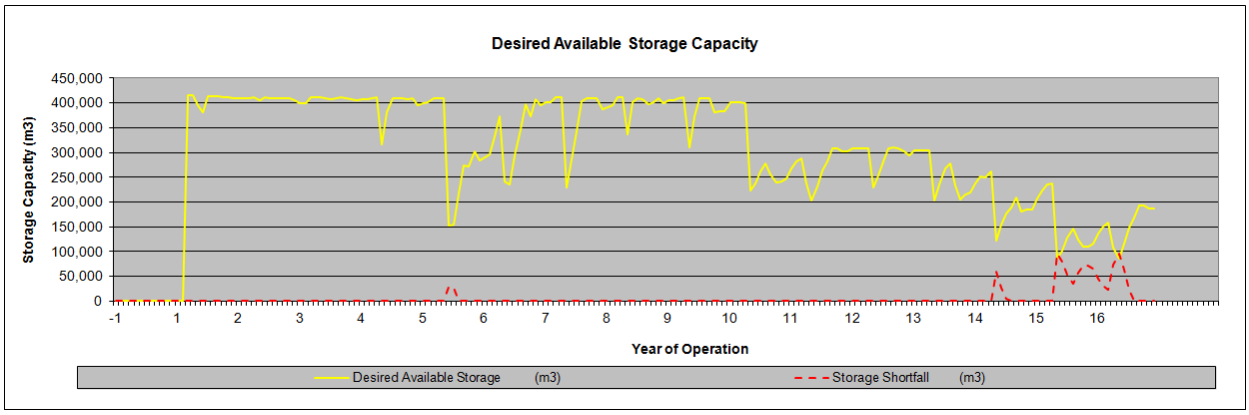


Figure 75 - Impact on Desired Available Storage Capacity from Pumping to Treatment at 5 l/s, Phase 3



6 Draindown Model

This section briefly describes the development of a spreadsheet based draindown model for incorporation into the site-wide GoldSim water balance model. Once all gold production has ceased and the proposed cyanide neutralization and rinsing of the HLF is finished, the post closure heap will be allowed to dewater and drain. The draindown process is an unsaturated flow process that is controlled by the soil water retention characteristics of the ore. The rate of flow during draindown is a function of the unsaturated hydraulic conductivity which is in turn a function of the moisture content of the ore (see Figure 76). Unsaturated hydraulic conductivity was estimated using the Van Genuchten equations. As the ore drains the moisture content decreases and the effective unsaturated hydraulic conductivity declines as well leading to an exponentially declining flow rate curve. There are two (2) distinctly different areas of the HLF that will behave differently during the draindown period. The first area is the column of ore below the area under leach which will have an elevated moisture content relative to the adjacent unirrigated ore. The elevated moisture allows the leach column to drain at a faster rate than the unirrigated ore. At some point in time the moisture content of the leach column will essentially equal the moisture content of the unirrigated ore and there will be no measureable difference in the draindown rate anywhere across the heap.

It is not practical nor advantageous to simply turn off the pumps and allow the heap to just drain as a very large volume of water would report quickly to the ponds filling and overtopping them. Therefore, the model assumes that pumping of process solution will continue at a declining rate until such time as the water content in the active leach column approaches the water content in the unirrigated ore or the potential draindown volume[5] remaining would not fill the ponds but would be captured in the pond system and still provide sufficient capacity to capture and store the design events (i.e., 1% probability (100 yr) 24 hr storm and a short-term drain-down). At that point the pumps would be turned off while allowing the heap to continue to drain until it reaches a meta-stable equilibrium with the level of meteoric water that continues to enter the pad year after year.

In the environment at the Project site, it is not expected to be possible to fully dewater the HLF and pond system without diverting some water to treatment. The rate at which the water is diverted to treatment will control the time required for the leach column to reach the moisture content of the unirrigated ore and also the time required to reach equilibrium with the meteoric precipitation regime. Although less of an impact, the placement of a cover material on the surface of the HLF will also impact the rate of drainage and time to equilibrium by creating clean surface runoff that can be diverted off of the HLF and released directly into the environment.

Figure 76 through Figure 79 show draindown model results (flow rate, water content change, and water stored in ponds) for a scenario that assumes about 8 l/s of water flow to a treatment plant both before and after the leach column water content equals the water content of the unirrigated ore.

[5] The volume of water in the active leach column that is above the water content of the unirrigated ore.

Figure 76 – Assumed Unsaturated Hydraulic Conductivity vs. Volumetric Water Content

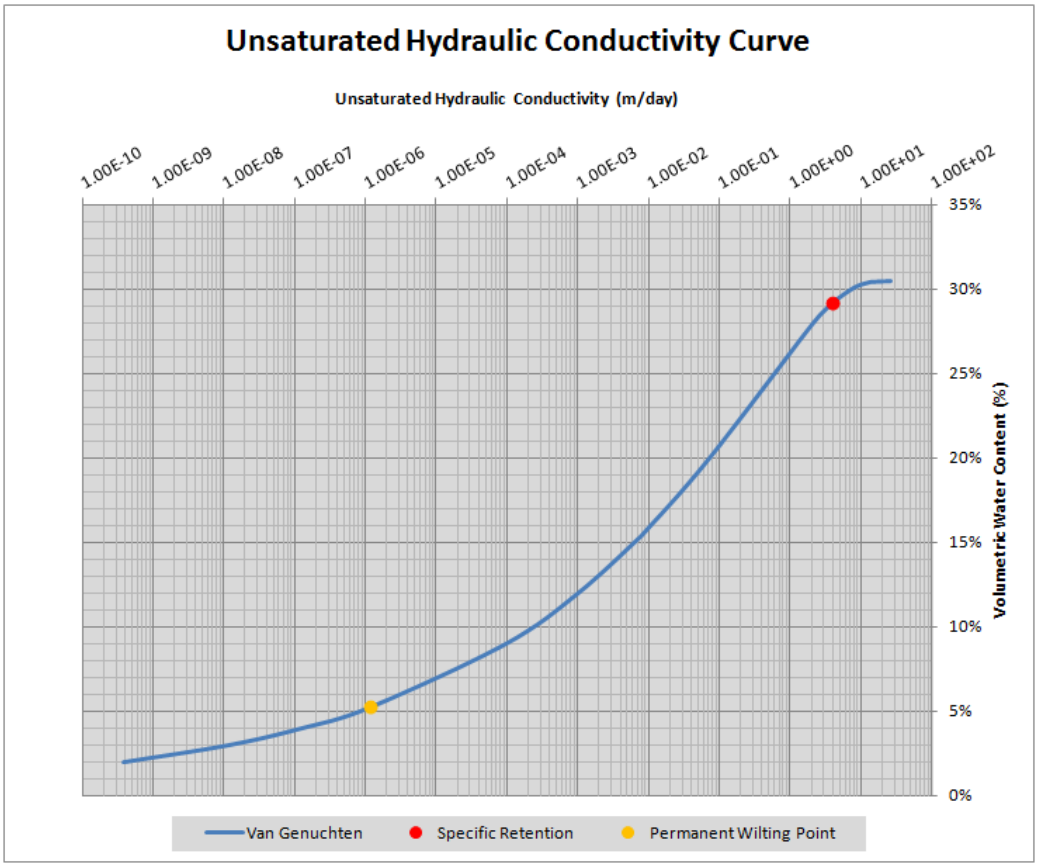


Figure 77 – Draindown Flow rate Over Time

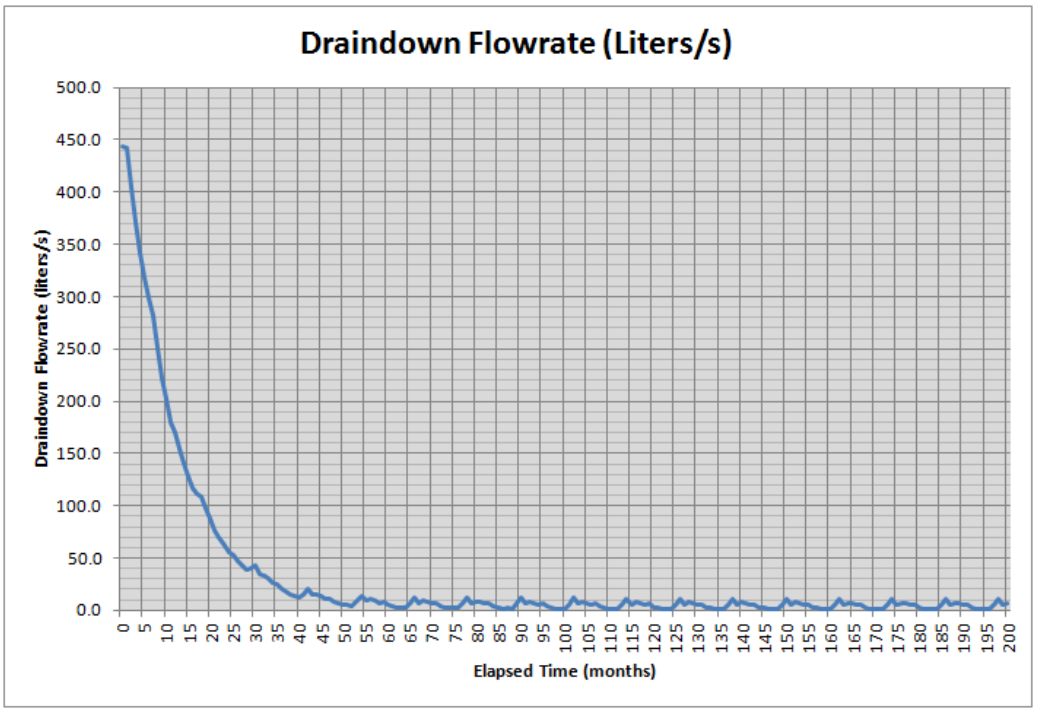


Figure 78 - Changes in Volumetric Water Content Over Time

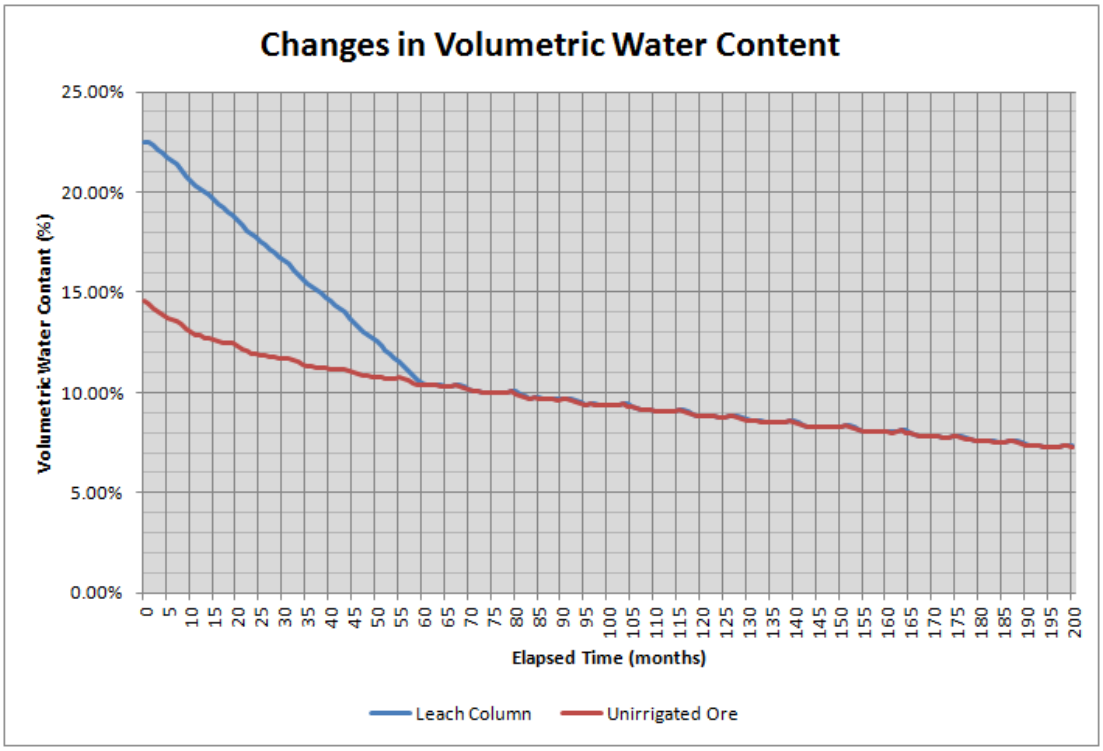


Figure 79 – Estimate of Water Volume Stored in Ponds Over Time

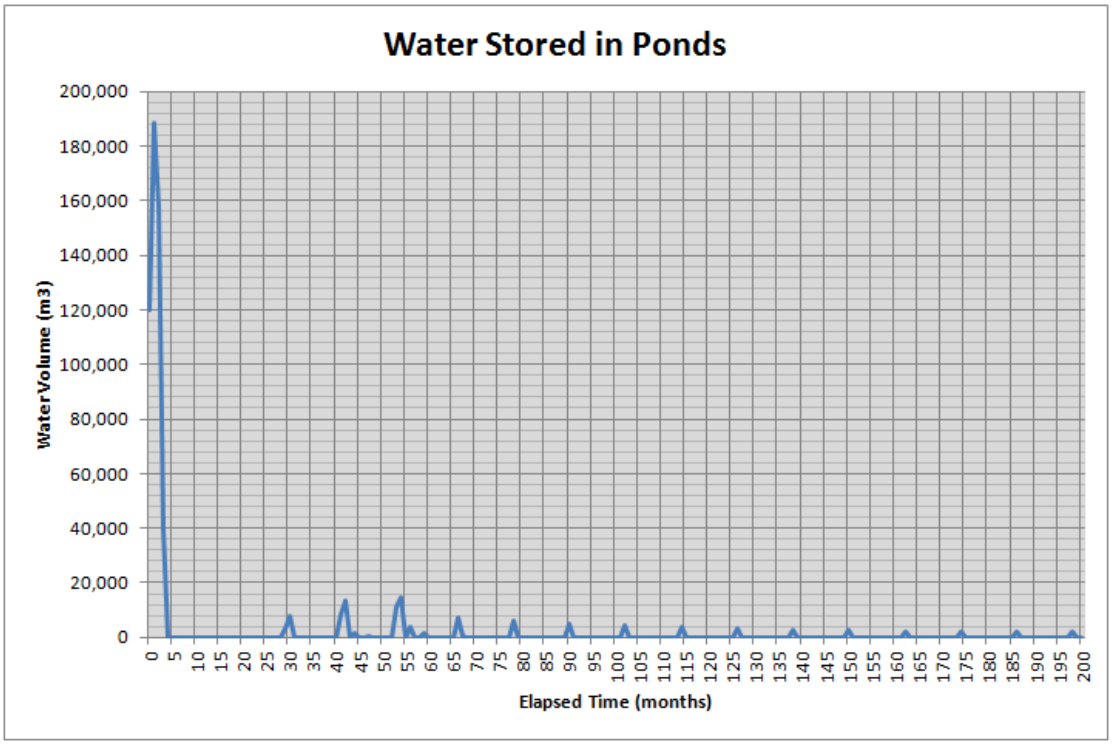
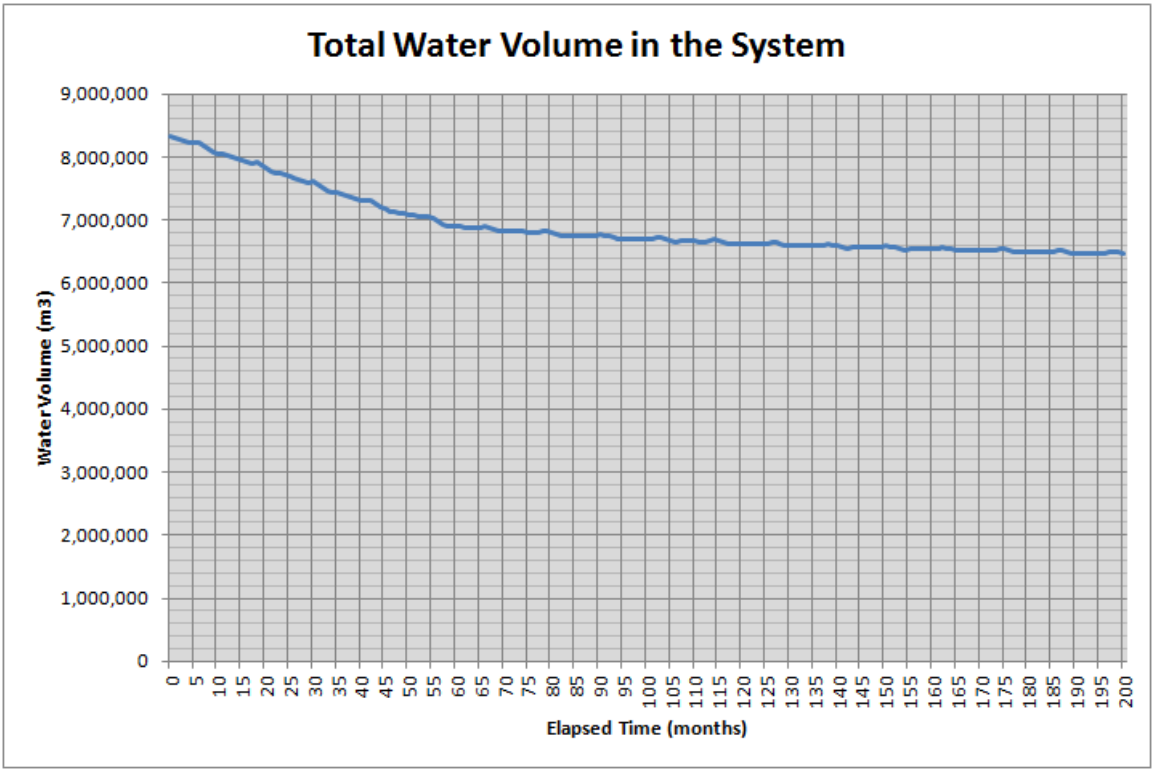


Figure 80 – Changes in Total Water Volume



The above results only address "average" annual precipitation conditions and do not consider the impacts of variation in the meteoric record over time.

Table 15 shows the expected impact of treatment rate on the significant thresholds in time. This includes the expected elapsed time to:

1. The earliest point in time at which pumping of solution to the heap leach pad can be safely stopped.
2. Dewatering of the leach column (the point at which the average water content in the column beneath the area under leach equals the average water content in the unirrigated ore).
3. The point at which the year to year change in the average draindown rate falls below 10% (a level of stability that might favor passive treatment options).

The design treatment rate should be viewed as a maximum rate that can be realized only when there is sufficient water available in the ponds. When there is not sufficient water present, the mean treatment rate would reflect the rate required to empty the ponds over the course of a monthly time step (see Figure 81).

Figure 81 – Expected Actual Treatment Flows

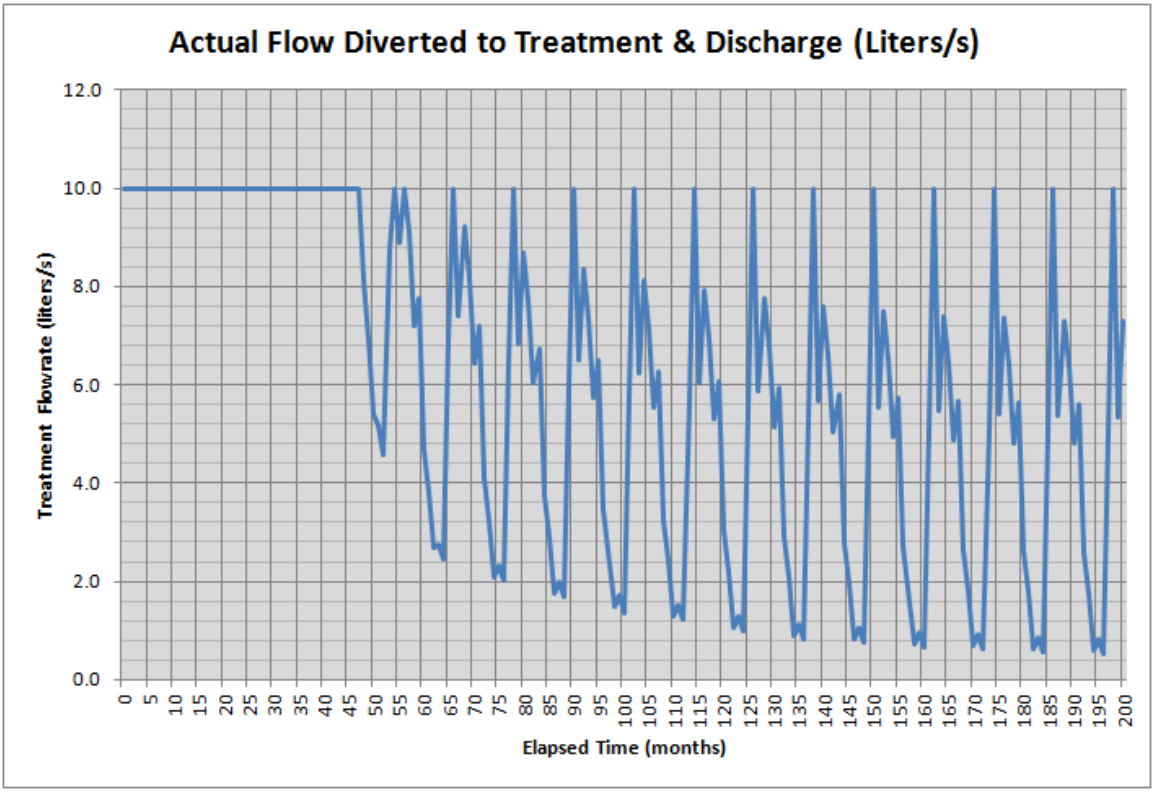


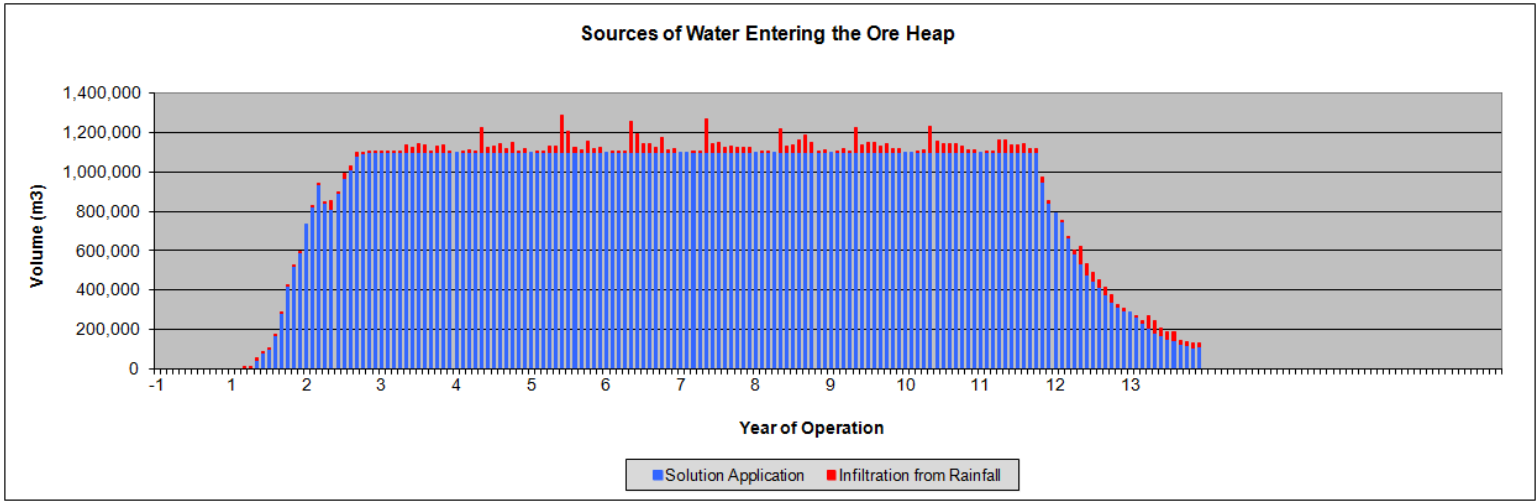
Table 15 – Treatment Rate vs. Important Time Thresholds

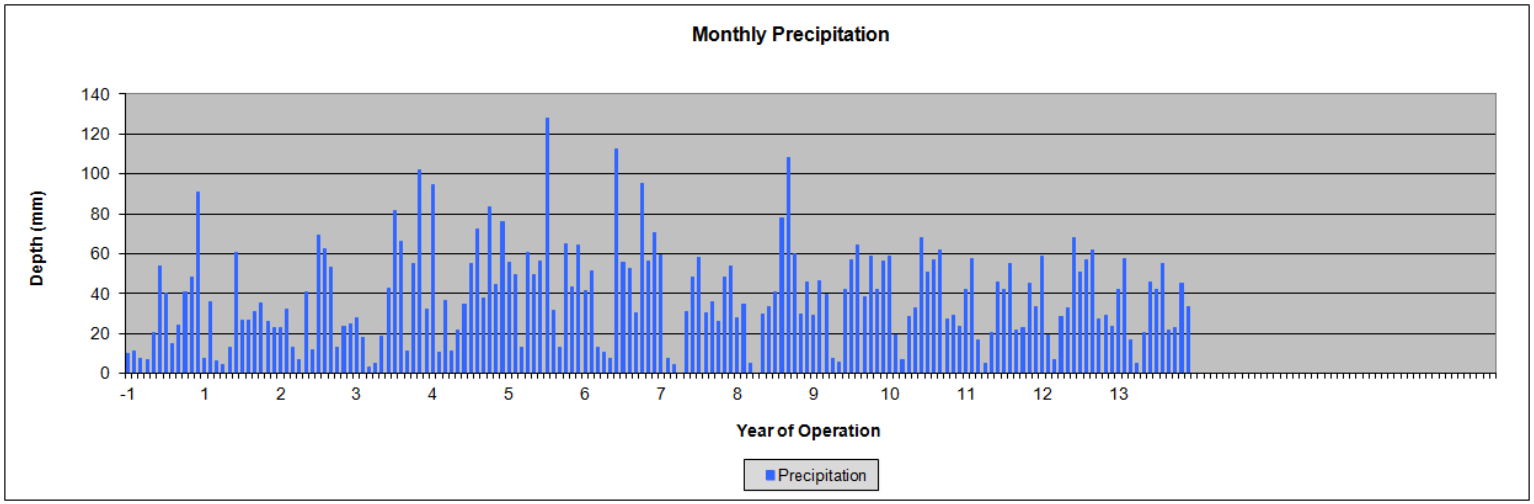
Treatment Rate (l/s)	Elapsed time (Years) to:		
	Stop Pumping	Dewatering of Leach Column	Year to Year Δ Draindown Rate < 10%
4	10.75	14.33	12.58
6	7.25	8.50	9.50
8	5.50	6.08	6.83
9	4.92	5.33	6.50
10	4.42	4.67	5.58

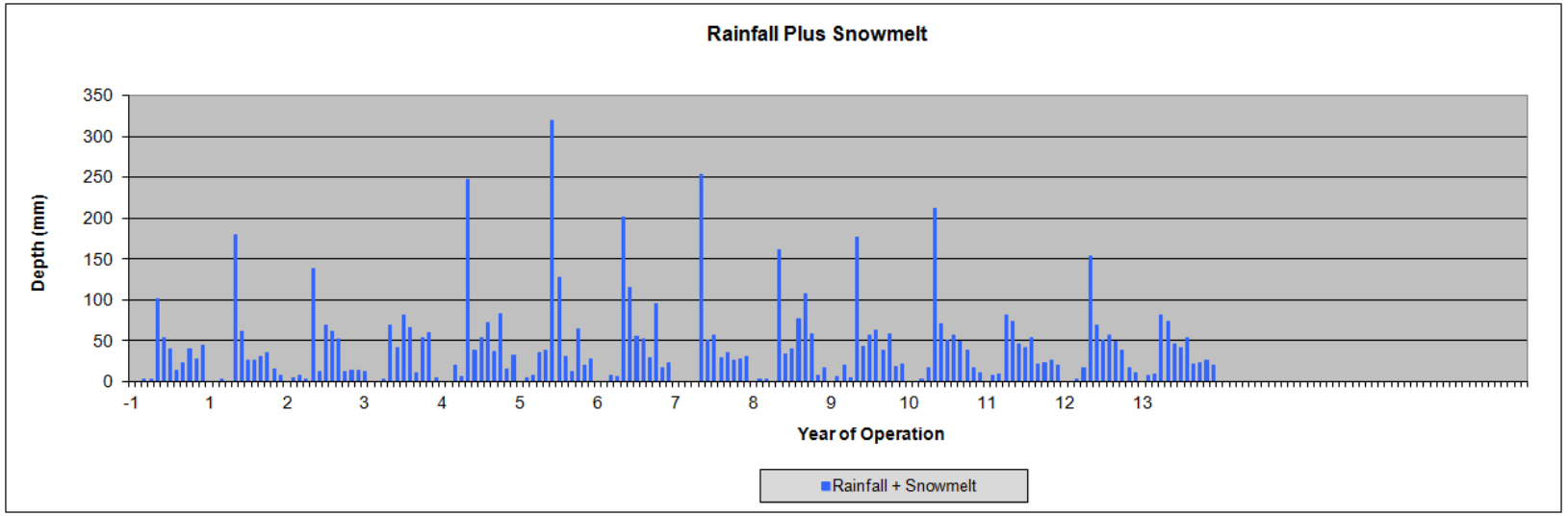
Appendix A
Deterministic Modeling Results
All Scenarios

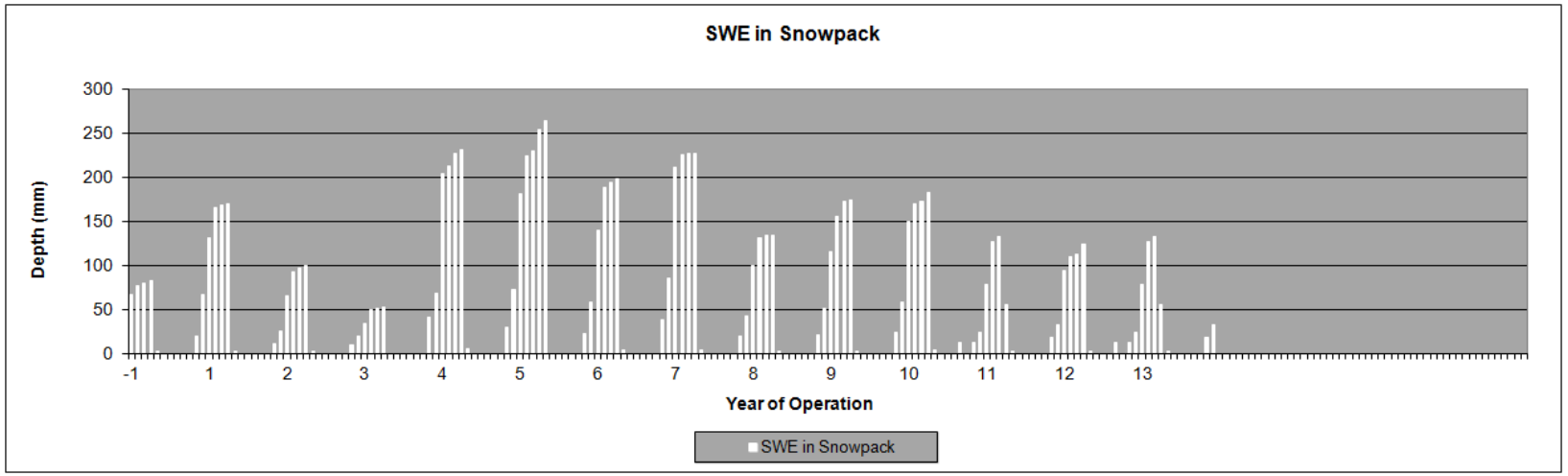
Results Summary from Deterministic Model – Dry/Wet Design Sequence – No Mitigation

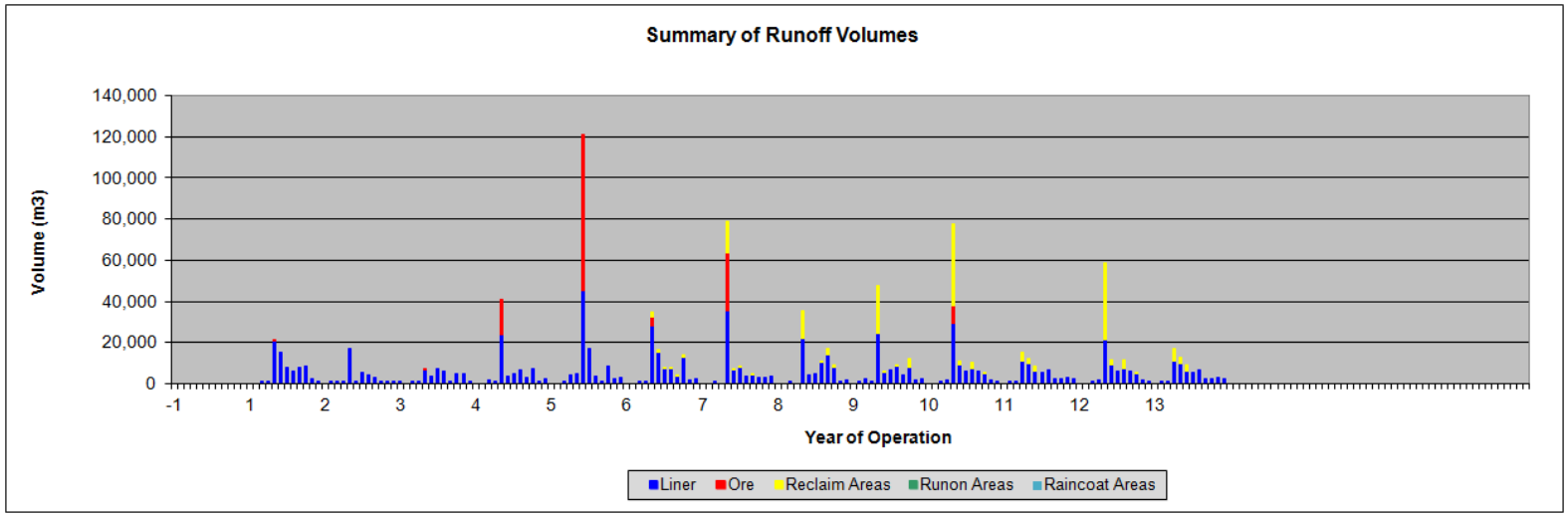
Parameter	Phase	Max	Mean	Min
Water in Stored in Ponds (m3)	**1**	39,563	12,400	4757
	2	104,680	17,184	9454
	3	267,857	59,179	4757
	4	361,118	212,237	48,193
	5	419,946	389,869	329,501
Runoff from Reclaimed Areas (m3/month)	**1**	0	0	0
	2	0	0	0
	3	22,729	1220	0
	4	39,820	2322	0
	5	37,469	2281	0
Outside Makeup Water (m3/month)	**1**	82,815	37,776	0
	2	61,980	26,652	0
	3	55,705	10,806	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/s)	**1**	31.5	14.4	0
	2	23.6	10.1	0
	3	21.2	4.1	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/tonne of ore)	**1**	79.7	33.5	0
	2	52.0	22.3	0
	3	46.8	9.1	0
	4	0	0	0
	5	0	0	0
% of Time Makeup Water Demand is Zero	**1**	---	27.3%	---
	2	---	26.9%	---
	3	---	66.0%	---
	4	---	100.0%	---
	5	---	100.0%	---

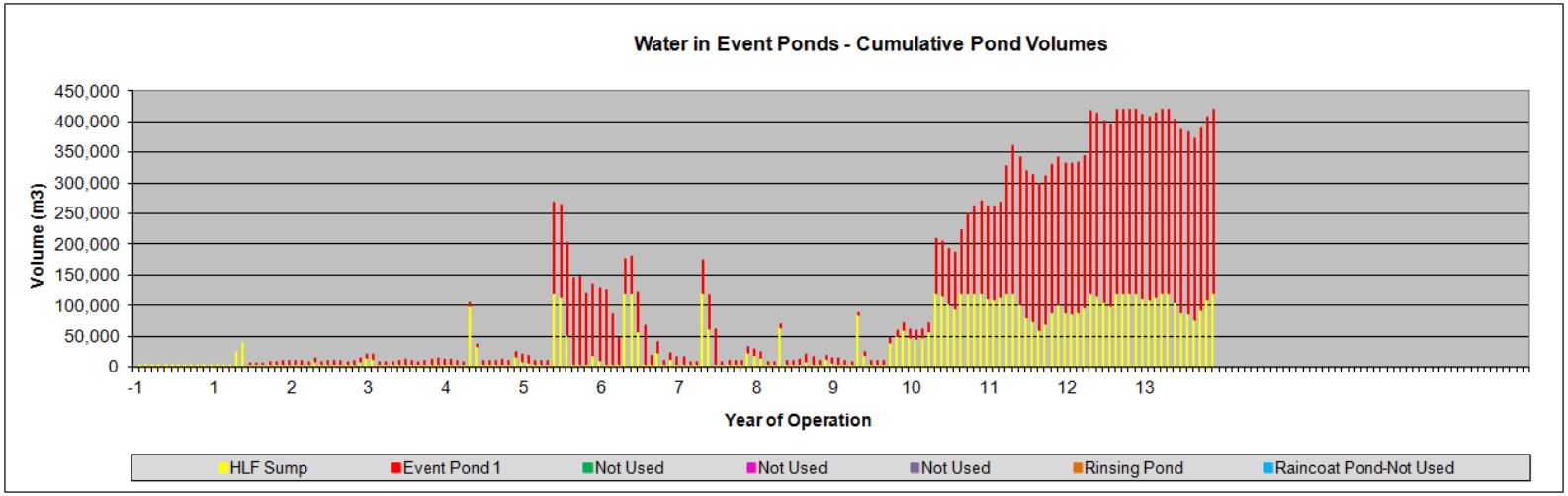

Sources of Water Entering the Ore Heap
Volume (m3)
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Solution Application
Infiltration from Rainfall

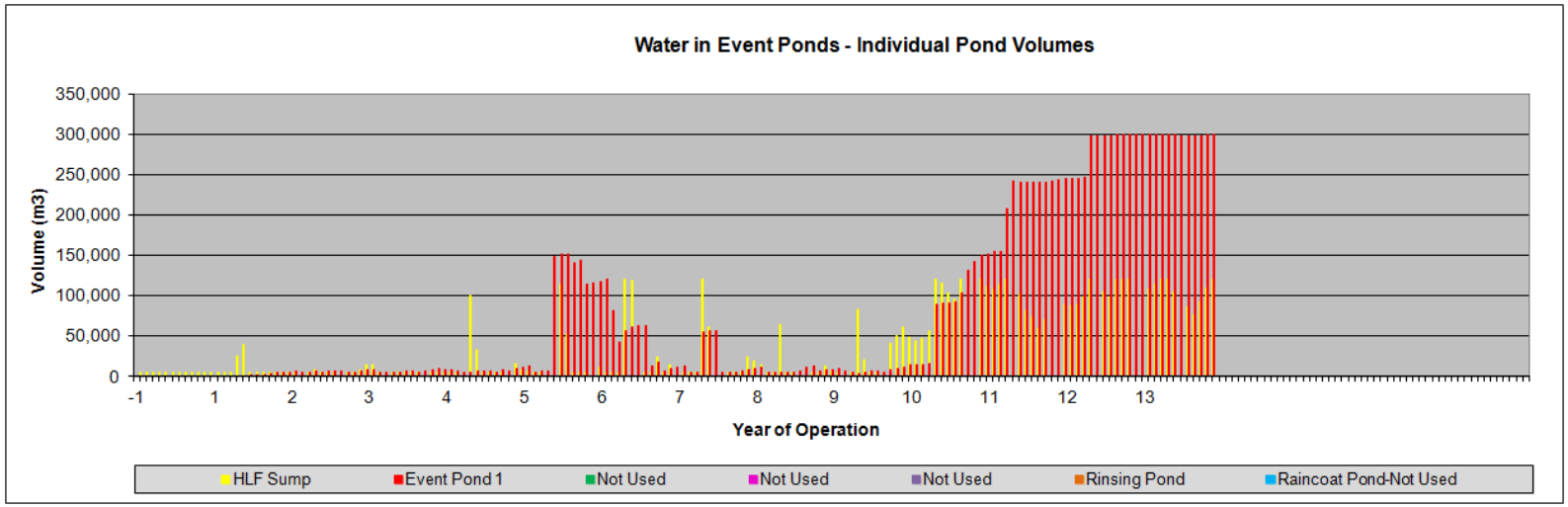

Monthly Precipitation
Depth (mm)
140
120
100
80
60
40
20
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Precipitation

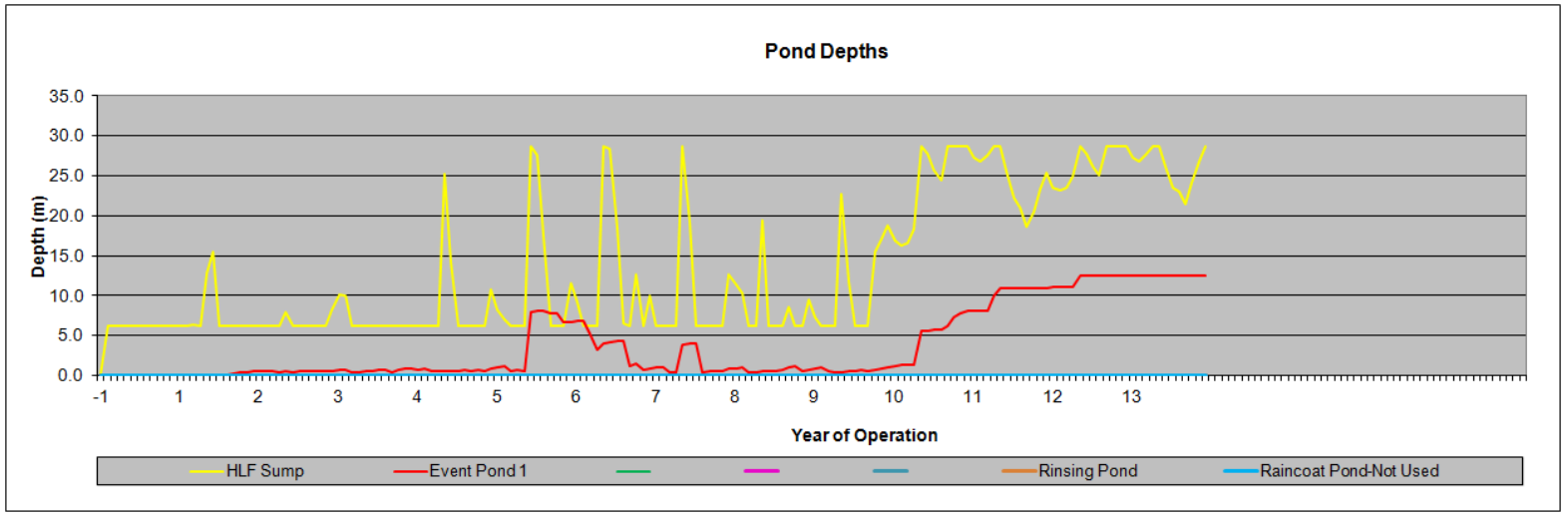

Rainfall Plus Snowmelt
Depth (mm)
350
300
250
200
150
100
50
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Rainfall + Snowmelt

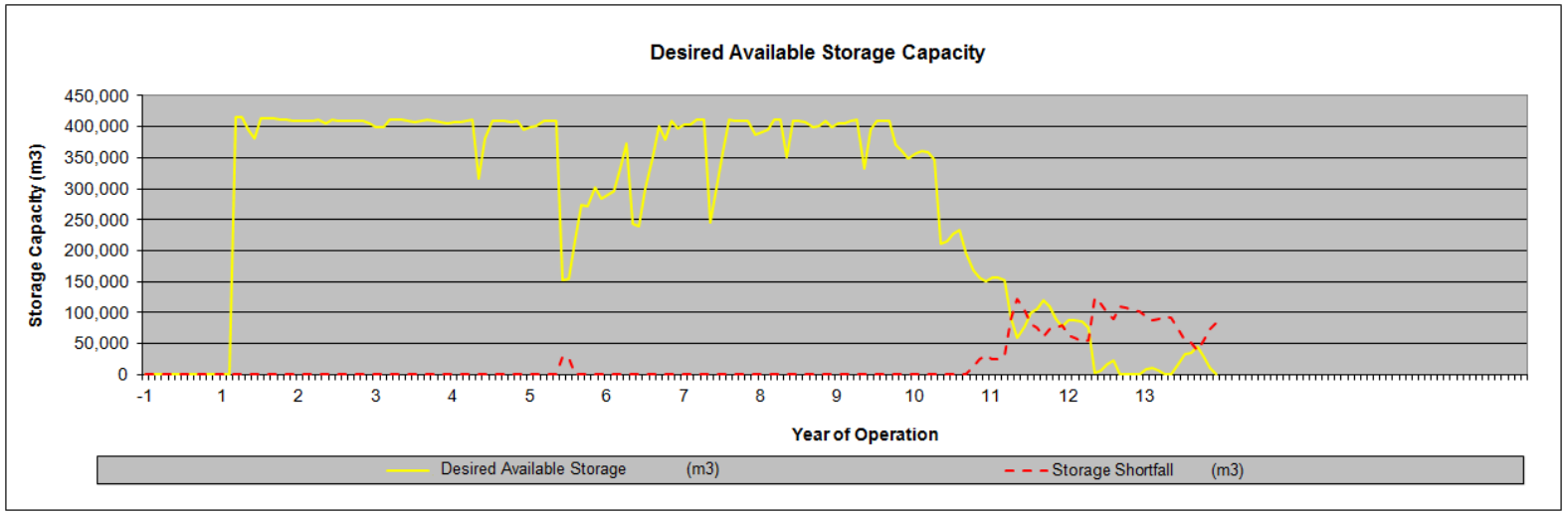

SWE in Snowpack
Depth (mm)
300
250
200
150
100
50
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
SWE in Snowpack

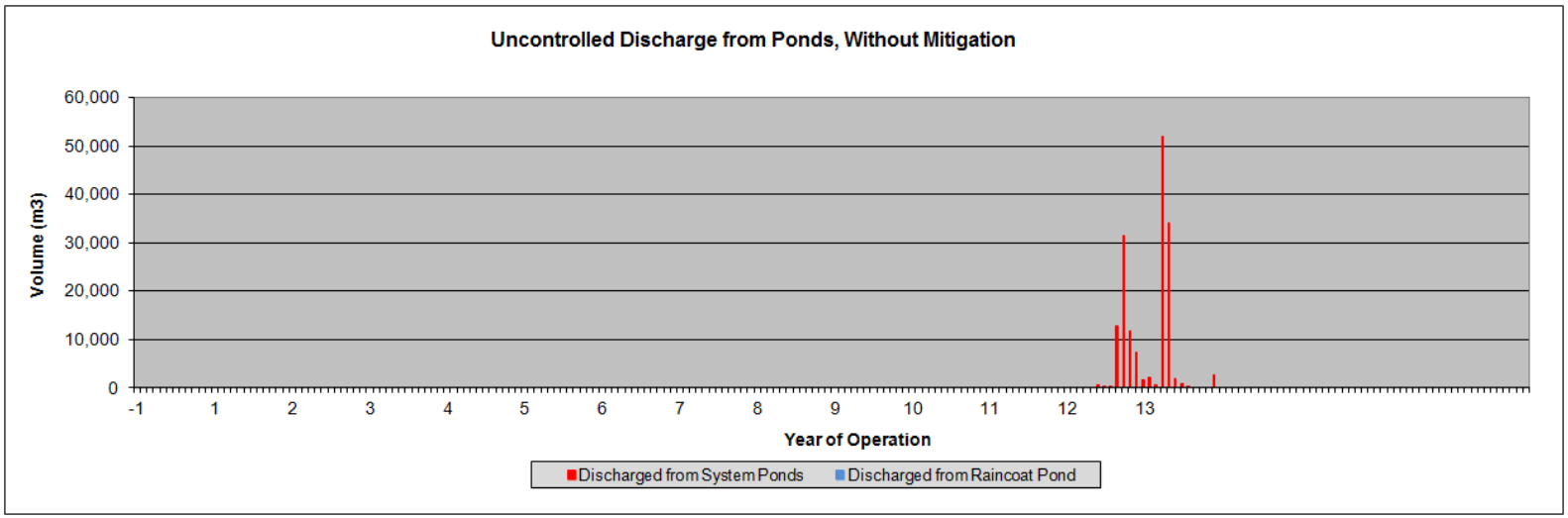

Summary of Runoff Volumes
Volume (m3)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Liner
Ore
Reclaim Areas
Runon Areas
Raincoat Areas

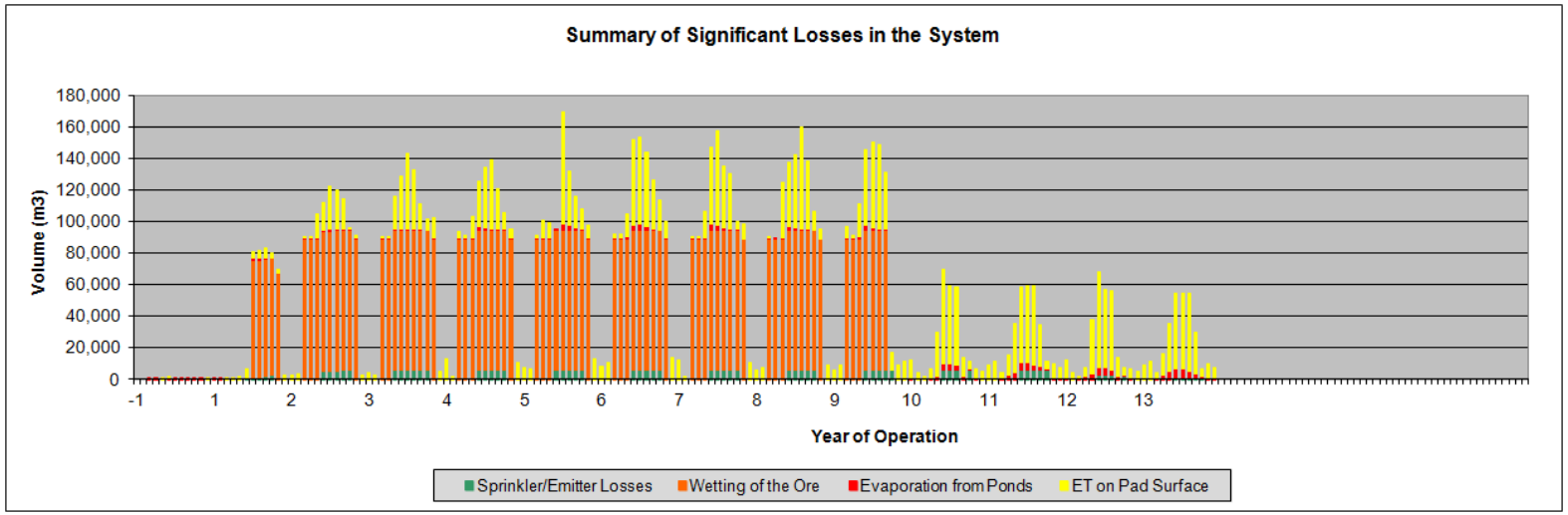

Water in Event Ponds - Cumulative Pond Volumes
Volume (m3)
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Not Used
Not Used
Not Used
Rinsing Pond
Raincoat Pond-Not Used

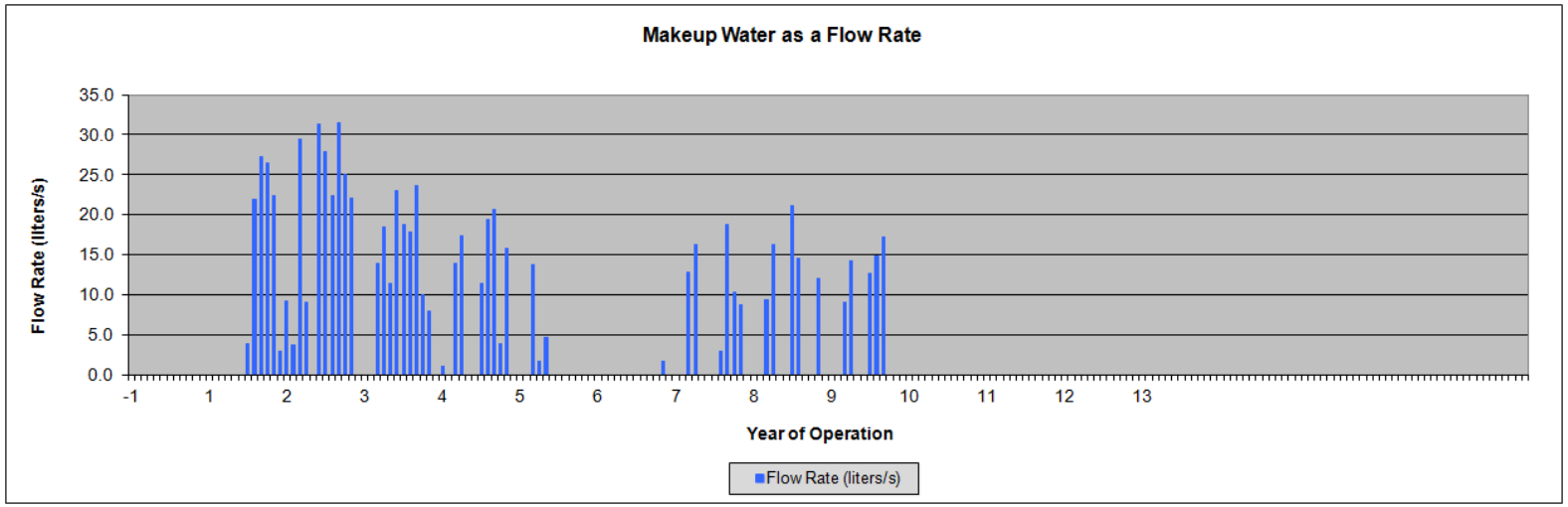

Water in Event Ponds - Individual Pond Volumes
Volume (m3)
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Not Used
Not Used
Not Used
Rinsing Pond
Raincoat Pond-Not Used

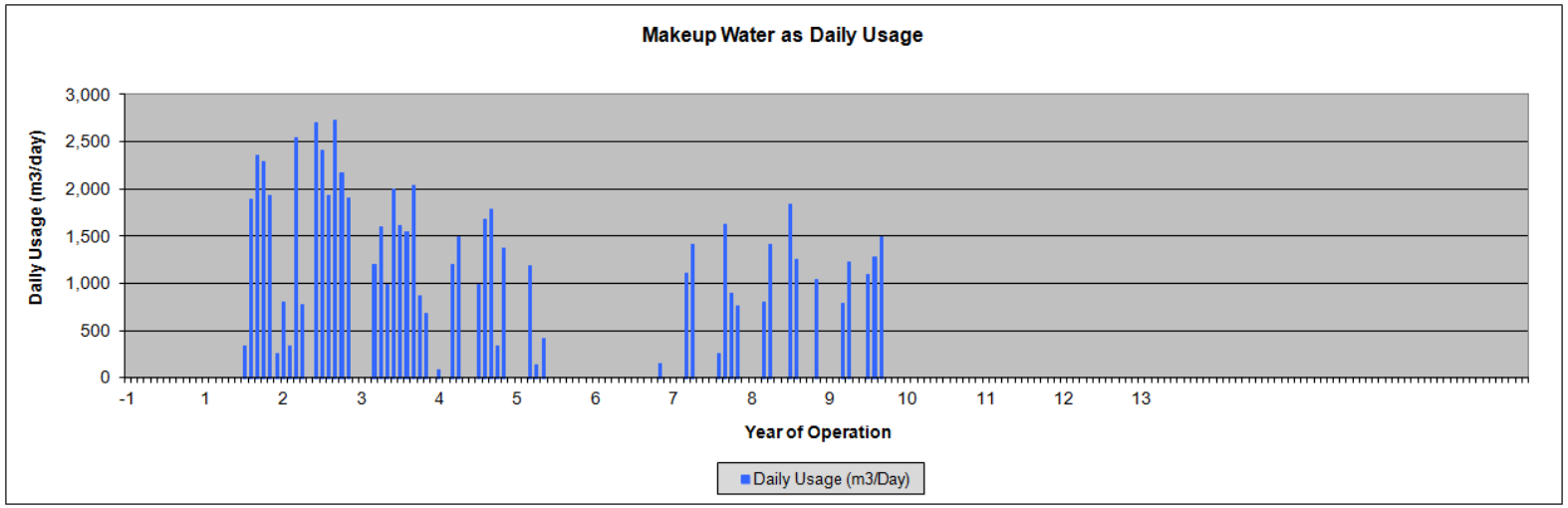

Pond Depths
Depth (m)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Rinsing Pond
Raincoat Pond-Not Used

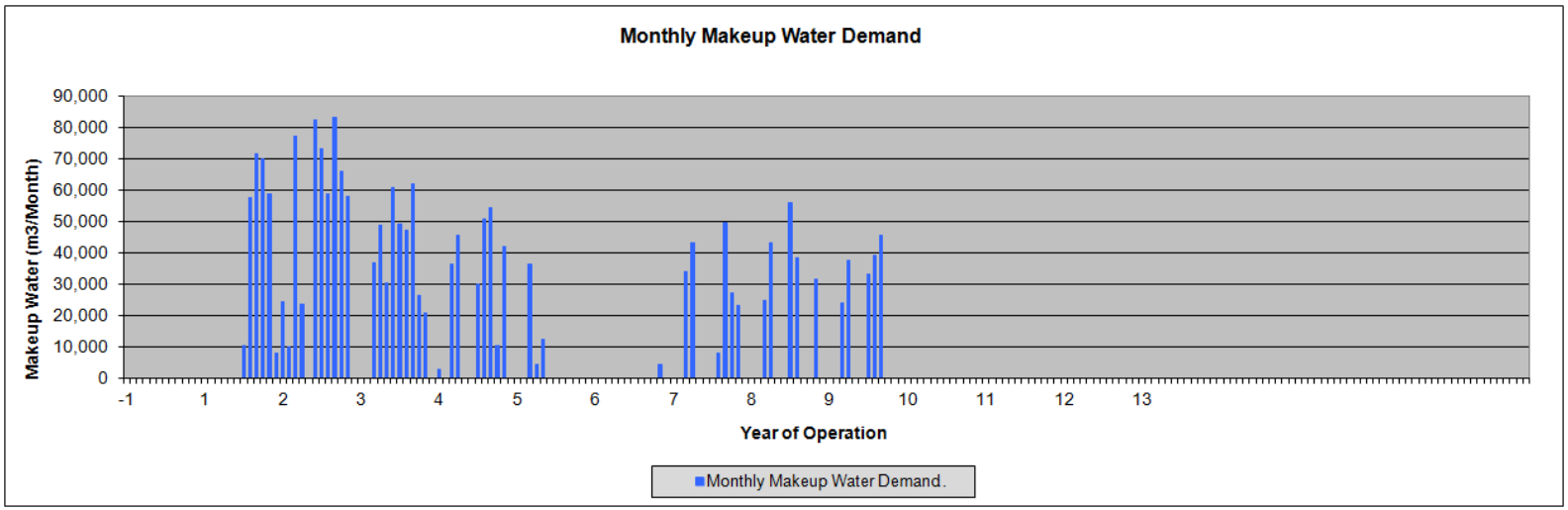

Desired Available Storage Capacity
Storage Capacity (m3)
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Desired Available Storage (m3)
Storage Shortfall (m3)

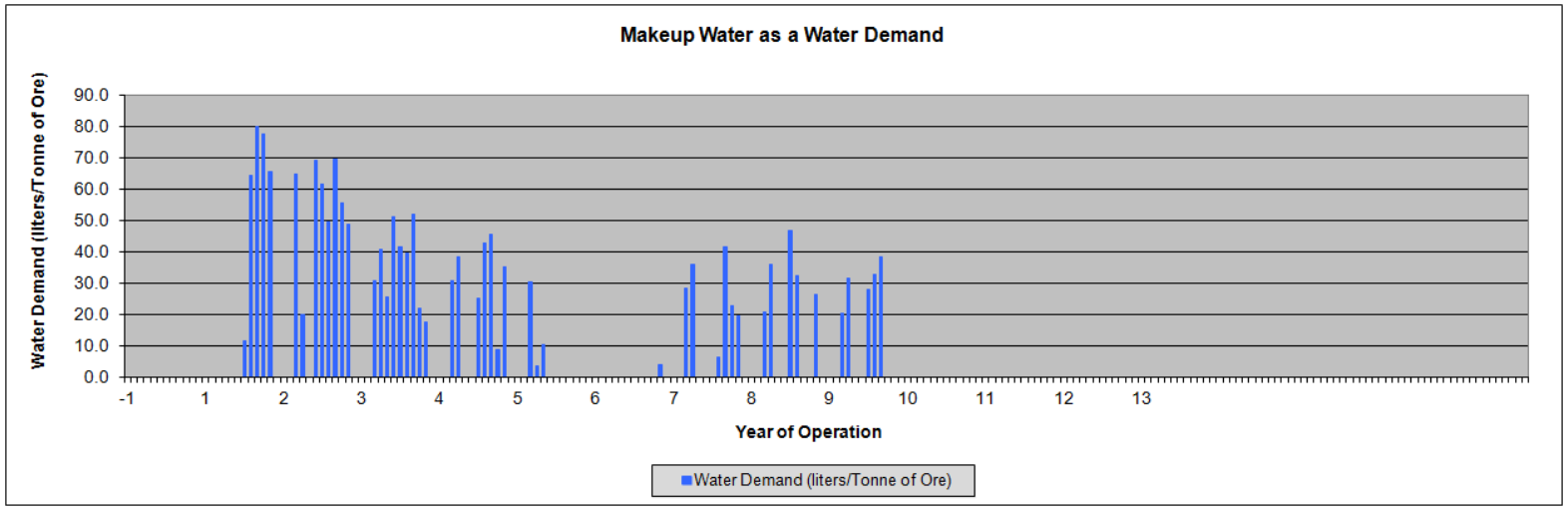

Uncontrolled Discharge from Ponds, Without Mitigation
Volume (m3)
60,000
50,000
40,000
30,000
20,000
10,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Discharged from System Ponds
Discharged from Raincoat Pond


Summary of Significant Losses in the System
Volume (m3)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Sprinkler/Emitter Losses
Wetting of the Ore
Evaporation from Ponds
ET on Pad Surface


Makeup Water as a Flow Rate
Flow Rate (liters/s)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Flow Rate (liters/s)

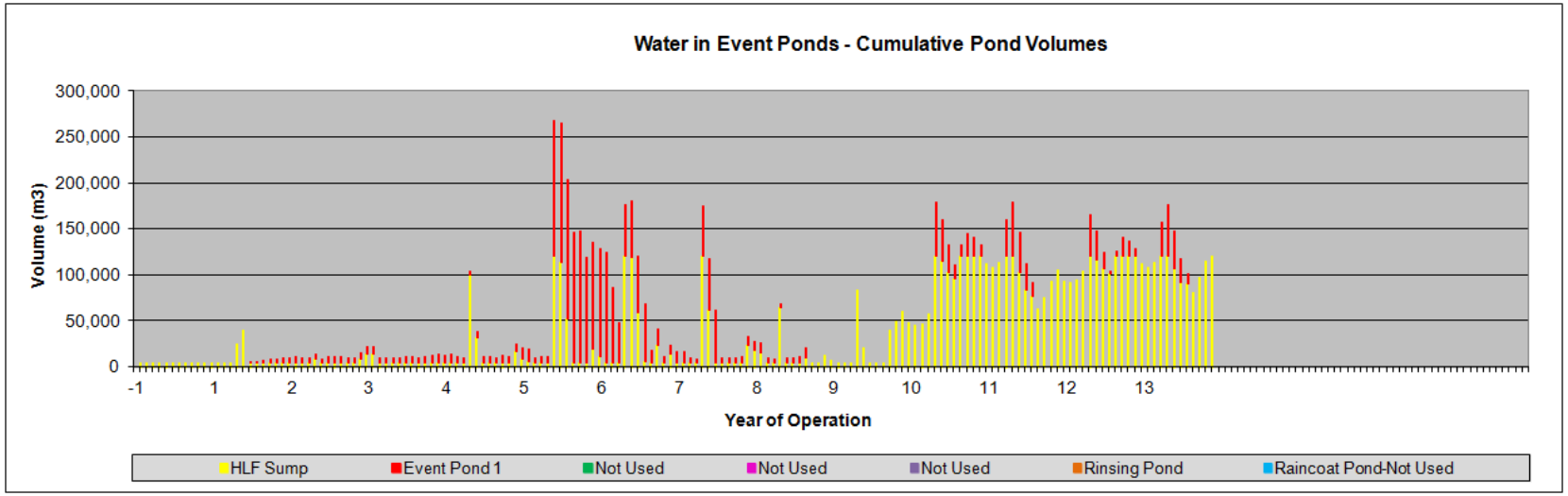

Makeup Water as Daily Usage
Daily Usage (m3/day)
3,000
2,500
2,000
1,500
1,000
500
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Daily Usage (m3/Day)

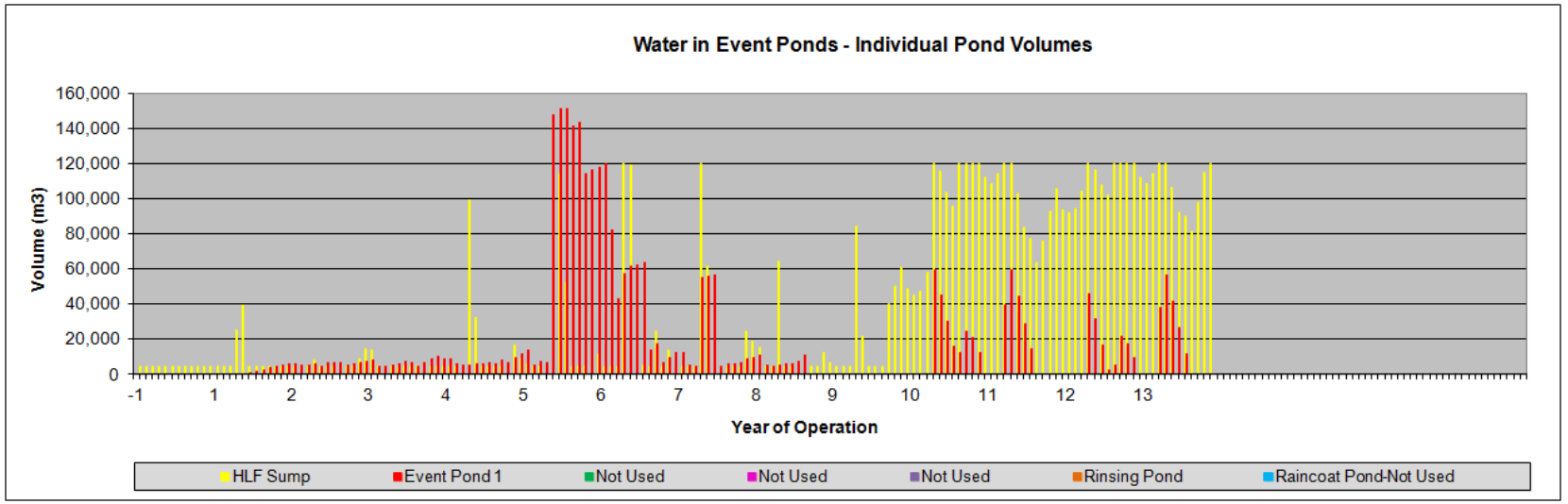

Monthly Makeup Water Demand
Makeup Water (m3/Month)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Monthly Makeup Water Demand.

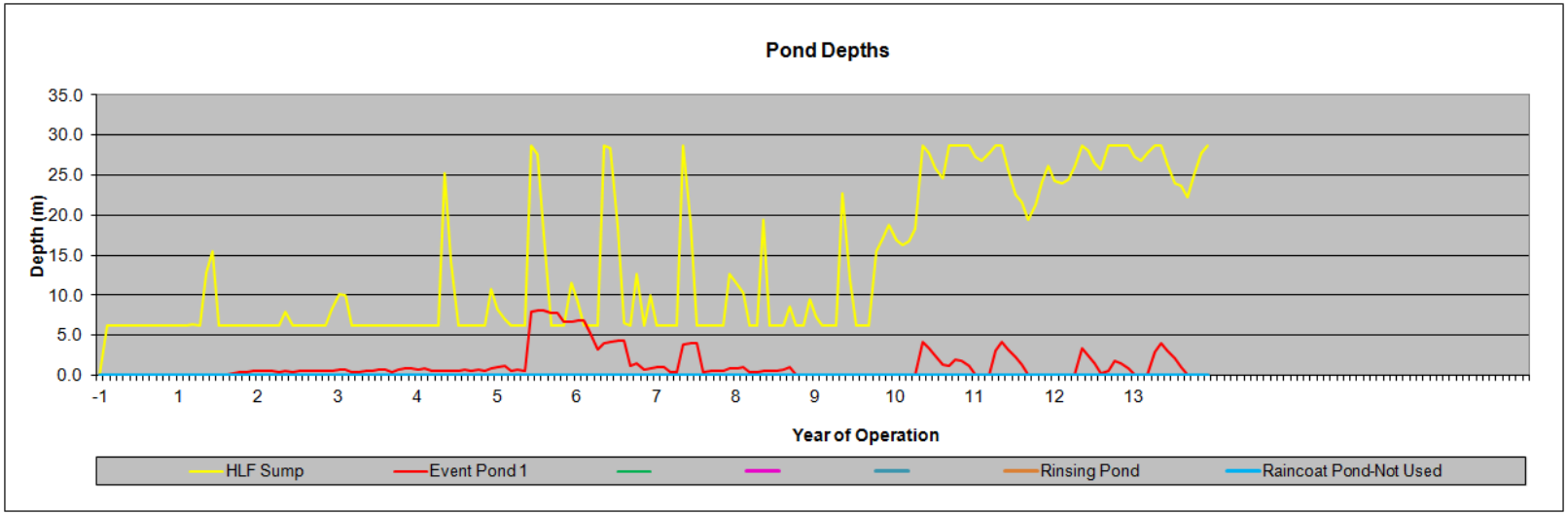

Makeup Water as a Water Demand
Water Demand (liters/Tonne of Ore)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Water Demand (liters/Tonne of Ore)

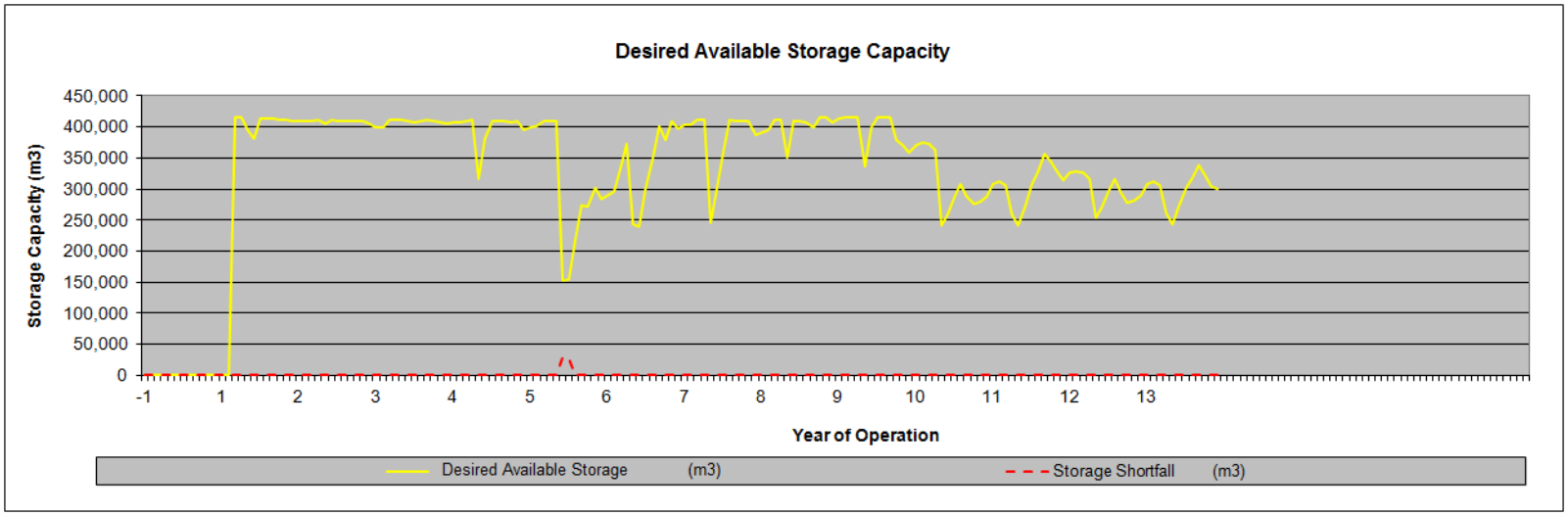
Results Summary - Deterministic Model – Dry/Wet Design Sequence – 6 Liters/Second Pumping to Treatment Beginning in Yr 9

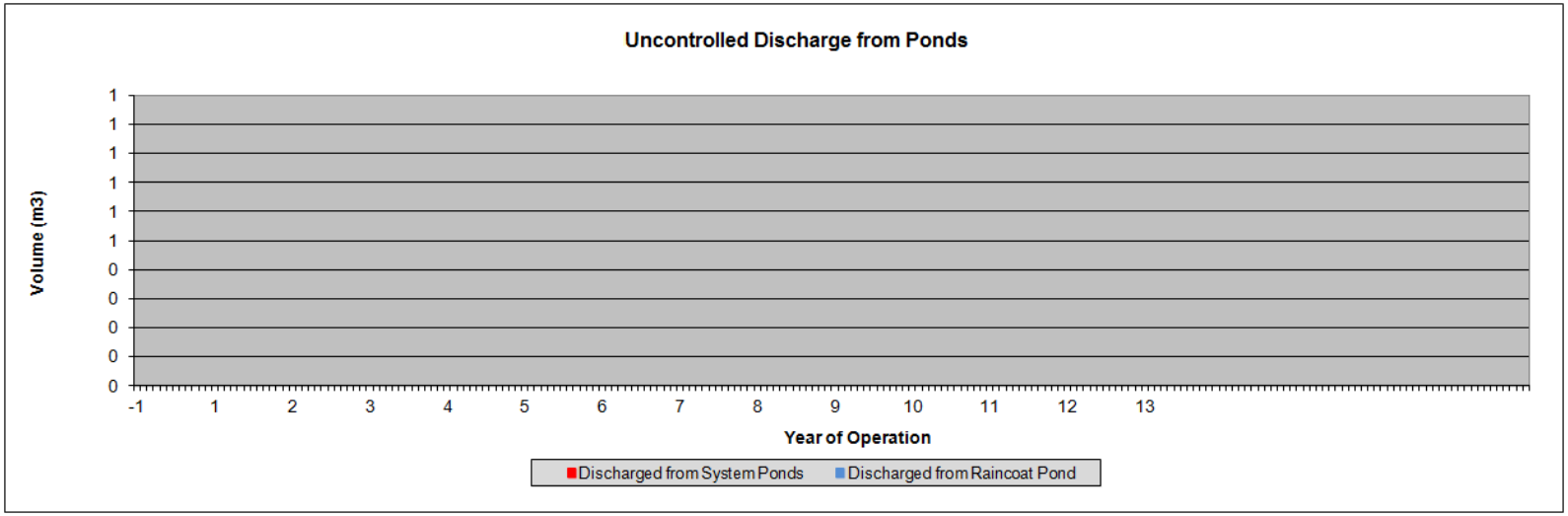
Parameter	Phase	Max	Mean	Min
Water in Stored in Ponds (m3)	**1**	39,563	12,400	4757
	2	104,680	17,184	9454
	3	267,857	59,719	4757
	4	179,389	105,911	40,251
	5	176,782	119,551	81,211
Runoff from Reclaimed Areas (m3/month)	**1**	0	0	0
	2	0	0	0
	3	22,729	1220	0
	4	39,820	2322	0
	5	37,469	2281	0
Outside Makeup Water (m3/month)	**1**	82,815	37,776	0
	2	61,980	26,652	0
	3	55,705	11,658	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/s)	**1**	31.5	14.4	0
	2	23.6	10.1	0
	3	21.2	4.4	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/tonne of ore)	**1**	79.7	33.5	0
	2	52.0	22.3	0
	3	46.8	9.8	0
	4	0	0	0
	5	0	0	0
% of Time Makeup Water Demand is Zero	**1**	---	27.3%	---
	2	---	26.9%	---
	3	---	64.3%	---
	4	---	100%	---
	5	---	100%	---


Water in Event Ponds - Cumulative Pond Volumes
Volume (m3)
300,000
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Not Used
Not Used
Not Used
Rinsing Pond
Raincoat Pond-Not Used


Water in Event Ponds - Individual Pond Volumes
Volume (m3)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Not Used
Not Used
Not Used
Rinsing Pond
Raincoat Pond-Not Used

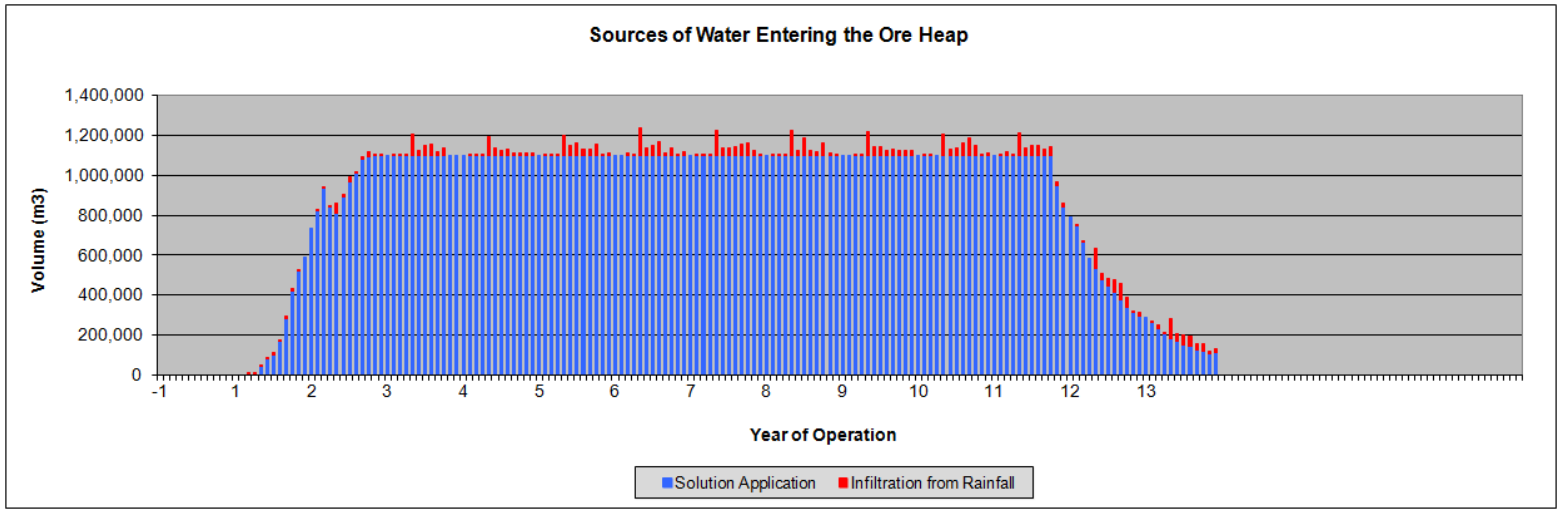

Pond Depths
Depth (m)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Rinsing Pond
Raincoat Pond-Not Used

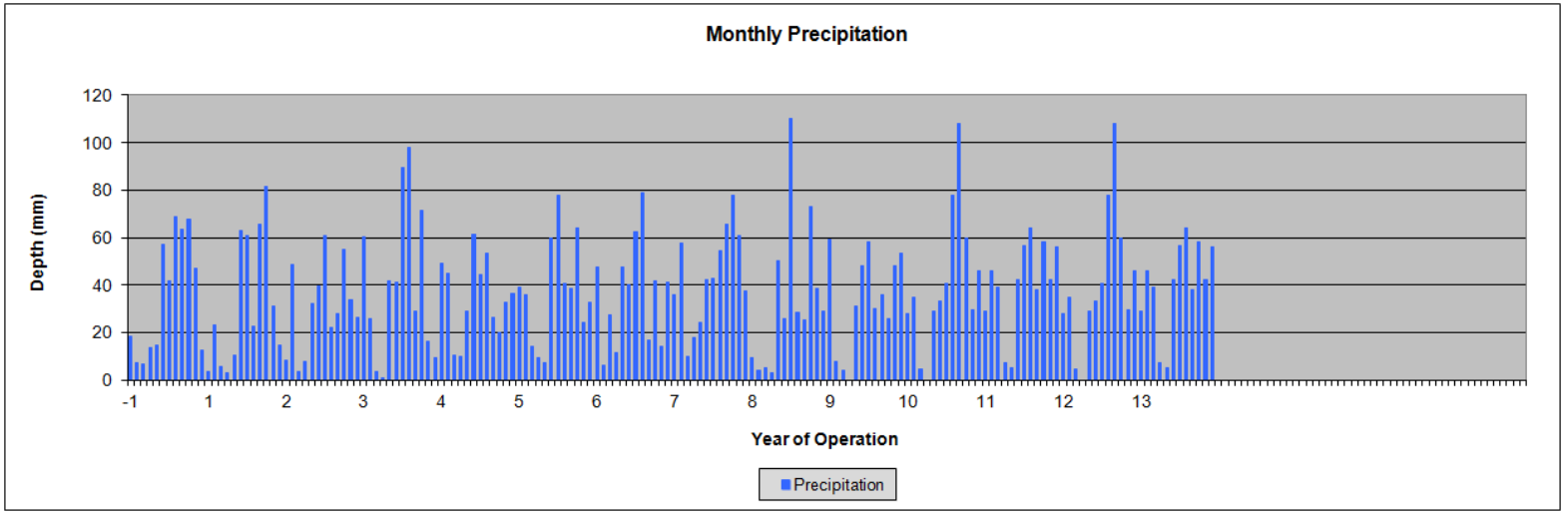

Desired Available Storage Capacity
Storage Capacity (m3)
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Desired Available Storage (m3)
Storage Shortfall (m3)

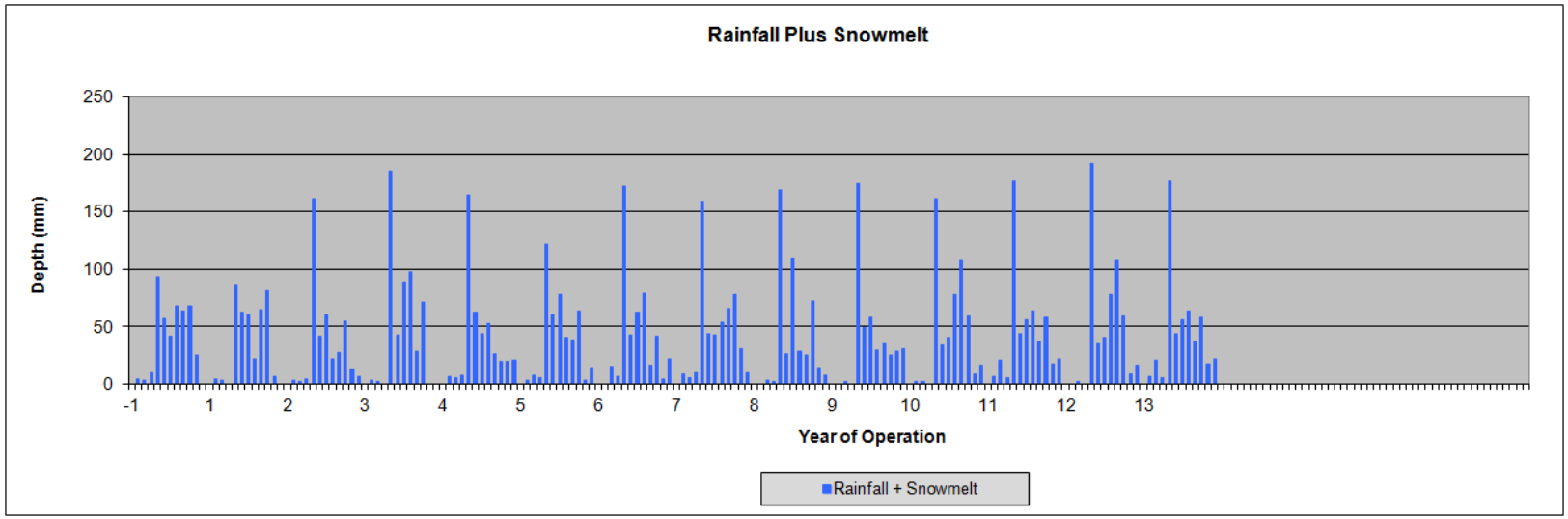

Uncontrolled Discharge from Ponds
Volume (m3)
1
1
1
1
1
1
0
0
0
0
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Discharged from System Ponds
Discharged from Raincoat Pond

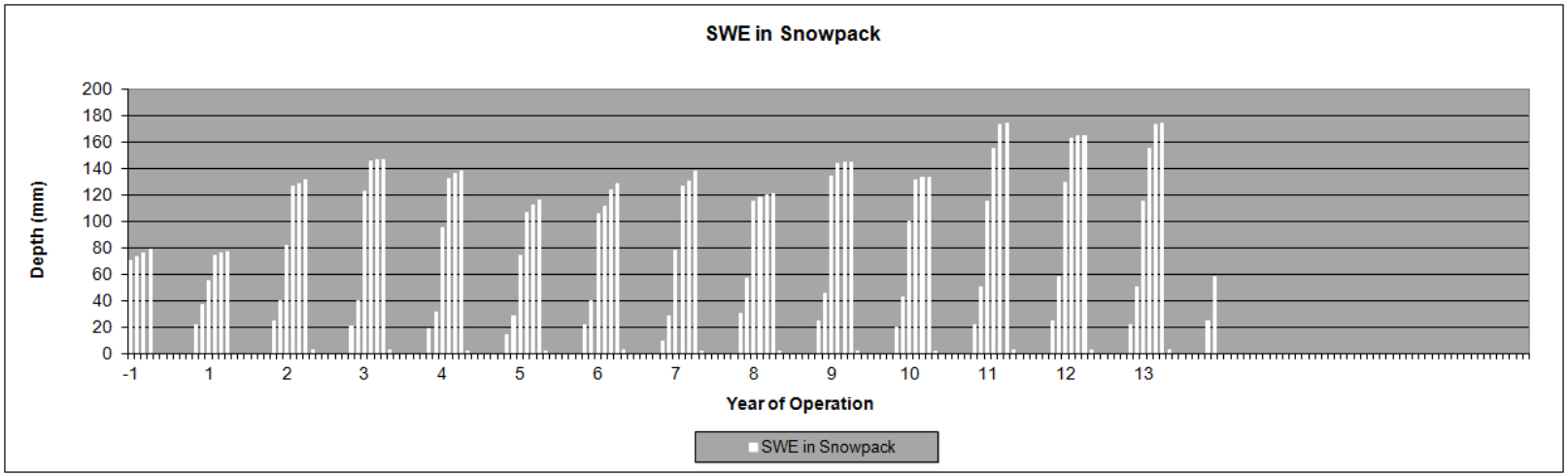
Results Summary - Deterministic Model – Avg Precip with Mod Variability – 6 Liters/Second Pumping to Treatment Beginning in Yr 9

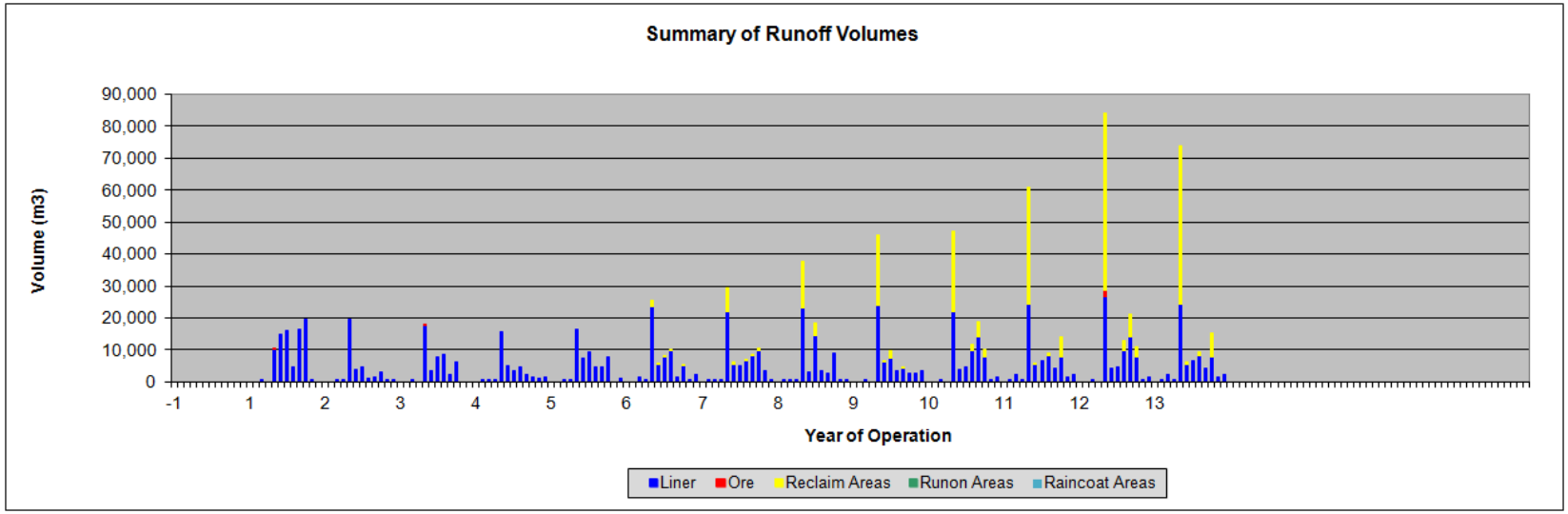
Parameter	Phase	Max	Mean	Min
Water in Stored in Ponds (m3)	**1**	28,652	11,569	4757
	2	48,639	14,133	9255
	3	85,651	17,195	4757
	4	215,833	106,292	19,296
	5	282,986	141,966	108,435
Runoff from Reclaimed Areas (m3/month)	**1**	0	0	0
	2	0	0	0
	3	22,056	1012	0
	4	36,565	3140	0
	5	55,340	5104	0
Outside Makeup Water (m3/month)	**1**	93,354	35,936	0
	2	60,242	28,735	0
	3	63,303	20,794	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/s)	**1**	35.5	13.7	0
	2	22.9	10.9	0
	3	24.1	7.9	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/tonne of ore)	**1**	78.4	31.4	0
	2	50.6	24.1	0
	3	53.2	17.3	0
	4	0	0	0
	5	0	0	0
% of Time Makeup Water Demand is Zero	**1**	---	22.7%	---
	2	---	26.9%	---
	3	---	41.5%	---
	4	---	100.0%	---
	5	---	100.0%	---

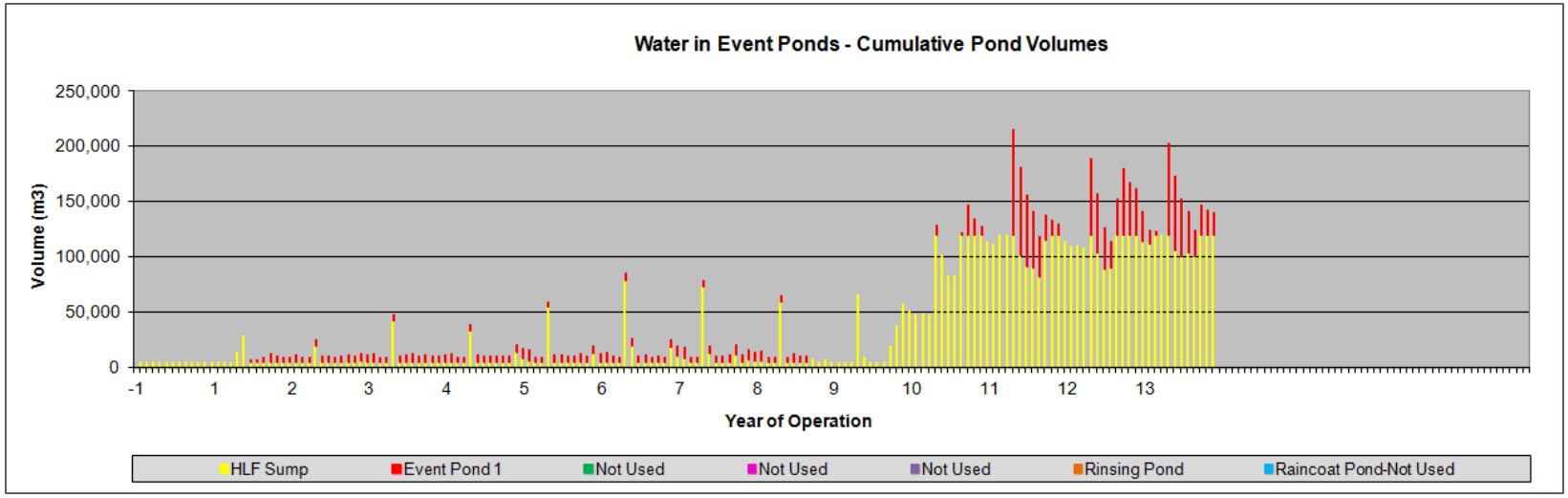

Sources of Water Entering the Ore Heap
Volume (m3)
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Solution Application
Infiltration from Rainfall

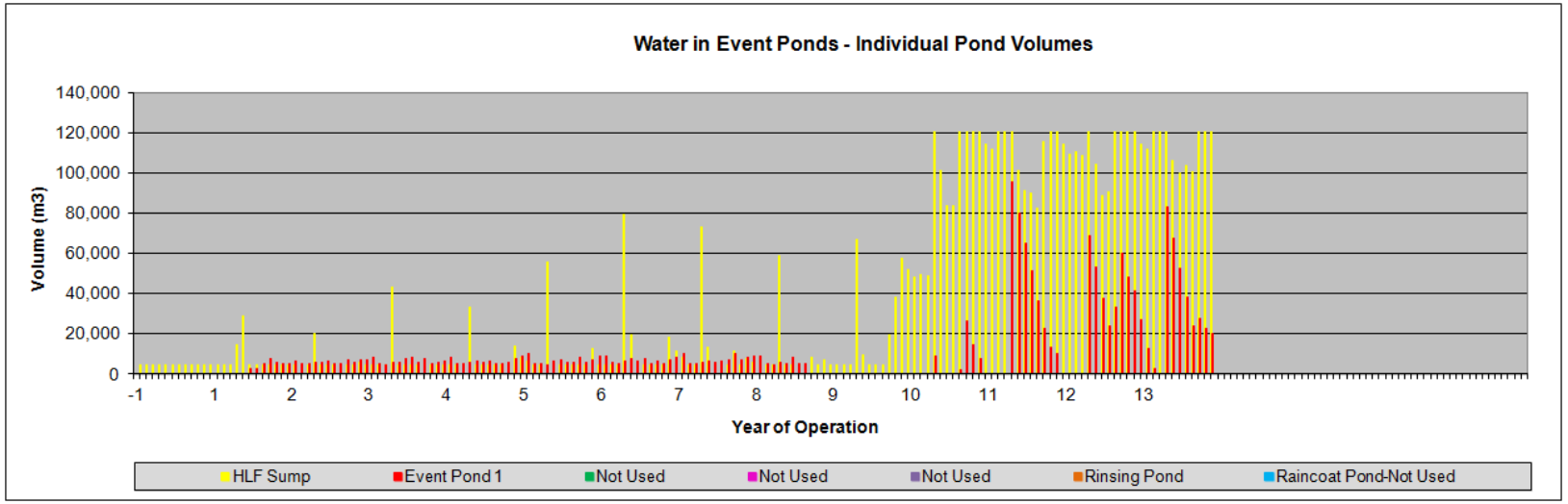

Monthly Precipitation
Depth (mm)
120
100
80
60
40
20
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Precipitation

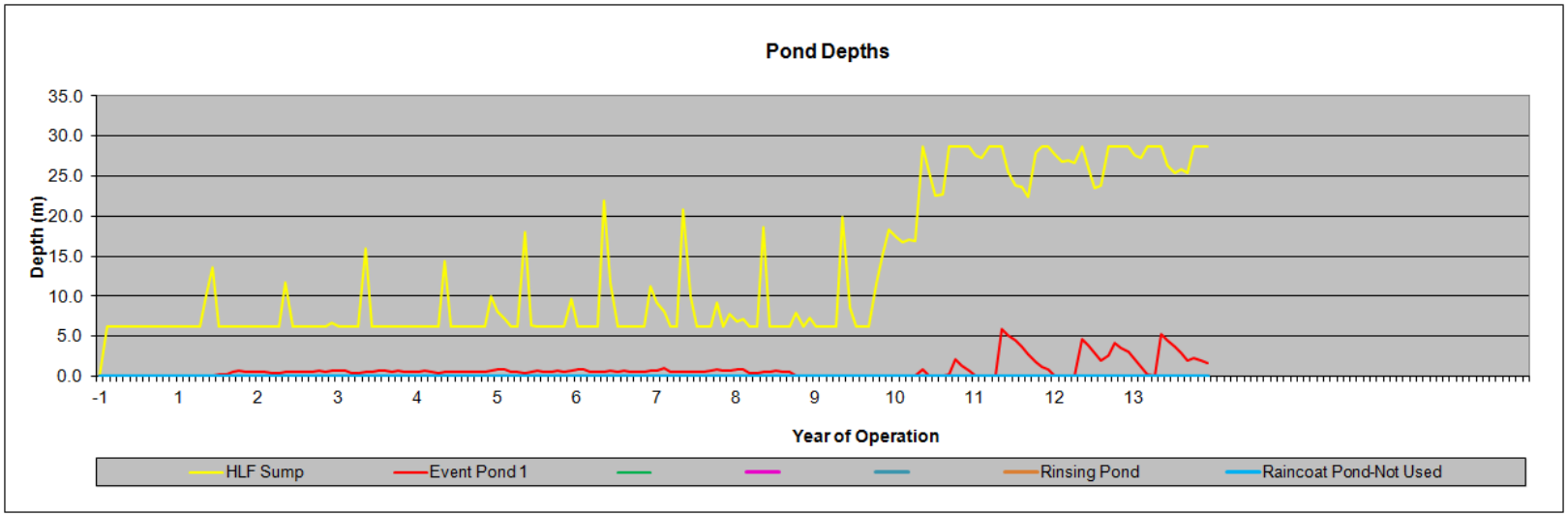

Rainfall Plus Snowmelt
Depth (mm)
250
200
150
100
50
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Rainfall + Snowmelt

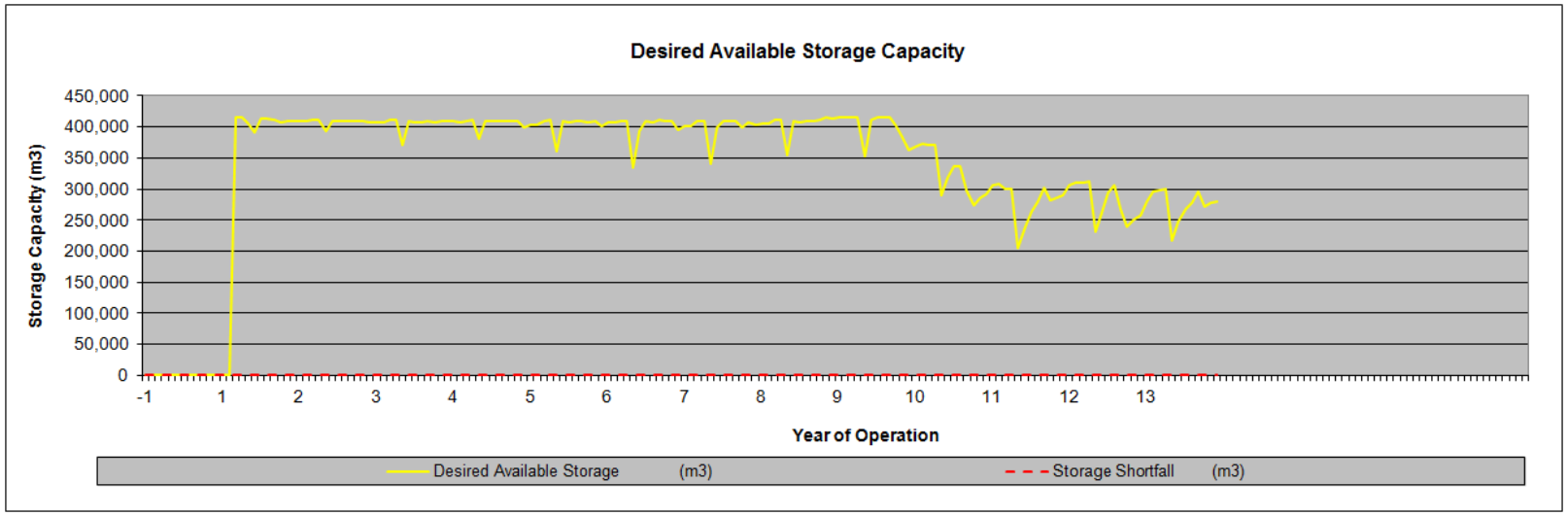

SWE in Snowpack
Depth (mm)
200
180
160
140
120
100
80
60
40
20
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
SWE in Snowpack

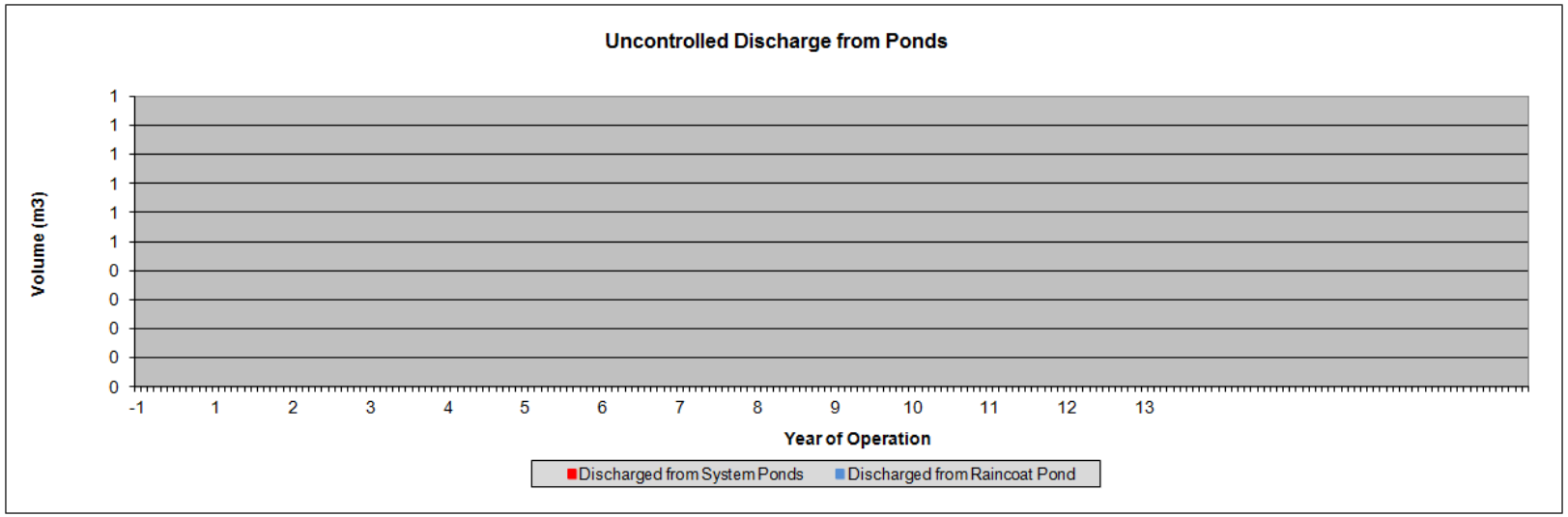

Summary of Runoff Volumes
Volume (m3)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Liner
Ore
Reclaim Areas
Runon Areas
Raincoat Areas

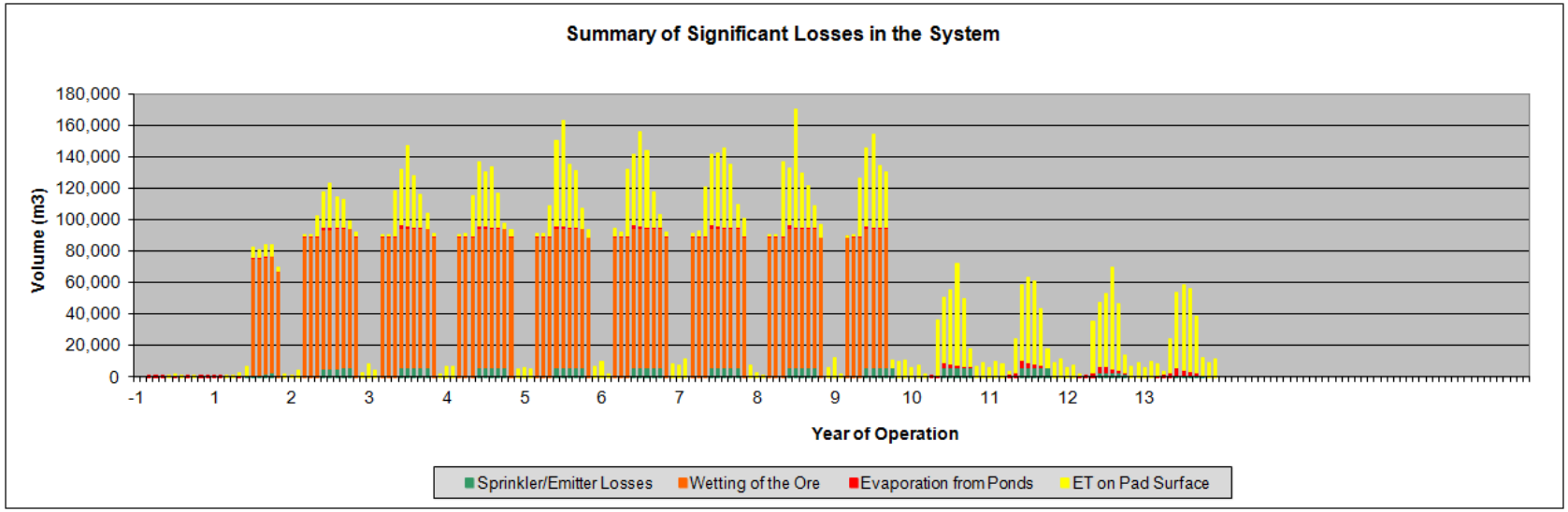

Water in Event Ponds - Cumulative Pond Volumes
Volume (m3)
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Not Used
Not Used
Not Used
Rinsing Pond
Raincoat Pond-Not Used

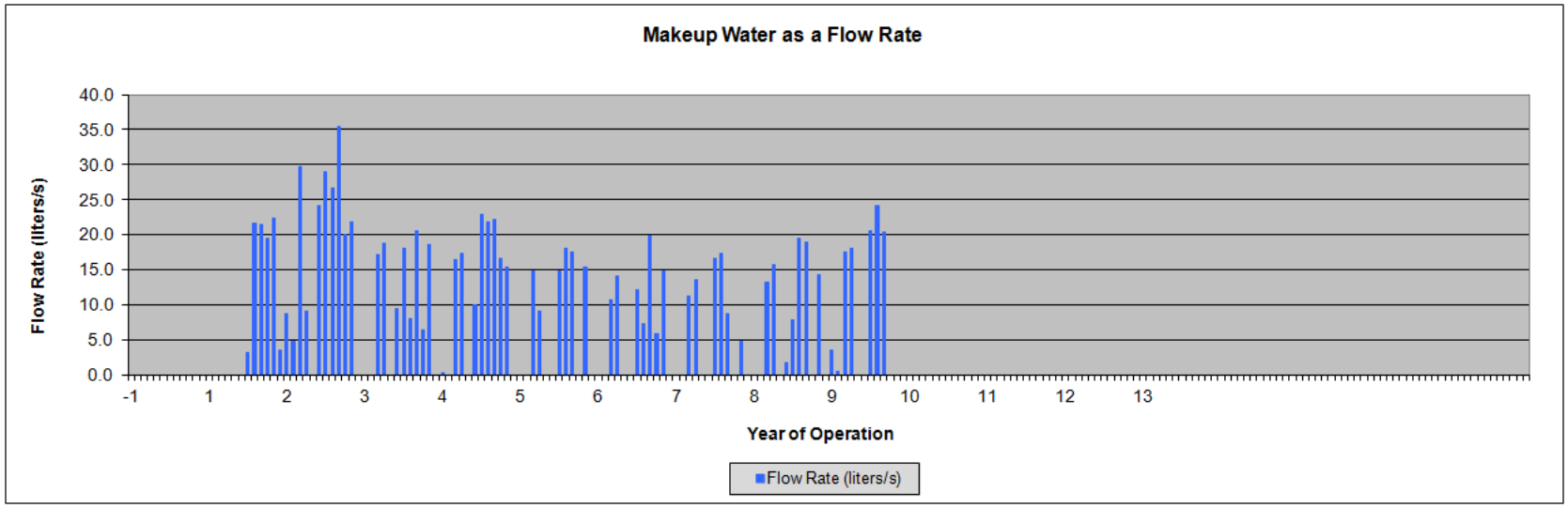

Water in Event Ponds - Individual Pond Volumes
Volume (m3)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Not Used
Not Used
Not Used
Rinsing Pond
Raincoat Pond-Not Used

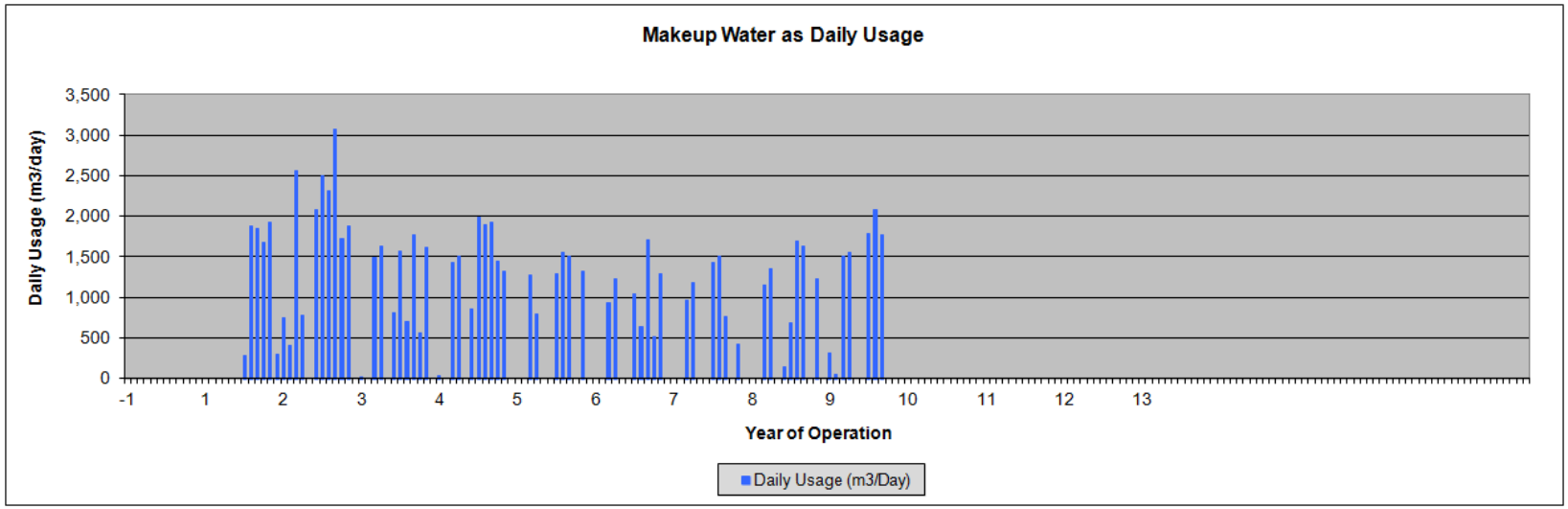

Pond Depths
Depth (m)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Rinsing Pond
Raincoat Pond-Not Used

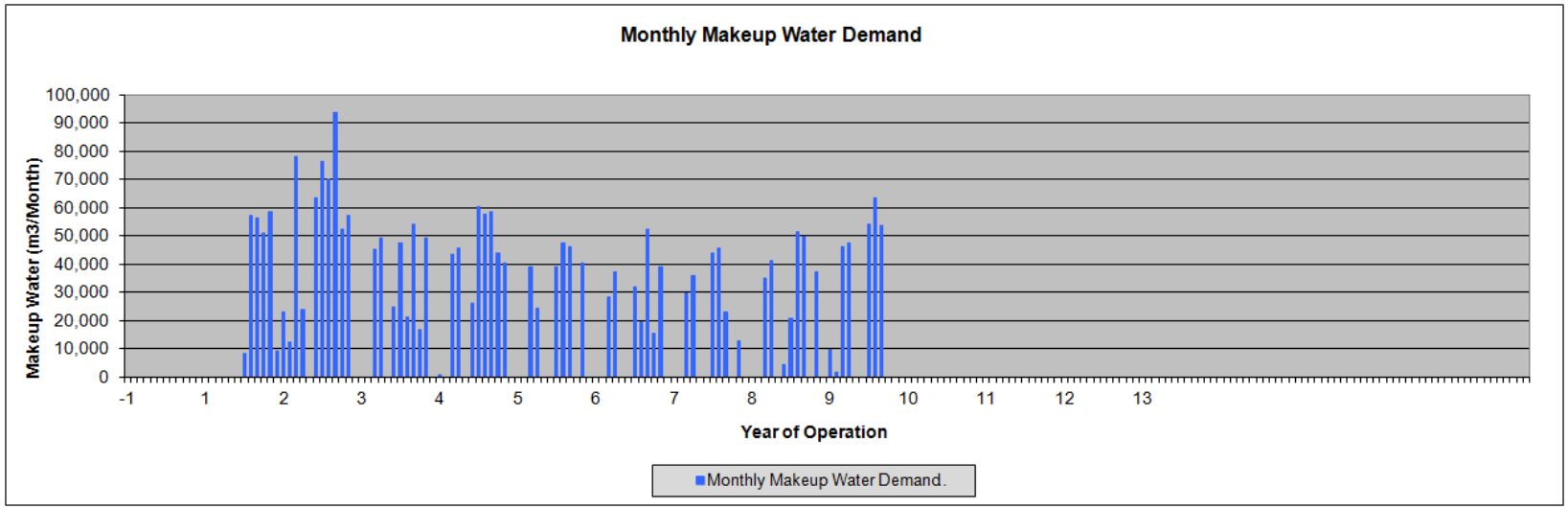

Desired Available Storage Capacity
Storage Capacity (m3)
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Desired Available Storage (m3)
Storage Shortfall (m3)

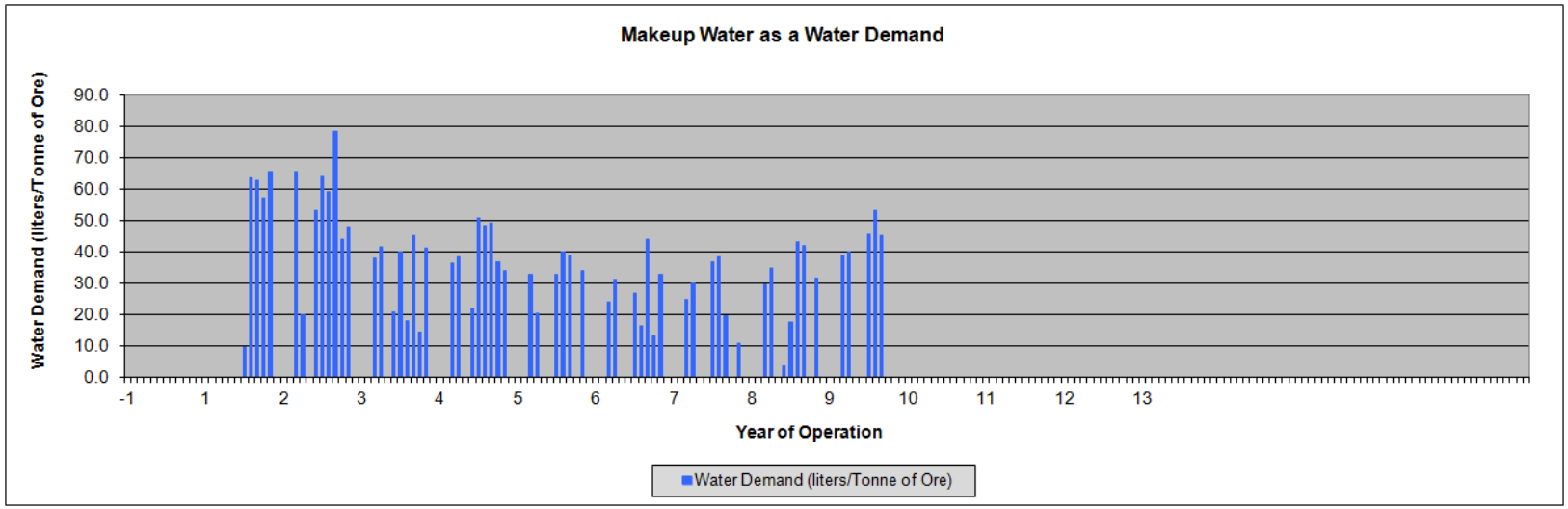

Uncontrolled Discharge from Ponds
Volume (m3)
1
1
1
1
1
1
0
0
0
0
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Discharged from System Ponds
Discharged from Raincoat Pond


Summary of Significant Losses in the System
Volume (m3)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Sprinkler/Emitter Losses
Wetting of the Ore
Evaporation from Ponds
ET on Pad Surface


Makeup Water as a Flow Rate
Flow Rate (liters/s)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Flow Rate (liters/s)

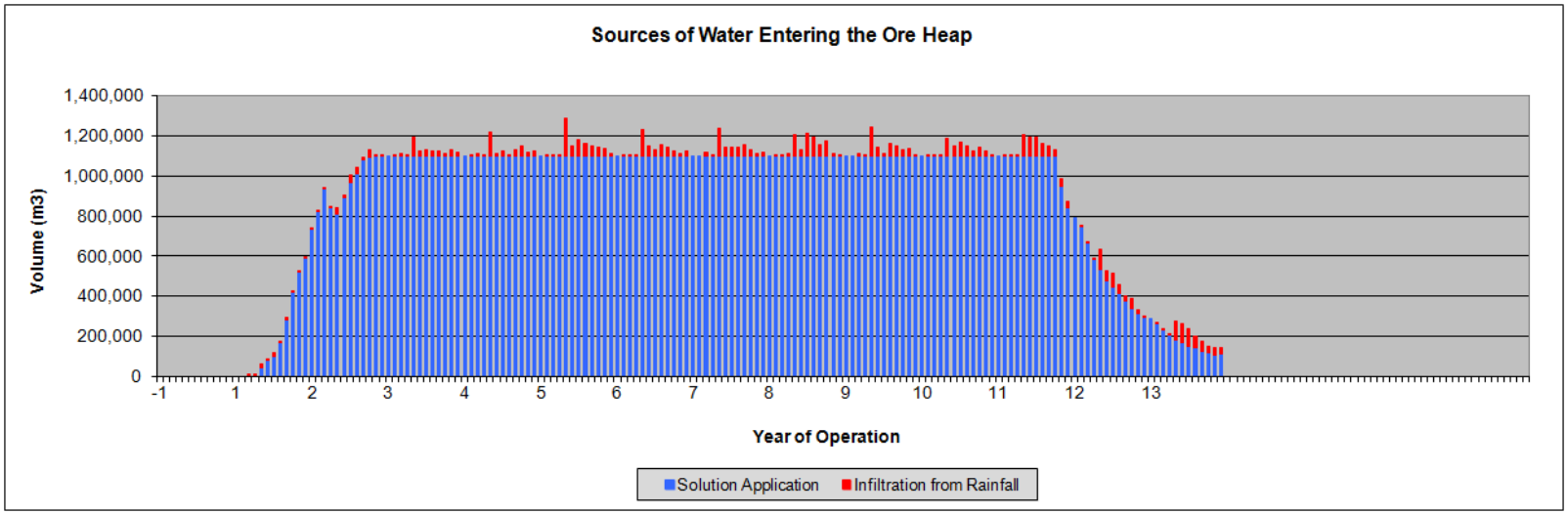

Makeup Water as Daily Usage
Daily Usage (m3/day)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Daily Usage (m3/Day)

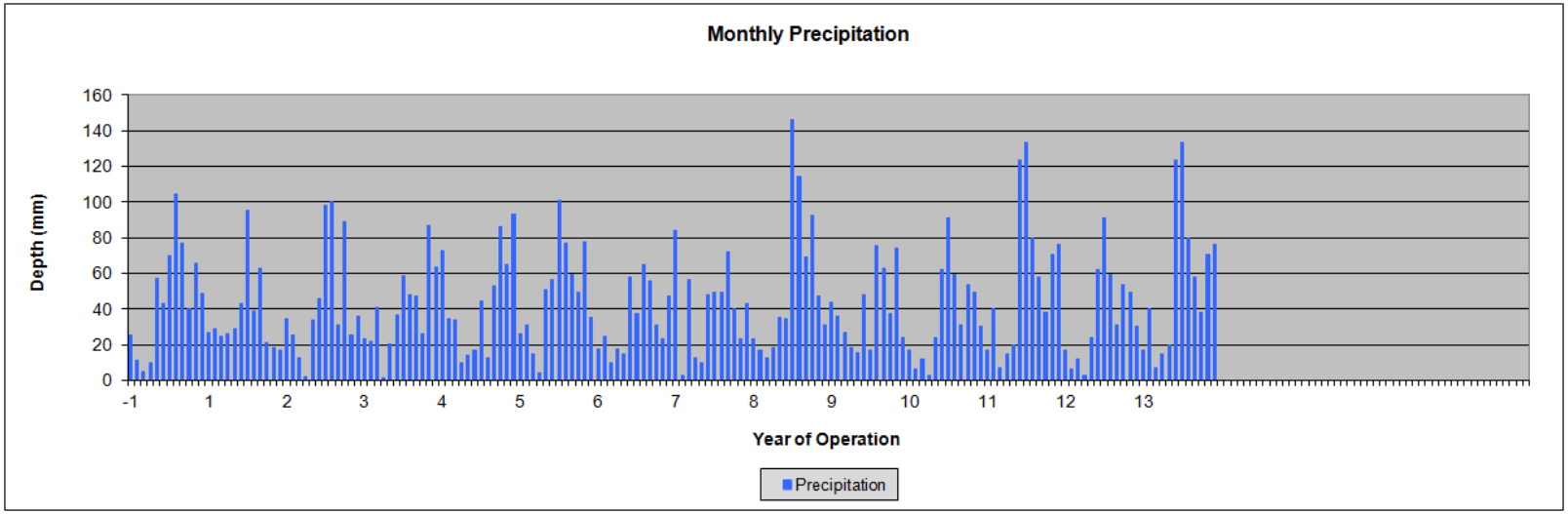

Monthly Makeup Water Demand
Makeup Water (m3/Month)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Monthly Makeup Water Demand.

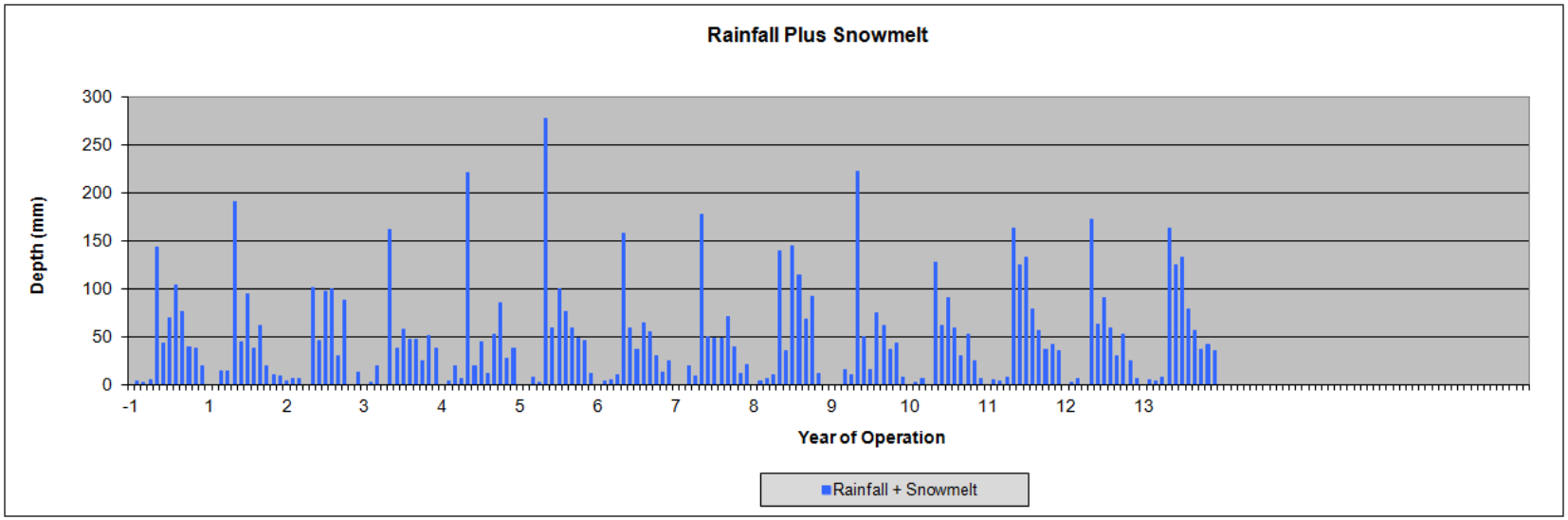

Makeup Water as a Water Demand
Water Demand (liters/Tonne of Ore)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Water Demand (liters/Tonne of Ore)

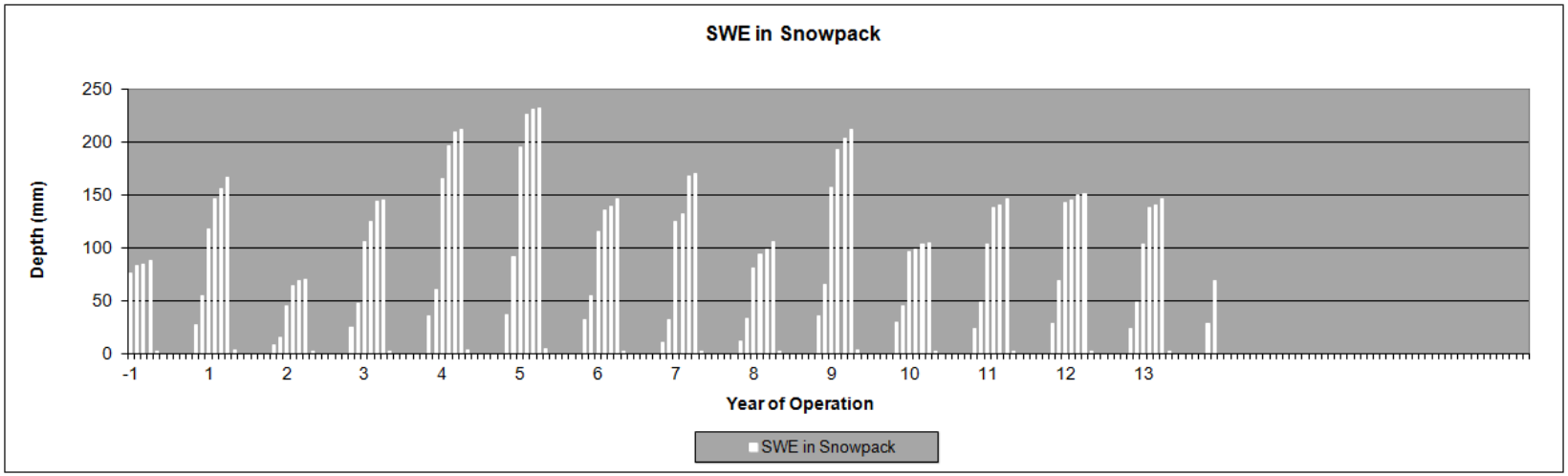
Results Summary - Deterministic Model – Wetter Precip with High Variability – 6 Liters/Second Pumping to Treatment Beginning Yr 9

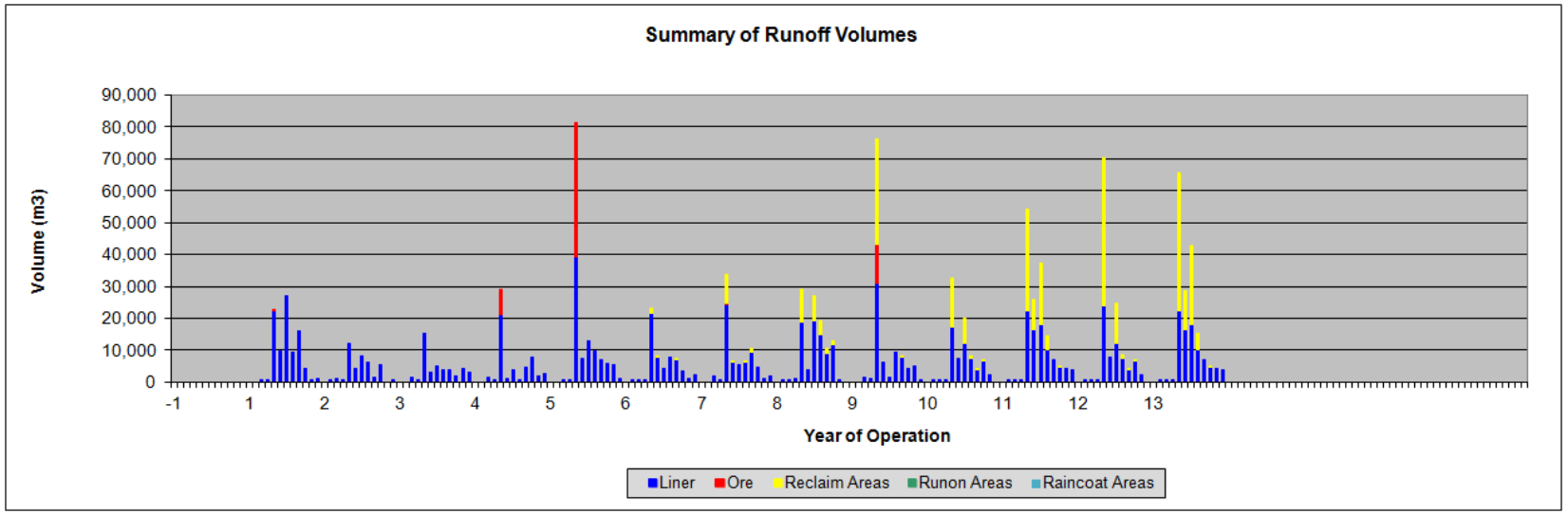
Parameter	Phase	Max	Mean	Min
Water in Stored in Ponds (m3)	**1**	36,608	12,1780	5159
	2	82,669	18,215	9236
	3	212,336	33,274	4757
	4	228,873	120,297	28,184
	5	234,205	185,524	116,026
Runoff from Reclaimed Areas (m3/month)	**1**	0	0	0
	2	0	0	0
	3	32,931	1321	0
	4	31,795	3560	0
	5	46,529	5826	0
Outside Makeup Water (m3/month)	**1**	88,412	33,637	0
	2	72,091	27,387	0
	3	48,835	13,894	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/s)	**1**	33.6	12.8	0
	2	27.4	10.4	0
	3	18.6	5.3	0
	4	0	0	0
	5	0	0	0
Outside Makeup Water (liters/tonne of ore)	**1**	78.1	29.6	0
	2	60.5	23.0	0
	3	41.0	11.3	0
	4	0	0	0
	5	0	0	0
% of Time Makeup Water Demand is Zero	**1**	---	27.3%	---
	2	---	30.8%	---
	3	---	49.1%	---
	4	---	100.0%	---
	5	---	100.0%	---

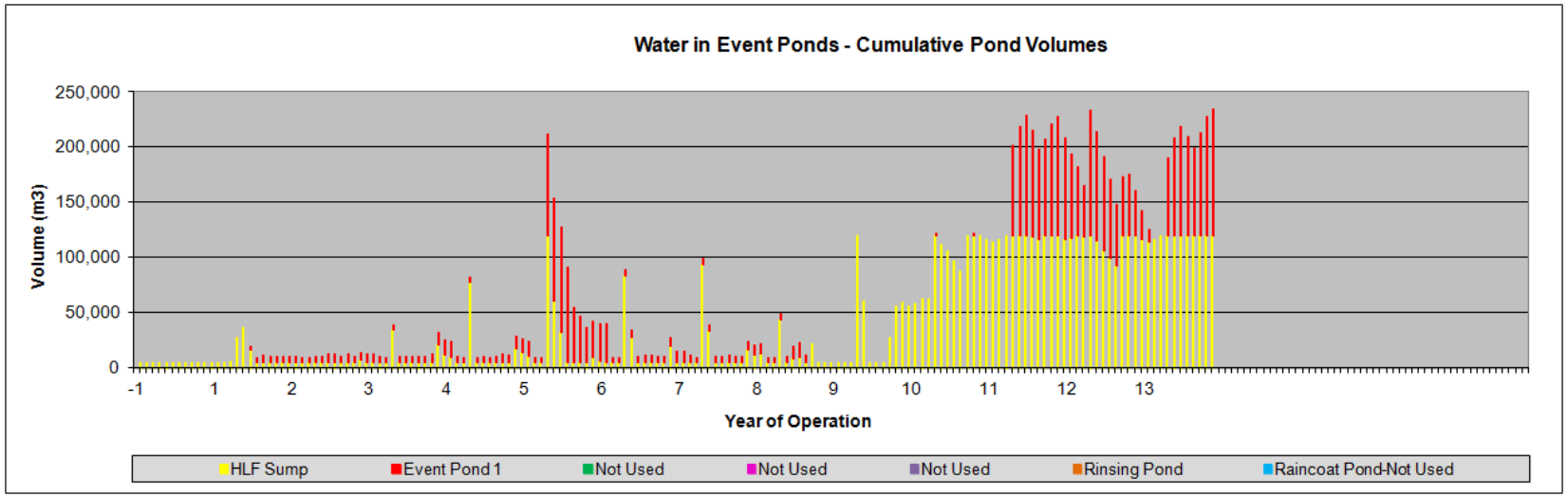

Sources of Water Entering the Ore Heap
Volume (m3)
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Solution Application
Infiltration from Rainfall

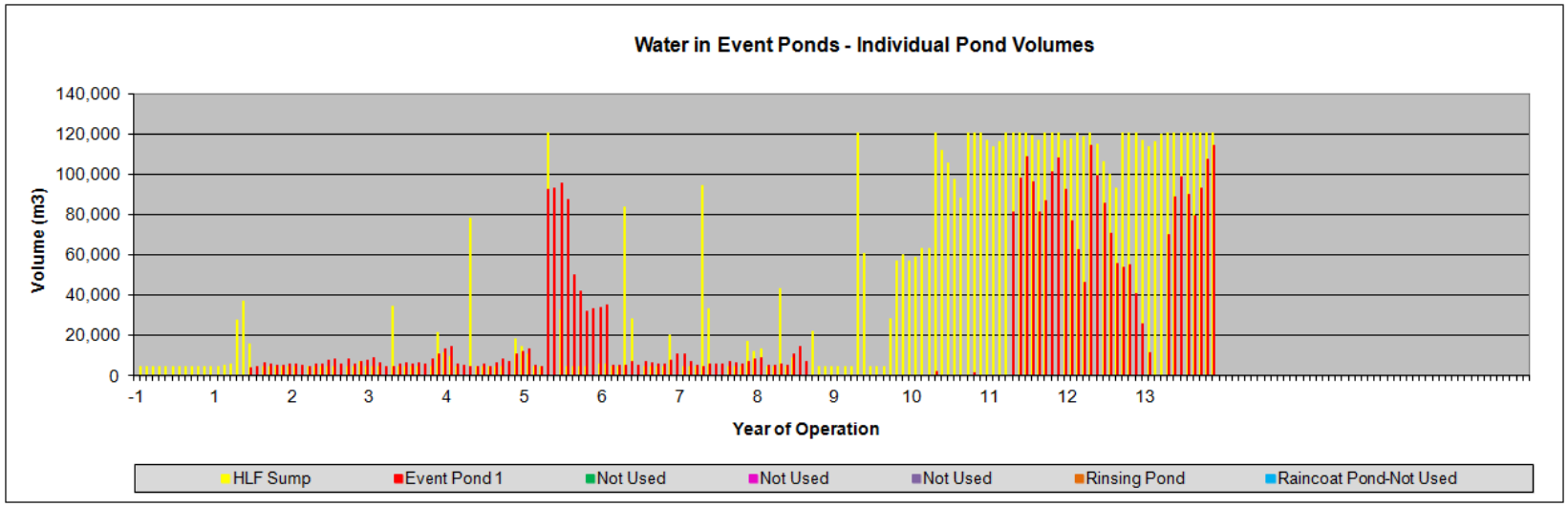

Monthly Precipitation
Depth (mm)
160
140
120
100
80
60
40
20
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Precipitation

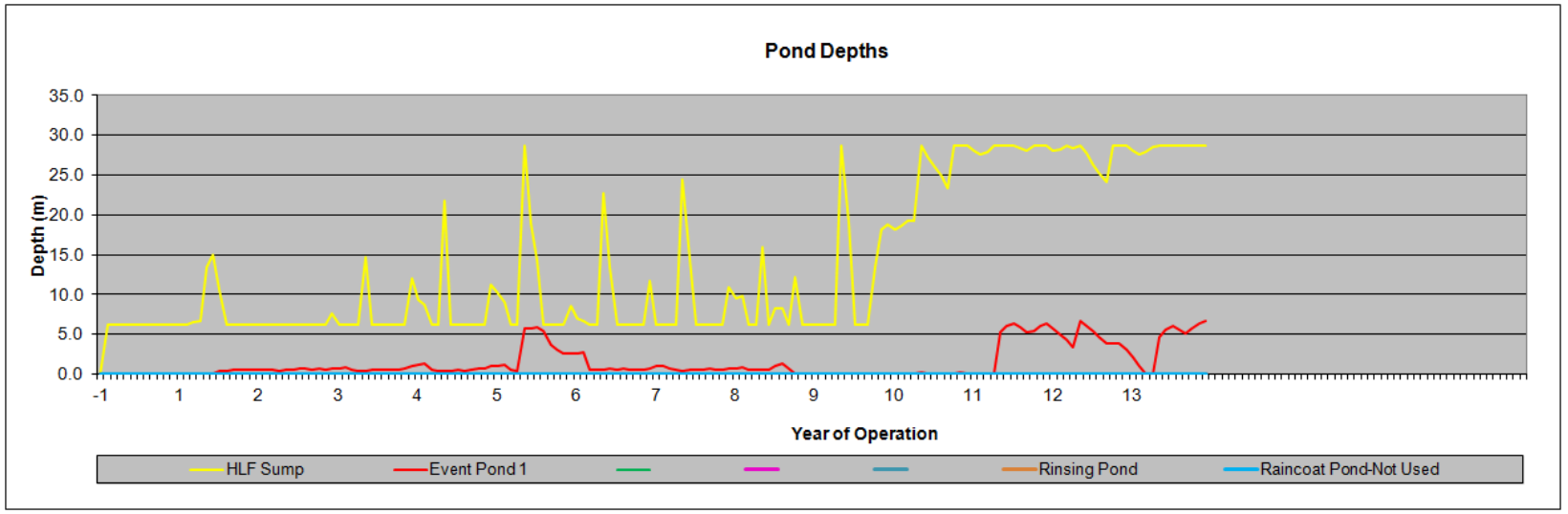

Rainfall Plus Snowmelt
Depth (mm)
300
250
200
150
100
50
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Rainfall + Snowmelt

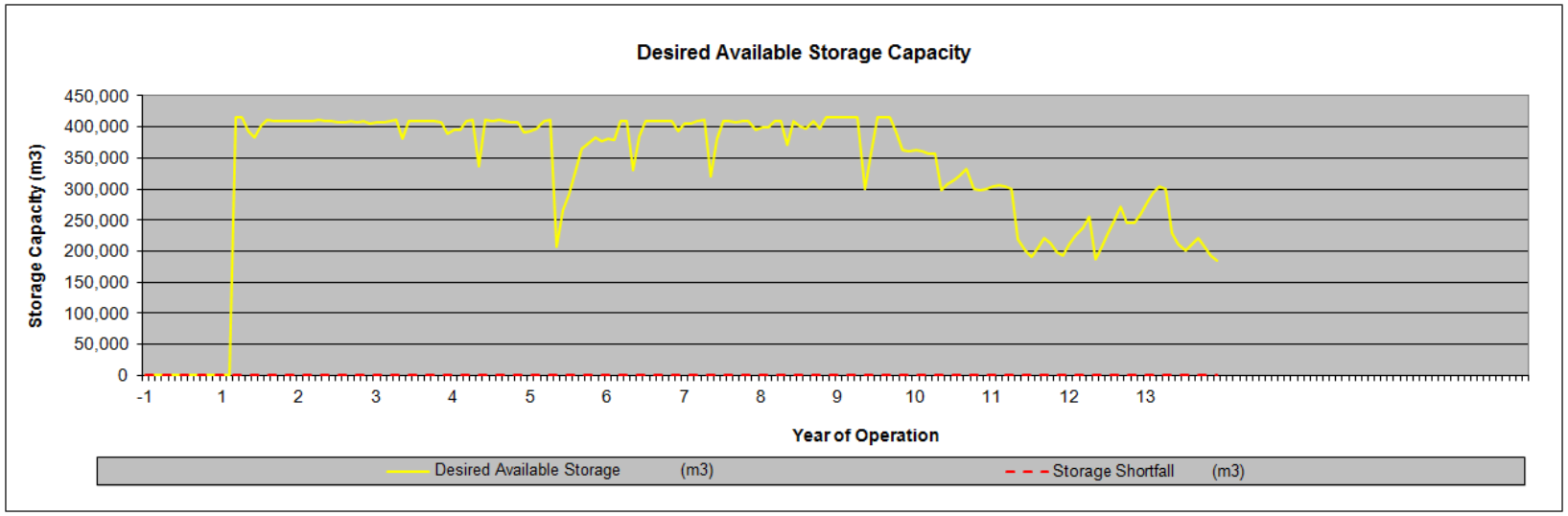

SWE in Snowpack
Depth (mm)
250
200
150
100
50
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
SWE in Snowpack

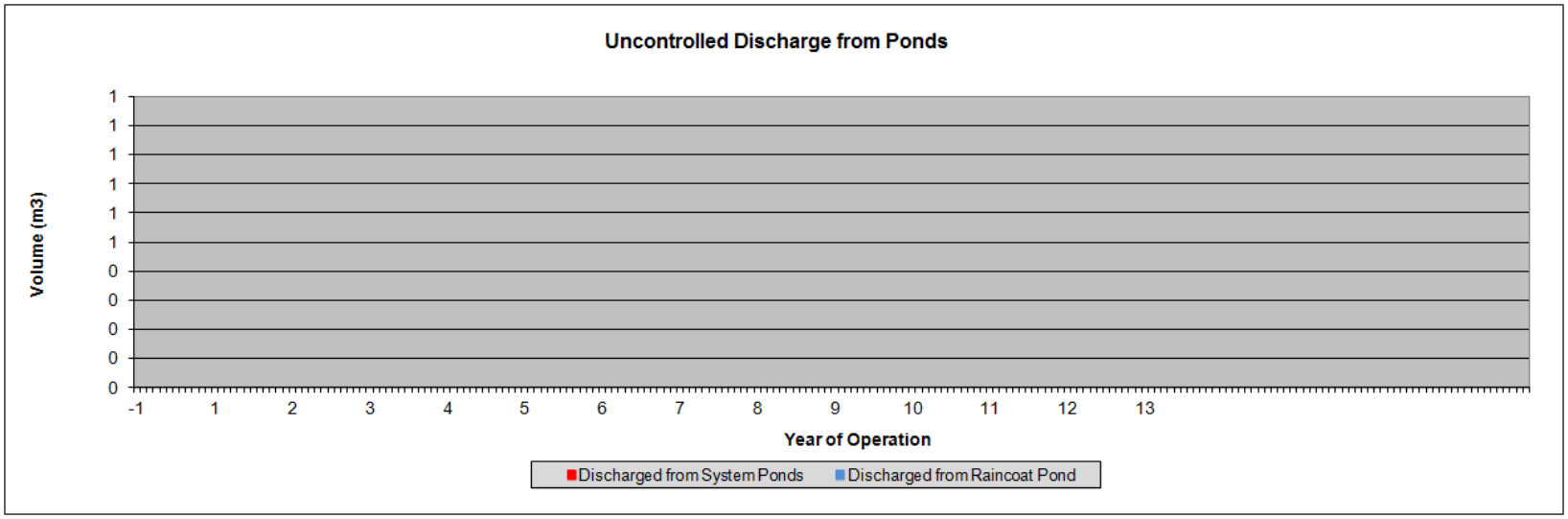

Summary of Runoff Volumes
Volume (m3)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Liner
Ore
Reclaim Areas
Runon Areas
Raincoat Areas

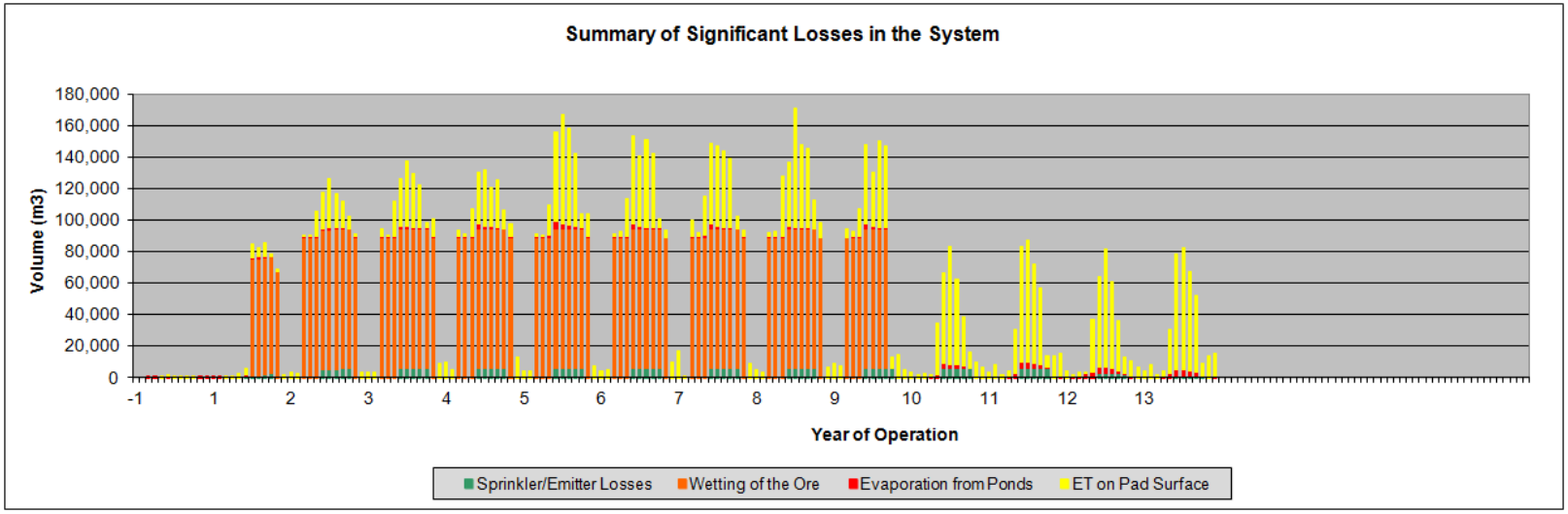

Water in Event Ponds - Cumulative Pond Volumes
Volume (m3)
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Not Used
Not Used
Not Used
Rinsing Pond
Raincoat Pond-Not Used

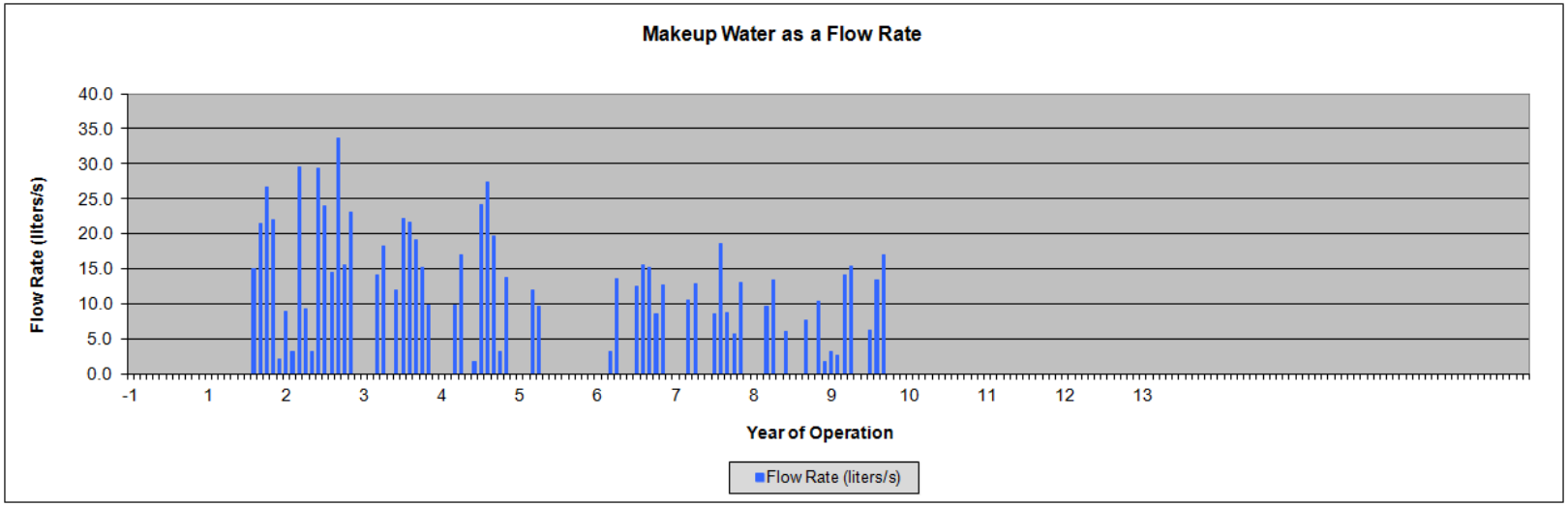

Water in Event Ponds - Individual Pond Volumes
Volume (m3)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Not Used
Not Used
Not Used
Rinsing Pond
Raincoat Pond-Not Used

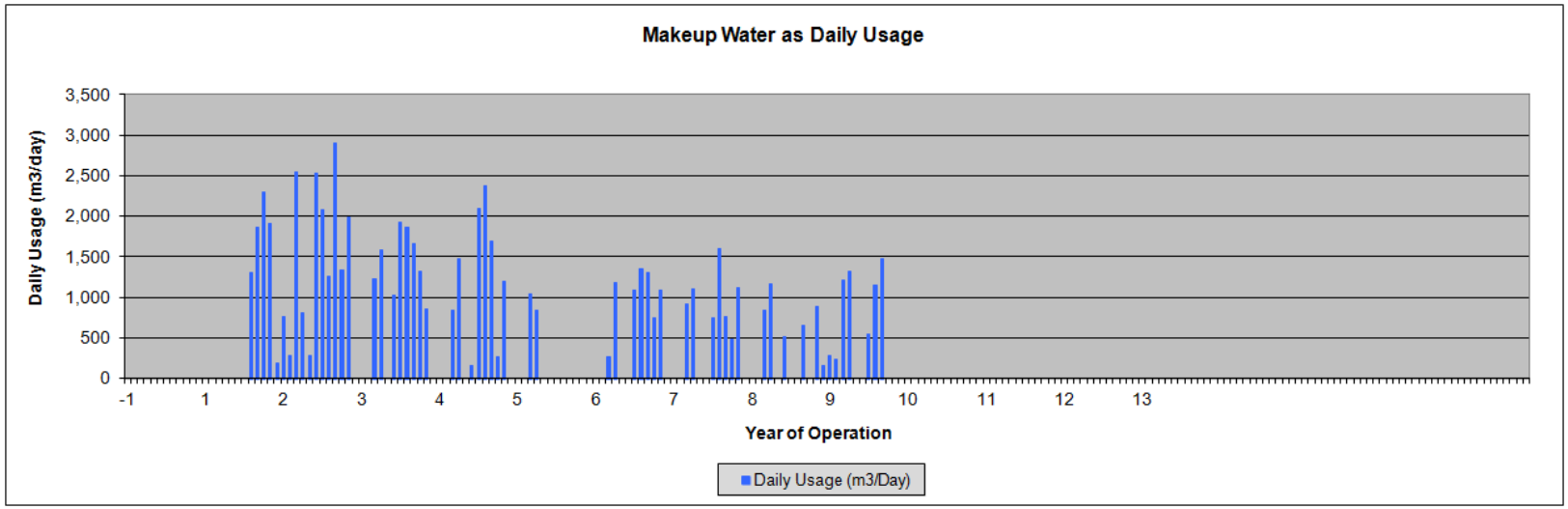

Pond Depths
Depth (m)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
HLF Sump
Event Pond 1
Rinsing Pond
Raincoat Pond-Not Used

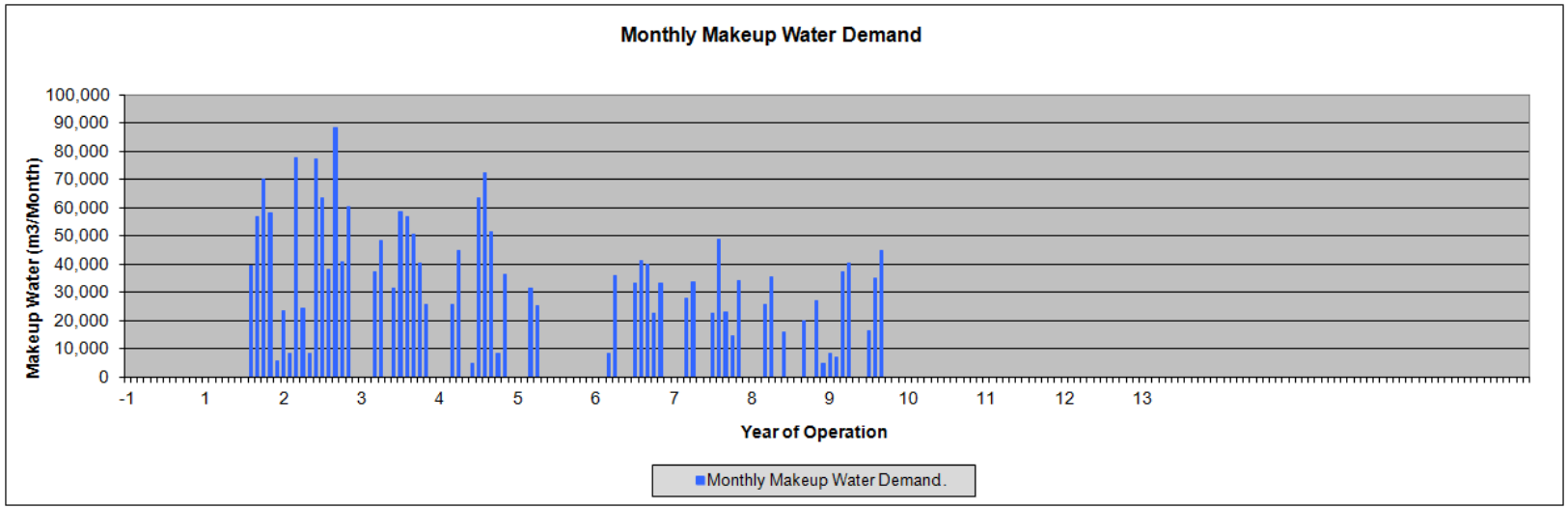

Desired Available Storage Capacity
Storage Capacity (m3)
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Desired Available Storage (m3)
Storage Shortfall (m3)

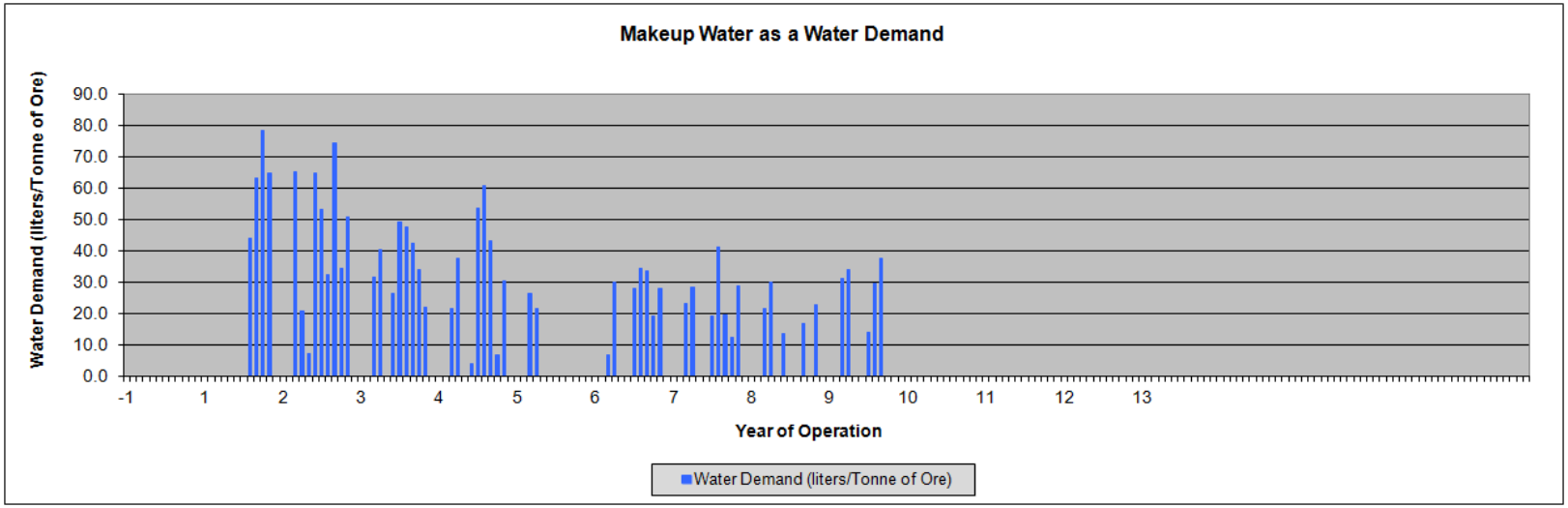

Uncontrolled Discharge from Ponds
Volume (m3)
1
1
1
1
1
1
0
0
0
0
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Discharged from System Ponds
Discharged from Raincoat Pond


Summary of Significant Losses in the System
Volume (m3)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Sprinkler/Emitter Losses
Wetting of the Ore
Evaporation from Ponds
ET on Pad Surface


Makeup Water as a Flow Rate
Flow Rate (liters/s)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Flow Rate (liters/s)


Makeup Water as Daily Usage
Daily Usage (m3/day)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Daily Usage (m3/Day)

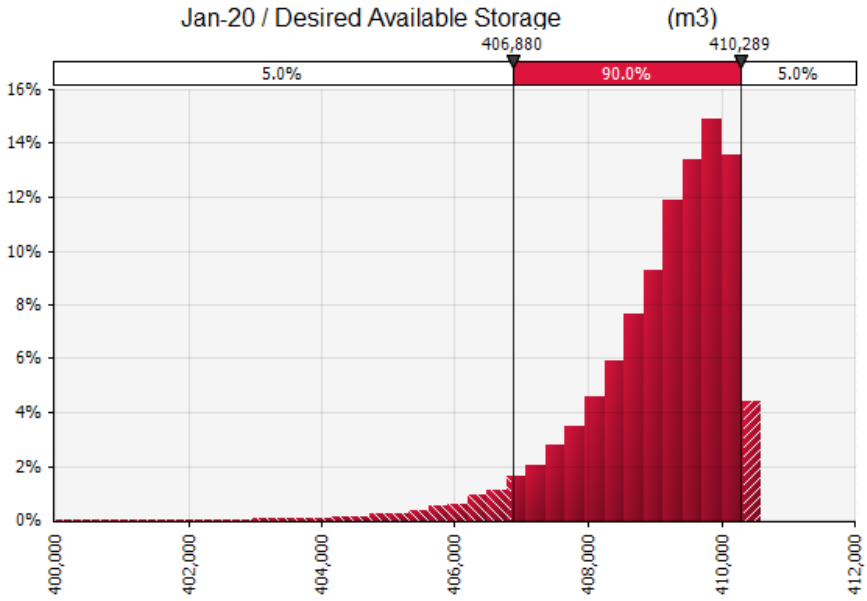

Monthly Makeup Water Demand
Makeup Water (m3/Month)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Monthly Makeup Water Demand.


Makeup Water as a Water Demand
Water Demand (liters/Tonne of Ore)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
-1
1
2
3
4
5
6
7
8
9
10
11
12
13
Year of Operation
Water Demand (liters/Tonne of Ore)

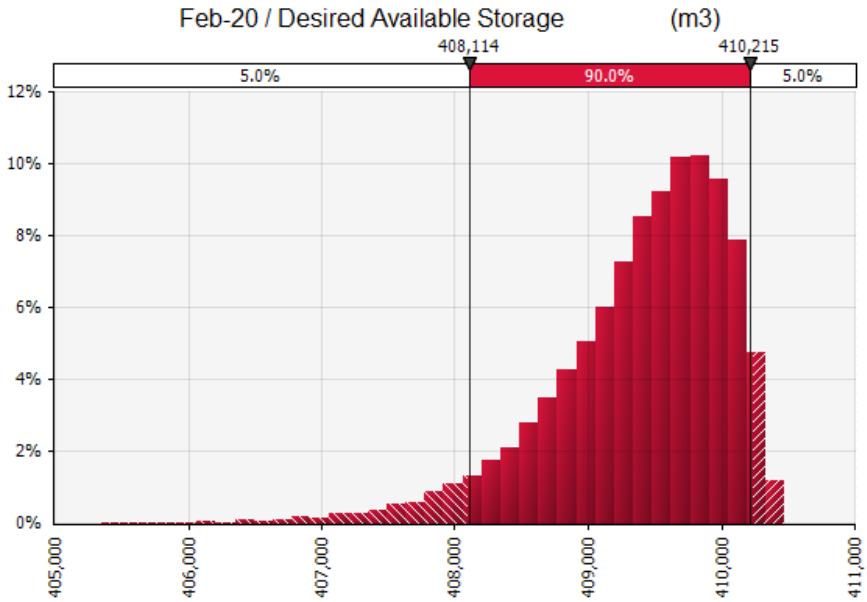
Appendix B
Stochastic Modeling Results
Desired Available Storage

Phase 1 Results

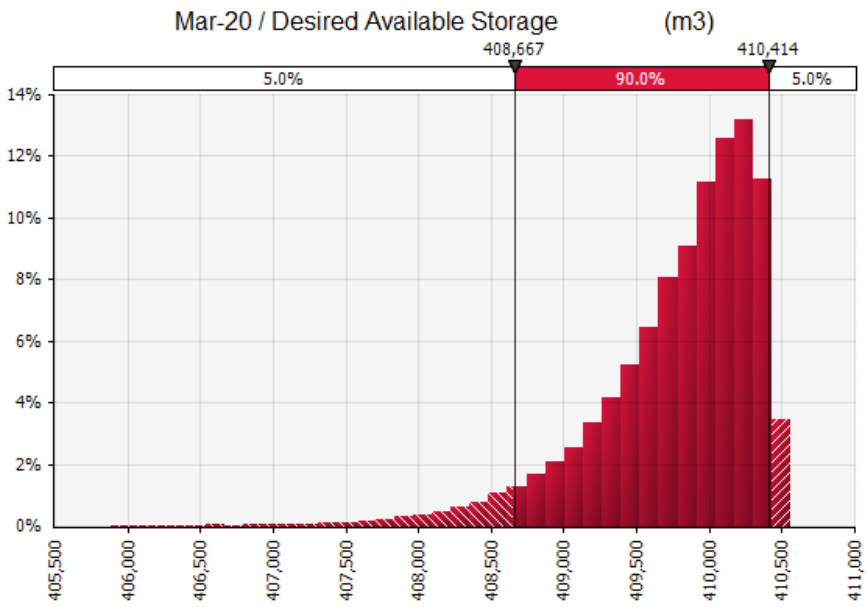
Desired Available Storage



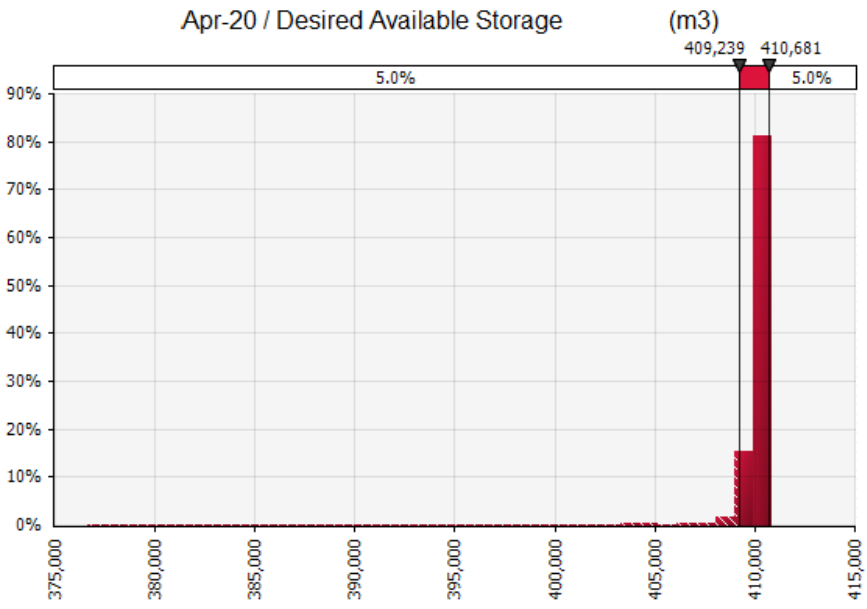
	Jan-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	400,021.97
Maximum	410,598.69
Mean	409,058.23
90% CI	± 25.90
Mode	410,017.87
Median	409,335.86
Std Dev	1,113.01
Skewness	-1.5824
Kurtosis	6.8337
Values	5000
Errors	0
Filtered	0
Left X	406,880
Left P	5.0%
Right X	410,289
Right P	95.0%
Dif. X	3,409.26
Dif. P	90.0%



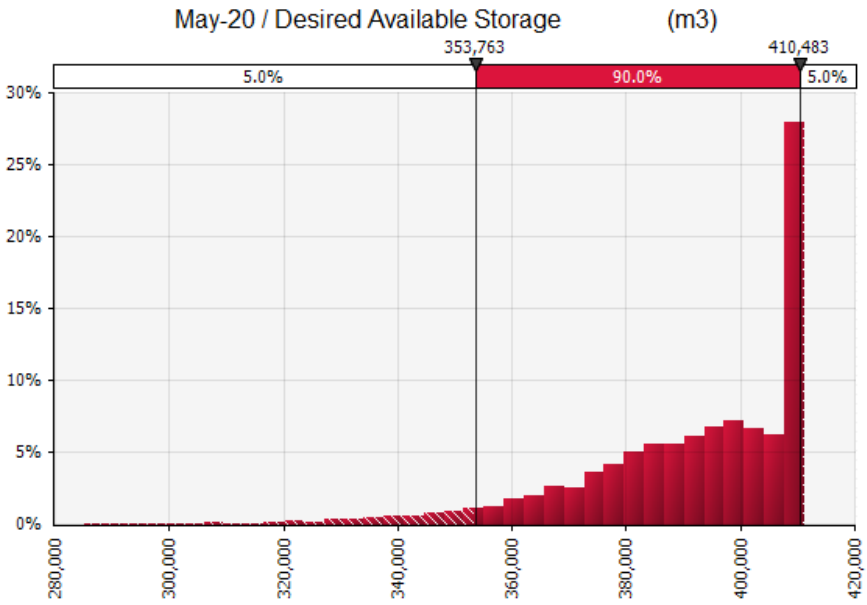
	Feb-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	405,356.04
Maximum	410,478.82
Mean	409,394.28
90% CI	± 15.50
Mode	409,737.68
Median	409,526.01
Std Dev	666.40
Skewness	-1.2201
Kurtosis	5.1247
Values	5000
Errors	0
Filtered	0
Left X	408,114
Left P	5.0%
Right X	410,215
Right P	95.0%
Dif. X	2,100.59



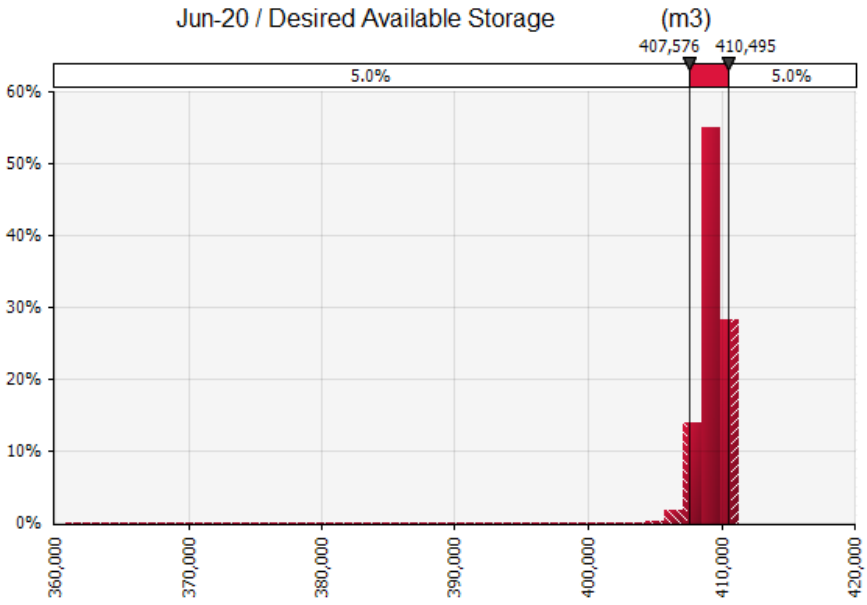
	Mar-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	405,886.24
Maximum	410,562.63
Mean	409,788.18
90% CI	± 13.21
Mode	410,064.81
Median	409,932.62
Std Dev	567.80
Skewness	-1.5756
Kurtosis	6.6154
Values	5000
Errors	0
Filtered	0
Left X	408,667
Left P	5.0%
Right X	410,414
Right P	95.0%
Dif. X	1,746.70



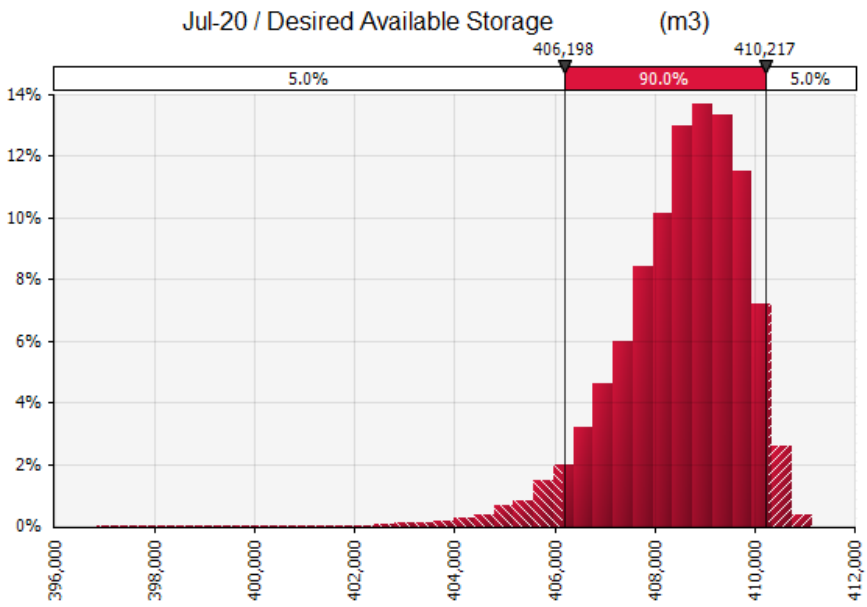
	Apr-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	376,636.63
Maximum	410,894.44
Mean	410,102.80
90% CI	± 33.52
Mode	410,565.91
Median	410,361.44
Std Dev	1,440.93
Skewness	-11.1437
Kurtosis	171.1414
Values	5000
Errors	0
Filtered	0
Left X	409,239
Left P	5.0%
Right X	410,681
Right P	95.0%
Dif. X	1,442.63
Dif. P	90.0%



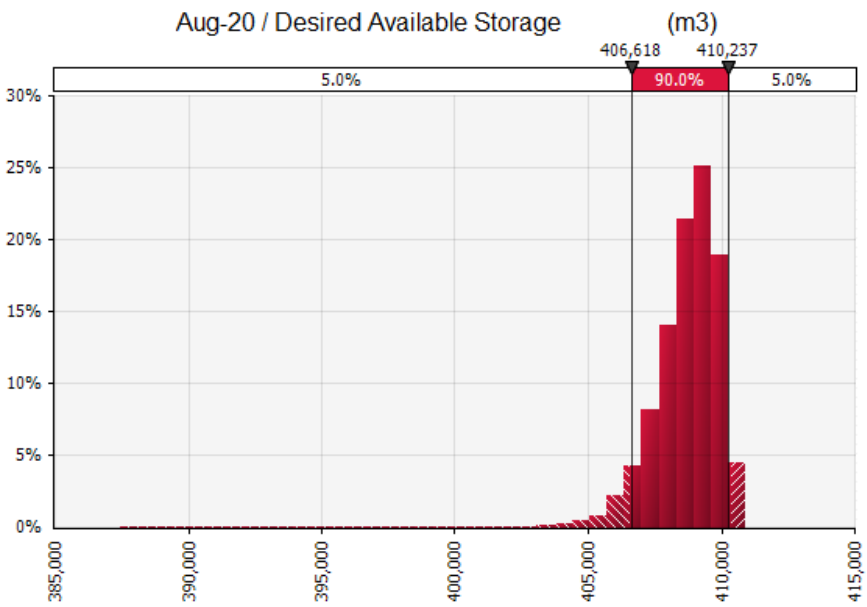
	May-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	285,049.37
Maximum	411,205.17
Mean	391,477.40
90% CI	± 447.63
Mode	410,323.44
Median	396,095.50
Std Dev	19,239.51
Skewness	-1.2655
Kurtosis	4.6927
Values	5000
Errors	0
Filtered	0
Left X	353,763
Left P	5.0%
Right X	410,483
Right P	95.0%
Dif. X	56,720.08



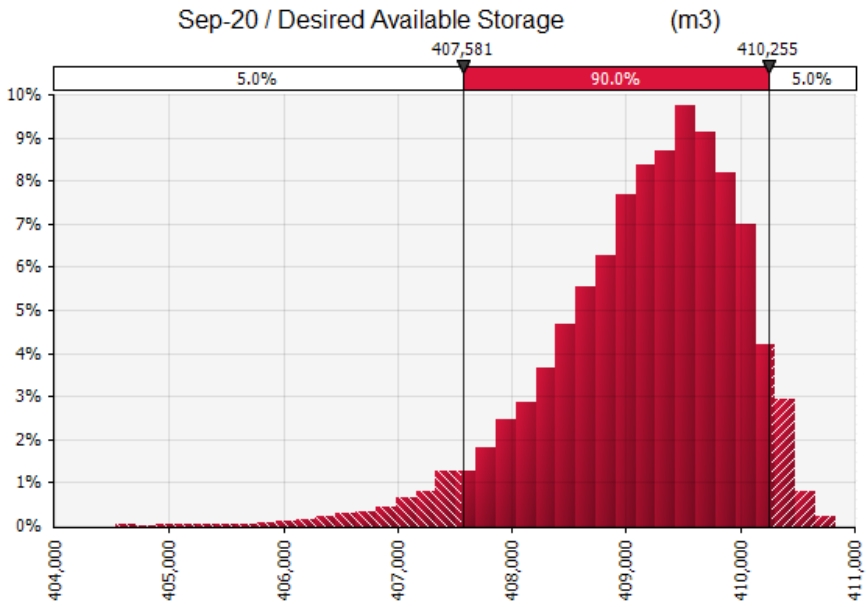
	Jun-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	360,815.70
Maximum	411,291.93
Mean	409,202.90
90% CI	± 42.16
Mode	409,592.85
Median	409,445.02
Std Dev	1,812.12
Skewness	-12.1673
Kurtosis	232.2999
Values	5000
Errors	0
Filtered	0
Left X	407,576
Left P	5.0%
Right X	410,495
Right P	95.0%
Dif. X	2,918.22
Dif. P	90.0%



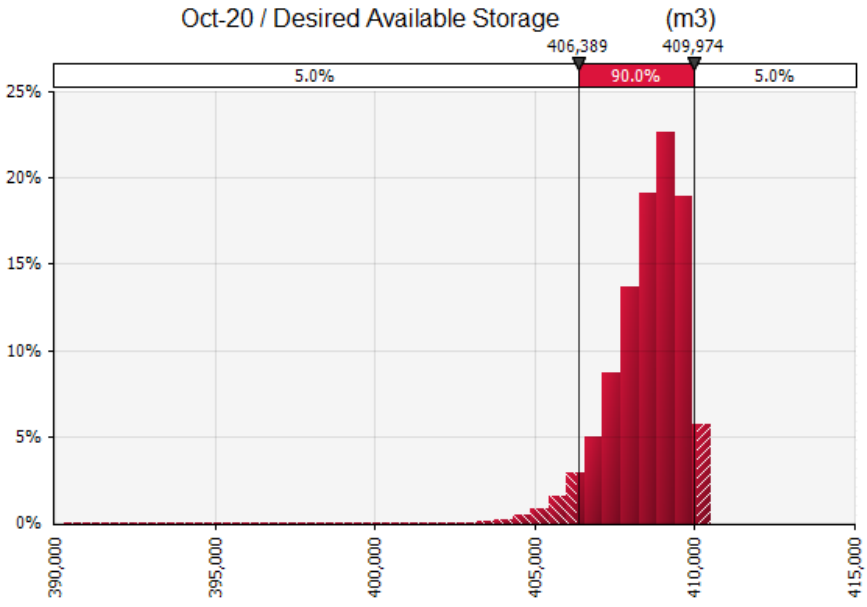
	Jul-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	396,835.83
Maximum	411,147.41
Mean	408,536.76
90% CI	± 29.32
Mode	408,946.16
Median	408,727.78
Std Dev	1,260.41
Skewness	-1.0461
Kurtosis	5.4953
Values	5000
Errors	0
Filtered	0
Left X	406,198
Left P	5.0%
Right X	410,217
Right P	95.0%
Dif. X	4,019.33
Dif. P	90.0%



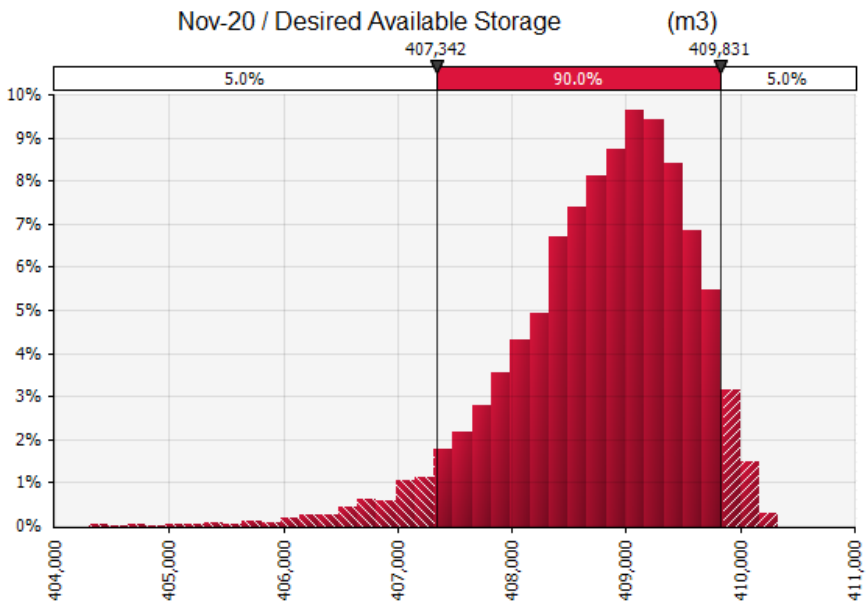
	Aug-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	387,441.39
Maximum	410,922.68
Mean	408,739.81
90% CI	± 27.23
Mode	409,225.97
Median	408,925.75
Std Dev	1,170.37
Skewness	-2.1229
Kurtosis	26.3259
Values	5000
Errors	0
Filtered	0
Left X	406,618
Left P	5.0%
Right X	410,237
Right P	95.0%
Dif. X	3,618.27



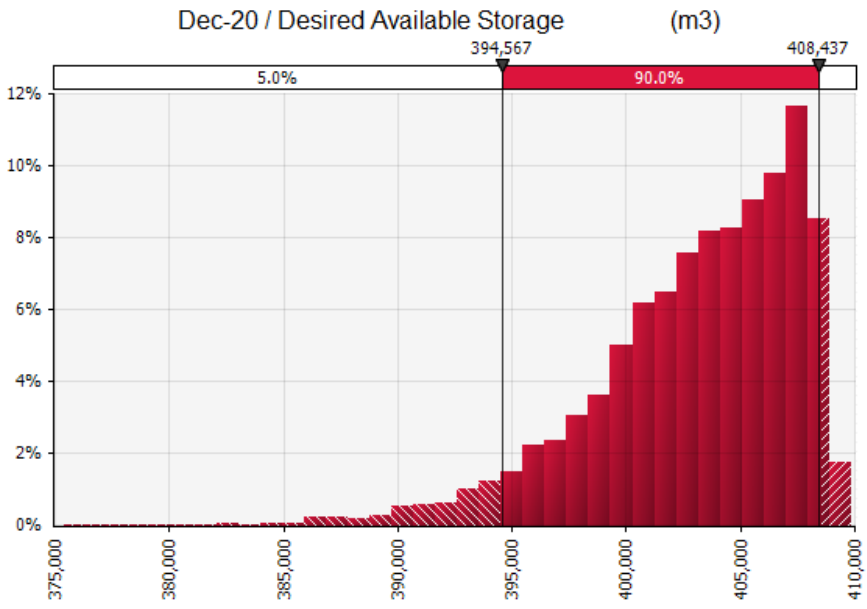
	Sep-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	404,535.39
Maximum	410,834.64
Mean	409,150.79
90% CI	± 19.25
Mode	409,536.67
Median	409,277.74
Std Dev	827.36
Skewness	-0.9491
Kurtosis	4.2952
Values	5000
Errors	0
Filtered	0
Left X	407,581
Left P	5.0%
Right X	410,255
Right P	95.0%
Dif. X	2,674.71



	Oct-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	390,253.95
Maximum	410,500.47
Mean	408,531.59
90% CI	± 26.92
Mode	409,201.71
Median	408,739.22
Std Dev	1,156.92
Skewness	-1.8034
Kurtosis	16.7689
Values	5000
Errors	0
Filtered	0
Left X	406,389
Left P	5.0%
Right X	409,974
Right P	95.0%
Dif. X	3,584.68
Dif. P	90.0%



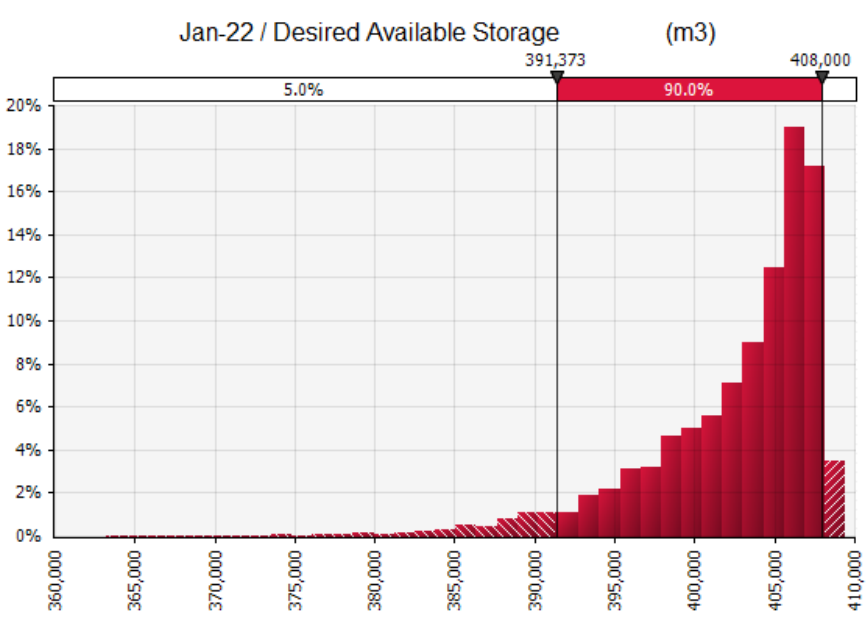
	Nov-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	404,301.94
Maximum	410,334.21
Mean	408,778.04
90% CI	± 18.08
Mode	409,316.26
Median	408,893.18
Std Dev	777.13
Skewness	-0.8981
Kurtosis	4.1987
Values	5000
Errors	0
Filtered	0
Left X	407,342
Left P	5.0%
Right X	409,831
Right P	95.0%
Dif. X	2,488.74



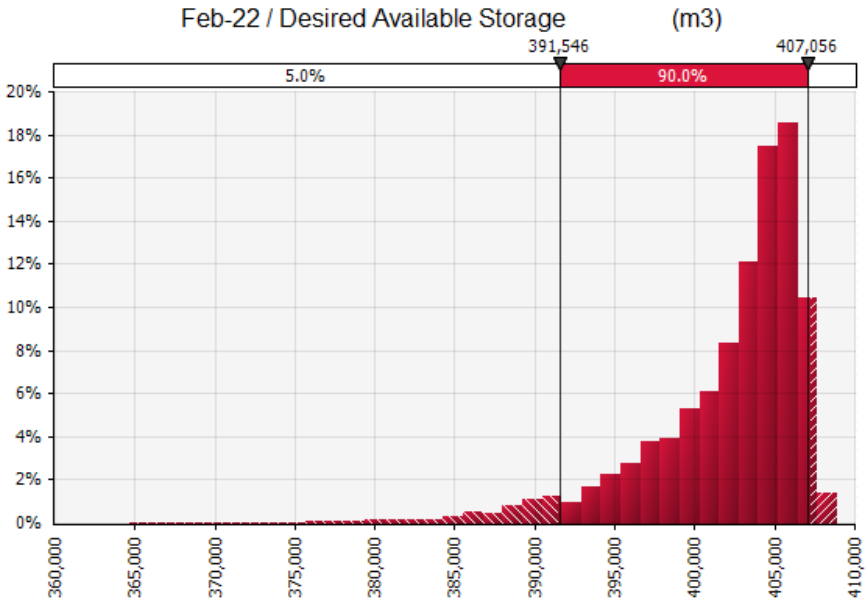
	Dec-20 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	375,362.33
Maximum	409,863.06
Mean	403,144.96
90% CI	± 104.06
Mode	407,762.84
Median	404,008.36
Std Dev	4,472.44
Skewness	-1.1491
Kurtosis	4.7046
Values	5000
Errors	0
Filtered	0
Left X	394,567
Left P	5.0%
Right X	408,437
Right P	95.0%
Dif. X	13,869.64

Phase 2 Results

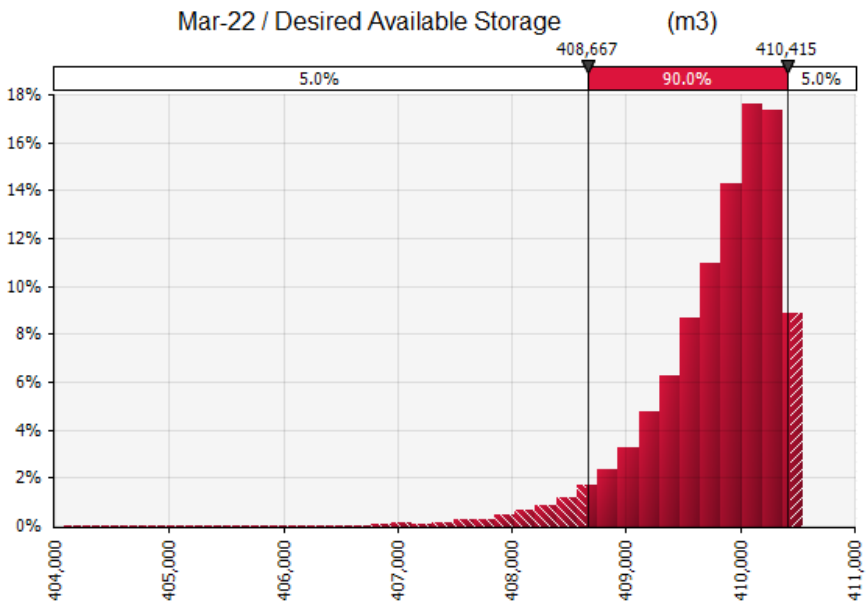
Desired Available ~~Emergency~~ Storage



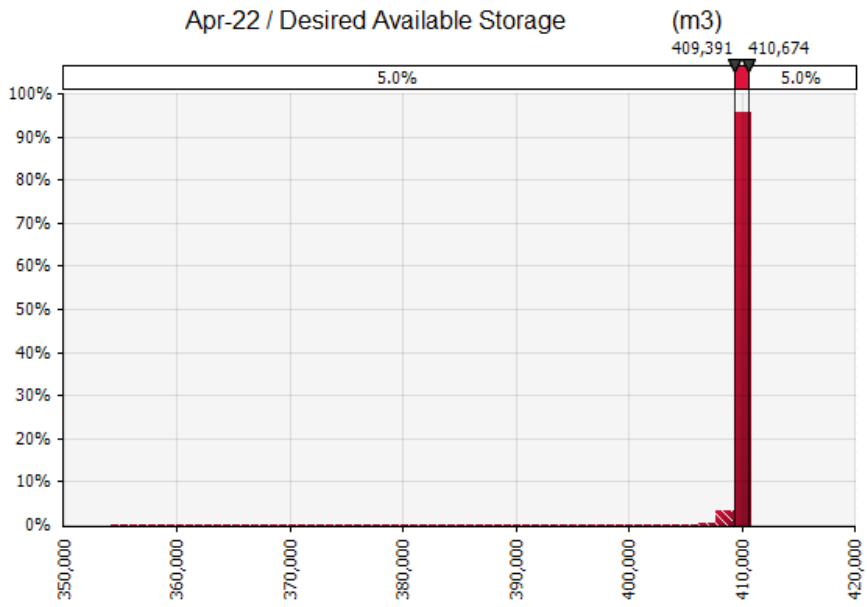
	Jan-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	363,257.73
Maximum	409,445.43
Mean	402,681.52
90% CI	± 127.67
Mode	407,277.85
Median	404,576.34
Std Dev	5,487.42
Skewness	-1.6921
Kurtosis	6.6525
Values	5000
Errors	0
Filtered	0
Left X	391,373
Left P	5.0%
Right X	408,000
Right P	95.0%
Dif. X	16,627.74
Dif. P	90.0%



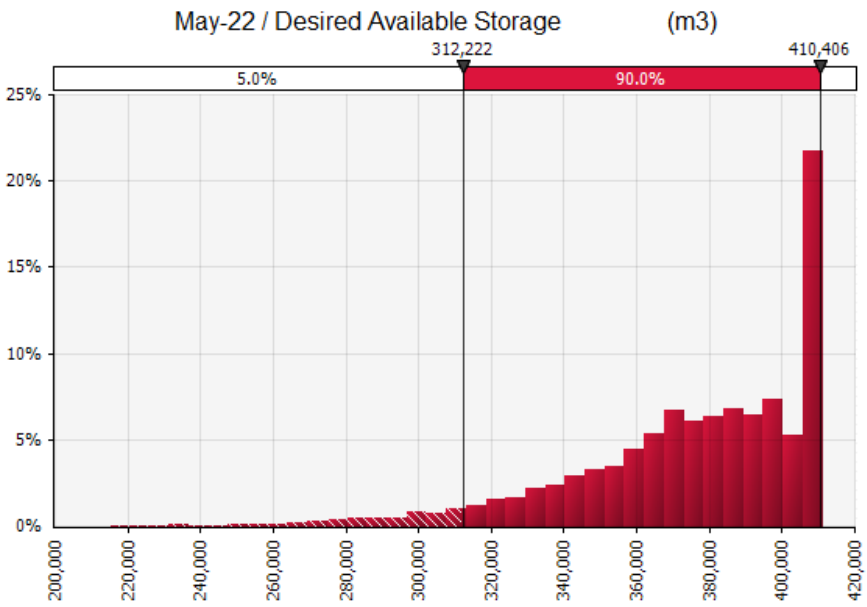
	Feb-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	364,620.98
Maximum	408,919.66
Mean	402,161.22
90% CI	± 115.60
Mode	405,522.68
Median	403,775.05
Std Dev	4,968.51
Skewness	-1.8024
Kurtosis	7.3233
Values	5000
Errors	0
Filtered	0
Left X	391,546
Left P	5.0%
Right X	407,056
Right P	95.0%
Dif. X	15,510.06



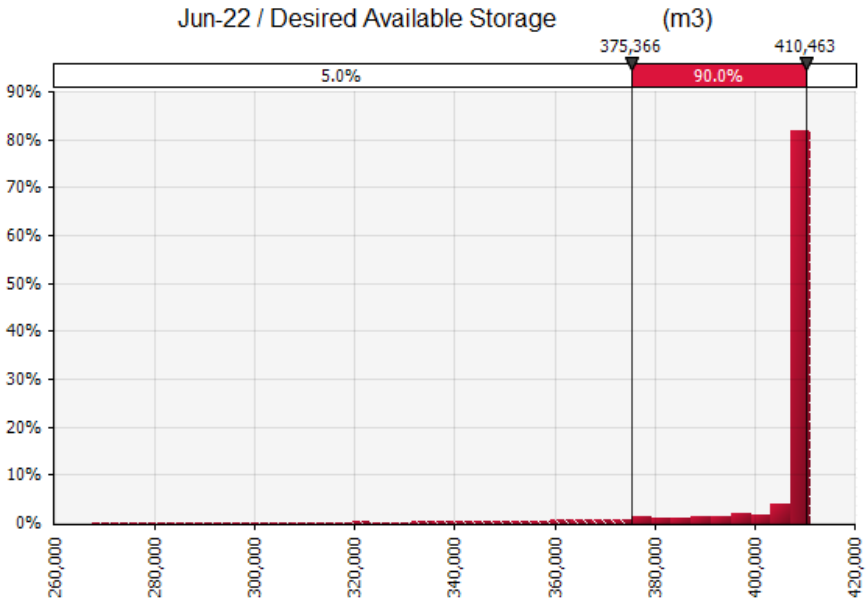
	Mar-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	404,063.14
Maximum	410,553.09
Mean	409,792.42
90% CI	± 13.29
Mode	410,190.30
Median	409,935.85
Std Dev	571.17
Skewness	-1.6792
Kurtosis	8.0161
Values	5000
Errors	0
Filtered	0
Left X	408,667
Left P	5.0%
Right X	410,415
Right P	95.0%
Dif. X	1,748.04



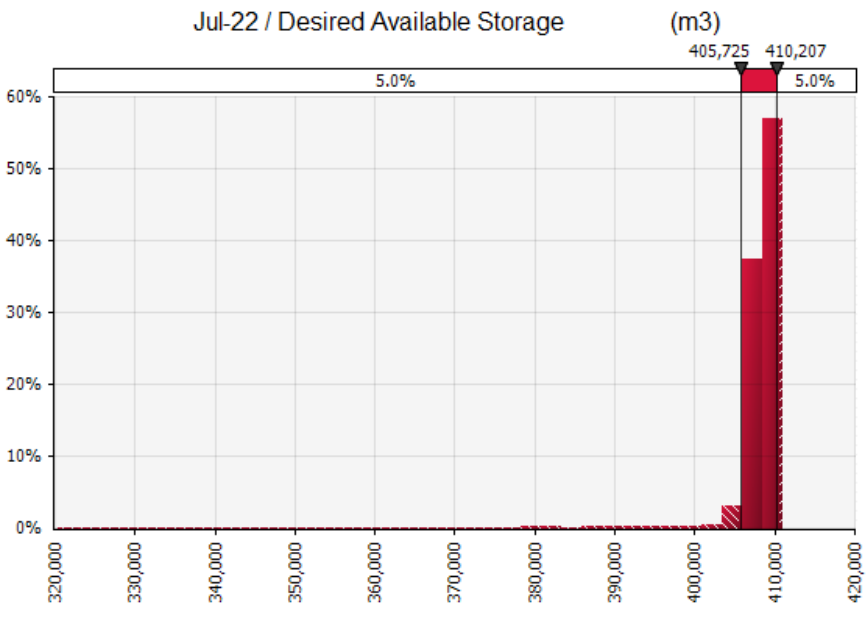
	Apr-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	354,073.97
Maximum	410,905.69
Mean	410,177.12
90% CI	± 33.00
Mode	410,526.65
Median	410,378.92
Std Dev	1,418.25
Skewness	-21.2272
Kurtosis	649.5855
Values	5000
Errors	0
Filtered	0
Left X	409,391
Left P	5.0%
Right X	410,674
Right P	95.0%
Dif. X	1,282.35
Dif. P	90.0%



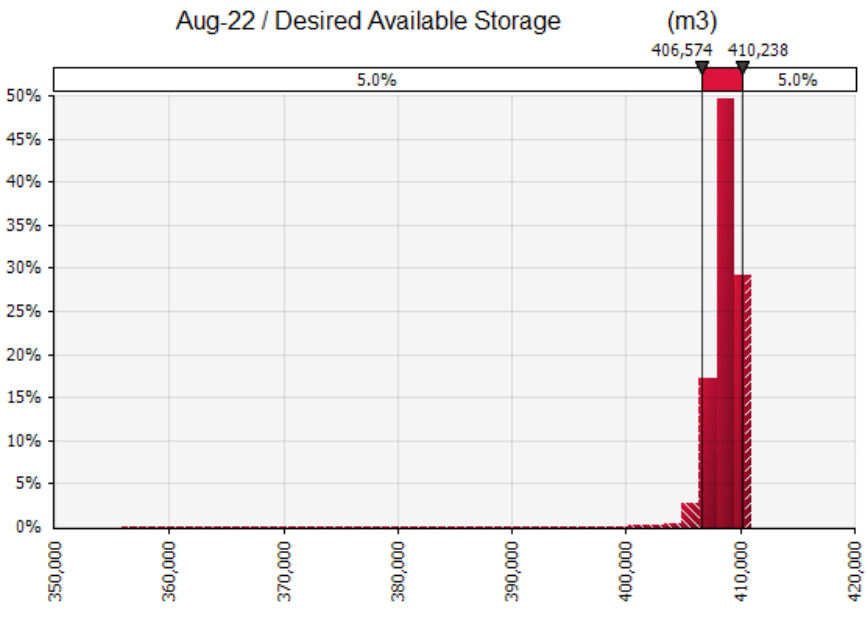
	May-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	215,022.01
Maximum	411,245.95
Mean	375,563.85
90% CI	± 749.63
Mode	410,314.99
Median	381,763.40
Std Dev	32,220.08
Skewness	-1.1287
Kurtosis	4.2504
Values	5000
Errors	0
Filtered	0
Left X	312,222
Left P	5.0%
Right X	410,406
Right P	95.0%
Dif. X	98,184.31



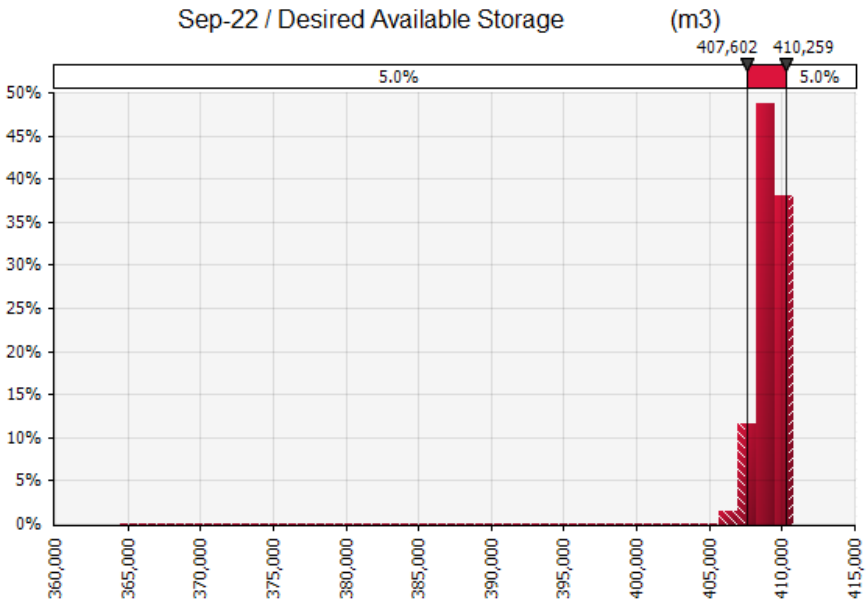
	Jun-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	267,409.11
Maximum	411,274.05
Mean	404,636.74
90% CI	± 335.46
Mode	409,828.81
Median	409,246.76
Std Dev	14,418.46
Skewness	-4.0660
Kurtosis	22.4378
Values	5000
Errors	0
Filtered	0
Left X	375,366
Left P	5.0%
Right X	410,463
Right P	95.0%
Dif. X	35,096.40
Dif. P	90.0%



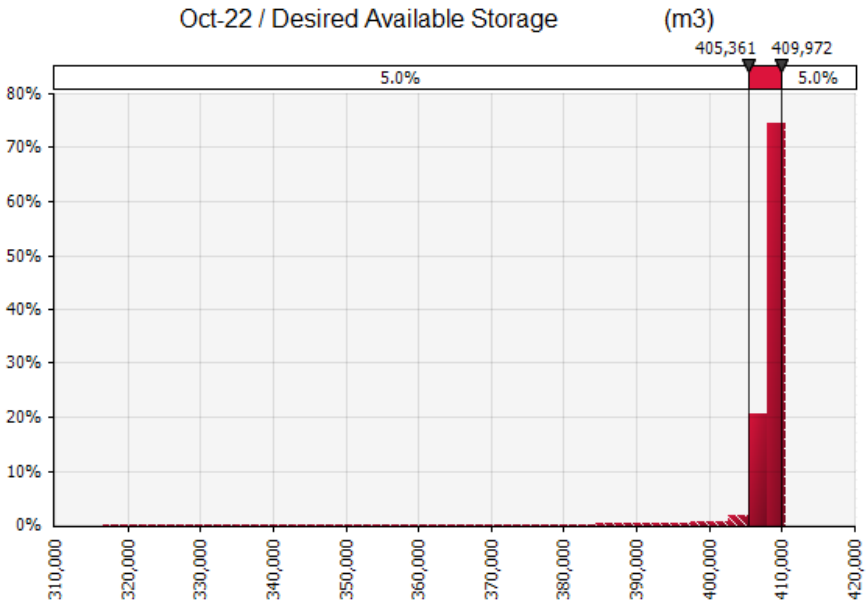
	Jul-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	320,421.46
Maximum	411,006.38
Mean	407,940.64
90% CI	± 116.34
Mode	409,131.67
Median	408,703.88
Std Dev	5,000.24
Skewness	-9.3177
Kurtosis	110.9306
Values	5000
Errors	0
Filtered	0
Left X	405,725
Left P	5.0%
Right X	410,207
Right P	95.0%
Dif. X	4,482.16
Dif. P	90.0%



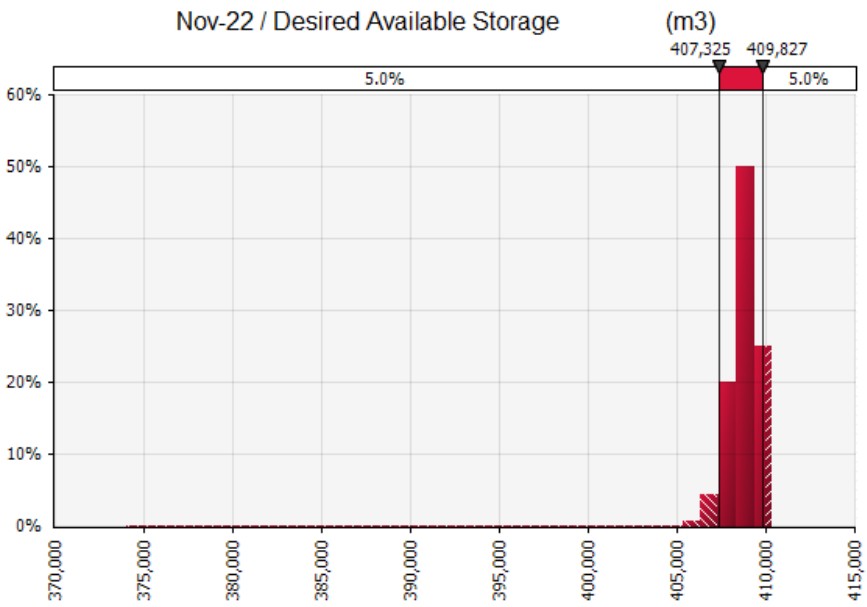
	Aug-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	355,888.06
Maximum	410,994.87
Mean	408,604.73
90% CI	± 55.30
Mode	409,667.65
Median	408,918.81
Std Dev	2,376.74
Skewness	-11.2845
Kurtosis	182.4850
Values	5000
Errors	0
Filtered	0
Left X	406,574
Left P	5.0%
Right X	410,238
Right P	95.0%
Dif. X	3,664.08



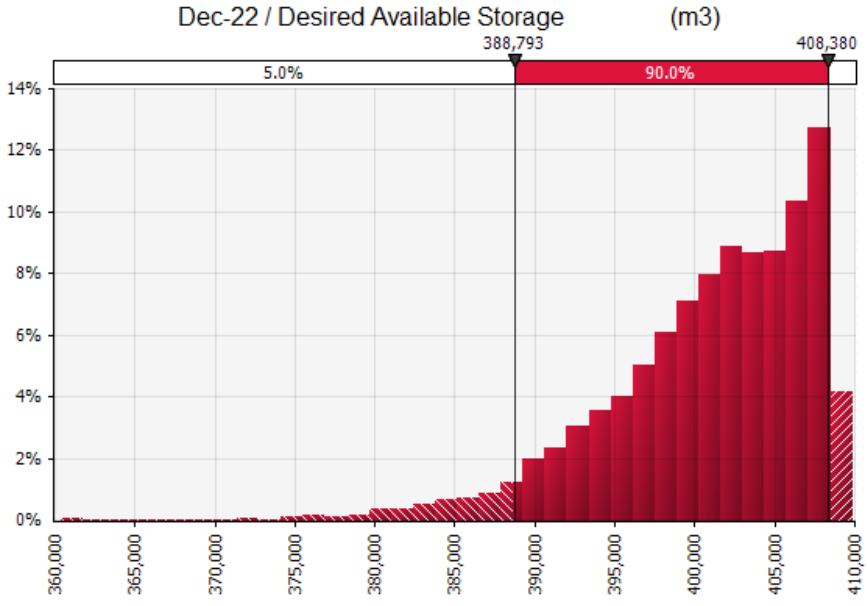
	Sep-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	364,465.18
Maximum	410,799.07
Mean	409,131.11
90% CI	± 26.65
Mode	409,348.64
Median	409,275.42
Std Dev	1,145.36
Skewness	-14.8371
Kurtosis	507.2400
Values	5000
Errors	0
Filtered	0
Left X	407,602
Left P	5.0%
Right X	410,259
Right P	95.0%
Dif. X	2,657.09



	Oct-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	316,700.01
Maximum	410,554.49
Mean	408,040.52
90% CI	± 91.90
Mode	409,248.85
Median	408,743.86
Std Dev	3,949.88
Skewness	-8.7395
Kurtosis	115.8049
Values	5000
Errors	0
Filtered	0
Left X	405,361
Left P	5.0%
Right X	409,972
Right P	95.0%
Dif. X	4,611.37
Dif. P	90.0%



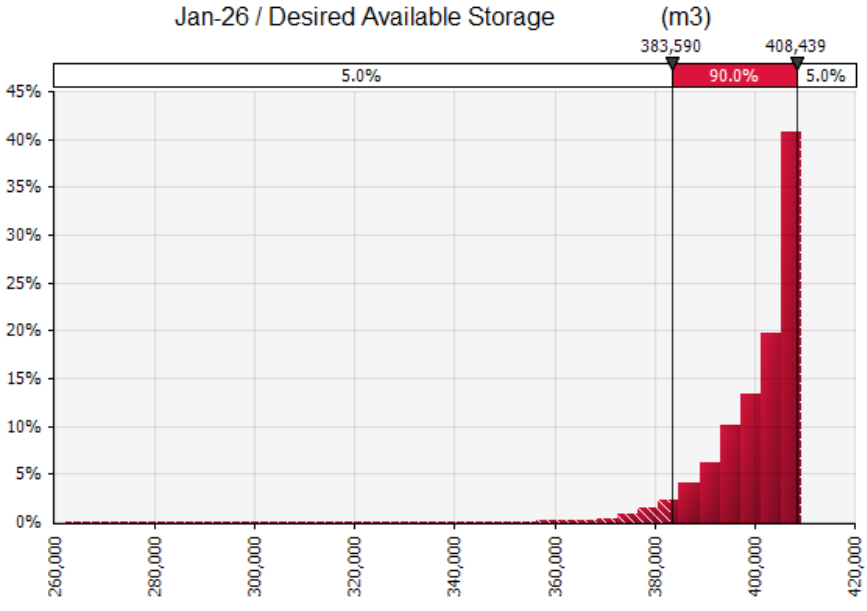
	Nov-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	374,016.04
Maximum	410,356.16
Mean	408,770.40
90% CI	± 21.41
Mode	409,155.84
Median	408,898.52
Std Dev	920.14
Skewness	-11.3187
Kurtosis	409.7789
Values	5000
Errors	0
Filtered	0
Left X	407,325
Left P	5.0%
Right X	409,827
Right P	95.0%
Dif. X	2,501.64



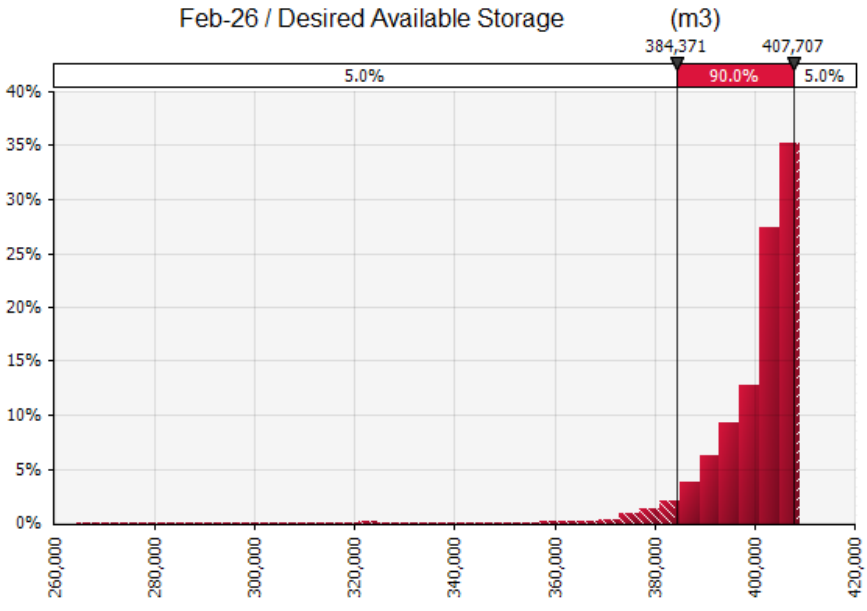
	Dec-22 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	360,417.46
Maximum	409,870.13
Mean	400,904.30
90% CI	± 149.66
Mode	407,146.45
Median	402,245.51
Std Dev	6,432.71
Skewness	-1.1851
Kurtosis	4.8774
Values	5000
Errors	0
Filtered	0
Left X	388,793
Left P	5.0%
Right X	408,380
Right P	95.0%
Dif. X	19,587.26

Phase 3 Results

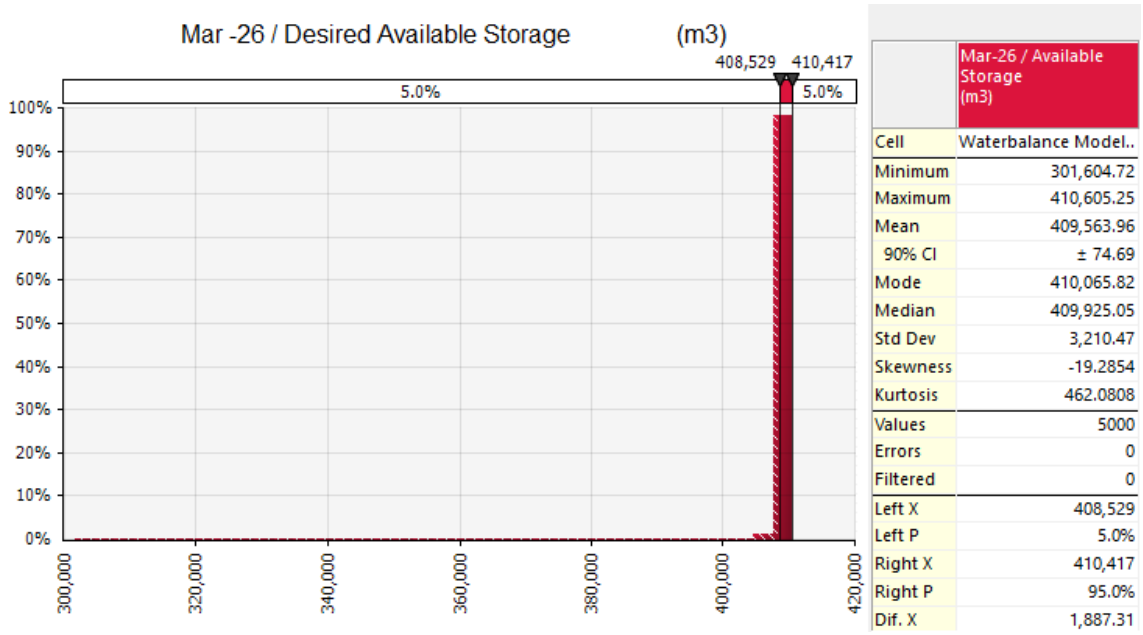
Desired Available Storage



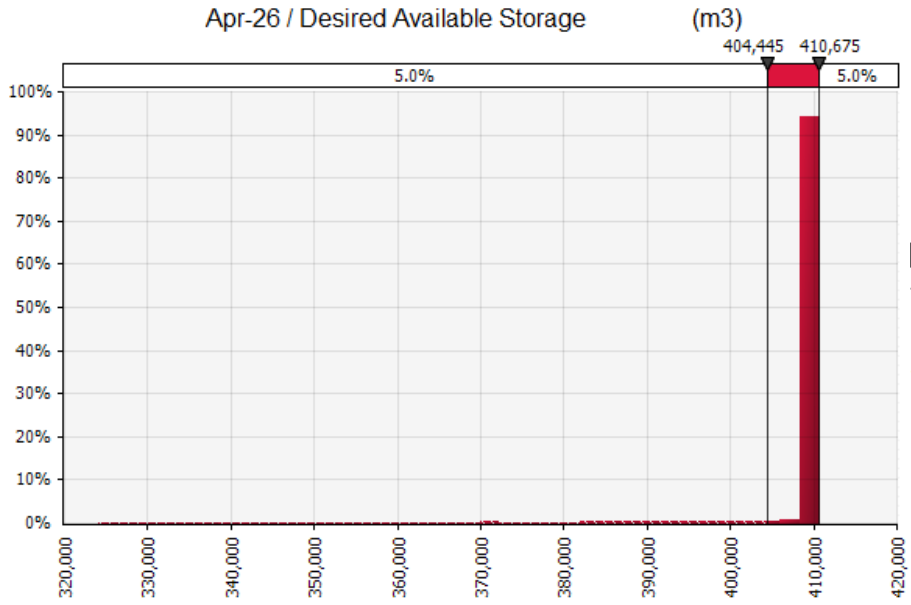
	Jan-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	262,286.64
Maximum	409,433.56
Mean	400,524.70
90% CI	± 217.72
Mode	406,704.08
Median	403,849.17
Std Dev	9,357.82
Skewness	-3.2639
Kurtosis	26.6037
Values	5000
Errors	0
Filtered	0
Left X	383,590
Left P	5.0%
Right X	408,439
Right P	95.0%
Dif. X	24,849.49
Dif. P	90.0%



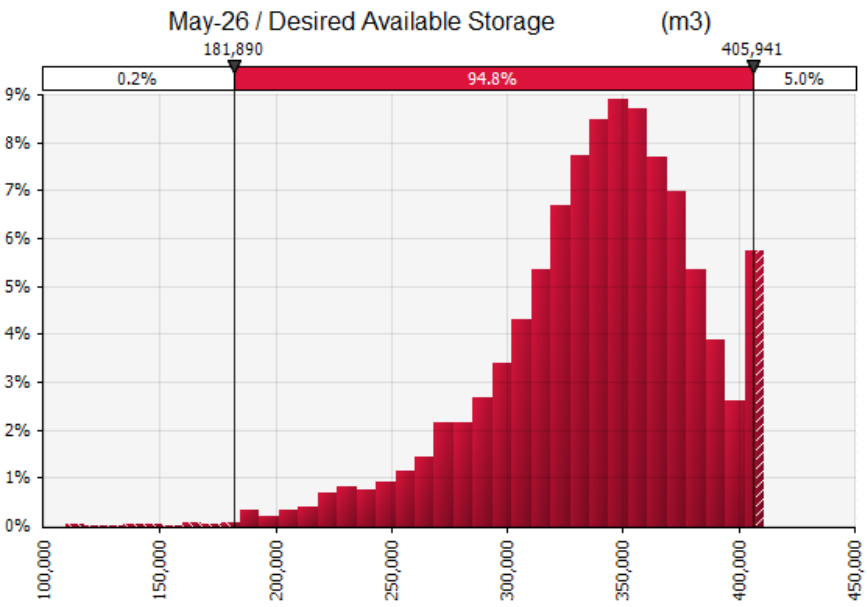
	Feb-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	264,478.18
Maximum	409,048.38
Mean	400,286.77
90% CI	± 205.18
Mode	405,706.51
Median	403,430.98
Std Dev	8,818.88
Skewness	-3.5787
Kurtosis	30.6336
Values	5000
Errors	0
Filtered	0
Left X	384,371
Left P	5.0%
Right X	407,707
Right P	95.0%
Dif. X	23,336.34



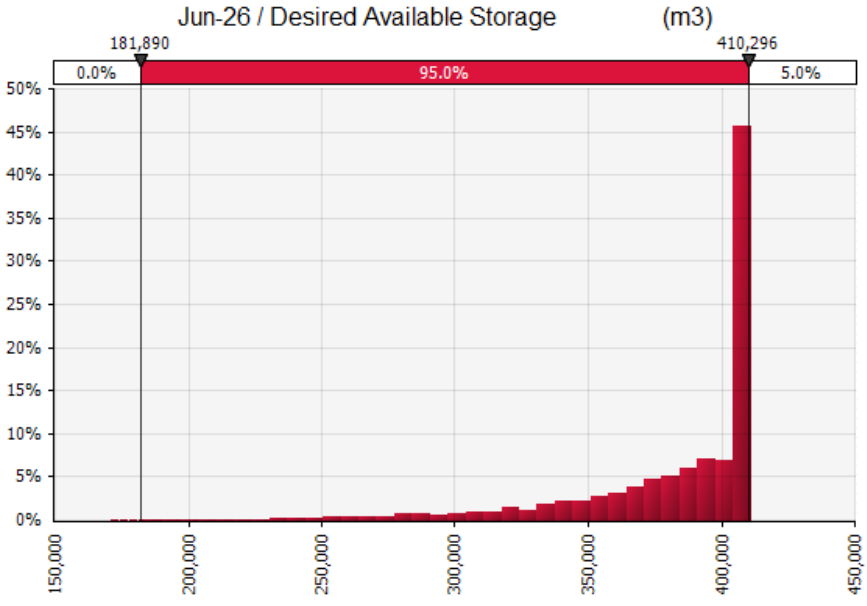
	Mar-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	301,604.72
Maximum	410,605.25
Mean	409,563.96
90% CI	± 74.69
Mode	410,065.82
Median	409,925.05
Std Dev	3,210.47
Skewness	-19.2854
Kurtosis	462.0808
Values	5000
Errors	0
Filtered	0
Left X	408,529
Left P	5.0%
Right X	410,417
Right P	95.0%
Dif. X	1,887.31



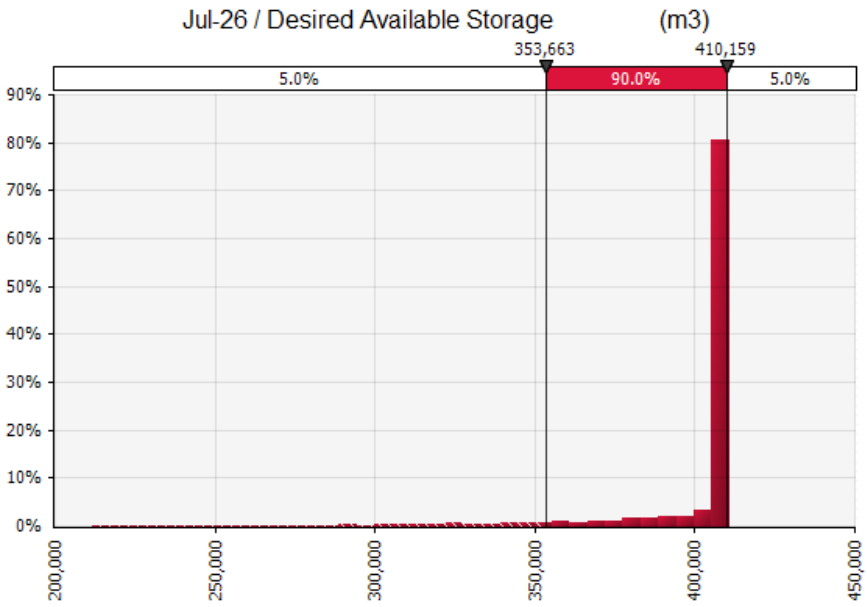
Minimum	324,138.89
Maximum	410,859.03
Mean	409,141.51
Std Dev	5,675.15
Values	5000



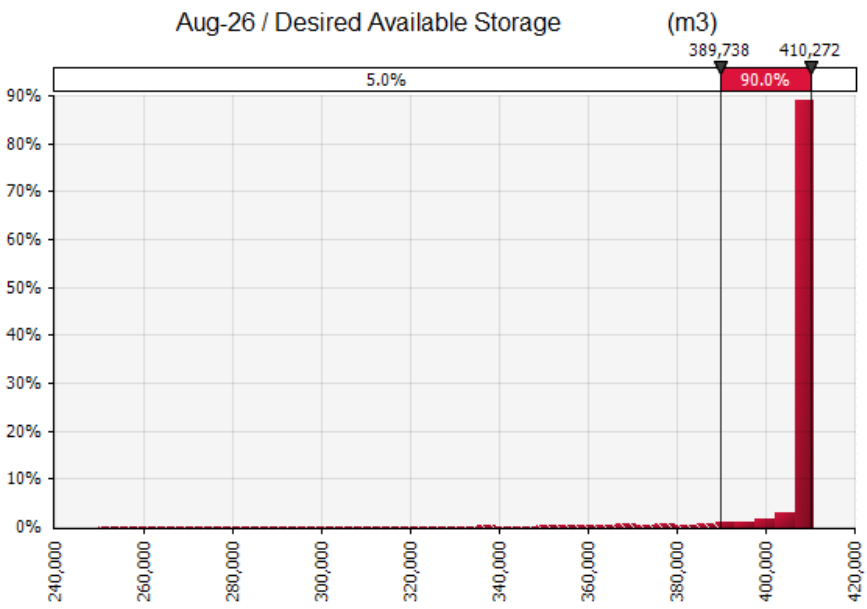
	May-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	109,424.30
Maximum	410,983.90
Mean	338,413.00
90% CI	± 1,024.90
Mode	409,934.50
Median	343,815.99
Std Dev	44,051.32
Skewness	-0.8378
Kurtosis	4.0146
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.2%
Right X	405,941
Right P	95.0%
Dif. X	224,050.74



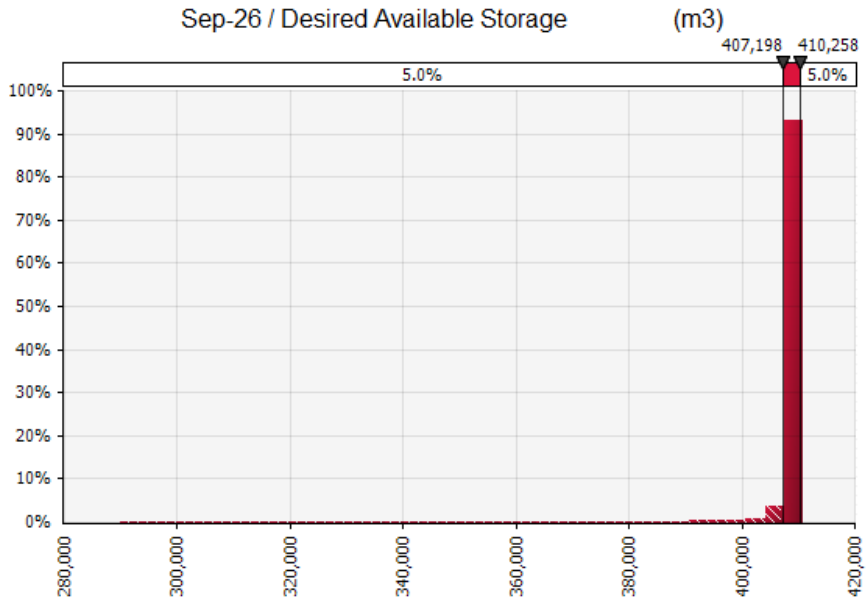
	Jun-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	170,465.74
Maximum	411,140.29
Mean	384,561.97
90% CI	± 819.09
Mode	410,078.01
Median	400,392.23
Std Dev	35,205.57
Skewness	-1.8718
Kurtosis	6.6856
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.0%
Right X	410,296
Right P	95.0%
Dif. X	228,406.21
Dif. P	95.0%



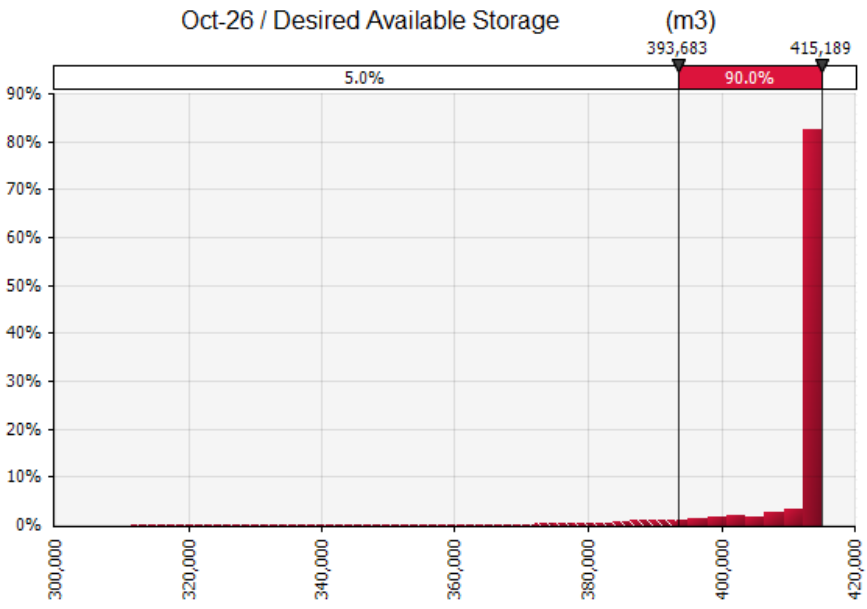
	Jul-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	211,255.44
Maximum	410,901.48
Mean	401,108.85
90% CI	± 492.32
Mode	408,809.07
Median	408,404.06
Std Dev	21,160.46
Skewness	-3.6064
Kurtosis	17.7557
Values	5000
Errors	0
Filtered	0
Left X	353,663
Left P	5.0%
Right X	410,159
Right P	95.0%
Dif. X	56,496.17
Dif. P	90.0%



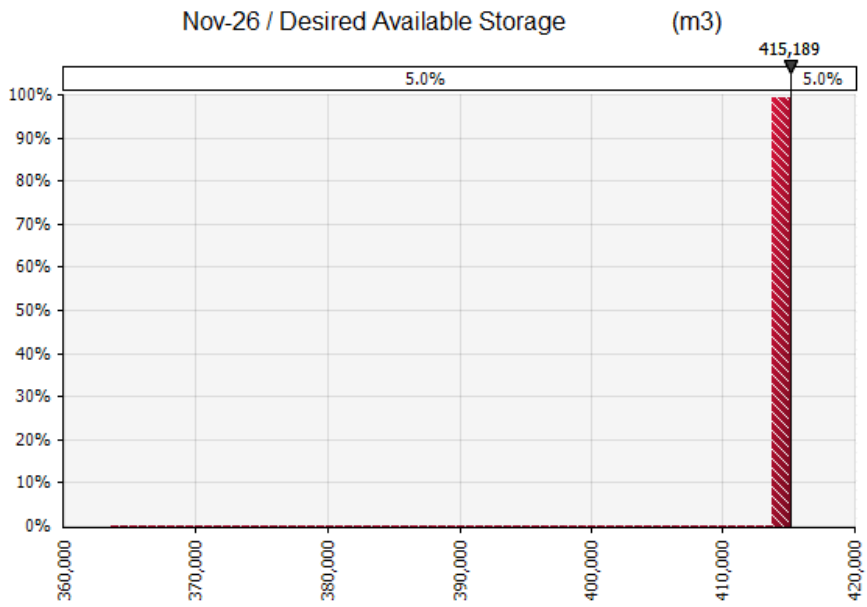
	Aug-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	249,993.57
Maximum	410,974.18
Mean	405,976.91
90% CI	± 282.26
Mode	409,341.10
Median	408,859.77
Std Dev	12,131.63
Skewness	-5.7029
Kurtosis	43.2223
Values	5000
Errors	0
Filtered	0
Left X	389,738
Left P	5.0%
Right X	410,272
Right P	95.0%
Dif. X	20,533.18



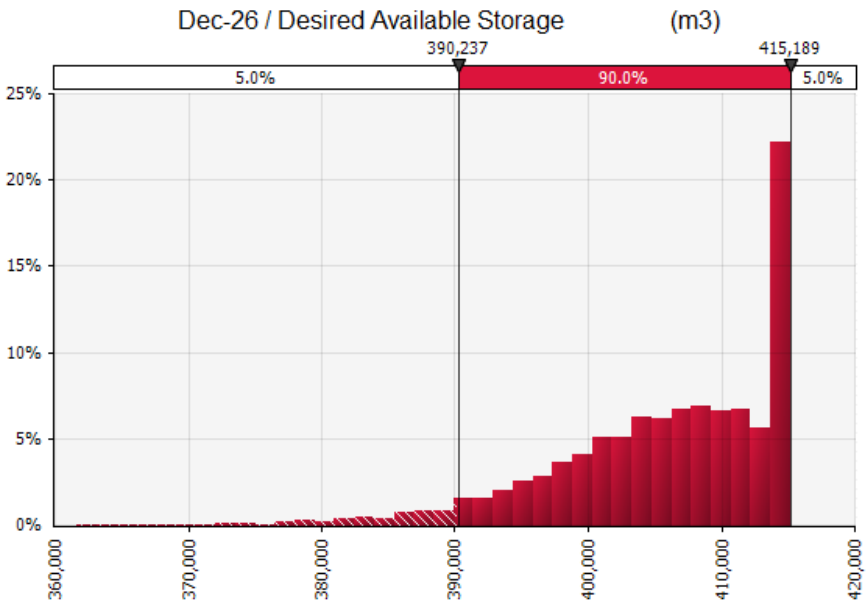
	Sep-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	289,585.11
Maximum	410,918.90
Mean	408,385.45
90% CI	± 138.59
Mode	409,252.98
Median	409,261.14
Std Dev	5,956.77
Skewness	-10.3103
Kurtosis	136.0911
Values	5000
Errors	0
Filtered	0
Left X	407,198
Left P	5.0%
Right X	410,258
Right P	95.0%
Dif. X	3,060.76



	Oct-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	311,443.63
Maximum	415,188.87
Mean	412,067.57
90% CI	± 206.21
Mode	415,188.87
Median	415,188.87
Std Dev	8,863.03
Skewness	-4.0942
Kurtosis	24.5929
Values	5000
Errors	0
Filtered	0
Left X	393,683
Left P	5.0%
Right X	415,189
Right P	95.0%
Dif. X	21,505.66
Dif. P	90.0%



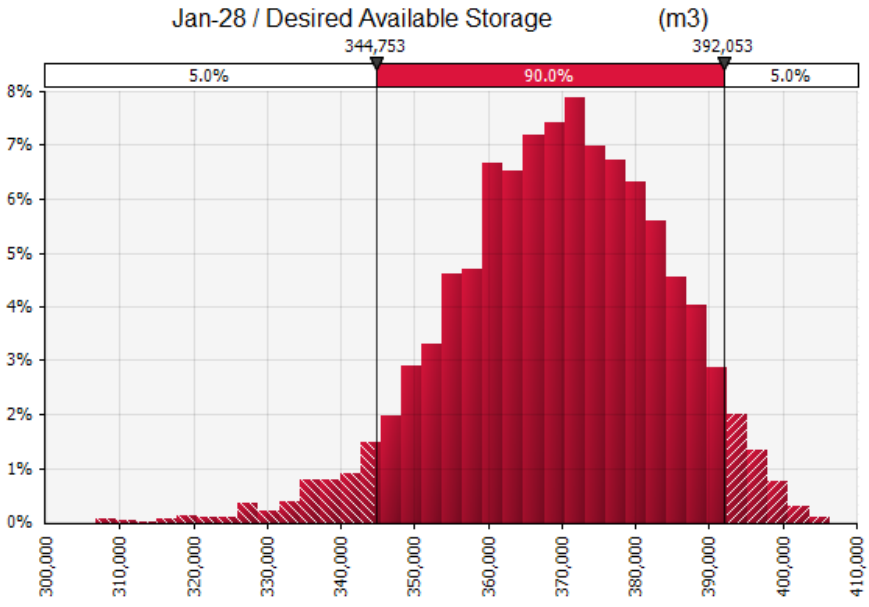
	Nov-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	363,457.99
Maximum	415,188.87
Mean	415,111.14
90% CI	± 29.87
Mode	415,188.87
Median	415,188.87
Std Dev	1,283.83
Skewness	-24.5602
Kurtosis	752.8195
Values	5000
Errors	0
Filtered	0
Left X	415,189
Left P	5.0%
Right X	415,189
Right P	95.0%
Dif. X	0.00



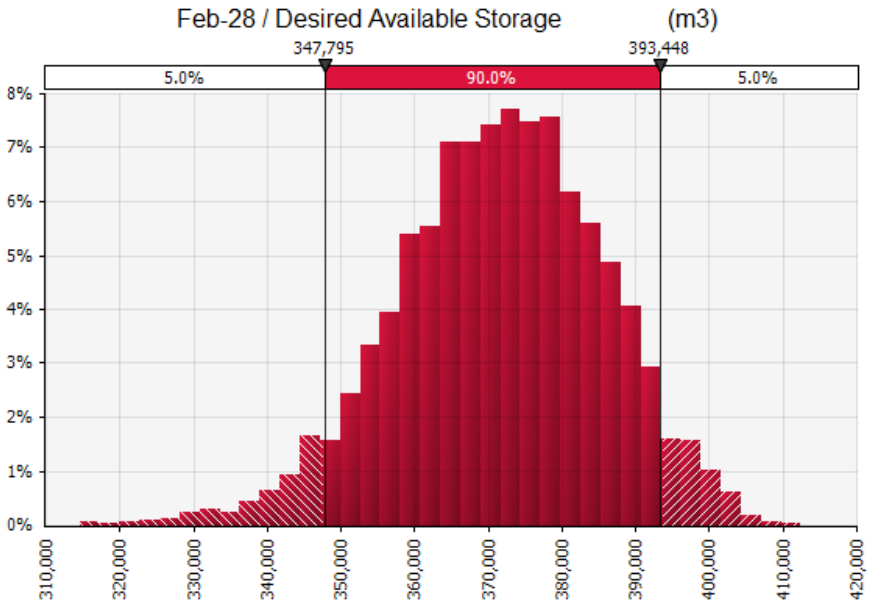
	Dec-26 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	361,658.26
Maximum	415,188.87
Mean	405,900.73
90% CI	± 193.00
Mode	415,188.87
Median	407,276.35
Std Dev	8,295.49
Skewness	-1.0088
Kurtosis	4.0370
Values	5000
Errors	0
Filtered	0
Left X	390,237
Left P	5.0%
Right X	415,189
Right P	95.0%
Dif. X	24,951.59

Phase 4 Results

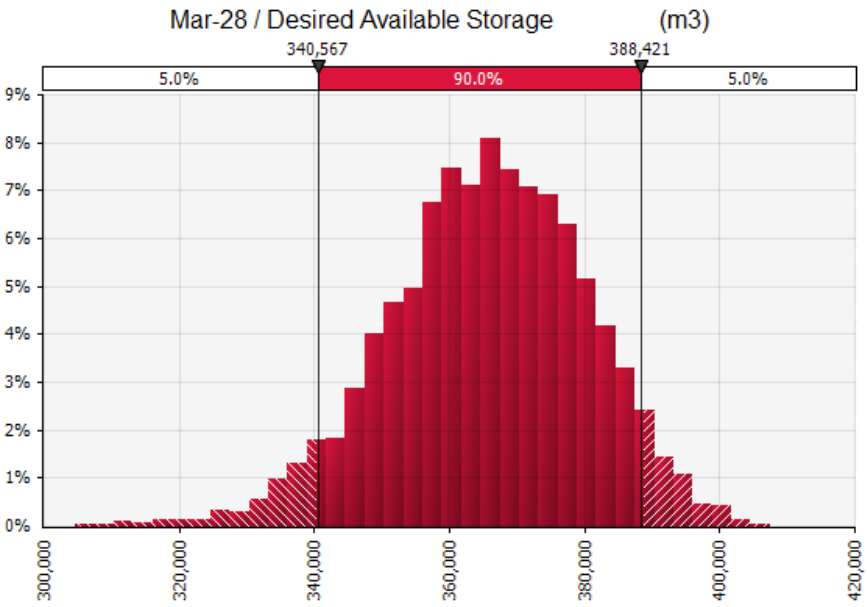
Desired Available Storage



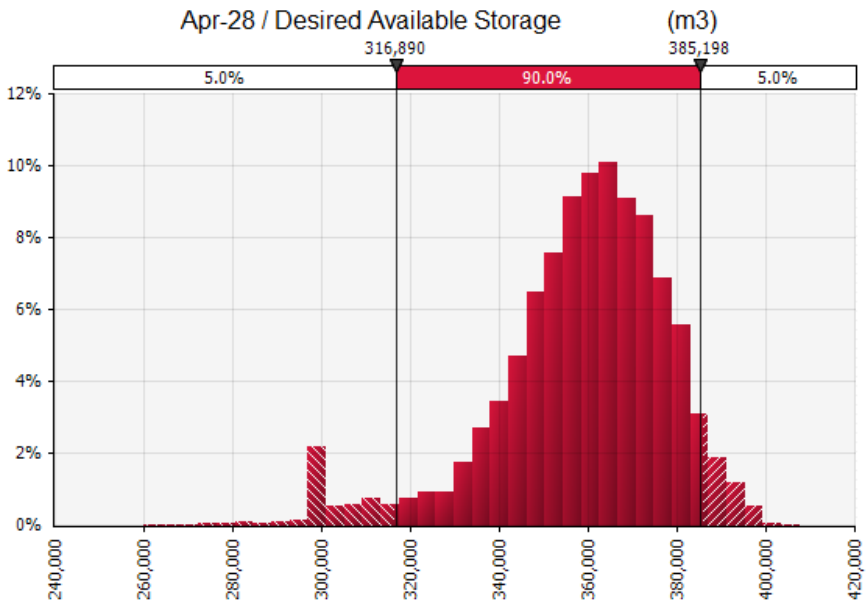
	Jan-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	306,733.59
Maximum	406,328.35
Mean	369,484.21
90% CI	± 336.77
Mode	369,985.91
Median	370,130.31
Std Dev	14,474.53
Skewness	-0.3748
Kurtosis	3.2119
Values	5000
Errors	0
Filtered	0
Left X	344,753
Left P	5.0%
Right X	392,053
Right P	95.0%
Dif. X	47,300.46
Dif. P	90.0%



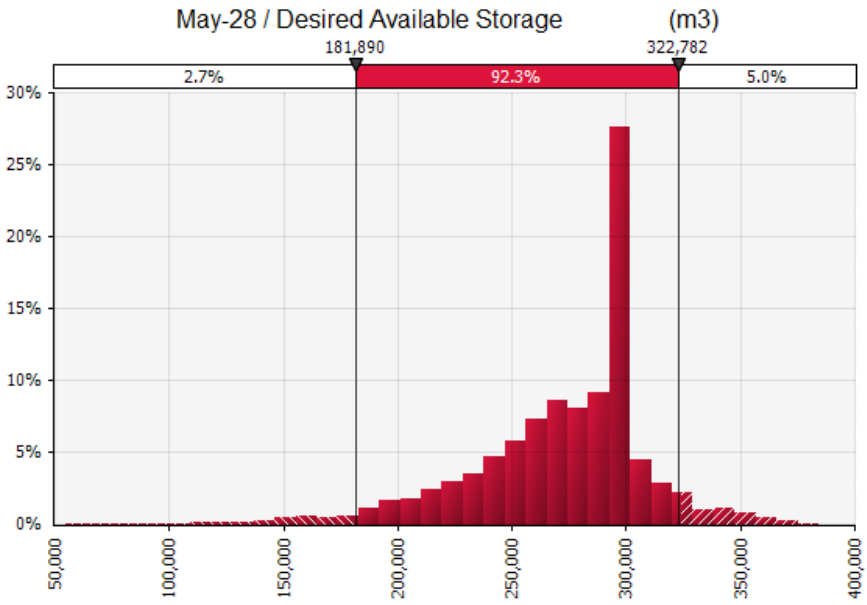
	Feb-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	314,560.78
Maximum	412,479.06
Mean	371,639.20
90% CI	± 326.00
Mode	371,303.22
Median	372,172.19
Std Dev	14,011.95
Skewness	-0.2966
Kurtosis	3.1885
Values	5000
Errors	0
Filtered	0
Left X	347,795
Left P	5.0%
Right X	393,448
Right P	95.0%
Dif. X	45,653.72



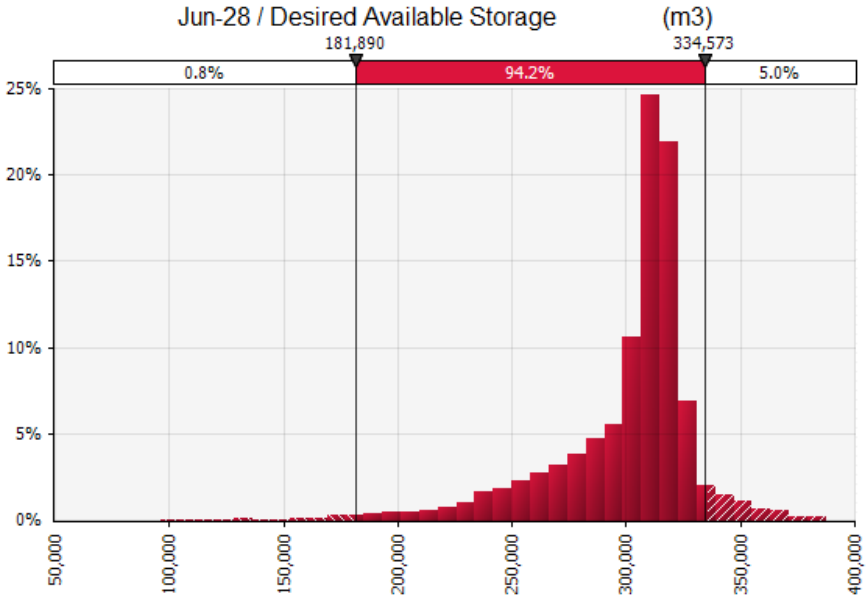
	Mar-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	304,662.10
Maximum	407,492.52
Mean	365,688.94
90% CI	± 340.47
Mode	363,003.74
Median	366,255.28
Std Dev	14,633.80
Skewness	-0.3113
Kurtosis	3.1963
Values	5000
Errors	0
Filtered	0
Left X	340,567
Left P	5.0%
Right X	388,421
Right P	95.0%
Dif. X	47,854.28



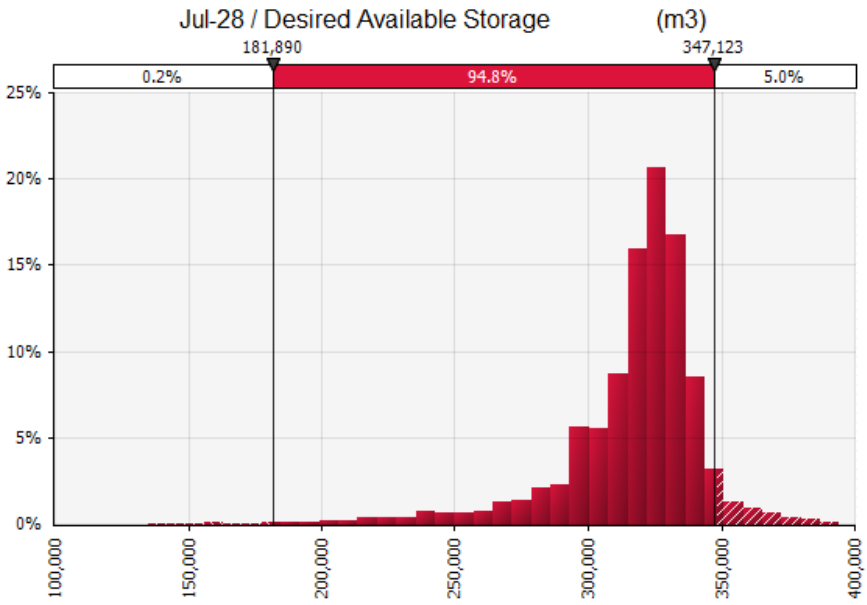
	Apr-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	260,144.13
Maximum	407,600.35
Mean	358,630.15
90% CI	± 459.11
Mode	299,850.87
Median	361,200.88
Std Dev	19,733.05
Skewness	-1.0481
Kurtosis	4.6026
Values	5000
Errors	0
Filtered	0
Left X	316,890
Left P	5.0%
Right X	385,198
Right P	95.0%
Dif. X	68,307.84
Dif. P	90.0%



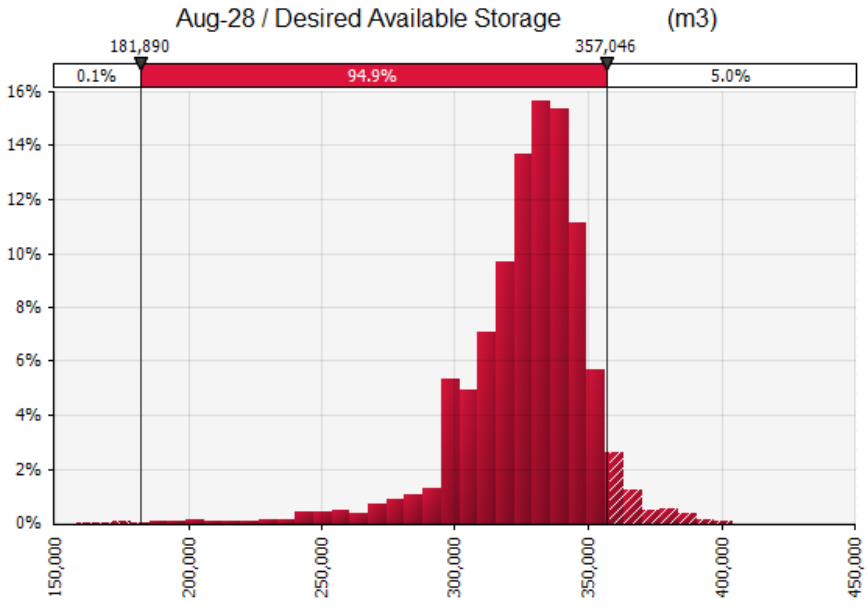
	May-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	54,756.15
Maximum	384,264.33
Mean	274,041.49
90% CI	± 900.08
Mode	299,850.87
Median	283,292.51
Std Dev	38,686.38
Skewness	-0.9953
Kurtosis	4.6660
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	2.7%
Right X	322,782
Right P	95.0%
Dif. X	140,891.90



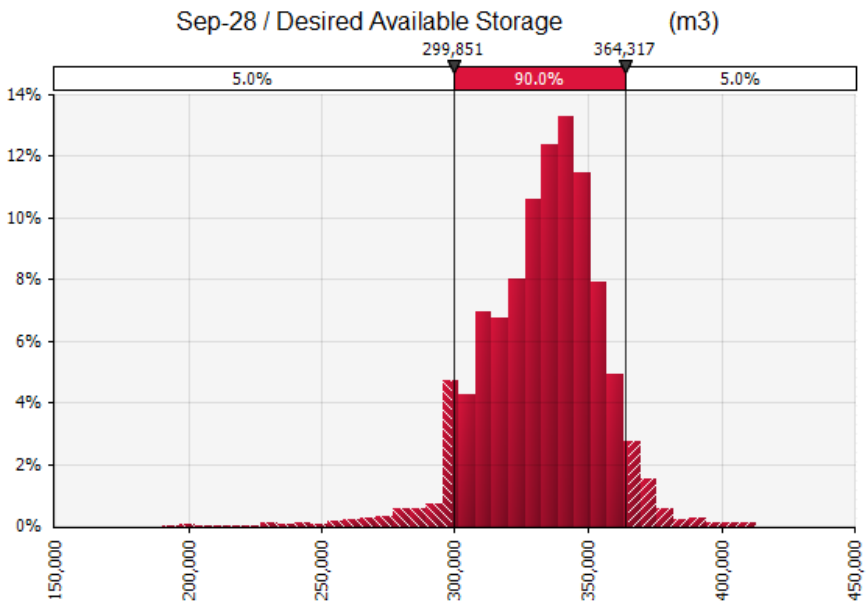
	Jun-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	96,235.92
Maximum	387,647.74
Mean	300,795.62
90% CI	± 730.15
Mode	299,850.87
Median	310,322.24
Std Dev	31,382.71
Skewness	-1.6549
Kurtosis	7.1998
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.8%
Right X	334,573
Right P	95.0%
Dif. X	152,683.03
Dif. P	94.2%



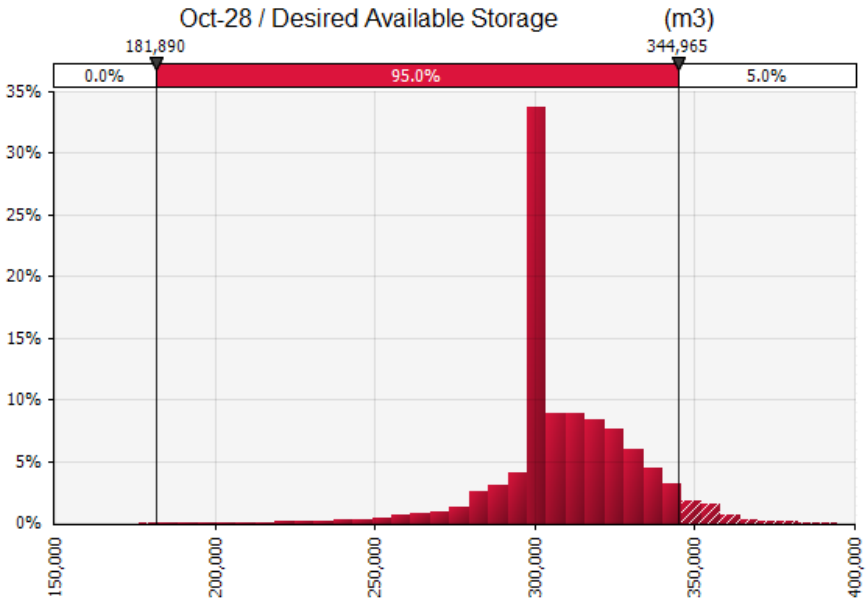
	Jul-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	134,246.45
Maximum	394,414.82
Mean	317,756.27
90% CI	± 608.41
Mode	299,850.87
Median	323,097.76
Std Dev	26,150.16
Skewness	-1.8429
Kurtosis	9.2978
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.2%
Right X	347,123
Right P	95.0%
Dif. X	165,233.00
Dif. P	94.8%



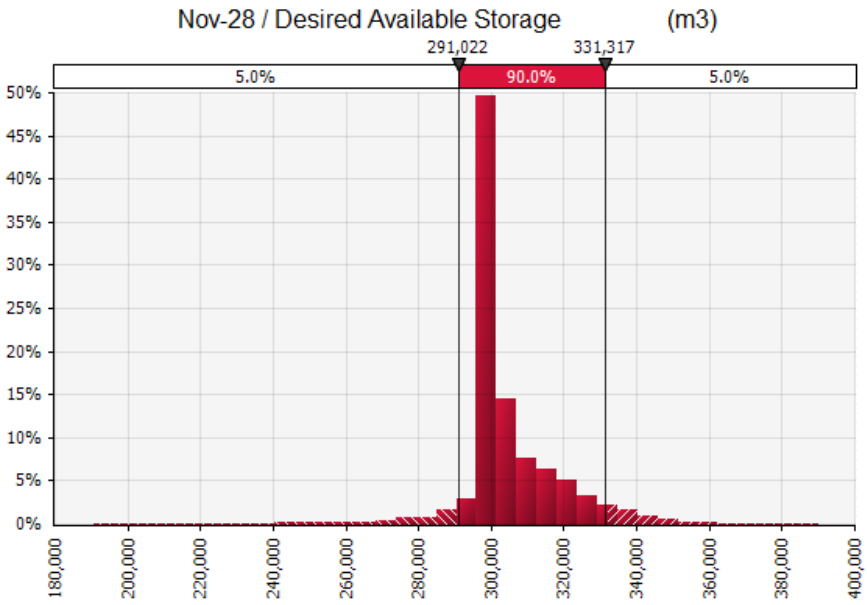
	Aug-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	158,118.08
Maximum	404,434.41
Mean	327,391.22
90% CI	± 542.48
Mode	299,850.87
Median	330,758.61
Std Dev	23,316.30
Skewness	-1.4095
Kurtosis	8.3115
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.1%
Right X	357,046
Right P	95.0%
Dif. X	175,156.07



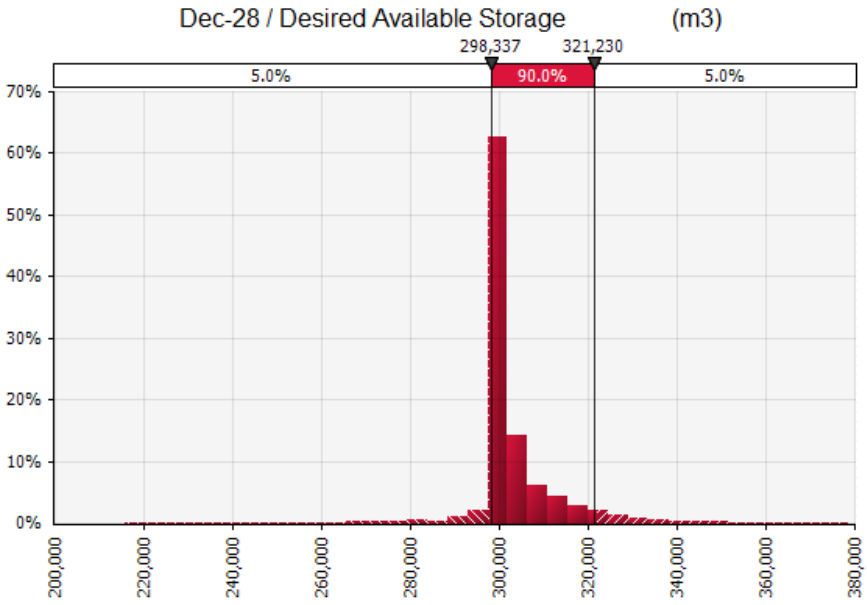
	Sep-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	190,310.59
Maximum	412,947.79
Mean	333,052.56
90% CI	± 508.27
Mode	299,850.87
Median	335,270.84
Std Dev	21,846.01
Skewness	-0.6776
Kurtosis	5.4564
Values	5000
Errors	0
Filtered	0
Left X	299,851
Left P	5.0%
Right X	364,317
Right P	95.0%
Dif. X	64,466.19



	Oct-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	176,457.63
Maximum	394,608.78
Mean	309,587.05
90% CI	± 482.19
Mode	299,850.87
Median	304,734.60
Std Dev	20,725.06
Skewness	-0.2297
Kurtosis	5.6222
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.0%
Right X	344,965
Right P	95.0%
Dif. X	163,074.91
Dif. P	95.0%



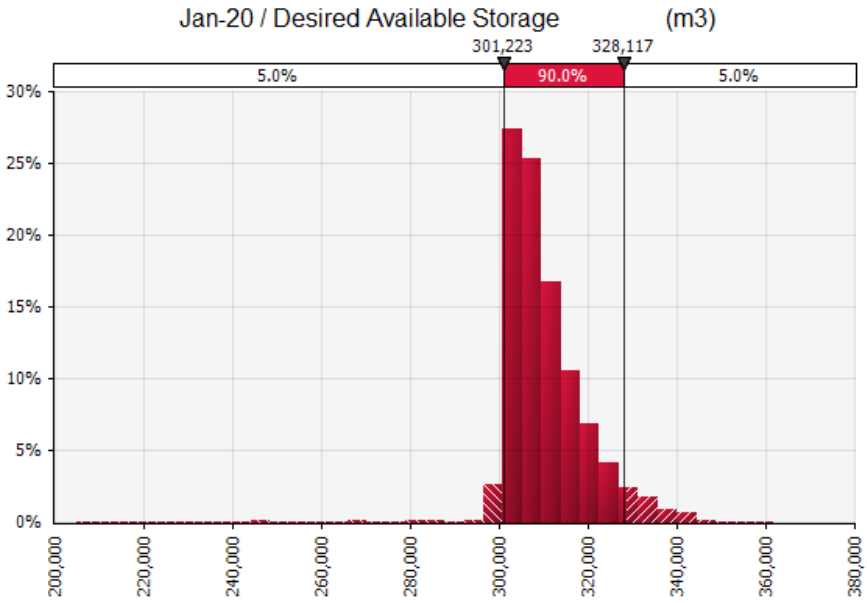
	Nov-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	190,785.42
Maximum	390,081.21
Mean	305,042.10
90% CI	± 320.04
Mode	299,850.87
Median	299,850.87
Std Dev	13,755.73
Skewness	0.1564
Kurtosis	10.4442
Values	5000
Errors	0
Filtered	0
Left X	291,022
Left P	5.0%
Right X	331,317
Right P	95.0%
Dif. X	40,294.65



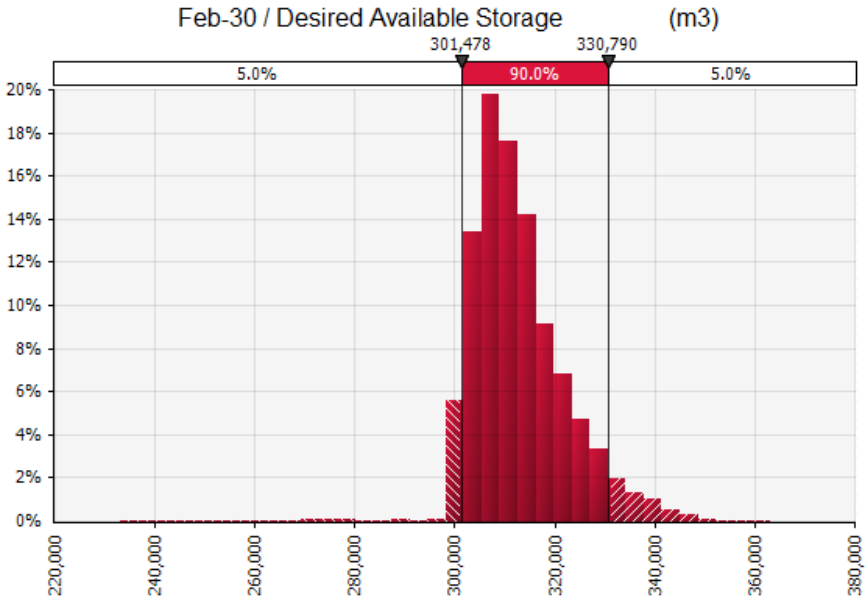
	Dec-28 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	215,850.06
Maximum	378,897.67
Mean	303,101.86
90% CI	± 214.64
Mode	299,850.87
Median	299,850.87
Std Dev	9,225.49
Skewness	0.7441
Kurtosis	17.5090
Values	5000
Errors	0
Filtered	0
Left X	298,337
Left P	5.0%
Right X	321,230
Right P	95.0%
Dif. X	22,892.41

Phase 5 Results

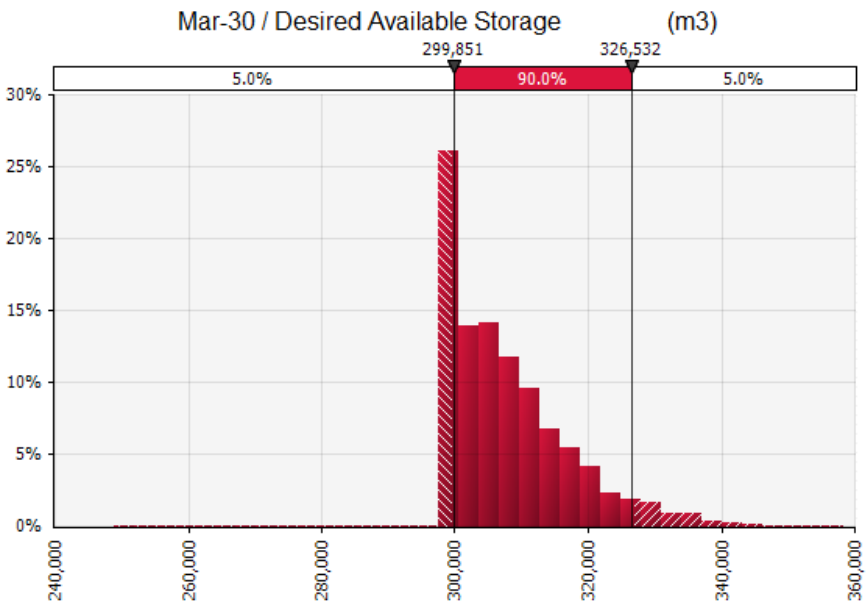
Desired Available Storage



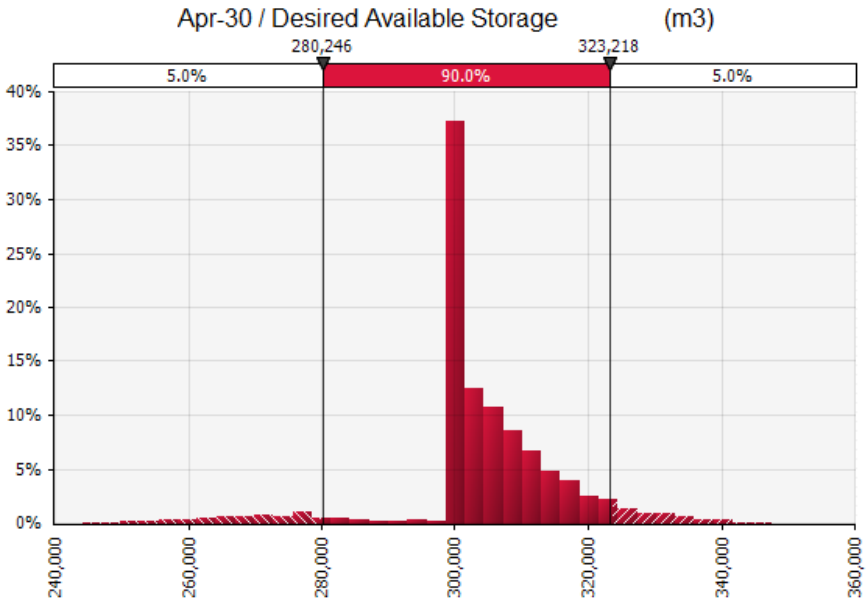
	Jan-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	205,006.21
Maximum	361,811.98
Mean	310,470.26
90% CI	± 219.34
Mode	299,850.87
Median	308,377.75
Std Dev	9,427.43
Skewness	-0.2002
Kurtosis	14.1849
Values	5000
Errors	0
Filtered	0
Left X	301,223
Left P	5.0%
Right X	328,117
Right P	95.0%
Dif. X	26,893.79
Dif. P	90.0%



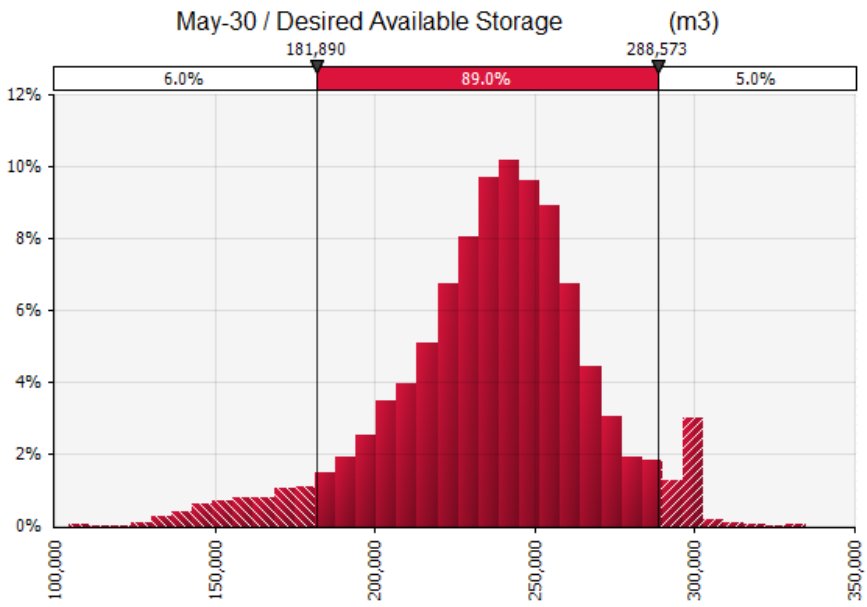
	Feb-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	233,253.44
Maximum	363,123.75
Mean	312,957.97
90% CI	± 215.92
Mode	299,850.87
Median	311,250.71
Std Dev	9,280.52
Skewness	0.6436
Kurtosis	6.3871
Values	5000
Errors	0
Filtered	0
Left X	301,478
Left P	5.0%
Right X	330,790
Right P	95.0%
Dif. X	29,311.40



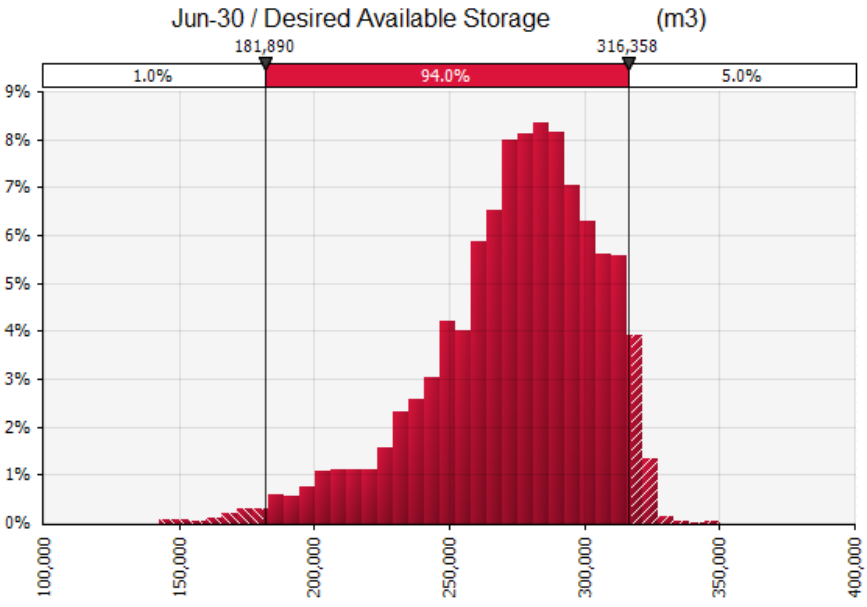
	Mar-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	248,993.49
Maximum	358,476.07
Mean	308,169.60
90% CI	± 206.82
Mode	299,850.87
Median	305,943.26
Std Dev	8,889.29
Skewness	1.1680
Kurtosis	5.0456
Values	5000
Errors	0
Filtered	0
Left X	299,851
Left P	5.0%
Right X	326,532
Right P	95.0%
Dif. X	26,681.48



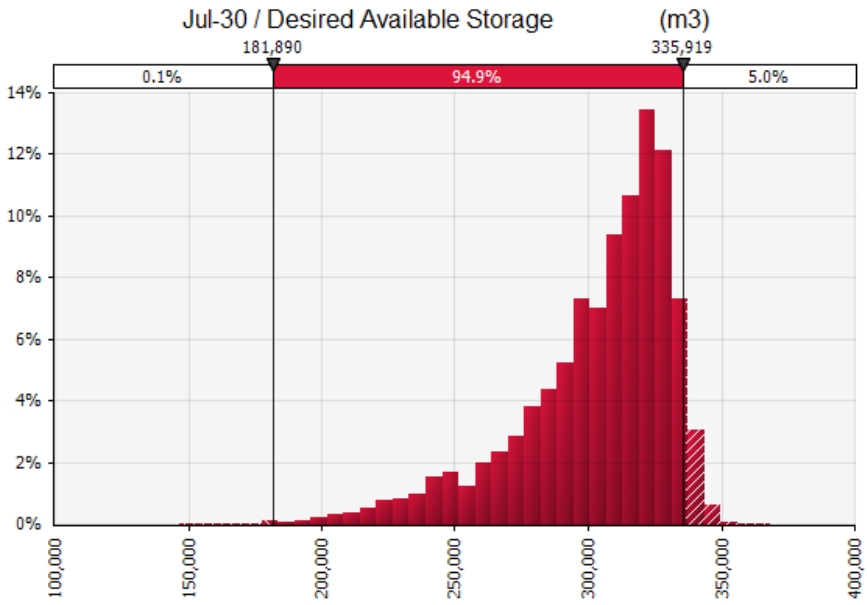
	Apr-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	244,092.58
Maximum	347,494.66
Mean	304,462.21
90% CI	± 275.78
Mode	299,850.87
Median	302,662.23
Std Dev	11,853.45
Skewness	-0.8723
Kurtosis	7.0911
Values	5000
Errors	0
Filtered	0
Left X	280,246
Left P	5.0%
Right X	323,218
Right P	95.0%
Dif. X	42,972.09
Dif. P	90.0%



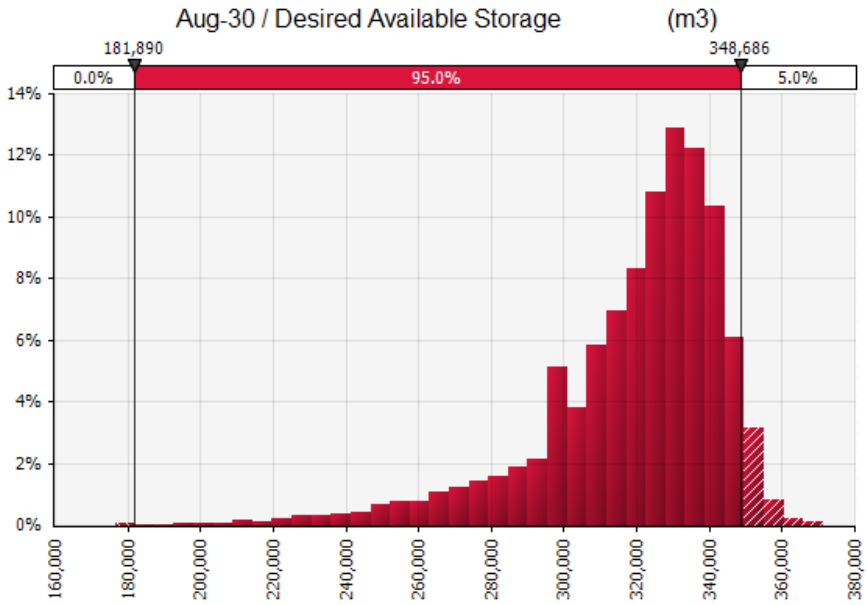
	May-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	104,522.69
Maximum	334,829.10
Mean	236,816.57
90% CI	± 739.44
Mode	299,850.87
Median	239,653.82
Std Dev	31,782.06
Skewness	-0.5566
Kurtosis	3.8154
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	6.0%
Right X	288,573
Right P	95.0%
Dif. X	106,683.42



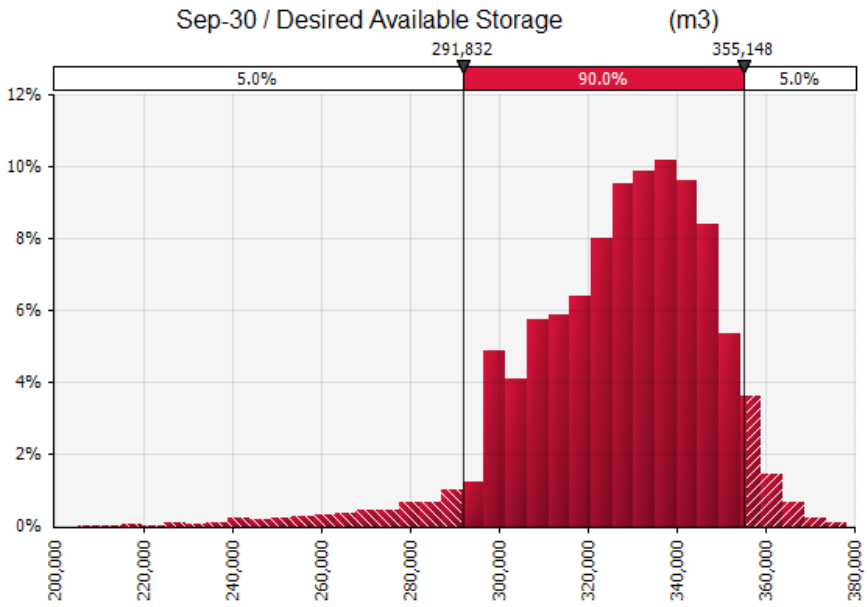
	Jun-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	142,489.37
Maximum	350,528.15
Mean	274,186.17
90% CI	± 727.11
Mode	270,552.94
Median	278,704.16
Std Dev	31,251.77
Skewness	-0.8956
Kurtosis	3.8179
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	1.0%
Right X	316,358
Right P	95.0%
Dif. X	134,468.29
Dif. P	94.0%



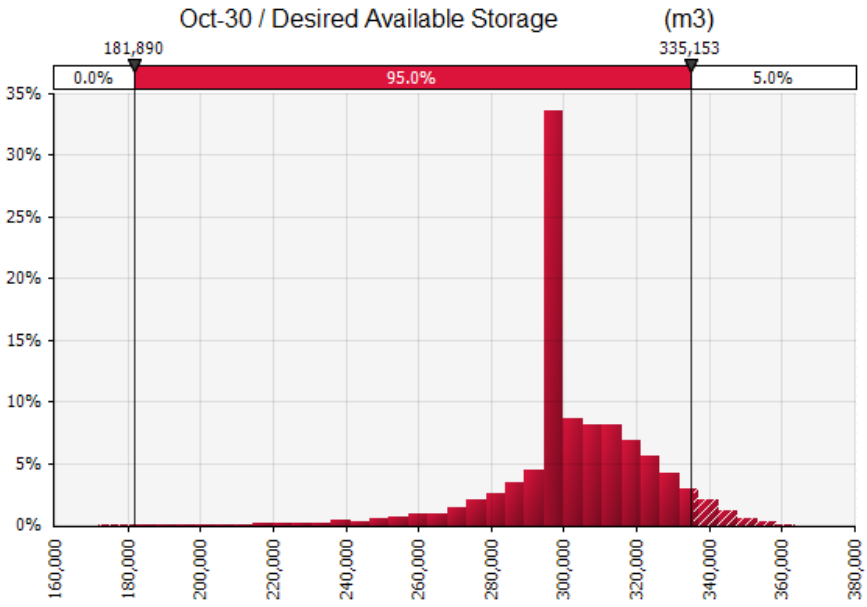
	Jul-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	146,953.61
Maximum	368,306.92
Mean	303,350.87
90% CI	± 677.11
Mode	299,850.87
Median	311,350.73
Std Dev	29,103.07
Skewness	-1.2851
Kurtosis	4.6287
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.1%
Right X	335,919
Right P	95.0%
Dif. X	154,028.96
Dif. P	94.9%



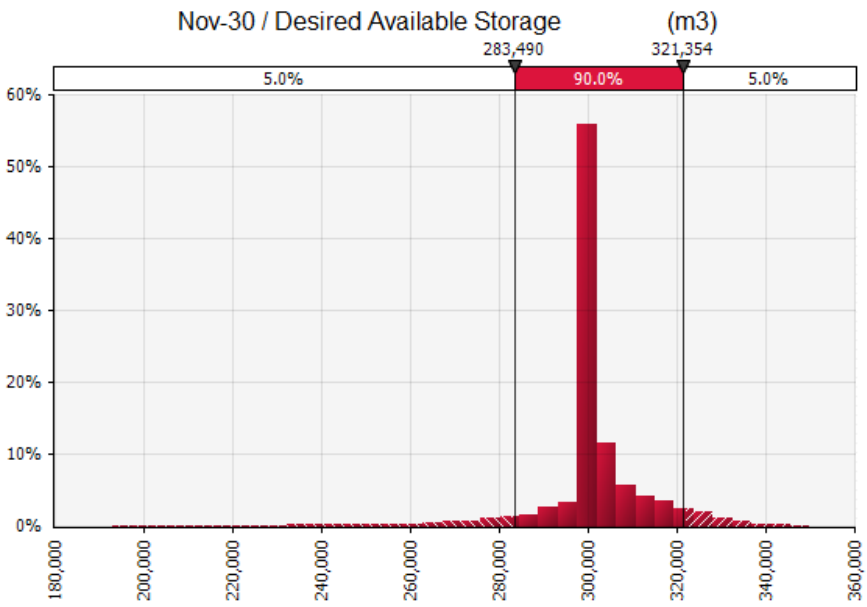
	Aug-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	176,522.53
Maximum	371,317.30
Mean	319,756.44
90% CI	± 584.52
Mode	299,850.87
Median	325,926.22
Std Dev	25,123.32
Skewness	-1.4814
Kurtosis	5.8354
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.0%
Right X	348,686
Right P	95.0%
Dif. X	166,795.58



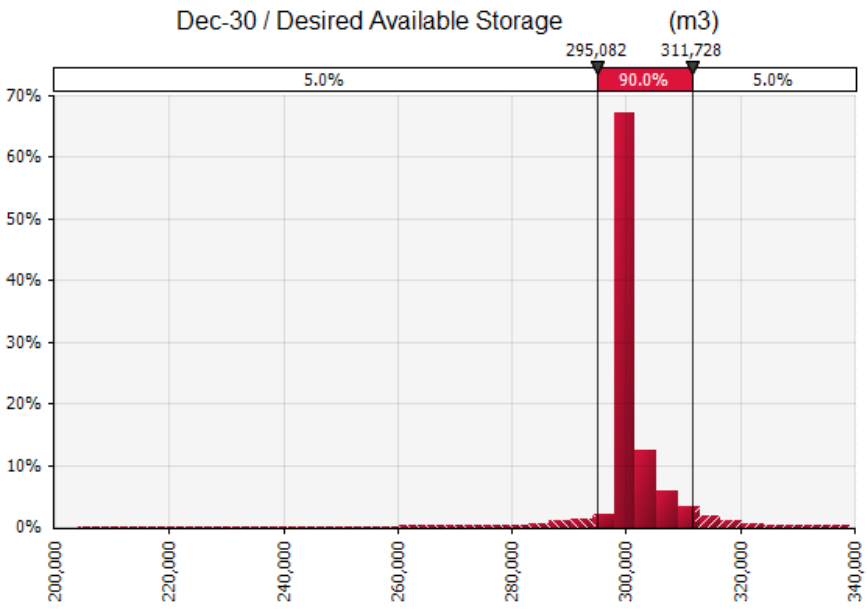
	Sep-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	205,323.72
Maximum	378,344.33
Mean	326,967.09
90% CI	± 495.02
Mode	299,850.87
Median	330,007.78
Std Dev	21,276.69
Skewness	-1.0793
Kurtosis	5.3237
Values	5000
Errors	0
Filtered	0
Left X	291,832
Left P	5.0%
Right X	355,148
Right P	95.0%
Dif. X	63,315.99



	Oct-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	171,993.98
Maximum	363,880.82
Mean	304,033.63
90% CI	± 445.29
Mode	299,850.87
Median	299,850.87
Std Dev	19,138.98
Skewness	-0.7875
Kurtosis	6.3959
Values	5000
Errors	0
Filtered	0
Left X	181,890
Left P	0.0%
Right X	335,153
Right P	95.0%
Dif. X	153,263.41
Dif. P	95.0%



	Nov-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	193,011.74
Maximum	349,962.12
Mean	301,468.26
90% CI	± 281.14
Mode	299,850.87
Median	299,850.87
Std Dev	12,083.67
Skewness	-1.3885
Kurtosis	13.4008
Values	5000
Errors	0
Filtered	0
Left X	283,490
Left P	5.0%
Right X	321,354
Right P	95.0%
Dif. X	37,863.91

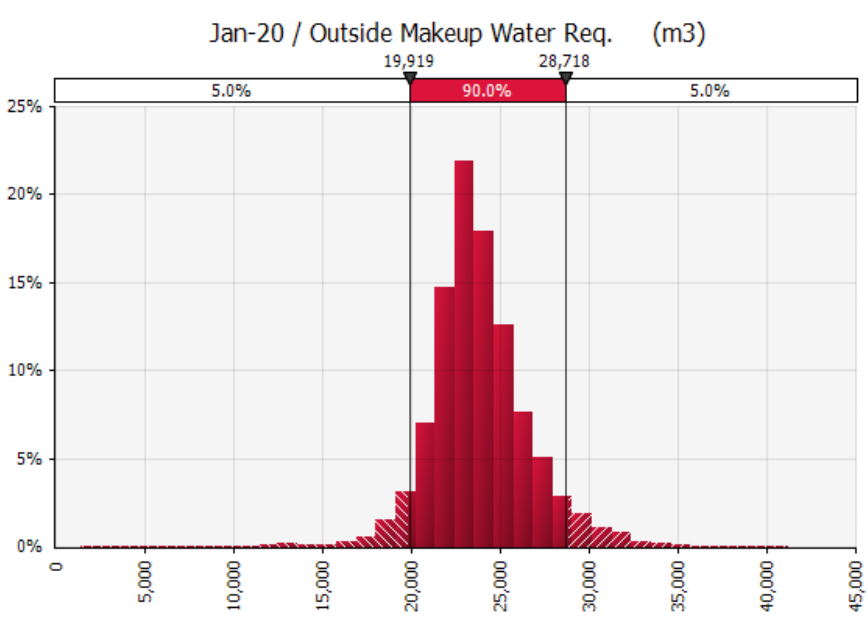


	Dec-30 / Available Storage (m3)
Cell	Waterbalance Model..
Minimum	204,067.26
Maximum	339,157.23
Mean	300,997.63
90% CI	± 170.92
Mode	299,850.87
Median	299,850.87
Std Dev	7,346.43
Skewness	-2.2098
Kurtosis	28.2004
Values	5000
Errors	0
Filtered	0
Left X	295,082
Left P	5.0%
Right X	311,728
Right P	95.0%
Dif. X	16,645.92

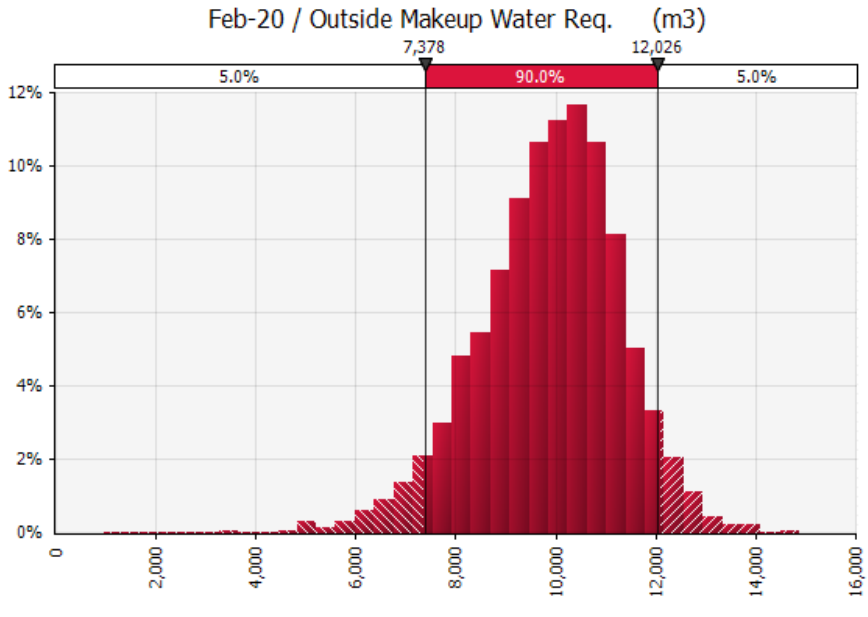
Appendix C
Stochastic Modeling results
Outside Makeup Water Demand

Phase 1 Results

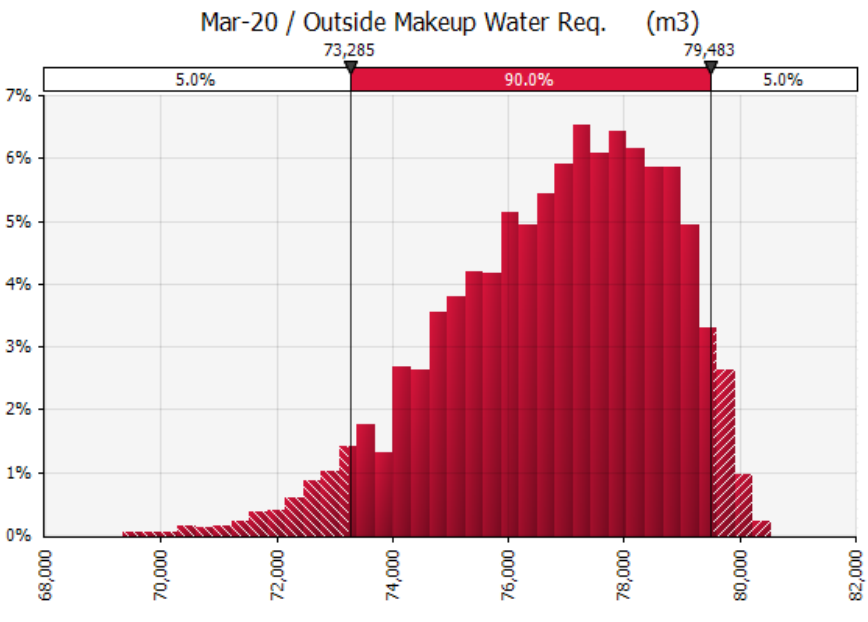
Outside Makeup Water Demand



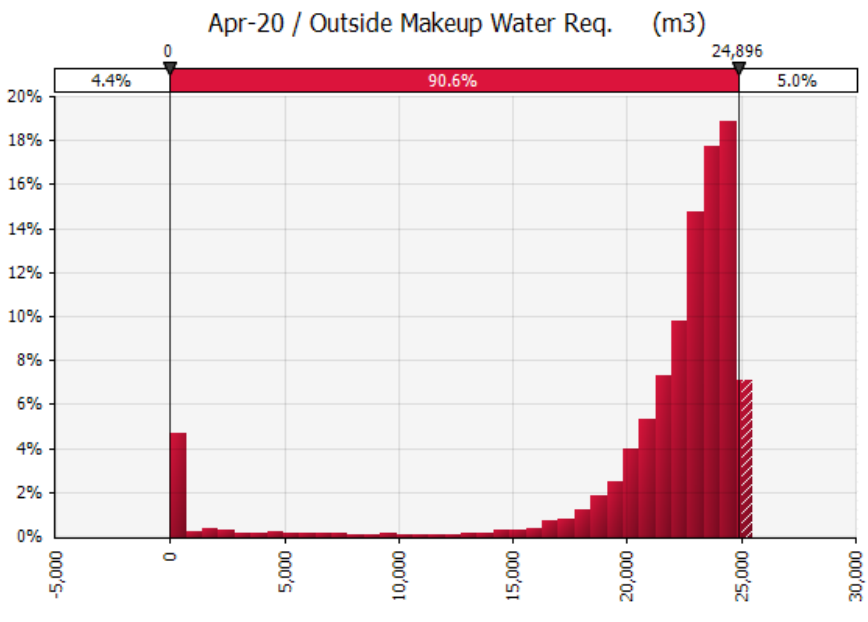
	Jan-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	1,398.04
Maximum	41,256.47
Mean	23,868.47
90% CI	± 63.70
Mode	22,566.71
Median	23,572.85
Std Dev	2,737.92
Skewness	0.3398
Kurtosis	6.0189
Values	5000
Errors	0
Filtered	0
Left X	19,919
Left P	5.0%
Right X	28,718
Right P	95.0%
Dif. X	8,798.99
Dif. P	90.0%



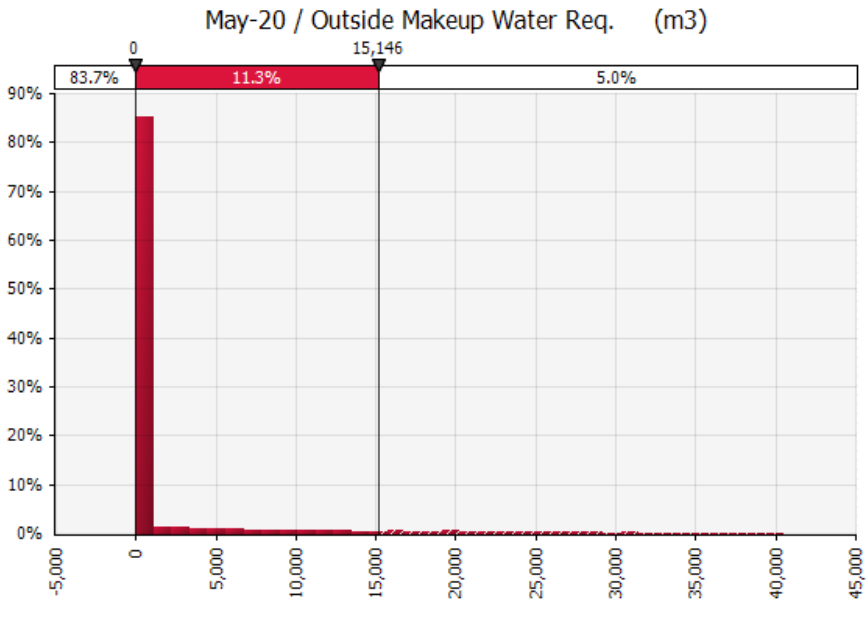
	Feb-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	953.92
Maximum	14,886.56
Mean	9,880.48
90% CI	± 33.41
Mode	9,594.38
Median	9,988.86
Std Dev	1,436.14
Skewness	-0.4945
Kurtosis	4.0080
Values	5000
Errors	0
Filtered	0
Left X	7,378
Left P	5.0%
Right X	12,026
Right P	95.0%
Dif. X	4,648.10
Dif. P	90.0%



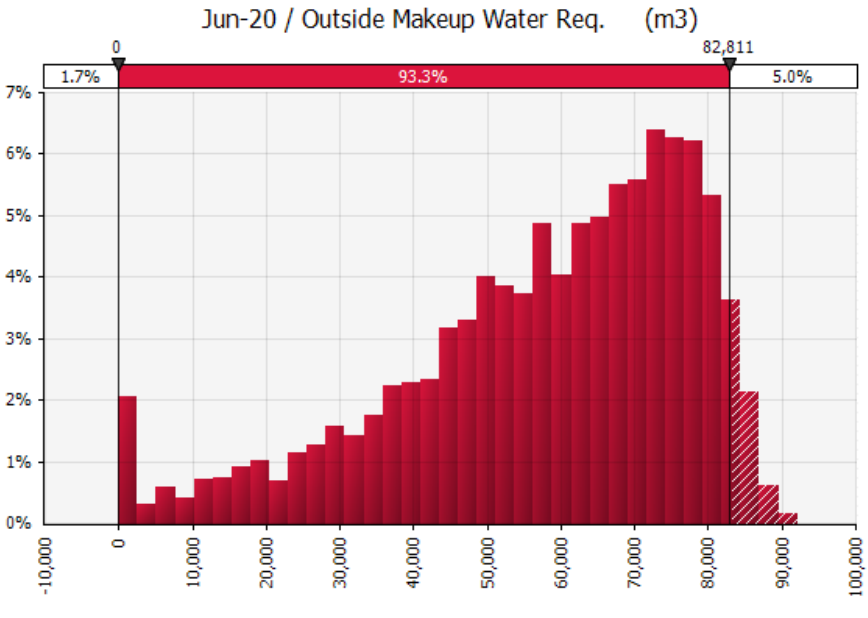
	Mar-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	69,358.01
Maximum	80,540.05
Mean	76,813.88
90% CI	± 44.58
Mode	77,281.40
Median	77,064.01
Std Dev	1,916.26
Skewness	-0.6125
Kurtosis	3.0229
Values	5000
Errors	0
Filtered	0
Left X	73,285
Left P	5.0%
Right X	79,483
Right P	95.0%
Dif. X	6,198.41
Dif. P	90.0%



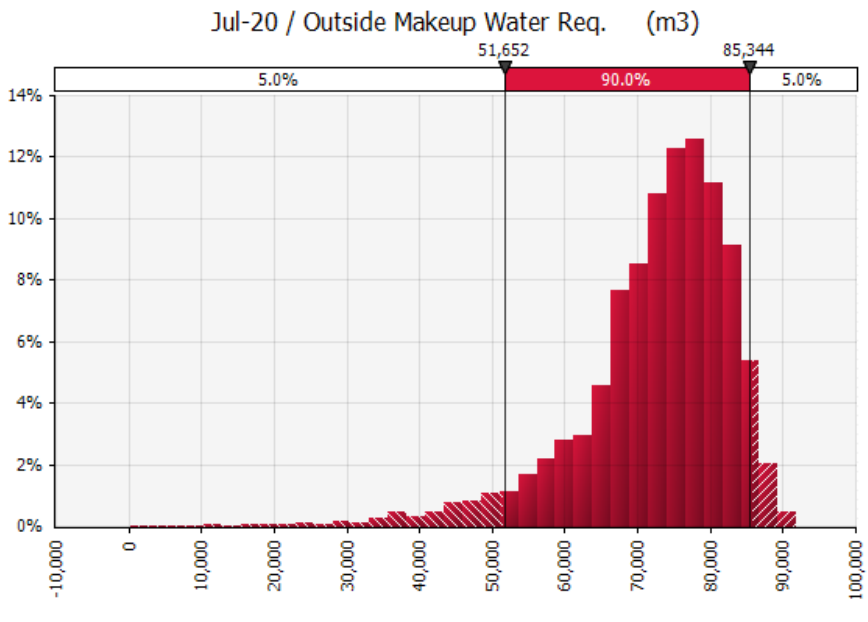
	Apr-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	25,491.35
Mean	21,246.46
90% CI	± 134.17
Mode	0.00
Median	23,098.44
Std Dev	5,766.65
Skewness	-2.8731
Kurtosis	10.4470
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	4.4%
Right X	24,896
Right P	95.0%
Dif. X	24,896.25
Dif. P	90.6%



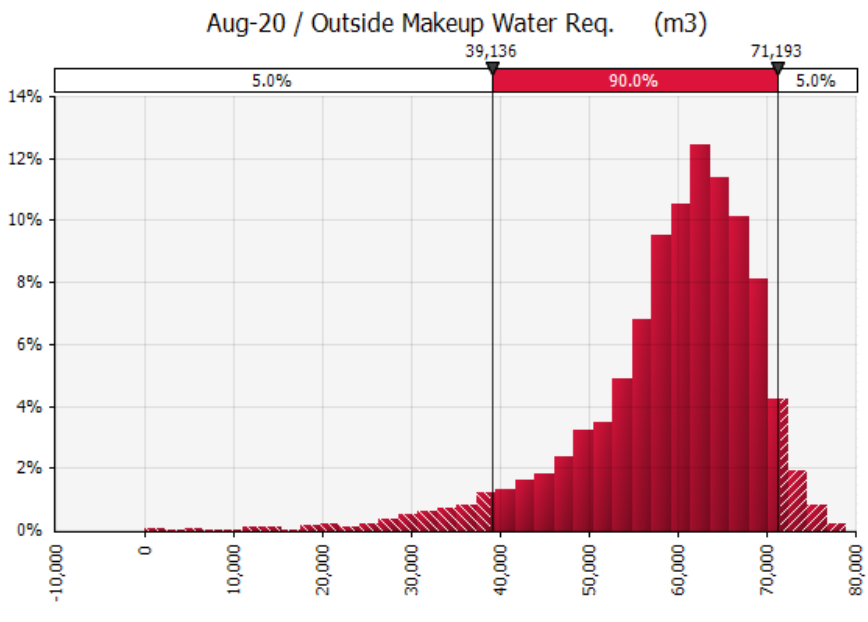
	May-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	40,493.88
Mean	1,832.42
90% CI	± 130.83
Mode	0.00
Median	0.00
Std Dev	5,623.16
Skewness	3.6847
Kurtosis	17.1176
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	83.7%
Right X	15,146
Right P	95.0%
Dif. X	15,145.69
Dif. P	11.3%



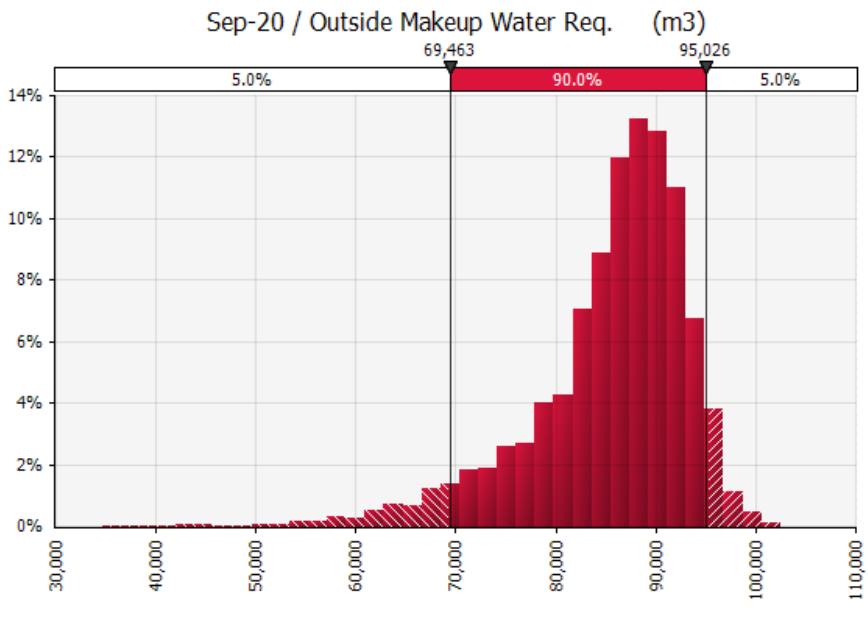
	Jun-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	92,106.29
Mean	57,903.73
90% CI	± 474.50
Mode	0.00
Median	62,321.96
Std Dev	20,394.56
Skewness	-0.9026
Kurtosis	3.2750
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	1.7%
Right X	82,811
Right P	95.0%
Dif. X	82,811.35
Dif. P	93.3%



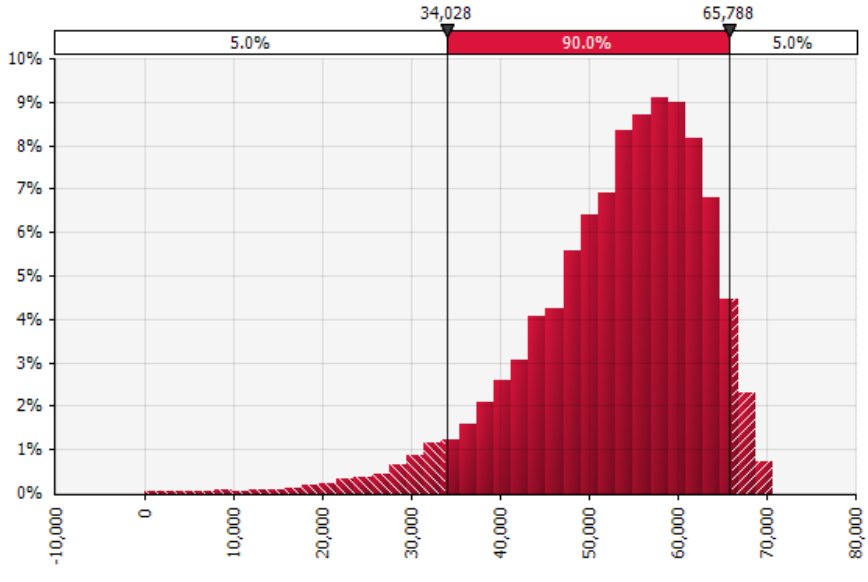
	Jul-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	91,900.47
Mean	72,630.75
90% CI	± 246.36
Mode	78,027.87
Median	74,663.03
Std Dev	10,588.97
Skewness	-1.5228
Kurtosis	6.7587
Values	5000
Errors	0
Filtered	0
Left X	51,652
Left P	5.0%
Right X	85,344
Right P	95.0%
Dif. X	33,692.10
Dif. P	90.0%



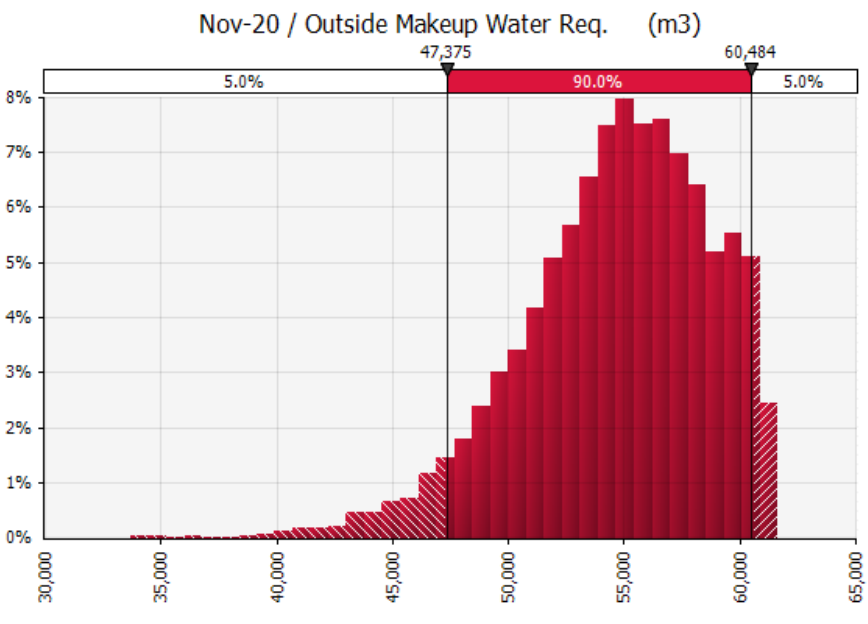
	Aug-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	79,016.62
Mean	59,248.90
90% CI	± 232.71
Mode	63,021.07
Median	61,329.14
Std Dev	10,001.95
Skewness	-1.4725
Kurtosis	6.3169
Values	5000
Errors	0
Filtered	0
Left X	39,136
Left P	5.0%
Right X	71,193
Right P	95.0%
Dif. X	32,057.54
Dif. P	90.0%



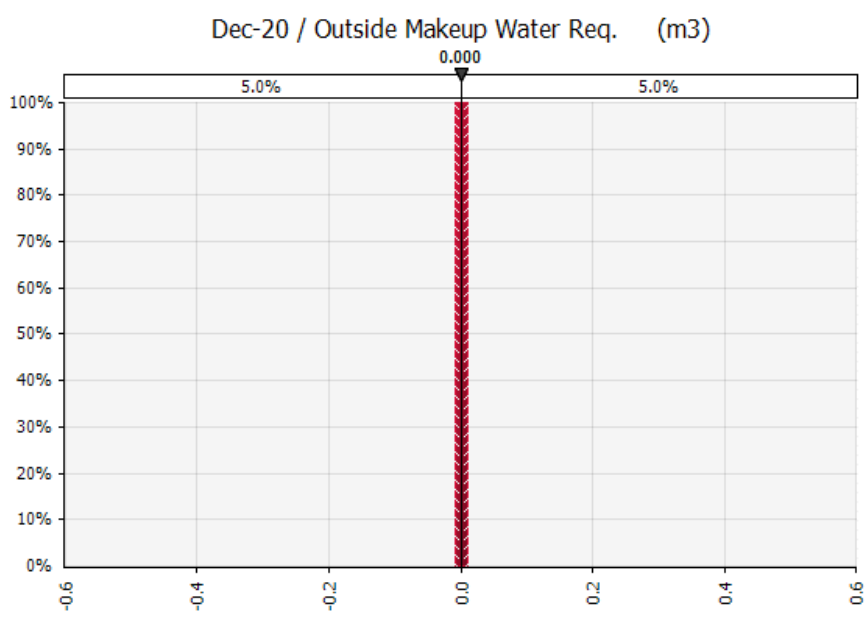
	Sep-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	34,486.38
Maximum	102,471.62
Mean	85,556.31
90% CI	± 182.40
Mode	90,660.16
Median	87,222.12
Std Dev	7,839.58
Skewness	-1.3401
Kurtosis	5.5259
Values	5000
Errors	0
Filtered	0
Left X	69,463
Left P	5.0%
Right X	95,026
Right P	95.0%
Dif. X	25,562.29
Dif. P	90.0%



	Oct-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	70,708.62
Mean	53,039.79
90% CI	± 231.70
Mode	59,798.62
Median	54,848.32
Std Dev	9,958.77
Skewness	-1.0788
Kurtosis	4.6248
Values	5000
Errors	0
Filtered	0
Left X	34,028
Left P	5.0%
Right X	65,788
Right P	95.0%
Dif. X	31,760.56
Dif. P	90.0%



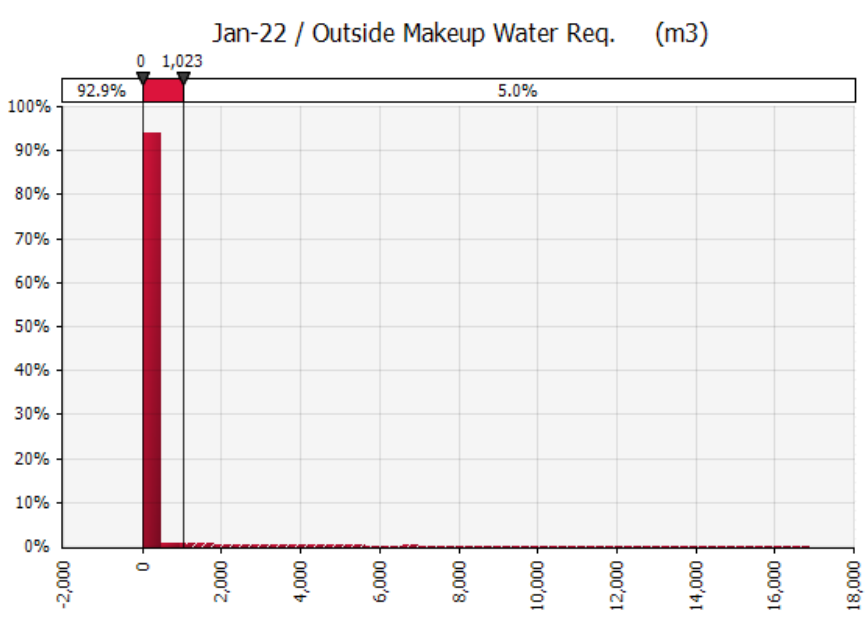
	Nov-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	33,699.02
Maximum	61,652.60
Mean	54,713.25
90% CI	± 93.91
Mode	54,536.12
Median	55,105.17
Std Dev	4,036.20
Skewness	-0.7143
Kurtosis	3.5843
Values	5000
Errors	0
Filtered	0
Left X	47,375
Left P	5.0%
Right X	60,484
Right P	95.0%
Dif. X	13,108.05
Dif. P	90.0%



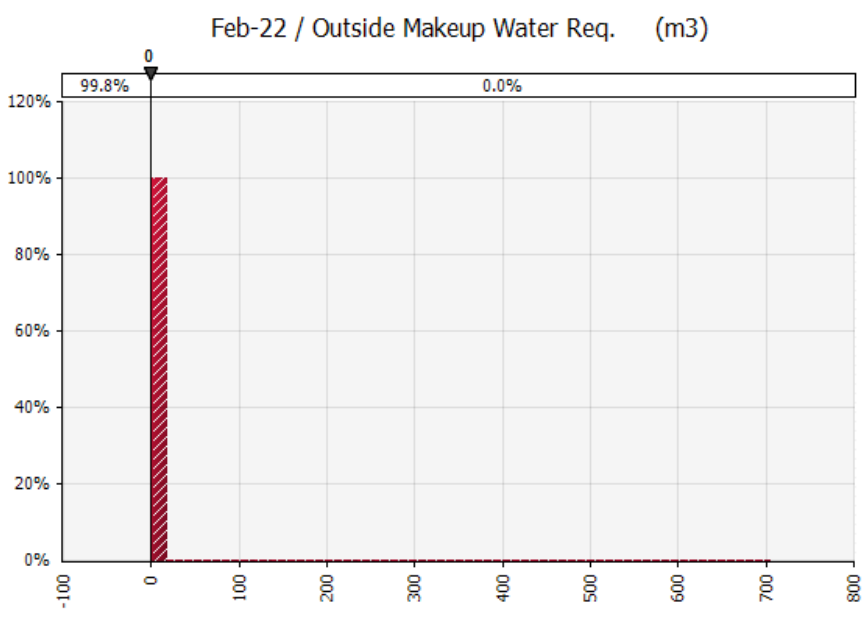
	Dec-20 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.0000
Maximum	0.0000
Mean	0.0000
90% CI	± 0.0000
Mode	0.0000
Median	0.0000
Std Dev	0.0000
Skewness	N/A
Kurtosis	N/A
Values	5000
Errors	0
Filtered	0
Left X	0.000
Left P	5.0%
Right X	0.000
Right P	95.0%
Dif. X	0.0000
Dif. P	90.0%

Phase 2 Results

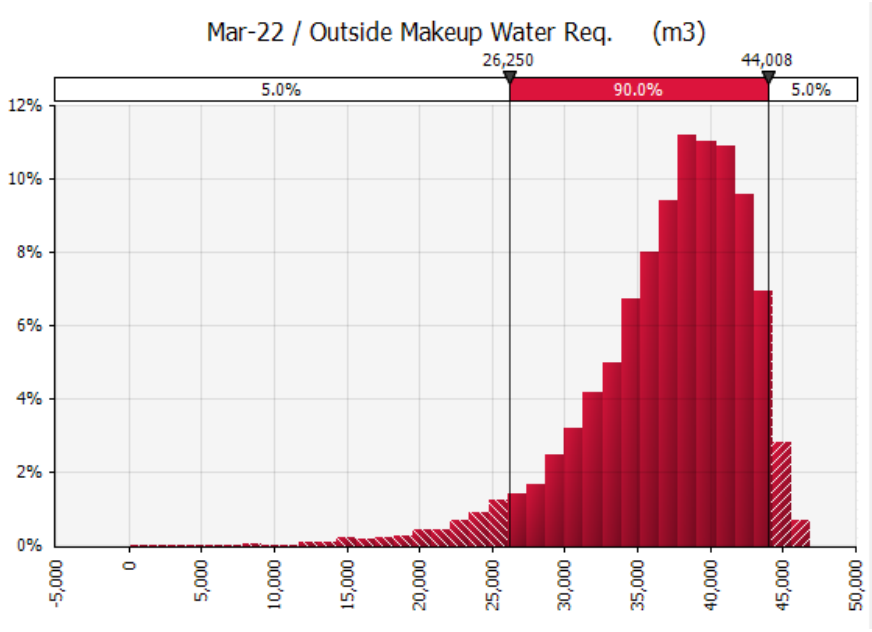
Outside Makeup Water Demand



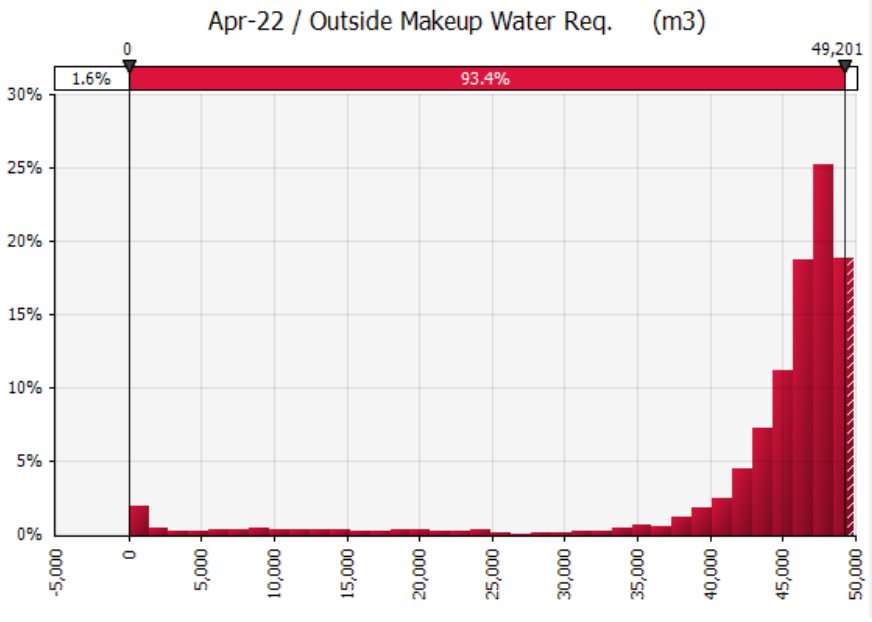
	Jan-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	16,926.67
Mean	216.59
90% CI	± 25.46
Mode	0.00
Median	0.00
Std Dev	1,094.42
Skewness	7.1091
Kurtosis	67.5193
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	92.9%
Right X	1,023
Right P	95.0%
Dif. X	1,023.47
Dif. P	2.1%



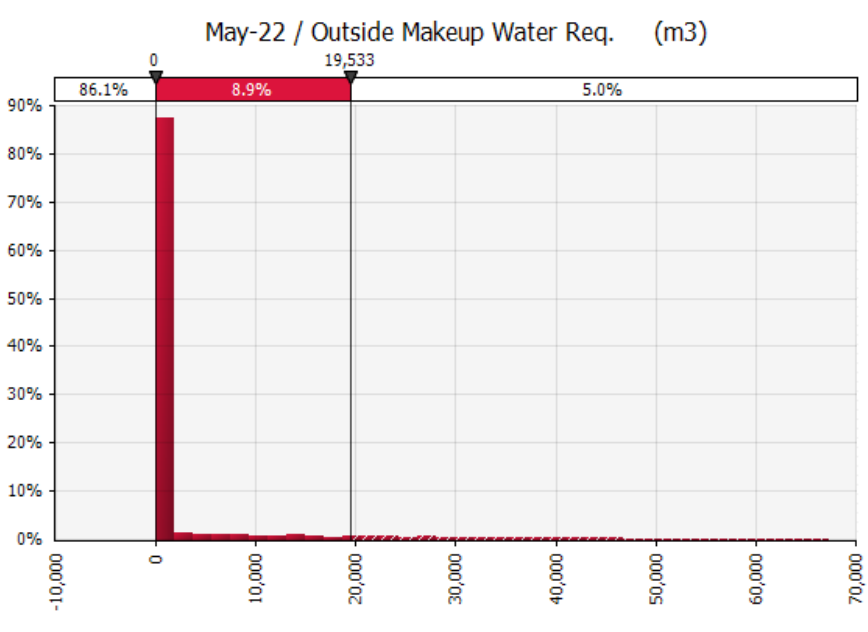
	Feb-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	706.62
Mean	0.155
90% CI	± 0.23354
Mode	0.00
Median	0.00
Std Dev	10.04
Skewness	69.8285
Kurtosis	4,914.8134
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	99.8%
Right X	0
Right P	100.0%
Dif. X	0.00
Dif. P	0.2%



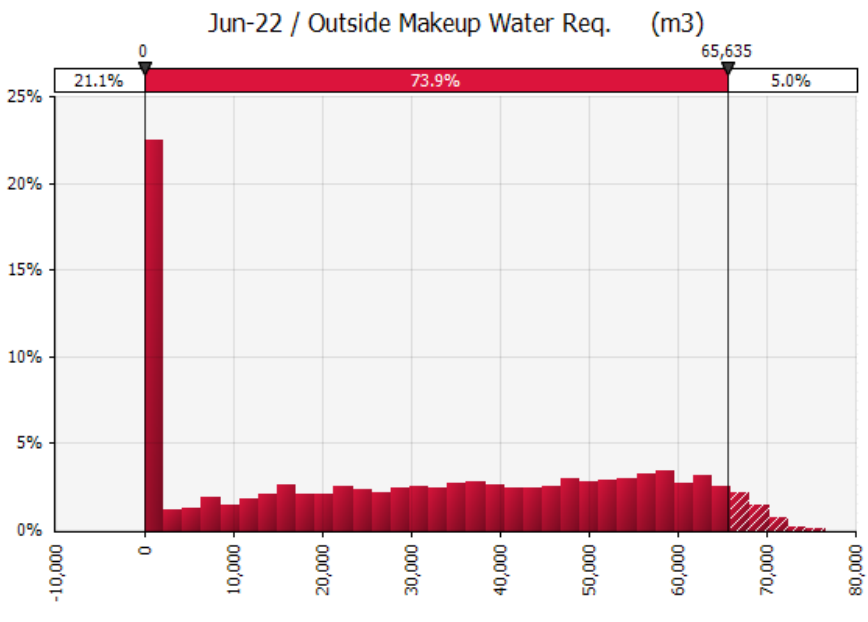
	Mar-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	46,928.63
Mean	37,082.89
90% CI	± 130.79
Mode	38,727.58
Median	38,153.38
Std Dev	5,621.65
Skewness	-1.3278
Kurtosis	5.7946
Values	5000
Errors	0
Filtered	0
Left X	26,250
Left P	5.0%
Right X	44,008
Right P	95.0%
Dif. X	17,758.39
Dif. P	90.0%



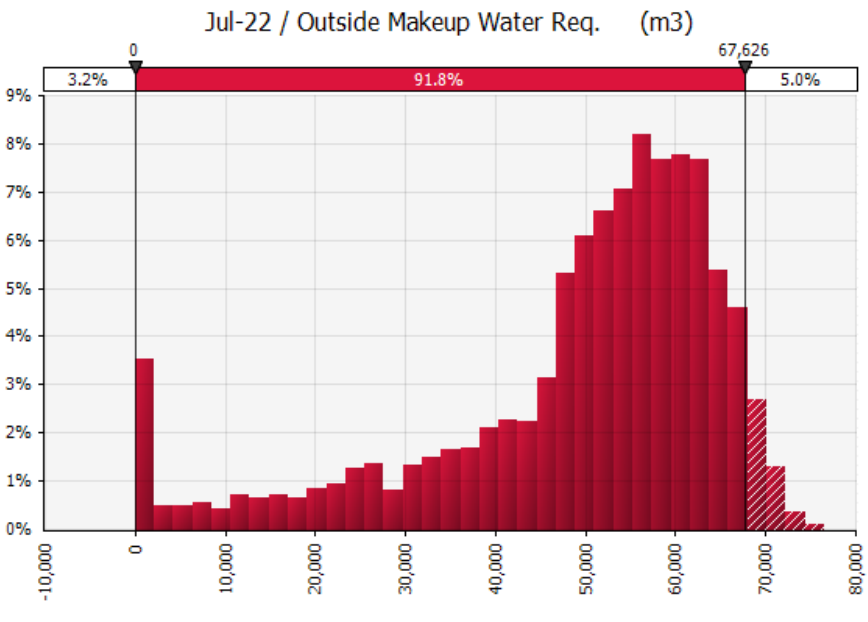
	Apr-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	49,854.08
Mean	43,572.68
90% CI	± 232.07
Mode	0.00
Median	46,706.40
Std Dev	9,974.79
Skewness	-3.1980
Kurtosis	12.6845
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	1.6%
Right X	49,201
Right P	95.0%
Dif. X	49,200.67
Dif. P	93.4%



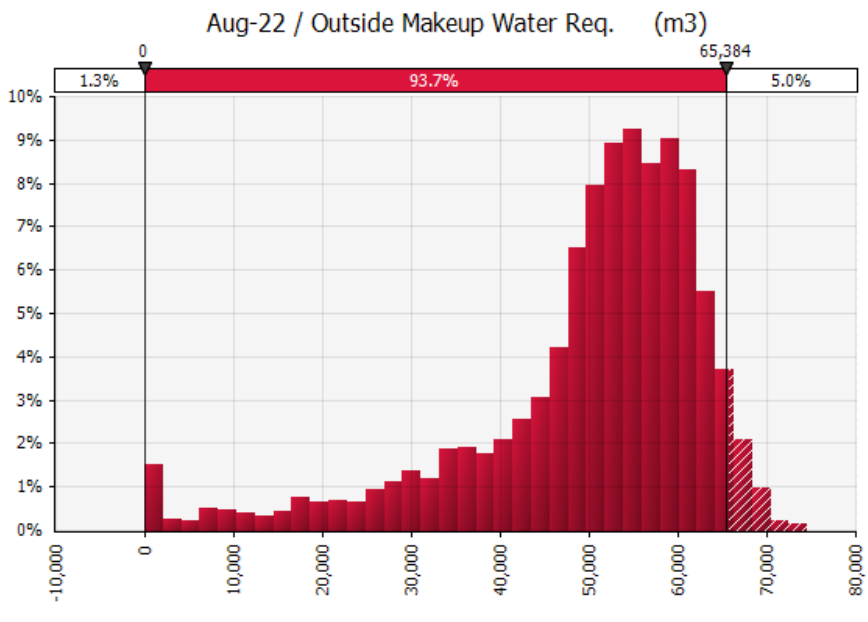
	May-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	67,382.93
Mean	2,316.35
90% CI	± 176.16
Mode	0.00
Median	0.00
Std Dev	7,571.58
Skewness	3.9104
Kurtosis	19.1312
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	86.1%
Right X	19,533
Right P	95.0%
Dif. X	19,532.84
Dif. P	8.9%



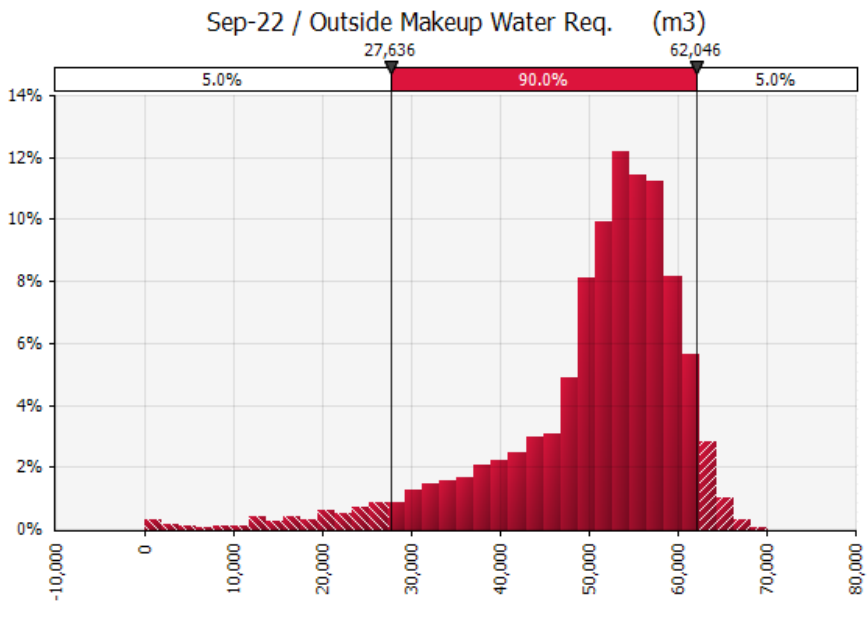
	Jun-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	76,672.29
Mean	30,527.73
90% CI	± 540.34
Mode	0.00
Median	31,219.94
Std Dev	23,224.33
Skewness	0.0380
Kurtosis	1.6298
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	21.1%
Right X	65,635
Right P	95.0%
Dif. X	65,634.95
Dif. P	73.9%



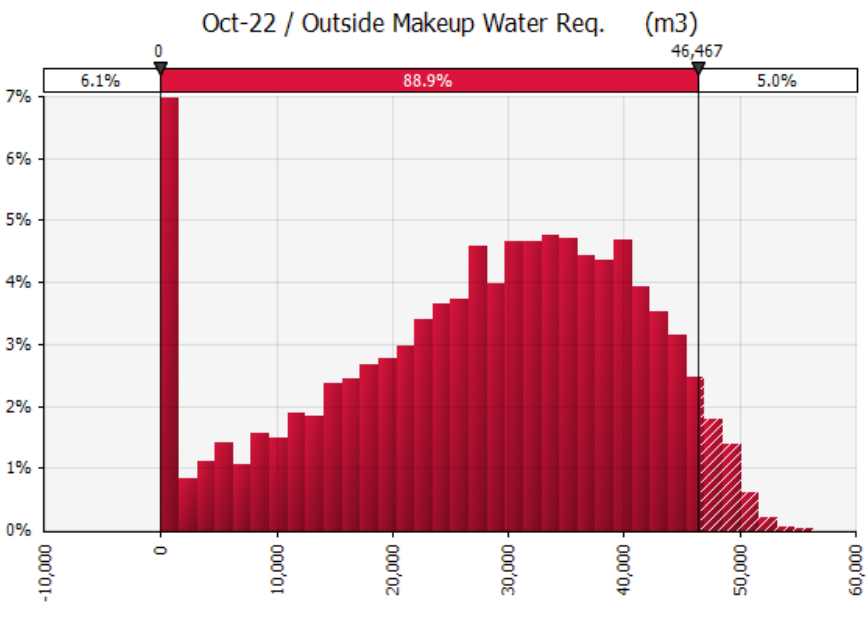
	Jul-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	76,505.01
Mean	49,173.02
90% CI	± 394.34
Mode	0.00
Median	53,984.68
Std Dev	16,949.21
Skewness	-1.3590
Kurtosis	4.3110
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	3.2%
Right X	67,626
Right P	95.0%
Dif. X	67,626.35
Dif. P	91.8%



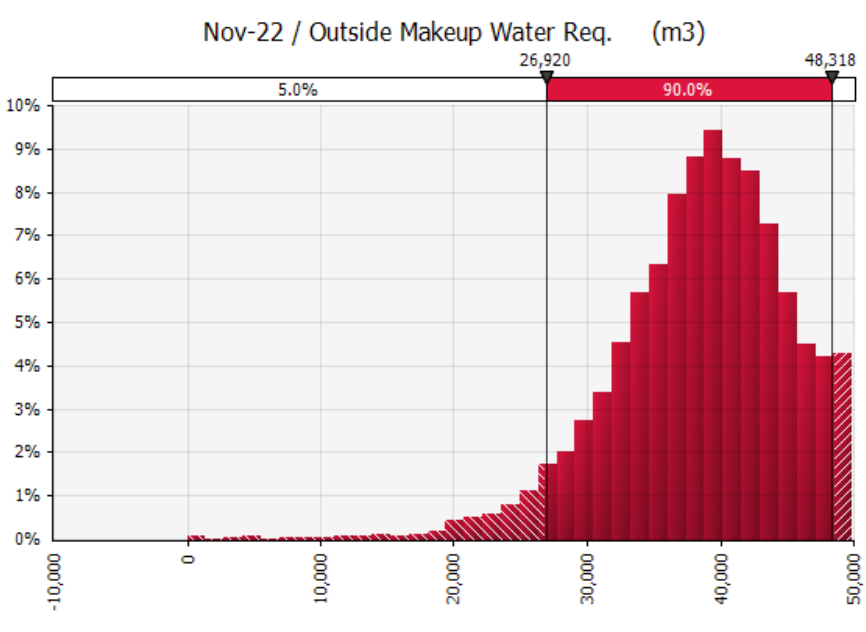
	Aug-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	74,594.94
Mean	49,897.55
90% CI	± 324.54
Mode	0.00
Median	53,391.41
Std Dev	13,949.26
Skewness	-1.5460
Kurtosis	5.4651
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	1.3%
Right X	65,384
Right P	95.0%
Dif. X	65,383.89
Dif. P	93.7%



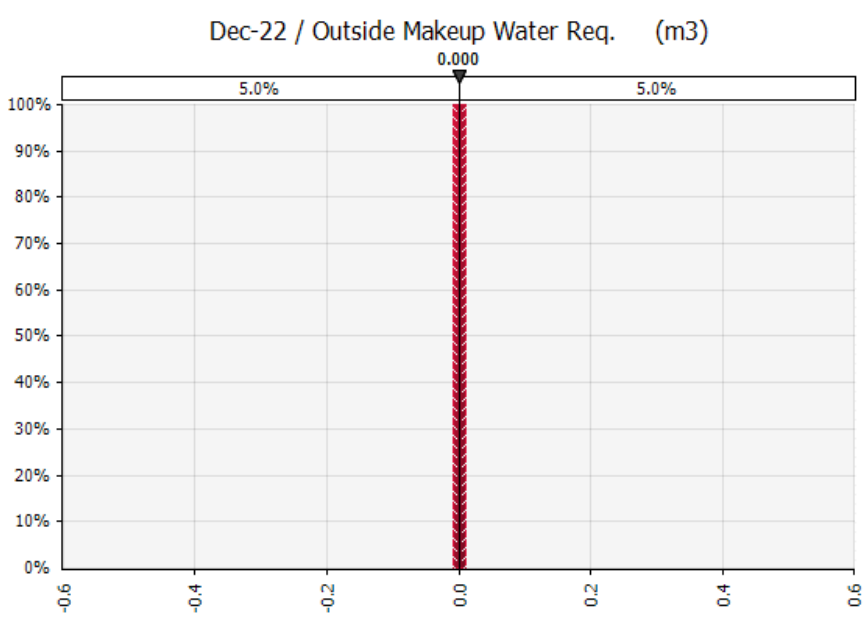
	Sep-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	70,193.86
Mean	50,302.89
90% CI	± 249.15
Mode	0.00
Median	53,033.78
Std Dev	10,708.83
Skewness	-1.6442
Kurtosis	6.2525
Values	5000
Errors	0
Filtered	0
Left X	27,636
Left P	5.0%
Right X	62,046
Right P	95.0%
Dif. X	34,409.44
Dif. P	90.0%



	Oct-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	56,375.15
Mean	27,422.69
90% CI	± 313.68
Mode	0.00
Median	29,513.84
Std Dev	13,482.30
Skewness	-0.4709
Kurtosis	2.3616
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	6.1%
Right X	46,467
Right P	95.0%
Dif. X	46,466.63
Dif. P	88.9%



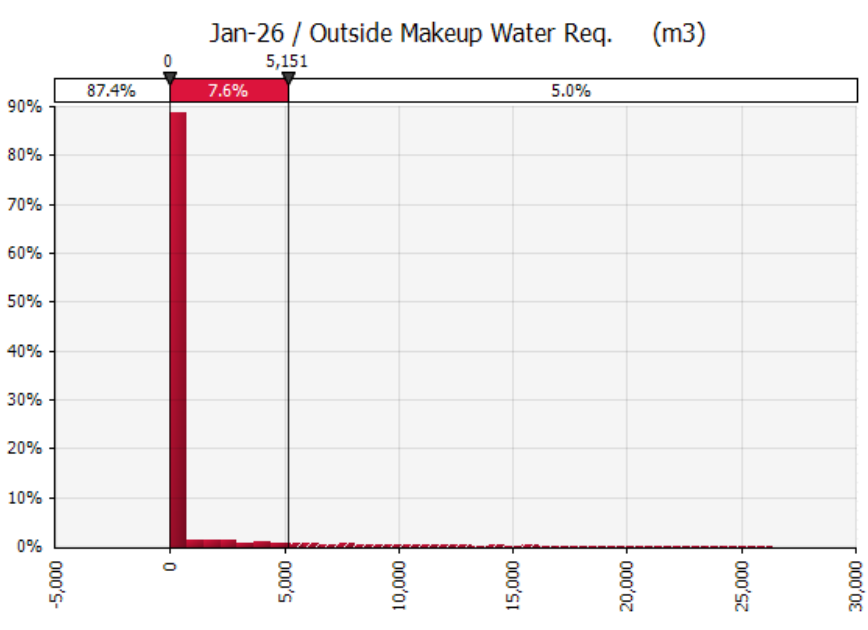
	Nov-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	49,916.22
Mean	38,574.80
90% CI	± 152.78
Mode	40,942.36
Median	39,191.69
Std Dev	6,566.45
Skewness	-0.9038
Kurtosis	4.9723
Values	5000
Errors	0
Filtered	0
Left X	26,920
Left P	5.0%
Right X	48,318
Right P	95.0%
Dif. X	21,398.10
Dif. P	90.0%



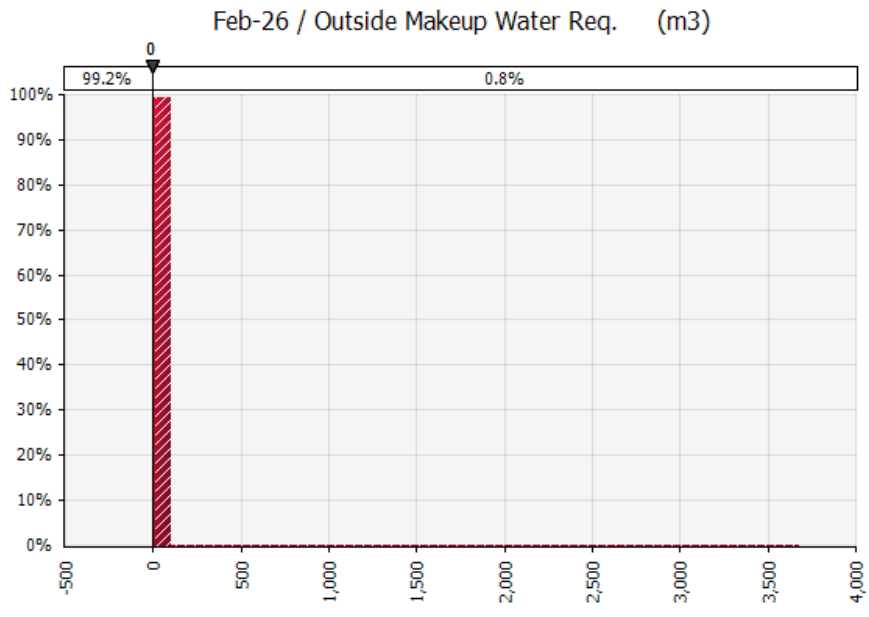
	Dec-22 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.0000
Maximum	0.0000
Mean	0.0000
90% CI	± 0.0000
Mode	0.0000
Median	0.0000
Std Dev	0.0000
Skewness	N/A
Kurtosis	N/A
Values	5000
Errors	0
Filtered	0
Left X	0.000
Left P	5.0%
Right X	0.000
Right P	95.0%
Dif. X	0.0000
Dif. P	90.0%

Phase 3 Results

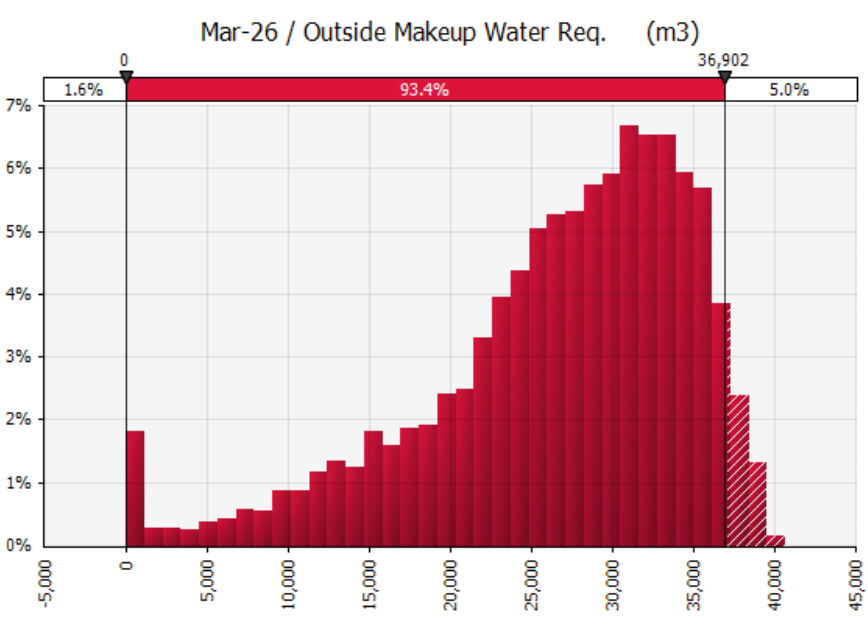
Outside Makeup Water Demand



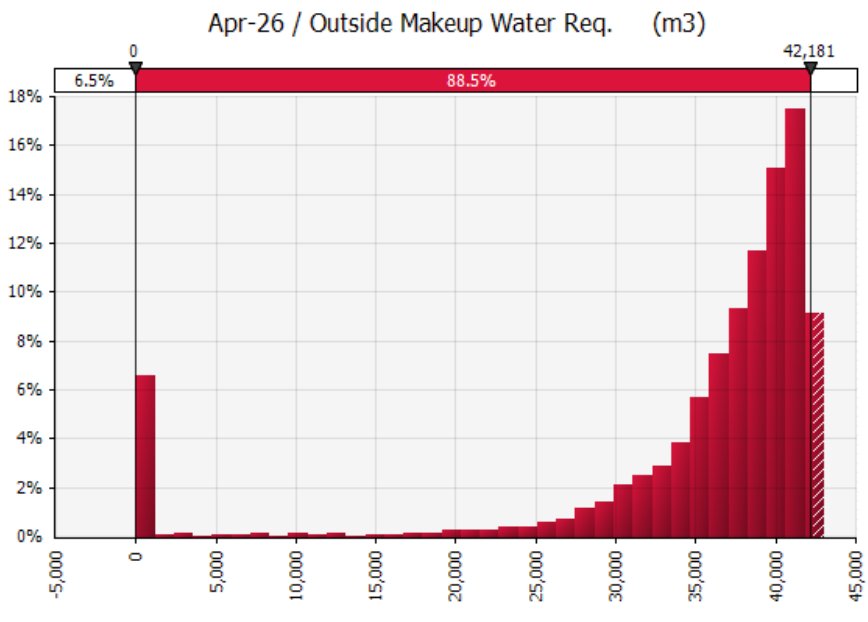
	Jan-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	26,408.68
Mean	662.29
90% CI	± 56.35
Mode	0.00
Median	0.00
Std Dev	2,421.83
Skewness	4.9648
Kurtosis	32.4485
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	87.4%
Right X	5,151
Right P	95.0%
Dif. X	5,151.40
Dif. P	7.6%



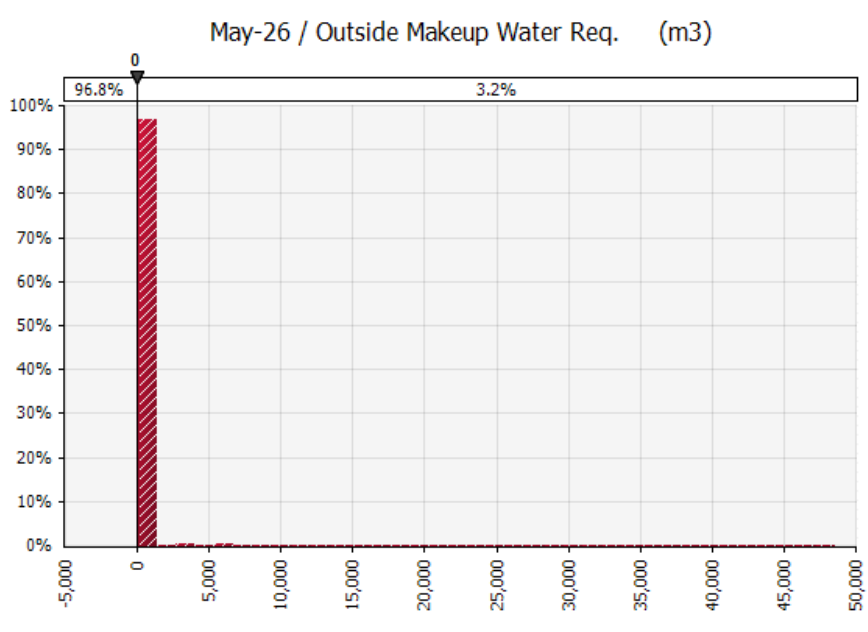
	Feb-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	3,681.29
Mean	7.20
90% CI	± 2.6855
Mode	0.00
Median	0.00
Std Dev	115.43
Skewness	21.7308
Kurtosis	550.2576
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	99.2%
Right X	0
Right P	99.2%
Dif. X	0.00
Dif. P	0.0%



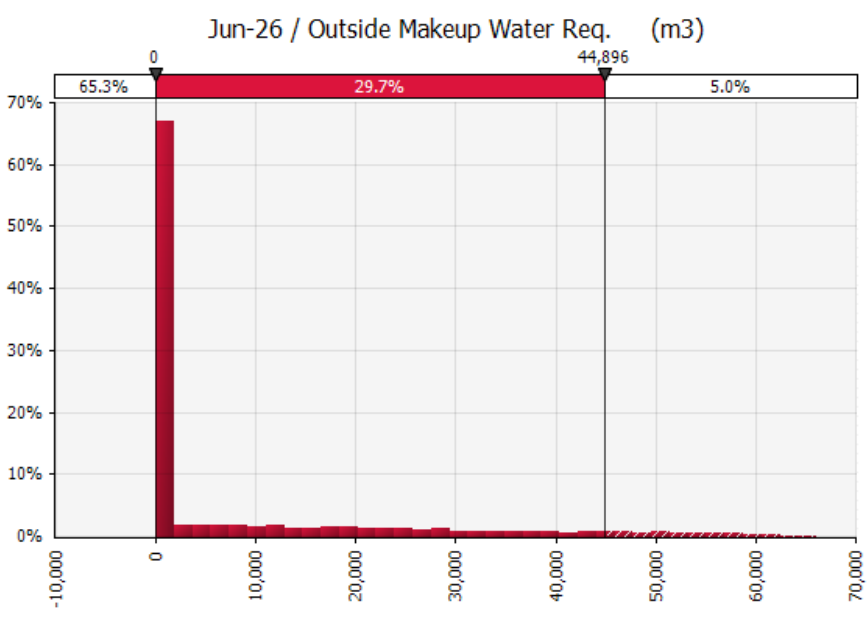
	Mar-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	40,685.32
Mean	26,619.02
90% CI	± 196.42
Mode	0.00
Median	28,373.02
Std Dev	8,442.21
Skewness	-1.0654
Kurtosis	3.9090
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	1.6%
Right X	36,902
Right P	95.0%
Dif. X	36,902.05
Dif. P	93.4%



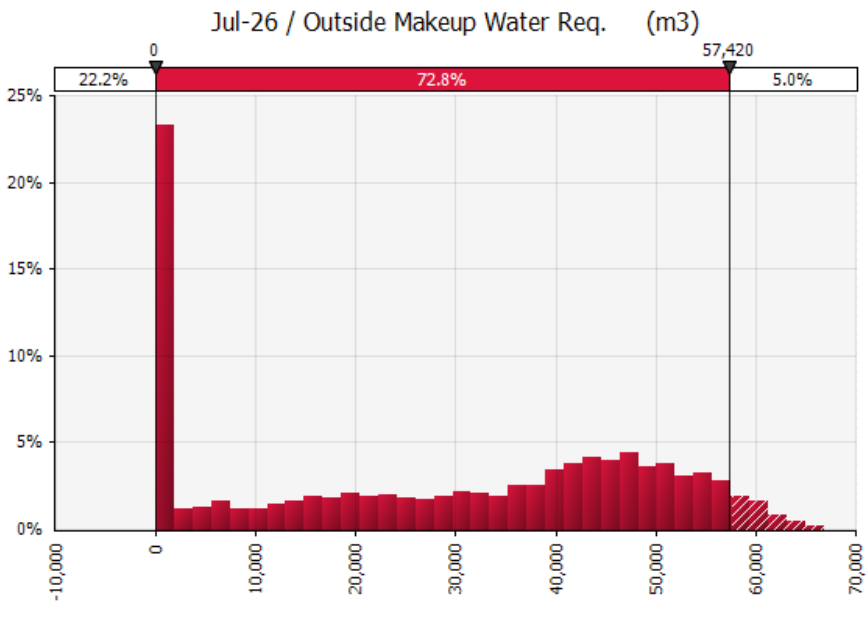
	Apr-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	43,045.65
Mean	35,061.51
90% CI	± 244.79
Mode	0.00
Median	38,657.31
Std Dev	10,521.17
Skewness	-2.5405
Kurtosis	8.6126
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	6.5%
Right X	42,181
Right P	95.0%
Dif. X	42,180.87
Dif. P	88.5%



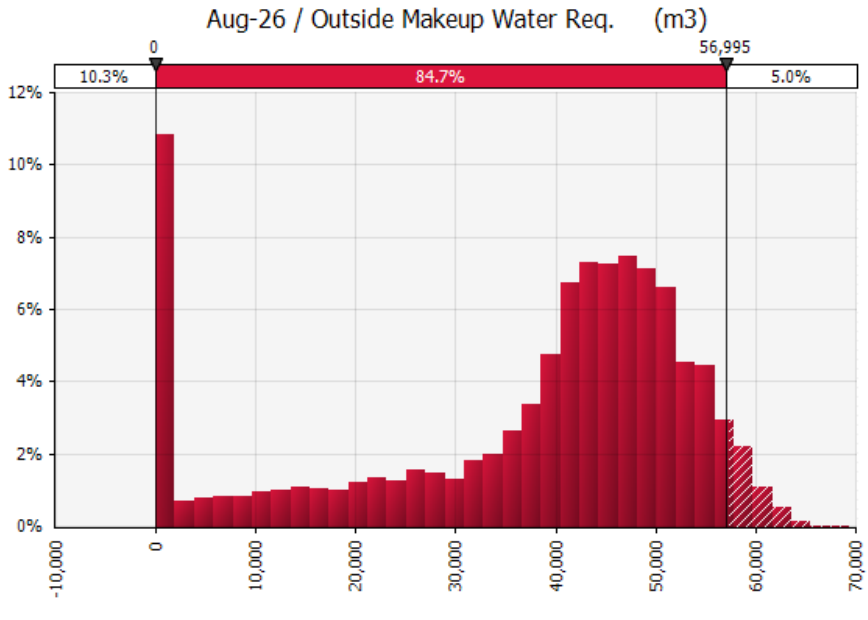
	May-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	48,615.22
Mean	541.74
90% CI	± 85.45
Mode	0.00
Median	0.00
Std Dev	3,672.82
Skewness	8.0098
Kurtosis	72.6682
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	96.8%
Right X	0
Right P	96.8%
Dif. X	0.00
Dif. P	0.0%



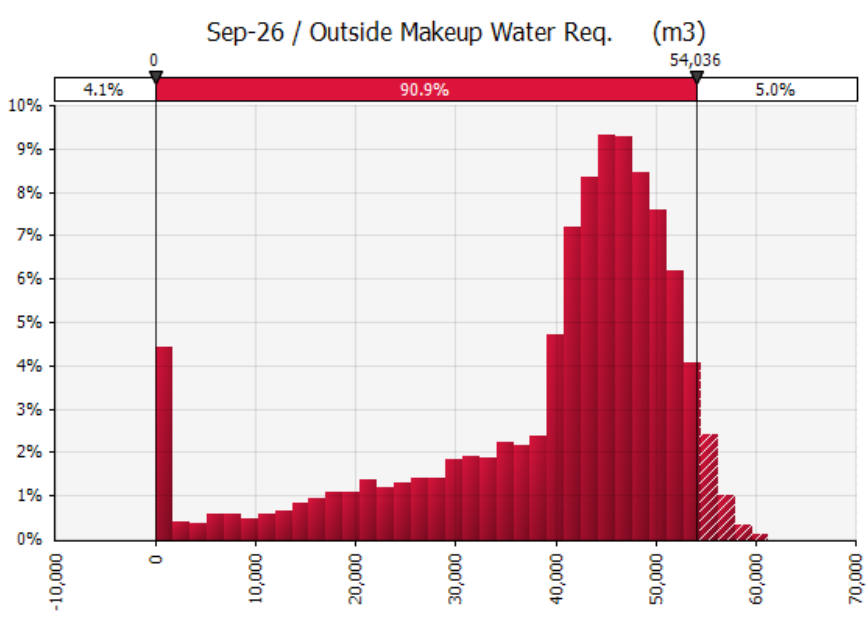
	Jun-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	66,127.29
Mean	8,034.40
90% CI	± 343.61
Mode	0.00
Median	0.00
Std Dev	14,768.56
Skewness	1.9250
Kurtosis	5.7588
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	65.3%
Right X	44,896
Right P	95.0%
Dif. X	44,895.72
Dif. P	29.7%



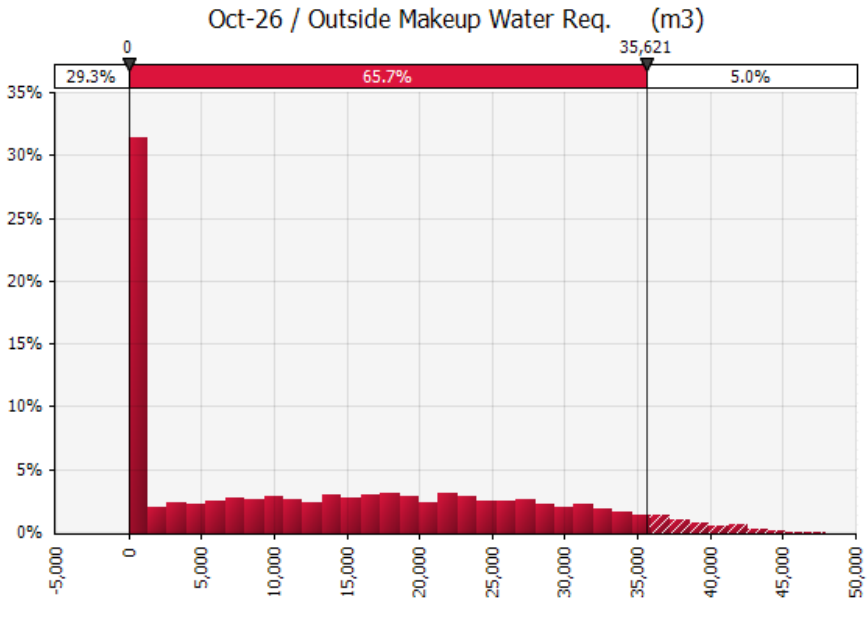
	Jul-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	66,814.42
Mean	28,295.61
90% CI	± 485.69
Mode	0.00
Median	31,748.39
Std Dev	20,875.32
Skewness	-0.1292
Kurtosis	1.5594
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	22.2%
Right X	57,420
Right P	95.0%
Dif. X	57,419.82
Dif. P	72.8%



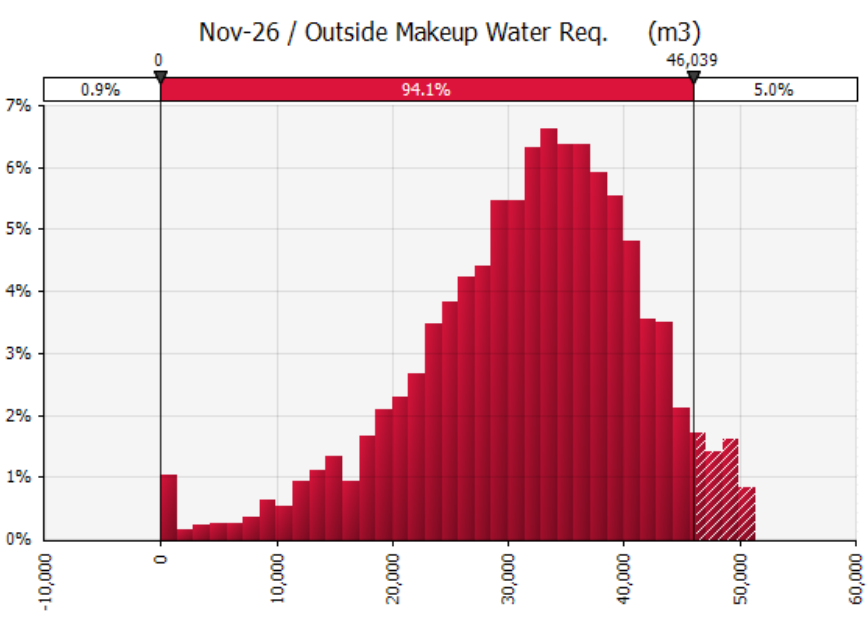
	Aug-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	69,385.18
Mean	36,820.71
90% CI	± 413.99
Mode	0.00
Median	42,750.94
Std Dev	17,793.91
Skewness	-0.9602
Kurtosis	2.7360
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	10.3%
Right X	56,995
Right P	95.0%
Dif. X	56,995.30
Dif. P	84.7%



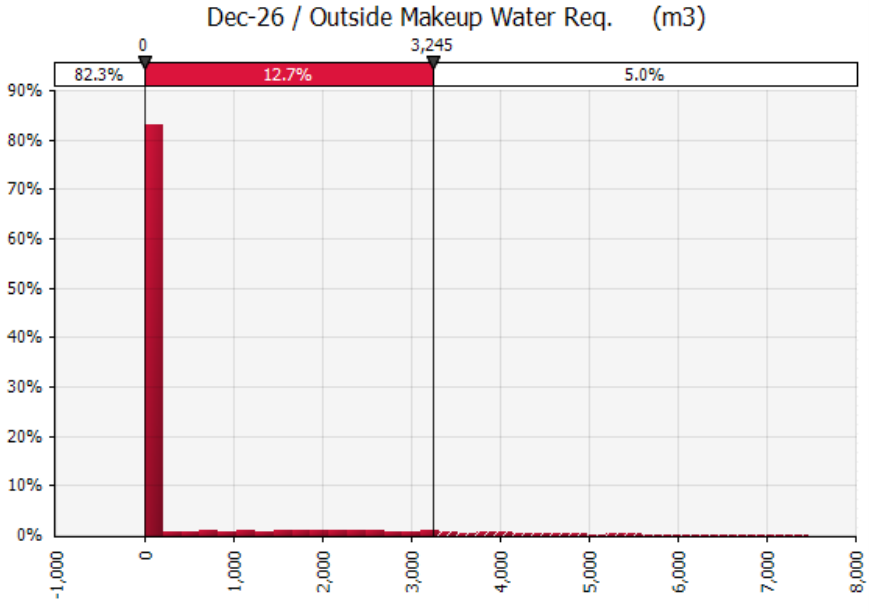
	Sep-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	61,333.87
Mean	39,421.83
90% CI	± 327.00
Mode	0.00
Median	44,070.32
Std Dev	14,054.76
Skewness	-1.4035
Kurtosis	4.2410
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	4.1%
Right X	54,036
Right P	95.0%
Dif. X	54,036.15
Dif. P	90.9%



	Oct-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	47,947.67
Mean	13,349.99
90% CI	± 290.82
Mode	0.00
Median	11,373.92
Std Dev	12,499.72
Skewness	0.4880
Kurtosis	2.0151
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	29.3%
Right X	35,621
Right P	95.0%
Dif. X	35,621.22
Dif. P	65.7%



	Nov-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	51,377.93
Mean	31,773.97
90% CI	± 226.63
Mode	0.00
Median	32,896.22
Std Dev	9,740.81
Skewness	-0.6703
Kurtosis	3.5497
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	0.9%
Right X	46,039
Right P	95.0%
Dif. X	46,039.01
Dif. P	94.1%

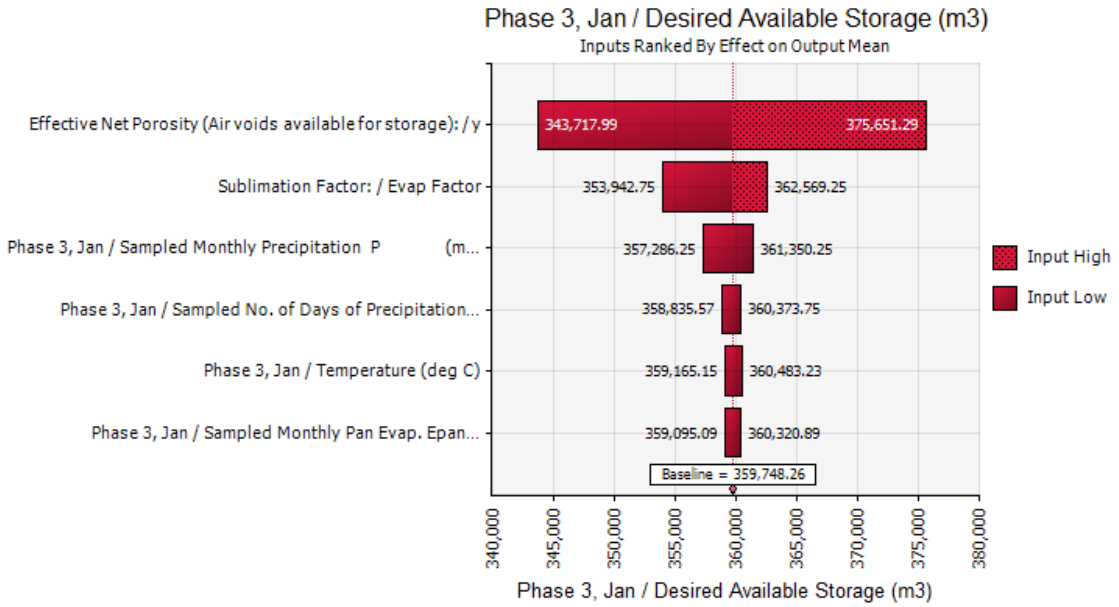


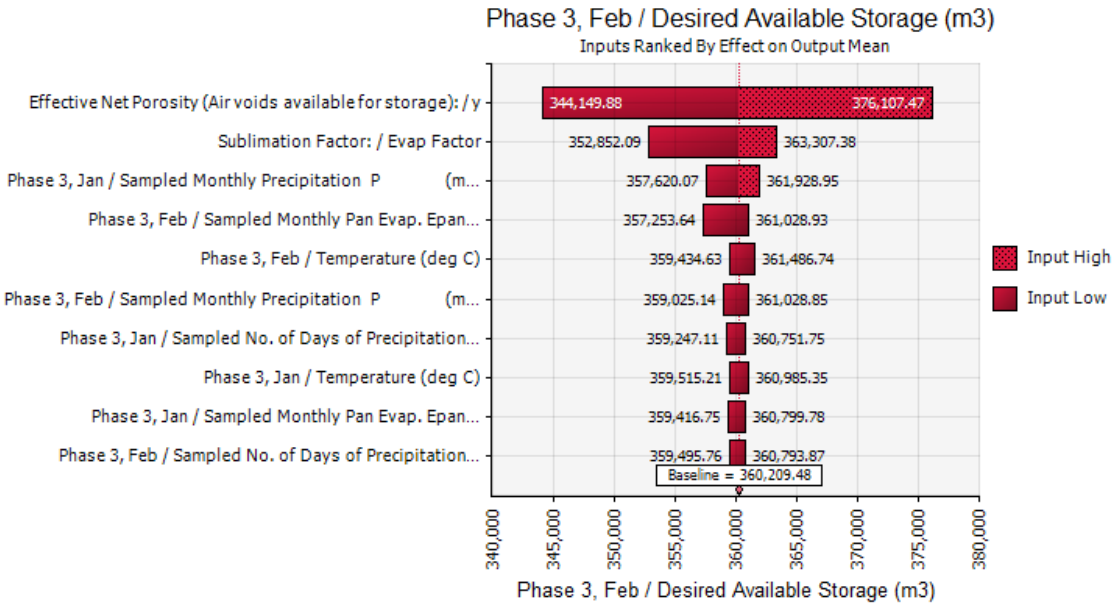
	Dec-26 / Outside Makeup Water Req. (m3)
Cell	Waterbalance Model..
Minimum	0.00
Maximum	7,465.34
Mean	429.32
90% CI	± 26.23
Mode	0.00
Median	0.00
Std Dev	1,127.52
Skewness	2.9190
Kurtosis	11.3760
Values	5000
Errors	0
Filtered	0
Left X	0
Left P	82.3%
Right X	3,245
Right P	95.0%
Dif. X	3,244.69
Dif. P	12.7%

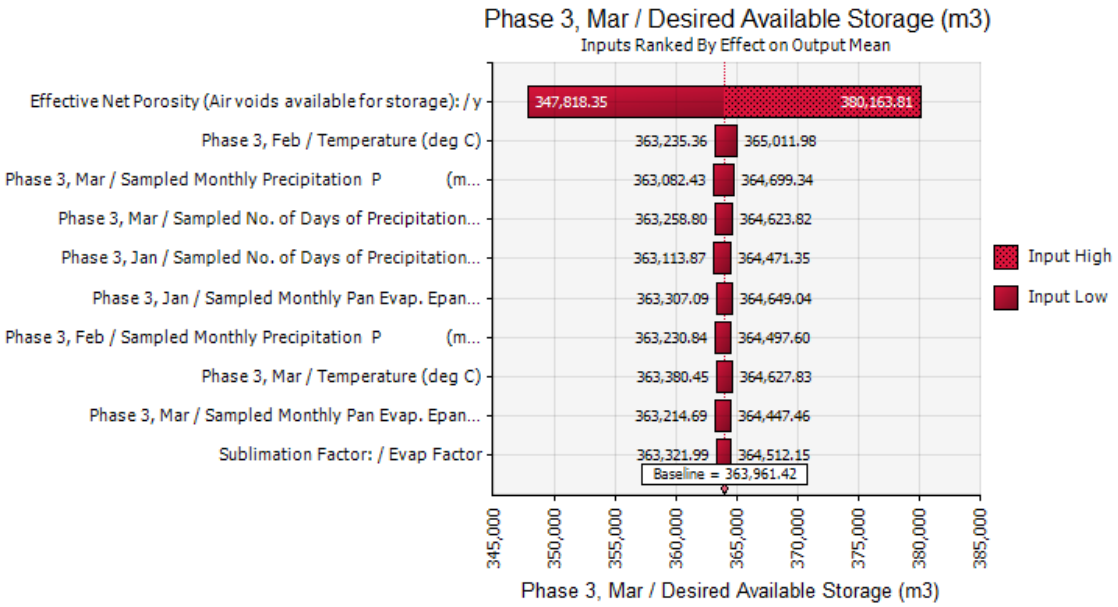
Appendix D
Sensitivity Analysis Results

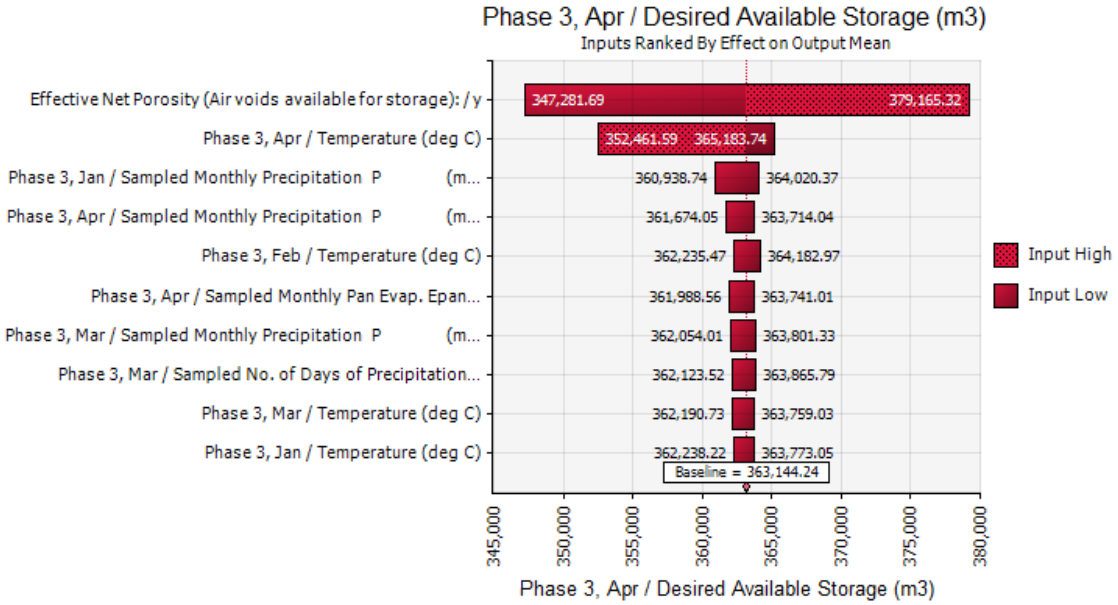
Phase 3

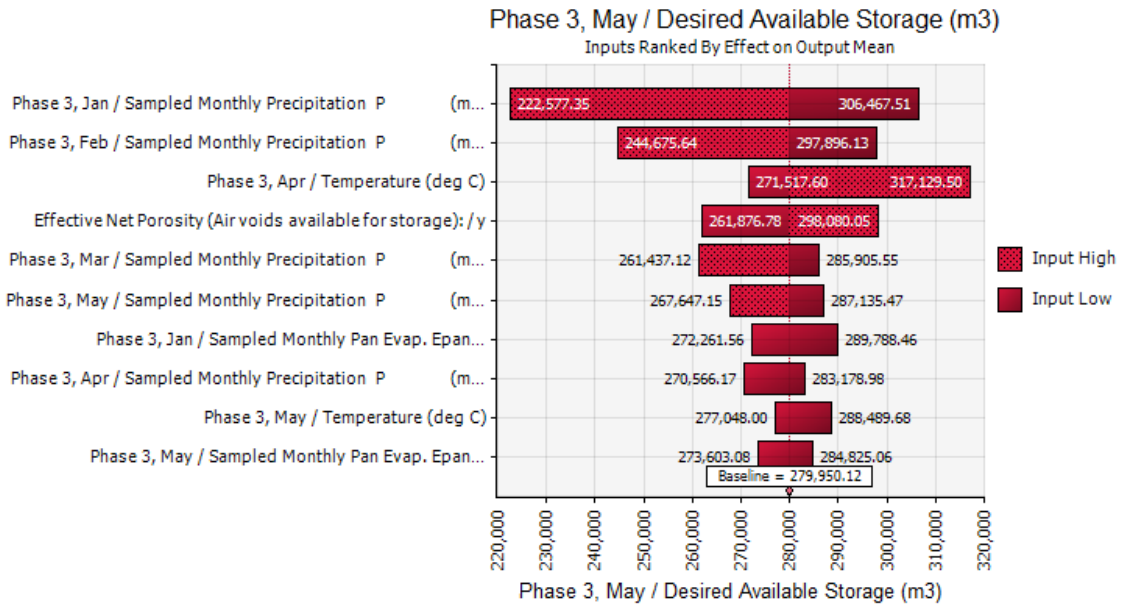
Desired Available Storage

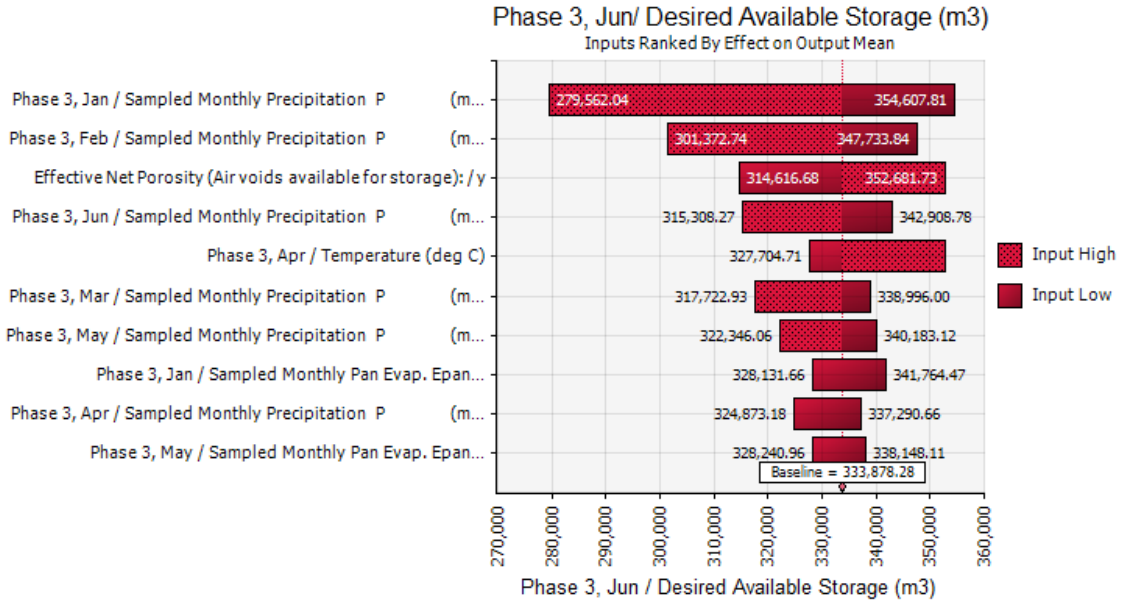


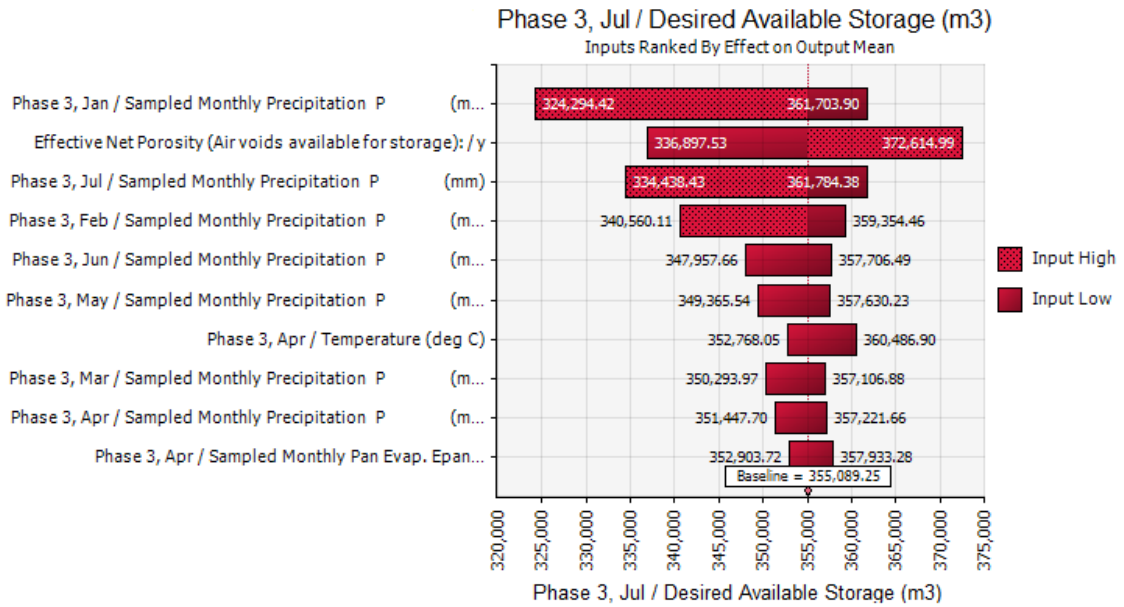


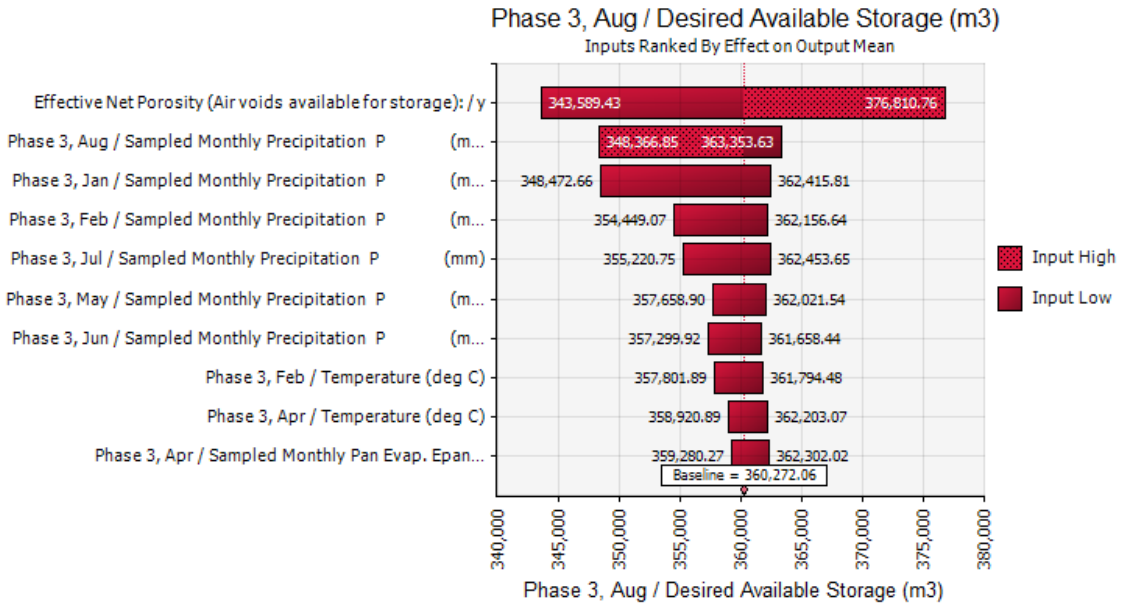

Phase 3, Mar / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Feb / Temperature (deg C)
Phase 3, Mar / Sampled Monthly Precipitation P (m...
Phase 3, Mar / Sampled No. of Days of Precipitation...
Phase 3, Jan / Sampled No. of Days of Precipitation...
Phase 3, Jan / Sampled Monthly Pan Evap. Epan...
Phase 3, Feb / Sampled Monthly Precipitation P (m...
Phase 3, Mar / Temperature (deg C)
Phase 3, Mar / Sampled Monthly Pan Evap. Epan...
Sublimation Factor: / Evap Factor
347,818.35
380,163.81
363,235.36
365,011.98
363,082.43
364,699.34
363,258.80
364,623.82
363,113.87
364,471.35
363,307.09
364,649.04
363,230.84
364,497.60
363,380.45
364,627.83
363,214.69
364,447.46
363,321.99
364,512.15
Baseline = 363,961.42
345,000
350,000
355,000
360,000
365,000
370,000
375,000
380,000
385,000
Phase 3, Mar / Desired Available Storage (m3)
Input High
Input Low

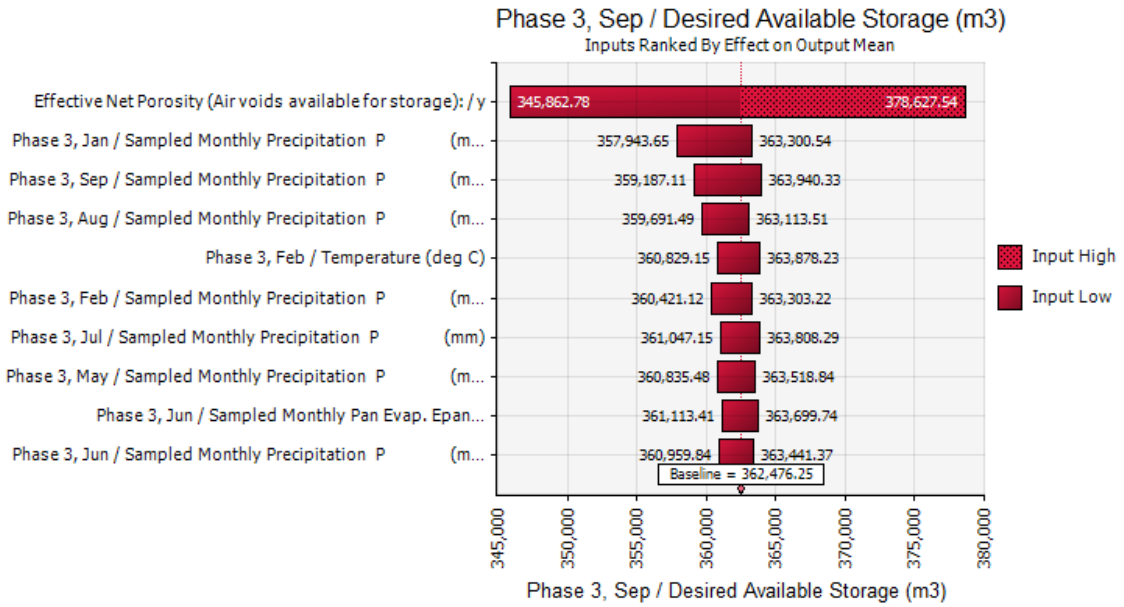

Phase 3, Apr / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Apr / Temperature (deg C)
Phase 3, Jan / Sampled Monthly Precipitation P (m...
Phase 3, Apr / Sampled Monthly Precipitation P (m...
Phase 3, Feb / Temperature (deg C)
Phase 3, Apr / Sampled Monthly Pan Evap. Epan...
Phase 3, Mar / Sampled Monthly Precipitation P (m...
Phase 3, Mar / Sampled No. of Days of Precipitation...
Phase 3, Mar / Temperature (deg C)
Phase 3, Jan / Temperature (deg C)
347,281.69
379,165.32
362,461.59
365,183.74
360,938.74
364,020.37
361,674.05
363,714.04
362,235.47
364,182.97
361,988.56
363,741.01
362,054.01
363,801.33
362,123.52
363,865.79
362,190.73
363,759.03
362,238.22
363,773.05
Baseline = 363,144.24
345,000
350,000
355,000
360,000
365,000
370,000
375,000
380,000
Phase 3, Apr / Desired Available Storage (m3)
Input High
Input Low

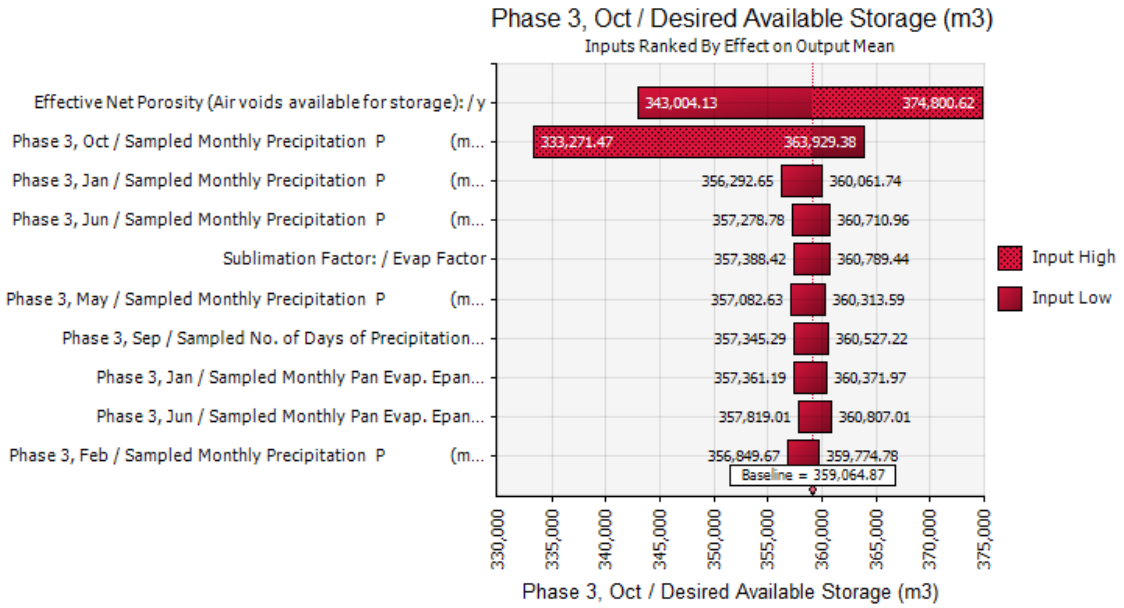

Phase 3, May / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 3, Jan / Sampled Monthly Precipitation P (m...
Phase 3, Feb / Sampled Monthly Precipitation P (m...
Phase 3, Apr / Temperature (deg C)
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Mar / Sampled Monthly Precipitation P (m...
Phase 3, May / Sampled Monthly Precipitation P (m...
Phase 3, Jan / Sampled Monthly Pan Evap. Epan...
Phase 3, Apr / Sampled Monthly Precipitation P (m...
Phase 3, May / Temperature (deg C)
Phase 3, May / Sampled Monthly Pan Evap. Epan...
222,577.35
306,467.51
244,675.64
297,896.13
271,517.60
317,129.50
261,876.78
298,080.05
261,437.12
285,905.55
267,647.15
287,135.47
272,261.56
289,788.46
270,566.17
283,178.98
277,048.00
288,489.68
273,603.08
284,825.06
Baseline = 279,950.12
Input High
Input Low
220,000
230,000
240,000
250,000
260,000
270,000
280,000
290,000
300,000
310,000
320,000
Phase 3, May / Desired Available Storage (m3)

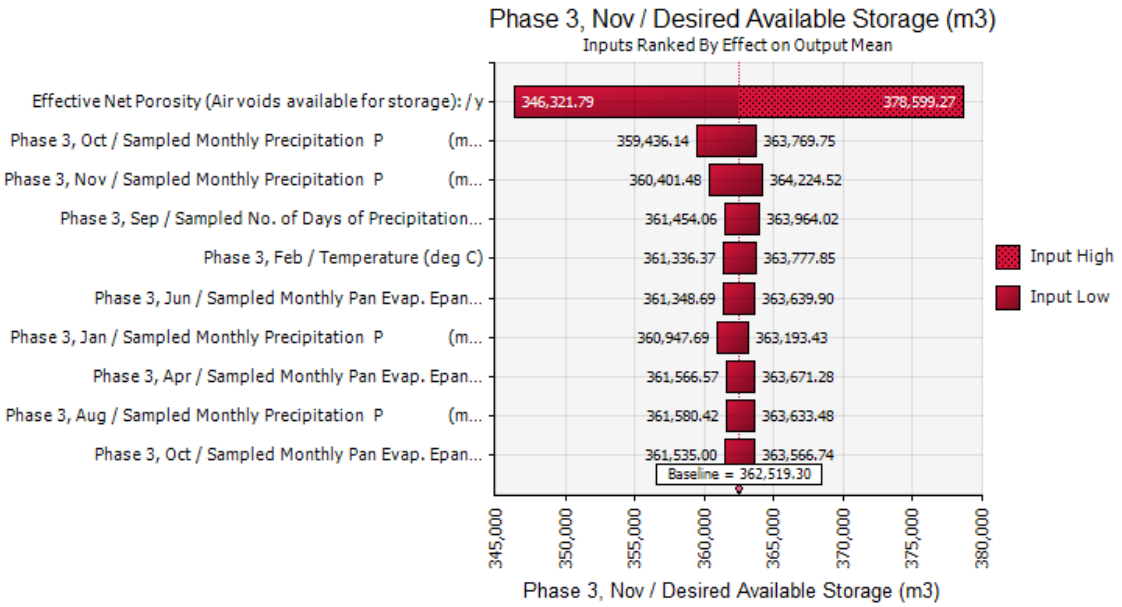

Phase 3, Jun/ Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 3, Jan / Sampled Monthly Precipitation P (m...
Phase 3, Feb / Sampled Monthly Precipitation P (m...
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Jun / Sampled Monthly Precipitation P (m...
Phase 3, Apr / Temperature (deg C)
Phase 3, Mar / Sampled Monthly Precipitation P (m...
Phase 3, May / Sampled Monthly Precipitation P (m...
Phase 3, Jan / Sampled Monthly Pan Evap. Epan...
Phase 3, Apr / Sampled Monthly Precipitation P (m...
Phase 3, May / Sampled Monthly Pan Evap. Epan...
279,562.04
354,607.81
301,372.74
347,733.84
314,616.68
352,681.73
315,308.27
342,908.78
327,704.71
317,722.93
338,996.00
322,346.06
340,183.12
328,131.66
341,764.47
324,873.18
337,290.66
328,240.96
338,148.11
Baseline = 333,878.28
Input High
Input Low
270,000
280,000
290,000
300,000
310,000
320,000
330,000
340,000
350,000
360,000
Phase 3, Jun / Desired Available Storage (m3)

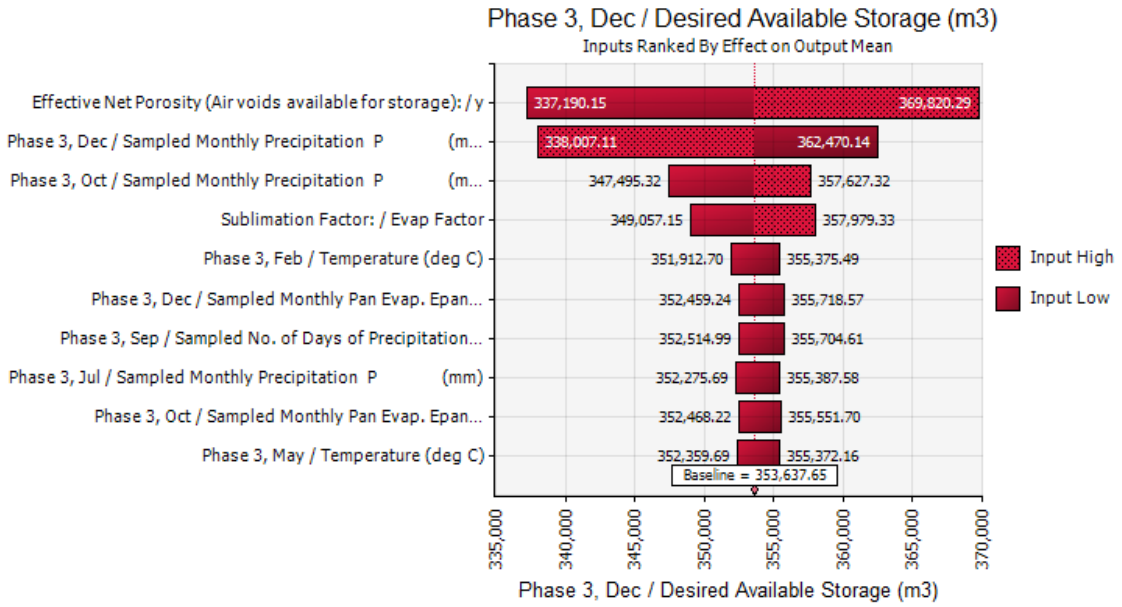

Phase 3, Jul / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 3, Jan / Sampled Monthly Precipitation P (m...
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Jul / Sampled Monthly Precipitation P (mm)
Phase 3, Feb / Sampled Monthly Precipitation P (m...
Phase 3, Jun / Sampled Monthly Precipitation P (m...
Phase 3, May / Sampled Monthly Precipitation P (m...
Phase 3, Apr / Temperature (deg C)
Phase 3, Mar / Sampled Monthly Precipitation P (m...
Phase 3, Apr / Sampled Monthly Precipitation P (m...
Phase 3, Apr / Sampled Monthly Pan Evap. Epan...
324,294.42
361,703.90
336,897.53
372,614.99
334,438.43
361,784.38
340,560.11
359,354.46
347,957.66
357,706.49
349,365.54
357,630.23
352,768.05
360,486.90
350,293.97
357,106.88
351,447.70
357,221.66
352,903.72
357,933.28
Baseline = 355,089.25
Input High
Input Low
320,000
325,000
330,000
335,000
340,000
345,000
350,000
355,000
360,000
365,000
370,000
375,000
Phase 3, Jul / Desired Available Storage (m3)


Phase 3, Aug / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Aug / Sampled Monthly Precipitation P (m...
Phase 3, Jan / Sampled Monthly Precipitation P (m...
Phase 3, Feb / Sampled Monthly Precipitation P (m...
Phase 3, Jul / Sampled Monthly Precipitation P (mm)
Phase 3, May / Sampled Monthly Precipitation P (m...
Phase 3, Jun / Sampled Monthly Precipitation P (m...
Phase 3, Feb / Temperature (deg C)
Phase 3, Apr / Temperature (deg C)
Phase 3, Apr / Sampled Monthly Pan Evap. Epan...
343,589.43
376,810.76
348,366.85
363,353.63
348,472.66
362,415.81
354,449.07
362,156.64
355,220.75
362,453.65
357,658.90
362,021.54
357,299.92
361,658.44
357,801.89
361,794.48
358,920.89
362,203.07
359,280.27
362,302.02
Baseline = 360,272.06
Input High
Input Low
340,000
345,000
350,000
355,000
360,000
365,000
370,000
375,000
380,000
Phase 3, Aug / Desired Available Storage (m3)


Phase 3, Sep / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Jan / Sampled Monthly Precipitation P (m...
Phase 3, Sep / Sampled Monthly Precipitation P (m...
Phase 3, Aug / Sampled Monthly Precipitation P (m...
Phase 3, Feb / Temperature (deg C)
Phase 3, Feb / Sampled Monthly Precipitation P (m...
Phase 3, Jul / Sampled Monthly Precipitation P (mm)
Phase 3, May / Sampled Monthly Precipitation P (m...
Phase 3, Jun / Sampled Monthly Pan Evap. Epan...
Phase 3, Jun / Sampled Monthly Precipitation P (m...
345,862.78
378,627.54
357,943.65
363,300.54
359,187.11
363,940.33
359,691.49
363,113.51
360,829.15
363,878.23
360,421.12
363,303.22
361,047.15
363,808.29
360,835.48
363,518.84
361,113.41
363,699.74
360,959.84
363,441.37
Baseline = 362,476.25
345,000
350,000
355,000
360,000
365,000
370,000
375,000
380,000
Phase 3, Sep / Desired Available Storage (m3)
Input High
Input Low

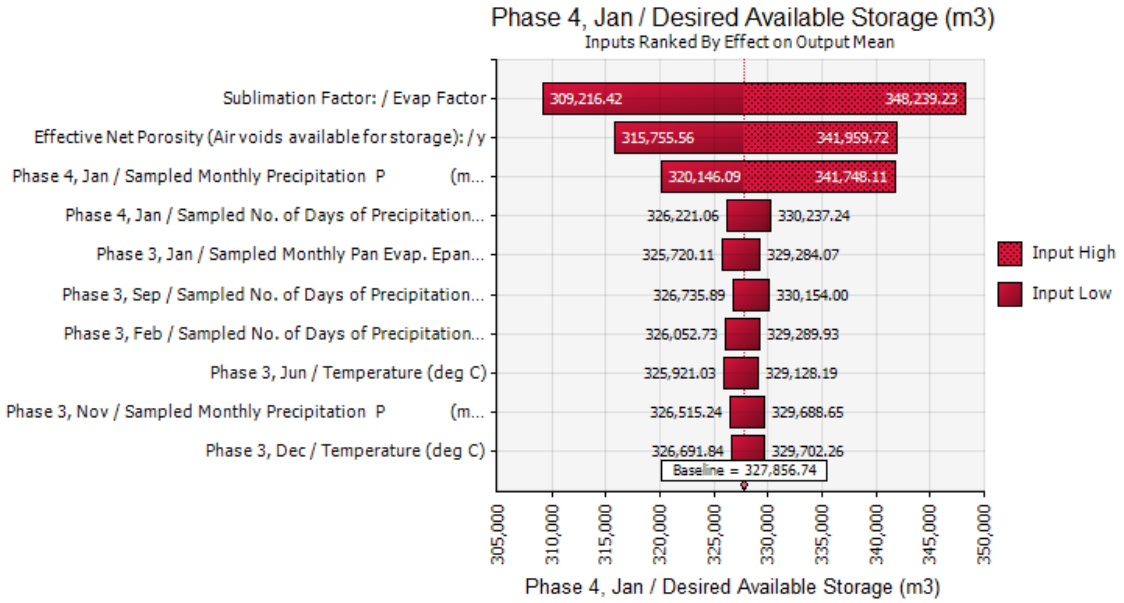

Phase 3, Oct / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Oct / Sampled Monthly Precipitation P (m...
Phase 3, Jan / Sampled Monthly Precipitation P (m...
Phase 3, Jun / Sampled Monthly Precipitation P (m...
Sublimation Factor: / Evap Factor
Phase 3, May / Sampled Monthly Precipitation P (m...
Phase 3, Sep / Sampled No. of Days of Precipitation...
Phase 3, Jan / Sampled Monthly Pan Evap. Epan...
Phase 3, Jun / Sampled Monthly Pan Evap. Epan...
Phase 3, Feb / Sampled Monthly Precipitation P (m...
343,004.13
374,800.62
333,271.47
363,929.38
356,292.65
360,061.74
357,278.78
360,710.96
357,388.42
360,789.44
357,082.63
360,313.59
357,345.29
360,527.22
357,361.19
360,371.97
357,819.01
360,807.01
356,849.67
359,774.78
Baseline = 359,064.87
330,000
335,000
340,000
345,000
350,000
355,000
360,000
365,000
370,000
375,000
Phase 3, Oct / Desired Available Storage (m3)
Input High
Input Low

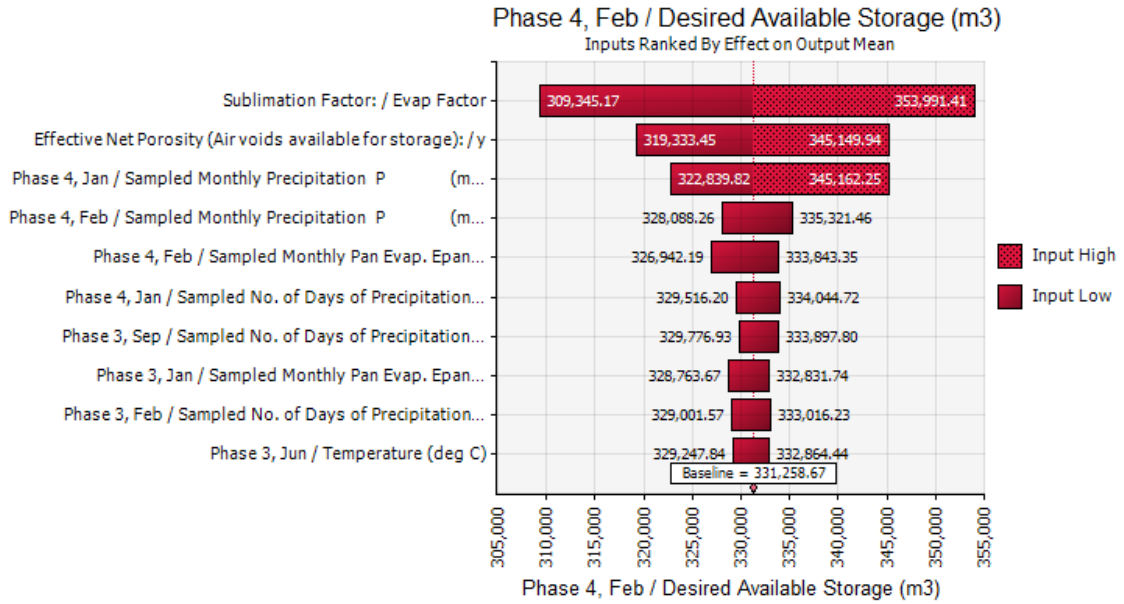

Phase 3, Nov / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Oct / Sampled Monthly Precipitation P (m...
Phase 3, Nov / Sampled Monthly Precipitation P (m...
Phase 3, Sep / Sampled No. of Days of Precipitation...
Phase 3, Feb / Temperature (deg C)
Phase 3, Jun / Sampled Monthly Pan Evap. Epan...
Phase 3, Jan / Sampled Monthly Precipitation P (m...
Phase 3, Apr / Sampled Monthly Pan Evap. Epan...
Phase 3, Aug / Sampled Monthly Precipitation P (m...
Phase 3, Oct / Sampled Monthly Pan Evap. Epan...
346,321.79
378,599.27
359,436.14
363,769.75
360,401.48
364,224.52
361,454.06
363,964.02
361,336.37
363,777.85
361,348.69
363,639.90
360,947.69
363,193.43
361,566.57
363,671.28
361,580.42
363,633.48
361,535.00
363,566.74
Baseline = 362,519.30
345,000
350,000
355,000
360,000
365,000
370,000
375,000
380,000
Phase 3, Nov / Desired Available Storage (m3)
Input High
Input Low

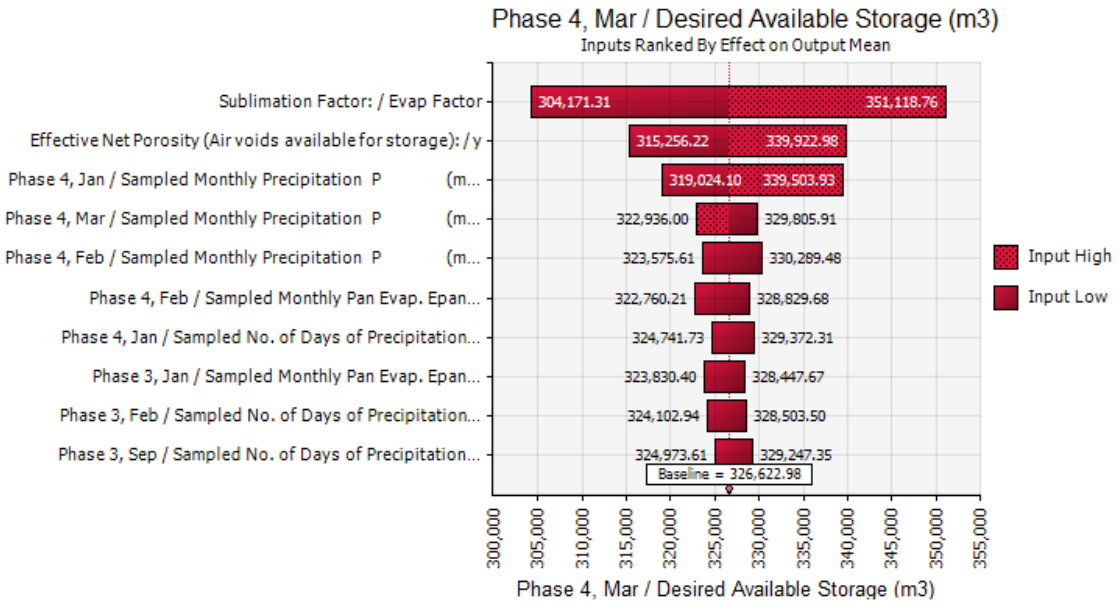

Phase 3, Dec / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Effective Net Porosity (Air voids available for storage): / y
Phase 3, Dec / Sampled Monthly Precipitation P (m...
Phase 3, Oct / Sampled Monthly Precipitation P (m...
Sublimation Factor: / Evap Factor
Phase 3, Feb / Temperature (deg C)
Phase 3, Dec / Sampled Monthly Pan Evap. Epan...
Phase 3, Sep / Sampled No. of Days of Precipitation...
Phase 3, Jul / Sampled Monthly Precipitation P (mm)
Phase 3, Oct / Sampled Monthly Pan Evap. Epan...
Phase 3, May / Temperature (deg C)
337,190.15
369,820.29
338,007.11
362,470.14
347,495.32
357,627.32
349,057.15
357,979.33
351,912.70
355,375.49
352,459.24
355,718.57
352,514.99
355,704.61
352,275.69
355,387.58
352,468.22
355,551.70
352,359.69
355,372.16
Baseline = 353,637.65
335,000
340,000
345,000
350,000
355,000
360,000
365,000
370,000
Phase 3, Dec / Desired Available Storage (m3)
Input High
Input Low

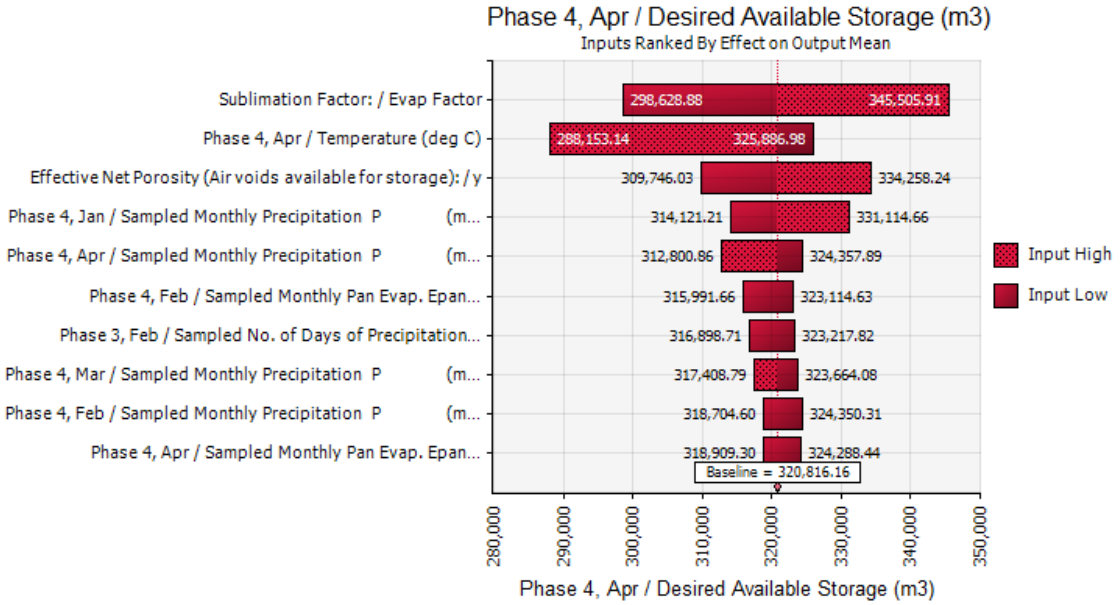
Phase 4

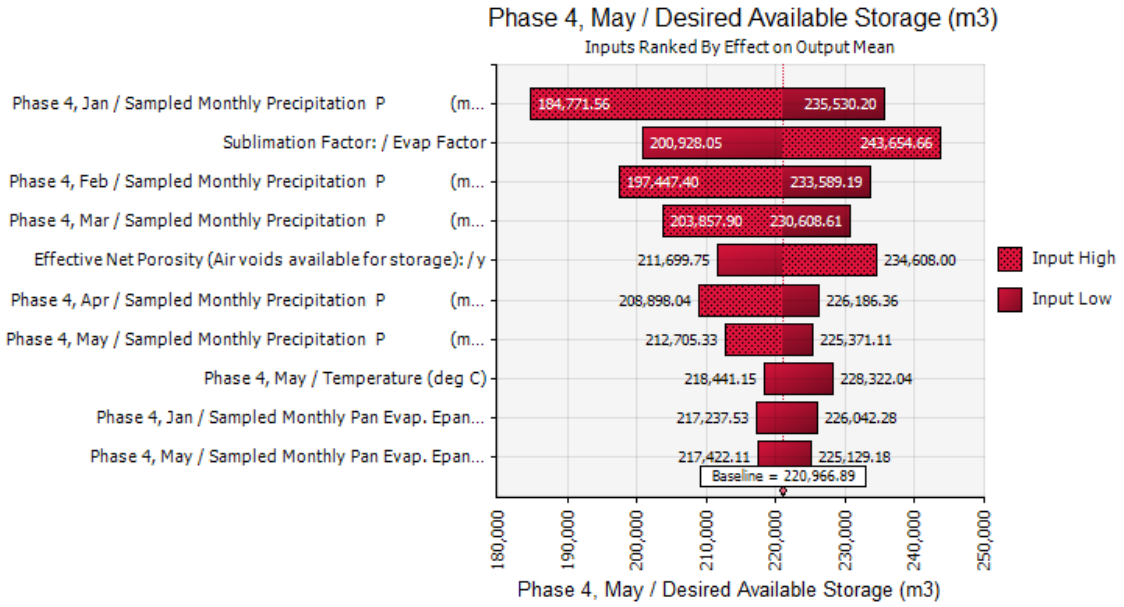
Desired Available Storage

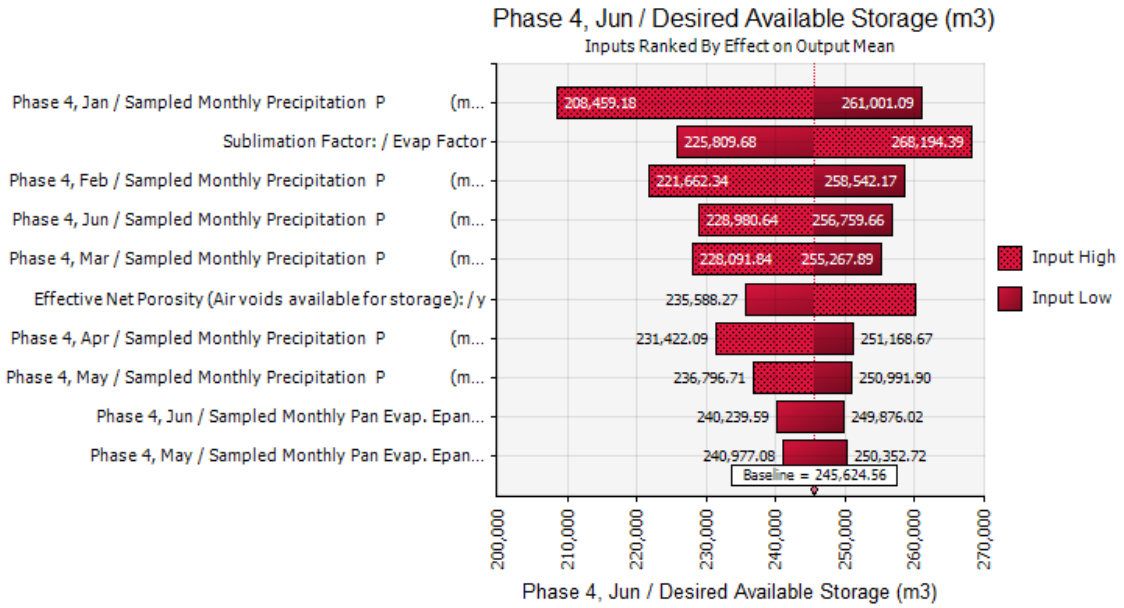


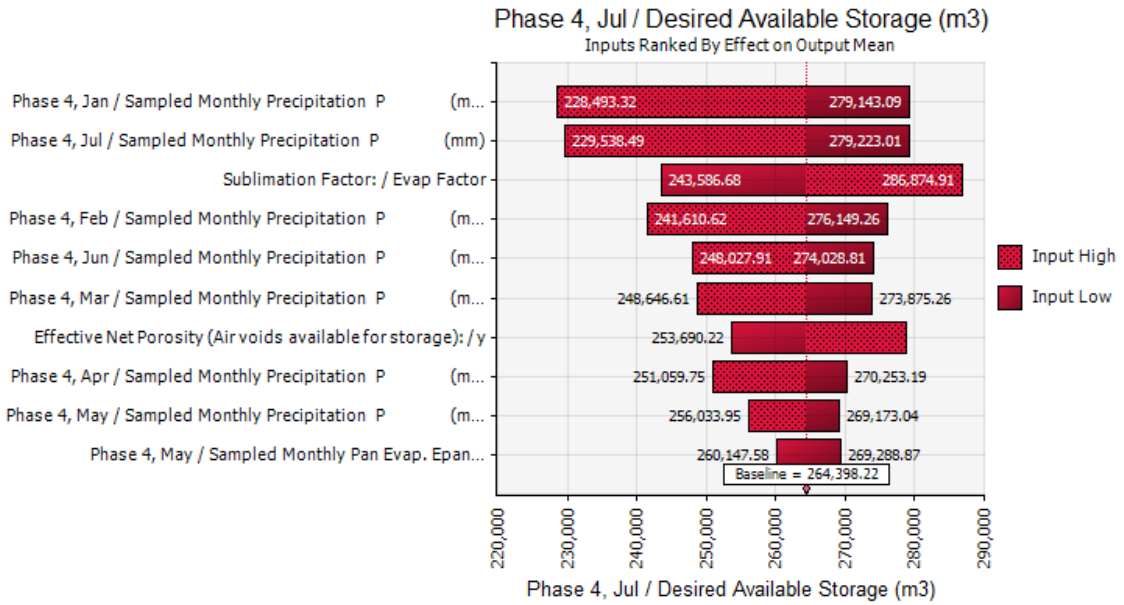


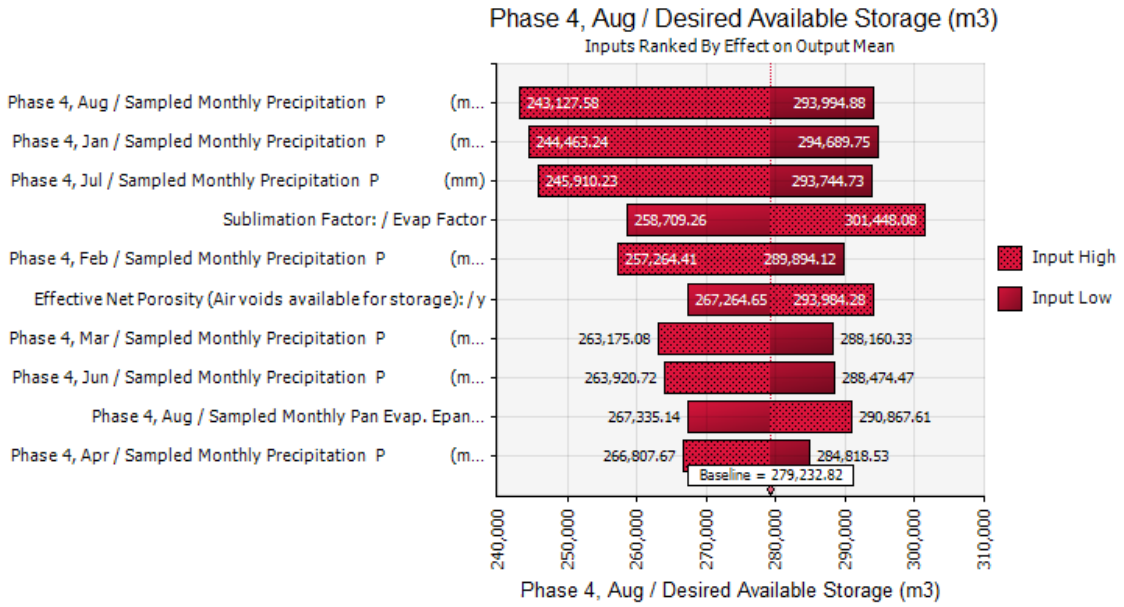

Phase 4, Mar / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Sublimation Factor: / Evap Factor
Effective Net Porosity (Air voids available for storage): / y
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Phase 4, Mar / Sampled Monthly Precipitation P (m...
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Phase 4, Feb / Sampled Monthly Pan Evap. Epan...
Phase 4, Jan / Sampled No. of Days of Precipitation...
Phase 3, Jan / Sampled Monthly Pan Evap. Epan...
Phase 3, Feb / Sampled No. of Days of Precipitation...
Phase 3, Sep / Sampled No. of Days of Precipitation...
304,171.31
351,118.76
315,256.22
339,922.98
319,024.10
339,503.93
322,936.00
329,805.91
323,575.61
330,289.48
322,760.21
328,829.68
324,741.73
329,372.31
323,830.40
328,447.67
324,102.94
328,503.50
324,973.61
329,247.35
Baseline = 326,622.98
Input High
Input Low
300,000
305,000
310,000
315,000
320,000
325,000
330,000
335,000
340,000
345,000
350,000
355,000
Phase 4, Mar / Desired Available Storage (m3)

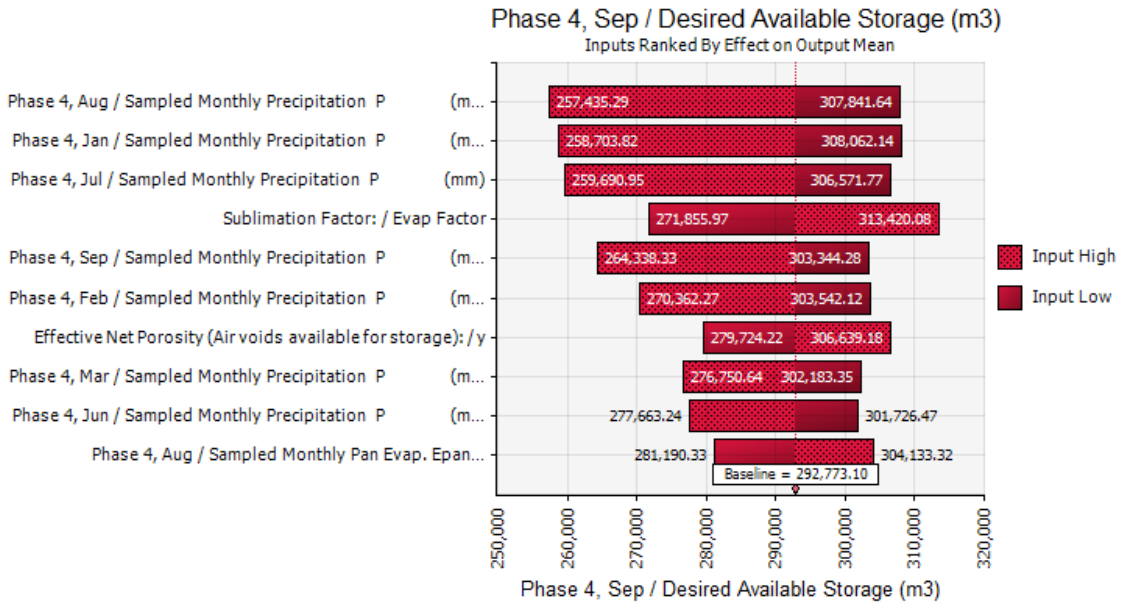

Phase 4, Apr / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Sublimation Factor: / Evap Factor
Phase 4, Apr / Temperature (deg C)
Effective Net Porosity (Air voids available for storage): / y
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Phase 4, Apr / Sampled Monthly Precipitation P (m...
Phase 4, Feb / Sampled Monthly Pan Evap. Epan...
Phase 3, Feb / Sampled No. of Days of Precipitation...
Phase 4, Mar / Sampled Monthly Precipitation P (m...
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Phase 4, Apr / Sampled Monthly Pan Evap. Epan...
298,628.88
345,505.91
288,153.14
325,886.98
309,746.03
334,258.24
314,121.21
331,114.66
312,800.86
324,357.89
315,991.66
323,114.63
316,898.71
323,217.82
317,408.79
323,664.08
318,704.60
324,350.31
318,909.30
324,288.44
Baseline = 320,816.16
Input High
Input Low
280,000
290,000
300,000
310,000
320,000
330,000
340,000
350,000
Phase 4, Apr / Desired Available Storage (m3)

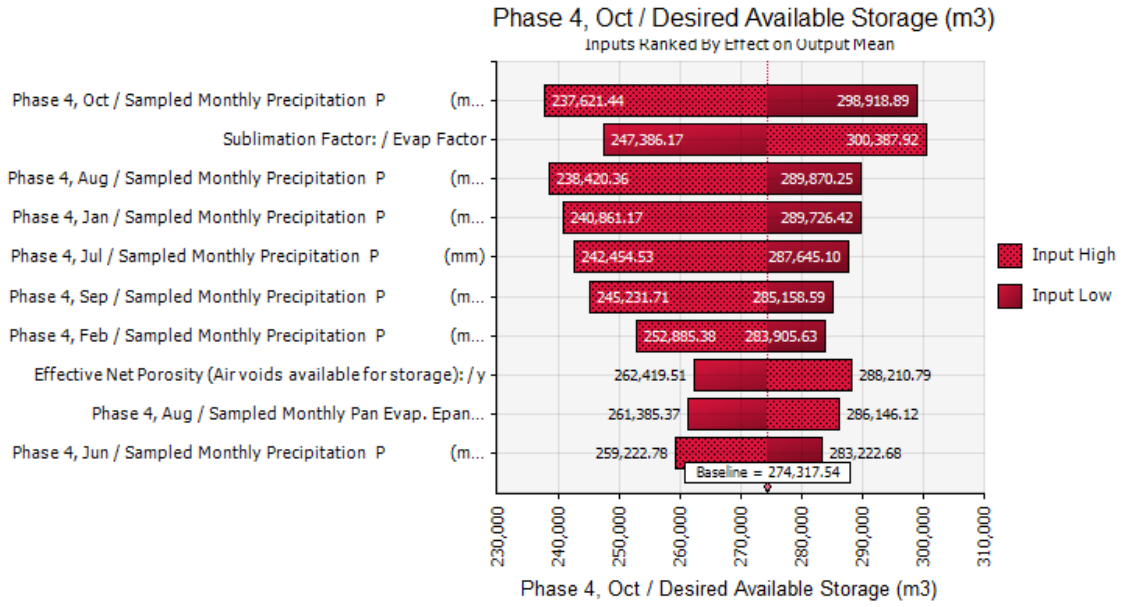

Phase 4, May / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Sublimation Factor: / Evap Factor
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Phase 4, Mar / Sampled Monthly Precipitation P (m...
Effective Net Porosity (Air voids available for storage): / y
Phase 4, Apr / Sampled Monthly Precipitation P (m...
Phase 4, May / Sampled Monthly Precipitation P (m...
Phase 4, May / Temperature (deg C)
Phase 4, Jan / Sampled Monthly Pan Evap. Epan...
Phase 4, May / Sampled Monthly Pan Evap. Epan...
184,771.56
235,530.20
200,928.05
243,654.66
197,447.40
233,589.19
203,857.90
230,608.61
211,699.75
234,608.00
208,898.04
226,186.36
212,705.33
225,371.11
218,441.15
228,322.04
217,237.53
226,042.28
217,422.11
225,129.18
Baseline = 220,966.89
Input High
Input Low
180,000
190,000
200,000
210,000
220,000
230,000
240,000
250,000
Phase 4, May / Desired Available Storage (m3)

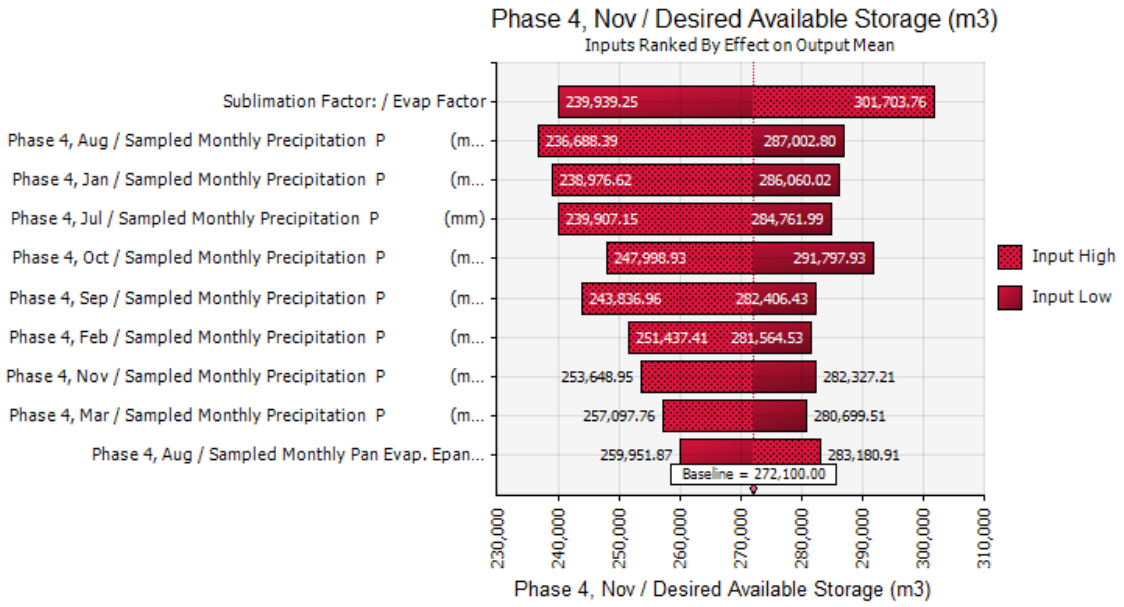

Phase 4, Jun / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Sublimation Factor: / Evap Factor
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Phase 4, Jun / Sampled Monthly Precipitation P (m...
Phase 4, Mar / Sampled Monthly Precipitation P (m...
Effective Net Porosity (Air voids available for storage): / y
Phase 4, Apr / Sampled Monthly Precipitation P (m...
Phase 4, May / Sampled Monthly Precipitation P (m...
Phase 4, Jun / Sampled Monthly Pan Evap. Epan...
Phase 4, May / Sampled Monthly Pan Evap. Epan...
208,459.18
261,001.09
225,809.68
268,194.39
221,662.34
258,542.17
228,980.64
256,759.66
228,091.84
255,267.89
235,588.27
231,422.09
251,168.67
236,796.71
250,991.90
240,239.59
249,876.02
240,977.08
250,352.72
Baseline = 245,624.56
Input High
Input Low
200,000
210,000
220,000
230,000
240,000
250,000
260,000
270,000
Phase 4, Jun / Desired Available Storage (m3)

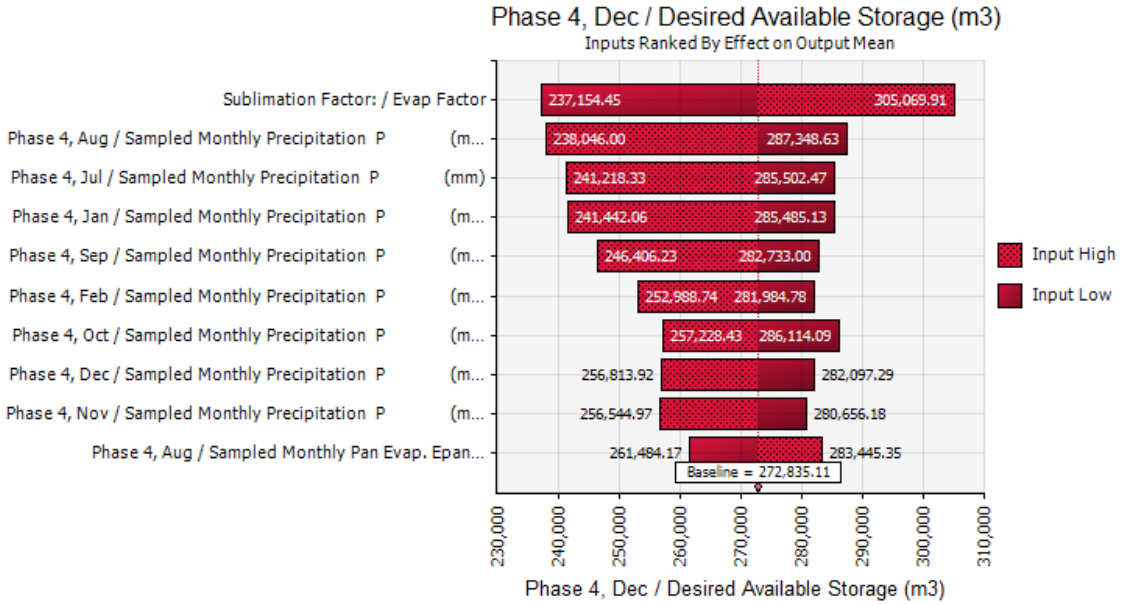

Phase 4, Jul / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Phase 4, Jul / Sampled Monthly Precipitation P (mm)
Sublimation Factor: / Evap Factor
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Phase 4, Jun / Sampled Monthly Precipitation P (m...
Phase 4, Mar / Sampled Monthly Precipitation P (m...
Effective Net Porosity (Air voids available for storage): / y
Phase 4, Apr / Sampled Monthly Precipitation P (m...
Phase 4, May / Sampled Monthly Precipitation P (m...
Phase 4, May / Sampled Monthly Pan Evap. Epan...
228,493.32
279,143.09
229,538.49
279,223.01
243,586.68
286,874.91
241,610.62
276,149.26
248,027.91
274,028.81
248,646.61
273,875.26
253,690.22
251,059.75
270,253.19
256,033.95
269,173.04
260,147.58
269,288.87
Baseline = 264,398.22
Input High
Input Low
220,000
230,000
240,000
250,000
260,000
270,000
280,000
290,000
Phase 4, Jul / Desired Available Storage (m3)


Phase 4, Aug / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 4, Aug / Sampled Monthly Precipitation P (m...
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Phase 4, Jul / Sampled Monthly Precipitation P (mm)
Sublimation Factor: / Evap Factor
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Effective Net Porosity (Air voids available for storage): / y
Phase 4, Mar / Sampled Monthly Precipitation P (m...
Phase 4, Jun / Sampled Monthly Precipitation P (m...
Phase 4, Aug / Sampled Monthly Pan Evap. Epan...
Phase 4, Apr / Sampled Monthly Precipitation P (m...
243,127.58
293,994.88
244,463.24
294,689.75
245,910.23
293,744.73
258,709.26
301,448.08
257,264.41
289,894.12
267,264.65
293,984.28
263,175.08
288,160.33
263,920.72
288,474.47
267,335.14
290,867.61
266,807.67
284,818.53
Baseline = 279,232.82
Input High
Input Low
240,000
250,000
260,000
270,000
280,000
290,000
300,000
310,000
Phase 4, Aug / Desired Available Storage (m3)


Phase 4, Sep / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 4, Aug / Sampled Monthly Precipitation P (m...
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Phase 4, Jul / Sampled Monthly Precipitation P (mm)
Sublimation Factor: / Evap Factor
Phase 4, Sep / Sampled Monthly Precipitation P (m...
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Effective Net Porosity (Air voids available for storage): / y
Phase 4, Mar / Sampled Monthly Precipitation P (m...
Phase 4, Jun / Sampled Monthly Precipitation P (m...
Phase 4, Aug / Sampled Monthly Pan Evap. Epan...
257,435.29
307,841.64
258,703.82
308,062.14
259,690.95
306,571.77
271,855.97
313,420.08
264,338.33
303,344.28
270,362.27
303,542.12
279,724.22
306,639.18
276,750.64
302,183.35
277,663.24
301,726.47
281,190.33
304,133.32
Baseline = 292,773.10
Input High
Input Low
250,000
260,000
270,000
280,000
290,000
300,000
310,000
320,000
Phase 4, Sep / Desired Available Storage (m3)


Phase 4, Oct / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Phase 4, Oct / Sampled Monthly Precipitation P (m...
Sublimation Factor: / Evap Factor
Phase 4, Aug / Sampled Monthly Precipitation P (m...
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Phase 4, Jul / Sampled Monthly Precipitation P (mm)
Phase 4, Sep / Sampled Monthly Precipitation P (m...
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Effective Net Porosity (Air voids available for storage): / y
Phase 4, Aug / Sampled Monthly Pan Evap. Epan...
Phase 4, Jun / Sampled Monthly Precipitation P (m...
237,621.44
298,918.89
247,386.17
300,387.92
238,420.36
289,870.25
240,861.17
289,726.42
242,454.53
287,645.10
245,231.71
285,158.59
252,885.38
283,905.63
262,419.51
288,210.79
261,385.37
286,146.12
259,222.78
283,222.68
Baseline = 274,317.54
Input High
Input Low
230,000
240,000
250,000
260,000
270,000
280,000
290,000
300,000
310,000
Phase 4, Oct / Desired Available Storage (m3)


Phase 4, Nov / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Sublimation Factor: / Evap Factor
Phase 4, Aug / Sampled Monthly Precipitation P (m...
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Phase 4, Jul / Sampled Monthly Precipitation P (mm)
Phase 4, Oct / Sampled Monthly Precipitation P (m...
Phase 4, Sep / Sampled Monthly Precipitation P (m...
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Phase 4, Nov / Sampled Monthly Precipitation P (m...
Phase 4, Mar / Sampled Monthly Precipitation P (m...
Phase 4, Aug / Sampled Monthly Pan Evap. Epan...
239,939.25
301,703.76
236,688.39
287,002.80
238,976.62
286,060.02
239,907.15
284,761.99
247,998.93
291,797.93
243,836.96
282,406.43
251,437.41
281,564.53
253,648.95
282,327.21
257,097.76
280,699.51
259,951.87
283,180.91
Baseline = 272,100.00
Input High
Input Low
230,000
240,000
250,000
260,000
270,000
280,000
290,000
300,000
310,000
Phase 4, Nov / Desired Available Storage (m3)


Phase 4, Dec / Desired Available Storage (m3)
Inputs Ranked By Effect on Output Mean
Sublimation Factor: / Evap Factor
Phase 4, Aug / Sampled Monthly Precipitation P (m...
Phase 4, Jul / Sampled Monthly Precipitation P (mm)
Phase 4, Jan / Sampled Monthly Precipitation P (m...
Phase 4, Sep / Sampled Monthly Precipitation P (m...
Phase 4, Feb / Sampled Monthly Precipitation P (m...
Phase 4, Oct / Sampled Monthly Precipitation P (m...
Phase 4, Dec / Sampled Monthly Precipitation P (m...
Phase 4, Nov / Sampled Monthly Precipitation P (m...
Phase 4, Aug / Sampled Monthly Pan Evap. Epan...
237,154.45
305,069.91
238,046.00
287,348.63
241,218.33
285,502.47
241,442.06
285,485.13
246,406.23
282,733.00
252,988.74
281,984.78
257,228.43
286,114.09
256,813.92
282,097.29
256,544.97
280,656.18
261,484.17
283,445.35
Baseline = 272,835.11
Input High
Input Low
230,000
240,000
250,000
260,000
270,000
280,000
290,000
300,000
310,000
Phase 4, Dec / Desired Available Storage (m3)

APPENDIX G

2017 Geochemical Barrel Test Results

THIS PAGE INTENTIONALLY LEFT BLANK

JUNE GEOCHEMICAL BARREL IN-SITU TEST RESULTS

Lab data available but no in-situ samples taken.

AUGUST GEOCHEMICAL BARREL INSITU TEST RESULTS

Barrel	Time	Temp C	Sp.Cond. uS/cm	D.O. (mg/L)	pH	ORP (mv)	Volume (M^3)	Volume (L)	Depth (m)
DG-MET-01	15:45	23	345	9.13	8.79	120	0.007	7	0.108
DG-MET-02	16:10	21.6	390	8.6	8.79	128.3	0.013	13	0.198
DG-MET-03	16:30	22.6	446	10.02	8.64	119.8	0.008	8	0.117
DG-MET-04	16:45	24.7	495	8.49	8.77	121	0.015	15	0.235
DG-MET-05	17:00	20.4	860	9.53	8.4	167.6	0.016	16	0.243
DG-MET-06	17:20	21.7	727	10.3	8.67	134.6	0.015	15	0.235
DG-MET-07	17:45	19.47	523	10.8	8.72	134.1	0.018	18	0.277
DG-MET-08	18:05	18.9	287	10.66	9	120.2	0.018	18	0.277

SEPTEMBER GEOCHEMICAL BARREL INSITU TEST RESULTS

Barrel	Time	Temp ^0C	Sp Cond uS/cm	D.O. mg/L	D.O. %	pH	ORP mv	Volume m^3	Depth m
DG-MET-01	9:20	4.1	390	11.15	85.50	8.32	170.9	0.020	0.31
DG-MET-02	9:35	4.0	488	11.44	87.40	8.16	177.8	0.015	0.23
DG-MET-03	9:50	4.1	415	11.94	91.30	8.08	179.3	0.014	0.225
DG-MET-04	10:05	4.2	488	12.31	94.60	8.05	178.9	0.020	0.305
DG-MET-05	10:20	4.2	794	12.48	96.10	7.92	185.5	0.020	0.309
DG-MET-06	10:30	4.2	727	12.74	98.20	8.03	181.7	0.020	0.306
DG-MET-07	10:45	4.1	588	12.53	96.20	8.03	177.8	0.020	0.316
DG-MET-08	11:00	4.0	365	12.58	96.10	8.12	170.9	0.018	0.277

OCTOBER GEOCHEMICAL BARREL INSITU TEST RESULTS

Barrel	Time	Temp (°C)	Sp.Cond. (µS/cm)	pH	Volume (m^3)	Volume (L)
DG-MET-01	16:45	1.5	184.3	7.19	0.013	13
DG-MET-02	16:58	1.4	266.0	7.70	0.012	12
DG-MET-03	Insufficient water to sample					
DG-MET-04	17:17	1.3	254.0	7.85	0.013	13
DG-MET-05	17:47	1.0	451.0	7.88	0.012	12
DG-MET-06	18:00	0.7	430.0	7.86	0.014	14
DG-MET-07	18:19	0.6	376.0	7.74	0.014	14
DG-MET-08	18:26	0.6	163.4	7.86	0.014	14

APPENDIX H

Eagle Gold Mine - 2018 Update on Geochemical Source Terms

THIS PAGE INTENTIONALLY LEFT BLANK

TECHNICAL MEMORANDUM

To:	**Stephen Wilbur, Victoria Gold Corp.**	**Date: February 26, 2018**
From:	**Timo Kirchner & David Flather**	**Project #: A445-1**
Subject:	**Eagle Gold Mine – 2018 Update on Geochemical Source Terms**	

For the application of the Eagle Gold Water Use Licence (WUL QZ14-041), Victoria Gold Corporation (VIT) retained Lorax Environmental Services Ltd. (Lorax) to provide geochemical source term predictions for the waste rock storage facilities as well as the heap leach pad to be used for the site-wide water quality model. The source term model produced by Lorax was primarily based on laboratory- and field-kinetic testwork conducted on samples representing waste rock and ore.

As a condition of the WUL, VIT is required to prepare an updated water quality model that is reflective of changes climate, hydrology and water quality data collected since the submission of the WUL application. For the current update, the geochemistry of field bin leachates collected through 2017 was compiled and reviewed by Lorax and the potential effect of the additional data on the source term model was assessed. It was found that the major parameters of concern (SO_4, As, Sb, Se) show generally steady (As, Sb) or decreasing trends in concentrations leached from the field barrels. One exception is the Oxide Granodiorite field barrel which produces leachates that steadily increase in As concentration up to a value of 2.67 mg/L (Figure 1) in the most recent sample collected (October 2017). It should be noted, however, that this material's solid phase As content (1065 ppm) is well above the respective 90th percentile value (607 ppm) of the static test database for Eagle Gold waste rock. In other words, less than 10% of oxide granodiorite rock is expected to have an As content as high as that within the field barrel sample. Furthermore, this lithology is expected to comprise only around 16% of the total waste produced.

Overall it can be said that the most recent source term model output is still valid and does not currently require updating for the following reasons:

- The field bin leachate data were only directly used in the source term model to calculate a "first flush" value representing the effect of flushing easily soluble species. The values used for this approach have not changed since the last model iteration;
- Overall, the trends observed in field bin leachates over time were used qualitatively for model validation purposes. While variable, these trends have not changed sufficiently to warrant a re-mdoelling of the Eagle Gold waste rock facilities as a whole.

This document has been prepared by Lorax Environmental Services Ltd. ("Lorax") for the benefit of the client named in this document. No person other than the named client may use or rely upon this document or any of its contents, and Lorax has no liability, obligation or responsibility to any person other than the named client. In addition, Lorax has no liability, obligation or responsibility for any changes to this document or any of its contents made by any person other than Lorax or its authorized personnel.
Any reader or user of this document or any part of it hereby indemnifies Lorax and its directors, officers, employees, representatives and agents from and against, and releases Lorax and its directors, officers, employees, representatives and agents from, any and all liabilities, obligations, claims, proceedings and costs arising out of or relating to the use of or reliance upon this document or any of its contents by any person other than the named client or any changes to this document or any of its contents made by any person other than Lorax or its authorized personnel.

Should changes to the mine plan be made or new data become available, the source term model will be re-evaluated at that time.

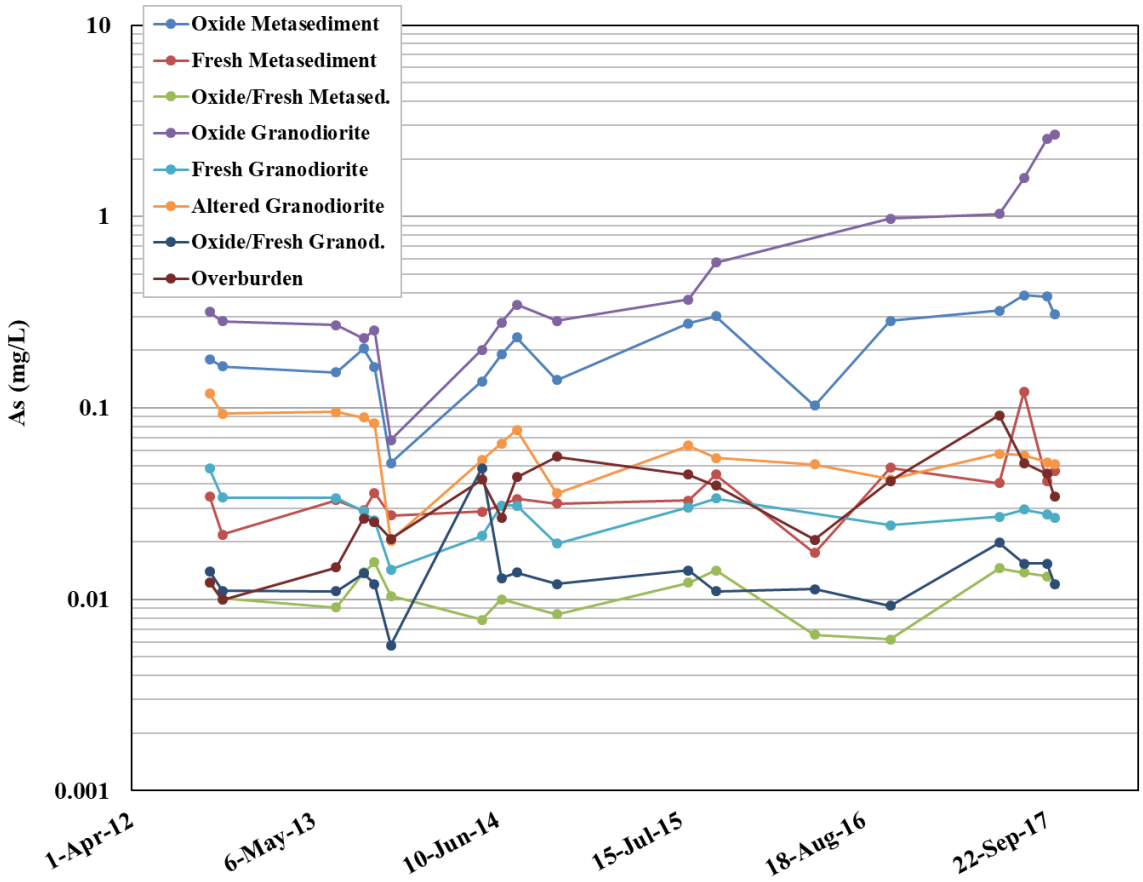


Figure 1: Arsenic concentrations in field barrel leachates from Eagle Gold waste rock and overburden

APPENDIX I

Eagle Gold Mine - Geochemical Acid Base Accounting (ABA) analyses 2017

THIS PAGE INTENTIONALLY LEFT BLANK

WH17192501 - Finalized
CLIENT : "STRGOL - StrataGold Corporation"
# of SAMPLES : 1
DATE RECEIVED : 2017-09-08 DATE FINALIZED : 2017-11-03
PROJECT : "EGP"
CERTIFICATE COMMENTS : "ME-MS41:Gold determinations by this method are semi-quantitative due to the small sample weight used (0.5g). "
PO NUMBER : " "

	OA-VOL08m	OA-VOL08m	OA-VOL08m	OA-VOL08m	OA-ELE07	OA-VOL08m	S-IR08	S-GRA06	S-GRA06a	S-CAL06	C-GAS05
SAMPLE	MPA	FIZZ RATING	NNP	NP	pH	Ratio (NP:MPA)	S	S	S	S	C
DESCRIPTION	tCaCO3/1Kt	Unity	tCaCO3/1Kt	tCaCO3/1Kt	Unity	Unity	%	%	%	%	%
EP-N1N2S1S2	1.3	1	7	8	8.1	6.4	0.04	0.01	<0.01	0.03	0.07

	C-GAS05	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41
SAMPLE	CO2	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd
DESCRIPTION	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm
EP-N1N2S1S2	0.3	0.08	0.94	149	<0.02	<10	170	0.33	0.65	0.35	0.2

	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41
SAMPLE	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In
DESCRIPTION	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
EP-N1N2S1S2	41.9	6	21	1.98	20.4	1.92	3.41	0.05	0.17	0.03	0.015

	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41
SAMPLE	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb
DESCRIPTION	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm
EP-N1N2S1S2	0.31	21	15.7	0.3	289	1.33	0.03	0.58	14.9	310	25.1

	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41
SAMPLE	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th
DESCRIPTION	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
EP-N1N2S1S2	24.6	<0.001	0.02	4.84	2.5	0.2	0.8	30	<0.01	0.03	9.6

	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	ME-MS41	OA-ELE18	OA-ELE08	OA-SFE01
SAMPLE	Ti	Tl	U	V	W	Y	Zn	Zr	Conductivity	pH	Ag
DESCRIPTION	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	uS/cm	Unity	mg/L
EP-N1N2S1S2	0.051	0.19	0.98	21	48.1	4.77	46	5.3	330	8.1	<0.00005

	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01
SAMPLE	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu
DESCRIPTION	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EP-N1N2S1S2	0.7	0.084	<0.01	0.049	<0.0005	<0.0005	9.1	<0.00005	0.0003	0.0008	0.005

	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01
SAMPLE	Fe	Hg	K	Li	Mg	Mn	Mo	Moisture	Na	Ni	Pb
DESCRIPTION	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	mg/L	mg/L
EP-N1N2S1S2	0.94	<0.00005	3.67	0.007	1.19	0.0161	0.0036	0.4	1.16	0.0012	0.0018

	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01	OA-SFE01
SAMPLE	P	Sb	Se	Si	Sn	Sr	Ti	Tl	U	V	Zn
DESCRIPTION	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ppm	mg/L	mg/L	mg/L
EP-N1N2S1S2	<0.3	0.0044	0.0013	4.16	<0.0005	0.0476	0.01	<0.0001	0.0006	0.002	<0.01

	OA-SFE01
SAMPLE	Final pH
DESCRIPTION	Unity
EP-N1N2S1S2	8.4

APPENDIX J

Stream Sediment Monitoring at the Eagle Gold Project

THIS PAGE INTENTIONALLY LEFT BLANK

STREAM SEDIMENT MONITORING

AT THE EAGLE GOLD PROJECT

SEPTEMBER 2017

For

Victoria GOLD CORP

Steve Wilbur

Submitted by

Laberge Environmental Services

November 2017

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

1.0 INTRODUCTION

Various monitoring projects are to be undertaken at the Eagle Gold Project during all phases of the site; construction, operation and closure as outlined in the Environmental Monitoring, Surveillance and Adaptive Management Plan (EMSAMP) version 2017-01 (StrataGold Corporation, 2017). The site is currently in the construction phase and the first annual late summer sediment monitoring program was conducted in September 2017.

The purpose of the study is to continue to obtain data on the sediment quality to evaluate changes related to all phases of the Project. Previous sampling has been conducted throughout the project area from 1976 to 2010 on the various watersheds. Relevant past data has been examined and is presented with the current study where appropriate.

2.0 METHODS

Triplicate stream sediments were collected from nine sites representing four drainage basins. Each sample was a composite of five or more individual sites within the sampled area. Depositional sites were targeted to obtain fine-grained sediment. Samples were collected with a steel trowel, well mixed and placed into acid washed glass jars. All samples were kept cool until delivered to the ALS laboratory in Whitehorse, Yukon.

These samples were collected from four drainage areas within the Victoria Gold footprint and the sites are detailed below in Table 1 and illustrated on Figure 1.

TABLE 1 LOCATION OF SAMPLE SITES

Drainage	Site	Date Sampled	Site Description	Coordinates	
				Northing	Easting
Haggart Creek	W22	9/21/2017	Haggart Creek upstream Dublin Gulch	7101377	458319
	W4	9/21/2017	Haggart Creek downstream Dublin Gulch	7101223	458144
	W29	9/21/2017	Haggart Creek downstream Eagle Creek	7099583	458225
	W5	9/22/2017	Haggart Creek upstream Lynx Creek	7095887	457815
	W23	9/19/2017	Haggart Creek downstream Lynx Creek	7095682	457790
Dublin Gulch	W1	9/20/2017	Dublin Gulch upstream Stewart Gulch	7101545	460249
	W26	9/20/2017	Stewart Gulch upstream Dublin Gulch	7101443	460331
Eagle Cr	W27	9/20/2017	Eagle Creek near Camp Climate Station	7100997	458235
Lynx Cr	W6	9/22/2017	Lynx Creek upstream Haggart Creek	7095964	458099

At the laboratory, all samples were sieved and the portion passing 63 microns was analyzed for metals using inductively coupled plasma mass spectrophotometry (ICP-MS) or optical emission spectrophotometry (ICP-OES) as appropriate. Mercury was analyzed by cold vapour atomic fluorescence spectrophotometry (CVAFS).

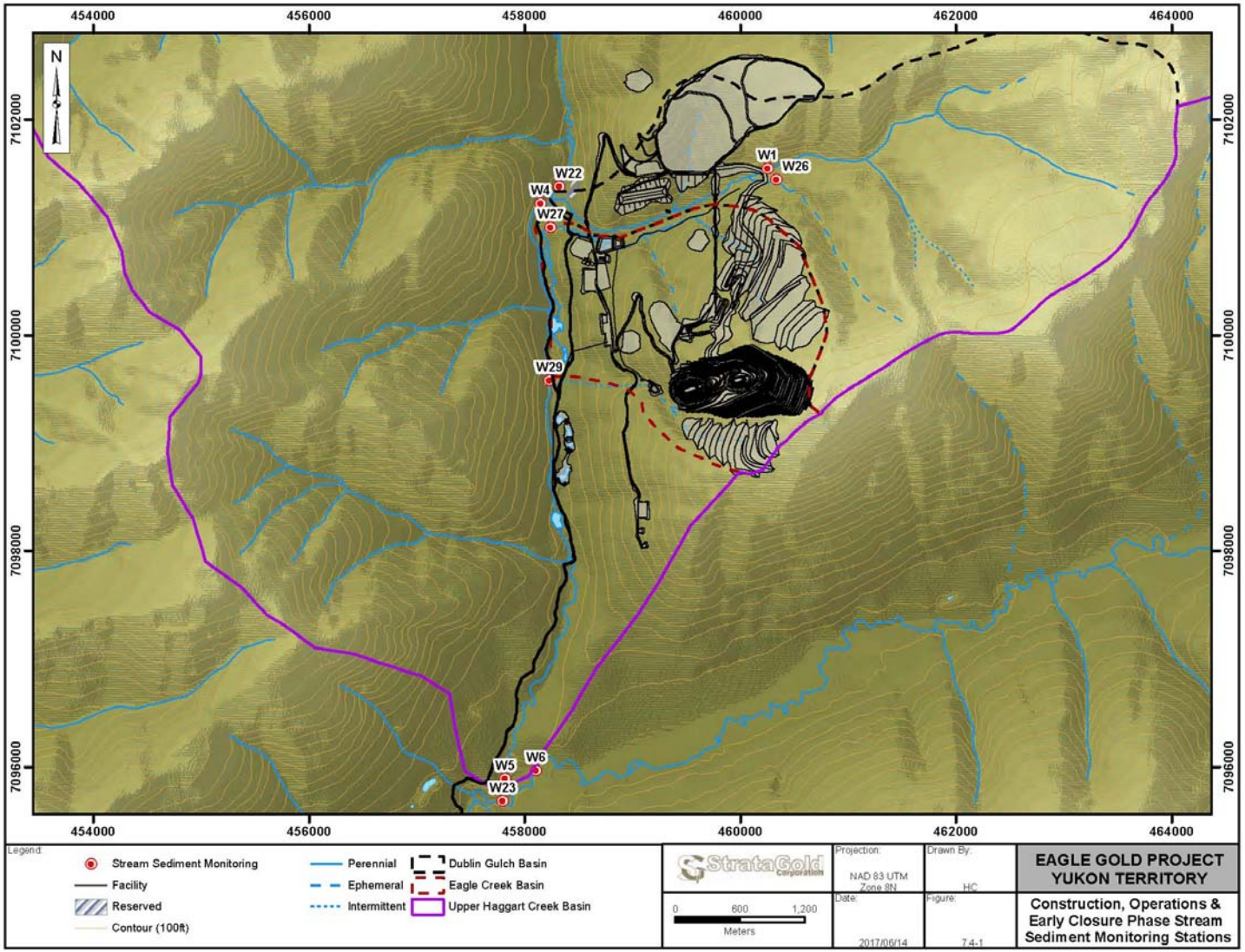


Figure 1 Locations of Stream Sediment Sample Sites During Construction Phase

As a measure of quality assurance/quality control (QA/QC) one duplicate set of sediment samples was collected. Strict sampling protocols were adhered to throughout the field study; sampling equipment was cleaned between samples and sites, disposable gloves were worn per sample and samples were kept cool until relinquished at the laboratory. The lab also performed their own QA/QC by analyzing spiked samples with known concentrations of various parameters.

Upon receipt of the data various metrics were performed. To characterize the stream sediment conditions at each site the triplicates were averaged. Standard deviation was performed to determine the spread of the values. As each of the triplicate samples was collected at different depositional areas within each site, the coefficient variation was calculated (standard deviation divided by mean multiplied by 100) to assess heterogeneity of the stream environment.

3.0 RESULTS AND DISCUSSION

3.1 2017 Data

The analytical report is presented in Appendix A. Samples were analyzed for soil pH, total organic carbon and a suite of 32 metals. The triplicate samples at each site were averaged and these data were used for the tables and discussions. The streams throughout the study area are near neutral to slightly alkaline ranging from a pH of 7.27 at W23, Haggart Creek to 8.49 at W27, Eagle Creek. The total organic carbon content of the stream sediments was low and ranged from 0.21% at W27, Eagle Creek to 2.09% at W22, Haggart Creek. These two parameters are presented below in Table 2. The sites have been arranged per watershed from upstream to downstream.

Of the 32 metals analyzed, boron was not detected in any of the samples. The averages of selected metals are also presented in Table 2. These elements were chosen for closer examination as they can be potentially toxic to aquatic systems, some may be present in the mineral deposit and several have environmental guidelines for the protection of freshwater aquatic life. Since there are no Canadian Environmental Quality Guidelines established for nickel, selenium and silver, the British Columbia Working Sediment Quality Guidelines (BCWSG) were used. Concentrations that exceeded the Interim Sediment Quality Guidelines (ISQG) are displayed in bold and gray highlighted. The ISQG guideline represents where adverse biological effects may only rarely occur. Concentrations that exceeded the Probable Effects Level (PEL) are displayed in bold and highlighted in orange, and indicate a 50% incidence of creating adverse biological effects.

The highest concentrations of six of the ten metals examined were reported at W1, upstream of all Project activities on Dublin Gulch. Lynx Creek, W6, also a reference site, had the highest concentrations of cadmium and selenium in the stream sediments. With the exception of arsenic there was not a great spread of concentrations per parameter throughout the study area.

Several guidelines were exceeded for the protection of freshwater aquatic life. The PEL for arsenic, 17 mg/kg, was significantly exceeded at all of the sites ranging from 55.5 mg/kg at W22 to 458.0 mg/kg at W1.

The concentration of nickel exceeded the BCWSG low level effect guideline (16 mg/kg) in the stream sediments at all of the sites and ranged from 25.9 mg/kg at W23 to 57.2 at W1.

The ISQG was exceeded for cadmium at W6 and W22, for chromium at W1, for copper at W27, for lead at W29 and W1, and for zinc at W1. Guidelines were met in the study area for mercury, selenium and silver.

TABLE 2 SUMMARY OF MEAN STREAM SEDIMENT CONCENTRATIONS, SEPTEMBER 2017

Drainage	Haggart Creek					Dublin Gulch		Eagle Cr	Lynx Cr	CEQG Guidelines	
Site	W22	W4	W29	W5	W23	W1	W26	W27	W6	ISQG	PEL
pH	7.61	7.68	7.79	7.87	7.27	7.42	7.69	8.49	7.77	na	na
Total Organic Carbon (%)	2.09	0.92	0.45	0.84	1.35	0.56	0.82	0.21	0.92	na	na
Arsenic (mg/kg)	**55.5**	**109.6**	**127.2**	**76.8**	**88.8**	**458.0**	**209.0**	**200.3**	**85.8**	5.9	17
Cadmium (mg/kg)	**0.6**	0.4	0.5	0.3	0.4	0.6	0.5	0.3	**0.9**	0.6	3.5
Chromium (mg/kg)	20.1	20.0	21.8	20.8	20.8	**45.3**	30.8	18.6	21.2	37.3	90
Copper (mg/kg)	20.0	21.4	26.5	23.3	23.3	30.9	20.3	**36.3**	22.0	35.7	197
Lead (mg/kg)	15.9	20.5	**40.3**	24.3	23.3	**47.2**	23.9	32.7	15.4	35	91.3
Mercury (mg/kg)	0.114	0.069	0.069	0.049	0.049	0.052	0.074	0.046	0.039	0.170	0.486
Nickel* (mg/kg)	**31.3**	**28.0**	**31.7**	**26.9**	**25.9**	**57.2**	**28.7**	**31.0**	**27.5**	16	75
Selenium* (mg/kg)	0.37	0.35	0.39	0.27	0.34	0.49	0.54	0.30	0.74	5	na
Silver* (mg/kg)	0.15	0.23	0.25	0.18	0.19	0.43	0.29	0.20	0.14	0.5	na
Zinc (mg/kg)	89.7	88.0	106.4	80.0	89.6	**150.3**	92.7	80.5	102.7	123	315

* BCWSG na = not applicable

In attempts to determine the reliability of the current data set and the heterogeneity of each site, standard deviation (SD) and coefficient variation (CV) were calculated on the means of the triplicates. The target for CV is no more than 20% when replicate samples collected at the same time and location are all at least five times the detection limit. These results are tabulated in Table A-1 in Appendix A. The parameters where CV was 20% or less for all sites were aluminum, barium, calcium, lithium, magnesium, phosphorus, selenium, sodium, strontium, thallium, tin, titanium, uranium and vanadium. The CV was greater than 20% for the remainder of metals at a minimum of at least one site. The higher CVs frequently occurred at the sites W22 and/or W29. This would indicate that the stream sediments at these sites are not homogeneous throughout the stream reach sampled.

A set of duplicate stream sediment samples was collected from W29 and the relative percent difference for all parameters in each sample was less than 25% (Table A-2, Appendix A). Although there were higher CVs for some parameters at W29, the duplicate sampling shows that each of the triplicate samples was representative of the area within site W29 where it was collected.

Arsenic is prevalent in the stream sediments throughout the study area and as previously mentioned the PEL was exceeded at all sites. Arsenic is typically associated with the

mineralogy of gold. The high concentrations documented at W1, Dublin Gulch upstream of Project activities, indicate that this stream drains a mineralized area. The standard deviation showed a small spread of values and the CV was 17.5% (Table A-1, Appendix A) confirming that the arsenic concentrations at W1 are representative of the site.

Nickel also was widespread throughout the study area and concentrations in the stream sediments exceeded the ISQG at all sites.

These two elements have been graphed below in Figures 2 and 3. Concentrations of arsenic fluctuate throughout the study area whereas nickel concentrations are relatively similar.

Figure 2 Arsenic (mg/kg) in Stream Sediments, 2017

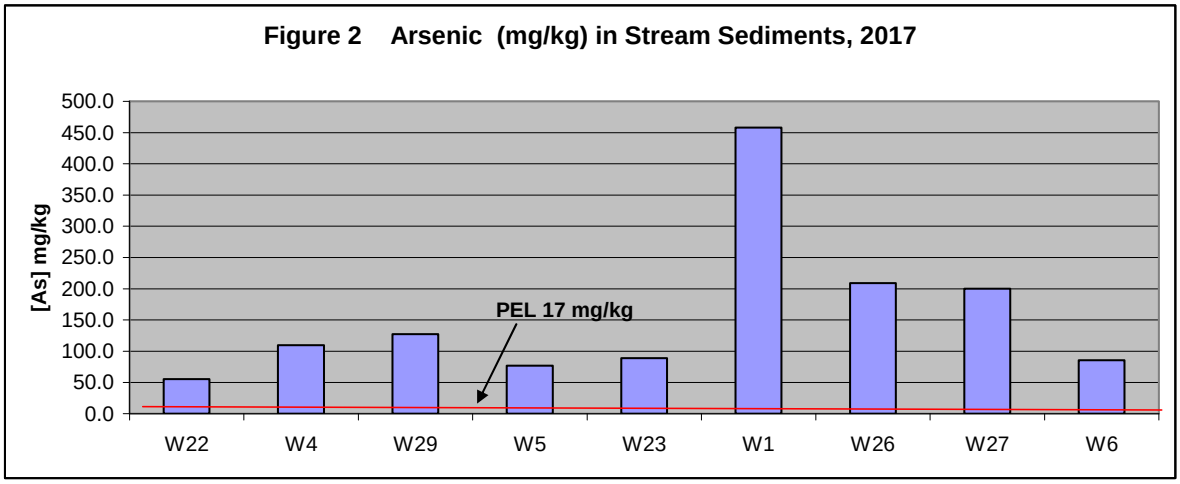
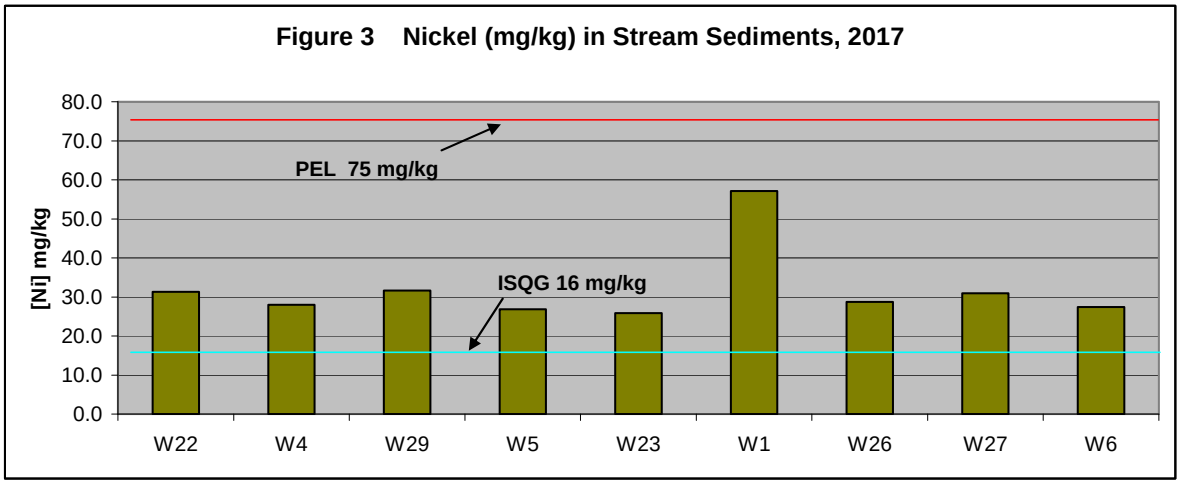


Figure 3 Nickel (mg/kg) in Stream Sediments, 2017



3.2 Previous Data

Stream sediment samples have been collected in the general Project area in 1976, 1977, 1993, 1995, 2007, 2009 and 2010 (Stantec, 2011). The number of sites sampled, and the number of replicates collected varied in a given year. Data was examined from these surveys where the analysis was completed on the portion of the sediment that was less than 63 microns and for sites that were sampled in 2017. The mean concentrations for arsenic and nickel over time have been tabulated (Table 3) and graphically represented in Figures 4 and 5 with the 2017 data.

High levels of arsenic were reported at all sites and on all occasions, exceeding the PEL. Concentrations tended to fluctuate year to year at the sites.

Concentrations of nickel exceeded the ISQG throughout the study area and study period with the exception in 2007 at Eagle Creek, W27 and 2009 at W1, Dublin Gulch.

There were periodic exceedances of guidelines of other metals. This data has not been presented here but is available in a report prepared by Stantec (2011).

TABLE 3 MEAN CONCENTRATIONS OF ARSENIC AND NICKEL IN STREAM SEDIMENTS, 1995 - 2017

Drainage	Site	ARSENIC (mg/kg)					NICKEL (mg/kg)				
		1995 n=5	2007 n=3	2009 n=3	2010 n=3	2017 n=3	1995 n=5	2007 n=3	2009 n=3	2010 n=3	2017 n=3
Haggart Creek	W22	**70.0**	**40.1**	**129.2**		**55.5**	**27.0**	**27.4**	**25.0**		**31.3**
	W4	**152.7**	**91.5**		**165.0**	**109.6**	**21.0**	**24.5**		**35.2**	**28.0**
	W29			**63.6**	**142.4**	**127.2**			**25.3**	**25.7**	**31.7**
	W5	**128.5**	**92.7**	**118.3**		**76.8**	**22.4**	**25.6**	**26.8**		**26.9**
	W23		**93.4**			**88.8**		**28.8**			**25.9**
Dublin Gulch	W1		**300.0**	**156.0**	**360.4**	**458.0**		**65.5**	13.3	**39.3**	**57.2**
	W26		**89.1**	**342.0**		**209.0**		15.7	**17.0**		**28.7**
Eagle Cr	W27		**175.0**	**173.7**	**77.9**	**200.3**		**25.3**	**20.6**	**21.1**	**31.0**
Lynx Cr	W6		**65.9**			**85.8**		**23.6**			**27.5**
CEQG Guideline	**ISQG**	5.9					16				
	PEL	17					75				

Figure 4 Mean Arsenic Concentrations in the Study Area Over Time

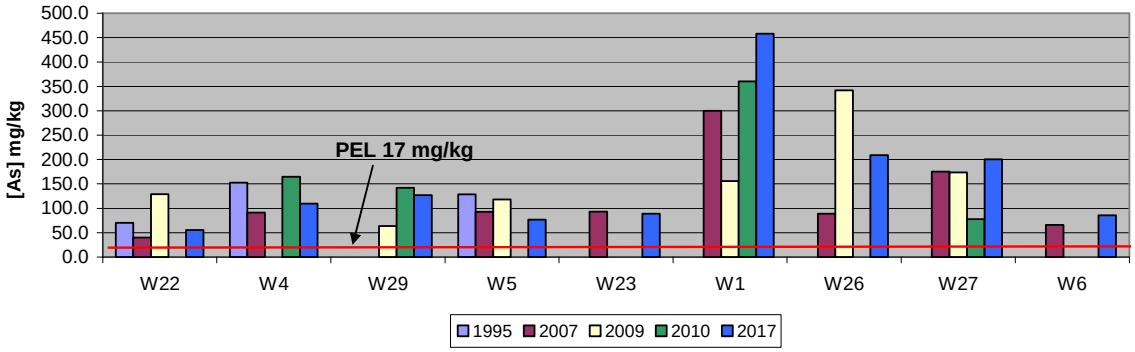
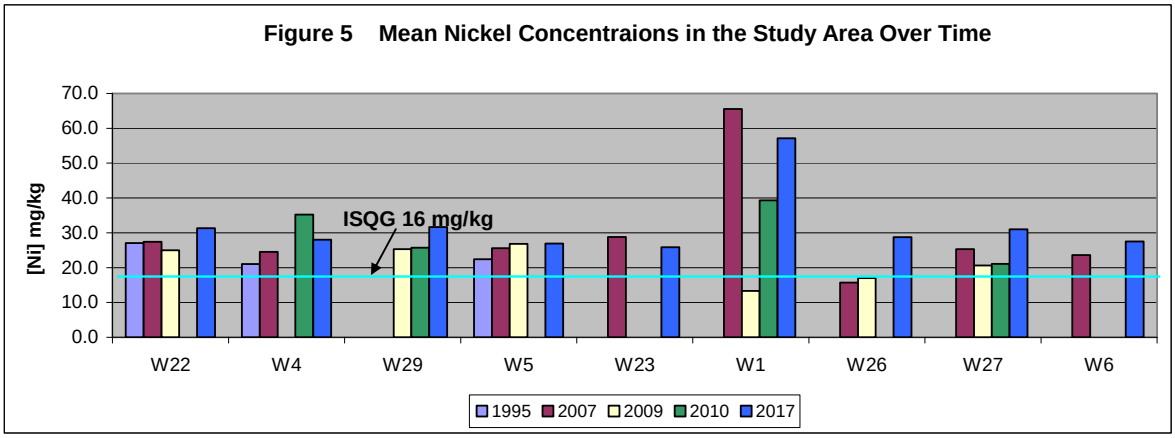


Figure 5 Mean Nickel Concentraions in the Study Area Over Time



4.0 REFERENCES

Canadian Council of Ministers of the Environment (CCME). 2007. Canadian sediment quality guidelines for the Protection of Aquatic Life. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba

Stantec Consulting Ltd. 2011. Baseline Environmental Report: Water Quality and Aquatic Biota. Prepared for Victoria Gold Corp. Project # 1231-10377.

StrataGold Corporation. 2017. Eagle Gold Project Environmental Monitoring, Surveillance and Adaptive Management Plan. Version 2017-01.

APPENDIX A

- **Table A-1 Statistics on the Triplicate Analyses**
- **Table A-2 RPD for Duplicate Sample**
- **Analytical Report: L1996642**
- **Analytical Report: L1996555**

TABLE A-1 STATISTICS ON THE TRIPLICATE ANALYSES

Site	Client Sample ID	pH (1:2 soil:water)	Total Organic Carbon	Aluminum (Al)	Antimony (Sb)	Arsenic (As)	Barium (Ba)	Beryllium (Be)	Bismuth (Bi)	Boron (B)	Cadmium (Cd)	Calcium (Ca)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Lithium (Li)	Magnesium (Mg)	Manganese (Mn)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Phosphorus (P)	Potassium (K)	Selenium (Se)	Silver (Ag)	Sodium (Na)	Strontium (Sr)	Thallium (Tl)	Tin (Sn)	Titanium (Ti)	Uranium (U)	Vanadium (V)	Zinc (Zn)
	Units	pH	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	DL	0.10	0.050	50	0.10	0.050	0.50	0.10	0.10	10	0.050	50	0.50	0.10	0.50	50	0.10	5.0	10	0.20	0.0050	0.10	0.50	50	100	0.10	0.050	100	0.10	0.050	0.20	1.0	0.050	0.20	1.0
	5 x DL	0.50	0.25	250.00	0.50	0.25	2.50	0.50	0.50	50.00	0.25	250.00	2.50	0.50	2.50	250.00	0.50	25.00	50.00	1.00	0.03	0.50	2.50	250.00	500.00	0.50	0.25	500.00	0.50	0.25	1.00	5.00	0.25	1.00	5.00
W22	Avg	7.61	2.09	9013.33	2.93	55.53	163.00	0.34	0.59		0.61	3956.67	20.10	15.10	20.03	27800.00	15.90	14.83	3260.00	1013.67	0.11	0.70	31.33	685.33	786.67	0.37	0.15	#DIV/0!	30.13	0.14	0.68	245.33	1.21	26.87	89.67
	SD	0.17	2.75	90.74	1.23	38.52	15.10	0.02	0.45		0.20	192.18	4.51	2.75	3.33	4788.53	2.55	0.40	160.93	275.70	0.08	0.26	5.54	19.43	134.29	0.06	0.01	#DIV/0!	2.77	0.02	0.29	31.77	0.22	1.42	11.88
	CV	2.3	131.3	1.0	42.1	69.4	9.3	4.5	75.9		31.9	4.9	22.4	18.2	16.6	17.2	16.1	2.7	4.9	27.2	73.4	36.6	17.7	2.8	17.1	16.4	9.2	#DIV/0!	9.2	14.9	42.8	12.9	18.3	5.3	13.3
W4	Avg	7.68	0.92	9950.00	4.49	109.57	161.00	0.41	0.55		0.41	3953.33	20.00	12.73	21.37	25033.33	20.53	16.57	3490.00	836.33	0.07	0.86	28.00	668.33	1093.33	0.35	0.23	105.00	31.57	0.15	0.69	311.67	1.40	28.60	88.00
	SD	0.10	0.39	216.56	1.48	46.84	9.85	0.05	0.26		0.04	83.27	1.18	1.18	4.13	2328.81	5.97	0.51	40.00	152.22	0.00	0.16	0.95	2.52	149.78	0.02	0.08	7.07	0.67	0.00	0.17	11.72	0.24	0.92	5.12
	CV	1.2	42.4	2.2	33.1	42.7	6.1	11.6	46.7		8.5	2.1	5.9	9.3	19.3	9.3	29.1	3.1	1.1	18.2	6.7	19.1	3.4	0.4	13.7	6.7	32.6	6.7	2.1	2.0	24.6	3.8	17.2	3.2	5.8
W29	Avg	7.79	0.45	9523.33	10.74	127.23	157.67	0.38	0.65		0.54	4080.00	21.77	15.30	26.53	29600.00	40.33	15.67	3780.00	1393.00	0.07	0.86	31.67	672.67	1026.67	0.39	0.25	#DIV/0!	33.27	0.13	0.86	276.33	1.53	27.70	106.37
	SD	0.11	0.12	1108.89	5.23	64.59	18.77	0.09	0.18		0.21	463.57	3.41	5.68	8.03	7318.47	18.22	2.20	504.78	873.62	0.01	0.21	9.60	38.37	219.39	0.14	0.10	#DIV/0!	4.97	0.03	0.22	16.26	0.43	1.30	31.79
	CV	1.4	26.2	11.6	48.7	50.8	11.9	23.4	28.5		38.4	11.4	15.7	37.1	30.3	24.7	45.2	14.0	13.4	62.7	16.9	24.0	30.3	5.7	21.4	35.9	41.1	#DIV/0!	15.0	21.8	25.4	5.9	28.2	4.7	29.9
DUP	Avg	7.79	#DIV/0!	9113.33	10.62	130.67	154.67	0.38	0.75		0.54	4023.33	20.70	15.37	25.83	29533.33	42.17	14.90	3736.67	1397.67	0.07	0.81	31.47	665.33	970.00	0.41	0.25	#DIV/0!	32.37	0.13	0.78	246.67	1.53	26.43	106.60
	SD	0.07	#DIV/0!	575.01	4.70	61.33	17.93	0.07	0.31		0.16	279.34	2.13	4.80	5.55	5819.22	16.66	1.15	332.47	764.21	0.01	0.16	7.52	30.11	149.33	0.12	0.08	#DIV/0!	3.06	0.02	0.14	36.47	0.38	1.57	23.44
	CV	0.9	#DIV/0!	6.3	44.2	46.9	11.6	17.3	41.9		29.7	6.9	10.3	31.2	21.5	19.7	39.5	7.7	8.9	54.7	17.3	19.1	23.9	4.5	15.4	29.3	34.4	#DIV/0!	9.5	15.8	17.4	14.8	24.5	5.9	22.0
W5	Avg	7.87	0.84	8770.00	6.26	76.77	148.67	0.33	0.47	Not detected in any samples	0.32	4906.67	20.77	11.07	23.30	25466.67	24.33	13.87	4380.00	715.33	0.05	0.66	26.87	843.00	960.00	0.27	0.18	110.00	33.90	0.10	0.56	303.00	1.21	26.63	80.00
	SD	0.05	0.31	766.03	0.63	1.72	8.39	0.02	0.02		0.06	285.01	2.11	0.49	0.78	493.29	1.21	1.10	165.23	95.04	0.00	0.03	2.23	43.49	87.18	0.02	0.00	0.00	0.95	0.01	0.23	17.00	0.09	1.21	7.66
	CV	0.6	36.6	8.7	10.1	2.2	5.6	6.4	3.3		18.9	5.8	10.2	4.5	3.4	1.9	5.0	7.9	3.8	13.3	3.3	4.8	8.3	5.2	9.1	7.4	1.0	0.0	2.8	12.7	41.1	5.6	7.1	4.5	9.6
W23	Avg	7.27	1.35	9153.33	6.00	88.83	165.00	0.33	0.40		0.41	4600.00	20.80	11.60	23.30	24933.33	23.30	14.53	4230.00	512.00	0.05	0.69	25.87	825.33	873.33	0.34	0.19	116.67	32.20	0.10	0.43	332.33	1.12	27.33	89.63
	SD	0.57	0.79	839.36	0.25	14.52	6.24	0.03	0.02		0.04	190.00	1.31	0.72	2.10	1266.23	0.95	1.23	294.62	108.60	0.01	0.02	1.17	42.85	92.38	0.07	0.02	11.55	0.82	0.01	0.05	39.46	0.05	0.93	6.93
	CV	7.8	59.1	9.2	4.1	16.3	3.8	9.2	3.8		10.0	4.1	6.3	6.2	9.0	5.1	4.1	8.5	7.0	21.2	17.3	2.2	4.5	5.2	10.6	20.6	11.5	9.9	2.5	11.2	10.7	11.9	4.6	3.4	7.7
W26	Avg	7.69	0.82	14066.67	3.89	209.00	211.00	0.53	0.40		0.46	5163.33	30.77	11.83	20.30	26500.00	23.87	24.97	5163.33	438.33	0.07	2.05	28.73	844.67	1626.67	0.54	0.29	123.33	48.60	0.25	0.76	617.00	2.39	41.90	92.73
	SD	0.17	0.13	1418.92	0.25	13.75	19.08	0.06	0.02		0.01	505.21	3.52	1.72	2.10	2406.24	1.20	3.69	591.81	12.86	0.01	0.12	4.09	48.85	272.09	0.03	0.11	15.28	4.95	0.04	0.05	88.39	0.43	3.65	7.57
	CV	2.2	16.3	10.1	6.4	6.6	9.0	11.5	3.8		3.0	9.8	11.4	14.5	10.3	9.1	5.0	14.8	11.5	2.9	19.5	5.8	14.2	5.8	16.7	5.6	39.1	12.4	10.2	15.2	6.2	14.3	18.0	8.7	8.2
W1	Avg	7.42	0.56	16200.00	17.03	458.00	262.33	1.05	0.44		0.59	4756.67	45.27	21.17	30.93	36800.00	47.23	26.03	6006.67	882.67	0.05	5.42	57.17	1062.33	2600.00	0.49	0.43	163.33	40.60	0.33	0.98	646.67	5.66	52.03	150.33
	SD	0.09	0.27	3274.14	3.18	80.22	54.56	0.18	0.08		0.06	486.86	8.62	6.16	5.56	5501.82	8.32	3.33	879.00	227.62	0.01	1.07	9.91	83.16	583.87	0.08	0.14	32.15	5.63	0.07	0.17	52.92	0.71	9.09	17.62
	CV	1.2	48.6	20.2	18.7	17.5	20.8	16.9	17.5		9.7	10.2	19.0	29.1	18.0	15.0	17.6	12.8	14.6	25.8	14.5	19.7	17.3	7.8	22.5	16.7	32.7	19.7	13.9	20.1	17.3	8.2	12.6	17.5	11.7
W27	Avg	8.49	0.21	7373.33	9.14	200.33	123.33	0.40	0.84		0.33	5893.33	18.60	13.40	36.33	29266.67	32.70	12.77	4080.00	535.00	0.05	0.87	30.97	708.00	1386.67	0.30	0.20	115.00	36.50	0.15	0.71	252.67	1.34	21.37	80.47
	SD	0.10	0.08	766.44	0.27	17.04	9.24	0.03	0.08		0.02	94.52	3.32	0.61	1.70	2112.66	0.36	1.33	329.70	5.57	0.00	0.16	2.29	20.42	176.73	0.03	0.02	7.07	1.93	0.02	0.13	10.21	0.05	1.42	3.25
	CV	1.1	39.0	10.4	3.0	8.5	7.5	8.0	9.4		5.7	1.6	17.8	4.5	4.7	7.2	1.1	10.4	8.1	1.0	10.0	18.4	7.4	2.9	12.7	10.6	12.2	6.1	5.3	11.4	17.9	4.0	3.9	6.6	4.0
W6	Avg	7.77	0.92	11266.67	2.30	85.77	188.00	0.38	0.28		0.94	5816.67	21.17	10.77	22.00	22666.67	15.40	17.53	4476.67	955.00	0.04	0.96	27.47	804.67	880.00	0.74	0.14	166.67	36.07	0.13	0.52	311.67	1.05	30.87	102.67
	SD	0.12	0.47	404.15	0.08	11.99	12.17	0.00	0.10		0.14	275.92	0.32	0.45	0.00	1266.23	0.26	0.40	101.16	88.66	0.01	0.11	1.31	28.57	30.00	0.10	0.01	5.77	2.19	0.01	0.10	41.79	0.08	1.72	2.52
	CV	1.5	51.0	3.6	3.5	14.0	6.5	0.0	35.7		15.3	4.7	1.5	4.2	0.0	5.6	1.7	2.3	2.3	9.3	14.7	10.9	4.8	3.6	3.4	13.0	4.5	3.5	6.1	6.6	20.1	13.4	8.0	5.6	2.5

TABLE A-2	RPD VALUES FOR DUPLICATE SEDIMENT SAMPLES COLLECTED AT W29									
Parameter	Units	W29-A	DUP A	RPD%	W29-B	DUP B	RPD%	W29-C	DUP C	RPD %
pH (1:2 soil:w	pH	7.68	7.73	0.6	7.80	7.78	0.3	7.90	7.87	0.4
Aluminum (Al	mg/kg	8800	9420	6.8	10800	9470	13.1	8970	8450	6.0
Antimony (Sb	mg/kg	8.59	9.07	5.4	16.7	15.9	4.9	6.92	6.90	0.3
Arsenic (As)	mg/kg	105	116	10.0	200	198	1.0	76.7	78.0	1.7
Barium (Ba)	mg/kg	154	166	7.5	178	164	8.2	141	134	5.1
Beryllium (Be	mg/kg	0.35	0.38	8.2	0.48	0.44	8.7	0.31	0.31	0.0
Bismuth (Bi)	mg/kg	0.60	0.69	14.0	0.85	1.09	24.7	0.49	0.47	4.2
Boron (B)	mg/kg	<10	<10	ND	<10	<10	ND	<10	<10	ND
Cadmium (Cd	mg/kg	0.427	0.489	13.5	0.783	0.722	8.1	0.418	0.414	1.0
Calcium (Ca)	mg/kg	3880	4080	5.0	4610	4270	7.7	3750	3720	0.8
Chromium (C	mg/kg	19.7	20.3	3.0	25.7	23.0	11.1	19.9	18.8	5.7
Cobalt (Co)	mg/kg	12.8	14.6	13.1	21.8	20.5	6.1	11.3	11.0	2.7
Copper (Cu)	mg/kg	22.2	24.6	10.3	35.8	31.9	11.5	21.6	21.0	2.8
Iron (Fe)	mg/kg	26200	28500	8.4	38000	35800	6.0	24600	24300	1.2
Lead (Pb)	mg/kg	32.2	37.7	15.7	61.2	60.6	1.0	27.6	28.2	2.2
Lithium (Li)	mg/kg	14.3	15.3	6.8	18.2	15.8	14.1	14.5	13.6	6.4
Magnesium (M	mg/kg	3440	3690	7.0	4360	4090	6.4	3540	3430	3.2
Manganese (M	mg/kg	1080	1290	17.7	2380	2210	7.4	719	693	3.7
Mercury (Hg)	mg/kg	0.0635	0.0767	18.8	0.0822	0.0730	11.9	0.0608	0.0547	10.6
Molybdenum	mg/kg	0.80	0.81	1.2	1.09	0.97	11.7	0.69	0.66	4.4
Nickel (Ni)	mg/kg	27.1	30.3	11.1	42.7	39.5	7.8	25.2	24.6	2.4
Phosphorus (	mg/kg	701	699	0.3	688	641	7.1	629	656	4.2
Potassium (K	mg/kg	900	1030	13.5	1280	1080	16.9	900	800	11.8
Selenium (Se	mg/kg	0.33	0.37	11.4	0.55	0.55	0.0	0.29	0.32	9.8
Silver (Ag)	mg/kg	0.199	0.247	21.5	0.361	0.329	9.3	0.176	0.160	9.5
Sodium (Na)	mg/kg	<100	<100	ND	<100	<100	ND	<100	<100	ND
Strontium (Sr	mg/kg	30.7	33.5	8.7	39.0	34.7	11.7	30.1	28.9	4.1
Thallium (Tl)	mg/kg	0.114	0.136	17.6	0.166	0.153	8.2	0.118	0.111	6.1
Tin (Sn)	mg/kg	0.69	0.76	9.7	1.11	0.93	17.6	0.79	0.66	17.9
Titanium (Ti)	mg/kg	273	287	5.0	262	216	19.2	294	237	21.5
Uranium (U)	mg/kg	1.36	1.51	10.5	2.02	1.92	5.1	1.21	1.17	3.4
Vanadium (V)	mg/kg	26.9	28.2	4.7	29.2	25.9	12.0	27.0	25.2	6.9
Zinc (Zn)	mg/kg	90.1	102	12.4	143	132	8.0	86.0	85.8	0.2
ND = not detected therefore RPD could not be calculated										

STRATAGOLD CORPORATION
ATTN: Hugh Coyle
Suite 910 - 1050 W. Pender St
Vancouver BC V6E 3S7

Date Received: 22-SEP-17
Report Date: 10-OCT-17 14:19 (MT)
Version: FINAL

Client Phone: 604-682-5122

Certificate of Analysis

Lab Work Order #: L1996642

Project P.O. #: NOT SUBMITTED
Job Reference: EAGLE GOLD
C of C Numbers:
Legal Site Desc: Victoria Gold Corp

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1996642-1 Sediment 19-SEP-17 16:45 W23-A	L1996642-2 Sediment 19-SEP-17 16:45 W23-B	L1996642-3 Sediment 19-SEP-17 16:45 W23-C	L1996642-4 Sediment 20-SEP-17 15:00 W26-A	L1996642-5 Sediment 20-SEP-17 15:00 W26-B
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)	7.17	7.88	6.76	7.50	7.75
Organic / Inorganic Carbon	Total Organic Carbon (%)	1.42	0.516	2.10	0.971	0.710
Metals	Aluminum (Al) (mg/kg)	8860	8500	10100	15600	12800
	Antimony (Sb) (mg/kg)	5.72	6.15	6.14	4.03	3.60
	Arsenic (As) (mg/kg)	105	76.9	84.6	221	194
	Barium (Ba) (mg/kg)	170	158	167	231	193
	Beryllium (Be) (mg/kg)	0.34	0.30	0.36	0.60	0.49
	Bismuth (Bi) (mg/kg)	0.42	0.39	0.40	0.42	0.39
	Boron (B) (mg/kg)	<10	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	0.440	0.362	0.423	0.477	0.463
	Calcium (Ca) (mg/kg)	4410	4790	4600	5730	5000
	Chromium (Cr) (mg/kg)	19.9	20.2	22.3	34.8	28.3
	Cobalt (Co) (mg/kg)	11.8	10.8	12.2	13.8	10.6
	Copper (Cu) (mg/kg)	23.8	21.0	25.1	22.1	18.0
	Iron (Fe) (mg/kg)	25400	23500	25900	29000	24200
	Lead (Pb) (mg/kg)	23.2	22.4	24.3	25.1	22.7
	Lithium (Li) (mg/kg)	14.2	13.5	15.9	29.2	22.4
	Magnesium (Mg) (mg/kg)	4170	3970	4550	5800	4630
	Manganese (Mn) (mg/kg)	480	633	423	429	433
	Mercury (Hg) (mg/kg)	0.0581	0.0416	0.0467	0.0893	0.0702
	Molybdenum (Mo) (mg/kg)	0.67	0.70	0.69	2.18	2.02
	Nickel (Ni) (mg/kg)	26.1	24.6	26.9	33.4	25.8
	Phosphorus (P) (mg/kg)	813	873	790	901	819
	Potassium (K) (mg/kg)	820	820	980	1940	1450
	Selenium (Se) (mg/kg)	0.37	0.26	0.39	0.51	0.54
	Silver (Ag) (mg/kg)	0.168	0.185	0.211	0.255	0.414
	Sodium (Na) (mg/kg)	110	110	130	140	120
	Strontium (Sr) (mg/kg)	31.3	32.9	32.4	54.3	46.1
	Thallium (Tl) (mg/kg)	0.102	0.093	0.116	0.296	0.223
	Tin (Sn) (mg/kg)	0.48	0.39	0.42	0.74	0.72
	Titanium (Ti) (mg/kg)	287	351	359	716	589
	Uranium (U) (mg/kg)	1.11	1.08	1.18	2.89	2.18
	Vanadium (V) (mg/kg)	26.9	26.7	28.4	46.1	39.5
	Zinc (Zn) (mg/kg)	91.7	81.9	95.3	100	84.9

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1996642-6 Sediment 20-SEP-17 15:00 W26-C	L1996642-7 Sediment 20-SEP-17 16:50 W1-A	L1996642-8 Sediment 20-SEP-17 16:50 W1-B	L1996642-9 Sediment 20-SEP-17 16:50 W1-C	L1996642-10 Sediment 20-SEP-17 18:00 W27-A
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)	7.82	7.47	7.47	7.32	8.41
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.785	0.273	0.596	0.816	0.147
Metals	Aluminum (Al) (mg/kg)	13800	13400	15400	19800	6830
	Antimony (Sb) (mg/kg)	4.03	15.0	15.4	20.7	9.05
	Arsenic (As) (mg/kg)	212	432	394	548	190
	Barium (Ba) (mg/kg)	209	215	250	322	118
	Beryllium (Be) (mg/kg)	0.50	0.96	0.93	1.25	0.39
	Bismuth (Bi) (mg/kg)	0.40	0.38	0.42	0.53	0.87
	Boron (B) (mg/kg)	<10	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	0.449	0.555	0.550	0.651	0.313
	Calcium (Ca) (mg/kg)	4760	4610	4360	5300	5860
	Chromium (Cr) (mg/kg)	29.2	38.6	42.2	55.0	17.6
	Cobalt (Co) (mg/kg)	11.1	14.8	21.6	27.1	13.0
	Copper (Cu) (mg/kg)	20.8	25.6	30.5	36.7	35.4
	Iron (Fe) (mg/kg)	26300	32500	34900	43000	28200
	Lead (Pb) (mg/kg)	23.8	40.7	44.4	56.6	32.6
	Lithium (Li) (mg/kg)	23.3	23.0	25.5	29.6	12.0
	Magnesium (Mg) (mg/kg)	5060	5180	5910	6930	3870
	Manganese (Mn) (mg/kg)	453	682	836	1130	541
	Mercury (Hg) (mg/kg)	0.0612	0.0454	0.0503	0.0602	0.0439
	Molybdenum (Mo) (mg/kg)	1.95	4.50	5.18	6.59	0.86
	Nickel (Ni) (mg/kg)	27.0	48.2	55.5	67.8	29.8
	Phosphorus (P) (mg/kg)	814	1100	967	1120	685
	Potassium (K) (mg/kg)	1490	2120	2430	3250	1270
	Selenium (Se) (mg/kg)	0.57	0.45	0.43	0.58	0.28
	Silver (Ag) (mg/kg)	0.196	0.310	0.386	0.580	0.173
	Sodium (Na) (mg/kg)	110	140	150	200	<100
	Strontium (Sr) (mg/kg)	45.4	37.2	37.5	47.1	35.1
	Thallium (Tl) (mg/kg)	0.239	0.281	0.312	0.410	0.141
	Tin (Sn) (mg/kg)	0.81	0.97	0.82	1.16	0.65
	Titanium (Ti) (mg/kg)	546	598	639	703	241
	Uranium (U) (mg/kg)	2.11	5.63	4.96	6.38	1.31
	Vanadium (V) (mg/kg)	40.1	44.7	49.2	62.2	20.1
	Zinc (Zn) (mg/kg)	93.3	134	148	169	77.6

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1996642-11 Sediment 20-SEP-17 18:00 W27-B	L1996642-12 Sediment 20-SEP-17 18:00 W27-C	L1996642-13 Sediment 21-SEP-17 08:45 W22-A	L1996642-14 Sediment 21-SEP-17 08:45 W22 B	L1996642-15 Sediment 21-SEP-17 08:45 W22 C
Sample ID / **Description** / **Sampled Date** / **Sampled Time** / **Client ID**						
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)	8.60	8.47	7.74	7.41	7.67
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.178	0.301	0.667	5.26	0.352
Metals	Aluminum (Al) (mg/kg)	8250	7040	9050	8910	9080
	Antimony (Sb) (mg/kg)	9.44	8.92	2.45	2.01	4.33
	Arsenic (As) (mg/kg)	220	191	42.4	25.3	98.9
	Barium (Ba) (mg/kg)	134	118	179	149	161
	Beryllium (Be) (mg/kg)	0.44	0.38	0.32	0.34	0.35
	Bismuth (Bi) (mg/kg)	0.90	0.75	0.36	0.30	1.10
	Boron (B) (mg/kg)	<10	<10	<10	<10	<10
	Cadmium (Cd) (mg/kg)	0.334	0.351	0.751	0.389	0.700
	Calcium (Ca) (mg/kg)	6000	5820	3750	4130	3990
	Chromium (Cr) (mg/kg)	22.3	15.9	17.7	17.3	25.3
	Cobalt (Co) (mg/kg)	14.1	13.1	15.0	12.4	17.9
	Copper (Cu) (mg/kg)	38.3	35.3	18.8	17.5	23.8
	Iron (Fe) (mg/kg)	31700	27900	28500	22700	32200
	Lead (Pb) (mg/kg)	33.1	32.4	15.3	13.7	18.7
	Lithium (Li) (mg/kg)	14.3	12.0	14.9	14.4	15.2
	Magnesium (Mg) (mg/kg)	4460	3910	3280	3090	3410
	Manganese (Mn) (mg/kg)	534	530	1300	750	991
	Mercury (Hg) (mg/kg)	0.0516	0.0433	0.0620	0.0692	0.210
	Molybdenum (Mo) (mg/kg)	1.04	0.72	0.54	0.57	1.00
	Nickel (Ni) (mg/kg)	33.6	29.5	35.3	25.0	33.7
	Phosphorus (P) (mg/kg)	715	724	690	664	702
	Potassium (K) (mg/kg)	1590	1300	730	690	940
	Selenium (Se) (mg/kg)	0.34	0.29	0.33	0.34	0.44
	Silver (Ag) (mg/kg)	0.220	0.208	0.139	0.140	0.163
	Sodium (Na) (mg/kg)	120	110	<100	<100	<100
	Strontium (Sr) (mg/kg)	38.7	35.7	29.4	27.8	33.2
	Thallium (Tl) (mg/kg)	0.165	0.133	0.144	0.119	0.161
	Tin (Sn) (mg/kg)	0.86	0.63	0.59	0.44	1.00
	Titanium (Ti) (mg/kg)	260	257	228	226	282
	Uranium (U) (mg/kg)	1.40	1.31	1.04	1.13	1.46
	Vanadium (V) (mg/kg)	22.9	21.1	25.9	26.2	28.5
	Zinc (Zn) (mg/kg)	84.0	79.8	101	77.3	90.7

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1996642-16	L1996642-17	L1996642-18	L1996642-19	L1996642-20
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	21-SEP-17	21-SEP-17	21-SEP-17	21-SEP-17	21-SEP-17
Sampled Time	11:45	11:45	11:45	14:20	14:20
Client ID	W4-A	W4-B	W4-C	W29-A	W29-B
Grouping / **Analyte**					
SOIL					
Physical Tests pH (1:2 soil:water) (pH)	7.62	7.79	7.63	7.68	7.80
Organic / Inorganic Carbon Total Organic Carbon (%)	1.05	0.478	1.22	0.578	0.350
Metals Aluminum (Al) (mg/kg)	10200	9830	9820	8800	10800
Antimony (Sb) (mg/kg)	3.54	6.20	3.73	8.59	16.7
Arsenic (As) (mg/kg)	75.6	163	90.1	105	200
Barium (Ba) (mg/kg)	172	153	158	154	178
Beryllium (Be) (mg/kg)	0.39	0.46	0.37	0.35	0.48
Bismuth (Bi) (mg/kg)	0.35	0.84	0.46	0.60	0.85
Boron (B) (mg/kg)	<10	<10	<10	<10	<10
Cadmium (Cd) (mg/kg)	0.372	0.441	0.417	0.427	0.783
Calcium (Ca) (mg/kg)	4020	3860	3980	3880	4610
Chromium (Cr) (mg/kg)	19.7	21.3	19.0	19.7	25.7
Cobalt (Co) (mg/kg)	12.1	14.1	12.0	12.8	21.8
Copper (Cu) (mg/kg)	18.5	26.1	19.5	22.2	35.8
Iron (Fe) (mg/kg)	24000	27700	23400	26200	38000
Lead (Pb) (mg/kg)	16.6	27.4	17.6	32.2	61.2
Lithium (Li) (mg/kg)	16.7	17.0	16.0	14.3	18.2
Magnesium (Mg) (mg/kg)	3490	3530	3450	3440	4360
Manganese (Mn) (mg/kg)	773	1010	726	1080	2380
Mercury (Hg) (mg/kg)	0.0742	0.0663	0.0662	0.0635	0.0822
Molybdenum (Mo) (mg/kg)	0.77	1.05	0.76	0.80	1.09
Nickel (Ni) (mg/kg)	27.4	29.1	27.5	27.1	42.7
Phosphorus (P) (mg/kg)	671	668	666	701	688
Potassium (K) (mg/kg)	1050	1260	970	900	1280
Selenium (Se) (mg/kg)	0.32	0.36	0.36	0.33	0.55
Silver (Ag) (mg/kg)	0.153	0.234	0.303	0.199	0.361
Sodium (Na) (mg/kg)	100	110	<100	<100	<100
Strontium (Sr) (mg/kg)	32.0	30.8	31.9	30.7	39.0
Thallium (Tl) (mg/kg)	0.152	0.156	0.150	0.114	0.166
Tin (Sn) (mg/kg)	0.60	0.89	0.59	0.69	1.11
Titanium (Ti) (mg/kg)	325	303	307	273	262
Uranium (U) (mg/kg)	1.22	1.67	1.30	1.36	2.02
Vanadium (V) (mg/kg)	29.6	27.8	28.4	26.9	29.2
Zinc (Zn) (mg/kg)	84.8	93.9	85.3	90.1	143

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1996642-21 Sediment 21-SEP-17 14:20 W29-C	L1996642-22 Sediment 21-SEP-17 DUP A	L1996642-23 Sediment 21-SEP-17 DUP B	L1996642-24 Sediment 21-SEP-17 DUP C	
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)	7.90	7.73	7.78	7.87	
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.416				
Metals	Aluminum (Al) (mg/kg)	8970	9420	9470	8450	
	Antimony (Sb) (mg/kg)	6.92	9.07	15.9	6.90	
	Arsenic (As) (mg/kg)	76.7	116	198	78.0	
	Barium (Ba) (mg/kg)	141	166	164	134	
	Beryllium (Be) (mg/kg)	0.31	0.38	0.44	0.31	
	Bismuth (Bi) (mg/kg)	0.49	0.69	1.09	0.47	
	Boron (B) (mg/kg)	<10	<10	<10	<10	
	Cadmium (Cd) (mg/kg)	0.418	0.489	0.722	0.414	
	Calcium (Ca) (mg/kg)	3750	4080	4270	3720	
	Chromium (Cr) (mg/kg)	19.9	20.3	23.0	18.8	
	Cobalt (Co) (mg/kg)	11.3	14.6	20.5	11.0	
	Copper (Cu) (mg/kg)	21.6	24.6	31.9	21.0	
	Iron (Fe) (mg/kg)	24600	28500	35800	24300	
	Lead (Pb) (mg/kg)	27.6	37.7	60.6	28.2	
	Lithium (Li) (mg/kg)	14.5	15.3	15.8	13.6	
	Magnesium (Mg) (mg/kg)	3540	3690	4090	3430	
	Manganese (Mn) (mg/kg)	719	1290	2210	693	
	Mercury (Hg) (mg/kg)	0.0608	0.0767	0.0730	0.0547	
	Molybdenum (Mo) (mg/kg)	0.69	0.81	0.97	0.66	
	Nickel (Ni) (mg/kg)	25.2	30.3	39.5	24.6	
	Phosphorus (P) (mg/kg)	629	699	641	656	
	Potassium (K) (mg/kg)	900	1030	1080	800	
	Selenium (Se) (mg/kg)	0.29	0.37	0.55	0.32	
	Silver (Ag) (mg/kg)	0.176	0.247	0.329	0.160	
	Sodium (Na) (mg/kg)	<100	<100	<100	<100	
	Strontium (Sr) (mg/kg)	30.1	33.5	34.7	28.9	
	Thallium (Tl) (mg/kg)	0.118	0.136	0.153	0.111	
	Tin (Sn) (mg/kg)	0.79	0.76	0.93	0.66	
	Titanium (Ti) (mg/kg)	294	287	216	237	
	Uranium (U) (mg/kg)	1.21	1.51	1.92	1.17	
	Vanadium (V) (mg/kg)	27.0	28.2	25.9	25.2	
	Zinc (Zn) (mg/kg)	86.0	102	132	85.8	

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217

A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.

C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2

Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)

C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2

The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.

HG-63UM-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 63 um (230 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

Deviation from Reference Method: This procedure deviates from the BC CSR SALM method, which specifies sieving to 2 mm (10 mesh).

IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO3 Equivalent	Calculation
MET-63UM-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 63 um (230 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modifed from EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

PH-1:2-VA	Soil	pH in Soil (1:2 Soil:Water Extraction)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

L1996642-COFC

ALS Environmental

Chain of C
Cana

www.alsglobal.com

COC # _____

Page 1 of 2

Report To				Report Format / Distribution				Service Requested (Rush for routine analysis subject to availability)
Company:	StrataGold Corporation			☑ Standard	☐ Other			◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Hugh Coyle			☑ PDF	☑ Excel	☑ Digital	☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	1000 - 1050 West Pender Street			Email 1:	hcoyle@vitgoldcorp.com			○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6E 3S7			Email 2:	bonniebums@northwestel.net			○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-696-6600	Fax:		Email 3:	swilbur@vitgoldcorp.com; and rmaciak@vitgoldco			Analysis Request
Invoice To	Same as Report ?	☑ Yes	☐ No	Client / Project Information				Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?		☐ Yes	☑ No	Job #:	Eagle Gold			
Company:				PO / AFE:				
Contact:				LSD:	Victoria Gold Corp.			
Address:								
Phone:		Fax:		Quote #:				
Lab Work Order # (lab use only):				ALS Contact:	Amber Springer	Sampler:	Bonnie Burns & Patrick Soprovich	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC	pH	Metals*	Particle Size Analysis									Number of Containers
	W23-A	19-Sep-17	16:45		X	X	X	X									2
	W23-B	19-Sep-17	16:45	Sediment	X	X	X	X									2
	W23-C	19-Sep-17	16:45		X	X	X	X									2
	W26-A	20-Sep-17	15:00		X	X	X	X									2
	W26-B	20-Sep-17	15:00		X	X	X	X									2
	W26-C	20-Sep-17	15:00		X	X	X	X									2
	W1-A	20-Sep-17	16:50		X	X	X	X									2
	W1-B	20-Sep-17	16:50		X	X	X	X									2
	W1-C	20-Sep-17	16:50		X	X	X	X									2
	W27-A	20-Sep-17	18:00		X	X	X	X									2
	W27-B	20-Sep-17	18:00		X	X	X	X									2
	W27-C	20-Sep-17	18:00		X	X	X	X									2
	W22-A	21-Sep-17	8:45		X	X	X	X									2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

* ANALYZE THE PORTION THAT PASSES A 63 MICRON SIEVE FOR METALS

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Bonnie Burns				Sept 22/17	10:40	6.0 °C		Sept. 23	1550	

9/8/7 C

L1996642-COFC

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 2 of 2

Report To				**Report Format / Distribution**				**Service Requested** (Rush for routine analysis subject to availability)
Company:	StrataGold Corporation			☑ Standard	☐ Other			◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Hugh Coyle			☑ PDF	☑ Excel	☑ Digital	☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	1000 - 1050 West Pender Street			Email 1:	hcoyle@vitgoldcorp.com			○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6E 3S7			Email 2:	bonnieburns@northwestel.net			○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-696-6600	Fax:		Email 3:	swilbur@vitgoldcorp.com; and rmaciak@vitgoldcc			**Analysis Request**
Invoice To	Same as Report ?	☑ Yes	☐ No	**Client / Project Information**				Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?		☐ Yes	☑ No	Job #:	Eagle Gold			
Company:				PO / AFE:				
Contact:				LSD:	Victoria Gold Corp.			
Address:								
Phone:		Fax:		Quote #:				

Lab Work Order # (lab use only)	[redacted]	ALS Contact:	Amber Springer	Sampler:	Bonnie Burns & Patrick Soprovich

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC	pH	Metals*	Particle Size Analysis								Number of Containers
[redacted]	W22-B	21-Sep-17	8:45		X	X	X	X								2
[redacted]	W22-C	21-Sep-17	8:45	Sediment	X	X	X	X								2
[redacted]	W4-A	21-Sep-17	11:45		X	X	X	X								2
[redacted]	W4-B	21-Sep-17	11:45		X	X	X	X								2
[redacted]	W4-C	21-Sep-17	11:45		X	X	X	X								2
[redacted]	W29-A	21-Sep-17	14:20		X	X	X	X								2
[redacted]	W29-B	21-Sep-17	14:20		X	X	X	X								2
[redacted]	W29-C	21-Sep-17	14:20		X	X	X	X								2
[redacted]	DUP-A						X									1
[redacted]	DUP-B						X									1
[redacted]	DUP-C						X									1
[redacted]																
[redacted]																

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

* ANALYIS THE PORTION THAT PASSES A 63 MICRON SIEVE FOR METALS

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Bonnie Burns			LADY	SEP 23	18:50	9/8/7°C				

GENF 20.00 Front

STRATAGOLD CORPORATION
ATTN: Hugh Coyle
Suite 1000 - 1050 W. Pender St
Vancouver BC V6E 3S7

Date Received: 25-SEP-17
Report Date: 11-OCT-17 11:53 (MT)
Version: FINAL

Client Phone: 604-682-5122

Certificate of Analysis

Lab Work Order #: L1996555

Project P.O. #:	NOT SUBMITTED
Job Reference:	EAGLE GOLD
C of C Numbers:	1 of 1
Legal Site Desc:	Victoria Gold Corp

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1996555-1	L1996555-2	L1996555-3	L1996555-4	L1996555-5
Description	Sediment	Sediment	Sediment	Sediment	Sediment
Sampled Date	22-SEP-17	22-SEP-17	22-SEP-17	22-SEP-17	22-SEP-17
Sampled Time	08:45	08:45	11:45	11:45	11:45
Client ID	W5-A	W5-B	W5-C	W6-A	W6-B
Grouping / **Analyte**					
SOIL					
Physical Tests pH (1:2 soil:water) (pH)	7.92	7.82	7.86	7.79	7.88
Particle Size % Gravel (>2mm) (%)	20.1	2.6	<1.0	7.4	9.8
% Sand (2.0mm - 0.063mm) (%)	55.0	41.4	41.9	88.0	85.8
% Silt (0.063mm - 4um) (%)	22.0	52.0	54.5	4.0	3.9
% Clay (<4um) (%)	2.9	3.9	3.4	<1.0	<1.0
Texture	Sandy loam	Silt loam	Silt loam	Sand	Sand
Organic / Inorganic Carbon Total Organic Carbon (%)	0.537	1.15	0.826	0.709	0.596
Metals Aluminum (Al) (mg/kg)	9610	8590	8110	10800	11500
Antimony (Sb) (mg/kg)	6.95	5.72	6.10	2.38	2.22
Arsenic (As) (mg/kg)	78.0	74.8	77.5	94.5	90.7
Barium (Ba) (mg/kg)	154	153	139	174	194
Beryllium (Be) (mg/kg)	0.35	0.32	0.31	0.38	0.38
Bismuth (Bi) (mg/kg)	0.48	0.45	0.47	0.40	0.23
Boron (B) (mg/kg)	<10	<10	<10	<10	<10
Cadmium (Cd) (mg/kg)	0.394	0.284	0.293	1.08	0.944
Calcium (Ca) (mg/kg)	4620	5190	4910	5610	6130
Chromium (Cr) (mg/kg)	23.2	19.5	19.6	20.8	21.3
Cobalt (Co) (mg/kg)	11.3	11.4	10.5	11.2	10.3
Copper (Cu) (mg/kg)	23.7	23.8	22.4	22.0	22.0
Iron (Fe) (mg/kg)	25800	25700	24900	22900	23800
Lead (Pb) (mg/kg)	25.7	23.4	23.9	15.6	15.5
Lithium (Li) (mg/kg)	15.1	13.5	13.0	17.1	17.9
Magnesium (Mg) (mg/kg)	4370	4550	4220	4360	4530
Manganese (Mn) (mg/kg)	804	727	615	1020	854
Mercury (Hg) (mg/kg)	0.0500	0.0487	0.0468	0.0341	0.0449
Molybdenum (Mo) (mg/kg)	0.70	0.64	0.65	1.07	0.96
Nickel (Ni) (mg/kg)	29.4	26.0	25.2	28.7	27.6
Phosphorus (P) (mg/kg)	793	864	872	772	825
Potassium (K) (mg/kg)	1060	920	900	850	910
Selenium (Se) (mg/kg)	0.27	0.29	0.25	0.67	0.85
Silver (Ag) (mg/kg)	0.173	0.176	0.176	0.131	0.135
Sodium (Na) (mg/kg)	110	110	110	160	170
Strontium (Sr) (mg/kg)	34.8	34.0	32.9	33.6	37.8
Thallium (Tl) (mg/kg)	0.119	0.099	0.094	0.117	0.131
Tin (Sn) (mg/kg)	0.82	0.44	0.41	0.57	0.59
Titanium (Ti) (mg/kg)	320	303	286	266	321
Uranium (U) (mg/kg)	1.19	1.30	1.13	1.04	0.973

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1996555-6				
	Description	Sediment				
	Sampled Date	22-SEP-17				
	Sampled Time	14:20				
	Client ID	W6-C				
Grouping	**Analyte**					
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)	7.65				
Particle Size	% Gravel (>2mm) (%)	1.3				
	% Sand (2.0mm - 0.063mm) (%)	72.7				
	% Silt (0.063mm - 4um) (%)	23.8				
	% Clay (<4um) (%)	2.2				
	Texture	Loamy sand				
Organic / Inorganic Carbon	Total Organic Carbon (%)	1.46				
Metals	Aluminum (Al) (mg/kg)	11500				
	Antimony (Sb) (mg/kg)	2.30				
	Arsenic (As) (mg/kg)	72.1				
	Barium (Ba) (mg/kg)	196				
	Beryllium (Be) (mg/kg)	0.38				
	Bismuth (Bi) (mg/kg)	0.22				
	Boron (B) (mg/kg)	<10				
	Cadmium (Cd) (mg/kg)	0.793				
	Calcium (Ca) (mg/kg)	5710				
	Chromium (Cr) (mg/kg)	21.4				
	Cobalt (Co) (mg/kg)	10.8				
	Copper (Cu) (mg/kg)	22.0				
	Iron (Fe) (mg/kg)	21300				
	Lead (Pb) (mg/kg)	15.1				
	Lithium (Li) (mg/kg)	17.6				
	Magnesium (Mg) (mg/kg)	4540				
	Manganese (Mn) (mg/kg)	991				
	Mercury (Hg) (mg/kg)	0.0365				
	Molybdenum (Mo) (mg/kg)	0.86				
	Nickel (Ni) (mg/kg)	26.1				
	Phosphorus (P) (mg/kg)	817				
	Potassium (K) (mg/kg)	880				
	Selenium (Se) (mg/kg)	0.70				
	Silver (Ag) (mg/kg)	0.143				
	Sodium (Na) (mg/kg)	170				
	Strontium (Sr) (mg/kg)	36.8				
	Thallium (Tl) (mg/kg)	0.132				
	Tin (Sn) (mg/kg)	0.40				
	Titanium (Ti) (mg/kg)	348				
	Uranium (U) (mg/kg)	1.14				

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1996555-1	L1996555-2	L1996555-3	L1996555-4	L1996555-5
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	22-SEP-17	22-SEP-17	22-SEP-17	22-SEP-17	22-SEP-17
	Sampled Time	08:45	08:45	11:45	11:45	11:45
	Client ID	W5-A	W5-B	W5-C	W6-A	W6-B
Grouping	**Analyte**					
SOIL						
Metals	Vanadium (V) (mg/kg)	27.9	26.5	25.5	28.9	31.6
	Zinc (Zn) (mg/kg)	88.8	74.8	76.4	103	105

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1996555-6				
	Description	Sediment				
	Sampled Date	22-SEP-17				
	Sampled Time	14:20				
	Client ID	W6-C				
Grouping	**Analyte**					
SOIL						
Metals	Vanadium (V) (mg/kg)	32.1				
	Zinc (Zn) (mg/kg)	100				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217

A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.

C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2

Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)

C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2

The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.

HG-63UM-CVAF-VA	Soil	Hg in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 63 um (230 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

Deviation from Reference Method: This procedure deviates from the BC CSR SALM method, which specifies sieving to 2 mm (10 mesh).

IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO3 Equivalent	Calculation
MET-63UM-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 63 um (230 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modifed from EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

PH-1:2-VA	Soil	pH in Soil (1:2 Soil:Water Extraction)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

PSA-PIPET+GRAVEL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Ana
Canada Toll Free:
www.alsgl

L1996555-COFC

)C #

Page 1 of 1

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	StrataGold Corporation	☑ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Hugh Coyle	☑ PDF ☑ Excel ☑ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	1000 - 1050 West Pender Street	Email 1: hcoyle@vitgoldcorp.com	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6E 3S7	Email 2: bonnieburns@northwestel.net	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-696-6600 Fax:	Email 3: swilbur@vitgoldcorp.com; and rmaciak@vitgold	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**	Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: Eagle Gold	
Company:		PO / AFE:	
Contact:		LSD: Victoria Gold Corp.	
Address:			
Phone:	Fax:	Quote #:	
Lab Work Order # (lab use only)		**ALS Contact:** Amber Springer **Sampler:** Bonnie Burns & Patrick Soprovich	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC	pH	Metals*	Particle Size Analysis								Number of Containers
	W5-A	22-Sep-17	8:45	Sediment	X	X	X	X								2
	W5-B	22-Sep-17	8:45	Sediment	X	X	X	X								2
	W5-C	22-Sep-17	11:45	Sediment	X	X	X	X								2
	W6-A	22-Sep-17	11:45	Sediment	X	X	X	X								2
	W6-B	22-Sep-17	11:45	Sediment	X	X	X	X								2
	W6-C	22-Sep-17	14:20	Sediment	X	X	X	X								2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

* ANALYIS THE PORTION THAT PASSES A 63 MICRON SIEVE FOR METALS

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Bonnie Burns	Sept 25/17			Sept 25/17	09:49	8 °C				

GENF 20.00 Front

APPENDIX K

Benthic Invertebrate Monitoring at the Eagle Gold Project Site, 2017

THIS PAGE INTENTIONALLY LEFT BLANK

BENTHIC INVERTEBRATE MONITORING

AT

THE EAGLE GOLD PROJECT SITE, 2017

For

Victoria GOLD CORP

Submitted by

Laberge Environmental Services

March 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The 2017 annual benthic invertebrate monitoring program represents the first survey completed during the construction phase of the Eagle Gold Project. Nine sites were investigated within four drainages. The 2017 data indicates healthy robust benthos communities at all sites with good representation of pollution sensitive species.

Water quality and stream sediment programs were also undertaken during the benthic invertebrate assessment and details on those results have been submitted previously; the results of these programs were examined to support characterization of the existing habitat conditions. Arsenic concentrations were high in the water column and in the stream sediments at all monitoring sites and exceeded the recommended federal guidelines for the protection of aquatic life for both media types. The two major uptake vectors of contaminants are through the ingestion of metal enriched sediments or suspended particles and/or uptake from solution. Although concentrations of arsenic were high, it is likely that it is not in a bioavailable form. The presence of pollution-sensitive insects, as reflected in the high numbers of Ephemeroptera, Plecoptera, Trichoptera (EPT) at all of the sites, would support this conclusion.

1.0 INTRODUCTION

Various monitoring tasks are to be undertaken at the Eagle Gold Project during all phases of the site, including construction, operation and closure as outlined in the Environmental Monitoring, Surveillance and Adaptive Management Plan (EMSAMP) version 2017-01 (StrataGold Corporation, 2017). The construction phase began in August 2017 and the first annual benthic invertebrate monitoring program was conducted in September 2017.

Monthly water quality samples are collected under the EMSAMP, with nine of these locations generally coinciding with the benthic invertebrate sites. Water quality samples were also collected at these sites during the benthic invertebrate survey to characterize the existing aquatic conditions.

The surveys included four drainage areas within the Eagle Gold footprint and the sites are detailed below in Table 1 and illustrated on Figure 1.

TABLE 1 LOCATION OF SAMPLE SITES

Drainage	Site	Date Sampled	Site Description	Coordinates	
				Northing	Easting
Haggart Creek	W22	9/21/2017	Haggart Creek upstream Dublin Gulch	7101377	458319
	W4	9/21/2017	Haggart Creek downstream Dublin Gulch	7101223	458144
	W29	9/21/2017	Haggart Creek downstream Eagle Creek	7099583	458225
	W5	9/22/2017	Haggart Creek upstream Lynx Creek	7095887	457815
	W23	9/19/2017	Haggart Creek downstream Lynx Creek	7095682	457790
Dublin Gulch	W1	9/20/2017	Dublin Gulch upstream Stewart Gulch	7101545	460249
	W26	9/20/2017	Stewart Gulch upstream Dublin Gulch	7101443	460331
Eagle Cr	W27	9/20/2017	Eagle Creek near Camp Climate Station	7100997	458235
Lynx Cr	W6	9/22/2017	Lynx Creek upstream Haggart Creek	7095964	458099

2.0 METHODS

2.1 Water Quality

Water quality samples were collected at each benthic invertebrate site in a fast-flowing section of the stream, prior to any other sampling activity. In-situ water quality measurements were obtained using a YSI multi-probe.

Samples were collected in bottles supplied by Analytical Laboratory Services (ALS) from their Whitehorse, Yukon depot. At each site, samples were collected in a one litre plastic bottle for general physical parameters. Samples to be analyzed for nitrite and nitrate were collected in 120 mL plastic bottles. The same type of bottle was used for the ammonia samples but they were preserved with sulfuric acid (H_2SO_4). Samples to be analyzed for metals were collected in 50 mL falcon tubes. The dissolved metals samples were filtered in the field using disposable sterile syringes and in-line filters (filter pore size 0.45 microns), then both dissolved and total metals samples were preserved with nitric acid (HNO_3).

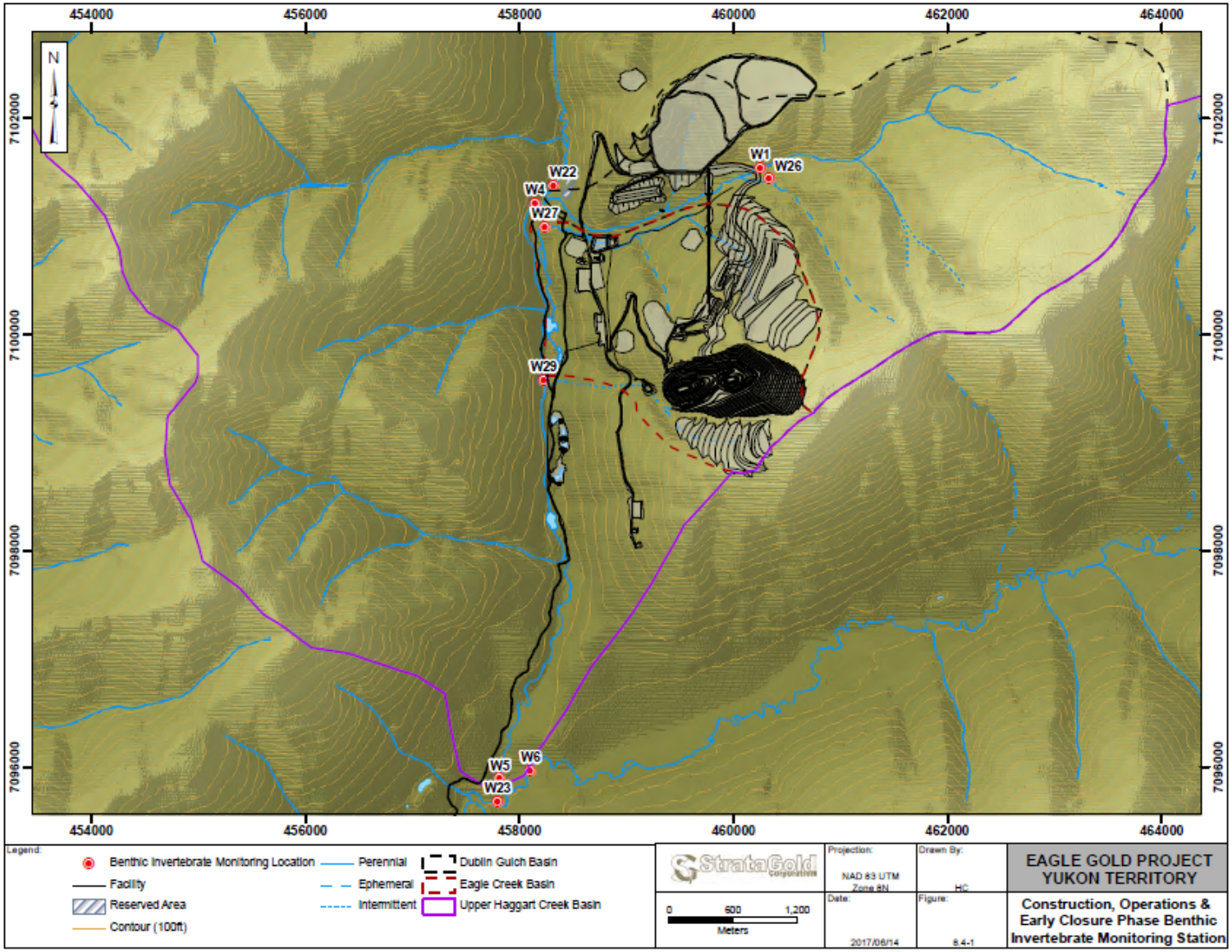


Figure 1 Locations of Benthic Invertebrate Sampling Sites for the Construction Phase

Mercury samples were collected in 40 mL glass vials with the same filtering procedure for dissolved mercury as for dissolved metals. Samples were kept cool prior to delivery to the ALS depot. The methods used by ALS are based on the B.C. Ministry of Environment & Climate Change Strategy (BC-MOE) and American Public Health Association (APHA) standard methods and are included in the analytical reports in Appendix A.

2.2 Benthic Invertebrates

Triplicate samples were collected from the nine sites using a Surber sampler (area = 0.0920m^2) with a mesh size of 300 microns. The sampler was positioned securely at a random location on the stream bottom, parallel to the water flow. The bed material within the frame was cleaned and washed by hand with the fast-flowing current carrying the disturbed bottom fauna and detritus into the collection bag. The remaining sediment was stirred to a 10 cm depth to dislodge invertebrates. The level of effort for each sample and at each site was comparable. Riffle areas were targeted at each site as this habitat supports the greatest density and diversity of invertebrates (Epele et al, 2012). The triplicate samples were collected approximately 5m to 15m apart, as the site-specific geomorphology allowed, starting downstream and moving upstream to minimize substrate disruption and avoid potential contamination.

The captured invertebrates and detritus were transferred from the collection bags to one litre nalgene bottles and preserved with 10% buffered formalin. Samples were shipped by ground transport to an entomologist for sorting, identification and enumeration.

Analysis of the benthic invertebrate samples was conducted by Cordillera Consulting in Summerland, BC. Once the samples were received at the laboratory they were assigned a Cordillera Consulting code (CC#) and entered into a database. Samples were sorted and evaluated for total numbers. If the numbers were estimated to be greater than 600 the sample was subsampled to achieve a minimum number of 300 organisms. Organisms were identifed to genus or species level for all insects and if possible to that level for non-insect specimens. For full details on the methodology used, Cordillera Consulting's method and QC report is provided in Appendix B.

2.2.1 Quality Assurance / Quality Control (QA/QC)

Quality assurance and quality control (QA/QC) procedures for the field component consisted of; ensuring all personnel were adequately trained, sampling methods per site and between sites were consistent, samples were correctly collected, labeled and preserved, equipment was properly maintained, detailed field notes were kept, chain-of-custody forms were used, and safe shipping and storage methods were followed.

As a measure of QA/QC for the laboratory component, refer to Cordillera Consulting's report in Appendix B.

2.2.2 Data Analysis

The data was subjected to several metrics and indices to describe the benthic populations. Abundance was determined by summing all of the individuals present in the sample. As the area of substrate sampled was known, the abundance per site was calculated as density (organisms/m^3) to allow comparisons with previous surveys.

Taxonomic richness is a simple measure of diversity where each type of invertebrate is counted per site. Diversity can be further defined using many different indices and the Simpson's Index of Diversity was used on this dataset using the equation:

$$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$$

Where n = number of individual of each species and N = total number of individuals of all species.

The Simpson's Diversity Index is a measure of diversity which takes into account the number of species present, as well as the relative abundance of each species, and was chosen to allow comparisons to previous surveys.

Biotic indices are often used to ascertain the general water quality at a particular site. The Hilsenhoff Biotic Index (HBI) is based on a formula using pre-assigned pollution tolerance scores for families. The following equation was used where n equals the number of individuals in taxa i, a is the preassigned pollution tolerance value assigned to taxa i, and N is the total number of individuals in the sample.

$$HBI = \frac{\sum n_i \times a_i}{N}$$

3.0 RESULTS

All data in the tables and figures have been grouped into drainage and arranged from upstream sites to downstream sites per drainage.

3.1 Water Quality

In-situ data were collected at each site and are presented below in Table 2. Water temperatures were generally cool and reflected late summer/early autumn conditions, ranging from 1.1^{o}C to 5.5^{o}C.

All sites were well aerated with the dissolved oxygen content ranging from 79.3% at W22 to 90.5% at W5.

All sites were slightly alkaline with pH ranging from 7.73 at W1 to 8.14 at W27. ORP is a measure of the sampled water's ability to reduce or oxidize other substances. The higher the ORP the greater the number of oxidizing agents present. ORP was low at W22 with a value of 43.7 mV. ORP was relatively more consistent throughout the rest of the study area ranging from 102.3 mV to 189.6 mV.

Water quality samples were also collected from the benthic invertebrate sites as a component of the regular monthly monitoring program. The water quality data for the benthic sites has been tabulated in Table A-1 in Appendix A. The water was clear throughout the study area during the time of sampling with total suspended solids concentrations ranging from below detection (3.0 mg/L) to 5.0 mg/L. Total and dissolved metals results were thus very similar. With the exception of arsenic, all metal concentrations were very low and met their respective guidelines. Concentrations of arsenic exceeded the Canadian Council Ministers of Environment (CCME) guideline of 0.005 mg/L for the protection of freshwater quality at all of the sites except at W22. Concentrations at the other sites ranged from 0.0052 mg/L at W23 to 0.0416 mg/L at W1.

TABLE 2 IN-SITU CONDITIONS AT THE TIME OF SAMPLING, SEPTEMBER 2017

Drainage	Site #	Date 2017	Time	Temp °C	Conductivity (µS/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	ORP
Haggart Creek	W22	21-Sep	8:45	1.1	270	79.3	11.2	8.04	43.7
	W4	21-Sep	11:15	1.6	262	84.9	11.9	7.76	102.3
	W29	21-Sep	14:20	3.0	281	89.1	12.0	7.87	159.3
	W5	22-Sep	14:00	2.9	280	90.5	12.2	7.84	189.6
	W23	19-Sep	16:30	3.7	293	83.5	11.0	7.75	187.5
Dublin Gulch	W1	20-Sep	16:10	3.1	194	85.8	11.5	7.73	180.5
	W26	20-Sep	14:30	1.2	264	83.8	11.8	7.97	185.1
Eagle Creek	W27	20-Sep	18:15	5.5	342	90.1	11.4	8.14	182.6
Lynx Creek	W6	22-Sep	15:00	2.6	278	89.3	12.2	7.78	172.7

The complete reporting of the September 2017 monthly water quality program (including the data for the benthic sites and QA/QC) has previously been reported (StrataGold Corporation, 2017a) and will not be duplicated or discussed here.

3.2 Benthic Invertebrates

Four phyla were found in the study area: Arthropoda, Annelida, Nematoda, and Platyhelminthes. Of these, taxonomists do not consider Nematoda and Platyhelminthes to be benthic organisms. In addition, crustaceans and springtails (order Collembola) within the phylum Arthropoda were not considered as benthos, however the presence of these four groups has been noted where encountered in each sample. The numbers for these taxa reported in Appendix B reflect presence, not total numbers of individuals in the sample.

To be consistent with the scientific community studying benthic invertebrates, Nematodes, Playthelminthes, crustaceans and springtails were not included in the calculations for abundance, diversity and taxonomic richness. Of the organisms that were enumerated, a total of 13,612 invertebrates, representing 106 different taxonomic groups were identified. The following sections pertain to these taxa.

3.2.1 Abundance and Taxonomic Richness

The total number of organisms for the triplicates from each site was summed to give a total abundance value for that site. Densities were calculated based on the total area sampled per site. Community size varied throughout the study area with densities ranging from 2,339 individuals/m^2 at W5, Haggart Creek upstream of Lynx Creek, to 11,704 individuals/m^2 at W6, Lynx Creek (Table 3).

Diversity was determined for each site by enumerating all the taxonomic groups identified from species to phylum. For biomonitoring purposes, total taxa richness is the index of choice (Reice and Wohlenberg, 1993). All communities were diverse, ranging from 36 different taxonomic groups at W26, Stewart Gulch, to 55 different taxonomic groups at W27, Eagle Creek.

The Simpson's Index of Diversity was determined for each sample (Appendix B) and the average per site is presented below in Table 3. This index takes into account the number of species present, as well as the relative abundance of each species, and ranges from 0 to 1. The results

mirrored the taxonomic richness data with the lowest diversity of 0.74 at W26 and the highest diversity of 0.91 at W27.

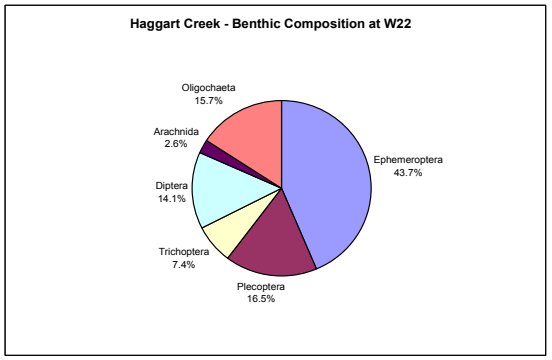
TABLE 3	GENERAL STATISTICS ON THE BENTHIC COMMUNITIES, 2017				
Drainage	**Site**	**Abundance (organisms /site)**	**Density (organisms/m^3)**	**Taxonomic Richness/site**	**Simpson's Index of Diversity/site**
Haggart Creek	W22	1202	4,313	51	0.88
	W4	1506	5,404	51	0.84
	W29	1001	3,592	51	0.86
	W5	652	2,339	43	0.89
	W23	1177	4,223	54	0.86
Dublin Gulch	W1	1970	7,069	48	0.88
	W26	1544	5,540	36	0.74
Eagle Creek	W27	1298	4,657	55	0.91
Lynx Creek	W6	3262	11,704	50	0.82

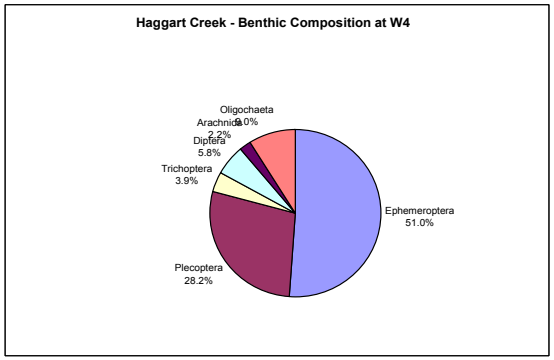
4.2.2 Distribution

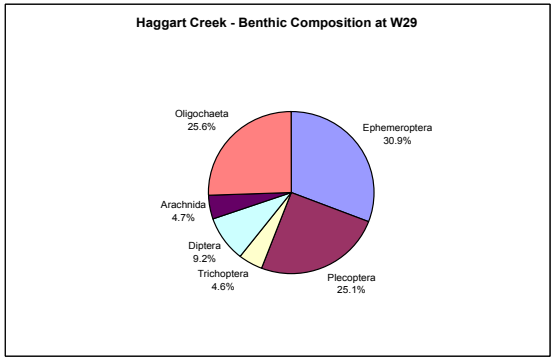
The composition of the benthos communities was calculated as a percentage of the major taxonomic orders present, with pie charts generated for each site (Figure 2). The grouping “Other” consists of invertebrates from Coleoptera and Lepidoptera.

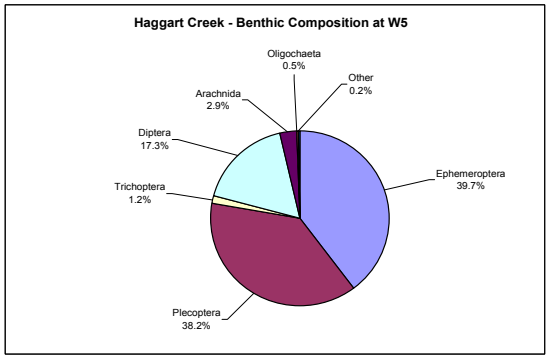
The Insect orders Ephemoptera (mayflies), Plecoptera (stoneflies) and Diptera (true flies) formed the bulk of each community. Significant numbers of Oligochaeta (aquatic earthworms) were also present at W22, W4, W23, W6, W1 and W26. The majority of Oligochaeta belonged to the Family Lumbriculidae.

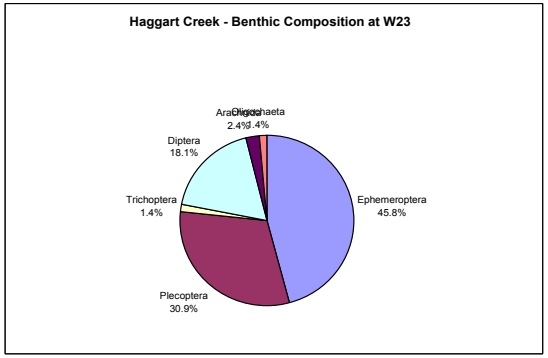
FIGURE 2 THE COMPOSITION OF THE BENTHIC INVERTEBRATE COMMUNITIES AT EACH SITE, 2017

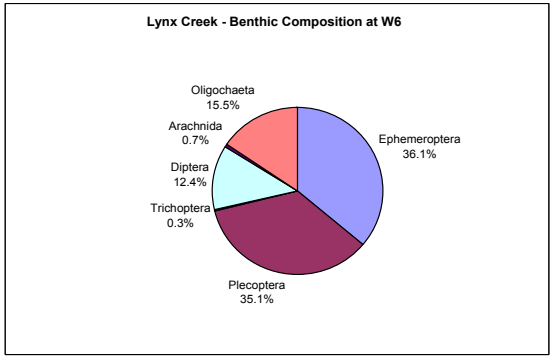


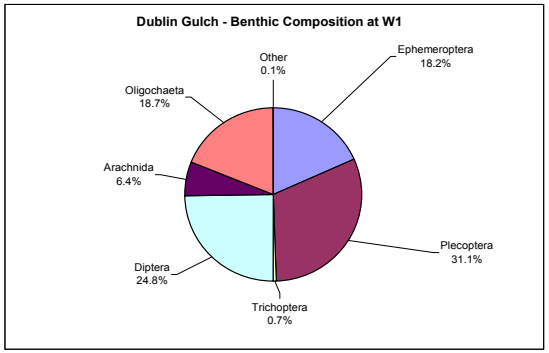


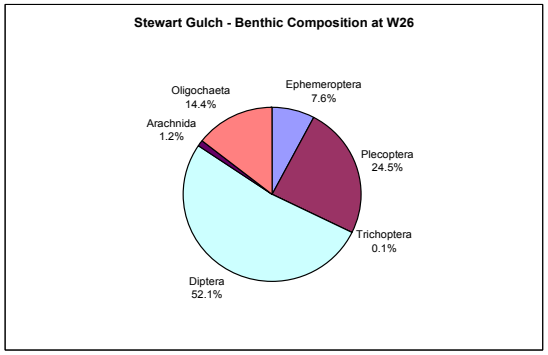


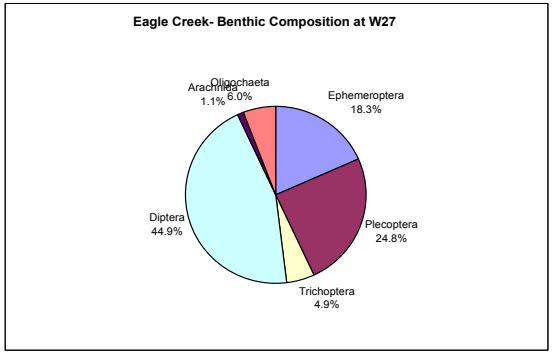












Many aquatic insects require good water quality to thrive. Larvae of mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera) require clear, clean, well oxygenated water and have very low tolerance to pollution (Rosenberg and Resh, 1993). Analyzing the combined EPT (Ephemeroptera, Plecoptera, Trichoptera) at a site, gives an indication of the overall health of the stream (Hauer and Lamberti, 2006, Resh and Jackson, 1993, DFO-Streamkeepers). Table 4 summarizes the number of EPT found per site, the proportion of EPT in the benthic invertebrate community and the number of EPT taxa (richness) in each community.

TABLE 4 EPT ABUNDANCE, PROPORTION & RICHNESS, 2017

Drainage	Site #	Site Description	EPT Abundance	EPT %	EPT Richness
Haggart Creek	W22	Upstream Dublin Gulch	812	67.6	23
	W4	Downstream Dublin Gulch	1251	83.1	23
	W29	Downstream Eagle Creek	606	60.5	23
	W5	Upstream Lynx Creek	516	79.1	19
	W23	Downstream Lynx Creek	919	78.1	26
Dublin Gulch	W1	Upstream Stewart Gulch	985	50.0	23
	W26	Stewart Gulch	499	32.2	12
Eagle Creek	W27	Eagle Creek	622	47.8	23
Lynx Creek	W6	Upstream Haggart Creek	2331	71.5	23

Overall, all communities in the study area had good representation of pollution sensitive invertebrates. The highest abundance of EPT occurred at W6, Lynx Creek, with 2.331 individuals present. The highest proportion of EPT was documented at W4, forming 83.1% of the community. The community at W23 had the greatest EPT richness with 26 different taxa identified. The population at W26, Stewart Gulch had the lowest abundance, richness and proportion of EPT.

The Pacific Stream Keepers Federation has indicated that streams with an EPT richness greater than 8 are of good quality (DFO). Based on this water quality assessment protocol, all sites in the Eagle Gold Project study area are of good quality.

Another method to determine the health of a stream is to calculate the Hilsenholf Biotic Index (HBI) (Hauer and Lamberti, 2006). Due to differences in their tolerance to pollution, the presence or absence of certain invertebrate families can provide valuable information on stream water quality. The HBI ranges from 0 to 10, where lower numbers indicate the presence of pollution sensitive organisms and the higher numbers represent a greater presence of pollution tolerant families. Therefore, sites with excellent water quality would contain benthic communities with a high number of pollution sensitive families. This index was calculated for each sample (Appendix B) and averaged for each site. Table 5 gives the listing of the categories for the condition of the water and Table 6 summarizes the mean data for the study area.

Stewart Gulch, W26, was the only site that had a poor quality category. This is likely due to the habitat characteristics at this site: narrow, shallow, shaded stream (see Photos in Appendix B). The other sites rated good to excellent.

TABLE 5 WATER QUALITY CATEGORIES BASED ON HBI

Hilsenhoff Biotic Index	Water Quality Category
0.00 - 3.75	Excellent
3.76 - 4.25	Very Good
4.26 - 5.00	Good
5.01 - 5.75	Fair
5.76 - 6.50	Fairly Poor
6.51 - 7.25	Poor
7.26 - 10.00	Very Poor

TABLE 6 WATER QUALITY BASED ON HBI FOR THE EAGLE GOLD PROJECT

Drainage	Site	Hilsenhoff Biotic Index	Water Quality Category
Haggart Creek	W22	4.07	Very good
	W4	3.34	Excellent
	W29	4.28	Good
	W5	3.71	Excellent
	W23	2.53	Excellent
Dublin Gulch	W1	3.66	Excellent
	W26	5.88	Fairly Poor
Eagle Creek	W27	4.14	Very good
Lynx Creek	W6	3.33	Excellent

4.3.3 Comparisons with Past Data

Benthic invertebrate monitoring was conducted in the Eagle Gold Project area in 1995, 2007, 2009 and 2010. These studies have been summarized in a report prepared by Stantec (2011). Data from these surveys have been compared to the data collected in 2017 for the sites that overlap. W1 and W5 are the only sites where benthic invertebrates have been collected during each period.

Two parameters were chosen to detect any changes or trends over time; abundance as density, and diversity using the Simpson's Index (Table 7).

The highest densities were documented in the Dublin Gulch watershed in 1995 and have not been duplicated since. There has been some fluctuation in numbers at some of the sites between years. Many variables come into play regarding population numbers including climate (flooding, drought, rainfall events, unusually high or low temperatures), time of year sampled, sampling methods, wildfires in the area or upstream, disturbance to riparian zones, etc.

Generally, it appears that all sites have been diverse over time. The highest diversities generally occurred in 2017.

Although not the same number of sites nor the same frequency of sampling is available per drainage, averages have been performed to give an overall idea of possible differences between watersheds. These indicate that although Haggart Creek had the lowest densities the communities were the most diverse. The benthic communities in Dublin Gulch had the greatest populations but were not as diverse. Eagle Creek had the lowest diversity and a slightly higher density than Haggart Creek. High densities were also documented in Lynx Creek with diverse communities. Overall, the limited data suggests stable benthic communities at the sites sampled.

TABLE 7		DENSITY AND DIVERSITY IN STREAMS OVER THE STUDY PERIOD								
Drainage		**Haggart Creek**					**Dublin Gulch**		**Eagle Creek**	**Lynx Creek**
Site		**W22**	**W4**	**W29**	**W5**	**W23**	**W1**	**W26**	**W27**	**W6**
Site Description		Upstream Dublin Gulch	Downstream Dublin Gulch	Downstream Eagle Creek	Upstream Lynx Creek	Downstream Lynx Creek	Upstream Stewart Gulch	Stewart Gulch	Eagle Creek	Upstream Haggart Creek
Density (organisms/m^3)	**1995**		2,700		2,200		20,000	19,000		9,100
	2007	2,100	2,100		1,700	2,400	4,800			3,700
	2009	3,138		3,171	5,518		8,087	4,461	5,374	
	2010	1,832		1,888	968	2,219	3,916		1,890	
	2017	4,313	5,404	3,592	2,339	4,223	7,069	5,540	4,657	11,704
Average/Drainage		2,878					9,109		3,974	8,168
Diveristy (Simpson's Index)	**1995**		0.85		0.76		0.71	0.35		0.83
	2007	0.81	0.85		0.85	0.84	0.81			0.68
	2009	0.85		0.74	0.78		0.83	0.76	0.70	
	2010	0.71		0.57	0.86	0.87	0.73		0.51	
	2017	0.88	0.84	0.86	0.89	0.86	0.88	0.74	0.91	0.82
Average/Drainage		0.82					0.73		0.71	0.78

4.0 DISCUSSION

The benthic invertebrate data indicates healthy robust populations at each of the sites sampled, with good representation of EPT throughout. When examined against previous surveys (Stantec, 2011) the 2017 habitat conditions have not changed significantly and appear to support healthy benthic populations at all sites.

In contrast to the benthic invertebrate data, water quality and sediment data are not necessarily reflective of a healthy aquatic environment. Stream sediment samples were collected during the benthic survey and the findings have been submitted under separate cover (Laberge, 2017). The high concentrations of arsenic found in the water column and in the stream sediments were well above the guidelines for the protection of freshwater aquatic life. The CCME guideline of 0.005 mg/L for arsenic in water was exceeded at all of the sites with the exception of W22. The concentrations of arsenic in the stream sediments exceeded the Probable Effects Level (PEL) of 17 mg/kg at all sites, and at some locations significantly. The arsenic levels have been tabulated and depicted graphically below (Table 8 and Figures 3 and 4). The sites have been arranged in the table and on the X-axes of the graphs to depict site locations from upstream to downstream throughout the study area.

TABLE 8 ARSENIC CONCENTRATIONS IN DIFFERENT MEDIA		
Site #	**Arsenic in Sediment (mg/kg)**	**Arsenic in Water (ml/L)**
W22	55.5	0.00070
W26	209.0	0.0232
W1	458.0	0.0416
W4	109.6	0.00630
W27	200.3	0.0302
W29	127.2	0.00653
W5	76.8	0.00678
W6	85.8	0.00620
W23	88.8	0.00522

Figure 3 Arsenic Concentrations in Sediment

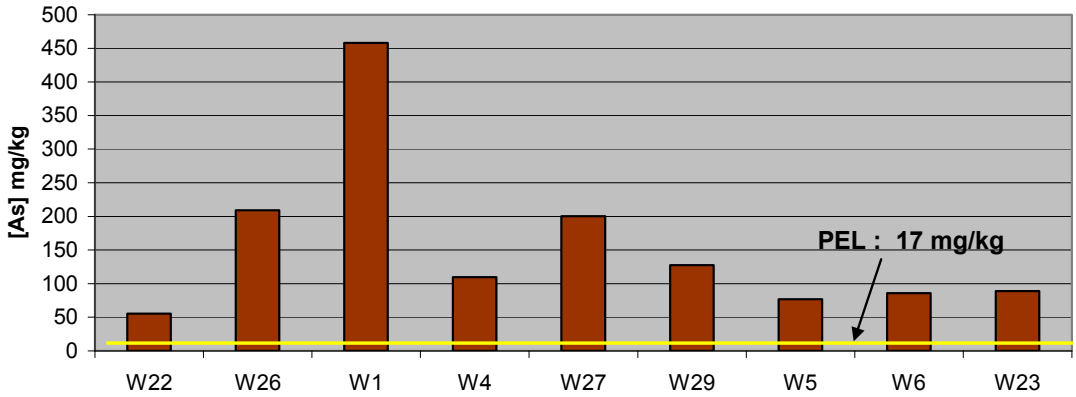
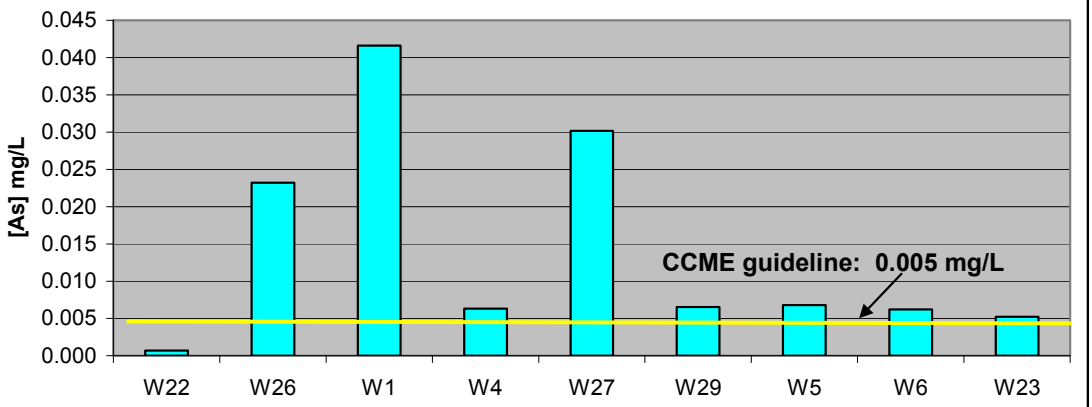


Figure 4 Arsenic Concentrations in Water



The highest concentrations of arsenic in both forms of media were reported at W1, Dublin upstream of all Project activities. Levels were generally lower throughout the Haggart watershed, but likely are influenced by Dublin Gulch. Concentrations in the water and stream sediments were quite high in Stewart Gulch (W26) and Eagle Creek (W27). Lynx Creek, W6, has similar concentrations to W5 and W23.

The metalloid arsenic is ubiquitous in the aquatic environment as a result of natural processes (mineral rock weathering, volcanic emissions and biological activities) (Irving et al, 2007). It undergoes multiple electron transfer reactions and forms a variety of inorganic and organic compounds of different toxicity to aquatic organisms (Moore and Ramamoorthy, 1984). The toxicity of arsenic is dependent on speciation. Arsenite (AsO_3^{-3}) forms are much more toxic to biological species. Metallo-organic forms of arsenic also may be much more bioavailable than inorganic forms; however, organic-bound arsenic is excreted by most species and does not appear to be highly toxic (Luoma, 1983). The two major uptake vectors are through the ingestion of metal enriched sediments or suspended particles and/or uptake from solution.

The abundant presence of pollution sensitive organisms at each of the sites suggests that the arsenic concentrations found in the water column and in the stream sediments are not in a bioavailable form. Without conducting costly speciation analysis, it is unknown what the prevalent form of arsenic is in the Project area.

It is concluded that the benthos populations documented in 2017 are healthy, stable and had good representation of the major groups of organisms that are typically present in lotic waters.

5.0 REFERENCES

Canadian Council of Minister of the Environment. 1999. Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg, Canada.

DFO (Department of Fisheries and Oceans). Stream Keepers Module 4 Stream Invertebrate Survey. Stewardship Series. British Columbia.

Epele LB, Miserendino ML, Brand C. 2012. Does nature and persistence of substrate at a mesohabitat scale matter for Chironomidae assemblages? A study of two perennial mountain streams in Patagonia, Argentina. *Journal of Insect Science* 12:68 available online: insectscience.org/12.68

Hauer, R.F. and G.A. Lamberti, Editors. 2006. Methods in Stream Ecology, Second Edition. Academic Press. New York.

Irving, E.C., R.B. Lowell, J.M. Culp, K.Liber, Q. Xie and R. Kerrich. 2008. Effects of Arsenic Speciation and Low Dissolved Oxygen Condition on the Toxicity of Arsenic to a Lotic Mayfly. Environmental Toxicology and Chemistry, Vol. 27, No. 3, pp. 583-590.

Laberge Environmental Services. 2017. Stream Sediment Monitoring at the Eagle Gold Project, 2017. Submitted to Victoria Gold Corporation.

Luoma, Samuel N. 1983. Bioavailability of Trace Metals to Aquatic Organisms - A Review. The Science of the total Environment, 28 (1983) 1-22.

Moore, James W. and S. Ramamoorthy. 1984. Heavy Metals in Natural Waters and Applied Monitoring and Impact Assessment. Springer – Verlag. ISBN 13:978-1-4612-9739-0.

Reice, S.R. and M. Wohlenberg. 1993. Monitoring Freshwater Benthic Macroinvertebrates and Benthic Processes: Measures for Assessment of Ecosystem Health. p. 287-305.

Resh, V.V. and J.K. Jackson. 1993. Rapid Assessment Approaches to Biomonitoring Using Benthic Macroinvertebrates. p. 195-233. Chapman & Hall Inc, New York.

Rosenberg, David M. and Vincent H. Resh. 1993. Freshwater biomonitoring and benthic macroinvertebrates. Chapman & Hall Inc. New York.

Stantec Consulting Ltd. 2011. Baseline Environmental Report: Water Quality and Aquatic Biota. Prepared for Victoria Gold Corp. Project # 1231-10377.

StrataGold Corporation. 2017. Eagle Gold Project Environmental Monitoring, Surveillance and Adaptive Management Plan. Version 2017-01.

StrataGold Corporation. 2017a. Eagle Gold Project Type A Water Use Licence QZ14-041 Monthly Report – September. Available at https://apps.gov.yk.ca/waterline/.

APPENDIX A

- **Table A-1 Water Quality and CCME Guidelines**
- **Analytical Report: L1995822**
- **Analytical Report: L1996554**

TABLE A - 1 WATER QUALITY ANALYTICAL DATA WITH CCME GUIDELINES, APPENDIX A

		Haggart Creek					Dublin Gulch		Eagle Creek	Lynx Cr	CCME Guidelines for the protection of freshwater aquatic life*
Client Sample ID		W22	W4	W29	W5	W23	W1	W26	W27	W6	
Date Sampled		21-Sep-2017	21-Sep-2017	21-Sep-2017	22-Sep-2017	19-Sep-2017	20-Sep-2017	20-Sep-2017	20-Sep-2017	22-Sep-2017	
Time Sampled		8:45	11:15	14:20	14:00	10:00	15:43	14:16	17:30	15:00	
Physical Tests (Water)											
Conductivity	uS/cm	278	265	276	302	287	111	277	357	295	
Hardness (as CaCO3)	mg/L	140	133	141	155	148	50.1	147	196	155	
Total Suspended Solids	mg/L	<3.0	4.4	5.0	<3.0	<3.0	3.3	<3.0	3.5	<3.0	
Total Metals (Water)											
Aluminum (Al)-Total	mg/L	0.0181	0.0564	0.0416	0.0834	0.0199	0.0823	0.0156	0.0307	0.0454	
Antimony (Sb)-Total	mg/L	0.00026	0.00045	0.00058	0.00071	0.00051	0.00116	0.00105	0.00468	0.00043	
Arsenic (As)-Total	mg/L	0.00070	0.00630	0.00653	0.00678	0.00522	0.0416	0.0232	0.0302	0.00620	0.005
Barium (Ba)-Total	mg/L	0.0370	0.0280	0.0325	0.0378	0.0428	0.0486	0.0616	0.0708	0.0515	
Cadmium (Cd)-Total	mg/L	0.0000120	0.0000092	0.0000110	0.0000113	0.0000093	0.0000079	0.0000067	0.0000153	0.0000139	0.00009
Calcium (Ca)-Total	mg/L	36.5	34.2	36.6	39.4	43.6	14.9	32.0	39.2	48.7	
Chromium (Cr)-Total	mg/L	<0.00010	0.00013	0.00013	<0.00040	<0.00010	0.00021	<0.00010	0.00011	<0.00040	0.001
Cobalt (Co)-Total	mg/L	0.00013	0.00015	0.00013	0.00019	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Copper (Cu)-Total	mg/L	0.00059	0.00061	0.00072	0.00092	0.00081	<0.00050	0.00052	0.00103	0.00132	0.002
Iron (Fe)-Total	mg/L	0.082	0.133	0.127	0.217	0.063	0.103	<0.010	0.088	0.155	0.3
Lead (Pb)-Total	mg/L	<0.000050	0.000104	0.000135	0.000254	<0.000050	0.000198	<0.000050	0.000156	0.000060	0.001
Lithium (Li)-Total	mg/L	0.0046	0.0051	0.0051	0.0060	0.0036	0.0020	0.0044	0.0107	0.0013	
Magnesium (Mg)-Total	mg/L	12.6	11.8	12.7	14.4	10.8	3.37	16.1	22.9	8.24	
Manganese (Mn)-Total	mg/L	0.0368	0.0319	0.0379	0.0515	0.0251	0.00386	0.00013	0.00605	0.0164	
Molybdenum (Mo)-Total	mg/L	<0.00020	<0.00040	<0.00045	0.000310	0.000620	0.00230	0.00350	0.00122	0.000782	0.073
Nickel (Ni)-Total	mg/L	0.00103	0.00102	0.00103	0.00127	0.00084	<0.00050	<0.00050	0.00065	0.00109	0.025
Potassium (K)-Total	mg/L	0.85	0.85	0.94	1.02	1.05	0.78	1.06	2.01	1.13	
Selenium (Se)-Total	mg/L	0.000136	0.000152	0.000174	0.000148	0.000242	0.000102	0.000348	0.000321	0.000316	0.001
Silicon (Si)-Total	mg/L	3.81	4.04	4.04	4.17	3.96	5.97	4.82	5.54	4.09	
Sodium (Na)-Total	mg/L	1.56	1.64	1.70	1.77	1.92	2.31	1.80	3.17	1.98	
Strontium (Sr)-Total	mg/L	0.184	0.181	0.189	0.209	0.206	0.0871	0.278	0.275	0.197	
Sulfur (S)-Total	mg/L	22.2	20.0	20.8	22.1	21.4	4.18	12.0	21.6	19.8	
Titanium (Ti)-Total	mg/L	0.00040	<0.0018	0.00113	0.00297	0.00034	0.00320	<0.00030	0.00123	0.00115	
Uranium (U)-Total	mg/L	0.000900	0.000968	0.00116	0.00120	0.000959	0.000840	0.00493	0.00416	0.000779	0.015
Zinc (Zn)-Total	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0047	<0.0030	0.030
Zirconium (Zr)-Total	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00050	<0.00030	<0.00030	
Dissolved Metals (Water)											
Aluminum (Al)-Dissolved	mg/L	0.0109	0.0099	0.0103	0.0110	0.0101	0.0099	0.0081	0.0017	0.0117	
Antimony (Sb)-Dissolved	mg/L	0.00024	0.00042	0.00053	0.00064	0.00048	0.00107	0.00102	0.00461	0.00041	
Arsenic (As)-Dissolved	mg/L	0.00067	0.00508	0.00521	0.00478	0.00496	0.0392	0.0235	0.0310	0.00585	0.005
Barium (Ba)-Dissolved	mg/L	0.0255	0.0289	0.0360	0.0362	0.0425	0.0440	0.0642	0.0747	0.0508	
Beryllium (Be)-Dissolved	mg/L	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	
Bismuth (Bi)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Boron (B)-Dissolved	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Cadmium (Cd)-Dissolved	mg/L	0.0000089	0.0000088	0.0000101	0.0000074	0.0000098	0.0000052	0.0000074	0.0000128	0.0000121	0.00009
Calcium (Ca)-Dissolved	mg/L	36.0	34.2	35.7	38.9	41.6	14.8	32.4	39.8	48.7	
Chromium (Cr)-Dissolved	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.001
Cobalt (Co)-Dissolved	mg/L	0.00012	0.00011	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Copper (Cu)-Dissolved	mg/L	0.00053	0.00051	0.00056	0.00067	0.00076	0.00025	0.00049	0.00090	0.00094	0.002
Iron (Fe)-Dissolved	mg/L	0.044	0.042	0.036	0.036	0.033	<0.010	<0.010	0.013	0.042	0.3
Lead (Pb)-Dissolved	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.001
Lithium (Li)-Dissolved	mg/L	0.0047	0.0050	0.0051	0.0056	0.0034	0.0018	0.0042	0.0101	0.0012	
Magnesium (Mg)-Dissolved	mg/L	12.1	11.6	12.6	14.0	10.8	3.19	16.1	23.5	8.02	
Manganese (Mn)-Dissolved	mg/L	0.0352	0.0295	0.0340	0.0443	0.0232	0.00081	<0.00010	0.00458	0.0117	
Mercury (Hg)-Dissolved	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.000026
Molybdenum (Mo)-Dissolved	mg/L	0.000076	0.000287	0.000303	0.000307	0.000494	0.00205	0.00320	0.00113	0.000765	0.073
Nickel (Ni)-Dissolved	mg/L	0.00100	0.00089	0.00089	0.00100	0.00076	<0.00050	<0.00050	0.00057	0.00084	0.025
Phosphorus (P)-Dissolved	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Potassium (K)-Dissolved	mg/L	0.83	0.86	0.91	0.95	1.04	0.73	1.07	2.12	1.08	
Selenium (Se)-Dissolved	mg/L	0.000120	0.000135	0.000179	0.000126	0.000198	0.000111	0.000334	0.000367	0.000311	
Silicon (Si)-Dissolved	mg/L	3.77	3.95	3.95	3.73	3.91	5.85	4.78	5.45	3.95	
Silver (Ag)-Dissolved	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Sodium (Na)-Dissolved	mg/L	1.61	1.57	1.70	1.72	1.83	2.26	1.81	3.19	1.95	
Strontium (Sr)-Dissolved	mg/L	0.182	0.176	0.184	0.198	0.194	0.0825	0.267	0.274	0.199	
Sulfur (S)-Dissolved	mg/L	21.4	19.7	20.2	20.5	21.0	3.89	11.5	20.5	19.0	
Thallium (Tl)-Dissolved	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Tin (Sn)-Dissolved	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Titanium (Ti)-Dissolved	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	
Uranium (U)-Dissolved	mg/L	0.000861	0.000921	0.00111	0.00116	0.000958	0.000730	0.00510	0.00424	0.000727	0.015
Vanadium (V)-Dissolved	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Zinc (Zn)-Dissolved	mg/L	0.0012	0.0021	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	0.0032	<0.0010	0.030
Zirconium (Zr)-Dissolved	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	

* Exceedances are highlighted in red

STRATAGOLD CORPORATION
ATTN: Hugh Coyle
Suite 1000 - 1050 W. Pender St
Vancouver BC V6E 3S7

Date Received: 22-SEP-17
Report Date: 06-OCT-17 16:55 (MT)
Version: FINAL

Client Phone: 604-682-5122

Certificate of Analysis

Lab Work Order #: L1995822

Project P.O. #:	NOT SUBMITTED
Job Reference:	EAGLE GOLD
C of C Numbers:	1 of 1, 2 of 2
Legal Site Desc:	Victoria Gold Corp

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1995822-1	L1995822-2	L1995822-3	L1995822-4	L1995822-5
Description	Water	Water	Surface Water	Surface Water	Surface Water
Sampled Date			19-SEP-17	20-SEP-17	20-SEP-17
Sampled Time			10:00	11:40	14:16
Client ID	TRAVEL BLANK	DUP	W23	W20	W26
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	<2.0	412	287	76.5	277
Hardness (as CaCO3) (mg/L)	<0.50 HTC	226	148	32.7	147
pH (pH)	5.36	8.09	8.09	7.66	8.22
Total Suspended Solids (mg/L)	<3.0	4.9	<3.0	4.9	<3.0
Total Dissolved Solids (mg/L)	<10	278	210	64	177
TDS (Calculated) (mg/L)	<1.0	264	181	42.2	162
Turbidity (NTU)	<0.10	6.35	0.36	2.26	0.12
Anions and Nutrients Alkalinity, Total (as CaCO3) (mg/L)	<1.0	153	95.8	31.9	120
Ammonia, Total (as N) (mg/L)	<0.010 RRV	<0.0050	<0.0050	<0.0050	<0.0050
Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl) (mg/L)	<0.10	0.25	<0.10	<0.10	<0.10
Fluoride (F) (mg/L)	<0.020	0.139	0.104	0.056	0.152
Nitrate (as N) (mg/L)	<0.0050	0.0355	0.117	0.0138	0.116
Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen (mg/L)	<0.050	0.115	0.093	<0.050	0.070
Total Nitrogen (mg/L)	<0.030	0.150	0.209	0.052	0.187
Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	0.0012	<0.0010	0.0042 RRV	0.0039 RRV
Phosphorus (P)-Total Dissolved (mg/L)	<0.0020				
Phosphorus (P)-Total (mg/L)	<0.0020	0.0025	<0.0020	0.0076	<0.0040 DLM
Phosphorus (P)-Total Dissolved (mg/L)		<0.0020	<0.010 DLM	<0.010 DLM	<0.010 DLM
Sulfate (SO4) (mg/L)	<5.0	85.1	63.1	7.1	34.8
Anion Sum (meq/L)	<0.10	4.84	3.24	0.79	3.14
Cation Sum (meq/L)	<0.10	4.74	3.07	0.75	3.04
Cation - Anion Balance (%)	0.0	-1.0	-2.7	-2.4	-1.5
Cyanides Cyanide, Weak Acid Diss (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide, Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Organic / Inorganic Carbon Dissolved Organic Carbon (mg/L)		4.03	4.28	1.69	3.33
Total Organic Carbon (mg/L)	<0.50	3.65	4.11	1.44	3.27
Total Metals Aluminum (Al)-Total (mg/L)	<0.0030	0.0922	0.0199	0.151	0.0156
Antimony (Sb)-Total (mg/L)	<0.00010	0.00219	0.00051	0.00072	0.00105
Arsenic (As)-Total (mg/L)	<0.00010	0.0246	0.00522	0.0766	0.0232
Barium (Ba)-Total (mg/L)	<0.000050	0.0588	0.0428	0.0340	0.0616
Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total (mg/L)	<0.0000050	0.0000124	0.0000093	0.0000091	0.0000067

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1995822-6 Surface Water 20-SEP-17 15:43 W1	L1995822-7 Surface Water 20-SEP-17 17:30 W27	L1995822-8 Surface Water 21-SEP-17 08:45 W22	L1995822-9 Surface Water 21-SEP-17 10:10 W21	L1995822-10 Surface Water 21-SEP-17 11:15 W4
WATER						
Physical Tests	Conductivity (uS/cm)	111	357	278	184	265
	Hardness (as CaCO3) (mg/L)	50.1	196	140	90.2	133
	pH (pH)	7.82	8.32	8.07	8.03	8.09
	Total Suspended Solids (mg/L)	3.3	3.5	<3.0	19.5	4.4
	Total Dissolved Solids (mg/L)	84	223	193	134	182
	TDS (Calculated) (mg/L)	62.5	220	169	107	162
	Turbidity (NTU)	1.03	1.09	0.40	17.8	1.17
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	44.5	145	84.0	71.9	83.5
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.57	0.19	<0.10	<0.10	<0.10
	Fluoride (F) (mg/L)	0.088	0.154	0.091	0.104	0.092
	Nitrate (as N) (mg/L)	0.0262	0.0378	0.135	0.0601	0.120
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.053	0.059	0.057	0.060	0.062
	Total Nitrogen (mg/L)	0.079	0.097	0.192	0.120	0.182
	Orthophosphate-Dissolved (as P) (mg/L)	0.0034 HTD	0.0025 RRV	<0.0010	0.0025	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)					
	Phosphorus (P)-Total (mg/L)	0.0044	0.0041	<0.0020	0.0033	<0.0020
	Phosphorus (P)-Total Dissolved (mg/L)	<0.010 DLM	<0.0020	<0.0020	<0.0040 DLM	<0.0020
	Sulfate (SO4) (mg/L)	12.1	61.7	64.3	28.3	59.7
	Anion Sum (meq/L)	1.16	4.19	3.03	2.04	2.93
	Cation Sum (meq/L)	1.12	4.11	2.89	1.91	2.75
	Cation - Anion Balance (%)	-2.0	-0.9	-2.4	-3.1	-3.1
Cyanides	Cyanide, Weak Acid Diss (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Cyanide, Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.08	2.10	2.83	2.34	2.84
	Total Organic Carbon (mg/L)	2.01	2.08	2.80	1.91	2.86
Total Metals	Aluminum (Al)-Total (mg/L)	0.0823	0.0307	0.0181	0.133	0.0564
	Antimony (Sb)-Total (mg/L)	0.00116	0.00468	0.00026	0.00169	0.00045
	Arsenic (As)-Total (mg/L)	0.0416	0.0302	0.00070	0.0431	0.00630
	Barium (Ba)-Total (mg/L)	0.0486	0.0708	0.0370	0.0372	0.0280
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000079	0.0000153	0.0000120	0.0000127	0.0000092

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1995822-11	L1995822-12			
	Description	Surface Water	Surface Water			
	Sampled Date	21-SEP-17	21-SEP-17			
	Sampled Time	13:30	14:20			
	Client ID	W45	W29			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	422	276			
	Hardness (as CaCO3) (mg/L)	221	141			
	pH (pH)	8.29	8.11			
	Total Suspended Solids (mg/L)	3.4	5.0			
	Total Dissolved Solids (mg/L)	301	195			
	TDS (Calculated) (mg/L)	265	169			
	Turbidity (NTU)	6.86	3.27			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	159	88.8			
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050			
	Bromide (Br) (mg/L)	<0.050	<0.050			
	Chloride (Cl) (mg/L)	0.25	<0.10			
	Fluoride (F) (mg/L)	0.139	0.097			
	Nitrate (as N) (mg/L)	0.0349	0.109			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.136	0.058			
	Total Nitrogen (mg/L)	0.171	0.167			
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)					
	Phosphorus (P)-Total (mg/L)	0.0024	<0.0020			
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020			
	Sulfate (SO4) (mg/L)	85.0	61.5			
	Anion Sum (meq/L)	4.96	3.07			
	Cation Sum (meq/L)	4.60	2.92			
	Cation - Anion Balance (%)	-3.7	-2.5			
Cyanides	Cyanide, Weak Acid Diss (mg/L)	<0.0050	<0.0050			
	Cyanide, Total (mg/L)	<0.0050	<0.0050			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.79	3.13			
	Total Organic Carbon (mg/L)	3.79	3.06			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0885	0.0416			
	Antimony (Sb)-Total (mg/L)	0.00220	0.00058			
	Arsenic (As)-Total (mg/L)	0.0256	0.00653			
	Barium (Ba)-Total (mg/L)	0.0507	0.0325			
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020			
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050			
	Boron (B)-Total (mg/L)	<0.010	<0.010			
	Cadmium (Cd)-Total (mg/L)	0.0000127	0.0000110			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1995822-1 Water TRAVEL BLANK	L1995822-2 Water DUP	L1995822-3 Surface Water 19-SEP-17 10:00 W23	L1995822-4 Surface Water 20-SEP-17 11:40 W20	L1995822-5 Surface Water 20-SEP-17 14:16 W26
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	<0.050	57.9	43.6	10.4	32.0
	Chromium (Cr)-Total (mg/L)	<0.00010	0.00018	<0.00010	0.00028	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	0.00023	<0.00010	0.00011	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	0.00114	0.00081	<0.00050	0.00052
	Iron (Fe)-Total (mg/L)	<0.010	0.421	0.063	0.179	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	0.000459	<0.000050	0.000216	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	0.0095	0.0036	0.0017	0.0044
	Magnesium (Mg)-Total (mg/L)	<0.10	20.4	10.8	1.71	16.1
	Manganese (Mn)-Total (mg/L)	<0.00010	0.143	0.0251	0.00770	0.00013
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000780	0.000620	0.00109	0.00350
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00087	0.00084	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	<0.10	2.00	1.05	0.55	1.06
	Selenium (Se)-Total (mg/L)	<0.000050	0.000595	0.000242	0.000060	0.000348
	Silicon (Si)-Total (mg/L)	<0.10	4.47	3.96	6.46	4.82
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	<0.050	3.26	1.92	1.96	1.80
	Strontium (Sr)-Total (mg/L)	<0.00020	0.314	0.206	0.0630	0.278
	Sulfur (S)-Total (mg/L)	<0.50	28.8	21.4	2.61	12.0
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	0.00265	0.00034	0.00797	<0.00030
	Uranium (U)-Total (mg/L)	<0.000010	0.00386	0.000959	0.000689	0.00493
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	0.00062	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0060	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00050
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0857	0.0101	0.0135	0.0081
	Antimony (Sb)-Dissolved (mg/L)		0.00212	0.00048	0.00067	0.00102
	Arsenic (As)-Dissolved (mg/L)		0.0237	0.00496	0.0720	0.0235
	Barium (Ba)-Dissolved (mg/L)		0.0602	0.0425	0.0320	0.0642
	Beryllium (Be)-Dissolved (mg/L)		<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)		<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)		0.0000161	0.0000098	<0.0000050	0.0000074

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1995822-6 Surface Water 20-SEP-17 15:43 W1	L1995822-7 Surface Water 20-SEP-17 17:30 W27	L1995822-8 Surface Water 21-SEP-17 08:45 W22	L1995822-9 Surface Water 21-SEP-17 10:10 W21	L1995822-10 Surface Water 21-SEP-17 11:15 W4
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	14.9	39.2	36.5	22.9	34.2
	Chromium (Cr)-Total (mg/L)	0.00021	0.00011	<0.00010	0.00028	0.00013
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	0.00013	0.00017	0.00015
	Copper (Cu)-Total (mg/L)	<0.00050	0.00103	0.00059	0.00072	0.00061
	Iron (Fe)-Total (mg/L)	0.103	0.088	0.082	0.282	0.133
	Lead (Pb)-Total (mg/L)	0.000198	0.000156	<0.000050	0.000403	0.000104
	Lithium (Li)-Total (mg/L)	0.0020	0.0107	0.0046	0.0068	0.0051
	Magnesium (Mg)-Total (mg/L)	3.37	22.9	12.6	8.91	11.8
	Manganese (Mn)-Total (mg/L)	0.00386	0.00605	0.0368	0.00877	0.0319
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.00230	0.00122	<0.00020 DLB	0.00179	<0.00040 DLB
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00065	0.00103	0.00081	0.00102
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.78	2.01	0.85	1.08	0.85
	Selenium (Se)-Total (mg/L)	0.000102	0.000321	0.000136	0.000208	0.000152
	Silicon (Si)-Total (mg/L)	5.97	5.54	3.81	5.97	4.04
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	2.31	3.17	1.56	2.04	1.64
	Strontium (Sr)-Total (mg/L)	0.0871	0.275	0.184	0.146	0.181
	Sulfur (S)-Total (mg/L)	4.18	21.6	22.2	9.61	20.0
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.00320	0.00123	0.00040	0.00579	<0.0018 DLM
	Uranium (U)-Total (mg/L)	0.000840	0.00416	0.000900	0.00193	0.000968
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0047	<0.0030	0.0037	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0099	0.0017	0.0109	0.0070	0.0099
	Antimony (Sb)-Dissolved (mg/L)	0.00107	0.00461	0.00024	0.00158	0.00042
	Arsenic (As)-Dissolved (mg/L)	0.0392	0.0310	0.00067	0.0368	0.00508
	Barium (Ba)-Dissolved (mg/L)	0.0440	0.0747	0.0255	0.0392	0.0289
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.0000052	0.0000128	0.0000089	0.0000056	0.0000088

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1995822-11	L1995822-12			
	Description	Surface Water	Surface Water			
	Sampled Date	21-SEP-17	21-SEP-17			
	Sampled Time	13:30	14:20			
	Client ID	W45	W29			
Grouping	**Analyte**					
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	57.0	36.6			
	Chromium (Cr)-Total (mg/L)	0.00018	0.00013			
	Cobalt (Co)-Total (mg/L)	0.00023	0.00013			
	Copper (Cu)-Total (mg/L)	0.00115	0.00072			
	Iron (Fe)-Total (mg/L)	0.436	0.127			
	Lead (Pb)-Total (mg/L)	0.000492	0.000135			
	Lithium (Li)-Total (mg/L)	0.0085	0.0051			
	Magnesium (Mg)-Total (mg/L)	20.4	12.7			
	Manganese (Mn)-Total (mg/L)	0.149	0.0379			
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Total (mg/L)	0.000794	<0.00045 DLB			
	Nickel (Ni)-Total (mg/L)	0.00092	0.00103			
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050			
	Potassium (K)-Total (mg/L)	1.98	0.94			
	Selenium (Se)-Total (mg/L)	0.000633	0.000174			
	Silicon (Si)-Total (mg/L)	4.56	4.04			
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010			
	Sodium (Na)-Total (mg/L)	3.19	1.70			
	Strontium (Sr)-Total (mg/L)	0.319	0.189			
	Sulfur (S)-Total (mg/L)	29.8	20.8			
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Total (mg/L)	0.00237	0.00113			
	Uranium (U)-Total (mg/L)	0.00369	0.00116			
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Total (mg/L)	0.0054	<0.0030			
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030			
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD			
	Dissolved Metals Filtration Location	FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	0.0043	0.0103			
	Antimony (Sb)-Dissolved (mg/L)	0.00199	0.00053			
	Arsenic (As)-Dissolved (mg/L)	0.0131	0.00521			
	Barium (Ba)-Dissolved (mg/L)	0.0457	0.0360			
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000082	0.0000101			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1995822-1	L1995822-2	L1995822-3	L1995822-4	L1995822-5
Description	Water	Water	Surface Water	Surface Water	Surface Water
Sampled Date			19-SEP-17	20-SEP-17	20-SEP-17
Sampled Time			10:00	11:40	14:16
Client ID	TRAVEL BLANK	DUP	W23	W20	W26
Grouping **Analyte**					
WATER					
Dissolved Metals Calcium (Ca)-Dissolved (mg/L)		57.0	41.6	10.3	32.4
Chromium (Cr)-Dissolved (mg/L)		0.00015	<0.00010	<0.00010	<0.00010
Cobalt (Co)-Dissolved (mg/L)		0.00021	<0.00010	<0.00010	<0.00010
Copper (Cu)-Dissolved (mg/L)		0.00105	0.00076	<0.00020	0.00049
Iron (Fe)-Dissolved (mg/L)		0.340	0.033	<0.010	<0.010
Lead (Pb)-Dissolved (mg/L)		0.000404	<0.000050	<0.000050	<0.000050
Lithium (Li)-Dissolved (mg/L)		0.0105	0.0034	0.0017	0.0042
Magnesium (Mg)-Dissolved (mg/L)		20.3	10.8	1.68	16.1
Manganese (Mn)-Dissolved (mg/L)		0.141	0.0232	0.00163	<0.00010
Mercury (Hg)-Dissolved (mg/L)		<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)-Dissolved (mg/L)		0.000586	0.000494	0.000998	0.00320
Nickel (Ni)-Dissolved (mg/L)		0.00079	0.00076	<0.00050	<0.00050
Phosphorus (P)-Dissolved (mg/L)		<0.050	<0.050	<0.050	<0.050
Potassium (K)-Dissolved (mg/L)		2.03	1.04	0.54	1.07
Selenium (Se)-Dissolved (mg/L)		0.000559	0.000198	0.000068	0.000334
Silicon (Si)-Dissolved (mg/L)		4.36	3.91	6.12	4.78
Silver (Ag)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved (mg/L)		3.26	1.83	1.90	1.81
Strontium (Sr)-Dissolved (mg/L)		0.309	0.194	0.0601	0.267
Sulfur (S)-Dissolved (mg/L)		28.3	21.0	2.37	11.5
Thallium (Tl)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010
Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved (mg/L)		0.00233	<0.00030	<0.00030	<0.00030
Uranium (U)-Dissolved (mg/L)		0.00372	0.000958	0.000557	0.00510
Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Dissolved (mg/L)		0.0060	<0.0010	<0.0010	<0.0010
Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1995822-6 Surface Water 20-SEP-17 15:43 W1	L1995822-7 Surface Water 20-SEP-17 17:30 W27	L1995822-8 Surface Water 21-SEP-17 08:45 W22	L1995822-9 Surface Water 21-SEP-17 10:10 W21	L1995822-10 Surface Water 21-SEP-17 11:15 W4
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
WATER						
Dissolved Metals	Calcium (Ca)-Dissolved (mg/L)	14.8	39.8	36.0	22.0	34.2
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	0.00012	<0.00010	0.00011
	Copper (Cu)-Dissolved (mg/L)	0.00025	0.00090	0.00053	0.00040	0.00051
	Iron (Fe)-Dissolved (mg/L)	<0.010	0.013	0.044	0.013	0.042
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0018	0.0101	0.0047	0.0062	0.0050
	Magnesium (Mg)-Dissolved (mg/L)	3.19	23.5	12.1	8.56	11.6
	Manganese (Mn)-Dissolved (mg/L)	0.00081	0.00458	0.0352	0.00382	0.0295
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00205	0.00113	0.000076	0.00178	0.000287
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00057	0.00100	0.00054	0.00089
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.73	2.12	0.83	1.03	0.86
	Selenium (Se)-Dissolved (mg/L)	0.000111	0.000367	0.000120	0.000188	0.000135
	Silicon (Si)-Dissolved (mg/L)	5.85	5.45	3.77	5.64	3.95
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	2.26	3.19	1.61	1.92	1.57
	Strontium (Sr)-Dissolved (mg/L)	0.0825	0.274	0.182	0.140	0.176
	Sulfur (S)-Dissolved (mg/L)	3.89	20.5	21.4	9.53	19.7
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000730	0.00424	0.000861	0.00174	0.000921
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	0.0032	0.0012	0.0019	0.0021
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1995822-11	L1995822-12			
Description	Surface Water	Surface Water			
Sampled Date	21-SEP-17	21-SEP-17			
Sampled Time	13:30	14:20			
Client ID	W45	W29			
Grouping / **Analyte**					
WATER					
Dissolved Metals Calcium (Ca)-Dissolved (mg/L)	55.4	35.7			
Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010			
Cobalt (Co)-Dissolved (mg/L)	0.00014	<0.00010			
Copper (Cu)-Dissolved (mg/L)	0.00077	0.00056			
Iron (Fe)-Dissolved (mg/L)	0.025	0.036			
Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050			
Lithium (Li)-Dissolved (mg/L)	0.0085	0.0051			
Magnesium (Mg)-Dissolved (mg/L)	20.1	12.6			
Manganese (Mn)-Dissolved (mg/L)	0.134	0.0340			
Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050			
Molybdenum (Mo)-Dissolved (mg/L)	0.000712	0.000303			
Nickel (Ni)-Dissolved (mg/L)	0.00067	0.00089			
Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050			
Potassium (K)-Dissolved (mg/L)	1.91	0.91			
Selenium (Se)-Dissolved (mg/L)	0.000615	0.000179			
Silicon (Si)-Dissolved (mg/L)	4.23	3.95			
Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010			
Sodium (Na)-Dissolved (mg/L)	3.07	1.70			
Strontium (Sr)-Dissolved (mg/L)	0.307	0.184			
Sulfur (S)-Dissolved (mg/L)	27.9	20.2			
Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010			
Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010			
Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030			
Uranium (U)-Dissolved (mg/L)	0.00348	0.00111			
Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050			
Zinc (Zn)-Dissolved (mg/L)	0.0031	0.0012			
Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Zinc (Zn)-Dissolved	MB-LOR	L1995822-4, -5
Method Blank	Molybdenum (Mo)-Total	MB-LOR	L1995822-10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L1995822-3, -4, -5, -6, -7, -8
Matrix Spike	Dissolved Organic Carbon	MS-B	L1995822-2
Matrix Spike	Total Organic Carbon	MS-B	L1995822-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Arsenic (As)-Dissolved	MS-B	L1995822-10, -11, -12, -6, -7, -8, -9
Matrix Spike	Arsenic (As)-Dissolved	MS-B	L1995822-2, -3
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1995822-10, -11, -12, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1995822-2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1995822-10, -11, -12, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1995822-2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1995822-10, -11, -12, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1995822-2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1995822-2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1995822-10, -11, -12, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1995822-2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1995822-10, -11, -12, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1995822-2, -3
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1995822-2, -3
Matrix Spike	Arsenic (As)-Total	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Total	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Total	MS-B	L1995822-1
Matrix Spike	Boron (B)-Total	MS-B	L1995822-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Total	MS-B	L1995822-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L1995822-1
Matrix Spike	Lithium (Li)-Total	MS-B	L1995822-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1995822-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1995822-1
Matrix Spike	Manganese (Mn)-Total	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Total	MS-B	L1995822-1
Matrix Spike	Potassium (K)-Total	MS-B	L1995822-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L1995822-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1995822-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L1995822-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1995822-1
Matrix Spike	Sulfur (S)-Total	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sulfur (S)-Total	MS-B	L1995822-1
Matrix Spike	Sulfur (S)-Total	MS-B	L1995822-1
Matrix Spike	Total Nitrogen	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Phosphorus (P)-Total Dissolved	MS-B	L1995822-4, -5, -6
Matrix Spike	Phosphorus (P)-Total Dissolved	MS-B	L1995822-9
Matrix Spike	Orthophosphate-Dissolved (as P)	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Sulfate (SO4)	MS-B	L1995822-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).

Reference Information

HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
BR-L-IC-N-WR	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-L-IC-N-WR	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CN-TOT-WT	Water	Cyanide, Total	ISO 14403-2
Total cyanide is determined by the combination of UV digestion and distillation. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex. When using this method, high levels of thiocyanate in samples can cause false positives at ~1-2% of the thiocyanate concentration. For samples with detectable cyanide analyzed by this method, ALS recommends analysis for thiocyanate to check for this potential interference			
CN-WAD-WT	Water	Cyanide, Weak Acid Diss	APHA 4500CN I-Weak acid Dist Colorimet
Weak acid dissociable cyanide (WAD) is determined by undergoing a distillation procedure. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-WR	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			

Reference Information

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N-T-COL-VA Water Total Nitrogen in water by Colour APHA4500-P(J)/NEMI9171/USGS03-4174

This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-WR Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-WR Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-PRES-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

Reference Information

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SO4-IC-WR	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-CALC-VA	Water	TDS (Calculated)	APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".
The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-CALC-VA	Water	TKN in Water (Calculation)	BC MOE LABORATORY MANUAL (2005)

Total Kjeldahl Nitrogen is a calculated parameter. Total Kjeldahl Nitrogen (calc) = Total Nitrogen - [Nitrite (as N) + Nitrate (as N)].

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
WR	ALS ENVIRONMENTAL - WHITEHORSE, YUKON, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1 of 1 2 of 2

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

L1995822-COFC

Chain of Custody / Canada Toll Free

www.alsglobal.com

COC # _____

Page 1 of 1

ALS Environmental

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	StrataGold Corporation	☑ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Hugh Coyle	☑ PDF ☑ Excel ☑ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	910 - 105 West Pender Street	Email 1:	hcoyle@vitgoldcorp.com	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6E 3S7	Email 2:	bonnieburns@northwestel.net	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-696-6600 Fax:	Email 3:	swilbur@vitgoldcorp.com; and rmaciak@vitgoldco	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Eagle Gold	
Company:		PO / AFE:		
Contact:		LSD:	Victoria Gold Corp.	
Address:				
Phone:	Fax:	Quote #:		
Lab Work Order # (lab use only)		ALS Contact:	Amber Springer	Sampler: Bonnie Burns & Patrick Soprovich

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	pH, EC, Turbidity, Total Alk.	TDS, TSS, Anion Scan	Total Cyanide, WAD Cyanide P	T-PO4, TD-PO4, Ortho-PO4 P	TKN, HN3, TN-CALC-VA F/P	DOC F/P	MET-O-NDR-VA F/P	MET-T-NDR-VA P	HG-DIS-LOW-CVAFS-VA	HG-TOT-LOW-CVAFS-VA	TOC		Number of Containers
	TRAVEL BLANK			Water	X	X	X	X	X		X			X	X		6
	Dup			Water	X	X	X	X	X	X	X	X	X	X	X		9
	W23	19-Sep-17	10:00	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W20	20-Sep-17	11:40	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W26	20-Sep-17	14:16	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W1	20-Sep-17	15:43	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W27	20-Sep-17	17:30	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W22	21-Sep-17	8:45	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W21	21-Sep-17	10:10	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W4	21-Sep-17	11:15	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W45	21-Sep-17	13:30	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W29	21-Sep-17	14:20	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Bonnie Burns	Sept			Sept 22/17	10:40	6 °C	Lady	Sept. 23	1550	

9/8/17 c

STRATAGOLD CORPORATION
ATTN: Hugh Coyle
Suite 1000 - 1050 W. Pender St
Vancouver BC V6E 3S7

Date Received: 25-SEP-17
Report Date: 12-OCT-17 14:10 (MT)
Version: FINAL

Client Phone: 604-682-5122

Certificate of Analysis

Lab Work Order #: L1996554

Project P.O. #:	NOT SUBMITTED
Job Reference:	EAGLE GOLD
C of C Numbers:	1 of 1
Legal Site Desc:	VICTORIA GOLD CORP

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1996554-1	L1996554-2	L1996554-3		
Description	WATER	SURFACE WATE	SURFACE WATE		
Sampled Date		22-SEP-17	22-SEP-17		
Sampled Time		14:00	15:00		
Client ID	FIELD BLANK	W5	W6		
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	<2.0	302	295		
Hardness (as CaCO3) (mg/L)	<0.50	155	155		
pH (pH)	5.44	8.09	8.08		
Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0		
TDS (Calculated) (mg/L)	<1.0	181	188		
Turbidity (NTU)	<0.10	3.96	0.58		
Anions and Nutrients Alkalinity, Total (as CaCO3) (mg/L)	<1.0	93.6	105		
Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050		
Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
Chloride (Cl) (mg/L)	<0.10	<0.10	0.11		
Fluoride (F) (mg/L)	<0.020	0.094	0.099		
Nitrate (as N) (mg/L)	<0.0050	0.111	0.122		
Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010		
Total Kjeldahl Nitrogen (mg/L)	<0.050	0.110	0.186		
Total Nitrogen (mg/L)	<0.050	0.221	0.308		
Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010		
Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020		
Phosphorus (P)-Total (mg/L)	<0.0020	<0.0040 DLM	<0.0020		
Sulfate (SO4) (mg/L)	<5.0	65.0	58.8		
Anion Sum (meq/L)	<0.10	3.24	3.33		
Cation Sum (meq/L)	<0.10	3.19	3.21		
Cation - Anion Balance (%)	0.0	-0.7	-1.9		
Cyanides Cyanide, Weak Acid Diss (mg/L)	<0.0050	<0.0050	<0.0050		
Cyanide, Total (mg/L)	<0.0050	<0.0050	<0.0050		
Organic / Inorganic Carbon Dissolved Organic Carbon (mg/L)	<0.50	3.61	5.65		
Total Organic Carbon (mg/L)	<0.50	3.64	5.66		
Total Metals Aluminum (Al)-Total (mg/L)	<0.0030	0.0834	0.0454		
Antimony (Sb)-Total (mg/L)	<0.00010	0.00071	0.00043		
Arsenic (As)-Total (mg/L)	<0.00010	0.00678	0.00620		
Barium (Ba)-Total (mg/L)	<0.000050	0.0378	0.0515		
Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020		
Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010		
Cadmium (Cd)-Total (mg/L)	<0.0000050	0.0000113	0.0000139		
Calcium (Ca)-Total (mg/L)	<0.050	39.4	48.7		
Chromium (Cr)-Total (mg/L)	<0.00010	<0.00040 DLB	<0.00040 DLB		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1996554-1	L1996554-2	L1996554-3		
	Description	WATER	SURFACE WATE	SURFACE WATE		
	Sampled Date		22-SEP-17	22-SEP-17		
	Sampled Time		14:00	15:00		
	Client ID	FIELD BLANK	W5	W6		
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	0.00019	<0.00010		
	Copper (Cu)-Total (mg/L)	<0.00050	0.00092	0.00132		
	Iron (Fe)-Total (mg/L)	<0.010	0.217	0.155		
	Lead (Pb)-Total (mg/L)	<0.000050	0.000254	0.000060		
	Lithium (Li)-Total (mg/L)	<0.0010	0.0060	0.0013		
	Magnesium (Mg)-Total (mg/L)	<0.10	14.4	8.24		
	Manganese (Mn)-Total (mg/L)	<0.00010	0.0515	0.0164		
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000310	0.000782		
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00127	0.00109		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	<0.10	1.02	1.13		
	Selenium (Se)-Total (mg/L)	<0.000050	0.000148	0.000316		
	Silicon (Si)-Total (mg/L)	<0.10	4.17	4.09		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Total (mg/L)	<0.050	1.77	1.98		
	Strontium (Sr)-Total (mg/L)	<0.00020	0.209	0.197		
	Sulfur (S)-Total (mg/L)	<0.50	22.1	19.8		
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Total (mg/L)	<0.00030	0.00297	0.00115		
	Uranium (U)-Total (mg/L)	<0.000010	0.00120	0.000779		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030		
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	0.0110	0.0117		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	0.00064	0.00041		
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00478	0.00585		
	Barium (Ba)-Dissolved (mg/L)	<0.000050	0.0362	0.0508		
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	0.0000074	0.0000121		
	Calcium (Ca)-Dissolved (mg/L)	<0.050	38.9	48.7		
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1996554-1	L1996554-2	L1996554-3		
Description	WATER	SURFACE WATE	SURFACE WATE		
Sampled Date		22-SEP-17	22-SEP-17		
Sampled Time		14:00	15:00		
Client ID	FIELD BLANK	W5	W6		
Grouping / **Analyte**					
WATER					
Dissolved Metals Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00011	<0.00010		
Copper (Cu)-Dissolved (mg/L)	<0.00020	0.00067	0.00094		
Iron (Fe)-Dissolved (mg/L)	<0.010	0.036	0.042		
Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
Lithium (Li)-Dissolved (mg/L)	<0.0010	0.0056	0.0012		
Magnesium (Mg)-Dissolved (mg/L)	<0.10	14.0	8.02		
Manganese (Mn)-Dissolved (mg/L)	<0.00010	0.0443	0.0117		
Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		
Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	0.000307	0.000765		
Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00100	0.00084		
Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
Potassium (K)-Dissolved (mg/L)	<0.10	0.95	1.08		
Selenium (Se)-Dissolved (mg/L)	<0.000050	0.000126	0.000311		
Silicon (Si)-Dissolved (mg/L)	<0.050	3.73	3.95		
Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
Sodium (Na)-Dissolved (mg/L)	<0.050	1.72	1.95		
Strontium (Sr)-Dissolved (mg/L)	<0.00020	0.198	0.199		
Sulfur (S)-Dissolved (mg/L)	<0.50	20.5	19.0		
Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		
Uranium (U)-Dissolved (mg/L)	<0.000010	0.00116	0.000727		
Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Chromium (Cr)-Total	MB-LOR	L1996554-2, -3
Matrix Spike	Dissolved Organic Carbon	MS-B	L1996554-1, -2, -3
Matrix Spike	Dissolved Organic Carbon	MS-B	L1996554-1, -2, -3
Matrix Spike	Total Organic Carbon	MS-B	L1996554-1, -2, -3
Matrix Spike	Total Organic Carbon	MS-B	L1996554-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1996554-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1996554-1
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1996554-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1996554-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1996554-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1996554-1
Matrix Spike	Barium (Ba)-Total	MS-B	L1996554-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L1996554-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L1996554-1
Matrix Spike	Cobalt (Co)-Total	MS-B	L1996554-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1996554-1, -2, -3
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1996554-1
Matrix Spike	Manganese (Mn)-Total	MS-B	L1996554-1, -2, -3
Matrix Spike	Manganese (Mn)-Total	MS-B	L1996554-1
Matrix Spike	Molybdenum (Mo)-Total	MS-B	L1996554-1
Matrix Spike	Potassium (K)-Total	MS-B	L1996554-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1996554-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L1996554-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1996554-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L1996554-1
Matrix Spike	Sulfur (S)-Total	MS-B	L1996554-1
Matrix Spike	Uranium (U)-Total	MS-B	L1996554-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
BR-L-IC-N-WR	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
		Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

Reference Information

CARBONS-TOC-VA Water

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CL-L-IC-N-WR Water Chloride in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CN-T-CFA-VA Water Total Cyanide in water by CFA ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

CN-WAD-CFA-VA Water Weak Acid Diss. Cyanide in water by CFA APHA 4500-CN CYANIDE

This analysis is carried out using procedures adapted from APHA Method 4500-CN I. "Weak Acid Dissociable Cyanide". Weak Acid Dissociable (WAD) cyanide is determined by in-line sample distillation with final determination by colourimetric analysis.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EC-SCREEN-VA Water Conductivity Screen (Internal Use Only) APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

F-IC-N-WR Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-WR Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-WR Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SO4-IC-WR Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".
The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TN-CALC-VA Water Total Nitrogen (Calculation) BC MOE LABORATORY MANUAL (2005)

Total Nitrogen is a calculated parameter. Total Nitrogen = Total Kjeldahl Nitrogen + [Nitrate and Nitrite (as N)]

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WR	ALS ENVIRONMENTAL - WHITEHORSE, YUKON, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Ana
Canada Toll Free:
www.alsgl

L1996554-COFC

IC #

Page 1 of 1

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	StrataGold Corporation	☑ Standard ☐ Other		● Regular (Standard Turnaround Times - Business Days)
Contact:	Hugh Coyle	☑ PDF ☑ Excel ☑ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	910 - 105 West Pender Street	Email 1:	hcoyle@vitgoldcorp.com	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6E 3S7	Email 2:	bonnieburns@northwestel.net	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-696-6600 Fax:	Email 3:	swilbur@vitgoldcorp.com; and rmaciak@vitgoldc	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Eagle Gold	
Company:		PO / AFE:		
Contact:		LSD:	Victoria Gold Corp.	
Address:				
Phone:	Fax:	Quote #:		
Lab Work Order # (lab use only)		**ALS Contact:**	Amber Springer	**Sampler:** Bonnie Burns & Patrick Soprovich

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	pH, EC, Turbidity, Total Alk.	TDS, TSS, Anion Scan	Total Cyanide, WAD Cyanide	T-PO4,TD-PO4, Ortho-PO4	TKN, HN3, TN-CALC-VA	DOC	MET-D-NDR-VA	MET-T-NDR-VA	HG-DIS-LOW-CVAFS-VA	HG-TOT-LOW-CVAFS-VA	TOC		Number of Containers
							P		P	F/P	F/P	P					
	FIELD BLANK			Water	X	X	X	X	X	X	X	X	X	X	X		9
	W5	22-Sep-17	14:00	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9
	W6	22-Sep-17	15:00	Surface Water	X	X	X	X	X	X	X	X	X	X	X		9

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Bonnie Burns	Sept 25/17			Sept 25/17	09:49	6 °C				

GENF 20.00 Front

APPENDIX B

- **Cordillera Consulting Methods and QC Report, 2017**
- **Additional Metrics per Sample Site**
- **General Habitat Characteristics**
- **Benthic Invertebrate Taxonomic Data, 2017**

Methods and QC Report 2017

Project ID: Dublin Gulch 2017

Client: Laberge Environmental

Prepared by:
Sue Salter R.P.Bio.
Cordillera Consulting Inc.
Summerland, BC
© 2016

Unit 1, 13216 Henry Ave B1202
Summerland, BC, V0H 1Z0
www.cordilleraconsulting.ca

P:250.494.7553
F: 250.494.7562

Table of Contents

Sample Reception

On October 15, 2017, Cordillera Consulting received 27 EEM benthic samples from Laberge Environmental. When samples arrived to Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Next, samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Site	Sample	CC#	Date	Size	# of Jars
W1	W1-A	CC181469	10/1/2017	300µM	1
W1	W1-B	CC181470	10/1/2017	300µM	1
W1	W1-C	CC181471	10/1/2017	300µM	1
W4	W4-A	CC181472	10/1/2017	300µM	1
W4	W4-B	CC181473	10/1/2017	300µM	1
W4	W4-C	CC181474	10/1/2017	300µM	1
W5	W5-A	CC181475	10/1/2017	300µM	1
W5	W5-B	CC181476	10/1/2017	300µM	1
W5	W5-C	CC181477	10/1/2017	300µM	1
W6	W6-A	CC181478	10/1/2017	300µM	1
W6	W6-B	CC181479	10/1/2017	300µM	1

W6	W6-C	CC181480	10/1/2017	300µM	1
W22	W22-A	CC181481	10/1/2017	300µM	1
W22	W22-B	CC181482	10/1/2017	300µM	1
W22	W22-C	CC181483	10/1/2017	300µM	1
W23	W23-A	CC181484	10/1/2017	300µM	1
W23	W23-B	CC181485	10/1/2017	300µM	1
W23	W23-C	CC181486	10/1/2017	300µM	1
W26	W26-A	CC181487	10/1/2017	300µM	1
W26	W26-B	CC181488	10/1/2017	300µM	1
W26	W26-C	CC181489	10/1/2017	300µM	1
W27	W27-A	CC181490	10/1/2017	300µM	1
W27	W27-B	CC181491	10/1/2017	300µM	1
W27	W27-C	CC181492	10/1/2017	300µM	1
W29	W29-A	CC181493	10/1/2017	300µM	1
W29	W29-B	CC181494	10/1/2017	300µM	1
W29	W29-C	CC181495	10/1/2017	300µM	1

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.
- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.
- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Sample	Date	CC#	300 micron fraction	
			% Sampled	# Invertebrates
W1-A	01-Oct-17	CC181469	50%	334
W1-B	01-Oct-17	CC181470	50%	384
W1-C	01-Oct-17	CC181471	62.5%	337
W4-A	01-Oct-17	CC181472	50%	342
W4-B	01-Oct-17	CC181473	75%	320
W4-C	01-Oct-17	CC181474	75%	311
W5-A	01-Oct-17	CC181475	100%	260
W5-B	01-Oct-17	CC181476	100%	12
W5-C	01-Oct-17	CC181477	100%	386
W6-A	01-Oct-17	CC181478	37.5%	361
W6-B	01-Oct-17	CC181479	37.5%	401
W6-C	01-Oct-17	CC181480	25%	311
W22-A	01-Oct-17	CC181481	100%	60
W22-B	01-Oct-17	CC181482	100%	275
W22-C	01-Oct-17	CC181483	37.5%	325
W23-A	01-Oct-17	CC181484	75%	352
W23-B	01-Oct-17	CC181485	100%	61
W23-C	01-Oct-17	CC181486	100%	655
W26-A	01-Oct-17	CC181487	50%	353
W26-B	01-Oct-17	CC181488	50%	389
W26-C	01-Oct-17	CC181489	100%	65
W27-A	01-Oct-17	CC181490	100%	344
W27-B	01-Oct-17	CC181491	100%	269
W27-C	01-Oct-17	CC181492	62.5%	430
W29-A	01-Oct-17	CC181493	75%	417
W29-B	01-Oct-17	CC181494	100%	128
W29-C	01-Oct-17	CC181495	100%	324

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera's laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound} * 100 = \%OM$$

Table 3: Summary of sorting efficiency

CC #	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
CC181469	334	5	99%
CC181478	361	0	100%
CC181490	344	5	99%
Average Recovery			100.00%

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason, subsampling was performed by experienced employees only. Another common source of area would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Station ID		Organisms in Subsample		Actual Total	Precision Error		Accuracy Error	
CC#	Sample Name				Min (%)	Max (%)	Min (%)	Max (%)
		1	2					
181472	W4	337	269	606	20.18	20.18	11.22	11.22
181487	W26-A	350	326	676	6.86	6.86	3.55	3.55
181470	W1-B	384	411	795	6.57	6.57	3.40	3.40

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomic QC

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2.

Sue Salter: Group 1 General Arthropods (West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta
Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta
Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae
Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomy Notes: Baetis tricaudatus group has now been renamed to Baetis rhodani group. There has been no change in the determination of the taxa. See Webb 2017 in the taxonomy keys.

References

[1] McDermott, H., Paull, T., Strachan, S. (May 2014). Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples, Environment Canada. ISBN: 978-1-100-25417-3

[2] Southwest Association of Freshwater Invertebrate Taxonomists. (2015). www.safit.org

[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015).
http://www.safit.org/Docs/SAFIT_Taxonomic_Literature_Database_1_March_2011.enl

Brook, Arthur R. and Leonard A. Kelton. 1967. Aquatic and semiaquatic Heteroptera of Alberta, Saskatchewan and Manitoba (Hemiptera) Memoirs of the Entomological Society of Canada. No. 51.

Brown HP & White DS (1978) Notes on Seperation and Identification of North
American Riffle Beetles (Coleoptera: Dryopidea: Elmidae).Entomological News 89 (1&2): 1-13

Clifford, Hugh F. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press Edmonton, Alberta.

Epler, John. 2001 The Larval Chironomids of North and South Carolina. http://home.earthlink.net/~johnepler/

Epler, John. Identification Manual for the Water Beetles of Florida. http://home.earthlink.net/~johnepler/

Epler, John. Identification Manual for the Aquatic and Semi-aquatic Heteroptera of Florida.
http://home.earthlink.net/~johnepler/

Trond Andersen, Peter S. Cranston & John H. Epler (Eds) (2013) Chironomidae of the Holarctic Region: Keys and DIagnoses. Part 1. Larvae. *Insect Systematics and Evolution Supplements* 66: 1-571.

Jacobus, Luke and Pat Randolph. 2005. Northwest Ephemeroptera Nymphs. Manual from Northwest Biological Assessment Working Group. Moscow Idaho 2005. Not Published.

Jacobus LM, McCafferty WP (2004) Revisionary Contributions to the Genus Drunella (Ephemeroptera : Ephemerellidae). Journal of the New York Entomological Society 112: 127-147

Jacobus LM, McCafferty WP (2003) Revisionary Contributions to North American Ephemerella and Serratella (Ephemeroptera : Ephemerellidae). Journal of the New York Entomological Society 111 (4): 174-193.

Kathman,R.D., R.O. Brinkhurst. 1999. Guide to the Freshwater Oligochaetes of North America. Aquatic Resources Center, College Grove, Tennessee.

Larson, D.J., Y. Alarie, R.E. Roughly.2005. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Neararctic Region. NRC-CNRC Research Press. Ottawa.

Merritt, R.W., K.W. Cummins, M. B. Berg. (eds.). 2007. An introduction to the aquatic insects of North America, 4th. Kendall/Hunt, Dubuque, IA

Morihara DK, McCafferty WP (1979) The Baetis Larvae of North American (Ephemeroptera: Baetidae). Transactions of the American Entomological Society 105: 139-221.

Needham, James, M. May, M. Westfall Jr. 2000. Dragonflies of North America. Scientific Publishers. Gainsville FL.

Prescott David, R.C.and Medea M. Curteanu.2004. Survey of Aquatic Gastropods of Alberta. Species at Risk Report No. 104. ISSN: 1496-7146 (Online Edition)

Needham, K. 1996. An Identification Guide to the Nymphal Mayflies of British Columbia. Publication #046 Resource Inventory Committee, Government of British Columbia.

Oliver, Donald R. and Mary E. Roussel. 1983. The Insects and Arachnids of Canada Part 11. The Genera of larval midges of Canada. Biosystematics Research Institute. Ottawa, Ontario. Research Branch, Agriculture Canada. Publication 1746.

Proctor, H. The 'Top 18' Water Mite Families in Alberta. Zoology 351. University of Alberta, Edmonton, Alberta.

Rogers, D.C. and M. Hill, 2008. Key to the Freshwater Malacostraca (Crustacea) of the mid-Atlantic Region. EPA-230-R-08-017. US Environmental Protection Agency, Office of Environmental Information, Washington, DC.

Stewart, Kenneth W. and Bill Stark. 2002. The Nymphs of North American Stonefly Genera (Plecoptera). The Caddis Press. Columbus Ohio.

Stewart, Kenneth W. and Mark W. Oswood. 2006 The Stoneflies (Plecoptera) of Alaska and Western Canada. The Caddis Press.

Stonedahl, Gary and John D. Lattin. 1986. The Corixidae of Oregon and Washington (Hemiptera: Heteroptera). Technical Bulletin 150. Oregon State University, Corvalis Oregon.

Thorpe, J. H. and A. P. Covich [Eds.] 1991. Ecology and classification of North American freshwater invertebrates. Academic Press, San Diego.

Tinerella, Paul P. and Ralph W. Gunderson.2005. The Waterboatmen (Insecta: Heteroptera: Corixidae) of Minisota. Publication No.23 Dept. Of Entomology, North Dakota State University, Fargo, North Dakota, USA.

Webb, Jeff. 2017. Baetidae larvae of the western United States and Canada. SAFIT Taxonomic workshop, University of California Davis. Davis CA.

Weiderholm, Torgny (Ed.) 1983. The larvae of Chironomidae (Diptera) of the Holartic region. Entomologica Scaninavica. Supplement No. 19.

Westfall, Minter J. Jr. and May, Michael L. 1996. Damselflies of North America. Scientific Publishers, Gainesville, FL.

Wiggins, Glenn B. 1998. Larvae of the North American Caddisfly Genera (Tricoptera) 2nd ed. University of Toronto Press. Toronto Ontario.

APPENDIX B - ADDITIONAL METRICS PER SAMPLE, EAGLE GOLD BENTHIC INVERTEBRATE DATA, 2017

Site:	**W1**	**W1**	**W1**	**W4**	**W4**	**W4**
Sample:	W1-A	W1-B	W1-C	W4-A	W4-B	W4-C
Dominance Measures						
1st Dominant Taxon	Lumbriculidae	Zapada	Lumbriculidae	Baetidae	Baetidae	Baetidae
1st Dominant Abundance	158	152	80	236	165	111
% 1 Dominant Taxon	23.7%	19.9%	14.8%	34.7%	39.4%	27.3%
2nd Dominant Taxon	Baetidae	Pagastia	Zapada	Zapada	Capniidae	Lumbriculidae
2nd Dominant Abundance	118	142	80	118	47	57
% 2 Dominant Taxa	17.7%	18.6%	14.8%	17.4%	11.2%	14.0%
3rd Dominant Taxon	Pagastia	Lumbriculidae	Capniidae	Lumbriculidae	Heptageniidae	Zapada
3rd Dominant Abundance	82	128	72	68	44	53
% 3 Dominant Taxa	12.3%	16.8%	13.3%	10.0%	10.5%	13.0%
Functional Group Composition						
% Predators	11.71%	12.83%	15.37%	10.00%	7.88%	11.55%
% Shredder-Herbivores	22.82%	26.96%	32.96%	27.65%	26.01%	24.57%
% Collector-Gatherers	64.26%	58.64%	48.89%	55.88%	53.94%	53.07%
% Scrapers	0.60%	0.79%	0.93%	6.18%	11.22%	10.32%
% Macrophyte-Herbivore						
% Collector-Filterer	0.30%				0.95%	
% Omnivore	0.30%	0.26%	0.56%	0.29%		0.25%
% Parasite						
% Piercer-Herbivore						
% Gatherer						
% Unclassified	0.00%	0.52%	1.30%	0.00%	0.00%	0.25%
Functional Group Richness						
Predators Richness	11	21	13	12	10	11
Shredder-Herbivores Richness	6	8	6	9	8	8
Collector-Gatherers Richness	8	8	8	8	17	10
Scrapers Richness	1	2	1	2	2	3
MH Richness						
CF Richness	1				1	
OM Richness	1	1	1	1		1
PA Richness						
Piercer-Herbivore Richness						
Gatherer Richness						
Unclassified	0	1	2	0	0	1
Diversity/Evenness Measures						
Shannon-Weiner H' (log 10)	1.06	1.09	1.17	1.01	1.02	1.10
Shannon-Weiner H' (log 2)	3.51	3.62	3.87	3.36	3.40	3.66
Shannon-Weiner H' (log e)	2.43	2.51	2.68	2.33	2.36	2.54
Simpson's Index (D)	0.13	0.13	0.10	0.17	0.19	0.13
Simpson's Index of Diversity (1 - D	0.87	0.87	0.90	0.83	0.81	0.87
Simpson's Reciprocal Index (1/D)	7.82	7.88	10.41	5.79	5.26	7.82
Biotic Indices						
Hilsenhoff Biotic Index	4.16	3.56	3.24	3.39	3.09	3.57

APPENDIX B - ADDITIONAL METRICS PER SAMPLE, EAGLE GOLD BENTHIC INVERTEBRATE DATA, 2017

Site:	**W5**	**W5**	**W5**	**W6**	**W6**	**W6**
Sample:	W5-A	W5-B	W5-C	W6-A	W6-B	W6-C
Dominance Measures						
1st Dominant Taxon	Baetidae	Lebertia	Baetidae	Capniidae	Capniidae	Heptageniidae
1st Dominant Abundance	57	3	87	389	219	356
% 1 Dominant Taxon	22.2%	27.3%	22.7%	40.6%	20.6%	28.7%
2nd Dominant Taxon	Heptageniidae	Nemouridae	Zapada	Ephemerellidae	Heptageniidae	Lumbriculidae
2nd Dominant Abundance	44	2	60	205	216	340
% 2 Dominant Taxa	17.1%	18.2%	15.6%	21.4%	20.3%	27.4%
3rd Dominant Taxon	Capniidae	Baetidae	Capniidae	Heptageniidae	Tanytarsini	Capniidae
3rd Dominant Abundance	40	2	52	133	139	248
% 3 Dominant Taxa	15.6%	18.2%	13.5%	13.9%	13.1%	20.0%
Functional Group Composition						
% Predators	7.39%	45.45%	5.21%	3.24%	4.88%	4.52%
% Shredder-Herbivores	36.96%	27.27%	38.02%	47.13%	29.86%	23.87%
% Collector-Gatherers	36.96%	18.18%	40.89%	33.96%	41.41%	42.26%
% Scrapers	18.29%	9.09%	8.85%	14.21%	22.35%	28.71%
% Macrophyte-Herbivore						
% Collector-Filterer	0.39%		5.99%	0.31%	0.47%	0.32%
% Omnivore			1.04%	0.84%	0.56%	0.32%
% Parasite						
% Piercer-Herbivore						
% Gatherer						
% Unclassified	0.00%	0.00%	0.00%	0.31%	0.47%	0.00%
Functional Group Richness						
Predators Richness	11	3	12	8	9	7
Shredder-Herbivores Richness	8	2	7	6	5	4
Collector-Gatherers Richness	10	1	9	13	13	11
Scrapers Richness	2	1	2	2	3	1
MH Richness						
CF Richness	1		2	1	1	1
OM Richness			2	2	2	1
PA Richness						
Piercer-Herbivore Richness						
Gatherer Richness						
Unclassified	0	0	0	1	1	0
Diversity/Evenness Measures						
Shannon-Weiner H' (log 10)	1.07	0.80	1.13	0.87	1.12	0.88
Shannon-Weiner H' (log 2)	3.57	2.66	3.75	2.88	3.73	2.92
Shannon-Weiner H' (log e)	2.47	1.85	2.60	2.00	2.59	2.03
Simpson's Index (D)	0.13	0.09	0.11	0.24	0.12	0.20
Simpson's Index of Diversity (1 - D	0.87	0.91	0.89	0.76	0.88	0.80
Simpson's Reciprocal Index (1/D)	7.84	11.00	8.97	4.24	8.55	4.96
Biotic Indices						
Hilsenhoff Biotic Index	3.14	4.73	3.26	2.12	3.45	4.42

APPENDIX B - ADDITIONAL METRICS PER SAMPLE, EAGLE GOLD BENTHIC INVERTEBRATE DATA, 2017

Site:	**W22**	**W22**	**W22**	**W23**	**W23**	**W23**
Sample:	W22-A	W22-B	W22-C	W23-A	W23-B	W23-C
Dominance Measures						
1st Dominant Taxon	Baetidae	Baetidae	Baetidae	Ephemerellidae	Drunella doddsii	Heptageniidae
1st Dominant Abundance	17	54	184	103	24	98
% 1 Dominant Taxon	28.3%	19.6%	21.2%	22.2%	40.0%	15.0%
2nd Dominant Taxon	Oreogeton	Heptageniidae	Lumbriculidae	Capniidae	Baetidae	Baetidae
2nd Dominant Abundance	14	40	139	93	12	93
% 2 Dominant Taxa	23.3%	14.5%	16.0%	20.0%	20.0%	14.3%
3rd Dominant Taxon	Lumbriculidae	Lumbriculidae	Heptageniidae	Zapada	Diamesa	Zapada
3rd Dominant Abundance	7	40	131	40	4	83
% 3 Dominant Taxa	11.7%	14.5%	15.1%	8.6%	6.7%	12.7%
Functional Group Composition						
% Predators	28.33%	21.45%	16.72%	7.74%	6.67%	5.37%
% Shredder-Herbivores	13.33%	13.45%	16.61%	30.97%	10.00%	28.68%
% Collector-Gatherers	45.00%	42.55%	46.48%	49.25%	76.67%	44.79%
% Scrapers	11.67%	16.73%	19.49%	9.68%	6.67%	17.33%
% Macrophyte-Herbivore						
% Collector-Filterer	1.67%	3.64%	0.69%	0.65%		1.23%
% Omnivore		2.18%		0.22%		2.30%
% Parasite						
% Piercer-Herbivore						
% Gatherer						
% Unclassified	0.00%	0.00%	0.00%	1.51%	0.00%	0.31%
Functional Group Richness						
Predators Richness	3	12	13	12	3	16
Shredder-Herbivores Richness	4	5	7	5	2	5
Collector-Gatherers Richness	5	12	12	12	6	15
Scrapers Richness	2	3	4	5	3	4
MH Richness						
CF Richness	1	2	2	1		2
OM Richness		1		1		3
PA Richness						
Piercer-Herbivore Richness						
Gatherer Richness						
Unclassified	0	0	0	1	0	1
Diversity/Evenness Measures						
Shannon-Weiner H' (log 10)	0.94	1.20	1.17	1.15	0.86	1.23
Shannon-Weiner H' (log 2)	3.11	3.99	3.90	3.80	2.86	4.10
Shannon-Weiner H' (log e)	2.15	2.76	2.70	2.64	1.98	2.84
Simpson's Index (D)	0.15	0.10	0.11	0.11	0.21	0.09
Simpson's Index of Diversity (1 - D	0.85	0.90	0.89	0.89	0.79	0.91
Simpson's Reciprocal Index (1/D)	6.63	10.41	9.14	8.76	4.88	11.46
Biotic Indices						
Hilsenhoff Biotic Index	4.18	4.07	3.97	2.52	2.17	2.89

APPENDIX B - ADDITIONAL METRICS PER SAMPLE, EAGLE GOLD BENTHIC INVERTEBRATE DATA, 2017

Site:	**W26**	**W26**	**W26**	**W27**	**W27**	**W27**
Sample:	W26-A	W26-B	W26-C	W27-A	W27-B	W27-C
Dominance Measures						
1st Dominant Taxon	Eukiefferiella	Eukiefferiella	Lumbriculidae	Diamesa	Diamesa	Diamesa
1st Dominant Abundance	304	240	34	60	66	128
% 1 Dominant Taxon	43.2%	30.9%	53.1%	17.5%	24.6%	18.6%
2nd Dominant Taxon	Capniidae	Lumbriculidae	Eukiefferiella	Baetidae	Chironomidae	Baetidae
2nd Dominant Abundance	186	150	17	54	35	102
% 2 Dominant Taxa	26.4%	19.3%	26.6%	15.8%	13.1%	14.8%
3rd Dominant Taxon	Diamesa	Capniidae	Diamesa	Chironomidae	Baetidae	Zapada
3rd Dominant Abundance	48	132	5	36	34	58
% 3 Dominant Taxa	6.8%	17.0%	7.8%	10.5%	12.7%	8.4%
Functional Group Composition						
% Predators	2.27%	2.06%	3.13%	7.60%	10.07%	10.32%
% Shredder-Herbivores	32.67%	19.33%	1.56%	18.13%	14.93%	19.33%
% Collector-Gatherers	16.76%	43.81%	67.19%	54.97%	51.87%	49.56%
% Scrapers	4.83%	2.58%	1.56%	1.17%	1.87%	0.87%
% Macrophyte-Herbivore						
% Collector-Filterer		0.77%			0.37%	2.18%
% Omnivore	43.47%	30.93%	26.56%	7.60%	7.84%	10.03%
% Parasite						
% Piercer-Herbivore						
% Gatherer						
% Unclassified	0.00%	0.52%	0.00%	10.53%	13.06%	7.70%
Functional Group Richness						
Predators Richness	5	5	2	10	7	12
Shredder-Herbivores Richness	5	4	1	7	6	7
Collector-Gatherers Richness	8	10	4	16	14	14
Scrapers Richness	3	2	1	2	2	1
MH Richness						
CF Richness		1			1	2
OM Richness	2	1	1	2	2	2
PA Richness						
Piercer-Herbivore Richness						
Gatherer Richness						
Unclassified	0	1	0	1	1	1
Diversity/Evenness Measures						
Shannon-Weiner H' (log 10)	0.80	0.92	0.59	1.23	1.18	1.24
Shannon-Weiner H' (log 2)	2.65	3.07	1.96	4.10	3.93	4.12
Shannon-Weiner H' (log e)	1.84	2.12	1.36	2.84	2.72	2.86
Simpson's Index (D)	0.27	0.18	0.35	0.09	0.11	0.09
Simpson's Index of Diversity (1 - D	0.73	0.82	0.65	0.91	0.89	0.91
Simpson's Reciprocal Index (1/D)	3.76	5.68	2.84	11.57	9.50	11.48
Biotic Indices						
Hilsenhoff Biotic Index	4.93	5.65	7.06	4.19	4.21	4.02

APPENDIX B - ADDITIONAL METRICS PER SAMPLE, EAGLE GOLD BENTHIC INVERTEBRATE DATA, 2017

Site:	**W29**	**W29**	**W29**
Sample:	W29-A	W29-B	W29-C
Dominance Measures			
1st Dominant Taxon	Lumbriculidae	Baetidae	Baetidae
1st Dominant Abundance	187	26	71
% 1 Dominant Taxon	33.8%	20.6%	22.0%
2nd Dominant Taxon	Baetidae	Zapada	Lumbriculidae
2nd Dominant Abundance	137	24	63
% 2 Dominant Taxa	24.8%	19.0%	19.6%
3rd Dominant Taxon	Zapada	Rhyacophila	Zapada
3rd Dominant Abundance	60	10	41
% 3 Dominant Taxa	10.8%	7.9%	12.7%
Functional Group Composition			
% Predators	11.03%	34.92%	13.98%
% Shredder-Herbivores	19.89%	24.60%	28.57%
% Collector-Gatherers	64.01%	30.95%	47.83%
% Scrapers	3.25%	3.17%	9.01%
% Macrophyte-Herbivore			
% Collector-Filterer	0.18%		
% Omnivore	1.45%	0.79%	0.62%
% Parasite			
% Piercer-Herbivore			
% Gatherer			
% Unclassified	0.18%	5.56%	0.00%
Functional Group Richness			
Predators Richness	14	8	13
Shredder-Herbivores Richness	5	3	6
Collector-Gatherers Richness	11	6	8
Scrapers Richness	2	2	4
MH Richness			
CF Richness	1		
OM Richness	2	1	1
PA Richness			
Piercer-Herbivore Richness			
Gatherer Richness			
Unclassified	1	1	0
Diversity/Evenness Measures			
Shannon-Weiner H' (log 10)	0.98	1.12	1.09
Shannon-Weiner H' (log 2)	3.27	3.71	3.64
Shannon-Weiner H' (log e)	2.27	2.57	2.52
Simpson's Index (D)	0.19	0.10	0.12
Simpson's Index of Diversity (1 - D	0.81	0.90	0.88
Simpson's Reciprocal Index (1/D)	5.22	9.89	8.24
Biotic Indices			
Hilsenhoff Biotic Index	4.94	4.12	3.79

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE SITES, SEPTEMBER 2017

Site # W1

Site Description: Dublin Gulch upstream Stewart Gulch

Site Location: 7101545 N 460249 E

W1 Looking upstream

W1 looking downstream

Date Sampled: 20-Sep

Time Sampled: 16:30

Bankfull width: 2.9 m

Wetted Width: 1.8 m

Depth at Sample: 18 cm, 11 cm, 17 cm

Canopy Cover: 0 to 10%

Riparian Vegetation: alder, willows, grass, moss, spruce, blueberry, crowberry, lichen

Substrate: angular large gravels to small cobbles in a sandy matrix

Comments: Sampled 2 riffles upstream of the gauge and 2 downstream of the gauge

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE SITES, SEPTEMBER 2017

Site # W4

Site Description: Haggart Creek downstream of Dublin Gulch

Site Location: 7101223 N 458144 E

W4 looking upstream

W4 looking downstream

Date Sampled: 21-Sep

Time Sampled: 11:15

Bankfull width: 7.3 m

Wetted Width: 6.5 m

Depth at Sample: 20 cm, 24 cm, 26 cm

Canopy Cover: 0%, open

Riparian Vegetation: willows, spruce, grasses, fireweed, equisetum, labrador tea, alder

Substrate: gravels to cobbles/small boulders, slightly embedded

Comments: one benthic sample upstream of gauge and two downstream of gauge, good riffle areas

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE S

Site # W5

Site Description: Haggart Creek upstream Lynx Creek

Site Location: 7095887 N 457815 E

W5 looking upstream

Date Sampled: 22-Sep

Time Sampled: 14:30

Bankfull width: 9.0 m

Wetted Width: 7.2 m

Depth at Sample: 33 cm avg

Canopy Cover: 0 to 5%, some overhanging shrubs

Riparian Vegetation: willows, poplar, spruce, grasses, dwarf fireweed

All benthic samples collected upstream of the staff gauge

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE SITES, SEPTEMBER 2017

Site # W6

Site Description: Lynx Creek upstream of Haggart Creek

Site Location: 7095964 N 458099 E

W6 looking downstream from above staff gauge site

W6 looking upstream from discharge measuring site

Date Sampled: 22-Sep

Time Sampled: 15:30

Bankfull width: 6.0 m

Wetted Width: 5.5 m

Depth at Sample: 10 cm, 15 cm, 20 cm

Canopy Cover: 0 to 5%, some overhanging shrubs

Riparian Vegetation: willows, grasses, spruce, shrubby cinqfoil, alder

Substrate: sand to large gravels

Comments: water is quite deep (0.5m+) downstream of the gauge, sampled riffle areas upstream of gauge to access suitable depth usually grayling are sighted at this site but none present on this occasion

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE SITES, SEPTEMBER 2017

Site # W22

Site Description: Haggart Creek upstream of Dublin Gulch

Site Location: 7101377 N 458319 E

W22 looking upstream at riffle area, upstream of staff gauge

W22 looking upstream to the staff gauge

Date Sampled: 21-Sep

Time Sampled: 9:10

Bankfull width: 6.5

Wetted Width: 5.5

Depth at Sample: 30 cm avg

Canopy Cover: 0%, open

Riparian Vegetation: willows, spruce, grasses, fireweed

Substrate: large gravels to large cobbles

Comments: all benthic samples collected upstream of the staff gauge in riffle areas

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE SITES, SEPTEMBER 2017

Site # W23

Site Description: Haggart Creek downstream of Lynx Creek

Site Location: 7095682 N 457790 E

W23 looking downstream

W23 looking upstream from discharge measuring location

Date Sampled: 19-Sep

Time Sampled: 17:00

Bankfull width: 15.2 m

Wetted Width: 10.8 m

Depth at Sample: 18 cm, 25 cm, 12 cm

Canopy Cover: 0%

Riparian Vegetation: willows, alder, fireweed, grasses, moss, spruce, shrubby cinqufoil, blueberry, dwarf birch

Substrate: rounded gravels and cobbles

Comments:

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE SITES, SEPTEMBER 2017

Site # W26

Site Description: Stewart Gulch

Site Location: 7101443 N 460331 E

W26 looking downstream to flume

W26 looking upstream

Date Sampled: 20-Sep

Time Sampled: 15:00

Bankfull width: 1.8 m

Wetted Width: 1.35 m

Depth at Sample: 11 cm, 13 cm, 19 cm

Canopy Cover: 75%

Riparian Vegetation: willows, grasses, equisetum, moss, spruce, subalpine fir

Substrate: angular small to large gravels, partially embedded

Comments:

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE SITES, SEPTEMBER 2017

Site # W27

Site Description: Eagle Creek

Site Location: 7100997 N 458235 E

W27 looking upstream from the flume

Date Sampled: 20-Sep

Time Sampled: 18:15

Bankfull width: 3.0 m

Wetted Width: 0.84 m

Depth at Sample: 5 cm, 14 cm, 7 cm

Canopy Cover: 80%

Riparian Vegetation: moss, alder, willow, grasses, yarrow

Substrate: mostly fines with some small gravels

Comments:

APPENDIX B GENERAL HABITAT CHARACTERISTICS AT THE BENTHIC INVERTEBRATE SITES, SEPTEMBER 2017

Site # W29

Site Description: Haggart Creek downstream Eagle Creek

Site Location: 7099583 N 458225 E

W29 at datalogger location

Date Sampled: 21-Sep

Time Sampled: 14:20

Bankfull width: 6.5 m

Wetted Width: 5.3 m

Depth at Sample: avg 33 cm

Canopy Cover: 20%

Riparian Vegetation: birch, alder, spruce, moss, grass

Substrate: large gravels to boulders

Comments: all 3 benthic samples collected downstream of access trail where substrate had less boulders and velocity was a bit lower

APPENDIX B - BENTHIC INVERTEBRATE TAXONOMIC DATA FOR EAGLE GOLD PROJECT, 2017

Site:	W1	W1	W1	W4	W4	W4	W5	W5	W5	W6	W6	W6	W22	W22
Sample:	W1-A	W1-B	W1-C	W4-A	W4-B	W4-C	W5-A	W5-B	W5-C	W6-A	W6-B	W6-C	W22-A	W22-B
SubSample %:	50	50	62.5	50	75	75	100	100	100	37.5	37.5	25	100	100
Phylum: Arthropoda														
| Order: Collembola														
| Family: Hypogastruridae														
Subphylum: Hexapoda														
| Class: Insecta														
| Order: Ephemeroptera														
| Family: Ameletidae														
Ameletus				14	8	4					3			1
| Family: Baetidae	118	104	66	236	165	111	57	2	87	40	43	28	17	54
Baetis	4		2											
Baetis bicaudatus														
Baetis rhodani group					1									
| Family: Ephemerellidae	12	22	18	46	27	29	12		17	205	59	36		6
Drunella doddsii					1	3	2			3	13	16		5
Drunella spinifera														
| Family: Heptageniidae	4	4	5	38	44	32	44	1	33	133	216	356	2	40
Cinygmula										3	3			
Epeorus				4		5	3		1		19		5	3
Rhithrogena														
| Order: Plecoptera			2											
| Family: Capniidae	42	22	72	40	47	25	40		52	389	219	248		9
| Family: Chloroperlidae	6	10	6	10	3		1		1	3		8	2	3
Haploperla	6	2	8	4	1		2		1		13			
Paraperla	2	2	8		1	1								
Suwallia	2	2	5							3	8	24		
Sweltsa	8	2	11	6	4	1					3	4		1
| Family: Leuctridae	2	4	3	10	7	3	5		3	3			2	2
Paraleuctra		2												
| Family: Nemouridae		2	2	2	9	1		2						
Zapada	80	152	80	118	31	53	38	1	60	48	85	32	4	19
Zapada oregonensis group	20	20	18	8	5	11	6		9	3	8	4	1	5
Zapada cinctipes					1		2		3	3	3			
Zapada columbiana	2	2		2	1		1							
| Family: Perlodidae				2		1			3			4		
Diura												4		
Kogotus														
Megarcys		2	2											
| Family: Taeniopterygidae		2		4	8	5			17	5	3	12	1	2
Taenionema									2		3	4		
| Order: Trichoptera										3				
| Family: Glossosomatidae														
Glossosoma		2			3	5								3
| Family: Limnephilidae										3			1	
Ecclisomyia										3				
| Family: Rhyacophilidae														
Rhyacophila	2	2	3	14	5	13	1		5				1	19
Rhyacophila betteni group														
Rhyacophila hyalinata group		2												1
Rhyacophila vofixa group		2		6	4	8	1		1					3
| Family: Uenoidae														
Oligophlebodes														
| Order: Coleoptera		2												
| Order: Diptera														
| Family: Ceratopogonidae														
Bezzia/ Palpomyia														
Ceratopogon														
Culicoides														

APPENDIX B - BENTHIC INVERTEBRATE TAXONOMIC DATA FOR EAGLE GOLD PROJECT, 2017

Site:	W1	W1	W1	W4	W4	W4	W5	W5	W5	W6	W6	W6	W22	W22
Sample:	W1-A	W1-B	W1-C	W4-A	W4-B	W4-C	W5-A	W5-B	W5-C	W6-A	W6-B	W6-C	W22-A	W22-B
SubSample %:	50	50	62.5	50	75	75	100	100	100	37.5	37.5	25	100	100
| Subfamily: Diamesinae														
| Tribe: Diamesini														
Diamesa	10	10	16	6	3	1	2			8	13	20		3
Pagastia	82	142	66		1	1	1			16	35			
Pseudodiamesa												4		
| Subfamily: Orthocladiinae										3			1	1
Brillia	6		3	2		1	2		2					
Eukiefferiella		2		2					2					6
Heterotrissocladius														
Krenosmittia					1									
Limnophyes														
Metriocnemus														
Orthocladius complex	42	38	14	6	1	3	8		16	5	3	4		
Parakiefferiella	2													
Paraphaenocladius					1									
Parorthocladius														
Rheocricotopus	2		3							5	3			
Thienemanniella									1	3				
Tvetenia							2		16	8	11	16		1
| Subfamily: Podonominae														
Trichotanypus														1
| Subfamily: Tanypodinae														
| Tribe: Pentaneurini														
Thienemannimyia group														
| Family: Empididae						4	1		3			4		4
Clinocera		4												
Clinocerinae Unknown Genus A														
Neoplasta		2		4	1				1	3	3			
Oreogeton		4	3	8	4	8	1		1	8		8	14	17
Wiedemannia		2												4
| Family: Muscidae														
Limnophora														
| Family: Psychodidae														
Pericoma/Telmatoscopus			2	2	1	3	2		7		13	4		1
| Family: Simuliidae									3	3				
Helodon														2
Prosimulium/Helodon					4		1		20			4	1	8
Simulium														
| Family: Tipulidae				2										
Dicranota	2	10	8	2					1	5	11			1
Gonomyodes		2												
Limnophila						1								
Tipula						1								
| Order: Lepidoptera							1							
Subphylum: Chelicerata														
| Class: Arachnida														
| Order: Trombidiformes	4	2	2								3			2
| Family: Aturidae														
Aturus	18	4	14		9	3	2	1			3			
| Family: Feltriidae														
Feltria	22	30	11	2		4	1	1	1	3				
| Family: Hygrobatidae														
Atractides									1	3				
| Family: Lebertiidae														
Lebertia		2		6		1	3	3	1	3	5			
| Family: Sperchontidae														
Sperchon	6	6	2	4	1	3	5				3			3
| Order: Sarcoptiformes														
| Order: Oribatida		4												1
| Class: Malacostraca														
| Order: Amphipoda														
| Family: Crangonyctidae														
Crangonyx														
Phylum: Annelida														
Subphylum: Clitellata														
| Class: Oligochaeta														

APPENDIX B - BENTHIC INVERTEBRATE TAXONOMIC DATA FOR EAGLE GOLD PROJECT, 2017

Site:	**W1**	**W1**	**W1**	**W4**	**W4**	**W4**	**W5**	**W5**	**W5**	**W6**	**W6**	**W6**	**W22**	**W22**
Sample:	W1-A	W1-B	W1-C	W4-A	W4-B	W4-C	W5-A	W5-B	W5-C	W6-A	W6-B	W6-C	W22-A	W22-B
SubSample %:	50	50	62.5	50	75	75	100	100	100	37.5	37.5	25	100	100
| Order: Haplotaxida														
| Family: Haplotaxidae														
Haplotaxis														
| Order: Lumbriculida														
| Family: Lumbriculidae	158	128	80	68	9	57	1		2	21	53	340	7	40
Rhynchelmis		2			1					5	37	48		3
| Order: Tubificida														
| Family: Naididae														
Nais														
Total per sample	666	764	540	680	419	407	257	11	384	957	1065	1240	60	275
Total per site	1970			1506			652			3262			1202	
Taxonomic Richness/sample	28	41	31	32	38	34	32	7	34	33	34	25	15	35
Taxonomic Richness/site	48			51			43			50			51	
Taxa present but not included:														
Terrestrials														
Phylum: Arthropoda														
| Order: Collembola			3			1	2			11				
Subphylum: Crustacea														
| Class: Ostracoda				2	1	1	1				3			
| Class: Branchiopoda														
| Order: Cladocera		2				1				3	3			
| Class: Maxillipoda														
| Class: Copepoda							1		1	3	3			
Phylum: Nemata	2	2	2	2	1	1	1	1	1	3	0	4	0	0
Phylum: Platyhelminthes														
| Class: Turbellaria														
Totals:	2	4	5	4	2	4	5	1	2	20	9	4	0	0

APPENDIX B - BENTHIC INVERTEBRATE TAXONOMIC DATA FOR EAGLE GOLD PROJECT, 2017

Site:	**W22**	**W23**	**W23**	**W23**	**W26**	**W26**	**W26**	**W27**	**W27**	**W27**	**W29**	**W29**	**W29**
Sample:	W22-C	W23-A	W23-B	W23-C	W26-A	W26-B	W26-C	W27-A	W27-B	W27-C	W29-A	W29-B	W29-C
SubSample %:	37.5	75	100	100	50	50	100	100	100	62.5	75	100	100
Phylum: Arthropoda													
| Order: Collembola													
| Family: Hypogastruridae									1				
Subphylum: Hexapoda													
| Class: Insecta													
| Order: Ephemeroptera													
| Family: Ameletidae													
Ameletus	5			4	10	8	1		1		5	3	0
| Family: Baetidae	184	28	12	93	16	28		54	34	102	137	26	71
Baetis								2					
Baetis bicaudatus								7	8	10			
Baetis rhodani group									1	3	1		
| Family: Ephemerellidae	37	103		40				3	2	3	8		12
Drunella doddsii	5	24	24	51									4
Drunella spinifera				1									
| Family: Heptageniidae	131	39	2	98	26	18	1	3	2		15	3	22
Cinygmula	11	1		2	4								
Epeorus	19	3	1	12		2		1					2
Rhithrogena		1			4								
| Order: Plecoptera													
| Family: Capniidae	21	93	2	74	186	132		26	14	22	25	3	33
| Family: Chloroperlidae				3	2			1		3	4		1
Haploperla	3	4		2							1		2
Paraperla													
Suwallia	3		1	1									
Sweltsa				2						2			
| Family: Leuctridae	16							1					5
Paraleuctra													
| Family: Nemouridae								2		2			
Zapada	80	40		83	32	14		19	11	58	60	24	41
Zapada oregonensis group	16	1		8	2	2	1	8	5	16	15	4	3
Zapada cinctipes		3		3							3		
Zapada columbiana	3								1	2			
| Family: Perlodidae													3
Diura													
Kogotus		1											
Megarcys				2							1		
| Family: Taeniopterygidae	5	7	4	19	8			3	8	22	7		9
Taenionema		1		10				23	16	56	5		2
| Order: Trichoptera													
| Family: Glossosomatidae		1											
Glossosoma	8		1	1									4
| Family: Limnephilidae		1		2							3		
Ecclisomyia					2								
| Family: Rhyacophilidae													
Rhyacophila	37	4	1	3				9	9	24	7	10	11
Rhyacophila betteni group	3												
Rhyacophila hyalinata group								1		2			
Rhyacophila vofixa group	13			2				1	1	8	4	1	1
| Family: Uenoidae													
Oligophlebodes									3	6	3	1	1
| Order: Coleoptera													
| Order: Diptera													
| Family: Ceratopogonidae													
Bezzia/ Palpomyia									1				1
Ceratopogon													1
Culicoides										2			

APPENDIX B - BENTHIC INVERTEBRATE TAXONOMIC DATA FOR EAGLE GOLD PROJECT, 2017

Site:	W22	W23	W23	W23	W26	W26	W26	W27	W27	W27	W29	W29	W29
Sample:	W22-C	W23-A	W23-B	W23-C	W26-A	W26-B	W26-C	W27-A	W27-B	W27-C	W29-A	W29-B	W29-C
SubSample %:	37.5	75	100	100	50	50	100	100	100	62.5	75	100	100
| Subfamily: Diamesinae													
| Tribe: Diamesini													
Diamesa	3	3	4	11	48	64	5	60	66	128			1
Pagastia		8		4	10	12	3	3	3	2			1
Pseudodiamesa						4		1					
| Subfamily: Orthocladiinae					6	56		8		27	1		
Brillia						2		3	1	11			
Eukiefferiella				3	304	240	17	3	5	13	3		
Heterotrissocladius			1										
Krenosmittia	3							1					1
Limnophyes								11	1	2		3	
Metriocnemus						2		2					
Orthocladius complex	8	24	4	18				2	6	5	5	1	1
Parakiefferiella													
Paraphaenocladius	3												
Parorthocladius								2	1				
Rheocricotopus				2								1	
Thienemanniella		3		1									
Tvetenia	5	8		11							3	1	
| Subfamily: Podonominae													
Trichotanypus													
| Subfamily: Tanypodinae													
| Tribe: Pentaneurini													
Thienemannimyia group											1		
| Family: Empididae	29	1			2			1	3		1		
Clinocera						2							
Clinocerinae Unknown Genus A									1	8			
Neoplasta		4		8				7	10	11	12	5	8
Oreogeton	24	1	2	1						2	5	9	9
Wiedemannia	8			1		2				2	3		2
| Family: Muscidae													
Limnophora								1					
| Family: Psychodidae													
Pericoma/Telmatoscopus		19		35				9	2	6	1		
| Family: Simuliidae	3	3							1		1		
Helodon													
Prosimulium/Helodon	3			6		6				13			
Simulium										2			
| Family: Tipulidae	3				2								
Dicranota		1		1	4	4							
Gonomyodes													
Limnophila													1
Tipula													
| Order: Lepidoptera													
Subphylum: Chelicerata													
| Class: Arachnida													
| Order: Trombidiformes		1					1				3		
| Family: Aturidae													
Aturus	11	8		4	6					2	4	2	3
| Family: Feltriidae													
Feltria	3			1	2	6		2	2	5		3	2
| Family: Hygrobatidae													
Atractides	3												
| Family: Lebertiidae													
Lebertia	5	7		2							8	4	
| Family: Sperchontidae													
Sperchon	3	3		1		2		1			7	10	1
| Order: Sarcoptiformes													
| Order: Oribatida		1					1	2					
| Class: Malacostraca													
| Order: Amphipoda										2			
| Family: Crangonyctidae													
Crangonyx										2			
Phylum: Annelida													
Subphylum: Clitellata													
| Class: Oligochaeta													

APPENDIX B - BENTHIC INVERTEBRATE TAXONOMIC DATA FOR EAGLE GOLD PROJECT, 2017

Site:	**W22**	**W23**	**W23**	**W23**	**W26**	**W26**	**W26**	**W27**	**W27**	**W27**	**W29**	**W29**	**W29**
Sample:	W22-C	W23-A	W23-B	W23-C	W26-A	W26-B	W26-C	W27-A	W27-B	W27-C	W29-A	W29-B	W29-C
SubSample %:	37.5	75	100	100	50	50	100	100	100	62.5	75	100	100
| Order: Haplotaxida													
| Family: Haplotaxidae													
Haplotaxis											1		
| Order: Lumbriculida													
| Family: Lumbriculidae	139	5		10	24	150	34	21	10	46	187	5	63
Rhynchelmis				2		12							
| Order: Tubificida													
| Family: Naididae													
Nais					2								
Total per sample	867	465	60	652	704	776	64	342	268	688	553	126	322
Total per site		1177			1544			1298			1001		
Taxonomic Richness/sample	38	37	14	46	23	24	9	38	33	39	36	21	33
Taxonomic Richness/site		54			36			55			51		
Taxa present but not included:													
Terrestrials									1				
Phylum: Arthropoda													
| Order: Collembola		17	3		6	8		14	9	30			
Subphylum: Crustacea													
| Class: Ostracoda		1									1	1	1
| Class: Branchiopoda													
| Order: Cladocera				1									
| Class: Maxillipoda													
| Class: Copepoda		1		1				1	1	2			
Phylum: Nemata	3	1	1	1	2	2	1	1	1	2	1	1	1
Phylum: Platyhelminthes													
| Class: Turbellaria	3					2							
Totals:	6	20	4	3	8	12	1	16	12	34	2	2	2

APPENDIX L

Fish and Fish Habitat Monitoring at the Eagle Gold Project 2017

THIS PAGE INTENTIONALLY LEFT BLANK

EAGLE GOLD PROJECT
FISH AND FISH HABITAT MONITORING REPORT
2017

prepared for

Victoria GOLD CORP

Submitted by

Laberge Environmental Services

December 2017

Eagle Gold Project
Fish and Fish Habitat
Monitoring Report
2017

Nicholas de Graff, Can-nic-a-nick Environmental Sciences
P.O. Box 10106, Whitehorse, YT Y1A 7A1

Recommended citation: de Graff, N. M. 2017. Eagle Gold Project, Fish and Fish Habitat Monitoring Report 2017. Prepared for Victoria Gold, December 2017. 13p + appendices.

Use of the information in this report is for education and information purposes. If you want to use any portion of this report in any publications, you must use the citation above or please contact Victoria Gold Corporation if you require a copy.

Cover Photo: Haggart Creek monitoring site HC2.
Photo Credits: N. de Graff

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

The Eagle Gold Project currently under development by StrataGold Corporation, a subsidiary of Victoria Gold Corporation, is located in Dublin Gulch in the upper reaches of Haggart Creek in north-central Yukon near the town of Mayo, about 400 km north of Whitehorse. The project as proposed is comprised of an open pit mine and associated mine features, improvements to the Haggart Creek Road, and a 44 kilometer, 69 kV transmission line. It is within the Mayo Mining District where placer mining activities on Haggart Creek have occurred intermittently since 1895 (Tempelman-Kluit 1964).

Various projects have been recently initiated at the Eagle Gold Project to monitor all phases of development; construction, operation and closure as outlined in the Environmental Monitoring, Surveillance and Adaptive Management Plan (EMSAMP) version 2017-01 (StrataGold 2017). The purpose of this study is to report ongoing monitoring of fish and fish habitat related to all phases of the Project. Relevant past data (Stantec 2010) has been examined and is presented where appropriate. This study represents the first annual late summer fish monitoring program and was completed in September 2017.

2.0 STUDY AREA

The Eagle Gold Project is accessible via the Silver Trail and the South McQuesten and Haggart Creek Roads. The Project is situated within the traditional territory of the First Nation of the Na-Cho Nyäk Dun. The watersheds in the study area originate in the low lying mountains between the East and South McQuesten drainage basins of the Stewart Plateau in the north-central Yukon.

The principle drainage is Haggart Creek of which Dublin Gulch, Eagle, Ironrust and Lynx creeks are tributaries. Haggart Creek flows southwest and eventually discharges into the South McQuesten River. The South McQuesten River is a tributary of the Stewart River, a large tributary of the Yukon River drainage basin.

The study area is located in the Boreal Cordillera ecozone that is characterized by mountain ranges that contain numerous high peaks and extensive plateaus, and are separated by wide valleys and lowlands. Landscape features of the region are primarily the result of past glacial activity, erosion and widespread deposits however the majority of the study area remained un-glaciated during the last glacial period (Bostock 1965). Much of the Project area displays physiographic characteristics of the unglaciated areas of the region, with narrow, deep valleys that extend to the head of streams, where they rise steeply and end abruptly (StrataGold 2015).

Black spruce, trembling aspen, balsam poplar, and white birch are the most common forest types. At higher elevations, scrub birch and willow occur in subalpine sections with extensive landscapes of rolling alpine tundra characterized by sedge-

dominated meadows, and lichen-colonized rock fields. The climate in this region is an interior subalpine type with long cold winters and summers that are brief and cool.

3.0 METHODS

A total of 5 monitoring sites (HC1, HC2, HC3, IR2, and L1) were assessed in Haggart, Ironrust and Lynx creeks during this study. Figure 1 depicts the locations of each monitoring site. All monitoring sites are consistent with locations that were previously identified and assessed in past baseline studies (Stantec 2015) and are referred to in the Environmental Monitoring, Surveillance and Adaptive Management Plan (StrataGold 2017). Descriptions of the drainages included in this project are presented in Table 1.

3.1 Aquatic Habitat Surveying

A section of the stream containing representative mesohabitat type (riffle, rapid, run, glide, pool or backwater) was surveyed at each monitoring site (HC1 225 meters, HC2 175 meters, HC3 160 meters, IR2 100 meters and L1 100 meters). CABIN (2017) field assessment sheets and British Columbia Fish and Fish Habitat Inventory (BCMSRM 2001) field protocols were used to record biophysical data. This included the geo-referencing of each monitoring location with a hand held Garmin GPS (datum WGS 87). Determined attributes from field measurements included those related to site (date, elevation and UTM coordinates), channel characteristics (channel and wetted widths, gradient, stage, fish cover, residual pool depth, crown closure and riparian vegetation) and substrate data (Wolman pebble count, embeddedness, interstitial material and periphyton coverage). Digital photographs included upstream and downstream perspectives of each sampled site. Basic water quality parameters were additionally recorded (conductivity, pH and temperature).

3.2 Fish Sampling

Fish sampling was conducted under a permit (XR 284 2017) obtained from Fisheries and Oceans Canada. At each monitoring site electrofishing and minnow trapping were the primary techniques used to establish fish presence. For electrofishing, the conductivity of the water was first noted to assist in the initial setup. Captured fish were placed in a water filled bucket. The number of fish that were observed or “flipped” that avoided capture with the dipnet was also noted. Voltage was adjusted to enable fish in the bucket to recover within 5 to 20 seconds. A standard waveform of between 275 to 500 volts and a 15 percent duty cycle was effectively used throughout the project.

Galvanized ¼ inch “Gee” type minnow traps, which were baited with suspended sacs of Yukon River salmon roe, were also utilized at each sampling site using

methods described by the Yukon River Panel (2007). Minnow traps were set in various habitat types such as scour pools, side-channels, undercut banks or in woody debris that offered cover for fish. A total of five minnow traps were set for an overnight period at each monitoring site. Soak times were recorded for each trap. Angling employed the use of small spinners. The time spent angling was used as an index of sampling effort.

All captured fish were measured for either a fork or total length (± 1 mm) and weight (± 0.1 gm). Weight was determined using a digital scale by first blotting excess water from the fish and then placing each fish into a container on the scale. Total length was recorded for slimy sculpin and fork length for Arctic grayling and captured juvenile Chinook salmon. Fish were given time to recover in a bucket before being live-released in a still water area near their site of capture.

4.0 RESULTS AND DISCUSSION

4.1 Aquatic Habitat

A comparative summary of aquatic habitat characteristics determined for the five monitoring sites is presented in Table 2. Individual site summary tables are presented in Appendix I. While all sites shared a similar riffle-pool-run morphology, specific habitat characteristics varied and were dependent on stream gradients that link hydrological processes to substrate materials and channel form.

Site HC1, situated on the mainstem of Haggart Creek, had the greatest average channel width of 11.0 meters. Deep pool and undercut bank microhabitats were the dominant fish cover types with total cover estimated to be about 15 percent of the available aquatic habitat at this location. This site also had the deepest estimated residual pool depth relative to the other sites (0.7 m). Course gravels dominated the substrates and the embeddedness of individual rocks averaged 60 percent. Fine silt (<0.1 cm) was the predominant type of interstitial material (Figure 3). Periphyton coverage was moderate with rocks having a noticeable slippery feel, with patches of thicker green to brown algae. The irregular wandering channel contained some disturbance indicators in the form of elevated bars and multiple exposed channels that appear to reflect past upstream activities related to historic mining.

Site HC2 is about 4.5 kilometers upstream of site HC1. The landscape at this location displays physical modifications resulting from past placer mining activities. This monitoring site is situated just downstream of the Dublin Gulch confluence, the principle drainage associated with the Eagle Gold Project. Mining activity, access roads and construction activities were very evident near this site. The stream channel at this location was only marginally narrower and of slightly higher gradient than the downstream site. Total fish cover was low and estimated to be only 5 percent of the available aquatic habitat in the stream. Fish cover that was present was largely boulders however other cover types included some undercut banks, overhanging vegetation and the occasional deep scour pools with relatively

low residual depths (0.4 m). Course gravels dominated the substrate and the embeddedness of individual rocks averaged 68 percent. The interstitial material was largely composed of fine sands and gravel (0.2 to 1.6 cm). Periphyton coverage was noticeable with rocks having a definite slippery feel with a yellow brown to light green coloration on the surface. The channel pattern was sinuous with several disturbance indicators including elevated bars, multiple and abandoned channels, and areas of extensive bed scour.

Site HC3 is situated less than a kilometer upstream of site HC2. Higher stream velocities associated with the more confined channel (6.1 meters) resulted in the predominance of riffles, rapids and straight runs at this site. Boulders and undercut banks were the dominant forms of fish cover. The only noticeable other cover type that was present was overhanging vegetation along the channel margins. Total cover was estimated to be only 10 percent of the available habitat in the channel. Course gravel and various size classes of cobble were equally distributed throughout substrate (Figure 2). The embeddedness of individual rocks averaged 68 percent and the interstitial material was gravel (0.2 to 1.6 cm). Similar to site HC1 further downstream, periphyton coverage was again noticeable with rocks having a definite slippery feel with a yellow brown to light green coloration on the surface. The channel was sinuous in pattern and occasionally confined by the valley wall. No disturbance indicators were observed in the channel.

Riffles and rapids were the dominant mesohabitat channel types at site IR2 in Ironrust Creek. The channel width of 3.7 meters was the smallest of the project sites that were surveyed. Fish cover was low and estimated to be only 5 percent of the aquatic habitat that was present, largely consisting of boulders and overhanging vegetation. Pools were largely the result of bed scouring with residual depths estimated to be <0.2 meters. While a good proportion of the substrates were large gravels, the various size classes of cobbles dominated the channel. The gradient of this site was estimated to be 2.9 percent and was reflected in the larger armoring of the stream bed. The embeddedness of individual rocks averaged 55 percent and the interstitial material was composed of small gravel (0.2 to 1.6 cm). Periphyton thickness was modest with only a slightly slippery feel to the rocks. The sinuous channel pattern was frequently confined in the valley and no disturbance indicators were observed.

The stream channel of Lynx Creek at site L1 was a classic riffle-pool-glide sequence. Total fish cover was estimated to be 20 percent of the aquatic habitat present. Deep pools and undercut banks were the dominant fish cover types but small woody debris and overhanging vegetation also contributed when present. The estimated residual pool depth of 0.6 meters was one of the deepest in comparison to the other sites providing valuable habitat for fish. The low gradient of the channel at this site (1.1 percent) is likely a function of the large alluvial fan in the area that forms the confluence of Lynx Creek with Haggart Creek. Substrates at site L1 were composed of varying size classes of gravels making for some of the best substrates for fish located in the project area. The interstitial material was mostly composed of fines

(<0.1 cm) and the embeddedness of the rocks was 30 percent, the lowest of all the sites studied. Periphyton on the rock surfaces was modest with only a slightly slippery feel apparent. The channel pattern was characterized with irregular meanders and was completely unconfined being located near the middle of the Lynx Creek valley. No disturbance indicators were observed.

4.2 Fish Distribution

The composition of the catch from this study was represented by three fish species that included in decreasing frequency of capture: slimy sculpin (58) Arctic grayling (20) and Chinook salmon juveniles (7). A summary of sampling effort and catch at each of the five monitoring sites is presented in Table 3. All three species have been previously documented in the Haggart Creek watershed (Hallam Knight Piesold 1995, 1996; Madrone 1996; Stantec 2010). Other species reported to be present in the watershed but not captured during the current study include round whitefish, burbot, northern pike and Arctic lamprey. These species have been sporadically captured in the past and largely associated with sampling sites in the lower reaches of the watershed. In the most recent sampling by Stantec (2010) only slimy sculpin and Arctic grayling were captured in their baseline assessments of 10 watercourses that represented 38 sampling sites.

During this study slimy sculpin dominated the catch and were represented in varying abundance at each of the five monitoring sites. Site L1 in Lynx Creek had the highest capture frequency and was the only site where sculpin fry were readily observed in still water areas of the stream. Similar numbers of sculpin were represented in the catch in each of the three monitoring sites on the mainstem of Haggart Creek. Monitoring site IR2 in Ironrust Creek was only represented by the capture of two adults in the minnow traps. High water and turbidity prevented sampling of this site with the electroshocker and therefore inferences of abundance cannot be made to the other sites. Sculpin total lengths ranged from 33 to 110 mm indicating the presence of both juvenile and adult life history stages. This size range was similar to those reported by Stantec (2010) in their baseline study. A length frequency histogram of all captured sculpin is presented in Figure 4.

Arctic grayling were represented in the catch in modest numbers at each of the monitoring sites with the exception of site IR2 on Ironrust Creek. Site IR2 was the only monitoring location where the electroshocker was not deployed due to high water and turbidity making any inference on their presence or absence at this location uncertain. Grayling have been documented to occur at this site in previous studies (Stantec 2010). Captured grayling during this project were all young-of-the-year, ranging in fork length from 64 to 83 mm. Older age classes and larger grayling were noticeably absent in the catch. This artifact may have been a function of seasonal movements initiated by cooler stream temperatures (4 to 6.5°C) associated with the September sampling window. Arctic grayling adults were however observed in a deep pool on the mainstem of Haggart Creek just downstream of HC2.

Previous studies reported the presence of Chinook salmon in Haggart Creek (Madrone 1996; Hallam Knight Piésold 1995, 1996). In the baseline study by Stantec (2010) Chinook salmon were not captured at any of the Haggart creek mainstem monitoring sites despite four separate sampling occasions. In this study juvenile Chinook salmon (age 0^{+}) were only infrequently captured at monitoring sites HC1 and HC3. The presence at these locations represents their furthest upstream occurrence in the Haggart Creek watershed.

5.0 CONCLUSION

Biophysical characteristics observed and fish captured at each of the five monitoring site during September of 2017 are similar to previous surveys. While the absolute number of captured fish varies, the species composition continues to be consistent and indicative of a stable fish community. Notable during this project was the capture of several Chinook salmon juveniles (age 0^{+}) in the mainstem of Haggart Creek at monitoring sites HC1 and HC3. Chinook salmon juveniles have not been previously documented at these sites or this far upstream in the Haggart Creek watershed.

6.0 REFERENCES

BC Ministry of Sustainable Resource Management (BCMSRM). 2001. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures. Version 2.0. Resource Information Standards Committee (RISC), Victoria, BC. 170 pp.

Bostock. 1965. Physiography of the Canadian Cordillera with Special Reference to the area North of the Fifty- fifth parallel; Department of Energy and Mines, Geological Survey of Canada, ME247.

CABIN. 2017. Canadian Aquatic Biomonitoring Network. Environment Canada. Web Site: http://ec.gc.ca/rcba-cabin [accessed December 2017]

Hallam Knight Piésold Ltd. 1995. Dublin Gulch Project, Preliminary Baseline Fisheries Study Proposal. Prepared for Department of Fisheries and Oceans Canada. 8 pp.

Hallam Knight Piésold Ltd. 1996. New Millennium Mining Ltd., Dublin Gulch Project, 1996 Fisheries Survey. Prepared for Department of Fisheries and Oceans Canada. 12 pp.

Madrone Environmental Services Ltd. 2006. Dublin Gulch Project Gap Analysis: Environmental Baseline Information. Prepared for Strata Gold Corporation. 32 pp.

Stantec Consulting Ltd. 2010. Eagle Gold Project: Environmental Baseline Report – Fish and Fish Habitat. Prepared for Victoria Gold Corporation, Vancouver, BC.

StrataGold Corporation. 2015. Eagle Gold Project Environmental Characterization Report, March 2015 86 pp.

StrataGold Corporation. 2017. Eagle Gold Project Environmental Monitoring, Surveillance and Adaptive Management Plan. Version 2017-01. June 2017.

Tempelman-Kluit, D. J. 1964. Geology of the Haggart Creek-Dublin Gulch Area, Mayo district, Yukon Territory. (T). Retrospective Theses and Dissertations, 1919-2007. University of British Columbia. [accessed December 2017]

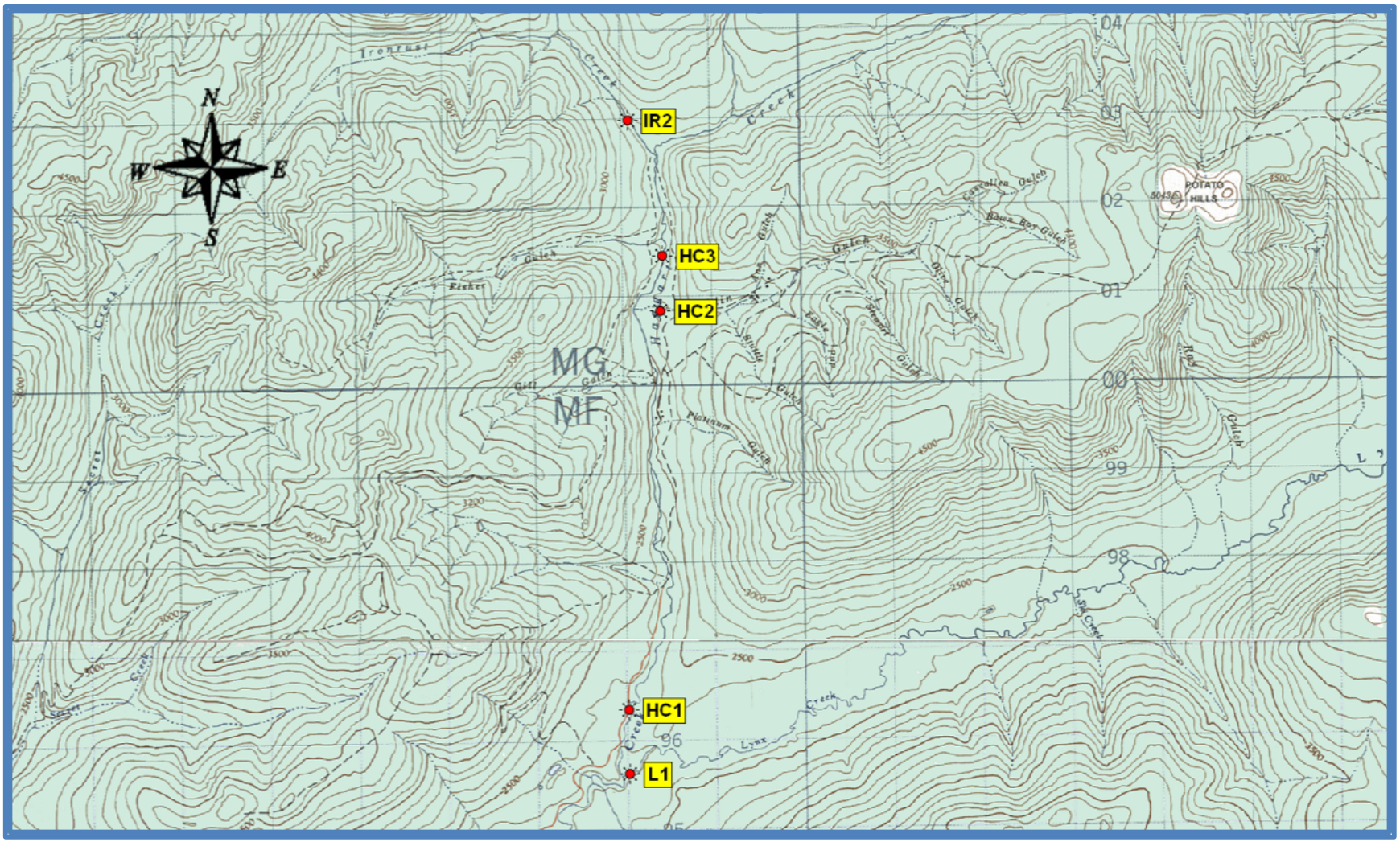


Figure 1 Monitoring locations associated with the Eagle Gold Project, September 2017.

Table 1 Drainage descriptions and monitoring sites associated with the Eagle Gold Project.

DRAINAGE	DESCRIPTION	MONITORING SITES
Haggart Creek	Receiving waters from the Eagle Gold Property and discharges into the South McQuesten River.	HC1, HC2 and HC3
Ironrust Creek	Creek draining the west face of Haggart Dome and discharges into Haggart Creek upstream of the Eagle Gold Property.	IR2
Lynx Creek	Creek draining the south face of Potato Hills and discharges into Haggart Creek downstream of the Eagle Gold Property.	L1

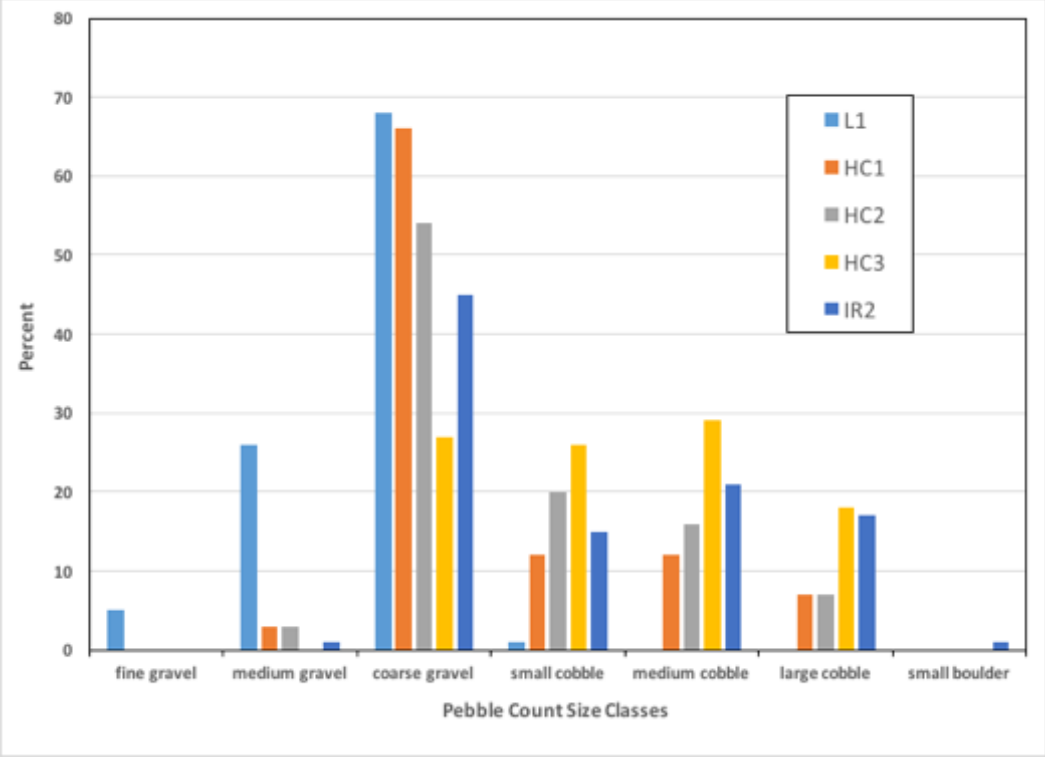


Figure 2 Substrate composition based on pebble counts at monitoring sites associated with the Eagle Gold Project, September 2017.

Table 2 Summary of biophysical characteristics determined at monitoring sites associated with the Eagle Gold Project, September 2017.

PARAMETER		MONITORING SITES				
		Haggart Creek Drainage			Ironrust Creek Drainage	Lynx Creek Drainage
		HC1	HC2	HC3	IR2	L1
SITE	Survey Date	Sept 5, 2017	Sept 6, 2017	Sept 7, 2017	Sept 7, 2017	Sept 5, 2017
	Site Elevation (m)	719	783	783	818	712
	UTM (08 V)	E 457967 N 7096518	E 458085 N 7101152	E 458427 N 7101584	E 458005 N 7103153	E 458003 N 7095825
BIOPHYSICAL DATA	Mean channel width (m)	11.0	10.8	6.1	3.7	6.8
	Mean wetted width (m)	7.7	6.3	6.1	3.5	4.7
	Gradient (%)	1.0	1.4	1.1	2.9	0.1
	Stage	moderate	moderate	high	high	moderate
	Total fish cover (%)	15	5	10	5	20
	Dominant cover types	deep pool, undercut banks	boulders	boulders, undercut banks	boulders, overhanging vegetation	deep pools, undercut banks
	Subdominant cover types	small woody debris, overhanging vegetation	deep pools, undercut banks, overhanging vegetation	overhanging vegetation	undercut banks	small woody debris, overhanging vegetation
	Residual pool depth (m)	0.7	0.4	0.4	< 0.2	0.6
	Crown closure (%)	0	0	0	0	0

Table 2 Continued

PARAMETER		MONITORING SITES				
		Haggart Creek Drainage			Ironrust Creek Drainage	Lynx Creek Drainage
		HC1	HC2	HC3	IR2	L1
SUBSTRATE	Dominant Bed Material (mm)	coarse gravel	coarse gravel	medium cobble	course gravel	course gravel
	Subdominant Bed Material (mm)	small to medium cobble	small cobble	course gravel	medium cobble	medium gravel
	Embeddedness (%)	60	68	68	55	30
	Interstitial Material (cm)	< 0.1	0.2-1.6	0.2-1.6	0.2-1.6	< 0.1
	Periphyton thickness (mm)	1-5	0.5-1	1-5	0.5-1	0.5-1
MORPHOLOGY	Channel Pattern	irregular meandering	sinuous	sinuous	sinuous	irregular meandering
	Confinement	unconfined	occasionally confined	occasionally confined	frequently confined	unconfined
	Disturbance Indicators	elevated bars, multiple channels	multiple / abandoned channels, elevated bars, bed scour	none	none	none

Figure 3 Fine silt was the predominant interstitial material that embedded rocks at monitoring site HC1 on Haggart Creek, September 2017.

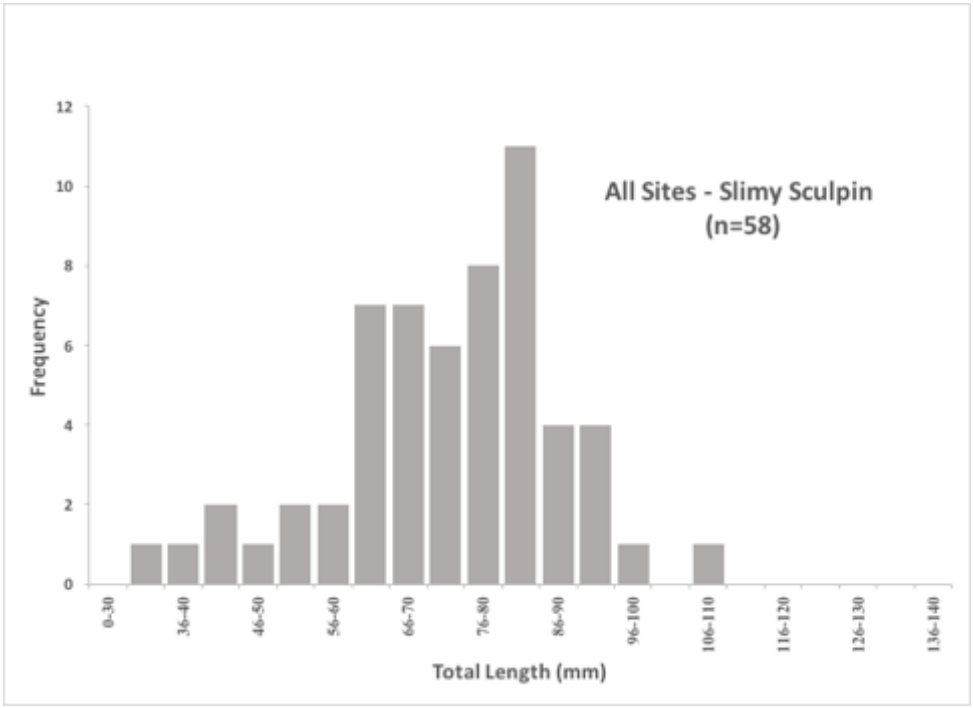


Figure 4 Length frequency of captured slimy sculpin at monitoring sites associated with the Eagle Gold Project, September 2017.

Table 3 Summary of sampling effort and catch using three fish capture techniques at monitoring sites associated with the Eagle Gold Project, September 2017.

MONITORING SITE		CAPTURE METHOD	SAMPLE EFFORT	CATCH			OBSERVED
				Arctic Grayling	Chinook Salmon	Slimy Sculpin	
Haggart Creek	HC1	Angling	35 min	0	0	0	
	HC1	Electro	613 sec	10	1	7	4 grayling and 2 sculpin
	HC1	MNT	16.0 hrs	3	1	3	
	HC2	Electro	519 sec	1	0	10	2 sculpin
	HC2	MNT	20.3 hrs	0	0	1	
	HC3	Electro	537 sec	1	4	5	4 sculpin
	HC3	MNT	18.0 hrs	0	1	4	
Ironrust Creek	IR2	MNT	19.0 hrs	0	0	2	
Lynx Creek	L1	Angling	30 min	0	0	0	
	L1	Electro	547 sec	2	0	22	1 grayling, 4 sculpin and fry
	L1	MNT	20.0 hrs	3	0	4	

Legend: MNT = Minnow trap (5 traps)
Electro = Electrofishing

APPENDIX 1
SITE SUMMARY SHEETS

SITE – HAGGART CREEK (HC1)

UTM Coordinates: E 457967 **N** 7096518 **Watercourse Name:** Haggart Creek

Surveyed Length (m): 225 **Survey date:** September 5, 2017

Baseline Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

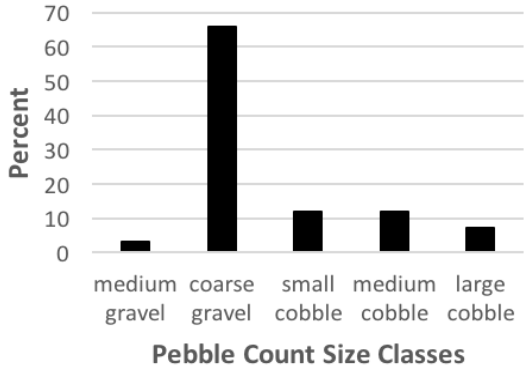
Mean channel width (m): 11.0
Mean wetted width (m): 7.7
Channel gradient (%): 1.0

Air temperature (°C): 12.0
Water temperature (°C): 6.5
Stage: Moderate
Turbidity: Clear
Conductivity ($\mu s/cm$): 390
pH: 8.6

Fish cover: Moderate (15%)
Functioning LWD: Few
Dominant cover types: DP, U
Subdominant cover types: SWD, OV
Residual pool depth (m): 0.7
Crown closure (%): 0

Habitat types: Riffle, rapids and pool
Dominant surrounding land use: Forest
RB riparian vegetation: Grasses and shrubs
LB riparian vegetation: Grasses and shrubs

SUBSTRATE



Embeddedness (%): 60
Interstitial material (cm): <0.1
Periphyton thickness (mm): 1-5

MORPHOLOGY

Channel pattern: Irregular meandering
Confinement: Unconfined
Disturbance indicators: EB, MC

FISH

Sampling method(s): Electrofishing (single pass), minnow trapping and angling
Fish captured: Arctic grayling, slimy sculpin and Chinook salmon

SITE – HAGGART CREEK (HC2)

UTM Coordinates: E 458085 **N** 7101152 **Watercourse Name:** Haggart Creek

Surveyed Length (m): 175 **Survey date:** September 6, 2017

Baseline Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

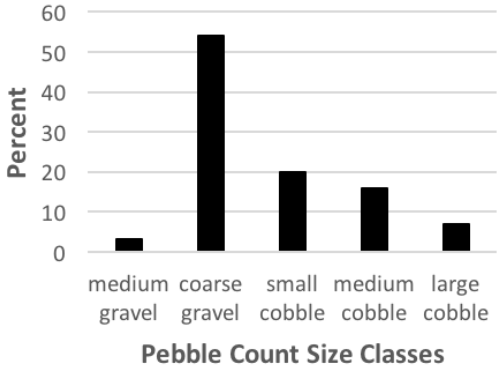
Mean channel width (m): 10.8
Mean wetted width (m): 6.3
Channel gradient (%): 1.4

Air temperature (°C): 12.0
Water temperature (°C): 5.0
Stage: Moderate
Turbidity: Clear
Conductivity ($\mu s/cm$): 330
pH: 8.6

Fish cover: Moderate (5%)
Functioning LWD: None
Dominant cover types: B
Subdominant cover types: U, OV, DP
Residual pool depth (m): 0.4
Crown closure (%): 0

Habitat types: Riffle, rapids and pool
Dominant surrounding land use: Forest, mining
RB riparian vegetation: Grasses and shrubs
LB riparian vegetation: Grasses and shrubs

SUBSTRATE



Embeddedness (%): 68
Interstitial material (cm): 0.2-1.6
Periphyton thickness (mm): 0.5-1

MORPHOLOGY
Channel pattern: Sinuous
Confinement: Frequently confined
Disturbance indicators: AC, EB, MC

FISH
Sampling method(s): Electrofishing (single pass) and minnow trapping
Fish captured: Arctic grayling and slimy sculpin

SITE – HAGGART CREEK (HC3)

UTM Coordinates: E 458427 **N** 7101584 **Watercourse Name:** Haggart Creek

Surveyed Length (m): 160 **Survey date:** September 7, 2017

Baseline Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

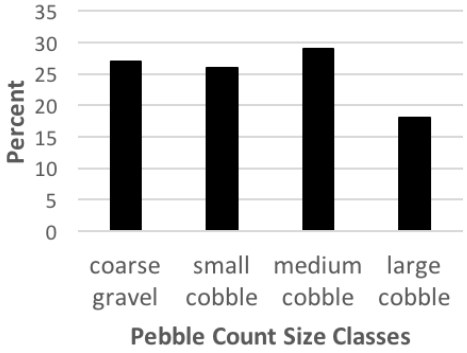
Mean channel width (m): 6.1
Mean wetted width (m): 6.1
Channel gradient (%): 1.1

Air temperature (°C): 7.0
Water temperature (°C): 4.5
Stage: High
Turbidity: Turbid
Conductivity ($\mu s/cm$): 240
pH: 8.2

Fish cover: Moderate (10%)
Functioning LWD: None
Dominant cover types: B, U
Subdominant cover types: OV
Residual pool depth (m): 0.4
Crown closure (%): 0

Habitat types: Riffle, rapids and straight run
Dominant surrounding land use: Forest
RB riparian vegetation: Shrubs
LB riparian vegetation: Shrubs

SUBSTRATE



Embeddedness (%): 68
Interstitial material (cm): 0.2-1.6
Periphyton thickness (mm): 1-5

MORPHOLOGY
Channel pattern: Sinuous
Confinement: Occasionally confined
Disturbance indicators: None

FISH
Sampling method(s): Electrofishing (single pass) and minnow trapping
Fish captured: Arctic grayling, slimy sculpin and Chinook salmon

SITE – IRONRUST CREEK (IR2)

UTM Coordinates: E 458005 **N** 7103153 **Watercourse Name:** Ironrust Creek

Surveyed Length (m): 100 **Survey date:** September 7, 2017

Baseline Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

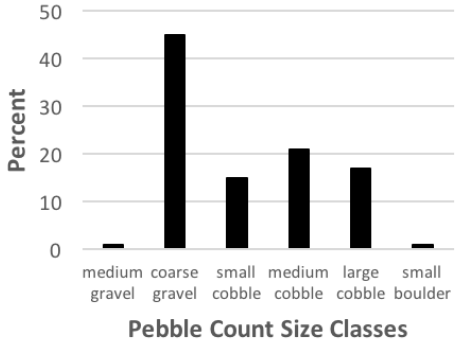
Mean channel width (m): 3.7
Mean wetted width (m): 3.5
Channel gradient (%): 2.9

Air temperature (°C): 8.0
Water temperature (°C): 4.0
Stage: High
Turbidity: Turbid
Conductivity ($\mu s/cm$): 150
pH: 7.8

Fish cover: Moderate (5%)
Functioning LWD: None
Dominant cover types: B, OV
Subdominant cover types: U
Residual pool depth (m): <0.2
Crown closure (%): 0

Habitat types: Riffle and rapids
Dominant surrounding land use: Forest
RB riparian vegetation: Shrubs
LB riparian vegetation: Shrubs

SUBSTRATE



Embeddedness (%): 55
Interstitial material (cm): 0.2-1.6
Periphyton thickness (mm): 0.5-1

MORPHOLOGY
Channel pattern: Sinuous
Confinement: Frequently confined
Disturbance indicators: None

FISH
Sampling method(s): Minnow trapping
Fish captured: Slimy sculpin

SITE – LYNX CREEK (L1)

UTM Coordinates: E 458003 **N** 7095825 **Watercourse Name:** Lynx Creek

Surveyed Length (m): 100 **Survey date:** September 5, 2017

Baseline Fish-bearing Status: Fish-bearing

UPSTREAM VIEW

DOWNSTREAM VIEW

BIOPHYSICAL DATA

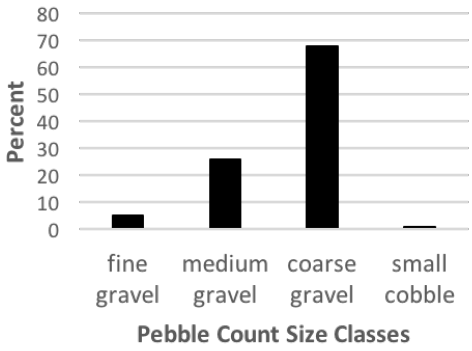
Mean channel width (m): 6.8
Mean wetted width (m): 4.7
Channel gradient (%): 0.1

Air temperature (°C): 10.0
Water temperature (°C): 5.0
Stage: Moderate
Turbidity: Clear
Conductivity ($\mu s/cm$): 390
pH: 8.8

Fish cover: Moderate (20%)
Functioning LWD: Few
Dominant cover types: DP, U
Subdominant cover types: SWD, OV
Residual pool depth (m): 0.6
Crown closure (%): 0

Habitat types: Riffle, straight run and pool
Dominant surrounding land use: Forest
RB riparian vegetation: Grasses and shrubs
LB riparian vegetation: Grasses and shrubs

SUBSTRATE



Embeddedness (%): 30
Interstitial material (cm): < 0.1
Periphyton thickness (mm): 0.5-1

MORPHOLOGY
Channel pattern: Irregular meandering
Confinement: Unconfined
Disturbance indicators: None

FISH
Sampling method(s): Electrofishing (single pass), minnow trapping and angling
Fish captured: Arctic grayling and slimy sculpin

APPENDIX II
FISH CAPTURE DATA

APPENDIX II Length, weight and condition factors of various species captured at monitoring sites within drainages associated with the Eagle Gold Project, September 2017.

Monitoring Site	Species	Length (mm)	Weight (gm)
HC1	AG	64	2.6
HC1	AG	64	2.6
HC1	AG	64	2.0
HC1	AG	66	2.8
HC1	AG	66	3.3
HC1	AG	66	3.1
HC1	AG	66	2.3
HC1	AG	67	2.8
HC1	AG	68	2.7
HC1	AG	68	2.8
HC1	AG	71	2.8
HC1	AG	72	3.1
HC1	AG	73	3.3
HC1	CH	71	4.8
HC1	CH	80	5.5
HC1	SS	51	1.3
HC1	SS	61	2.0
HC1	SS	67	2.3
HC1	SS	69	3.3
HC1	SS	72	2.7
HC1	SS	78	4.6
HC1	SS	79	4.3
HC1	SS	80	5.0
HC1	SS	82	4.2
HC1	SS	84	5.7
HC2	AG	80	5.0
HC2	SS	33	0.5
HC2	SS	41	0.7
HC2	SS	42	0.7
HC2	SS	77	5.1
HC2	SS	80	5.6
HC2	SS	82	5.6
HC2	SS	84	5.3
HC2	SS	90	7.7
HC2	SS	92	8.6
HC2	SS	93	7.1
HC2	SS	98	11.5
HC3	AG	83	7.7
HC3	CH	70	5.3
HC3	CH	75	6.0
HC3	CH	77	7.4
HC3	CH	77	6.9
HC3	CH	78	6.9

Monitoring Site	Species	Length (mm)	Weight (gm)
HC3	SS	68	3.1
HC3	SS	75	5.0
HC3	SS	76	4.9
HC3	SS	76	4.7
HC3	SS	83	5.6
HC3	SS	85	5.5
HC3	SS	85	5.9
HC3	SS	95	7.9
HC3	SS	110	13.0
IR2	SS	85	6.5
IR2	SS	88	7.2
L1	AG	66	2.4
L1	AG	68	2.9
L1	AG	69	3.0
L1	AG	72	3.8
L1	AG	73	3.3
L1	SS	37	0.7
L1	SS	48	0.9
L1	SS	53	1.5
L1	SS	58	2.0
L1	SS	58	2.1
L1	SS	62	2.2
L1	SS	63	2.5
L1	SS	64	2.7
L1	SS	65	2.3
L1	SS	65	2.6
L1	SS	65	3.0
L1	SS	66	2.5
L1	SS	67	3.7
L1	SS	68	3.0
L1	SS	69	3.0
L1	SS	71	3.6
L1	SS	72	3.7
L1	SS	72	3.7
L1	SS	75	4.2
L1	SS	78	4.9
L1	SS	82	5.7
L1	SS	84	6.4
L1	SS	85	6.3
L1	SS	86	7.1
L1	SS	90	7.0
L1	SS	91	8.4

AG = Arctic grayling CH = Chinook salmon SS = slimy sculpin

APPENDIX III
Fisheries and Oceans Canada
Collection Permit

Fisheries and Oceans Canada | Pêches et Océans Canada

Licence Number: XR 284 2017
Valid From: 05-Sep-2017
Expiry Date: 31-Oct-2017

This licence and/or permit is issued under the authority of SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS.

This licence and/or permit authorizes the person(s) listed below, subject to the following terms and conditions, to collect the species and quantity of fish identified below for: Scientific purposes. Non-compliance with any condition of this licence and/or permit may result in the cancellation of this licence and/or permit.

Licence/Permit Activity Description:
To sample fish within various tributaries associated with Haggart Creek to determine fish presence/absence and population density.

Licence Holder:
FIN: 125575

CAN-NIC-A-NICK
ENVIRONMENTAL SERVICES

BOX 10106, 138 ARCTIC DRIVE
WHITEHORSE YT Y1A 7A1

Contact Number: 867-668-4682

Contact Party:
FIN: 125576 DE GRAFF, NICHOLAS Contact Number: 867-335-4099

Individuals or groups assisting with the authorized activity:

Any additional assistants not listed below, must be named as part of the notification prior to sampling. Detailed information requirements is found under conditions of this licence.

FIN: 125576	NICHOLAS DE GRAFF	Contact Number: 867-335-4099
FIN: 129960	JOE DE GRAFF	Contact Number: 867-668-4682
FIN: 142042	CRYSTAL DAWN	Contact Number: 867-335-4099

Species, Quantity of Fish, Area(s) and Gear:

Species:	CHINOOK SALMON (Oncorhynchus tshawytscha); NORTHERN PIKE (Esox lucius); SLIMY SCULPIN (Cottus cognatus); ARCTIC GRAYLING (Thymallus arcticus); ARCTIC LAMPREY (Lampetra camtschatica);
Life Stage:	Adult
Gear:	Seine Net, Beach Rod & Reel (unspecified) Electroshocker (Maximum Second per Site: 600 Seconds) Trap, Gee/Minnow (Set Duration Max: 24 Hours)
Licence Area:	Yukon/Transboundary: Haggart Creek - inc tributaries of (Watershed code: 83199973027969)
To be Retained:	0
Additional Descriptions:	Note: as per conditions of this licence electrofishing is not permited in the vicinity of spawning fish or their redds. Electrofishing activities will cease if spawning-condition fish are encountered.

Reporting Requirements:

XR 284 2017 Summary Data Report **Due Date** 31-Dec-17
See "Terms and Conditions" of this licence for detailed reqirements.

Terms and Conditions:

This licence authorizes collections to be made by the licensee and employees, volunteers and students of the licensee provided that all persons, other than minors who are engaged in activities under the authority of this licence, are carrying suitable photo identification to be produced upon request of a Fishery Officer or Guardian.

This license is subject to immediate termination upon written or verbal notice from a representative of the Yukon Government- Department of Environment, or of Fisheries and Oceans Canada.

Samplers: It is the responsibility if the license holder to ensure that samplers are experienced and competent in the fish collection methods authorized in this license.

Need to carry and produce permit: A copy of this license must be in the immediate possession of the samplers during sampling, and must be produced upon the request of any representative designated as a Fishery Officer or Fishery Guardian pursuant to the Fisheries Act (Canada).

Notice: Prior to commencing sampling, notice is to be given to:

• Fisheries and Oceans Canada, Yukon/Transboundary Rivers Area - Tel: (867) 393-6722 Fax (867) 393-6738 or Email: YTLicence@dfo-mpo.gc.ca

• Oliver Barker, YTG Fisheries - Email: fisheries@gov.yk.ca

• Appropriate First Nation Government in whose Traditional Territory the activity is taking place.

The notice is to include following information:
i. The Collection License number,
ii. The watercourse or water body on which, and the location where the sampling is to take place,
iii. The dates on which sampling will occur
iv. The names of all assistants which will be engaged in the sampling.

• Note: Notice is also to be given to the Government of Yukon Conservation Officer responsible for any area where sampling is to take place at least 24 hours prior to the start of sampling.

Release of fish: All live fish must be released unharmed into the water body or course from which they originated and as near as possible to the location from which they were captured. Exception to this is where fish are retained for identification or forensic purposes.

Electrofishing: Is not permitted in the vicinity of spawning fish or their redds. A trained and certified electrofisher operator must be a part of the electrofishing crew.

Gear: All gear left unattended must be clearly labelled with the Licence Number and must not interfere with the public right of navigation.

Aquatic Invasive Species To prevent the introduction of aquatic invasive species there are a few simple things that can be considered: a) Before leaving an area: Drain water from boat, trailer and gear, remove all plant parts and

mud and b) Before entering another water body: Wash all your gear including waders with soapy water. For Further Information:
http://www.dfo-mpo.gc.ca/species-especes/index-eng.htm,
http://www.dfo-mpo.gc.ca/science/environmental-environnement/ais-eae/publications/plan/page01-eng.html

Disposition of fish: Any fish captured and retained under the authority of this license are not to enter any commercial markets or establishments. Any fish collected and retained, or incidental mortalities associated with non-lethal sampling, are not to be utilized for human consumption or personal use purposes unless authorized by Fisheries & Oceans Canada.

Species at Risk: Section 32 (1) of the federal Species at Risk Act prohibits killing, harming, harassing, capturing or taking an individual of a wildlife species which is listed on Schedule 1 as an extirpated species, an endangered species or a threatened species. Refer to the SARA Public Registry at http://www.sararegistry.gc.ca to determine if species at risk may be in your research area and to apply for a permit if required.

Transport or transplant of live fish and/or eggs/milt: Live fish and/or eggs (spawn) cannot be transported without prior written approval of the transplant committee or transplanted without a licence granted pursuant to Section 56 of the Fishery (General) Regulations.

Report: A report must be submitted after completion of sampling, in electronic spreadsheet form as provided by email with permit. If no sampling takes place a nil report is required. The report must be in the form of the spreadsheet provided but is not limited to and may also include photocopied data sheets or field notes, or the final report for the project, and must include the following:

a. The Collection License number
b. The location(s) of the sampling with GPS coordinates, and a map or detailed described if GPS coordinates were not possible;
c. Names of all individuals engaged in sampling;
d. The dates on which the sampling occurred;
e. The number of fish sampled, by species;
f. Any mortalities

A summary report is to be submitted by December 31, 2017 to:

Area Licensing Manager
Fisheries and Oceans Canada
100-419 Range Rd
Whitehorse Yukon
Y1A 3V1
Email: YTLicence@dfo-mpo.gc.ca

By signing on this document, the person(s) listed below, agree to be bound by the terms and conditions that pertain to each person as an individual and to the group as a whole.

125575	Nicholas de Graff		05/09/17
FIN	Licence Holder - Print Name	Signature	Date

Fisheries and Oceans Canada | Pêches et Océans Canada

Licence Number: XR 284 2017
Valid From: 05-Sep-2017
Expiry Date: 31-Oct-2017

Licence Issued: 01 September 2017

Licence Printed: 01 September 2017
Licence Issued By: LOUISE NAYLOR, Fisheries and Oceans Canada

APPENDIX N

2017 Wildlife Observations

THIS PAGE INTENTIONALLY LEFT BLANK

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
April										
16-Apr-17	14:30	Sunny	Moose	1	M	Adult	Visual	Bottom of Steiner Zone	Walking	N/A
17-Apr-17	16:00	Sunny, windy	Moose	1	F	Adult	Visual	McQuesten Bridge	Walking on side of road	Appeared angry
20-Apr-17	12:00	Sunny	Fox	1	Unknown	Adult	Visual	Camp	Walking by office towards kitchen	N/A
24-Apr-17	20:30	Partly cloudy	Moose	1	M	Adult	Visual	Bottom of Steiner Zone	Climbing up hill	N/A
25-Apr-17	6:00	Cloudy	Moose	1	M	Adult	Visual	459077 E, 7100274 N Steiner Zone	Walking down hill	N/A
30-Apr-17	6:00	Cloudy, cool	Moose	2	F + unknown	Adult/ Juvenile	Visual	Haggart Creek	Walking along creek	N/A
May										
02-May-17	17:54	Cloudy	Moose	1	F	Adult	Visual	Low road by camp	Walking down road	N/A
04-May-17	15:00	N/A	Moose	1	F	Adult	Visual	Dublin Gulch access trail	Eating	N/A
11-May-17	3:00	N/A	Bear	3	F + unknown	Adult/ Juvenile	Visual	459225 E, 7100800 N, Steiner Zone	Walking below rig	1 sow 2 cubs
12-May-17	17:10	Overcast	Moose	1	F	Adult	Visual	Steiner Zone	Very docile, staring	Large cow
14-May-17	10:10	Overcast and rain	Moose	1	M	Adult	Visual	Shamrock access trail	Walking along road	N/A

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
17-May-17	17:45	Partly cloudy	Black bear	2	Unknown	Adult	Visual	Km 28-29 S. McQuesten Rd	Walking along side of road	N/A
June										
12-Jun 17	8:30	Sunny	Black Bear	1 to 2	Unknown	Adult or juvenile	Visual/ fresh scratchings/ tracks/noise	455950 E, 7098800 N Headwaters of 15 Pup	Diggings and scratchings observed, huffing heard	Observer heard animal moving away from his location. Co-worker then encountered an animal digging/scavenging on his line. Animal did not respond to yelling or making noise, bear bangers were let off/samplers exited the area and regrouped on lower lines to work in pairs.
14-Jun-17	7:00	sunny, clear	Moose	2	F + unknown	Adult/ Juvenile	Visual	Camp, near waste storage area	Walking around waste storage area fence	Cow and calf
16-Jun-17	4:30	Partly cloudy	Moose	2	F + unknown	Adult/ Juvenile	Visual	Km 42 S. McQuesten Rd	Walking on road	Cow and calf
17-Jun-17	18:00	Cloudy	Moose	1	F	Adult	Visual	McQuesten Bridge	Walking on site of road	N/A
18-Jun-17	10:30	Sunny	Moose	3	F + unknowns	Adult/Juvenile	Visual	S. McQuesten Rd	Walking on low road	Cow and 2 calves

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
18-Jun-17	14:00	Cloudy	Moose	2	F + unknown	Adult/ Juvenile	Visual	Km 40 S. McQuesten Rd	Walking down middle of road	Cow and calf
25-Jun-17	6:30	Sunny	Moose	1	F	Adult	Visual	Eagle Pup Access trail near camp	N/A	N/A
July										
06-Jul-17	7:05	Sunny	Moose	1	F	Adult	Visual	S. McQuesten Rd near entrance to camp	Walking across road	N/A
07-Jul-17	8:20	Sunny	Moose	2	F + unknown	Adult/ Juvenile	Visual	Near McQuesten Bridge	Eating in pond near bridge	Cow and calf
09-Jul-17	6:00	Sunny	Moose	2	F + M	Adults	Visual	Km 3 Dublin Gulch Access Trail	Walking in middle of road	Cow and Bull
12-Jul-17	16:00	Cloudy	Moose	1	M	Adult	Visual	1 km from camp	Walking on side of road	N/A
14-Jul-17	12:30	Sunny, partly cloudy	Moose	2	F + unknown	Adult/ Juvenile	Visual	Headwaters of Eagle Pup	Walking on hill	Cow and calf
14-Jul-17	13:30	Sunny, partly cloudy	Moose	1	M	Adult	Visual	Eagle Pup Access Trail	Walking on road	N/A
15-Jul-17	15:30	Cloudy	Moose	2	F + unknown	Adult/ Juvenile	Visual	S. McQuesten Rd near entrance to camp	Walking across road	Cow and calf
15-Jul-17	15:30	cloudy	Moose	1	M	Juvenile	Visual	Below Platinum Junction in placer pond	Eating in pond	N/A

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
17-Jul-17	1:00	Cloudy	Black bear	1	Unknown	adult	Visual	Fire station seacan	Walking down the road towards lower camp	N/A
17-Jul-17	7:15	Sunny, partly cloudy	Black bear	1	Unknown	Adult	Visual	Drillers laydown	Digging around driller's laydown	N/A
17-Jul-17	18:15	Cloudy	Black bear	2	F + unknown	Adult/ Juvenile	Visual	Near Haggart Creek culvert crossing	Walking on side of road	Sow and cub
17-Jul-17	23:00	Cloudy	Black bear	1	Unknown	Adult	Visual	Near camp waste management area	Walking from fire station towards the waste management area	N/A
18-Jul-17	9:15	Cloudy	Black bear	1	Unknown	Adult	Visual	Behind camp waste management area	Walking around waste management area	Observer fired 1 bear banger, co-worker fired 1 bear banger
18-Jul-17	20:20	Cloudy	Black bear	1	Unknown	Adult	Visual	Near core shack	Walking around tents	Observer fired 2 bear bangers, co-worker fired 1 bear banger
18-Jul-17	20:40	Cloudy	Black bear	2	Unknown	Adults/ Juvenile	Visual	Near core shack	Walking around core shack	Observers left area for other workers (above) who returned with bear bangers
18-Jul-17	23:15	Cloudy	Moose	2	F + unknown	Adult/ Juvenile	Visual	Eagle Pup Access Trail	Walking up the road	Cow and calf

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
19-Jul-17	15:25	Sunny, partly cloudy	Black bear	1	Unknown	Adult	Visual	Dublin Gulch Access Trail, km 2.5	On the road	N/A
20-Jul-17	15:45	Sunny	Moose	3	2 F + unknown	Adults/ Juvenile	Visual	South McQuesten Bridge	Eating in the lake	2 cows and calf
21-Jul-17	5:45	Overcast, rainy	Moose	2	F + unknown	Adult/ Juvenile	Visual	Nugget Road	Eating on side of road	Cow and calf
23-Jul-17	14:00	Sunny, partly cloudy	Black bear	1	Unknown	Adult	Visual	Behind camp waste management area	Skinny black bear snooping around behind the waste management area	N/A
23-Jul-17	14:30	Sunny, partly cloudy	Black bear	1	Unknown	Adult	Visual	Dublin Gulch Access Trail, km 2.5	Watching the truck from middle of road then ran off	N/A
24-Jul-07	Unknown	Sunny, partly cloudy	Wolverine	2	Unknown	Juveniles	Visual	Past Potato Hills	Climbing a tree	N/A
27-Jul-17	10:45	N/A	Moose	2	F + unknown	Adult/ Juvenile	Visual	Haggart Creek	Observed near the creek eating	Adult and calf
July 29-31	Unknown	N/A	Black bear	1	Unknown	Adult	Visual	Camp	Observed around the waste management area, office, dorms and kitchen	Observed to be a problem bear, trying to get in windows walking around camp bothering the waste management area walking out the front of pick ups and down the

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
										roads, checking around doors on buildings. Mayo Conservation Officer called to site - bear since removed.
July xx	15:55	Cloudy	Moose	2	F + unknown	Adult/Juvenile	Visual	Platinum Junction	Walking on side of road	Adult and calf
August										
01-Aug-17	13:05	Sunny with clouds	Black bear	1	unknown	Adult	Visual	Rex Peso access trail	Walking across road	None
02-Aug-17	15:30	Sunny with clouds	Grizzly	1	Unknown	Adult	Visual	Km 1.5 Dublin Gulch access trail	Running off road	None
03-Aug-17	11:50	Sunny	Black bear	1	Unknown	Adult	Visual	Km 36.5 S. McQuesten Road	Running up side hill	None
04-Aug-17	18:30	Cloudy	Grizzly	1	Unknown	Adult	Visual	Km 43 S. McQuesten Road; Haggart Creek culvert	Walking across creek	None
04-Aug-17	22:30	Overcast	Grizzly	1	Unknown	Adult	Visual	Km 45, S. McQuesten Road	Standing on roadside watching vehicle pass	None
12-Aug-17	11:00	Sun, cloudy	Moose	2	F + unknown	Adult/Juvenile	Visual	Main Camp area	Running away	Cow and calf
16-Aug-17	NR	Cloudy	Moose	1	F	Adult	Visual	Exploration camp area	Eating in pond	Photo taken
16-Aug-17	10:00	Rain	Moose	1	F	Adult	Visual	Km 36 S. McQuesten Rd	Feeding	None

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
19-Aug-17	18:00	Sunny, 15C	Porcupine	1	Unknown	Adult	Visual	Km 37 S. McQuesten Rd	Walking across road	Large animal, healthy, not disturbed, walked into brush on east side of road
20-Aug-17	7:45	Overcast	Moose	1	F	Adult	Visual	Pond along lower access trail adjacent to Haggart Creek	Feeding in ponds past weather station	None
22-Aug-17	13:30	Mainly cloudy	Porcupine	1	Unknown	Adult	visual	McQuesten Road towards Haggart Creek	N/A	None
26-Aug-17	9:15	Overcast	Moose	1	Unknown	Juvenile	Visual	Km 43 S. McQuesten Road	Walking on side of road watching vehicle	None
26-Aug-17	11:30	Mild, overcast	Moose	1	M	Adult	Visual	N/A	Running away	Appeared frightened, running down hill almost into truck then into the bush
28-Aug-17	15:30	Partly cloudy	Brown hawk	1	Unknown	Adult	Visual	Potato Hill Area	Flying	None
28-Aug-17	22:00	Damp, 5C	Black bear	1	Unknown	Juvenile	Visual	Km 24.5 S. McQuesten Road	Running	2 year old size
September										
01-Sep-17	16:00	Dry, sunny 16C	Black bear	1	Unknown	Adult	Visual	Dublin Gulch access trail	Running	Ran upon seeing vehicle
02-Sep-17	16:51	Clear, windy	Moose	1	F	Adult	Visual	Km 2.5 Dublin Gulch access trail	Walking	Crossing Road

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
03-Sep-17	11:00	9C, sunny	Moose	3	2 F + unknown	Adult/Juvenile	Visual	Near Dublin Gulch access trail at culvert crossing	Feeding	2 Cows and calf
03-Sep-17	3:00	N/A	Wolf	N/A	Unknown	Adult	N/A	Km 24 S. McQuesten Road	N/A	Standing on road
04-Sep-17	14:00	Warm, 12-15C	Moose	1	F	Adult	Visual	Km 2 Eagle Pup access trail	N/A	None
04-Sep-17	15:43	Cloudy	Porcupine	1	unknown	Adult	Visual	Km 4 Dublin Gulch access trail	Walking	None
04-Sep-17	20:00	Partly cloudy 12C	Lynx	1	Unknown	Adult	Visual	At Haldane Bridge on S. McQuesten Rd	N/A	Standing in bushes observing vehicle pass
05-Sep-17	10:00	Overcast	Hawk	1	Unknown	Adult	Visual	Km 45 S. McQuesten Rd	N/A	None
05-Sep-17	13:45	Rain	Moose	1	F	Adult	Visual	Rex Peso access trail	walking	None
10-Sep-01	8:30	Partly cloudy 11C	Porcupine	1	Unknown	Adult	Visual	At Dublin/Eagle access trail intersections	Walking	Calm behavior, walking in willows
10-Sep-17	14:00	Overcast, cool	Bear	1	Unknown	Adult	Fresh scat	Eagle Pup Road; E 460095, N 7099557, 1238 m elevation	N/A	None
11-Sep-17	9:10	5C	Lynx	1	Unknown	Adult	Visual	Cleared area of proposed heap Leap embankment	Walking	Walked east to west across cleared area in front of vehicle

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
12-Sep-17	9:30	Partly cloudy	Moose	1	F	Adult	Visual	Exploration core shack	Startled by truck, ran away	Initially walking on road
12-Sep-17	19:00	N/A	Moose	1	Unknown	Juvenile	Visual	Km 12 S. McQuesten Road	Walking	None
12-Sep-17	15:30	N/A	Moose	2	M	Adult	Visual	Km 30 S. McQuesten Road	Fighting	2 young bulls clashing
12-Sep-17	9:45	N/A	Moose	1	M	Adult	Visual	Exploration core shack	Running	None
12-Sep-17	15:00	Sunny, 10C	Moose	2	F + Unknown	Adult/Juvenile	Visual	Km 7 Platinum Gulch access trail	Running	Moose on a slope
14-Sep-17	10:00	Sunny	Martin	1	Unknown	Adult	Visual	On Dublin Gulch access trail	N/A	None
21-Sep-17	9:00	N/A	Moose	1	M	Adult	Visual/ auditory	Exploration Core Shack	Rut vocalizing	"In rut, talking"
October										
01-Oct-17	7:25	Dark	Hare	1	Unknown	Unknown	Visual	Km 1 Dublin gulch access trail	None	“Blinded by truck lights”
03-Oct-17	15:00	N/A	Moose	2	F + unknown	Adult/Juvenile	Visual	Km 40 S. McQuesten Road	Running	Cow and calf, near river bank
03-Oct-17	19:28	Overcast	lynx	1	Unknown	Unknown	Visual	Lower exploration camp	Running	On road/bush

Date	Time (24 hr)	Weather	Species	No.	Sex (M/F)	Age Class	Sign	Location	Behaviors	Additional comments
06-Oct-17	23:45	Clear and dark	lynx	1	Unknown	Unknown	Visual	Exploration core yard	Running	None
22-Oct-17	10:20	Overcast	Moose	6	2 M, 3 F, 1 unknown (calf)	Adult/ Juvenile	Visual	Nugget access trail	Running, eating	Bulls running, cows and calf eating
23-Oct-17	13:30	Overcast	Moose	5	2 M, 2 F, 1 unknown (calf)	Adult/ Juvenile	Visual	Nugget access trail	Running, eating	Bulls running, cows and calf eating
25-Oct-17	N/A	Clear, -8C	Moose	1	M	Adult	Visual	Pond along lower access trail adjacent to Haggart Creek	None	Standing in willows hiding
25-Oct-17	10:00	Clear	Moose	1	Unknown	Adult	Visual	Pond along lower access trail adjacent to Haggart Creek	Walking	Walking around pond
November										
28-Nov-17	13:00	Overcast, -20C	Wolf	1	Unknown	Adult	Tracks	Km 1 Dublin Gulch access road	N/A	None
December - *No wildlife observations*										

NOTES:
N/A = Not Available, M=Male, F=Female

APPENDIX O

Eagle Gold Project Spill Response Plan Version 2017-02

THIS PAGE INTENTIONALLY LEFT BLANK

EAGLE GOLD PROJECT

SPILL RESPONSE PLAN

Version 2017-02

JULY 2017

THIS PAGE INTENTIONALLY LEFT BLANK

DOCUMENT CONTROL

Submission History

Version Number	Version Date	Document Description and Revisions Made
2013-01	Apr 2013 (draft)	Submission of preliminary draft
2013-01	Sep 2013	Original submission to the Department of Energy, Mines and Resources in support of an application for a Quartz Mining Licence allowing for preliminary construction activities and submitted to the Yukon Water Board in support of the application to amend Type B Water Use License QZ11-013. The amendment application considered the use of water and deposit of waste associated with preliminary construction activities and included the construction and operation of the Dublin Gulch Diversion Channel.
2014-01	Jun 2014	Revisions made in support of an application to the Yukon Water Board for a Type A Water Use License for the full Construction, Operation and Closure of the Project. Version 2014-01 was also submitted to the Department of Energy, Mines and Resources in support of an application for a Quartz Mining Licence allowing the full Construction, Operation and Closure of the Project.
2016-01	Feb 2016	Revisions made in support of an application to the Yukon Water Board for a renewal of the Type B Water Use Licence.
2017-01	Mar 2017	Revisions made to address comments received during the adequacy review of the application to the Yukon Water Board for a Type A Water Use Licence and to address the conditions of the Quartz Mining Licence QML-0011. Version 2017-01 was submitted to the Department of Energy, Mines and Resources and the Yukon Water Board to satisfy SGC's annual reporting requirements.
2017-02	Jul 2017	Revisions made to reflect the current site general arrangement and submitted as part of a consolidated application for *Environment Act* permits.

Version 2017-02 of the Spill Response Plan (the Plan) for the Project has been revised in July 2017 to update Version 2017-01 submitted in March 2017. The table below is intended to identify modifications to the Plan and provide the rationale for such modifications

Version 2017-02 Revisions

Section	Revision/Rationale
Figure 2.4-1 Storage Areas for Hazardous Materials	▪ Updated site general arrangement and confirmed solid waste handling and special waste storage areas
Figure 3.1-1 Planned Location of Spill Response Equipment	▪ Updated site general arrangement and confirmed location of spill response equipment.
Table 3.1-1 Inventory of Spill Response Equipment	▪ Updated to account for refinements to the site general arrangement.

Section	Revision/Rationale
Planned for the Project	
Appendix E Material Safety Data Sheets	▪ Added Appendix E, to reflect the materials SGC anticipates at the Project site and ensure accessibility of material safety data sheets.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

1 INTRODUCTION

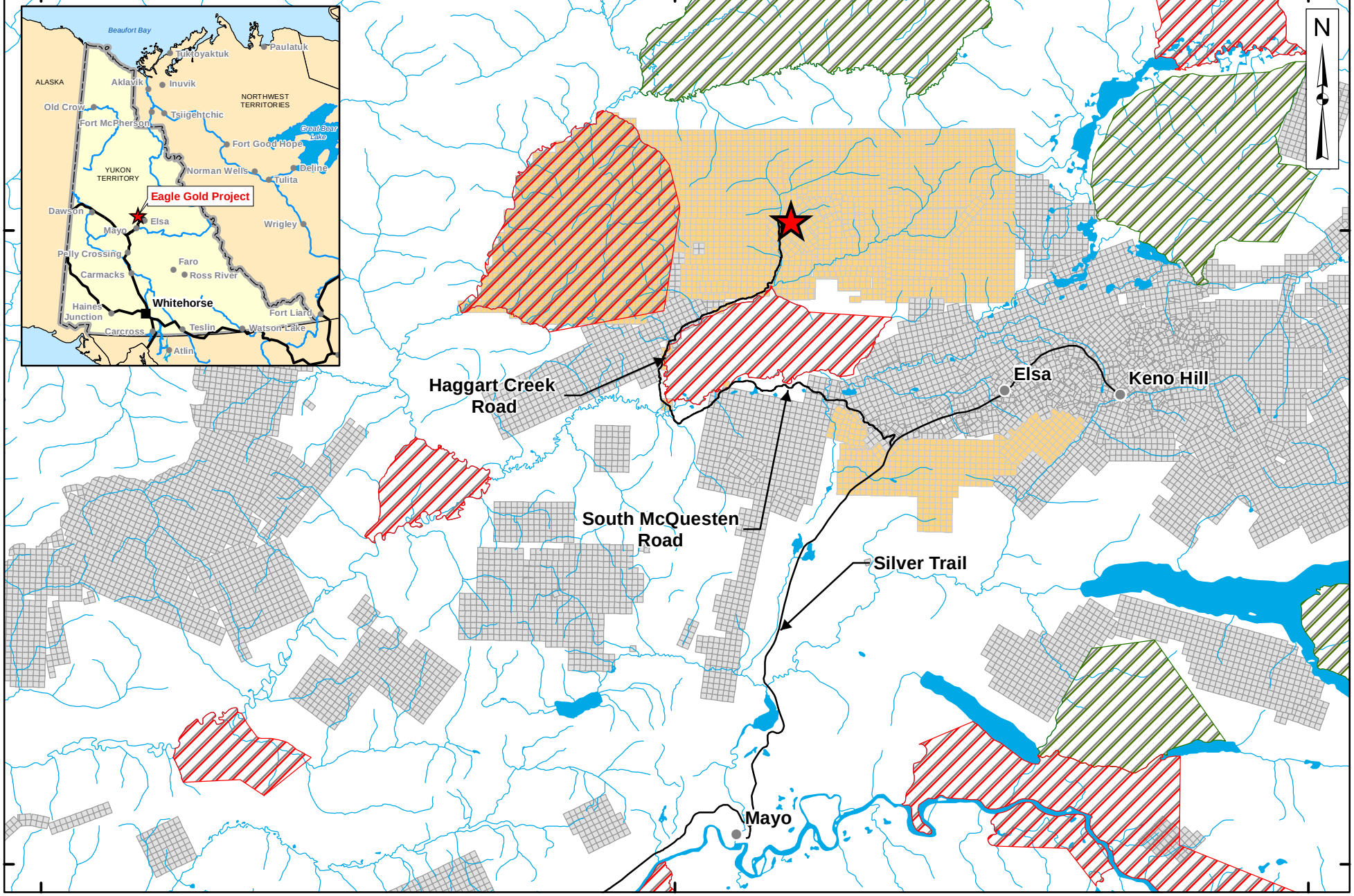
StrataGold Corporation (SGC), a directly held-wholly owned subsidiary of Victoria Gold Corp., has proposed to construct, operate, close and reclaim a gold mine in central Yukon. The Eagle Gold Project ('the Project') is located 85 km from Mayo Yukon using existing highway and access roads (Figure 1.1-1). The Project will involve open pit mining and gold extraction using a three stage crushing process, heap leaching, and a carbon adsorption, desorption, and recovery system over the mine life.

SGC is committed to exploring for, building, operating and closing mines in an environmentally, socially and financially responsible manner. SGC will endeavor to protect the environment in which it operates by providing a safe, responsible and efficient operating atmosphere through the development, and implementation of corporate policies as well as development and operational plans.

The purpose of this Spill Response Plan (the Plan) is to enable timely and effective responses to any spill throughout the life of the Project. The Plan provides measures to prevent spills from occurring, and response measures to be implemented in the event of a spill.

This plan was informed by the guidelines provided by Government of Yukon's Department of Energy, Mines and Resources and the Yukon Water Board in the Plan Requirement Guidance for Quartz Mining Projects (August 2013), the Terms and Conditions of Recommendation, Proponent Commitments and Proponent Mitigations specified in the Final Screening Report and Recommendation (Yukon Environmental and Socio-economic Assessment Board Project Assessment 2010-0267), and the regulatory approvals issued for the Project

Appendix A summarizes the requirements pertaining to spill prevention and response outlined in the Final Screening Report and Recommendation and other licenses and permits issued to date.



Legend:

- Eagle Gold Project
- StrataGold Claims
- Other Claims
- Town / Village
- Road
- Watercourse
- Category A Settlement Land
- Category B Settlement Land

StrataGold Corporation

0 3 6 12 Kilometres

Projection:	Drawn By:	EAGLE GOLD PROJECT YUKON TERRITORY
NAD 83 Zone 8N	HC	
Date:	Figure:	Project Location
2017/03/15	1.1-1	

2 SPILL DEFINITION AND CATEGORIES

2.1 SPILL DEFINITION

A spill is defined under Section 132 of the *Yukon Environment Act* ("the Act") as a "release of a substance into the natural environment; from or out of a structure, vehicle or other container; and that is abnormal in quantity or quality in light of all the circumstances of the release; or in excess of an amount specified in the regulations". For the purposes of the *Act*, a "substance" means a hazardous substance, pesticide, contaminant or special waste.

2.2 REPORTABLE SPILLS

Schedule A of the *Yukon Spills Regulations* defines reportable spill quantities in reference to hazardous material classes defined under the *Transportation of Dangerous Goods Regulations*. The release into the environment of a hazardous material above the reportable quantities or any release into a watercourse is a reportable spill under the *Yukon Spills Regulations* and SGC is required immediately notify the 24-hour Yukon Spill Report line at:

867-667-7244

Any staff member who is unsure of the volume of material or type of material release and/or is unable to follow the reporting structure described in Section 4 of this Plan, is advised to report the spill to the 24-hour Yukon Spill Report line.

Spill Reporting Forms will be completed for all spills (Appendix B).

Reporting thresholds for all substances including hazardous materials, pesticide, contaminant or special waste used or stored at the Project are provided in Table 2.2-1, Table 2.2-2 and Appendix C.

A list of emergency contact numbers is provided in Appendix D.

Material Safety Data Sheets (MSDS) for all hazardous substances used for the Project at risk of spills are provided in Appendix E.

Table 2.2-1: Reportable Spill Thresholds

Substance Name	Type	TDGA Class	Reportable Threshold
Propane	Petroleum product	2	Any amount of gas from a container larger than 100 L, or where the spill results from equipment failure, error, or deliberate action or inaction
Acetylene	Petroleum product	2	Any amount of gas from a container larger than 100 L, or where the spill results from equipment failure, error, or deliberate action or inaction
Oxygen	Gas	2	Any amount of gas from a container larger than 100 L, or where the spill results from equipment failure, error, or

Substance Name	Type	TDGA Class	Reportable Threshold
			deliberate action or inaction
Gasoline	Petroleum product	3	200 L (any amount if spilled into a watercourse)
Diesel	Petroleum product	3	200 L (any amount if spilled into a watercourse)
Jet A & B Aviation Fuel	Petroleum Product	3	200 L (any amount if spilled into a watercourse)
Antifreeze	Solvent	9	5 L
Lubricating and Hydraulic Oils	Lubricating oil	n/a	200 L (any amount if spilled into a watercourse)

Table 2.2-2: Reportable Spill Thresholds for Special Waste

Substance Type	Time period	Reportable Threshold
Special Waste that may cause an adverse effect	N/A	Any amount
Solid Special Waste	24 hours	500 g
	30 days	5 kg
Liquid Special Waste	24 hours	500 ml
	30 days	5 L
Mixture of Solid and Liquid Waste	24 hours	500 g or 500 ml whichever is less
	30 days	5 kg or 5 L whichever is less

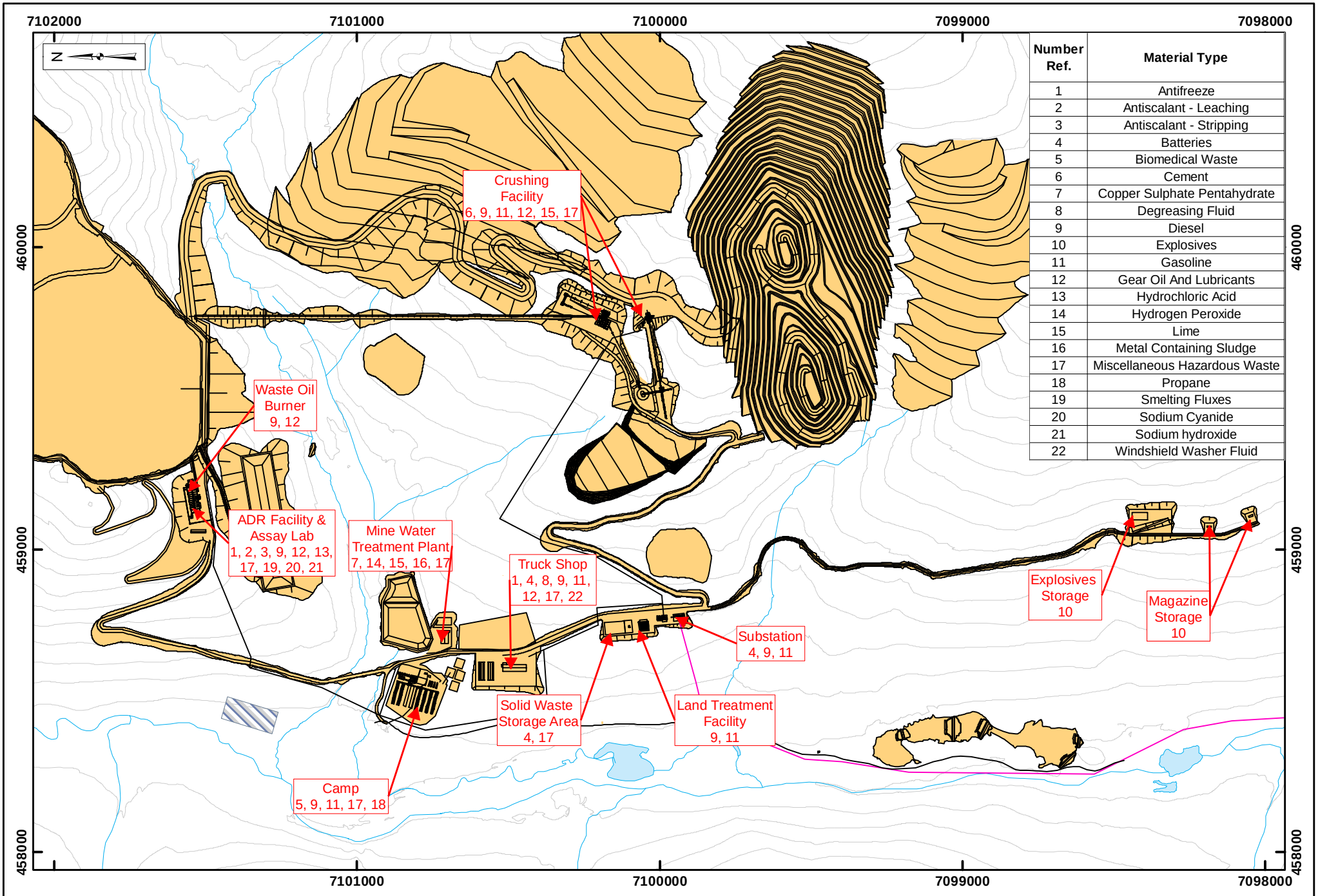
2.3 NON-REPORTABLE SPILLS

Spilled materials which are below the reporting thresholds are not required to be reported externally; however, all spills (whether reportable externally or not) must be reported internally to the SGC Environmental Department, and the SGC Environmental Department will maintain a record of all spills. Non-reportable spills will be handled according to the Spill Response Procedure described in Section 3 of this Plan. After any non-reportable spill is controlled and cleaned up, the Environmental Department will complete the Spill Response Form, and replenish spill cleanup supplies used for the response.

2.4 STORAGE LOCATIONS AND USE OF HAZARDOUS MATERIALS

Hazardous materials used on site and storage locations are described in the Solid Waste and Hazardous Materials Management Plan and shown on Figure 2.4-1.

SGC will ensure that spill kits compatible with the type and volume of material stored and used are available at sites where hazardous materials are stored and used.



Number Ref.	Material Type
1	Antifreeze
2	Antiscalant - Leaching
3	Antiscalant - Stripping
4	Batteries
5	Biomedical Waste
6	Cement
7	Copper Sulphate Pentahydrate
8	Degreasing Fluid
9	Diesel
10	Explosives
11	Gasoline
12	Gear Oil And Lubricants
13	Hydrochloric Acid
14	Hydrogen Peroxide
15	Lime
16	Metal Containing Sludge
17	Miscellaneous Hazardous Waste
18	Propane
19	Smelting Fluxes
20	Sodium Cyanide
21	Sodium hydroxide
22	Windshield Washer Fluid

Legend:

Facility
Watercourse
Reserved Area
Transmission Line
Contours (25m)

StrataGold Corporation

0 125 250 500
Meters

Projection:	Drawn By:	EAGLE GOLD PROJECT YUKON TERRITORY
NAD 83 Zone 8N	HC	
Date:	Figure:	Storage Areas for Hazardous Materials
2017/07/11	2.4-1	

3 SPILL RESPONSE PROCEDURE

The immediate priority in the event of a spill is to ensure the safety of any personnel in the immediate vicinity and to minimize the potential impact to the environment due to a sustained release of hazardous material. The implementation of spill containment measures and site cleanup and remediation will only be undertaken when safety is assured and the source of the release has been controlled.

Before responding to any spill, it is important to first STOP and THINK:

- Identify hazards
- Assess Risks
- Control Risks

The priority sequence for spill response is as follows:

1. **ENSURE SAFETY**
    - Identify the spilled material (if not possible, assume dangerous)
    - Use Personal Protective Equipment (PPE)
    - Ensure the safety of nearby personnel
    - Remove all ignition sources – no smoking
2. **FIRST AID**
    - Call for assistance if necessary
    - Attend to the injured
    - Begin first aid immediately as required by following the guidelines from MSDS for the substance released
3. **STOP THE FLOW (IF POSSIBLE)**
    - Close valves, shut off pumps and plug holes or leaks (if safe to do so)
4. **NOTIFY YOUR SUPERVISOR AND/OR SPILL RESPONSE TEAM**
    - Provide basic information of spill – What, Who, Where, When and How
    - Activate Spill Response Team
5. **SECURE THE AREA**
    - Limit access to the spill area and prevent unauthorized entry

6. CONTAIN THE RELEASE

- Block off and protect drains, culverts, and other drainage structures which are not designated for spill management
- Use dykes, berms, trenches, ditches or sorbent material from spill kits to control the spilled substances

7. CLEAN-UP

- Under the direction of the Spill Response Team, begin clean-up activities

8. REPORT THE SPILL

- The Environmental Manager, or designate, will report the spill to the appropriate agencies.

9. CONDUCT INCIDENT INVESTIGATION

- Undertake appropriate corrective and preventative action and document all activities on the Spill Report Form

3.1 SPILL RESPONSE EQUIPMENT

Spill kits will be available at all hazardous materials storage sites and transfer areas shown in Figure 2.4-1. Spill kits will also be available in hazardous material transporters, heavy equipment and light trucks. Spill kits will contain booms, sorbent materials, shovels and PPE, and fire extinguishers will be located in close proximity to assist in responding to a possible spill incident involving flammable materials. Spill kits will also contain a kit inventory sheet to assist with monthly inspections and the replenishment of spent supplies and equipment. The SGC Environmental Department will be responsible for monthly spill kit inspections, the replenishment of spent supplies and equipment, and ensuring that the site is equipped with a spare fully stocked 50 Gallon Spill response kit. The spare 50 Gallon Spill response kit will be deployed to other locations in the event of a spill requiring additional equipment or as a replacement until spent, location specific, kits can be replenished.

If there is a risk of spills on open water, surface booms will be available for deployment.

All spill kits will include the 2016 Emergency Response Guidebook which has been developed jointly by Transport Canada (TC), the U.S. Department of Transportation (DOT), the Secretariat of Transport and Communications of Mexico (SCT) and with the collaboration of CIQUIME (Centro de Informaciòn Quìmica para Emergencias) of Argentina, for use by fire fighters, police, and other emergency services personnel who may be the first to arrive at the scene of a transportation incident involving dangerous goods.

The Emergency Response Guidebook is a guide to aid first responders in quickly identifying the specific or generic hazards of the material(s) involved in the incident, and protecting themselves and the general public during the initial response phase of the incident.

Figures 3.1-1 and 3.1-2 provide the location of Spill Response Equipment and Table 3.1-1 provides an inventory of anticipated Spill Response Equipment located around the Project Site:

Table 3.1-1: Inventory of Spill Response Equipment Planned for the Project

Location	Type of Equipment
ADR Facility and Assay Lab – Reagent Storage area	2X100 Gallon Spill response carts containing: ▪ Booms, sorbent pads, socks, dikes, pillows ▪ Hazmat Chemical Absorbent Pulp ▪ Disposal bags and Ties ▪ Neoprene Drain Cover ▪ Spill Response Plan ▪ Emergency Response Guidebook ▪ Chemical-resistant gloves ▪ Goggles This location will also be equipped with the following: ▪ Self-contained breathing apparatus ▪ Totally-Encapsulating Chemical Protective (TECP) suits ▪ Escape air packs (10 minute)
ADR Facility and Assay Lab– At each reagent handling area	2X50 Gallon Spill kits containing: ▪ Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Hazmat Chemical Absorbent Pulp ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Self-contained breathing apparatus ▪ Totally-Encapsulating Chemical Protective (TECP) suits ▪ Escape air packs (10 minute)
Mine water treatment plant	1X100 Gallon Spill response carts containing: ▪ Booms, sorbent pads, socks, dikes, pillows ▪ Hazmat Chemical Absorbent Pulp ▪ Disposal bags and Ties ▪ Chemical-resistant Gloves ▪ Goggles ▪ Neoprene Drain Cover ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Self-contained breathing apparatus ▪ Totally-Encapsulating Chemical Protective (TECP) suits ▪ Escape air packs (10 minute)

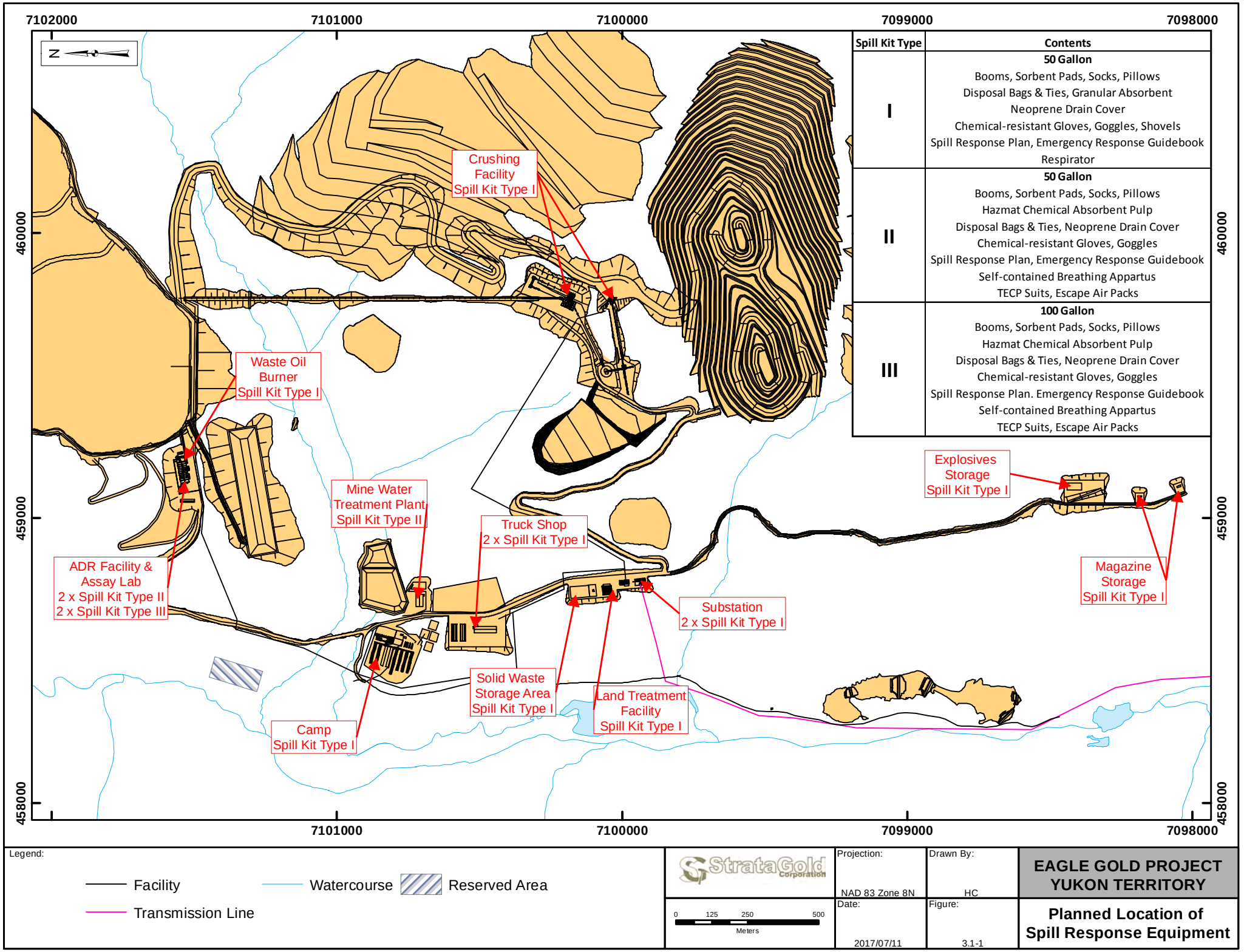
Location	Type of Equipment
Truck shop	2 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Respirators
Crushing and screening plants	1 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Respirators
Agglomerator Building	1 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: Respirators
Fuel storage areas	1 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves

Location	Type of Equipment
	▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Respirators
Explosives storage facility	1 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Respirators
Explosives magazine	1 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Respirators
Camp	1 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Respirators

Location	Type of Equipment
Solid Waste Storage Area	1 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Respirators
Substation	2 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook This location will also be equipped with the following: ▪ Respirators
Inside mine vehicles: Fuel carts Utility vehicles Explosive transport vehicles Emergency response vehicles	Vehicle spill kits containing: ▪ Sorbent Pads, Socks and Pillows ▪ Disposable Bags and Ties ▪ Granular Absorbent ▪ Neoprene Drain Cover ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan ▪ Emergency Response Guidebook
Strategic locations along access road	1 X 50 Gallon Spill kits containing: ▪ Booms, Sorbent Pads, Socks, Pillows ▪ Disposal Bags and Ties ▪ Granular Absorbent ▪ Chemical-resistant Gloves ▪ Goggles ▪ Shovels ▪ Spill Response Plan

Location	Type of Equipment
	▪ Emergency Response Guidebook

An inventory of spill kits will be maintained and monthly inspections will be carried out to ensure that they are suitably stocked. All spill kits will have MSDS for the substances used in the area serviced by the kit.



Legend:

Facility

Transmission Line

Watercourse

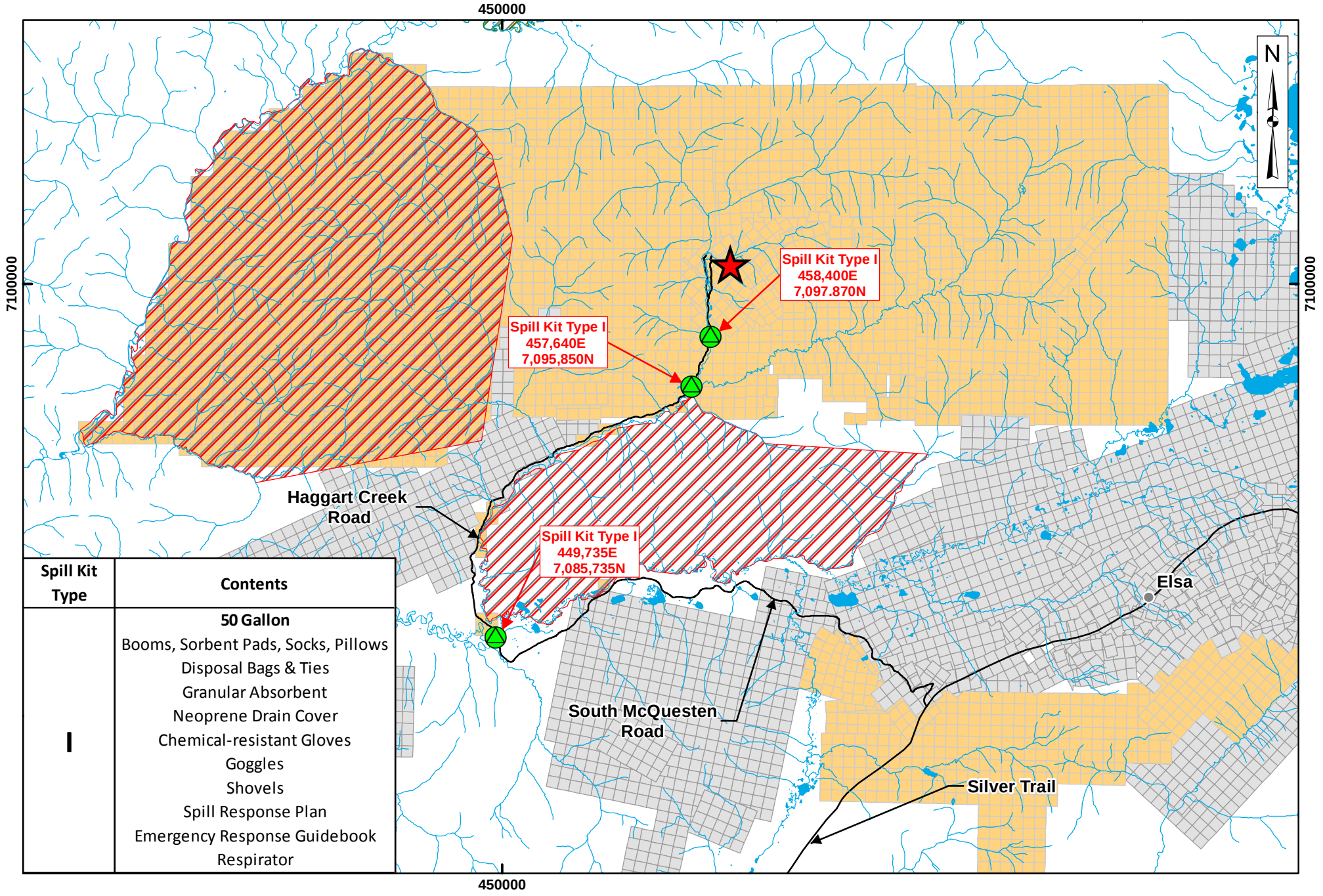
Reserved Area

StrataGold Corporation

0 125 250 500

Meters

Projection:	Drawn By:	EAGLE GOLD PROJECT YUKON TERRITORY
NAD 83 Zone 8N	HC	
Date:	Figure:	Planned Location of Spill Response Equipment
2017/07/11	3.1-1	



Spill Kit Type	Contents
	50 Gallon
	Booms, Sorbent Pads, Socks, Pillows
	Disposal Bags & Ties
	Granular Absorbent
	Neoprene Drain Cover
I	Chemical-resistant Gloves
	Goggles
	Shovels
	Spill Response Plan
	Emergency Response Guidebook
	Respirator

Legend:

- Eagle Gold Project
- Spill Kit Location
- Town / Village
- StrataGold Claims
- Other Claims
- Watercourse
- Road
- Category A Settlement Land
- Category B Settlement Land

0 1.25 2.5 5 Kilometres

StrataGold Corporation	Projection: NAD 83 Zone 8N	Drawn By: HC	**EAGLE GOLD PROJECT YUKON TERRITORY**
	Date: 2017/03/15	Figure: 3.1-2	**Additional Spill Response Resource Locations**

3.2 DUTIES AND RESPONSIBILITIES

To ensure human safety and limit potential environmental effects resulting from a spill, all site personnel will have specific responsibilities when responding to a spill. The responsibilities for spill response are summarized in Table 3.2-1 and depicted in Figure 3.2-1.

Table 3.2-1: Position and Responsibilities of Personnel Involved in Spill Response

Position	Responsibilities
All Personnel (Discoverer)	▪ Assess the initial severity of the spill and safety concerns ▪ Identify the source of the spill ▪ Ensure the safety of nearby personnel ▪ Begin first aid immediately as required ▪ Report all spills to Supervisor and Environmental Coordinator as soon as possible ▪ Determine the size of the spill and, if safe to do so, stop or contain it ▪ Remove all ignition sources if safe to do so ▪ Participate in spill response as a member of cleanup crew under the direction of the Spill Response Team
Supervisors	▪ Contact the Mine Manager ▪ Report to the site of the spill ▪ Gather information on the spill (substance, location, approximate area/quantity, in water, etc.) ▪ Participate in spill response as a member of cleanup crew under the direction of the Spill Response Team
Emergency Response/Spill Response Team	▪ Report to the site of the spill ▪ Assume primary role for first aid (Emergency Response Team) ▪ Stop or contain the spill ▪ Remove all ignition sources ▪ Take appropriate response measures – deploy booms, absorbents, and other equipment and materials as required ▪ Continue cleanup as directed by Mine Manager or Environmental Coordinator
Mine Manager	▪ Report to the site of the spill or Incident Command Centre (if Emergency Response Team has been deployed) ▪ Coordinate initial and ongoing response efforts ▪ Ensure source of spill has stopped and contain spill ▪ Record spill information ▪ Ensure a log book of all spill or unauthorized discharge occurrences is maintained ▪ Ensure coordination of equipment and personnel as needed ▪ Oversee the cleanup operation until it is satisfactorily completed ▪ Decide with the Environmental Coordinator if mobilization of additional equipment, resources or personnel is warranted
Environmental Manager /Coordinator	▪ Report to the site of the spill ▪ Report the spill to the Yukon 24-Hour Spill Report Line and Energy Mines and Resources - Client Services and Inspections

Position	Responsibilities
	▪ Ensure timely response and cleanup of spill site and impacted areas ▪ With the Mine Manager, decide if additional equipment, resources or personnel is required for containment and remedial activities ▪ Notify senior management ▪ Oversee completion and distribution of Spill Report ▪ Ensure investigation identifies measures to prevent similar spills
Executive Vice President	▪ Communicate with the media for large spills when required. ▪ Ensure that all press releases are accurate and in accordance with policy ▪ Make financial decisions on major expenses during large spill response ▪ Oversee preventative measures to ensure risk of a similar incident is mitigated

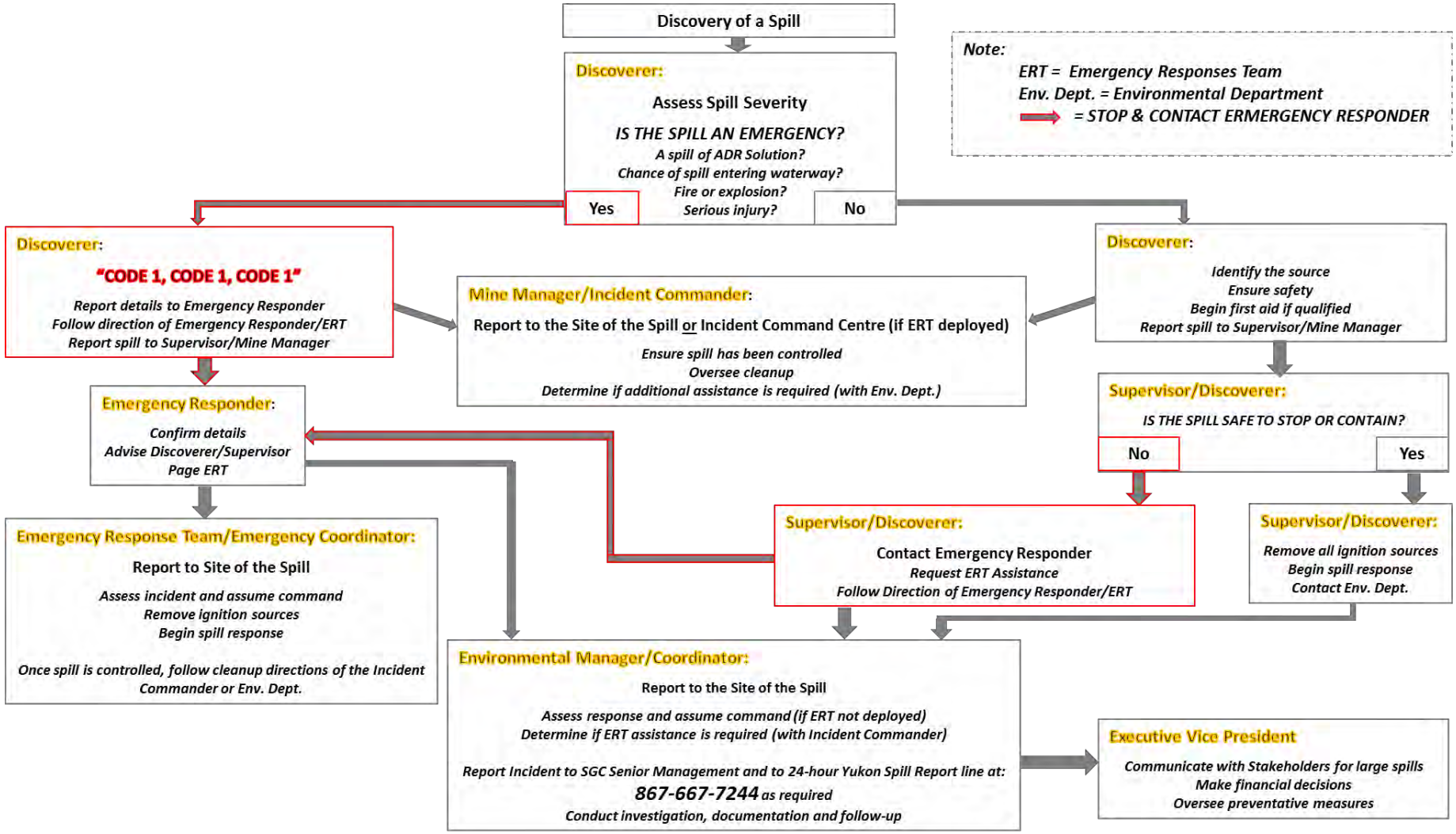


Figure 3.2-1: Spill Response Procedure

3.3 CONTAINMENT AND CLEANUP PROCEDURES

Containment methods for spills vary depending on the substance, size of the spill, location (inside buildings or outside), terrain and soil type, proximity to watercourses, climatic conditions and the availability of equipment and personnel.

Spill containment and response steps for each substance that could be spilled are summarized in Table 3.3-1 and Appendix C.

Table 3.3-1: Spill Containment Procedures by Substance

Substance Name	Type	TDG A Class	PPE required for Spill Response	Cleanup or disposal method
Propane	Petroleum product	2	Insulated gloves, safety glasses, respirator if there is a possible of oxygen reduction (confined spaces with poor ventilation)	Shut off flow and remove ignition sources if safe to do so and evacuate area. Consult supplier if container needs disposal.
Acetylene	Petroleum product	2	Insulated gloves, safety glasses, respirator	Shut off flow and remove ignition sources if safe to do so and evacuate area. Consult supplier if container needs disposal.
Oxygen	Gas	2	Insulated gloves, safety glasses	Allow gas to dissipate. Consult supplier if container needs disposal.
Gasoline	Petroleum product	3	Chemical-resistant impervious gloves, safety glasses, respirator if ventilation is inadequate	Approach from upwind, contain and collect spillage with sorbents from spill kits and/or sand and gravel. Pump free liquid into containment. Arrange for transport of material to an approved facility.
Diesel	Petroleum product	3	Chemical-resistant impervious gloves, safety glasses	Approach from upwind and contain and collect spillage with sorbents from spill kits and/or sand and gravel. Pump free liquid into containment. Arrange for transport of material to an approved facility.
Jet A & B Aviation Fuel	Petroleum Product	3	Chemical resistant gloves, safety glasses	Use sorbents, pump free liquid into containment. Arrange for transport of material to an approved facility.
Antifreeze	Solvent	9	Chemical-resistant impervious gloves, safety glasses	Approach from upwind, contain and collect spillage with sorbents from spill kits and/or sand and gravel. Pump free liquid into containment. Arrange for transport of material to an approved facility.
Lubricating and Hydraulic Oils	Lubricating oil	n/a	Chemical-resistant gloves, safety glasses.	Approach from upwind, contain and collect spillage with sorbents from spill kits and/or sand and gravel. Pump free liquid into containment. Arrange for transport of material to an approved facility.

Various practical methods of containment and recovery have been proven and effective for use in northern climates on land, snow ice or in open water. These methods are summarized in Table 3.3-2.

Table 3.3-2: Spill Containment Procedures by Location

Spill location	Response Actions	Containment Methods	Limitations	Required resources
Snow and Ice	▪ Stop spill source ▪ Eliminate ignition sources ▪ Block entry to waterways with snow dyke or other barrier ▪ Trench or ditch to intercept or contain spill ▪ Compact snow around spill to increase retention ▪ Contain or collect contaminated snow	Snow or Ice dykes	▪ Best suited for flat areas in winter ▪ Requires sufficient snow or ice	▪ Shovels ▪ Heavy equipment
		Snow or Ice trench	▪ Requires sufficient snow or ice ▪ Only applicable when ice is >1m thick ▪ Generally requires mechanical equipment for construction on ice	▪ Shovels ▪ Heavy equipment ▪ Ice chain saws
		Sorbent berm	▪ Requires sufficient, readily available sorbent material ▪ Impractical for larger spills	▪ Sorbents
Land	▪ Stop spill source ▪ Eliminate ignition sources ▪ Block entry to waterways with sand or gravel dyke ▪ Trench or ditch to intercept or contain spill ▪ Deploy sorbents ▪ Recover liquids with pumps or vacuum equipment	Sand or gravel dykes	▪ Best suited for flat areas ▪ Requires sufficient, easily excavated material if hand tools are being used	▪ Shovels ▪ Heavy equipment ▪ Sandbags or liner material if available ▪ Pump out equipment
		Land trench	▪ Can be difficult to excavated if soil is frozen ▪ Not conducive to areas with shallow bedrock	▪ Shovels ▪ Heavy equipment ▪ Pump out equipment
		Sorbent berm	▪ Requires sufficient, readily available sorbent material ▪ Impractical for larger spills	▪ Sorbents
Open Water	▪ Stop spill source ▪ Eliminate ignition sources ▪ Deploy sorbent booms or containment booms to control spread of substance	Sorbent boom	▪ Requires sufficient, readily available sorbent material ▪ No suitable for fast moving watercourses	▪ Sorbents
		Containment boom	▪ Requires sufficient, readily available sorbent material	▪ Sorbents

An effective way of controlling spills on land is through the construction of trenches or berms using sand and gravel. Small spills may be contained manually using shovels. More substantial spills may require the use of heavy equipment to dig trenches or place berm material.

Since snow has absorbent and containment properties, snow can be very effective for containing spills. Liquid spills typically become immobile within the snow pack and can be easily removed for transport and disposal. Snow will be used to its advantage in the construction of snow dykes, and whenever possible, the snow pack will be left in place to avoid contaminating the underlying substrate. For spills on ice, the methods of containment are similar to those used on land.

Spills occurring on open water (e.g. water retention ponds) will spread very rapidly, and therefore, initial preventative measures such as those described in Table 3.3-1 will be taken to minimize the potential for spills to enter open water. In the event of a petroleum product spills on open water, booms will be deployed immediately to limit the spread of the product and to facilitate recovery, by absorbents or by pumping.

3.4 OFF-SITE RESOURCES

With the exception of medical aid incidents, external resources will be authorized only by the Mine Manager or designate, or those with a higher level of responsibility. Key municipal, territorial and federal services and contact numbers are provided in Table 3.4-1.

Table 3.4-1: Municipal, Territorial and Federal Services and Contact Numbers

Name	Office	Location
Canutec – Emergency Response for TDG spill	**613-996-6666** or ***666 on a cellular phone**	Ottawa
Mayo Nursing Station	867-996-4444	Mayo
Mayo Fire & Rescue	867-996-2222	Mayo (Volunteer Responders)
Mayo RCMP	Emergency: 867-996-5555 Admin: 867-996-2677	Mayo
Whitehorse Regional Hospital - Emergency and Admissions	867-393-8700	Whitehorse
Environment Yukon Conservation Officer – Debra Morris	867-996-2202	Mayo
Environment Yukon Conservation Officer Services Branch	867-667-8005	Whitehorse
First Nation of Nacho Nyäk Dun	867-996-2265	Mayo
Environment Yukon Fish and Wildlife Branch	867-667-5715	Whitehorse
Fisheries and Oceans Canada	867-393-6722	Whitehorse
Yukon Energy Corporation	867-996-2387	Mayo

Name	Office	Location
Yukon Energy Corporation	1-800-676-2843	After hours Whitehorse
Yukon Workers' Compensation Health and Safety Board, Chief Mines Safety Officer, Occupational Health & Safety Branch - Michael Henney	867-667-8739	Whitehorse
Yukon Workers' Compensation Health and Safety Board 24-Hour Emergency Line for Reporting Serious Workplace Incidents and Injuries	867-667-5450	Whitehorse

3.5 FIRE SUPPRESSION

The Fire Response Procedure in the Emergency Response Plan must be implemented in the event of a fire.

Fire suppression equipment will be located at all hazardous materials storage, transfer and dispensing areas. If a spill of a flammable substance occurs and is ignited, firefighting efforts may be required prior to spill containment and cleanup. Personnel will be made aware of substance specific dangers prior to conducting fire suppression activities.

Any individual discovering a fire is responsible for attempting to control it and notifying his or her supervisor (Note: Any attempt to control the fire should be made without exposing oneself to risk or injury).

An individual should never enter a smoke-filled environment without self-contained breathing apparatus, appropriate protective clothing and proper training. If a fire is not immediately extinguished and poses an active threat to human health or the environment, then a 'Code 1' call that describes the size and location of the fire must be activated. Immediately notify the Mine Manager in such an event.

In the event that the Mine Manager deems that site wide evacuation is necessary, all personnel must gather at the appropriate muster station so that transport from the site can be arranged, and all mine personnel can be accounted for.

The Mine Manager or designate must:

- Take and remain in charge of firefighting activities until the fire is extinguished
- Ensure all personnel not involved are evacuated to a safe zone and instructed to be on standby for deployment on firefighting duties
- Identify all fire extinguishers used in the firefighting effort and ensure they are serviced, tested, re-charged, and returned for re-use.

3.6 CONTAMINATED SOIL

If cleanup material contains hazardous materials, it will be prepared for transport and taken to an approved offsite facility. Caution will be taken with reactive chemicals to make sure disposal of the material does not create additional danger through potential reaction with other materials.

Hazardous materials that cannot be re-used or recycled will be handled in accordance with SGC's Solid Waste and Hazardous Materials Management Plan.

A land treatment facility will be constructed for the progressive treatment and remediation of hydrocarbon contaminated soils as and when required. The land treatment facility will be located adjacent to the landfill area and will consist of two cells that are 10 m by 10 m each. If soil permeability in the facility is greater than 10^{-5} cm/s, a geo-membrane liner will be installed and covered with fine grained gravel or soil to temporarily store and land farm contaminated soil. The area will be leveled and sloped such that run-off from the area can be contained and treated prior to release to the receiving environment.

Hydrocarbon contaminated soils will be stored within the land treatment facility and remediated by regular tilling (aeration) and standard northern bioremediation practices. Runoff from the facility will be collected in a sump and treated via an oil water separator in the sump prior to discharge to ground. The construction of dual cells will allow the treatment of contaminants in cell 1 while soils are added to cell 2, remediation treatment will occur in summer months only. Contaminated soils will be tested for hydrocarbons prior to treatment and will be tested for F1/F2/F3/F4 (one test per 50 cubic meters).

4 INTERNAL AND EXTERNAL REPORTING

Any spill for which external reporting is required, as described in Section 2.2, will be reported to the 24-hour Yukon Spill Report Line. The reporting sequence below will be followed to allow for an efficient and effective response, completion of an accurate spill report, and timely notification of SGC management, government agencies, and First Nations.

- The First Observer (the person who discovers the spill) will identify the source and report to his/her direct supervisor.
- The supervisor will gather spill information and provide to the Mine Manager and Environmental Manager or designate.
- The Environmental Manager or designate will record the information regarding the spill and forward it to the Mine Manager.
- The Environmental Manager or Environmental Coordinator will report the spill to SGC senior management and the 24-hour Spill Report Line and the Department of Energy, Mines and Resources - Client Services and Inspections, as well as overseeing the completion and distribution of spill-related information.

5 TRAINING REQUIREMENTS

All personnel on site involved with the handling, use, storage and transportation of hazardous substances will be trained in the procedures for responding to and reporting of spills. Training topics will include:

- Workplace Hazardous Materials Information System (WHMIS) – renewed every 3 years and mandatory for all new hires
- Transportation of Dangerous Goods
- Hazmat training will be delivered to Emergency Response Team members

The following spill related topics will be covered during site orientation for all relevant personnel:

- Responsibilities of personnel
- Causes of spills and preventative measures
- Control, containment and cleanup methods for various spill locations
- Emergency contact information and location
- Storage and disposal of materials used on site
- Reporting requirement and procedure
- Overview of Spill Response Plan
- PPE requirements for handling potential spill materials

6 BEST MANAGEMENT PRACTICES

SGC will incorporate best management practices (BMPs) into all work procedures and plans. BMPs relating to spills are outlined below.

6.1 HEALTH AND SAFETY

SGC will implement a system of workplace inspections to ensure that procedures put in place to prevent incidents and accidents relating to hazardous materials are followed. This system will identify levels of hazard, which will trigger immediate work stoppages, and levels of hazards, which will trigger notification of management. This system will ensure that work does not continue with inadequate provisions for health and safety and those personnel are empowered to address unsafe or potentially unsafe scenarios.

Specifically in relation to hazardous materials, the following will be provided:

- Engineering controls and engineered hazardous material handling mechanisms to ensure that manual handling and ergonomic issues do not exacerbate the risk associated with working with hazardous materials.
- Monitoring systems for detection of hazardous solution and gaseous leaks.
- PPE designed for use in handling the various types of hazardous materials.
- Communication systems with emergency response capabilities.
- MSDS for all hazardous materials will be readily available anywhere these products are stored or used.
- A copy of the MSDSs will be accessible in the site offices.
- Emergency contact information will be posted and kept current.

6.2 SPILL PREVENTION

All relevant personnel that will use or handle hazardous materials will receive WHMIS training and will be trained in proper handling, spill response, and PPE use specific to their job tasks.

No lubrication, refueling or maintenance of equipment is permitted to occur within 30 m of watercourses or wetlands. All fuelling and lubrication of equipment will be conducted in a manner that minimizes the possibility of spills with containers, hoses and nozzles kept free of leaks and all fuel nozzles equipped with functional automatic shutoffs.

Sodium cyanide will be mixed with water in a well-ventilated area and maintained at a high pH to prevent the evolution of hydrogen cyanide gas.

The following mitigation measures will be implemented to minimize the potential for transportation incidents that could result in a hazardous substance spill:

- SGC will work with the Department of Highways and Public Works to ensure the access road is properly maintained.
- Speed limits will be strictly enforced for all Project vehicles.
- SGC will ensure trucking and hauling contractors have appropriate driver training, radio contact capabilities, properly maintained vehicles, and spill response capabilities.
- SGC will ensure all hazardous materials are transported and handled in accordance with the *Transportation of Dangerous Goods Act.*
- Signage will be posted along the access road to the Project to ensure non-Project traffic is aware of radio protocols.
- Wildlife migration corridors and crossings along the access road will be identified and signage provided in high risk areas.
- Wildlife crossing and escape points will be plowed in the access road snow banks.
- SGC will have on-site personnel with emergency first aid training to provide primary care in the event of an accident, and will implement the appropriate components of the Emergency Response Plan for the Project.

6.3 SPILL RESPONSE

All site personnel will be familiar with SGC's Spill Response Plan, and their duties and responsibilities. Storage sites will be well labeled, and MSDS are accessible in storage areas. This Spill Response Plan will be kept current, and made available to all personnel. SGC will ensure that suitable spill kits are used for spill response and that personnel are trained in using the spill response equipment.

6.4 STORAGE OF HAZARDOUS MATERIALS

The Solid Waste and Hazardous Materials Management Plan, describes the method of storage of hazardous materials for the Project. SGC will ensure that all hazardous materials are stored with secondary containment structures, either in the form of concrete foundations with curbed sides or double walling of the primary container. Hazardous material storage areas will be well labeled and access to the storage areas will be restricted.

Spill response equipment will be available at hazardous materials storage locations and will be inventoried, maintained and inspected monthly. Signage will be clearly visible in storage, dispensing and transfer areas. Fire extinguishers and/or fire suppression systems will be located at all hazardous material storage locations. Fuel and lubrication materials will be stored a minimum of 30 m from natural watercourses.

6.5 FUEL TRANSFER PROCEDURES

All personnel responsible for transfer, storage, transportation or handling of fuel will be trained in safe work practices for fuel and lubricants.

Caches of spill response materials will be placed along the South McQuesten Road and the Haggart Creek Road, including at the Haggart Creek crossing. Project personnel will have appropriate emergency response and spill contingency training and knowledge; equipment, materials and procedures will be maintained to limit consequences of releases of fuel or oil to the terrestrial or aquatic environment through prompt containment and clean-up.

6.5.1 Spill Protection and Prevention

Spill prevention will be undertaken through ensuring that accepted standard operating procedures are employed for the safe and secure transfer of hazardous materials from product transporters and within the Project site. Hazardous materials will be stored in areas that have containment structures such as concrete foundations with curbed sides. Hazardous material handling will be undertaken within the concrete foundations. Equipment handling hazardous materials will be inspected regularly and any inadequacies will be reported to maintenance personnel and repaired prior to continuation with work.

Spills will be responded to using the methods described in this Plan, according to what type of substance and what surface they occur on, as described in Section 3.3 and Appendix C. Routine inspections and maintenance will be conducted at hazardous material storage and transfer areas. Storage areas will be kept clean through good housekeeping practices.

6.5.2 Dispensing

Storage containers will be stored properly, and will not be over filled. Operating procedures will be established to minimize the potential for fuel spills during dispensing. All personnel handling fuel will be trained on these procedures.

6.6 ROUTINE MONITORING

Monitoring and maintenance is essential in the prevention of spills, and the effective handling of potential spills.

6.6.1 Maintenance

Maintenance procedures will be posted in applicable service areas. Maintenance personnel will be trained and familiar with the procedures. Regular checks will be performed on storage and dispensing equipment to identify any potential problems. If the regular checks identify issues, repairs are to be made prior to continued use of the piece of equipment. Spill response equipment will be kept stocked and maintained, and maintenance logs will be kept.

6.6.2 Perimeter Assessment

The following outlines items that will be identified during inspection:

- Signs of leakage from storage containers, loss of material, cracks, holes etc.
- Signs of inadequacy of secondary containment structures
- Unexpected solution or gaseous emissions will be thoroughly investigated to determine the source and nature of the emissions.
- Discoloration, oily discharges or any unusual odours.

6.6.3 Hazardous Material Storage and Transfer Areas

The following outlines items that will be identified during inspection:

- Spills or stains on the ground.
- Losses of material from storage containers.
- Cracks or damage to storage containers.
- Emergency shut off systems in place, functioning and clearly marked.
- Spill kits are available, adequate and accessible.
- Procedures posted for reference, MSDS are available

APPENDIX A

Assessment, Licence and Permit Requirements for Spill Prevention and Response

THIS PAGE INTENTIONALLY LEFT BLANK

Assessment, Licence and Permit Requirements for Spill Prevention and Response

Document, License or Permit	Section Number	Requirement
Final Screening Report and Recommendation: Terms and Condition of Recommendation	11	As proposed, the Proponent shall ensure a certified cyanide transporter is used and appropriate driver training, radio contact capabilities, vehicle maintenance, and emergency clean-up kits will be on trucks carrying NaCN. Furthermore, the Proponent shall ensure that emergency clean-up kits include equipment to contain NaCN as well and material to protect from, and respond to, cyanide toxicity in spill responders.
Final Screening Report and Recommendation: Terms and Condition of Recommendation	23	The proponent shall ensure that the following communication elements are in the ERP: a) Notification to management, regulatory agencies, outside response providers and medical facilities of the cyanide emergency. b) Notification to potentially affected communities of the cyanide related incident and any necessary response measures. c) Communication protocols with the media.
Final Screening Report and Recommendation: Proponent Commitments	97	SGC will implement the following to maximize road and transport safety: a) Ensure trucking/hauling contractors have appropriate driver training, radio contact capabilities, vehicle maintenance requirements, and spill response capabilities b) Ensure all hazardous materials are transported and handled in accordance with the Transport of Dangerous Goods Act and Regulations
Final Screening Report and Recommendation: Proponent Commitments	98	SGC commits to the following spill prevention and response measures: a) If there is any doubt regarding the size of a spill, material involved, and whether it is reportable, SGC will err on the side of caution and report the spill. b) Caches of spill response materials will be placed along the access road as required by the Spill Contingency Plan, including the Haggart Creek Crossing. c) Project staff will have appropriate emergency response and spill contingency training and knowledge. Equipment, materials, and procedures will be maintained to limit the consequences of releases to the environment through prompt containment and clean-up. d) Fuels, hydrogen peroxide, and other hazardous liquids will be transferred from tanker trucks to storage tanks by enclosed lines, hoses, and pumps equipped with pressure transducers and volume counters to ensure tanks cannot be overfilled. e) No lubrication, refuelling or maintenance of equipment will occur within 30 m of wetlands or watercourses. f) All fuelling and lubrication of construction equipment will be carried out in a manner that minimizes the possibility of spills. All containers, hoses, and nozzles will be free of leaks and all fuel nozzles equipped with functional automatic shut-offs. g) Where stationary equipment cannot be relocated more than 30 m from a watercourse, it will be situated in a designated area that has been bermed and lined with an impermeable barrier with a holding capacity equal to 125% of the largest tank within the berm. h) Equipment operators will be appropriately trained in spill response procedures and carry spill kits capable of handling spills on land and water.

Assessment, Licence and Permit Requirements for Spill Prevention and Response

Document, License or Permit	Section Number	Requirement
Final Screening Report and Recommendation: Proponent Commitments	110	SGC is committed to developing and implementing Environmental Management Plans with the following components: a) Spill Contingency Plan
Final Screening Report and Recommendation: Proponent Commitments	112	The ERP will include the following commitments: a) Resource inventories of personnel, equipment, first aid kits, spill kits, and clean-up materials will be maintained on-site and updated regularly. These inventories will also contain information on external resources available off-site (e.g., RCMP, fire department, other mining establishments in the vicinity). b) All staff on site will receive basic training, including environmental awareness, general emergency response, spill contingency measures, and communication procedures. Truck drivers transporting hazardous materials will also receive additional training on spill response, hazardous material handling, and emergency driving techniques. All security personnel will be trained in first aid.
Final Screening Report and Recommendation: Proponent Mitigations	26	Prevent and respond to all potential spills.
Final Screening Report and Recommendation: Proponent Mitigations	59	Fuel, hazardous material and explosives will be managed according to industry standards including; storage in appropriate containers; containment areas sized to hold the larger of 110% of the largest tank or 10% of the total maximum volume of all tanks in the facility; and storage of explosives in separate buildings away from the rest of the mine activities.
Quartz Mining License QML-0011	10.3	The Licensee must immediately implement the environmental management system if a spill or release of dangerous or hazardous substance or material occurs at the mine.
Class 4 Mining Lands Approval LQ00303	6	All spills must be reported immediately to the 24-Hour Yukon Spill Reporting Ling (867) 667-7244 and to the Mining Inspections Division (867) 456-3882.
Class 4 Mining Lands Approval LQ00303	37	A spill contingency plan for petroleum products and other hazardous waste must be prepared and posted in the camp and at all fuel handling locations used in carrying out the exploration program. The spill plan shall include reporting to EMR-CSI Mining Inspections and the Chief to ensure compliance with spill reporting requirements.
Class 4 Mining Lands Approval LQ00303	38	All spill clean-up equipment and material must be maintained in a state of readiness sufficient at all times to contain and clean-up any hazardous material spills.
Class 4 Mining Lands Approval LQ00303	39	If a spill occurs, the spill contingency plan must be immediately implemented and notice given to the 24-hour Yukon Spill Report Line. As soon as practicable, an inspector must be contacted. Whatever remedial action is required to clean-up the spill and reclaim the affected land and water must be taken.
Class 4 Mining Lands Approval LQ00303	40	Routine maintenance areas where heavy equipment is serviced or repaired should be inspected regularly for minor spills and stored waste hydrocarbons.
Class 4 Mining Lands Approval LQ00303	41	Any contaminated soils should be excavated and contained for eventual land farm treatment at an approved facility.
Type B Water Use Licence QZ16-	19	Where a spill or an unauthorized discharge occurs, that is of a reportable quantity under the Yukon Spills

Assessment, Licence and Permit Requirements for Spill Prevention and Response

Document, License or Permit	Section Number	Requirement
006		Regulations, the Licensee shall immediately contact the 24-hour Yukon Spill Report number, (867) 667-7244 and implement the Spill Contingency Plan. A detailed written report on any such event including, but not limited to, dates, quantities, parameters, causes and other relevant details and explanations, shall be submitted to the Board not later than 10 days after the occurrence.
Type B Water Use Licence QZ16-006	20	The Licensee shall apply the relevant procedures in the Spill Contingency Plan. The Licensee shall review the Spill Contingency Plan annually and shall provide a summary of that review, including any revisions to the plan, as a component of the annual report.
Type B Water Use Licence QZ16-006	21	The Licensee shall maintain a log book of all spill or unauthorized discharge occurrences, including spills that are less than the reportable quantities under the Yukon Spills Regulations. The log book shall be made available at the request of an Inspector. The log book shall include, but not necessarily be limited to the: a) date and time of the spill or unauthorized discharge occurrence; b) substance spilt or discharged; c) approximate amount spilt or discharged; d) location of the spill; e) distance between the spill or discharge and the nearest Watercourse; and f) remedial measures taken to contain and clean-up the spill area or to cease the unauthorized discharge.
Type B Water Use Licence QZ16-006	22	The Licensee shall include a summary of all spills or unauthorized discharges that occurred during the year reported, as part of the annual report.
Type B Water Use Licence QZ16-006	23	All personnel shall be trained in procedures to be followed and the equipment to be used in the containment of a spill.
Type B Water Use Licence QZ16-006	24	Prior to the commencement of construction. the Licensee shall update the Spill Contingency Plan and provide the updated plan to the Board.
Type B Water Use Licence QZ16-006	25	The Spill Contingency Plan shall be posted on site for the duration of the works.
Type B Water Use Licence QZ16-006	26	Ten days prior to construction, the Licensee shall submit material safety data sheets to the Board for all petroleum products and/or hazardous materials that are to be present during this undertaking.
Type B Water Use Licence QZ16-006	13	Fuel, lubricants, hydraulic fluids, coolants and similar substances shall be stored and/or transferred a minimum of 30 metres from the Natural Boundary of any Watercourse, in such a way that said substances are not deposited in or allowed to be deposited in waters.
Type A Water Use Licence QZ14-041	8	The Licensee shall apply the relevant procedures in the Spill Contingency Plan. The Licensee shall review the Spill Contingency Plan annually and shall provide a summary of that review, including any revisions to the plan, as a component of the annual report.
Type A Water Use Licence QZ14-041	9	The Licensee shall maintain a log book of all spill or unauthorized discharge occurrences, including spills that are less than the reportable quantities under the Yukon Spills Regulations. The log book shall be made available

Assessment, Licence and Permit Requirements for Spill Prevention and Response

Document, License or Permit	Section Number	Requirement
		at the request of an Inspector. The log book shall include, but not necessarily be limited to the: g) Date and time of the spill; h) Substance spilt or discharged; i) Approximate amount spilt or discharged; j) Location of the spill; k) Distance between the spill or discharge and the nearest Watercourse; and l) Remedial measures taken to contain and clean-up the spill area or to cease the unauthorized discharge.
Type A Water Use Licence QZ14-041	10	The Licensee shall include a summary of all spills or unauthorized discharges that occurred during the year reported, as part of the annual report.
Type A Water Use Licence QZ14-041	11	All relevant personnel shall be trained in procedures to be followed and the equipment to be used in the containment of a spill.
Type A Water Use Licence QZ14-041	12	Prior to the commencement of Development, the Licensee shall update the Spill Contingency Plan and provide the updated plan to the Board.
Type A Water Use Licence QZ14-041	13	The Spill Contingency Plan shall be posted on site for the duration of the works.
Type A Water Use Licence QZ14-041	14	Ten days prior to Development, the Licensee shall submit material safety data sheets to the Board for all petroleum products and/or hazardous materials that are to be present during the Project.
Type A Water Use Licence QZ14-041	15	Fuel, lubricants, hydraulic fluids, coolants and similar substances shall be stored and/or transferred a minimum of 30 meters from the Natural Boundary of any Watercourse, in such a way that said substances are not deposited in waters.

APPENDIX B

Eagle Gold Spill Report Form

THIS PAGE INTENTIONALLY LEFT BLANK

EAGLE GOLD PROJECT
SPILL RESPONSE FORM

Name (first observer):		**Department:**	
Date of spill:		**Time of spill:**	
Location of spill:		**Site conditions (temperature, wind, precipitations, etc.):**	
Photos: please list & append			
Safety hazards identified (Fire, explosive substance, etc.):			
Substance spilled:			
Estimated volume of spill (Liters or kilograms):			
Cause of spill (Equipment malfunction, vehicle accident, etc.)			
Environmental areas affected (watercourse, soil, wetland, etc.)			
Containment actions taken:			
Disposal method and location:			
Samples taken:			
Further actions required:			
Supervisor reported to:			
Is the Spill Reportable		**Who was it reported to?**	

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C

Reportable Spill Thresholds

THIS PAGE INTENTIONALLY LEFT BLANK

Reportable Spill Thresholds, Personal Protective Equipment and Clean-up Method by Substance FOR UNUSED PRODUCTS

Substance Name	Type	TDGA Class	Reportable Threshold	PPE required for Spill Response	Cleanup or disposal method
Propane	Petroleum product	2	Any amount of gas from a container larger than 100 L, or where the spill results from equipment failure, error, or deliberate action or inaction	Insulated gloves, safety glasses, respirator if there is a possible of oxygen reduction (confined spaces with poor ventilation)	Shut off flow and remove ignition sources if safe to do so and evacuate area. Consult supplier if container needs disposal.
Acetylene	Petroleum product	2	Any amount of gas from a container larger than 100 L, or where the spill results from equipment failure, error, or deliberate action or inaction	Insulated gloves, safety glasses, respirator	Shut off flow and remove ignition sources if safe to do so and evacuate area. Consult supplier if container needs disposal.
Oxygen	Gas	2	Any amount of gas from a container larger than 100 L, or where the spill results from equipment failure, error, or deliberate action or inaction	Insulated gloves, safety glasses	Allow gas to dissipate. Consult supplier if container needs disposal.
Gasoline	Petroleum product	3	200 L (any amount if spilled into a watercourse	Chemical-resistant impervious gloves, safety glasses, respirator if ventilation is inadequate	Approach from upwind, contain and collect spillage with sorbents from spill kits and/or sand and gravel. Pump free liquid into containment. Arrange for transport of material to an approved facility.
Diesel	Petroleum product	3	200 L (any amount if spilled into a watercourse)	Chemical-resistant impervious gloves, safety glasses	Approach from upwind and contain and collect spillage with sorbents from spill kits and/or sand and gravel. Pump free liquid into containment. Arrange for transport of material to an approved facility.
Jet A & B Aviation Fuel	Petroleum Product	3	200 L (any amount if spilled into a watercourse)	Chemical resistant gloves, safety glasses	Use sorbents, pump free liquid into containment. Arrange for transport of material to an approved facility.
Antifreeze	Solvent	9	5 L	Chemical-resistant impervious gloves, safety glasses	Approach from upwind, contain and collect spillage with sorbents from spill kits and/or sand and gravel. Pump free liquid into containment. Arrange for transport of material to an approved facility.
Lubricating and Hydraulic Oils	Lubricating oil	n/a	200 L (any amount if spilled into a watercourse)	Chemical-resistant gloves, safety glasses.	Approach from upwind, contain and collect spillage with sorbents from spill kits and/or sand and gravel. Pump free liquid into containment. Arrange for transport of material to an approved facility.

Reportable Spill Thresholds, Personal Protective Equipment and Clean-up Method by Substance
FOR USED/WASTE PRODUCTS

Substance Type	Time period	Reportable Threshold
Special Waste that may cause an adverse effect	N/A	Any amount
Solid Special Waste	24 hours	500 g
	30 days	5 kg
Liquid Special Waste	24 hours	500 ml
	30 days	5 L
Mixture of Solid and Liquid Waste	24 hours	500 g or 500 ml whichever is less
	30 days	5 kg or 5 L whichever is less

APPENDIX D

Spill Response Emergency Contact Numbers

THIS PAGE INTENTIONALLY LEFT BLANK

EAGLE GOLD PROJECT
SPILL RESPONSE
EMERGENCY CONTACT NUMBERS

Resource	Position/Division	Contact Number
Yukon Government - Environment	Spill Report Centre	**867-667-7244**
Eagle Gold Project Site	Site Manager	**Office 604-484-5665 or 778-785-0482** **Cell 867-335-4928**
StrataGold Corporation	VP Project Execution	**Office 604-696-6618** **Cell 778-386-3772**
StrataGold Corporation	Executive VP	**Office 604-696-6614** **Cell 778-888-4010**
StrataGold Corporation	Lands & Permitting Manager	**Office 604-696-6600** **Cell 604-349-6469**
Transport Canada	CANUTEC 24-hour service	**613-996-6666** or ***666 on a cellular phone**
Yukon Government – Energy, Mines and Resources	Client Services and Inspections – Mayo	**867-996-2568**
Yukon Government – Energy, Mines and Resources	Client Services and Inspections – Whitehorse	**867-456-3882**
Mayo Nursing Station		**867-996-4444**
Mayo Fire & Rescue		**867-996-2222**
Mayo RCMP		**Emergency: 867-996-5555** **Admin: 867-996-2677**
Yukon Government - Environment	Conservation	**867-996-2202**
Fisheries and Oceans Canada		**867-393-6722**

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX E

Material Safety Data Sheets

THIS PAGE INTENTIONALLY LEFT BLANK

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: MOBIL ANTIFREEZE EXTRA
Product Description: Glycol
Product Code: 330977, 351010601020
Intended Use: Antifreeze/coolant

COMPANY IDENTIFICATION

Supplier: **East Coast Lubes Pty Ltd (Queensland and Northern Territory)**
A.B.N. 37 117 203 611
Cnr North and Mort Streets
Toowoomba, Queensland 4350 Australia

24 Hour Environmental / Health Emergency Telephone 1300 131 001
Supplier General Contact 1800 069 019

Supplier: **Southern Cross Lubes (Victoria and Tasmania)**
58-66 Ajax Road
Altona, Victoria 3018, Australia

24 Hour Environmental / Health Emergency Telephone 1300 131 001
Product Technical Information 1300 466 245
Supplier General Contact 1300 552 861

Supplier: **Perkal Pty Ltd Trading as Statewide Oil (Western Australia)**
A.B.N. 43 009 283 363
14 Beete Street
Welshpool, Western Australia 6106 Australia

24 Hour Environmental / Health Emergency Telephone (8:00am to 4:30pm Mon to Fri) 1300 919 904
Product Technical Information (08) 9350 6777
Supplier General Contact (08) 9350 6777

Supplier: **Perkal Pty Ltd Trading as Roto Oil (South Australia)**
A.B.N. 43 009 283 363
6-10 Streiff Rd
Wingfield, South Australia 5013 Australia

24 Hour Environmental / Health Emergency Telephone (8:00am to 4:30pm Mon to Fri) 1300 919 904
Product Technical Information (08) 8359 8995
Supplier General Contact (08) 8359 8995

SECTION 2 HAZARDS IDENTIFICATION

This material is hazardous according to regulatory guidelines (see (M)SDS Section 15).

GHS CLASSIFICATION:

Acute oral toxicant: Category 4. Specific target organ toxicant (repeated exposure): Category 2.

GHS Label Elements:

Pictogram:

Signal Word: Warning

Hazard Statements:

Health: H302: Harmful if swallowed. H373: May cause damage to organs through prolonged or repeated exposure. Kidney

Precautionary Statements:

General: P101: If medical advice is needed, have product container or label at hand. P102: Keep out of reach of children. P103: Read label before use.
Prevention: P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P264: Wash skin thoroughly after handling. P270: Do not eat, drink or smoke when using this product. P280: Wear protective gloves and clothing.
Response: P301 + P312: IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. P308 + P313: IF exposed or concerned: Get medical advice/attention. P314: Get medical advice/attention if you feel unwell. P330: Rinse mouth.
Storage: P405: Store locked up.
Disposal: P501: Dispose of contents and container in accordance with local regulations.

Contains: ETHYLENE GLYCOL

Other hazard information:

Physical / Chemical Hazards:
No significant hazards.

Health Hazards:
High-pressure injection under skin may cause serious damage. Ingestion may cause serious adverse effects and may be fatal. May cause kidney failure and central nervous system effects. Prolonged exposure to elevated concentrations of mist or liquid may cause irritation of the skin, eyes, and respiratory tract.

Environmental Hazards:
No significant hazards.

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

Reportable Hazardous Substance(s) or Complex Substance(s)

Name	CAS#	Concentration*	GHS Hazard Codes
2-ETHYLHEXANOIC ACID, SODIUM SALT	19766-89-3	< 3.0%	H361(D)
DISODIUM TETRABORATE PENTAHYDRATE	12179-04-3	< 1.0%	H319(2A), H360(1B)(D), H360(1B)(F)
ETHYLENE GLYCOL	107-21-1	> 90.0%	H302, H373

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume. Other ingredients determined not to be hazardous up to 100%.

SECTION 4 FIRST AID MEASURES

INHALATION

Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.

SKIN CONTACT

Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

Seek immediate medical attention.

NOTE TO PHYSICIAN

This product contains ethylene glycol and/or diethylene glycol which, if ingested, are metabolized to toxic metabolites by the enzyme alcohol dehydrogenase, for which ethanol and 4-methylpyrazole {U.S. drug name Fomepizole, trade name Antizol} are antagonists. Administration of oral or intravenous ethanol or intravenous 4-methylpyrazole may arrest further metabolism of this material and thereby ameliorate the toxicity. Use of ethanol or 4-methylpyrazole does not affect toxic metabolites that are already present and is not a substitute for hemodialysis.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, alcohol-resistant foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight streams of water or standard foam

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Fire-fighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Aldehydes, Incomplete combustion products, Oxides of carbon, Smoke, Fume

FLAMMABILITY PROPERTIES

Flash Point [Method]: >120°C (248°F) [EN/ISO 2719]
Flammable Limits (Approximate volume % in air): LEL: 4.9 UEL: 14.6
Autoignition Temperature: >440°C (824°F) [DIN 51794]

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required, due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do so without risk. Do not touch or walk through spilled material. Small Spills: Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do so without risk. Material will sink. Remove material, as much as possible, using mechanical equipment.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Remove debris in path of spill and remove contaminated debris from shoreline and water surface. Dispose of according to local regulations. Large Spills: Dyke far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid breathing mists or vapour. Avoid contact with skin. Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is not a static accumulator.

STORAGE

Do not store in open or unlabelled containers.

Material is defined under the National Standard [NOHSC:1015] Storage and Handling of Workplace Dangerous Goods.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Substance Name	Form	Limit/Standard			Note	Source
DISODIUM TETRABORATE PENTAHYDRATE		TWA	1 mg/m3			Australia OELs
DISODIUM TETRABORATE PENTAHYDRATE	Inhalable fraction.	STEL	6 mg/m3			ACGIH
DISODIUM TETRABORATE PENTAHYDRATE	Inhalable fraction.	TWA	2 mg/m3			ACGIH
ETHYLENE GLYCOL	Vapour.	STEL	104 mg/m3	40 ppm	Skin	Australia OELs
ETHYLENE GLYCOL	Particulate.	TWA	10 mg/m3		Skin	Australia OELs
ETHYLENE GLYCOL	Vapour.	TWA	52 mg/m3	20 ppm	Skin	Australia OELs
ETHYLENE GLYCOL	Aerosol.	Ceiling	100 mg/m3			ACGIH

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

Biological limits

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Particulate

No protection is ordinarily required under normal conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapour warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

Nitrile,Viton

Chemical resistant gloves are recommended.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practise good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Colour: Blue-Green
Odour: Odourless
Odour Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 20 °C): 1.12
Flammability (Solid, Gas): N/A
Flash Point [Method]: >120°C (248°F) [EN/ISO 2719]
Flammable Limits (Approximate volume % in air): LEL: 4.9 UEL: 14.6
Autoignition Temperature: >440°C (824°F) [DIN 51794]
Boiling Point / Range: 170°C (338°F)
Decomposition Temperature: N/D
Vapour Density (Air = 1): N/D
Vapour Pressure: N/D
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/D
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Complete
Viscosity: [N/D at 40ºC]
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/D

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

INCOMPATIBLE MATERIALS: Strong Acids, Strong oxidisers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data for material.	Negligible hazard at ambient/normal handling temperatures.
Ingestion	
Acute Toxicity (Human): LDLo 100 ml	Moderately toxic. Based on assessment of the components.
Skin	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin Corrosion/Irritation: No end point data for material.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	

Serious Eye Damage/Irritation: No end point data for material.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.
Sensitisation	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: No end point data for material.	Not expected to be a skin sensitizer. Based on assessment of the components.
Aspiration: No end point data for material.	Not expected to be an aspiration hazard. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: No end point data for material.	Not expected to be a germ cell mutagen. Based on assessment of the components.
Carcinogenicity: No end point data for material.	Not expected to cause cancer. Based on assessment of the components.
Reproductive Toxicity: No end point data for material.	Contains a substance that may be a reproductive toxicant. Based on assessment of the components.
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: No end point data for material.	Concentrated, prolonged or deliberate exposure may cause organ damage. Based on assessment of the components.

TOXICITY FOR SUBSTANCES

NAME	ACUTE TOXICITY
ETHYLENE GLYCOL	Oral Lethality: LD 50 4700 mg/kg (Rat)

OTHER INFORMATION

For the product itself:

Target Organs Repeated Exposure: Kidney

Contains:

ETHYLENE GLYCOL (EG): Repeated high oral exposure has caused kidney damage, neurological effects, degeneration of the liver and changes in blood chemistry and circulating blood cells in laboratory animals. Repeated overexposure has the potential to cause similar toxic effects in humans. EG causes developmental and reproductive effects at high dose levels in laboratory animals. The relevance of these findings to humans is uncertain. However, as a precaution, avoid exposure during pregnancy. Sodium tetraborate: Adverse effects on fertility and fetal development have been observed in laboratory animals.

IARC Classification:

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = IARC 1 2 = IARC 2A 3 = IARC 2B

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Material -- Expected to remain in water or migrate through soil.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Material -- Expected to be readily biodegradable.

Atmospheric Oxidation:

Material -- Expected to degrade rapidly in air

BIOACCUMULATION POTENTIAL

Material -- Potential to bioaccumulate is low.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Even though this product is readily biodegradable, it must not be indiscriminately discarded into the environment. Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (ADG) : Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport
, EHS

SECTION 15 REGULATORY INFORMATION

This material is considered hazardous according to Australia Model Work Health and Safety Regulations.

Product is not regulated according to Australian Dangerous Goods Code.

Poison Schedule number allocated by the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) established under the Therapeutic Goods Act.
POISON SCHEDULE NUMBER: S5

AS1940 COMBUSTIBLE CLASS: C1

REGULATORY STATUS AND APPLICABLE LAWS AND REGULATIONS

Listed or exempt from listing/notification on the following chemical inventories: IECSC, KECI, TSCA
Special Cases:

Inventory	Status
AICS	Restrictions Apply
ENCS	Restrictions Apply

SECTION 16 OTHER INFORMATION

KEY TO ABBREVIATIONS AND ACRONYMS:

N/D = Not determined, N/A = Not applicable, STEL = Short-Term Exposure Limit, TWA = Time-Weighted Average

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H302: Harmful if swallowed; Acute Tox Oral, Cat 4
H319(2A): Causes serious eye irritation; Serious Eye Damage/Irr, Cat 2A
H360(1B)(D): May damage the unborn child; Repro Tox, Cat 1B (Develop)
H360(1B)(F): May damage fertility; Repro Tox, Cat 1B (Fertility)
H361(D): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop)
H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Company Logo (Fld 1) information was modified.
GHS Precautionary Statements - Prevention information was modified.
GHS Target Organ List information was added.
GHS Target Organ List information was deleted.
Perkal Pty Ltd Trading as Roto Oil (South Australia): Section 01: Supplier Mailing Address information was added.
Perkal Pty Ltd Trading as Roto Oil (South Australia): Section 01: Supplier Mailing Address information was deleted.
Perkal Pty Ltd Trading as Statewide Oil (Western Australia): Section 01: Supplier Mailing Address information was added.
Perkal Pty Ltd Trading as Statewide Oil (Western Australia): Section 01: Supplier Mailing Address information was

deleted.
Section 05: Fire Fighting Measures - Fire Fighting Instruction information was modified.
Section 16: Global Disclaimer information was modified.
Southern Cross Lubes (Victoria and Tasmania): Section 01: Supplier Mailing Address information was added.
Southern Cross Oil Pty Ltd Trading as Southern Cross Lubes (Victoria and Tasmania): Section 01: Supplier Mailing Address information was deleted.

The information and recommendations contained herein are, to the best of ExxonMobil's knowledge and belief, accurate and reliable as of the date issued. You can contact ExxonMobil to insure that this document is the most current available from ExxonMobil. The information and recommendations are offered for the user's consideration and examination. It is the user's responsibility to satisfy itself that the product is suitable for the intended use. If buyer repackages this product, it is the user's responsibility to insure proper health, safety and other necessary information is included with and/or on the container. Appropriate warnings and safe-handling procedures should be provided to handlers and users. Alteration of this document is strictly prohibited. Except to the extent required by law, re-publication or retransmission of this document, in whole or in part, is not permitted. The term, "ExxonMobil" is used for convenience, and may include any one or more of ExxonMobil Chemical Company, Exxon Mobil Corporation, or any affiliates in which they directly of indirectly hold any interest.

DGN: 7076356DAU (551452)

Prepared by: Exxon Mobil Corporation
EMBSI, Clinton NJ USA
Contact Point: See Section 1 for Local Contact number

End of (M)SDS

Gas Line Antifreeze

SECTION 1. IDENTIFICATION

Product Identifier	Gas Line Antifreeze
Other Means of Identification	15-355, 15-356, 35-351SO, 35-355C, 35-355H, 35-355WM, 35-356CHR, 35-356CQ, 35-356LAU, 35-356PC, 35-356SO, 35-356SS
Other Identification	Methyl Hydrate
Recommended Use	Please refer to Product label.
Restrictions on Use	None known.
Manufacturer / Supplier	Recochem Inc., 850 Montee de Liesse, Montreal, QC, H4T 1P4, Compliance and Regulatory Department, 905-878-5544, www.recochem.com
Emergency Phone No.	CANUTEC, 613-996-6666, 24 Hours
SDS No.	1605

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Flammable liquid - Category 2; Acute toxicity (Oral) - Category 3; Acute toxicity (Dermal) - Category 3; Acute toxicity (Inhalation) - Category 3; Specific target organ toxicity (single exposure) - Category 1

GHS Label Elements

Signal Word:
Danger

Hazard Statement(s):

H225	Highly flammable liquid and vapour.
H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H331	Toxic if inhaled.
H370	Causes damage to organs (eyes) if swallowed.

Precautionary Statement(s):

Prevention:

P210	Keep away from heat, sparks, open flames, and hot surfaces. – No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical, ventilating, lighting, and other equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P260	Do not breathe fume, mist, vapours, spray.
P264	Wash hands and skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.

P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/protective clothing.

Response:
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTRE/doctor.
P330 Rinse mouth.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P312 Call a POISON CENTRE/doctor if you feel unwell.
P363 Wash contaminated clothing before reuse.
P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a POISON CENTRE/doctor if you feel unwell.
P321 Specific treatment (see supplemental first aid instruction on this label).
P370 + P378 In case of fire: Use appropriate foam, carbon dioxide, dry chemical powder, water spray or fog to extinguish.

Storage:
Store in a well ventilated place. Keep cool. Keep container tightly closed. Store locked up.

Disposal:
Dispose of contents/container in accordance with applicable regional, national and local laws and regulations.

Other Hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance:

Chemical Name	CAS No.	%	Other Identifiers
Methanol	67-56-1	60-100	

SECTION 4. FIRST-AID MEASURES

First-aid Measures

Inhalation

Take precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). Remove source of exposure or move to fresh air. Keep at rest in a position comfortable for breathing. If breathing has stopped, trained personnel should begin rescue breathing. If the heart has stopped, trained personnel should start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED). Avoid mouth-to-mouth contact by using a barrier device. Get medical advice/attention if you feel unwell or are concerned.

Skin Contact

Avoid direct contact. Wear chemical protective clothing if necessary. Take off immediately contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Wash gently and thoroughly with lukewarm, gently flowing water and mild soap for 5 minutes. Get medical advice/attention if you feel unwell or are concerned. Thoroughly clean clothing, shoes and leather goods before reuse or dispose of safely.

Eye Contact

Avoid direct contact. Wear chemical protective gloves if necessary. Immediately rinse the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes, while holding the eyelid(s) open. If eye irritation persists, get medical advice/attention.

Ingestion

Rinse mouth with water. Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Do not induce vomiting. If vomiting occurs naturally, lie on your side in the recovery position. Rinse

mouth with water again. If breathing has stopped, trained personnel should immediately begin rescue breathing. If the heart has stopped, trained personnel should start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED). Avoid mouth-to-mouth contact by using a barrier device. Immediately call a Poison Centre or doctor. Treatment is urgently required.

Most Important Symptoms and Effects, Acute and Delayed

No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Immediate Medical Attention and Special Treatment

Target Organs

Eyes, liver, nervous system.

Special Instructions

Acute exposure to methanol, either through ingestion or breathing high airborne concentrations can result in symptoms appearing between 40 minutes and 72 hours after exposure. Symptoms and signs are usually limited to CNS, eyes and gastrointestinal tract. Because of the initial CNS's effects of headache, vertigo, lethargy and confusion, there may be an impression of ethanol intoxication. Blurred vision, decreased acuity and photophobia are common complaints. Treatment with ipecac or lavage is indicated in any patient presenting within two hours of ingestion. A profound metabolic acidosis occurs in severe poisoning and serum bicarbonate levels are a more accurate measure of severity than serum methanol levels. Treatment protocols are available from most major hospitals and early collaboration with appropriate hospitals is recommended.

Medical Conditions Aggravated by Exposure

Respiratory conditions, dermatitis, eye conditions.

SECTION 5. FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media

Carbon dioxide, dry chemical powder or appropriate foam. Special "alcohol resistant fire-fighting foams".

Unsuitable Extinguishing Media

Water is not effective for extinguishing a fire. It may not cool product below its flash point.

Specific Hazards Arising from the Chemical

Highly flammable liquid and vapour. Can ignite at room temperature. Releases vapour that can form explosive mixture with air. Can be ignited by static discharge. Can accumulate static charge by flow, splashing or agitation. Even dilute solutions in water may be flammable. May travel a considerable distance to a source of ignition and flash back to a leak or open container. See Section 9 (Physical and Chemical Properties) for flash point and explosive limits. Burns with an invisible flame. May accumulate in hazardous amounts in low-lying areas especially inside confined spaces, resulting in a fire hazard.
In a fire, the following hazardous materials may be generated: toxic chemicals; very toxic carbon monoxide, carbon dioxide; very toxic, flammable formaldehyde.

Special Protective Equipment and Precautions for Fire-fighters

Review Section 6 (Accidental Release Measures) for important information on responding to leaks/spills.
See Skin Protection in Section 8 (Exposure Controls/Personal Protection) for advice on suitable chemical protective materials.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures

Evacuate the area immediately. Isolate the hazard area. Keep out unnecessary and unprotected personnel. Evacuate downwind locations. Use the personal protective equipment recommended in Section 8 of this safety data sheet. Increase ventilation to area or move leaking container to a well-ventilated and secure area. Eliminate all ignition sources. Use grounded, explosion-proof equipment. May accumulate in hazardous amounts in low-lying areas especially inside confined spaces, if ventilation is not sufficient. Distant ignition and flashback are possible.

Environmental Precautions

Do not allow into any sewer, on the ground or into any waterway.

Methods and Materials for Containment and Cleaning Up

Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling

Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Conditions for Safe Storage

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

	ACGIH TLV®		OSHA PEL		AIHA WEEL	
Chemical Name	TWA	STEL	TWA	Ceiling	8-hr TWA	TWA
Methanol	200 ppm	250 ppm	200 ppm	250 ppm		

Appropriate Engineering Controls

General ventilation is usually adequate. For large scale use of this product: do not allow product to accumulate in the air in work or storage areas, or in confined spaces. Use local exhaust ventilation, if general ventilation is not adequate to control amount in the air. Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems in areas where this product is used and stored. Control static electricity discharges which includes bonding of equipment to ground. Use only non-combustible, compatible materials for walls, floors, ventilation system, air cleaning devices, pallets, shelving. Provide safety shower in work area, if contact or splash hazard exists.

Individual Protection Measures

Eye/Face Protection

Wear chemical safety goggles.

Skin Protection

Wear chemical protective clothing e.g. gloves, aprons, boots.
Nitrile rubber.

Respiratory Protection

Not normally required if product is used as directed. For non-routine or emergency situations: wear a NIOSH approved air-purifying respirator with an organic vapour cartridge.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Basic Physical and Chemical Properties

Appearance	Clear colourless liquid.
Odour	Pungent
Odour Threshold	4.2 - 5960 ppm (5.5 - 7794.2 mg/m3)
pH	Not available
Melting Point/Freezing Point	-97.7 ºC (-143.9 ºF) (melting); -97.7 ºC (-143.9 ºF) (freezing)
Initial Boiling Point/Range	64.7 ºC (148.5 ºF)
Flash Point	11 ºC (52 ºF) (closed cup)
Evaporation Rate	4.1 (n-butyl acetate = 1)
Flammability (solid, gas)	Not applicable
Upper/Lower Flammability or Explosive Limit	36% (upper); 6% (lower)
Vapour Pressure	96.0 mm Hg (12.8 kPa) at 20 ºC
Vapour Density (air = 1)	1.1
Relative Density (water = 1)	0.791 at 25 ºC
Solubility	Soluble in water; Soluble in all proportions in alcohols (e.g. ethanol).
Partition Coefficient, n-Octanol/Water (Log Kow)	-0.77 at 20 ºC
Auto-ignition Temperature	464 ºC (867 ºF)
Decomposition Temperature	Not available
Viscosity	0.686 - 0.699 mm2/s at 25 ºC (kinematic); 0.54 - 0.55 mPa.s at 20 ºC (dynamic)

Other Information

Physical State	Liquid
Molecular Weight	32.04

SECTION 10. STABILITY AND REACTIVITY

Reactivity

None known.

Chemical Stability

Normally stable.

Possibility of Hazardous Reactions

None known.

Conditions to Avoid

Heat. Open flames, sparks, static discharge, heat and other ignition sources. Temperatures above 11.0 ºC (51.8 ºF)

Incompatible Materials

Reacts violently with: reacts explosively with: strong oxidizing agents (e.g. perchloric acid).
Highly reactive. Strong acids (e.g. hydrochloric acid).

Hazardous Decomposition Products

Very toxic carbon monoxide, carbon dioxide; very toxic, flammable formaldehyde.

SECTION 11. TOXICOLOGICAL INFORMATION

Likely Routes of Exposure

Ingestion; eye contact; skin contact; inhalation.

Acute Toxicity

Chemical Name	LC50	LD50 (oral)	LD50 (dermal)
Methanol	83867.5 mg/m3 (rat) (4-hour exposure)	5628 mg/kg (rat)	15800 mg/kg (rabbit)

LC50: Not applicable.

LD50 (oral): Not applicable.

LD50 (dermal): Not applicable.

Skin Corrosion/Irritation

Human experience shows very mild irritation.

Serious Eye Damage/Irritation

Animal tests show serious eye irritation.

STOT (Specific Target Organ Toxicity) - Single Exposure

Inhalation

May be harmful based on human experience and animal tests. Depression of the central nervous system. Symptoms may include headache, nausea, dizziness, drowsiness and confusion. A severe exposure can cause unconsciousness.
Toxic, can cause death based on human experience. At high concentrations.

Skin Absorption

Harmful based on human experience. Can cause effects as described for inhalation. Depression of the central nervous system. Symptoms may include headache, nausea, dizziness, drowsiness and confusion. A severe exposure can cause unconsciousness.

Ingestion

Toxic, can cause death depression of the central nervous system, impaired vision and blindness. In some cases, there may be delayed effects on the nervous system. Symptoms may include headache, nausea, vomiting, dizziness, drowsiness and confusion. A severe exposure may cause stomach pain, muscle pain, difficult breathing and coma. Vision can be impaired and permanent blindness can result. There may be other permanent effects on the nervous system e.g. tremor, seizures.

Aspiration Hazard

Not known to be an aspiration hazard.

STOT (Specific Target Organ Toxicity) - Repeated Exposure

May cause damage to organs based on limited evidence. If inhaled: effects on the central nervous system. Symptoms may include restlessness, reduced ability to think, muscle tremors, memory loss and personality changes. effects similar to STOT (Specific Target Organ Toxicity) - Single Exposure, as described above.
May cause Following skin contact: dermatitis. Symptoms may include dry, red, cracked skin (dermatitis). effects similar to STOT (Specific Target Organ Toxicity) - Single Exposure, as described above.
May cause If inhaled: at high concentrations visual distubances, cataracts, opacities.
May cause If inhaled: at high concentrations harmful effects on the liver.

Respiratory and/or Skin Sensitization

Not known to be a respiratory sensitizer. Not known to be a skin sensitizer.

Carcinogenicity

Chemical Name	IARC	ACGIH®	NTP	OSHA
Methanol	Not Listed	Not designated	Not Listed	Not Listed

Reproductive Toxicity

Development of Offspring

Animal studies show effects on the offspring. If inhaled: known to cause: decreased weight, birth defects. Teratogenic(external, soft tissue and skeletal defects) embryotoxic (late resorptions).

Sexual Function and Fertility

Not known to cause effects on sexual function or fertility.

Effects on or via Lactation

May cause effects on or via lacation. Can transfer to mother's milk.

Germ Cell Mutagenicity

Conclusions cannot be drawn from the limited studies available.

Interactive Effects

No information was located.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity

Acute Aquatic Toxicity

Chemical Name	LC50 Fish	EC50 Crustacea	ErC50 Aquatic Plants	ErC50 Algae
Methanol	15400 mg/L (Lepomis macrochirus (bluegill); 96-hour)	10000 mg/L (Daphnia magna (water flea); 48-hour)		

Chronic Aquatic Toxicity

Chemical Name	NOEC Fish	EC50 Fish	NOEC Crustacea	EC50 Crustacea
Methanol	7900 mg/L (Lepomis macrochirus (bluegill); 200-hrs)			

Persistence and Degradability

Degrades rapidly based on quantitative tests.

Bioaccumulative Potential

This product and its degradation products are not expected to bioaccumulate.

Mobility in Soil

No information was located.

Other Adverse Effects

There is no information available.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal Methods

The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14. TRANSPORT INFORMATION

Regulation	UN No.	Proper Shipping Name	Transport Hazard Class(es)	Packing Group
Canadian TDG	1230	METHANOL	3 (6.1)	II
US DOT	1230	METHANOL	3 (6.1)	II

Environmental Hazards: Not applicable

Special Precautions for User: Please note: In containers of 1 L (1Kg) capacity or less this product is classified as a "Limited Quantities""Consumer Commodity" under TDG regulations.
In containers of 1 L (1Kg) this product is qualified as a "consumer commodity" ORM-D under DOT

Transport in Bulk According to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15. REGULATORY INFORMATION

Safety, Health and Environmental Regulations

Canada

Domestic Substances List (DSL) / Non-Domestic Substances List (NDSL)

All ingredients are listed on the DSL/NDSL.

USA

Toxic Substances Control Act (TSCA) Section 8(b)

All ingredients are listed on the TSCA Inventory.

Additional USA Regulatory Lists

California Proposition 65: WARNING: This product contains chemicals known to the State of California to cause birth defects.

SECTION 16. OTHER INFORMATION

SDS Prepared By: Compliance and Regulatory Department

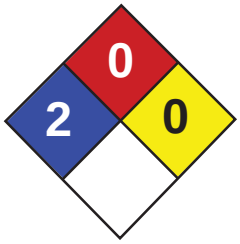
Phone No.: 905-878-5544

Date of Preparation: November 09, 2015

Additional Information: We are committed to uphold the Industry Consumer Ingredient Communication Voluntary Initiative.
Please send us your request by visiting our website at www.recochem.com.

Ingredients present (intentionally added ingredients) at a concentration of greater than one percent (1%) shall be listed in descending order of predominance. Ingredients present at a concentration of not more than one percent shall be listed but may be disclosed without respect to order of predominance.

Disclaimer: Notice to reader: To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.



Material Safety Data Sheet
Copper sulfate pentahydrate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Copper sulfate pentahydrate

Catalog Codes: SLC3778, SLC4567, SLC1774, SLC3565, SLC5353

CAS#: 7758-99-8

RTECS: GL8900000

TSCA: TSCA 8(b) inventory: No products were found.

CI#: Not applicable.

Synonym: Blue vitriol; Copper (II) Sulfate Pentahydrate

Chemical Name: Cupric sulfate pentrahydrate

Chemical Formula: CuSO4.5H2O

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Copper sulfate pentahydrate	7758-99-8	100

Toxicological Data on Ingredients: Copper sulfate pentahydrate: ORAL (LD50): Acute: 300 mg/kg [Rat.]. DERMAL (LD50): Acute: >2000 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
When heated to decomposition it emits toxic fumes. Solutions are acidic and can react with magnesium to evolve flammable hydrogen gas

Special Remarks on Explosion Hazards: Nitromethanes and copper salts spontaneously form explosive materials

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as metals, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation TWA: 0.1 (mg/m3) from OSHA (PEL) [United States] Inhalation TWA: 1 (mg/m3) from NIOSH InhalationConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline granules solid. Powdered solid.)

Odor: Odorless.

Taste: Nauseous metallic.

Molecular Weight: 249.69 g/mole

Color: Blue. (Light.)

pH (1% soln/water): Not available.

Boiling Point: 150°C (302°F)

Melting Point: 110°C (230°F)

Critical Temperature: Not available.

Specific Gravity: 2.28 @ 15.6 deg. C(Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol.

Solubility:
Easily soluble in hot water. Soluble in cold water, methanol. Solubility in water: 31.6 g/100 ml @ 0 deg. C.; 203.3 g/100 ml @ 100 deg. C Solubility in methanol: 15.6 g/100 ml @ 18 deg. C. Insoluble in ethanol. It readily forms alkaline complexes at sufficiently high concentrations of amines or alkali cyanides. Practically insoluble in most organic solvents.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat (high temperatures), incompatible materials, exposure to air

Incompatibility with various substances: Reactive with metals, alkalis.

Corrosivity: Highly corrosive in presence of steel.

Special Remarks on Reactivity:
Air Sensitive. Slowly efforescent in air. Solutions of hyprobromite are decomposed by powerful catalytic action of cupric ions, even as impurities. Incompatible with finely powdered metals.

Special Remarks on Corrosivity:
Corrosive to finely powdered metals. Very corrosive to plain steel

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 300 mg/kg [Rat.]. Acute dermal toxicity (LD50): >2000 mg/kg [Rat].

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. May cause damage to the following organs: kidneys, liver.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 1088 mg/kg

Special Remarks on Chronic Effects on Humans: May affect genetic material based on animal data

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation. May cause skin burns. It may cause and itching allergic eczema. Eyes: Causes eye irritation. May cause eye burns. It may cause conjunctivitis, corneal discoloration, ulceration and turbidity of the cornea. Inhalation: Causes respiratory tract (nose, throat, lung) irritation with coughing and wheezing. May cause ulceration and perforation of the nasal septum if inhaled in excessive quantities. Burning copper sulfate may result in irritating and poisonous gases which may irritate the respiratory tract and lungs, and may cause fume metal fever which is characterized by flu-like symptoms such as fever, chills, muscle aches. Ingestion: Harmful if swallowed. May cause gastrointestinal tract irritation with nausea, vomiting, diarrhea, metallic taste, burning sensation in the stomach or epigastrum, abdominal pain, and possible gastrointestinal tract bleeding. May affect metabolism(metabolic acidosis), liver (liver damage, jaundice), blood (Methemoglobin, hemalytic anemia), urinary system (kidney damage, hematuria, hemoglobinuria, albuminuria), behavior/nervous systems (somnolence, tremor, psychosis, muscle weakness, coma), cardiovascular system (lowering of blood pressure, dysthrythmia). Oral mucosa, vomitus, stools, and saliva may be stained blue or green following ingestion. Aspiration pneumonia may develop following emesis and CNS depression. Chronic Potential Health Effects: Skin: Repeated or prolonged skin contact may cause thickening of the skin.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 0.1 ppm 48 hours [Goldfish]. 0.1 mg/l 96 hours [Rainbow Trout]. 2.5 mg/l 96 hours [Rainbow Trout].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation:
If released to soil, copper sulfate may leach to groundwater, be partly oxidized, or bind to humic materials, clay, or hydrous of iron and manganese. In water, it will bind to carbonates as well as humic materials, clay and hydrous oxides of iron and manganese. Copper is accumulated by plants and animals, but it does not appear to biomagnify from plants to animals. This lack of biomagnification appears common with heavy metals. In air, copper aerosols (in general) have a residence time of 2 to 10 days in an unpolluted atmosphere and 0.1 to >4 in a polluted, urban areas.

Section 13: Disposal Considerations

Waste Disposal:
Copper dusts or mist or copper compounds may be disposed of in Group III sealed containers in a secure sanitary landfill. Copper containing soluble wastes can be concentrated through the use of ion exchange, reverse osmosis, or evaporators to the point where copper can be electrolytically removed and sent to a reclaiming firm. If recovery is not feasible, the copper can be precipitated through the use of caustics and the sludge depositied in a chemical waste landfill. Be sure to consult with authorities (waste regulators). Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 9: Miscellaneous hazardous material.

Identification: : Environmentally hazardous substance, n.o.s. (Cupric Sulfate) UNNA: 3077 PG: III

Special Provisions for Transport:
additional markings "Marine Pollutant" - required for bulk shipments. The words "Marine Pollutant" must be entered on the shipping paper in association iwth the basic DOT description for bulk shipments.

Section 15: Other Regulatory Information

Federal and State Regulations:
SARA 313 toxic chemical notification and release reporting: Copper compounds CERCLA: Hazardous substances.: Copper sulfate pentahydrate: 10 lbs. (4.536 kg)

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R22- Harmful if swallowed. R36/38- Irritating to eyes and skin. R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S22- Do not breathe dust. S60- This material and its container must be disposed of as hazardous waste. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information

References:
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.

Other Special Considerations: Not available.

Created: 10/09/2005 05:01 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

Safety Data Sheet

Section 1 – Identification

Product Identifier: SuperClean Degreaser and Foaming Degreaser

Other means of Identification: Cleaning Solution

Name and Address of Responsible Parties:

SuperClean Brands, LLC
1380 Corporate Center Curve, Suite 107
Eagan, MN 55121

Information Telephone #: 1-651-365-7500
24 Hr. Emergency Telephone Number: 1-800-424-9300
Contract Number: CCN644158

Section 2 – Hazards Identification

Classification of the Chemical: Clear light purple liquid. Citrus odor.

This material is classified as hazardous under OSHA regulations (29 CFR 1910.1200) (Hazcom 2012).

Hazardous classification: Corrosive to Metals – Category 1
Skin irritation – Category 2
Eye irritation – Category 2A

Label elements:

Signal Word: Warning

Hazard Statements: Corrosive liquid.
May cause skin irritation.
May cause serious eye irritation.

Precautionary Statements: Keep only in original container.
Store in corrosive resistant container with inner liner.
Absorb spillage to prevent material damage.
Wash hands thoroughly after handling.
If on Skin: Wash with plenty of soap and water.

Section 2 – Hazards Identification (Continued)

If skin irritation occurs get medical advice/attention.
Take off contaminated clothing and wash before reuse.
Wear protective gloves.
Wear eye protection such as goggles or safety glasses with side shields.
If in eyes: Rinse cautiously with water for 15 minutes.
Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists get medical advice/attention.
Do not eat, drink or smoke when using this product.
If swallowed: Immediately call a poison center/physician.
Rinse mouth.
Dispose of contents/container in accordance with local, state, federal or international regulations.

Hazard Pictogram(s):

Other Hazards not otherwise classified:
This product contains 7% ingredients of an unknown acute toxicity. See section 11 for more information.

Section 3 – Composition/Information on Ingredients

Chemical Name, Common Name	CAS #	Concentration wt/wt(*)
Sodium Metasilicate	6834-92-0	<5
Sodium hydroxide	1310-73-2	<5
Surfactant, blend	Trade secret	1-10

*** Note: The exact concentrations of the chemical(s) above are being withheld as a trade secret.**

Section 4 – First-Aid Measures

Description of first aid measures:

Inhalation: If inhaled remove victim to fresh air and keep at rest. Call a poison center or physician if you feel unwell.

Skin contact: Wash with plenty of soap and water. Take off contaminated clothing and wash before reuse. If skin irritation occurs get medical advice/attention.

Eye contact: If product gets in eyes flush with water for at least 15 minutes. If eye irritation persists seek medical advice/attention.

Ingestion: Do NOT induce vomiting unless instructed by medical personal. Never give anything by mouth to an unconscious person. Get medical attention.

Most important symptoms and effects, both acute and delayed:

May cause skin irritation.
May cause serious eye irritation.
Ingestion may cause gastrointestinal irritation, nausea, vomiting, diarrhea and burns to the mouth, throat and esophagus.

Indication of any immediate medical attention and special treatment needed:
Treat symptomatically.

Section 5 – Fire-Fighting Measures

Extinguishing media:
Suitable extinguishing media: Water fog, Carbon dioxide, Dry chemical, Foam.
Unsuitable extinguishing media: Not available.

Special hazards arising from the substance or mixture: None known.

Flammability classification: Not flammable by OSHA/WHMIS criteria.

Hazardous combustion products: Carbon oxides, other unidentified organic compounds.

Special protective equipment and precautions for firefighters:
Protective equipment for fire-fighters: Firefighters should wear proper protective equipment (Bunker gear) and self-contained breathing apparatus with full face operated in positive pressure mode.

Section 6 – Accidental Release Measures

Personal precautions, protective equipment and emergency procedures:
All persons dealing with the clean-up should the appropriate chemically protective equipment. Keep people away from and upwind of spill/leak. Restrict access to area until completion of clean-up.

Methods and materials for containment and clean up:
If possible, prevention measures should be taken to stop any chemical from entering the ground water system. Ventilate the area. Scoop up material and place into suitable container(s). Dispose of according to local, state and federal regulations.

Section 7 – Handling and Storage

Precautions for safe handling:
Obtain special instructions before use. Do not handle until all safety precautions have been read and understand. Wear protective gloves and eye/face protection. Adequate ventilation should be supplied. Avoid prolonged contact with skin, eyes and clothing. Keep away from heat. Keep container tightly closed.

Conditions for safe storage:
Store in cool, dry and well ventilated place. Containers should be clearly identified, clear of obstructions and accessible only to authorized personnel. Have appropriate fire extinguishers/sprinkler system in place. Spill clean-up equipment should be in or near storage area.

Incompatible materials: Strong oxidizers, Strong acids.

Section 8 – Exposure Controls/Personal Protection

Exposure limits:

Chemical Name	ACGIH-TLV	OSHA-PEL
Sodium Metasilicate	Not Available	5mg/m3 (TWA)
Sodium hydroxide	2mg/m3	2mg/m3
Surfactant, blend	Not Available	Not Available

Exposure controls:

Ventilation and Engineering Measures: Use in well ventilated area. Apply technical measures to comply with occupational exposure limits if needed.

Respiratory Measures: If airborne concentrations are above the permissible exposure limit, use NIOSH approved respirators.

Section 8 – Exposure Controls/Personal Protection (Continued)

Skin Protection: Wear protective gloves. Where extensive exposure to the product is possible, use resistant apron/suit and boots.

Eye/Face Protection: Goggles or safety glasses with side shields.

Other Protective Equipment: Ensure that eyewash stations and a safety shower are close to the workstation(s).

General Hygiene Considerations: Avoid prolonged contact with eyes, skin and clothing. Do not eat or drink when using this product. Wash hands after handling. Remove and wash all contaminated clothing before re-use. Handle in accordance with good industrial hygiene and safety practice.

Section 9 – Physical and Chemical Properties

Appearance: Clear light purple liquid.
Odor: Citrus Odor
Odor threshold: Not available
PH: 12.5 -13.8
Melting/Freezing pointing: ~ -3C (26.6F)
Boiling point and boiling range: >100C (212F)
Flash point: >93.3C (199.4F)
Evaporation point (Butyl Acetate=1): Not available.
Flammability (method determination): Not available.
Lower flammability limit (% by vol.): Not available.
Upper flammability limit (% by vol.): Not available.
Vapor pressure: Not available.
Vapor density: Not available.
Relative density: 1.00 – 1.05
Solubility in water: Complete.
Partition Coefficient (n-octanol/water): Not available.
Auto ignition temperature: Not available.
Decomposition temperature: Not available.
Viscosity: Not available.
Volatiles (% by wt) = 0%
Volatile organic compounds: Not available.
Other physical/chemical comments: No addition information.

Section 10 – Stability and Reactivity

Reactivity: Not normally reactive.

Chemical stability: Stable under normal conditions.

Section 10 – Stability and Reactivity (Continued)

Possibility of hazardous reactions: Hazardous polymerization does not occur.

Conditions to avoid: Heat. Contact with incompatible materials.

Incompatible materials: Strong oxidizers, Strong acids. Avoid contact with glass.

Hazardous decomposition products: Carbon oxides.

Section 11 – Toxicological Information

Information on routes of exposure:

Routes of entry - Inhalation: YES
Routes of entry - Skin & Eye: YES
Routes of entry - Ingestion: YES
Routes of entry - Skin Absorption: YES

Potential Health Effects:

Signs and symptoms of short term exposure:

Signs and symptoms: Inhalation – May cause respiratory irritation.

Signs and symptoms: Ingestion – Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Larger amounts may cause burns to the throat and esophagus.

Signs and symptoms: Skin – May cause irritation. Symptoms may include redness, edema, drying, defatting and cracking of the skin.

Signs and symptoms: Eyes – May cause serious irritation.

Potential Chronic Health Effects: None known.

Mutagenicity: Not hazardous by OSHA/WHMIS criteria.

Carcinogenicity: No components are listed as carcinogens by ACGIH, IARC, OSHA or NTP.

Reproductive effects: Not hazardous by OSHA/WHMIS criteria.

Sensitization to material: No data available to indicate product may be a sensitizer.

Specific target organ effects: Not Available.

Section 11 – Toxicological Information (Continued)

Medical conditions aggravated by overexposure: Pre-existing skin and eye conditions.

Toxicological data: The calculated ATE value for this mixture is well above classification parameters.

ATE (oral) = 21,690mg/kg

Chemical Name	LD50-Oral	Dermal
Sodium Metasilicate	847mg/kg (Rat)	Not Available
Sodium hydroxide	500mg/kg (Rabbit)	Not Available
Surfactant, blend	Not Available	Not Available

Section 12 – Ecological Information

Ecotoxicity: This product itself has not been tested.
Mobility is soil: This product itself has not been tested.
Persistence and degradability: This product itself has not been tested.
Bioaccumulation potential: This product itself has not been tested.
Other adverse environmental effects: None Known.

Section 13 – Disposal Information

Handling for disposal: Handle in accordance with good industrial hygiene and safety practice. Refer to protective measures listed in sections 7 and 8.

Methods of disposal: Dispose in accordance with all applicable federal, state, provincial and local regulation. Contact your federal, state, provincial and local authorities for specific rules.

Section 14 – Transportation Information

US 49 CFR/DOT. Ground Transportation

UN No.:	UN3266
UN Proper shipping name:	Corrosive liquid, basic, inorganic, N.O.S., (sodium hydroxide, sodium metasilicate).
Transport hazard class:	8
Packing group:	II
ERG:	154

Special Transportation Notes: May be shipped as Limited Quantity by ground per provisions of CFR 49 173.154 (b).

Section 15 – Regulatory Information

US Federal Information:
TSCA: All listed ingredients appear on the Toxic Substances Control Act.

US CERCLA Reportable quantity (RQ): Sodium hydroxide 1,000 lbs.

SARA Title III: Sec. 302, Extremely Hazardous Substances, 40 CFR 355:
No extremely hazardous substances are present in this material.

SARA Title III: Sec. 311 and 312, MSDS Requirements, 40 CFR 370 Hazard Classes:
Reactive Hazard, Acute Health Hazard, Chronic Health Hazard. Under SARA Section 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are 500 pounds for the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SARA Title III: Sec. 313, Toxic Chemicals Notification, 40 CFR 372:
No components are present in this material.

State Regulations:
California Proposition 65: This product does not contain a chemical known to the State of California to cause, birth defects or other reproductive harm.

International Information:
Canadian Environmental Protection Act (CEPA) information: All ingredients listed appear on the Domestic Substances List (DSL).

Section 16 – Other Information

HMIS – Hazardous Materials Identification System
Health -2 Flammability -1 Physical Hazard -1 PPE –B

NFPA – National Fire Protection Association
Health -2 Flammability -1 Reactivity -1

Abbreviations legend:

ACGIH: American Conference of Governmental Industrial Hygienist
CAS: Chemical abstract Services
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR: Code of Federal Regulations
CSA: Canadian Standards Association
DOT: Department of Transportation
ECOTOX: U.S. EPA Ecotoxicology Database
EINECS: European Inventory of Existing Commercial chemical Substances

Section 16 – Other Information (Continued)

EPA: Environmental Protection agency
HSDB: Hazardous Substances database
IARC: International Agency for Research on Cancer
IBC: Intermediate Bulk Container
IUCLID: International Uniform Chemical Information Database
LC: Lethal Concentration
LD: Lethal Dose
NIOSH: National Institute of Occupational Safety and Health
NTP: National Toxicology Program
OECD: Organization for Economic Cooperation and Development
PEL: Permissible exposure limit
RCRA: Resource Conservation and Recovery Act
RTECS: Registry of Toxic Effects of Chemical Substances
SARA: Superfund Amendments and Reauthorization Act
SDS: Safety Data Sheet
STEL: Short Term Exposure Limit
TDG: Canadian Transportation of Dangerous Goods Act & Regulations
TLV: Threshold Limit Values
TWA: Time Weighted Average
WHMIS: Workplace Hazardous Materials Identification System

Disclaimer

The information continued herein is based on the manufactures' own study and the work of others, implied, as to the accuracy, completeness or adequacy of the information contained herein, and neither the provider nor the manufacturer (nor the agents, directors, officers, contractors or employees of either) are liable to any party for any damages of any nature, including direct, special or consequential damages arising out of or in connection with the accuracy, completeness, adequacy or furnishing of any information in this SDS, or in any other way related (directly or indirectly) to this SDS. The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for the safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any other process.

Version: 1.0 – Initial Release
Version 2.0 – Corrected Pictogram Information

End of Document

SAFETY DATA SHEET

DIESEL FUEL

000003000395

Version 3.1 Revision Date 2017/04/20 Print Date 2017/04/20

SECTION 1. IDENTIFICATION

Product name	:	DIESEL FUEL
Synonyms	:	Seasonal Diesel, #1 Diesel, #2 Heating Oil, #1 Heating Oil, D50, Arctic Diesel, Farm Diesel, Marine Diesel, Low Sulphur Diesel, LSD, Ultra Low Sulphur Diesel, ULSD, Mining Diesel, Naval Distillate, Dyed Diesel, Marked Diesel, Coloured Diesel, Furnace special, Biodiesel blend, B1, B2, B5, Diesel Low Cloud (LC), Marine Gas Oil, Marine Gas Oil Dyed.
Product code	:	102762, 102763, 102755, 102302, 102744, 101801, 100678, 100677, 101802, 100107, 100668, 100658, 100911, 100663, 100652, 100460, 100065, 101796, 101793, 101795, 101792, 101794, 101791, 100768, 100643, 100642, 100103, 101798, 101800, 101797, 101788, 101789, 101787, 102531, 100734, 100733, 100640, 100997, 100995, 100732, 100731, 100994

Manufacturer or supplier's details

Petro-Canada
P.O. Box 2844, 150 - 6th Avenue South-West
Calgary Alberta T2P 3E3
Canada

Emergency telephone number

Suncor Energy: +1 403-296-3000;
Canutec Transportation: 1-888- 226-8832 (toll-free) or 613-996-6666;
Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Diesel fuels are distillate fuels suitable for use in high and medium speed internal combustion engines of the compression ignition type. Mining diesels, marine diesels, MDO and naval distillates may have a higher flash point requirement.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	Bright oily liquid.
Colour	Clear to yellow (This product may be dyed red for taxation purposes)
Odour	Mild petroleum oil like.

GHS Classification

Flammable liquids : Category 3

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Acute toxicity (Inhalation)	:	Category 4
Skin irritation	:	Category 2
Carcinogenicity	:	Category 2
Specific target organ toxicity - single exposure	:	Category 3 (Central nervous system)
Specific target organ toxicity - repeated exposure	:	Category 2 (Liver, thymus, Bone)
Aspiration hazard	:	Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Flammable liquid and vapour.
May be fatal if swallowed and enters airways.
Causes skin irritation.
Harmful if inhaled.
May cause drowsiness or dizziness.
Suspected of causing cancer.
May cause damage to organs (Liver, thymus, Bone) through prolonged or repeated exposure.

Precautionary statements : **Prevention:**
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Keep container tightly closed.
Ground and bond container and receiving equipment.
Use explosion-proof electrical/ ventilating/ lighting/ equipment.
Use non-sparking tools.
Take action to prevent static discharges.
Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
Wash skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
Response:
IF SWALLOWED: Immediately call a POISON CENTER/doctor.
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
IF exposed or concerned: Get medical advice/ attention.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Do NOT induce vomiting.
If skin irritation occurs: Get medical advice/ attention.
Take off contaminated clothing and wash it before reuse.
In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
Storage:
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion Inhalation Skin contact Skin Absorption
Target Organs	:	Skin Eyes Respiratory Tract
Inhalation	:	May cause respiratory tract irritation. Inhalation may cause central nervous system effects. Symptoms and signs include headache, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness.
Skin	:	Causes skin irritation.
Eyes	:	Causes eye irritation.
Ingestion	:	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea. Aspiration hazard if swallowed - can enter lungs and cause damage.
Aggravated Medical Condition	:	None known.

Other hazards

None known.

IARC	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH	Confirmed animal carcinogen with unknown relevance to humans

Petro-Canada is a Suncor Energy business.
™ Trademark of Suncor Energy Inc. Used under licence.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
fuels, diesel	68334-30-5	70 - 100 %
fuel oil no. 2	68476-30-2	
kerosine (petroleum)	8008-20-6	
kerosine (petroleum), hydrodesulfurized	64742-81-0	
Alkanes, C10-20-branched and linear	928771-01-1	0 - 25 %
Soybean oil, Methyl ester	67784-80-9	0 - 5 %
Rape oil, Methyl ester	73891-99-3	
Fatty acids, tallow, Methyl esters	61788-61-2	

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.
DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Never give anything by mouth to an unconscious person.
Seek medical advice.

Most important symptoms and effects, both acute and delayed : None known.

Protection of first-aiders : First Aid responders should pay attention to self-protection and use the recommended protective clothing
It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Dry chemical Carbon dioxide (CO2) Water fog. Foam
Unsuitable extinguishing media	:	Do NOT use water jet.
Specific hazards during fire-fighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), sulphur compounds (H2S), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid spark promoters. Ground/bond container and equipment. These alone may be insufficient to remove static electricity. Avoid contact with skin, eyes and clothing. Do not ingest.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Keep away from heat and sources of ignition.
Keep container closed when not in use.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
kerosine (petroleum)	8008-20-6	TWA	200 mg/m3 (total hydrocarbon vapor)	CA BC OEL
		TWA	200 mg/m3 (total hydrocarbon vapor)	CA AB OEL
		TWA	200 mg/m3 (total hydrocarbon vapor)	ACGIH
kerosine (petroleum), hydrodesulfurized	64742-81-0	TWA	200 mg/m3 (As total hydrocarbon vapour)	ACGIH
		TWA	200 mg/m3 (As total hydrocarbon vapour)	ACGIH

Engineering measures : Use only in well-ventilated areas.
Ensure that eyewash station and safety shower are proximal to the work-station location.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : organic vapour cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air-supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstances where air-purifying respirators may not provide adequate protection.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Hand protection Material	:	neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R). Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for wear and tear. At the first signs of hardening and cracks, they should be changed.
Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield and protective suit for abnormal processing problems.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Bright oily liquid.
Colour	:	Clear to yellow (This product may be dyed red for taxation purposes)
Odour	:	Mild petroleum oil like.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	No data available
Boiling point/boiling range	:	150 - 371 °C (302 - 700 °F)
Flash point	:	> 40 °C (104 °F) Method: closed cup
Auto-Ignition Temperature	:	225 °C (437 °F)
Evaporation rate	:	No data available
Flammability	:	Flammable in presence of open flames, sparks and heat. Va-

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

		pours are heavier than air and may travel considerable distance to sources of ignition and flash back. This product can accumulate static charge and ignite.
Upper explosion limit	:	6 %(V)
Lower explosion limit	:	0.7 %(V)
Vapour pressure	:	7.5 mmHg (20 °C / 68 °F)
Relative vapour density	:	4.5
Relative density	:	0.8 - 0.88
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	1.3 - 4.1 cSt (40 °C / 104 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Runoff to sewer may create fire or explosion hazard.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents and acids.
Hazardous decomposition products	:	May release COx, NOx, SOx, H2S, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Ingestion
Inhalation
Skin contact
Skin Absorption

Acute toxicity

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Product:

Acute oral toxicity : Remarks: No data available

Acute inhalation toxicity : Remarks: No data available

Acute dermal toxicity : Assessment: The substance or mixture has no acute dermal toxicity
Remarks: No data available

Components:

fuels, diesel:

Acute oral toxicity : LD50 (Rat): 7,500 mg/kg,

Acute dermal toxicity : LD50 (Mouse): 24,500 mg/kg,

fuel oil no. 2:

Acute oral toxicity : LD50 (Rat): 12,000 mg/kg,

Acute inhalation toxicity : LC50 (Rat): 4.1 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist

kerosine (petroleum):

Acute oral toxicity : LD50 (Rat): > 5,000 mg/kg,

Acute inhalation toxicity : LC50 (Rat): > 5 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist

Acute dermal toxicity : LD50 (Rabbit): > 2,000 mg/kg,

kerosine (petroleum), hydrodesulfurized:

Acute oral toxicity : LD50 (Rat): > 5,000 mg/kg,

Acute inhalation toxicity : LC50 (Rat): > 5.2 mg/l
Exposure time: 4 hrs
Test atmosphere: dust/mist

Acute dermal toxicity : LD50 (Rabbit): > 2,000 mg/kg,

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water

Petro-Canada is a Suncor Energy business. TM Trademark of Suncor Energy Inc. Used under licence.

courses or the soil.
Offer surplus and non-recyclable solutions to a licensed disposal company.
Waste must be classified and labelled prior to recycling or disposal.
Send to a licensed waste management company.
Dispose of as hazardous waste in compliance with local and national regulations.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

Contaminated packaging : Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

UN/ID No.	:	UN 1202
Proper shipping name	:	Diesel fuel
Class	:	3
Packing group	:	III
Labels	:	Class 3 - Flammable Liquid
Packing instruction (cargo aircraft)	:	366

IMDG-Code

UN number	:	UN 1202
Proper shipping name	:	DIESEL FUEL
Class	:	3
Packing group	:	III
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

National Regulations

TDG

UN number	:	UN 1202
Proper shipping name	:	DIESEL FUEL
Class	:	3
Packing group	:	III
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

SECTION 15. REGULATORY INFORMATION

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

The components of this product are reported in the following inventories:

DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
EINECS	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

For Copy of SDS	:	Internet: www.petro-canada.ca/msds Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228 For Product Safety Information: 1 905-804-4752
Prepared by	:	Product Safety: +1 905-804-4752
Revision Date	:	2017/04/20

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

SECTION 1. IDENTIFICATION

Product name	:	GASOLINE, UNLEADED
Synonyms	:	Regular, Unleaded Gasoline (US Grade), Mid-Grade, Plus, Super, WinterGas, SummerGas, Supreme, SuperClean, SuperClean WinterGas, RegularClean, PlusClean, Premium, marked or dyed gasoline, TQRUL, transitional quality regular unleaded, BOB, Blendstock for Oxygenate Blending, Conventional Gasoline, RUL, MUL, SUL, PUL.
Product code	:	100127, 100126, 101823, 100507, 101811, 101814, 100141, 101813, 101810, 101812, 100063, 101822, 100138, 101821, 100064, 101820, 101819, 100506, 101818, 101816, 101817, 100488
Manufacturer or supplier's details		Petro-Canada P.O. Box 2844, 150 - 6th Avenue South-West Calgary Alberta T2P 3E3 Canada
Emergency telephone number		Suncor Energy: +1 403-296-3000; Canutec Transportation: 1-888- 226-8832 (toll-free) or 613-996-6666; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Unleaded gasoline is used in spark ignition engines including motor vehicles, inboard and outboard boat engines, small engines such as chain saws and lawn mowers, and recreational vehicles.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	Clear liquid.
Colour	Clear to slightly yellow or green, undyed liquid. May be dyed red for taxation purposes.
Odour	Gasoline

GHS Classification

Flammable liquids	:	Category 1
Skin irritation	:	Category 2

Petro-Canada is a Suncor Energy business. TM Trademark of Suncor Energy Inc. Used under licence.

Germ cell mutagenicity	:	Category 1B
Carcinogenicity	:	Category 1A
Reproductive toxicity	:	Category 2
Specific target organ toxicity - single exposure	:	Category 3 (Central nervous system)
Specific target organ toxicity - repeated exposure	:	Category 1
Aspiration hazard	:	Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Extremely flammable liquid and vapour.
May be fatal if swallowed and enters airways.
Causes skin irritation.
May cause drowsiness or dizziness.
May cause genetic defects.
May cause cancer.
Suspected of damaging the unborn child.
Causes damage to organs () through prolonged or repeated exposure.

Precautionary statements : **Prevention:**
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ ventilating/ lighting/ equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
Wash skin thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
Response:
IF SWALLOWED: Immediately call a POISON CENTER/doctor.
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove person to fresh air and keep comfortable

TM Trademark of Suncor Energy Inc. Used under licence.

for breathing. Call a POISON CENTER/doctor if you feel unwell.
IF exposed or concerned: Get medical advice/ attention.
Do NOT induce vomiting.
If skin irritation occurs: Get medical advice/ attention.
Take off contaminated clothing and wash before reuse.
In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
Storage:
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion Inhalation Skin contact
Target Organs	:	Blood Immune system
Inhalation	:	Inhalation may cause central nervous system effects. Symptoms and signs include headache, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness.
Skin	:	Causes skin irritation.
Eyes	:	May irritate eyes.
Ingestion	:	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea. Aspiration hazard if swallowed - can enter lungs and cause damage.
Chronic Exposure	:	Chronic exposure to benzene may result in increased risk of leukemia and other blood disorders.
Aggravated Medical Condition	:	None known.

Other hazards

None known.

IARC	Group 1: Carcinogenic to humans	
	Benzene	71-43-2
OSHA	OSHA specifically regulated carcinogen	
	Benzene	71-43-2

Petro-Canada is a Suncor Energy business. TM Trademark of Suncor Energy Inc. Used under licence.

NTP	Known to be human carcinogen	
	Benzene	71-43-2

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
gasoline, natural	8006-61-9	95 - 100 %
toluene	108-88-3	1 - 40 %
benzene	71-43-2	0.5 - 1.5 %
ethanol	64-17-5	0.1 - 0.3 %

SECTION 4. FIRST AID MEASURES

If inhaled : Artificial respiration and/or oxygen may be necessary.
Move to fresh air.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.
DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Never give anything by mouth to an unconscious person.
Seek medical advice.

Most important symptoms and effects, both acute and delayed : None known.

Protection of first-aiders : First Aid responders should pay attention to self-protection and use the recommended protective clothing
It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Dry chemical Carbon dioxide (CO2) Water fog. Foam
Unsuitable extinguishing media	:	Do NOT use water jet.
Specific hazards during fire-fighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), polynuclear aromatic hydrocarbons, phenols, aldehydes, ketones, smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid spark promoters. Ground/bond container and equipment. These alone may be insufficient to remove static electricity. Avoid contact with skin, eyes and clothing. Do not ingest. Keep away from heat and sources of ignition. Keep container closed when not in use.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
gasoline, natural	8006-61-9	TWA	300 ppm 900 mg/m3	OSHA P0
		STEL	500 ppm 1,500 mg/m3	OSHA P0
		TWA	500 ppm 2,000 mg/m3	OSHA Z-1
		STEL	500 ppm 1,500 mg/m3	CAL PEL
		PEL	300 ppm 900 mg/m3	CAL PEL
toluene	108-88-3	TWA	20 ppm	ACGIH
		TWA	100 ppm 375 mg/m3	NIOSH REL
		ST	150 ppm 560 mg/m3	NIOSH REL
		TWA	200 ppm	OSHA Z-2
		CEIL	300 ppm	OSHA Z-2
		Peak	500 ppm (10 minutes)	OSHA Z-2
		TWA	100 ppm 375 mg/m3	OSHA P0
		STEL	150 ppm 560 mg/m3	OSHA P0
		PEL	10 ppm 37 mg/m3	CAL PEL
		C	500 ppm	CAL PEL
		STEL	150 ppm 560 mg/m3	CAL PEL
benzene	71-43-2	TWA	0.5 ppm	ACGIH
		STEL	2.5 ppm	ACGIH
		TWA	0.1 ppm	NIOSH REL
		ST	1 ppm	NIOSH REL
		TWA	10 ppm	OSHA Z-2
		CEIL	25 ppm	OSHA Z-2
		Peak	50 ppm (10 minutes)	OSHA Z-2
		PEL	1 ppm	OSHA CARC
		STEL	5 ppm	OSHA CARC

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

		PEL	1 ppm	CAL PEL
		STEL	5 ppm	CAL PEL
ethanol	64-17-5	TWA	1,000 ppm 1,900 mg/m3	NIOSH REL
		TWA	1,000 ppm 1,900 mg/m3	OSHA Z-1
		TWA	1,000 ppm 1,900 mg/m3	OSHA P0
		STEL	1,000 ppm	ACGIH
		PEL	1,000 ppm 1,900 mg/m3	CAL PEL

Biological occupational exposure limits

Components	CAS-No.	Control parameters	Biological specimen	Sam-pling time	Permissible concentra-tion	Basis
Toluene	108-88-3	Toluene	In blood	Prior to last shift of work-week	0.02 mg/l	ACGIH BEI
		Toluene	Urine	End of shift (As soon as possible after exposure ceases)	0.03 mg/l	ACGIH BEI

Engineering measures : Use only in well-ventilated areas.
Ensure that eyewash station and safety shower are proximal to the work-station location.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : A NIOSH-approved air-purifying respirator with an organic vapour cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air-supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circum-stances where air-purifying respirators may not provide ade-quate protection.

Hand protection
Material : polyvinyl alcohol (PVA), Viton(R). Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness,

TM Trademark of Suncor Energy Inc. Used under licence.

will get permeated by chemicals. Therefore, protective gloves should be regularly checked for wear and tear. At the first signs of hardening and cracks, they should be changed.

Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield and protective suit for abnormal processing problems.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Clear liquid.
Colour	:	Clear to slightly yellow or green, undyed liquid. May be dyed red for taxation purposes.
Odour	:	Gasoline
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	No data available
Boiling point/boiling range	:	25 - 225 °C (77 - 437 °F)
Flash point	:	-50 - -38 °C (-58 - -36 °F) Method: Tagliabue.
Auto-Ignition Temperature	:	257 °C (495 °F)
Evaporation rate	:	No data available
Flammability	:	Extremely flammable in presence of open flames, sparks, shocks, and heat. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back. Rapid escape of vapour may generate static charge causing ignition. May accumulate in confined spaces.
Upper explosion limit	:	7.6 %(V)

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Lower explosion limit	:	1.3 %(V)
Vapour pressure	:	< 802.5 mmHg (20 °C / 68 °F)
Relative vapour density	:	3
Relative density	:	0.685 - 0.8
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Containers may explode in heat of fire. Vapours may form explosive mixtures with air.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents, acids and interhalogens.
Hazardous decomposition products	:	May release COx, NOx, phenols, polycyclic aromatic hydrocarbons, aldehydes, ketones, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Ingestion
Inhalation
Skin contact

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Remarks: No data available

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Components:

toluene:

Acute oral toxicity	:	LD50 (Rat): 5,580 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): 7585 ppm Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): 12,125 mg/kg,

benzene:

Acute oral toxicity	:	LD50 (Rat): 2,990 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): 13700 ppm Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 8,240 mg/kg,

ethanol:

Acute oral toxicity	:	LD50 (Rat): 7,060 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 32380 ppm Exposure time: 4 h Test atmosphere: vapour

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

STOT - repeated exposure

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Offer surplus and non-recyclable solutions to a licensed disposal company. Waste must be classified and labelled prior to recycling or disposal. Send to a licensed waste management company. Dispose of as hazardous waste in compliance with local and national regulations. Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.
Contaminated packaging	:	Do not re-use empty containers.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

UN/ID No.	:	UN 1203
Proper shipping name	:	Gasoline
Class	:	3
Packing group	:	II
Labels	:	Class 3 - Flammable Liquid
Packing instruction (cargo aircraft)	:	364

IMDG-Code

UN number	:	UN 1203
Proper shipping name	:	GASOLINE
Class	:	3
Packing group	:	II
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

National Regulations

49 CFR

UN/ID/NA number	:	UN 1203
Proper shipping name	:	Gasoline
Class	:	3
Packing group	:	II
Labels	:	Class 3 - Flammable Liquid
ERG Code	:	128
Marine pollutant	:	no

SECTION 15. REGULATORY INFORMATION

The components of this product are reported in the following inventories:

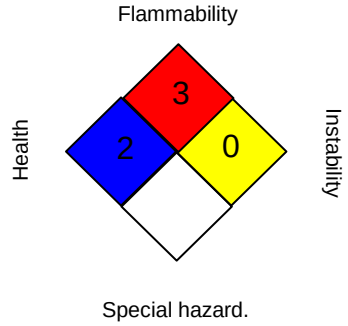
DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
EINECS	On the inventory, or in compliance with the inventory

TM Trademark of Suncor Energy Inc. Used under licence.

SECTION 16. OTHER INFORMATION

Further information

NFPA:



HMIS III:

HEALTH	3*
FLAMMABILITY	3
PHYSICAL HAZARD	0
PERSONAL PROTECTION	H

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

For Copy of SDS : Internet: www.petro-canada.ca/msds
Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

Revision Date : 2017/04/20

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

TM Trademark of Suncor Energy Inc. Used under licence.

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **CAT HYDRAULIC OIL (HYDO) SAE 10W**
Product Description: Base Oil and Additives
Product Code: 20202050B020, 478909-00, 971670
Intended Use: Hydraulic/transmission fluid

COMPANY IDENTIFICATION

Supplier: **EXXON MOBIL CORPORATION**
3225 GALLOWS RD.
FAIRFAX, VA. 22037 USA

24 Hour Health Emergency	609-737-4411
Transportation Emergency Phone	800-424-9300 or 703-527-3887 CHEMTREC
Product Technical Information	800-662-4525
MSDS Internet Address	http://www.exxon.com, http://www.mobil.com

SECTION 2 HAZARDS IDENTIFICATION

This material is not hazardous according to regulatory guidelines (see (M)SDS Section 15).

Other hazard information:

HAZARD NOT OTHERWISE CLASSIFIED (HNOC): None as defined under 29 CFR 1900.1200.

PHYSICAL / CHEMICAL HAZARDS
No significant hazards.

HEALTH HAZARDS
High-pressure injection under skin may cause serious damage. Excessive exposure may result in eye, skin, or respiratory irritation.

ENVIRONMENTAL HAZARDS
No significant hazards.

NFPA Hazard ID:	Health:	0	Flammability:	1	Reactivity:	0
HMIS Hazard ID:	Health:	0	Flammability:	1	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert

advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
ZINC DITHIOPHOSPHATE	68649-42-3	1 - 2.5%	H315, H318, H401, H411

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

As per paragraph (i) of 29 CFR 1910.1200, formulation is considered a trade secret and specific chemical identity and exact percentage (concentration) of composition may have been withheld. Specific chemical identity and exact percentage composition will be provided to health professionals, employees, or designated representatives in accordance with applicable provisions of paragraph (i).

SECTION 4 FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Pressurized mists may form a flammable mixture.

Hazardous Combustion Products: Aldehydes, Oxides of carbon, Smoke, Fume, Sulfur oxides, Incomplete combustion products

FLAMMABILITY PROPERTIES

Flash Point [Method]: >200°C (392°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

PROTECTIVE MEASURES

Avoid contact with spilled material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

For emergency responders: Respiratory protection: respiratory protection will be necessary only in special cases, e.g., formation of mists. Half-face or full-face respirator with filter(s) for dust/organic vapor or Self Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Work gloves that are resistant to hydrocarbons are recommended. Gloves made of polyvinyl acetate (PVA) are not water-resistant and are not suitable for emergency use. Chemical goggles are recommended if splashes or contact with eyes is possible. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic material is recommended.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). When the material is handled in bulk, an electrical spark could ignite any flammable vapors from liquids or residues that may be present (e.g., during switch-loading operations). Use proper bonding and/or ground procedures. However, bonding and grounds may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator.

STORAGE

The container choice, for example storage vessel, may effect static accumulation and dissipation. Do not store in open or unlabelled containers. Keep away from incompatible materials.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists/aerosols can occur the following are recommended: 5 mg/m³ - ACGIH TLV (inhalable fraction), 5 mg/m³ - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to

be considered for this material include:
No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:
No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:
No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Color: Amber
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.878
Flammability (Solid, Gas): N/A
Flash Point [Method]: >200°C (392°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D
Boiling Point / Range: > 316°C (600°F) [Estimated]
Decomposition Temperature: N/D
Vapor Density (Air = 1): > 2 at 101 kPa [Estimated]

Vapor Pressure: < 0.013 kPa (0.1 mm Hg) at 20 °C [Estimated]
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3.5 [Estimated]
Solubility in Water: Negligible
Viscosity: 37.7 cSt (37.7 mm2/sec) at 40 °C | 6.1 cSt (6.1 mm2/sec) at 100°C
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -18°C (0°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: See sub-sections below.

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data for material.	Negligible hazard at ambient/normal handling temperatures.
Ingestion	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin Corrosion/Irritation: No end point data for material.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	
Serious Eye Damage/Irritation: No end point data for material.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.
Sensitization	
Respiratory Sensitization: No end point data	Not expected to be a respiratory sensitizer.

for material.	
Skin Sensitization: No end point data for material.	Not expected to be a skin sensitizer. Based on assessment of the components.
Aspiration: Data available.	Not expected to be an aspiration hazard. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: No end point data for material.	Not expected to be a germ cell mutagen. Based on assessment of the components.
Carcinogenicity: No end point data for material.	Not expected to cause cancer. Based on assessment of the components.
Reproductive Toxicity: No end point data for material.	Not expected to be a reproductive toxicant. Based on assessment of the components.
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: No end point data for material.	Not expected to cause organ damage from prolonged or repeated exposure. Based on assessment of the components.

OTHER INFORMATION

Contains:
Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products. Protect the environment. Dispose of used oil at designated sites. Minimize skin contact. Do not mix used oils with solvents, brake fluids or coolants.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT): Not Regulated for Land Transport

LAND (TDG): Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: This material is not considered hazardous in accordance with OSHA HazCom 2012, 29 CFR 1910.1200.

Listed or exempt from listing/notification on the following chemical inventories: AICS, DSL, ENCS, IECSC, KECI, PICCS, TSCA

EPCRA SECTION 302: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY:

Chemical Name	CAS Number	Typical Value
ZINC DITHIOPHOSPHATE	68649-42-3	1 - 2.5%

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
ZINC DITHIOPHOSPHATE	68649-42-3	13, 15, 17, 19

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H315: Causes skin irritation; Skin Corr/Irritation, Cat 2
H318: Causes serious eye damage; Serious Eye Damage/Irr, Cat 1
H401: Toxic to aquatic life; Acute Env Tox, Cat 2
H411: Toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 2

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Updates made in accordance with implementation of GHS requirements.

The information and recommendations contained herein are, to the best of ExxonMobil's knowledge and belief, accurate and reliable as of the date issued. You can contact ExxonMobil to insure that this document is the most current available from ExxonMobil. The information and recommendations are offered for the user's consideration and examination. It is the user's responsibility to satisfy itself that the product is suitable for the intended use. If buyer repackages this product, it is the user's responsibility to insure proper health, safety and other necessary information is included with and/or on the container. Appropriate warnings and safe-handling procedures should be provided to handlers and users. Alteration of this document is strictly prohibited. Except to the extent required by law, re-publication or retransmission of this document, in whole or in part, is not permitted. The term, "ExxonMobil" is used for convenience, and may include any one or more of ExxonMobil Chemical Company, Exxon Mobil Corporation, or any affiliates in which they directly or indirectly hold any interest.

Internal Use Only
MHC: 0B, 0B, 0, 0, 0, 0 PPEC: A

DGN: 2004671XUS (546411)

Copyright 2002 Exxon Mobil Corporation, All rights reserved

Material Safety Data Sheet

TWO CYCLE MOTOR OIL

000003000604

Version 2.0 Revision Date 2014/08/08 Print Date 2014/08/08

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	TWO CYCLE MOTOR OIL
Product code	:	TWOCYCDRM, TWOCYCC12, TWOCYC, TWOCYCBLK

Manufacturer or supplier's details

Petro-Canada Lubricants Inc.
2310 Lakeshore Road West
Mississauga ON L5J 1K2
Canada

Petro-Canada America Lubricants Inc.
115N Oak Park Avenue #1C
Oak Park IL 60301-1366
United States

Emergency telephone number: Suncor Energy: +1 403-296-3000;
Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	A low ash 2-cycle engine oil designed to lubricate conventional pre-mixed fuel/oil as well as oil injection lubricated engines powering air-cooled two-stroke cycle engines.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Form	viscous liquid
Colour	Blue-green.
Odour	Mild petroleum oil like.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion Inhalation Skin contact
Aggravated Medical Condition	:	None known.

Carcinogenicity:

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

OSHA	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
NTP	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
ACGIH	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

Hazardous components

No hazardous ingredients

SECTION 4. FIRST AID MEASURES

If inhaled	:	Move to fresh air. Artificial respiration and/or oxygen may be necessary. Seek medical advice.
In case of skin contact	:	In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognized skin cleanser. Wash clothing before reuse. Seek medical advice.
In case of eye contact	:	Remove contact lenses. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.
If swallowed	:	Rinse mouth with water. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person. Seek medical advice.
Most important symptoms and effects, both acute and delayed	:	First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media : Use extinguishing measures that are appropriate to local

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

circumstances and the surrounding environment.

Unsuitable extinguishing media	:	No information available.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), phosphorus oxides (POx), hydrocarbons, aldehydes, smoke and irritating vapours as products of incomplete combustion.
Specific extinguishing methods	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest. Keep away from heat and sources of ignition. Keep container closed when not in use.
Conditions for safe storage	:	Store in original container. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Keep in a dry, cool and well-ventilated place. Keep in properly labelled containers. To maintain product quality, do not store in heat or direct sunlight.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures	:	No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants. Adequate ventilation to ensure that Occupational Exposure Limits are not exceeded.

Personal protective equipment

Respiratory protection	:	Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Recommended Filter type:
Filter type	:	organic vapour filter
Hand protection		
Material	:	neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R).
Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield if splashing hazard is likely.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash hands and face before breaks and immediately after handling the product. Wash contaminated clothing before re-use. Ensure that eyewash station and safety shower are proximal to the work-station location.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	viscous liquid
Colour	:	Blue-green.

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Odour	:	Mild petroleum oil like.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	-48 °C (-54 °F)
Boiling point/boiling range	:	No data available
Flash point	:	149 °C (300 °F) Method: Cleveland open cup
Fire Point	:	No data available
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available
Flammability	:	Low fire hazard. This material must be heated before ignition will occur.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	No data available
Density	:	0.8508 kg/l (15 °C / 59 °F)
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	37.1 cSt (40 °C / 104 °F)
		7.03 cSt (100 °C / 212 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
		No dangerous reaction known under conditions of normal use.
Conditions to avoid	:	No data available
Incompatible materials	:	Reactive with oxidising agents, reducing agents, and acids.
Hazardous decomposition	:	May release COx, NOx, SOx, aldehydes, methacrylate

Petro-Canada is a Suncor Energy business. TM Trademark of Suncor Energy Inc. Used under licence.

products	monomers, hydrocarbons, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Remarks: No data available

Skin corrosion/irritation

Product:

Result: Mild skin irritation

Serious eye damage/eye irritation

Product:

Result: Mild eye irritation

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

Aspiration toxicity

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Petro-Canada is a Suncor Energy business.
™ Trademark of Suncor Energy Inc. Used under licence.

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

No data available

Bioaccumulative potential

Product:

Partition coefficient: n-octanol/water	:	Remarks: No data available

Mobility in soil

No data available

Other adverse effects

No data available

Product:

Additional ecological information	:	No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Offer surplus and non-recyclable solutions to a licensed disposal company. Waste must be classified and labelled prior to recycling or disposal. Send to a licensed waste management company. Dispose of as hazardous waste in compliance with local and national regulations. Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.
Contaminated packaging	:	Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

International Regulation

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

49 CFR
Not regulated as a dangerous good
TDG
Not regulated as a dangerous good

Special precautions for user

Not applicable

SECTION 15. REGULATORY INFORMATION

OSHA Hazards	:	This material is non-hazardous as defined by the American OSHA Hazard Communication Standard.
WHMIS Classification	:	Not Rated

The components of this product are reported in the following inventories:

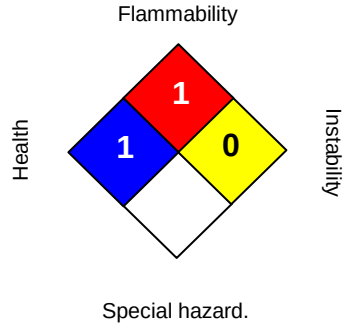
DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
ELINCS	At least one component is not listed in EINECS but all such components are listed in ELINCS.
IECSC	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

Petro-Canada is a Suncor Energy business.
TM Trademark of Suncor Energy Inc. Used under licence.

Further information

NFPA:



HMIS III:

HEALTH	1
FLAMMABILITY	1
PHYSICAL HAZARD	0
PERSONAL PROTECTION	B

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

For Copy of (M)SDS : The Canadian Controlled Products Regulations (CPR) (Under the Hazardous Products Act, part of the WHMIS legislation) only apply to WHMIS Controlled (i.e., hazardous) products. Therefore, the CPR and the 3-year update rule specified therein do not apply to WHMIS Non-Controlled products. Although this is true, customarily Petro-Canada reviews and updates Non-Controlled product MSDS if a customer requests such an update. These Non-Controlled product updates are given a lower priority than Controlled products but are handled as soon as practicable. If you would like to verify if the MSDS you have is the most current, or you require any further information, please contact:
Internet: lubricants.petro-canada.ca/msds
Western Canada, telephone: 1-800-661-1199; fax: 1-800-378-4518
Ontario & Central Canada, telephone: 1-800-268-5850; fax: 1-800-201-6285
Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 1-800-201-6285
United States, telephone: 1-800-268-5850; fax: 1-800-201-6285
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Petro-Canada is a Suncor Energy business.
™ Trademark of Suncor Energy Inc. Used under licence.

Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Delo 400 LE Synthetic SAE 5W-40

Product Use: Diesel Engine Oil
Product Number(s): 271207
Company Identification
Chevron Canada Limited
1050 West Pender
Vancouver, BC V6E 3T4
Canada
www.chevronlubricants.com

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
email : lubemsds@chevron.com
Product Information: (800) LUBE TEK

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Not classified as hazardous according to Canada regulatory guidelines.

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Highly refined mineral oil (C15 - C50)	Mixture	60 - 65 %weight
Zinc dialkyldithiophosphate	68649-42-3	0.1 - < 2.5 %weight
Phenol, dodecyl-, branched	121158-58-5	0.1 - < 1.5 %weight

Information on ingredients that are considered Controlled Products and/or that appear on the WHMIS Ingredient Disclosure List (IDL) is provided as required by the Canadian Hazardous Products Act (HPA, Sections 13 and 14). Ingredients considered hazardous under the OSHA Hazard Communication Standard, 29 CFR 1910.1200, are also listed. See Section 15 for additional regulatory information.

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.

Skin: To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.

Ingestion: No specific first aid measures are required. Do not induce vomiting. As a precaution, get medical advice.

Inhalation: No specific first aid measures are required. If exposed to excessive levels of material in the air, move the exposed person to fresh air. Get medical attention if coughing or respiratory discomfort occurs.

Most important symptoms and effects, both acute and delayed

IMMEDIATE HEALTH EFFECTS

Eye: Not expected to cause prolonged or significant eye irritation.

Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.

Ingestion: Not expected to be harmful if swallowed.

Inhalation: Not expected to be harmful if inhaled. Contains a petroleum-based mineral oil. May cause respiratory irritation or other pulmonary effects following prolonged or repeated inhalation of oil mist at airborne levels above the recommended mineral oil mist exposure limit. Symptoms of respiratory irritation may include coughing and difficulty breathing.

Indication of any immediate medical attention and special treatment needed Not Applicable

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: This material will burn although it is not easily ignited. See Section 7 for proper handling and storage. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in vicinity of spilled material.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Precautionary Measures: Keep out of the reach of children.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use in a well-ventilated area.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances in the workplace. Suggested materials for protective gloves include: 4H (PE/EVAL), Nitrile Rubber, Silver Shield, Viton.
Respiratory Protection: No respiratory protection is normally required.
If user operations generate an oil mist, determine if airborne concentrations are below the occupational exposure limit for mineral oil mist. If not, wear an approved respirator that provides adequate protection from the measured concentrations of this material. For air-purifying respirators use a particulate cartridge. Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Country/ Agency	TWA	STEL	Ceiling	Notation
Highly refined mineral oil (C15 - C50)	ACGIH	5 mg/m3	10 mg/m3	--	--
Highly refined mineral oil (C15 - C50)	ACGIH	5 mg/m3	10 mg/m3	--	--

NOTE ON OCCUPATIONAL EXPOSURE LIMITS: Consult local authorities for acceptable provincial values in Canada. Consult the Canadian Standards Association Standard 94.4-2002 Selection, Use and Care of Respirators.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Amber
Physical State: Liquid

Odor: Petroleum odor
Odor Threshold: No data available
pH: No data available
Vapor Pressure: <0.01 mmHg Maximum @ 37.8 °C (100 °F)
Vapor Density (Air = 1): >1 Minimum
Initial Boiling Point: No data available
Solubility: Soluble in hydrocarbons; insoluble in water
Freezing Point: Not Applicable
Melting Point: No data available
Density: 0.8590 kg/l @ 15°C (59°F) (Typical)
Viscosity: 14 mm2/s @ 100°C (212°F) Minimum
Coefficient of Therm. Expansion / °F: No data available
Evaporation Rate: No data available
Decomposition temperature: No data available
Octanol/Water Partition Coefficient: No data available

FLAMMABLE PROPERTIES:
Flammability (solid, gas): No Data Available

Flashpoint: (Cleveland Open Cup) 200 °C (392 °F) Minimum
Autoignition: No data available
Flammability (Explosive) Limits (% by volume in air): Lower: Not Applicable Upper: Not Applicable

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: Not applicable
Hazardous Decomposition Products: None known (None expected)
Hazardous Polymerization: Hazardous polymerization will not occur.
Sensitivity to Mechanical Impact: No.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects
Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation: The skin irritation hazard is based on evaluation of data for product components.

Skin Sensitization: The skin sensitization hazard is based on evaluation of data for product components.

Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for product components.

Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for product components.

Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for product components.
Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: The hazard evaluation is based on data for components or a similar material.

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:

During use in engines, contamination of oil with low levels of cancer-causing combustion products occurs. Used motor oils have been shown to cause skin cancer in mice following repeated application and continuous exposure. Brief or intermittent skin contact with used motor oil is not expected to have serious effects in humans if the oil is thoroughly removed by washing with soap and water.

This product contains petroleum base oils which may be refined by various processes including severe solvent extraction, severe hydrocracking, or severe hydrotreating. None of the oils requires a cancer warning under the OSHA Hazard Communication Standard (29 CFR 1910.1200). These oils have not been listed in the National Toxicology Program (NTP) Annual Report nor have they been classified by the International Agency for Research on Cancer (IARC) as; carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A), or possibly carcinogenic to humans (Group 2B).

These oils have not been classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as: confirmed human carcinogen (A1), suspected human carcinogen (A2), or confirmed animal carcinogen with unknown relevance to humans (A3).

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY

This material is not expected to be harmful to aquatic organisms.
The product has not been tested. The statement has been derived from the properties of the individual components.

MOBILITY

No data available.

PERSISTENCE AND DEGRADABILITY

This material is not expected to be readily biodegradable. The biodegradability of this material is based on an evaluation of data for the components or a similar material.
The product has not been tested. The statement has been derived from the properties of the individual components.

POTENTIAL TO BIOACCUMULATE

Bioconcentration Factor: No data available.
Octanol/Water Partition Coefficient: No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. Oil collection services are available for used oil recycling or disposal. Place contaminated materials in containers and dispose of in a manner consistent with applicable regulations. Contact your sales representative or local environmental or health authorities for approved disposal or recycling methods. (See B.C. Reg. GY/92 Waste Management Act; R.R.O. 1990, Reg. 347 General-Waste Management; C.C.SM.c. W40 The Waste Reduction and Prevention Act; N.S. Reg. 51/95 and N.S. Reg. 179/96 for examples of Provincial legislation.)

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

TC Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER TRANSPORT CANADA (TDG)

IMO/IMDG Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER THE IMDG CODE

ICAO/IATA Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER ICAO

DOT Shipping Description: NOT REGULATED AS A HAZARDOUS MATERIAL UNDER 49 CFR

SECTION 15 REGULATORY INFORMATION

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

No components of this material were found on the regulatory lists above.

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), KECI (Korea), PICCS (Philippines), TSCA (United States).

One or more components is listed on ELINCS (European Union). Secondary notification by the importer may be required. All other components are listed or exempted from listing on EINECS.

One or more components does not comply with the following chemical inventory requirements: ENCS (Japan), IECSC (China).

SECTION 16 OTHER INFORMATION

REVISION STATEMENT: This revision updates the following sections of this Material Safety Data Sheet: 1-16
Revision Date: OCTOBER 07, 2015

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Chevron Supreme Motor Oil SAE 30, 40, 10W-40, 20W-50

Product Use: Automotive Engine Oil
Product Number(s): 220002, 220011, 220059, 220060
Company Identification
Chevron Canada Limited
1050 West Pender
Vancouver, BC V6E 3T4
Canada
www.chevronlubricants.com

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
email : lubemsds@chevron.com
Product Information: (800) LUBE TEK

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Not classified as hazardous according to Canada regulatory guidelines.

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Highly refined mineral oil (C15 - C50)	Mixture	70 - 99 %weight

Information on ingredients that are considered Controlled Products and/or that appear on the WHMIS

Ingredient Disclosure List (IDL) is provided as required by the Canadian Hazardous Products Act (HPA, Sections 13 and 14). Ingredients considered hazardous under the OSHA Hazard Communication Standard, 29 CFR 1910.1200, are also listed. See Section 15 for additional regulatory information.

SECTION 4 FIRST AID MEASURES

Description of first aid measures
Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: No specific first aid measures are required. As a precaution, remove clothing and shoes if contaminated. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: No specific first aid measures are required. Do not induce vomiting. As a precaution, get medical advice.
Inhalation: No specific first aid measures are required. If exposed to excessive levels of material in the air, move the exposed person to fresh air. Get medical attention if coughing or respiratory discomfort occurs.

Most important symptoms and effects, both acute and delayed
IMMEDIATE HEALTH EFFECTS
Eye: Not expected to cause prolonged or significant eye irritation.
Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.
Ingestion: Not expected to be harmful if swallowed.
Inhalation: Not expected to be harmful if inhaled. Contains a petroleum-based mineral oil. May cause respiratory irritation or other pulmonary effects following prolonged or repeated inhalation of oil mist at airborne levels above the recommended mineral oil mist exposure limit. Symptoms of respiratory irritation may include coughing and difficulty breathing.

Indication of any immediate medical attention and special treatment needed Not Applicable

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: This material will burn although it is not easily ignited. See Section 7 for proper handling and storage. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in vicinity of spilled material.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Precautionary Measures: Keep out of the reach of children.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use in a well-ventilated area.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances in the workplace. Suggested materials for protective gloves include: 4H (PE/EVAL), Nitrile Rubber, Silver Shield, Viton.

Respiratory Protection: No respiratory protection is normally required.
If user operations generate an oil mist, determine if airborne concentrations are below the occupational exposure limit for mineral oil mist. If not, wear an approved respirator that provides adequate protection from the measured concentrations of this material. For air-purifying respirators use a particulate cartridge. Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Country/ Agency	TWA	STEL	Ceiling	Notation
Highly refined mineral oil (C15 - C50)	ACGIH	5 mg/m3	10 mg/m3	--	--

No applicable occupational exposure limits exist for this material or its components. NOTE ON OCCUPATIONAL EXPOSURE LIMITS: Consult local authorities for acceptable provincial values in Canada. Consult the Canadian Standards Association Standard 94.4-2002 Selection, Use and Care of Respirators.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Amber
Physical State: Liquid
Odor: Petroleum odor
Odor Threshold: No data available
pH: Not Applicable
Vapor Pressure: <0.01 mmHg @ 100 °C (212 °F)
Vapor Density (Air = 1): >1
Initial Boiling Point: 315°C (599°F)
Solubility: Soluble in hydrocarbons; insoluble in water
Freezing Point: Not Applicable @ 15.6°C (60.1°F) / 15.6°C (60.1°F)
Density: 0.8732 kg/l @ 15°C (59°F) Minimum
Viscosity: 9.9 mm2/s @ 100°C (212°F) (Min)
Decomposition temperature: No data available
Octanol/Water Partition Coefficient: No data available

FLAMMABLE PROPERTIES:
Flammability (solid, gas): No Data Available

Flashpoint: (Cleveland Open Cup) 205 °C (401 °F) (Min)
Autoignition: No data available
Flammability (Explosive) Limits (% by volume in air): Lower: Not Applicable Upper: Not Applicable

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Incompatibility With Other Materials: Not applicable
Hazardous Decomposition Products: None known (None expected)
Hazardous Polymerization: Hazardous polymerization will not occur.
Sensitivity to Mechanical Impact: No.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects
Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation: The skin irritation hazard is based on evaluation of data for product components.

Skin Sensitization: The skin sensitization hazard is based on evaluation of data for product components.

Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for product components.

Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for product components.

Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for product components.
Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: The hazard evaluation is based on data for components or a similar material.

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:
During use in engines, contamination of oil with low levels of cancer-causing combustion products occurs. Used motor oils have been shown to cause skin cancer in mice following repeated application and continuous exposure. Brief or intermittent skin contact with used motor oil is not expected to have serious effects in humans if the oil is thoroughly removed by washing with soap and water.
This product contains petroleum base oils which may be refined by various processes including severe solvent extraction, severe hydrocracking, or severe hydrotreating. None of the oils requires a cancer warning under the OSHA Hazard Communication Standard (29 CFR 1910.1200). These oils have not been listed in the National Toxicology Program (NTP) Annual Report nor have they been classified by the International Agency for Research on Cancer (IARC) as; carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A), or possibly carcinogenic to humans (Group 2B).
These oils have not been classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as: confirmed human carcinogen (A1), suspected human carcinogen (A2), or confirmed animal carcinogen with unknown relevance to humans (A3).

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY
This material is not expected to be harmful to aquatic organisms.
The product has not been tested. The statement has been derived from the properties of the individual components.

MOBILITY
No data available.

PERSISTENCE AND DEGRADABILITY
This material is not expected to be readily biodegradable. The biodegradability of this material is based on an evaluation of data for the components or a similar material.
The product has not been tested. The statement has been derived from the properties of the individual components.

POTENTIAL TO BIOACCUMULATE
Bioconcentration Factor: No data available.
Octanol/Water Partition Coefficient: No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. Oil collection services are available for used oil recycling or disposal. Place contaminated materials in containers and dispose of in a manner consistent with applicable regulations. Contact your sales representative or local environmental or health authorities for approved disposal or recycling methods. (See B.C. Reg. GY/92 Waste Management Act; R.R.O. 1990, Reg. 347 General-Waste Management; C.C.SM.c. W40 The Waste Reduction and Prevention Act; N.S. Reg. 51/95 and N.S. Reg. 179/96 for examples of Provincial legislation.)

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

TC Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORTATION UNDER TDG REGULATIONS

IMO/IMDG Shipping Description: PETROLEUM LUBRICATING OIL; NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER THE IMDG CODE

ICAO/IATA Shipping Description: PETROLEUM LUBRICATING OIL; NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER ICAO TI OR IATA DGR

DOT Shipping Description: PETROLEUM LUBRICATING OIL, NOT REGULATED AS A HAZARDOUS MATERIAL FOR TRANSPORTATION UNDER 49 CFR

SECTION 15 REGULATORY INFORMATION

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

No components of this material were found on the regulatory lists above.

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), KECI (Korea), PICCS (Philippines), TSCA (United States).

One or more components has been notified but may not be listed in the following chemical inventories: IECSC (China). Secondary notification may be required.

One or more components is listed on ELINCS (European Union). Secondary notification by the importer may be required. All other components are listed or exempted from listing on EINECS.

One or more components does not comply with the following chemical inventory requirements: ENCS (Japan).

SECTION 16 OTHER INFORMATION

REVISION STATEMENT: This revision updates the following sections of this Material Safety Data Sheet: 1-16.
Revision Date: SEPTEMBER 10, 2015

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

The above information is based on the data of which we are aware and is believed to be correct

as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

SAFETY DATA SHEET

DURON TM/MC -E 15W-40

000003000916

Version 4.1 Revision Date 2017/03/24 Print Date 2017/03/24

SECTION 1. IDENTIFICATION

Product name	:	DURON TM/MC -E 15W-40
Product code	:	DE15CBE, DE15P5R, DE15P20, DE15ICT, DE15IBC, DE15DRR, DE15DRM, DE15DCT, DE15C16, DE15C12, DE15C02, DE15, DE15BLK
Manufacturer or supplier's details		Petro-Canada Lubricants Inc. 2310 Lakeshore Road West Mississauga ON L5J 1K2 Canada
Emergency telephone number		Petro-Canada Lubricants Inc.: +1 905-403-5770; CHEMTREC Transport Emergency: 1-800-424-9300; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	DURON-E 15W-40 is a superior quality heavy duty diesel engine oil specifically designed for '07 EPA engine requirements along with improved performance benefits in legacy engines. Application includes modern low emission diesel engines with cooled exhaust gas recirculation and exhaust after treatment technology. It is suitable also for passenger car and light truck diesel engines, and spark ignition engines.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	viscous liquid
Colour	Light amber.
Odour	Mild petroleum oil like.

GHS Classification

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion

TM Owned or used under license by Petro-Canada Lubricants Inc.

Inhalation
Skin contact

Aggravated Medical Condition : None known.

Other hazards

None known.

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
White mineral oil (petroleum)	8042-47-5	30 - 50 %
lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	30 - 50 %
lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	72623-87-1	30 - 50 %
lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high viscosity	72623-85-9	30 - 50 %
Zinc alkyldithiophosphate	113706-15-3	1 - 5 %

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

TM Owned or used under license by Petro-Canada Lubricants Inc.

Obtain medical attention.

If swallowed	:	Rinse mouth with water. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person. Seek medical advice.
Most important symptoms and effects, both acute and delayed	:	First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	No information available.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), phosphorus oxides (POx), sulphur compounds (H2S), zinc oxides (ZnOx), metal oxides, hydrocarbons, smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

TM Owned or used under license by Petro-Canada Lubricants Inc.

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest. Keep away from heat and sources of ignition. Keep container closed when not in use.
Conditions for safe storage	:	Store in original container. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Keep in a dry, cool and well-ventilated place. Keep in properly labelled containers. To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
White mineral oil (petroleum)	8042-47-5	TWA (Mist)	5 mg/m3	CA AB OEL
		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhalable fraction)	5 mg/m3	ACGIH
lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	TWA (Mist)	5 mg/m3	CA AB OEL
		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhalable fraction)	5 mg/m3	ACGIH
lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	72623-87-1	TWA (Mist)	5 mg/m3	CA AB OEL
		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhalable fraction)	5 mg/m3	ACGIH
lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high viscosity	72623-85-9	TWA (Mist)	5 mg/m3	CA AB OEL

TM Owned or used under license by Petro-Canada Lubricants Inc.

		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhal-able fraction)	5 mg/m3	ACGIH

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : organic vapour filter

Hand protection

Material : neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R).

Remarks : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eye protection : Wear face-shield and protective suit for abnormal processing problems.

Skin and body protection : Choose body protection according to the amount and concentration of the dangerous substance at the work place.

Protective measures : Wash hands and face before breaks and immediately after handling the product.
Wash contaminated clothing before re-use.
Ensure that eyewash station and safety shower are proximal to the work-station location.

Hygiene measures : Wash face, hands and any exposed skin thoroughly after handling.
Remove and wash contaminated clothing and gloves, including the inside, before re-use.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : viscous liquid

Colour : Light amber.

TM Owned or used under license by Petro-Canada Lubricants Inc.

Odour	:	Mild petroleum oil like.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	-36 °C (-33 °F)
Boiling point/boiling range	:	No data available
Flash point	:	228 °C (442 °F) Method: Cleveland open cup
Fire Point	:	247 °C (477 °F)
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available
Flammability	:	Low fire hazard. This material must be heated before ignition will occur.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	No data available
Relative vapour density	:	No data available
Relative density	:	No data available
Density	:	0.8711 kg/l (15 °C / 59 °F)
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	118.2 cSt (40 °C / 104 °F) 15.6 cSt (100 °C / 212 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	No data available

TM Owned or used under license by Petro-Canada Lubricants Inc.

Incompatible materials	:	Reactive with oxidizing agents and water.
Hazardous decomposition products	:	May release COx, H2S, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Ingestion
Inhalation
Skin contact

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Assessment: The substance or mixture has no acute dermal toxicity

Components:

White mineral oil (petroleum):

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

TM Owned or used under license by Petro-Canada Lubricants Inc.

lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high viscosity:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available

TM Owned or used under license by Petro-Canada Lubricants Inc.

Toxicity to algae : Remarks: No data available

Toxicity to bacteria : Remarks: No data available

Persistence and degradability

Product:

Biodegradability : Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : The product should not be allowed to enter drains, water courses or the soil.
Offer surplus and non-recyclable solutions to a licensed disposal company.
Waste must be classified and labelled prior to recycling or disposal.
Send to a licensed waste management company.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

Not regulated as a dangerous good

IMDG-Code

Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

National Regulations

TDG

Not regulated as a dangerous good

TM Owned or used under license by Petro-Canada Lubricants Inc.

SECTION 15. REGULATORY INFORMATION

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

The components of this product are reported in the following inventories:

DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
ELINCS	At least one component is not listed in EINECS but all such components are listed in ELINCS.

SECTION 16. OTHER INFORMATION

For Copy of SDS	:	Internet: lubricants.petro-canada.com/sds Western Canada, telephone: 1-800-661-1199; fax: 1-800-378-4518 Ontario & Central Canada, telephone: 1-800-268-5850; fax: 1-800-201-6285 Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 1-800-201-6285 For Product Safety Information: 1 905-804-4752
Prepared by	:	Product Safety: +1 905-804-4752
Revision Date	:	2017/03/24

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

TM Owned or used under license by Petro-Canada Lubricants Inc.

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
NULON 85W-140 LIMITED SLIP DIFFERENTIAL OIL

SYNONYMS
"Product Code: LSD85W140"

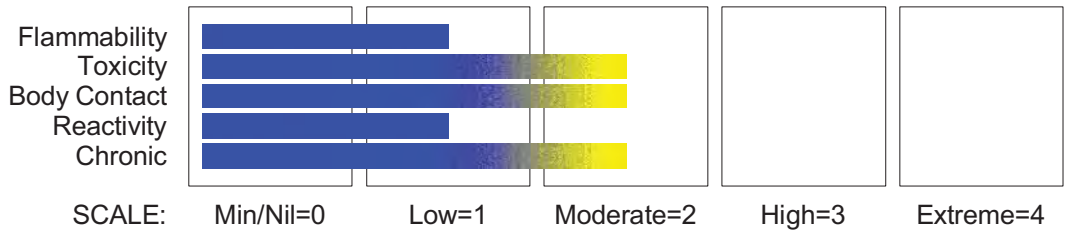
PRODUCT USE
• Used according to manufacturer's directions.
Limited slip differential oil.

SUPPLIER
Company: Nulon Products Pty Ltd
Address:
17 Yulong Close
Moorebank
NSW, 2170
Australia
Telephone: +61 2 9608 7800
Fax: +61 2 9601 4700
Email: msds@nulon.com.au

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



POISONS SCHEDULE
None

RISK
•None under normal operating conditions.

SAFETY

Safety Codes	Safety Phrases
S23	• Do not breathe gas/fumes/vapour/spray.
S24	• Avoid contact with skin.
S39	• Wear eye/face protection.
S26	• In case of contact with eyes rinse with plenty of water and contact Doctor or Poisons Information Centre.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
residual oils, petroleum, solvent- refined (severe)	64742-01-4.	80-85
paraffinic distillate, heavy, hydrotreated (severe)	64742-54-7.	5-10
mineral oil	Not avail.	5-15
ingredients at levels determined not to be hazardous		balance

continued...

Section 4 - FIRST AID MEASURES

SWALLOWED
• - Immediately give a glass of water.
- First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

EYE
• If this product comes in contact with the eyes:
- Wash out immediately with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention without delay; if pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
• If skin contact occurs:
- Immediately remove all contaminated clothing, including footwear.
- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

INHALED
• - If fumes or combustion products are inhaled remove from contaminated area.
- Other measures are usually unnecessary.

NOTES TO PHYSICIAN
• Treat symptomatically.
- Heavy and persistent skin contamination over many years may lead to dysplastic changes. Pre-existing skin disorders may be aggravated by exposure to this product.
- In general, emesis induction is unnecessary with high viscosity, low volatility products, i.e. most oils and greases.
- High pressure accidental injection through the skin should be assessed for possible incision, irrigation and/or debridement.
NOTE: Injuries may not seem serious at first, but within a few hours tissue may become swollen, discoloured and extremely painful with extensive subcutaneous necrosis.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• - Water spray or fog.
- Alcohol stable foam.
- Dry chemical powder.
- Carbon dioxide.

FIRE FIGHTING
• - Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Use water delivered as a fine spray to control fire and cool adjacent area.

FIRE/EXPLOSION HAZARD
• - Combustible.
- Slight fire hazard when exposed to heat or flame.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO).
Combustion products include: carbon dioxide (CO_2), phosphorus oxides (POx), sulfur oxides (SOx), other pyrolysis products typical of burning organic material.
May emit poisonous fumes.
CARE: Water in contact with hot liquid may cause foaming and a steam explosion with wide scattering of hot oil and possible severe burns. Foaming may cause overflow of containers and may result in possible fire.

FIRE INCOMPATIBILITY
• - Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

HAZCHEM
None

PERSONAL PROTECTION

Glasses:	Gloves:	Respirator:
Chemical goggles.	PVC chemical resistant type.	Type A- P Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Slippery when spilt.
- Remove all ignition sources.
- Clean up all spills immediately.

continued...

- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.

MAJOR SPILLS
• Slippery when spilt.
Moderate hazard.
- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• - DO NOT allow clothing wet with material to stay in contact with skin.
- Electrostatic discharge may be generated during pumping - this may result in fire.
- Ensure electrical continuity by bonding and grounding (earthing) all equipment.
- Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<=1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec).
- Avoid splash filling.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.

SUITABLE CONTAINER
• - Metal can or drum
- Packaging as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY
• CARE: Water in contact with heated material may cause foaming or a steam explosion with possible severe burns from wide scattering of hot material. Resultant overflow of containers may result in fire.
- Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS
• - Store in original containers.
- Keep containers securely sealed.
- No smoking, naked lights or ignition sources.
- Store in a cool, dry, well-ventilated area.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA mg/m³
Australia Exposure Standards	residual oils, petroleum, solvent-refined (severe) (Oil mist, refined mineral)	5
Australia Exposure Standards	paraffinic distillate, heavy, hydrotreated (severe) (Oil mist, refined mineral)	5
Australia Exposure Standards	mineral oil (Oil mist, refined mineral)	5

PERSONAL PROTECTION

RESPIRATOR
Type A-P Filter of sufficient capacity

EYE
• - Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

continued...

HANDS/FEET
• - Wear chemical protective gloves, eg. PVC.
- Wear safety footwear or safety gumboots, eg. Rubber.
NOTE:
- The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
- Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity.

OTHER
• - Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.

ENGINEERING CONTROLS
• General exhaust is adequate under normal operating conditions. Local exhaust ventilation may be required in special circumstances.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Clear bright amber liquid; not miscible with water.

PHYSICAL PROPERTIES
Liquid.
Does not mix with water.
Floats on water.

State	Liquid	Molecular Weight	Not Available
Melting Range (℃)	Not Available	Viscosity	384 cSt@40℃
Boiling Range (℃)	Not Available	Solubility in water (g/L)	I mmiscible
Flash Point (℃)	180 (PMCC)	pH (1% solution)	Not Applicable
Decomposition Temp (℃)	Not Available	pH (as supplied)	Not A pplicable
Autoignition Temp (℃)	Not Available	Vapour Pressure (kPa)	Not Available
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	0.88- 0.93
Lower Explosive Limit (%)	Not Available	Relative Vapour Density (air=1)	Not Available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Available

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY
• - Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
• Not applicable.

CHRONIC HEALTH EFFECTS
• Not applicable.

TOXICITY AND IRRITATION
PARAFFINIC DISTILLATE, HEAVY, HYDROTREATED (SEVERE):
MINERAL OIL:
RESIDUAL OILS, PETROLEUM, SOLVENT-REFINED (SEVERE):
• unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

• unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

• Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type.
No significant acute toxicological data identified in literature search.

RESIDUAL OILS, PETROLEUM, SOLVENT-REFINED (SEVERE):

continued...

• No significant acute toxicological data identified in literature search.
The substance is classified by IARC as Group 3:
NOT classifiable as to its carcinogenicity to humans.
Evidence of carcinogenicity may be inadequate or limited in animal testing.

PARAFFINIC DISTILLATE, HEAVY, HYDROTREATED (SEVERE):

TOXICITY	IRRITATION
Oral (rat) LD50: >15000 mg/kg	Nil Reported
Dermal (None) rabbit: None >5000 mg/kg	

• No data of toxicological significance identified in literature search.

MINERAL OIL:

• Toxicity and Irritation data for petroleum-based mineral oils are related to chemical components and vary as does the composition and source of the original crude.
A small but definite risk of occupational skin cancer occurs in workers exposed to persistent skin contamination by oils over a period of years.
Petroleum oils which are solvent refined/extracted or severely hydrotreated, contain very low concentrations of both.

Section 12 - ECOLOGICAL INFORMATION

No data

Section 13 - DISPOSAL CONSIDERATIONS

• - Containers may still present a chemical hazard/ danger when empty.
- Return to supplier for reuse/ recycling if possible.
Otherwise:
- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
- Where possible retain label warnings and MSDS and observe all notices pertaining to the product.
Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
A Hierarchy of Controls seems to be common - the user should investigate:
- Reduction.
- DO NOT allow wash water from cleaning or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Authority for disposal.
- Bury or incinerate residue at an approved site.
- Recycle containers if possible, or dispose of in an authorised landfill.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: ADG7, UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE
None

REGULATIONS
Regulations for ingredients

residual oils, petroleum, solvent-refined (severe) (CAS: 64742-01-4) is found on the following regulatory lists;
"Australia Hazardous Substances","Australia Inventory of Chemical Substances (AICS)","OECD Representative List of High Production Volume (HPV) Chemicals"

continued...

paraffinic distillate, heavy, hydrotreated (severe) (CAS: 64742-54-7) is found on the following regulatory lists;
"Australia Hazardous Substances","Australia High Volume Industrial Chemical List (HVICL)","Australia Inventory of Chemical Substances (AICS)","OECD Representative List of High Production Volume (HPV) Chemicals"

No data for Nulon 85W-140 Limited Slip Differential Oil (CW: 4731-28)
No data for mineral oil (CAS: , Not avail)

Section 16 - OTHER INFORMATION

• Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

• The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

This document is copyright. Apart from any fair dealing for the purposes of private study, research, review or criticism, as permitted under the Copyright Act, no part may be reproduced by any process without written permission from CHEMWATCH. TEL (+61 3) 9572 4700.

Issue Date: 24-Aug-2010
Print Date: 25-Aug-2010

This is the end of the MSDS.

THIS DOCUMENT IS THE PROPERTY OF MICROMERITICS INSTRUMENT CORP. AND MAY BE REPRODUCED IN WHOLE OR IN PART.

Cover Sheet

micromeritics®
INSTRUMENT CORPORATION
ONE MICROMERITICS DR.
NORCROSS, GA 30093-1877 U.S.A.

REV	REVISION DESCRIPTION	BY	DATE	CHK	REL. NO.		
						DWN BY	J. Pittman
						ENGR	J. Mocny
C	Revision	JAP	6/25/04		040265	ENGR SIG	P. Hendrix
B	Revision	MD	04/02/03	JM	030200	HR SIG	J. Mocny
A	New format and numbering system	C. Bills	5/24/00	—	990544	QA SIG	A. Dovin
-	Formal Release	C. Bills	6-26-07	—	970446	ES SIG	K. Massengill

MSDS
HYDRAULIC FLUID OD-15-10
(1-L)

SIZE	NUMBER	PAGE
A	920/16002/00MSDS	X of 3

Micromeritics Material Safety Data Sheet

Title : HYDRAULIC FLUID OD-15-10(1-L)
Date of Preparation : 06/25/04

MSDS No. : 920/16002/00MSDS
Revision : C

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: HYDRAULIC FLUID OD-15-10
Chemical Formula: Blend
CAS Number: n/a
Other Designations:
General Use:
Supplier: Micromeritics Instrument Corp. Contact: Human Resources
1 Micromeritics Dr. Phone: (770) 662-3620
Norcross, GA 30093-1877 USA Fax: (770) 662-3696
Manufacturer: Sun Company, Inc. Ten Penn Center 1801 Market St. Philadelphia, PA 19103-1699
(770) 662-3678

Section 2 - Composition / Information on Ingredients

Ingredient Name	CAS Number	% vol
Severely solvent refined heavy paraffinic petroleum oil	64741-88-4	90-100
Zinc dialkyl Dithiophosphats	68649-42-3	0-1
Butylated Phenol	n/a	0-1
Calcium Sulfonate	61789-86-4	0-1
Acrylic Copolymer	68171-46-0	0-1
2-Ethylhexanol	104-76-7	0-1

Trace Impurities:

	OSHA PEL		ACGIH TLV		NIOSH REL		NIOSH
Ingredient	**TWA**	**STEL**	**TWA**	**STEL**	**TWA**	**STEL**	**IDLH**
Severely solvent refined heavy paraffinic petroleum oil	5mg/m^3	-	5mg/m^3	-	n/a	n/a	n/a
Zinc dialkyl Dithiophosphats	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Butylated Phenol	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Calcium Sulfonate	n.a	n/a	n/a	n/a	n/a	n/a	n/a
Acrylic Copolymer	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2-Ethylhexanol	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Additional exposure limits: Oil Mist	5mg/m^3		5mg/m^3				

Section 3 - Hazards Identification

☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆

HMIS	
H	1
F	1
R	0
PPE†	
†Sec. 8	

Potential Health Effects

Primary Entry Routes: Skin
Effects of Overexposure:

Inhalation: No effects expected
Eye: Contact with the eye may cause minimal irritation.
Skin: Practically non-toxic if absorbed (LD50 greater than 2000 mg/kg). May cause mild irritation with prolonged or repeated contact.
Ingestion: Practically non-toxic (LD50 > 15g/Kg).

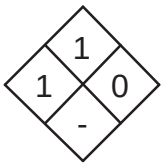
Section 4 - First Aid Measures

Inhalation: Move person to fresh air.
Eye: Flush with water.
Skin: Wash with soap and water until no odor remains. Wash clothing before reuse.
Swallowing: Practically non-toxic. Induction of vomiting not required. Obtain emergency medical attention. Small amounts which accidentally enter mouth should be rinsed out until taste of it is gone.

Other Information: Warning!! *High pressure injection of oil through the skin is a medial emergency. There may be no sign of injury and no initial pain. This oil must be removed completely by a physician. Failure to obtain immediate treatment has resulted in loss of a finger, hand or arm.*
WHMIS Classification: Not controlled.

Section 5 - Fire-Fighting Measures

NFPA



Flash Point: 380°F (192°C)
Flash Point Method: COC
Extinguishing Media: Water spray, regular foam, dry chemical, carbon dioxide.
Unusual Fire or Explosion Hazards: n/a
Fire-Fighting Procedures: Wear self-contained breathing apparatus. Wear structural firefighters protective clothing.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: n/a

Section 7 - Handling and Storage

Handling/ Storage Requirements: n/a

Section 8 - Exposure Controls / Personal Protection

N/A

Section 9 - Physical and Chemical Properties

Appearance and Odor: clear fluid, little odor
Odor Threshold: n/a
Vapor Pressure: <0.0001 (mm Hg at 20 °C)
Vapor Density (Air=1): 10 +
Formula Weight: n/a
Density: n/a
Specific Gravity (H_2O=1, at 4 °C): 0.87
Water Solubility: nil
Other Solubilities: n/a
Boiling Point: n/a
Melting Point: n/a
Viscosity: 165 sus @ 100°F. 32.0 CST @ 40 °C.
% Volatile: n/a
Evaporation Rate: 1000X slower (ehtyl ether = 1)

Section 10 - Stability and Reactivity

Stability: HYDRAULIC FLUID OD-15-10 is stable.
Polymerization: Hazardous polymerization will not occur.
Chemical Incompatibilities: Strong oxidizers.
Conditions to Avoid: n/a
Hazardous Decomposition Products: Combustion will produce carbon monoxide, oxides of sulfur and asphyxiants.

Section 11- Toxicological Information

n/a

Section 12 - Ecological Information

Ecotoxicity: n/a

Section 13 - Disposal Considerations

Disposal: n/a

Section 14 - Transport Information

n/a

Section 15 - Regulatory Information

n/a

Section 16 - Other Information

Prepared By: C. Bills
Revision Notes:

Disclaimer:

SAFETY DATA SHEET

DEXRON GEAR OIL 75W-90

000003000195

Version 7.1 Revision Date 2017/01/27 Print Date 2017/02/01

SECTION 1. IDENTIFICATION

Product name	:	DEXRON GEAR OIL 75W-90
Product code	:	DEX75IBC, DEX75DRM, DEX75, DEX75BLK

Manufacturer or supplier's details

Petro-Canada Lubricants Inc.
2310 Lakeshore Road West
Mississauga ON L5J 1K2
Canada

Emergency telephone number

Petro-Canada Lubricants Inc.: +1 905-403-5770;
CHEMTREC Transport Emergency: 1-800-424-9300;
Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	A rear axle and differential lubricant for light duty vehicles. Meets General Motors specification 9986285.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	viscous liquid
Colour	dark yellow
Odour	Mild petroleum oil like or no odour.

GHS Classification

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion Inhalation Skin contact
Aggravated Medical Condition	:	None known.

Other hazards

™ Owned or used under license by Petro-Canada Lubricants Inc.

None known.

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	30 - 50 %
1-Decene, homopolymer, hydrogenated	68037-01-4	30 - 50 %
Methacrylate copolymers		1 - 5 %
Petroleum oil		1 - 5 %
Alkyl phosphate		1 - 5 %
Long-chain alkyl amine with substituted heteromonocyclic		1 - 5 %
Long-chain alkyl amine		0.1 - 1 %

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.
DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Never give anything by mouth to an unconscious person.

TM Owned or used under license by Petro-Canada Lubricants Inc.

Seek medical advice.

Most important symptoms and effects, both acute and delayed	:	First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	No information available.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	Do not allow uncontrolled discharge of product into the environment.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest.

™ Owned or used under license by Petro-Canada Lubricants Inc.

Keep away from heat and sources of ignition.
Keep container closed when not in use.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	TWA (Mist)	5 mg/m3	CA AB OEL
		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhalable fraction)	5 mg/m3	ACGIH

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : organic vapour filter

Hand protection
Material : neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R).

Remarks : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eye protection : Wear face-shield and protective suit for abnormal processing

™ Owned or used under license by Petro-Canada Lubricants Inc.

problems.

Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	viscous liquid
Colour	:	dark yellow
Odour	:	Mild petroleum oil like or no odour.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	< -57 °C (< -71 °F)
Boiling point/boiling range	:	No data available
Flash point	:	187 °C (369 °F) Method: Cleveland open cup
Fire Point	:	225 °C (437 °F)
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available
Flammability	:	Low fire hazard. This material must be heated before ignition will occur.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	No data available
Relative vapour density	:	No data available
Density	:	0.8567 kg/l (15 °C / 59 °F)
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		

TM Owned or used under license by Petro-Canada Lubricants Inc.

Viscosity, kinematic	:	88.5 cSt (40 °C / 104 °F)
		15.2 cSt (100 °C / 212 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	No data available
Incompatible materials	:	Reactive with oxidising agents, acids, alkalis and reducing agents.
Hazardous decomposition products	:	May release COx, POx, SOx, NOx, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Ingestion
Inhalation
Skin contact

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Remarks: No data available

Components:

lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

™ Owned or used under license by Petro-Canada Lubricants Inc.

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

™ Owned or used under license by Petro-Canada Lubricants Inc.

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : The product should not be allowed to enter drains, water courses or the soil.
Offer surplus and non-recyclable solutions to a licensed disposal company.
Waste must be classified and labelled prior to recycling or disposal.
Send to a licensed waste management company.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

National Regulations

TDG
Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

The components of this product are reported in the following inventories:

DSL This product contains one or several components that are not on the Canadian DSL nor NDSL lists.

TSCA All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.

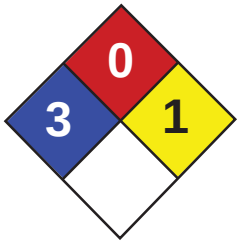
TM Owned or used under license by Petro-Canada Lubricants Inc.

SECTION 16. OTHER INFORMATION

For Copy of SDS	:	Internet: lubricants.petro-canada.com/sds Western Canada, telephone: 1-800-661-1199; fax: 1-800-378-4518 Ontario & Central Canada, telephone: 1-800-268-5850; fax: 1-800-201-6285 Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 1-800-201-6285 For Product Safety Information: 1 905-804-4752
Prepared by	:	Product Safety: +1 905-804-4752
Revision Date	:	2017/01/27

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

™ Owned or used under license by Petro-Canada Lubricants Inc.



Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

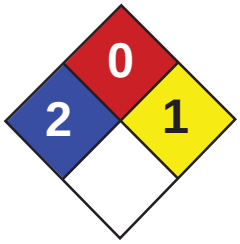
References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 05:45 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Material Safety Data Sheet
Hydrogen Peroxide 30% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrogen Peroxide 30%

Catalog Codes: SLH1552

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Water; Hydrogen Peroxide

CI#: Not applicable.

Synonym: Hydrogen Peroxide 30%

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Water	7732-18-5	70
Hydrogen Peroxide	7722-84-1	30

Toxicological Data on Ingredients: Hydrogen Peroxide: ORAL (LD50): Acute: 2000 mg/kg [Mouse]. DERMAL (LD50): Acute: 4060 mg/kg [Rat]. 2000 mg/kg [pig]. VAPOR (LC50): Acute: 2000 mg/m 4 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Hazardous in case of skin contact (corrosive), of eye contact (corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: combustible materials

Explosion Hazards in Presence of Various Substances: Slightly explosive in presence of open flames and sparks, of heat, of organic materials, of metals, of acids.

Fire Fighting Media and Instructions:
Fire: Small fires: Use water. Do not use dry chemicals or foams. CO2, or Halon may provide limited control. Large fires: Flood fire area with water from a distance. Move containers from fire area if you can do it without risk. Do not move cargo or vehicle if cargo has been exposed to heat. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. / Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/ [QC Reviewed] [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000,p. G-140]

Special Remarks on Fire Hazards:
Most cellulose (wood, cotton) materials contain enough catalyst to cause spontaneous ignition with 90% Hydrogen Peroxide. Hydrogen Peroxide is a strong oxider. It is not flammable itself, but it can cause spontaneous combustion of flammable materials and continued support of the combustion because it liberates oxygen as it decomposes. Hydrogen peroxide mixed with magnesium and a trace of magnesium dioxide will ignite immediately.

Special Remarks on Explosion Hazards:

Soluble fuels (acetone, ethanol, glycerol) will detonate on a mixture with peroxide over 30% concentration, the violence increasing with concentration. Explosive with acetic acid, acetic anhydride, acetone, alcohols, carboxylic acids, nitrogen containing bases, As2S3, Cl2 + KOH, FeS, FeSO4 + 2 methylpryidine + H2SO4, nitric acid, potassium permanganate, P2O5, H2Se, Alcohols + H2SO4, Alcohols + tin chloride, Antimoy trisulfide, chlorosulfonic acid, Aromatic hydrocarbons + trifluoroacetic acid, Azeliac acid + sulfuric acid (above 45 C), Benzenesulfonic anhydride, tert-butanol + sulfuric acid, Hydrazine, Sulfuric acid, Sodium iodate, Tetrahydrothiophene, Thiodiglycol, Mercurous oxide, mercuric oxide, Lead dioxide, Lead oxide, Manganese dioxide, Lead sulfide, Gallium + HCl, Ketenes + nitric acid, Iron (II) sulfate + 2-methylpyridine + sulfuric acid, Iron (II) sulfate + nitric acid, + sodium carboxymethylcellulose (when evaporated), Vinyl acetate, trioxane, water + oxygenated compounds (eg: acetaldehyde, acetic acid, acetone, ethanol, formaldehyde, formic acid, methanol, 2-propanol, propionaldehyde), organic compounds. Beware: Many mixitures of hydrogen peroxide and organic materials may not explode upon contact. However, the resulting combination is detonatable either upon catching fire or by impact. EXPLOSION HAZARD: SEVERE, WHEN HIGHLY CONCENTRATED OR PURE H2O2 IS EXPOSED TO HEAT, MECHANICAL IMPACT, OR CAUSED TO DECOMPOSE CATALYTICALLY BY METALS & THEIR SALTS, DUSTS & ALKALIES. ANOTHER SOURCE OF HYDROGEN PEROXIDE EXPLOSIONS IS FROM SEALING THE MATERIAL IN STRONG CONTAINERS. UNDER SUCH CONDITIONS EVEN GRADUAL DECOMPOSITION OF HYDROGEN PEROXIDE TO WATER + 1/2 OXYGEN CAN CAUSE LARGE PRESSURES TO BUILD UP IN THE CONTAINERS WHICH MAY BURST EXPLOSIVELY. Fire or explosion: May explode from friction, heat or contamination. These substances will accelerate burning when involved in a fire. May ignite combustibles (wood, paper, oil, clothing, etc.). Some will react explosively with hydrocarbons (fuels). Containers may explode when heated. Runoff may create fire or explosion hazard. /Hydrogen peroxide, aqueous solution, stabilized, with more than 60% Hydrogen peroxide; Hydrogen peroxide, stabilized/ [QC Reviewed] [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000,p. G-143] . Fire or explosion: These substances will accelerate burning when involved in a fire. Some may decompose explosively when heated or involved in a fire. May explode from heat or contamination. Some will react explosively with hydrocarbons (fuels). May ignite combustibles (wood, paper, oil, clothing, etc.). Containers may explode when heated. Runoff may create fire or explosion hazard. /Hydrogen peroxide, aqueous solution, with not less than 8% but less than 20% Hydrogen peroxide; Hydrogen peroxide, aqueous solution, with not less than 20% but not more than 60% Hydrogen peroxide (stabilized as necessary)/ [QC Reviewed] [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000,p. G-140] (Hydrogen Peroxide)

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Corrosive liquid. Oxidizing material. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, combustible materials, organic materials, metals, acids, alkalis.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 8°C (46.4°F). Refrigerate Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Hydrogen Peroxide TWA: 1 (ppm) from ACGIH (TLV) [United States] TWA: 1 (ppm) from OSHA (PEL) [United States] TWA: 1 STEL: 2 [Canada] TWA: 1.4 (mg/m3) from NIOSH TWA: 1.4 (mg/m3) from OSHA (PEL) [United States] TWA: 1 (ppm) [United Kingdom (UK)] TWA: 1.4 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Odorless.

Taste: Slightly acid. Bitter

Molecular Weight: Not applicable.

Color: Clear Colorless.

pH (1% soln/water): Not available

Boiling Point: 108°C (226.4°F)

Melting Point: -33°C (-27.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.1 (Water = 1)

Vapor Pressure: 3.1 kPa (@ 20°C)

Vapor Density: 1.1 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in cold water. Soluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable. It contains a stabilizer.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials

Incompatibility with various substances: Reactive with reducing agents, combustible materials, organic materials, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Light sensitive. Incompatible with reducing materials, ethers (dioxane, furfuran, tetrahydrofuran), oxidizing materials, Metals(eg. potassium, sodium lithium, iron, copper, brass, bronze, chromium, zinc, lead, silver, nickel), metal oxides (eg. cobalt oxide, iron oxide, lead oxide, lead hydroxide, manganese oxide), metal salts (eg. calcium permanganate, salts of iron), manganese, asbestos, vanadium, platinium, tungsten, molybdeum, triethylamine, palladium, sodium pyrophosphate, carboxylic acids, cyclopentadiene, formic acid, rust, ketones, sodium carbonate, alcohols, sodium borate, aniline, mercurous chloride, rust, nitric acid, sodium pyrophosphate, hexavalent chromium compounds, tetrahydrofuran, sodium fluoride organic matter, potassium permanganate, urea, chlorosulfonic acid, manganese dioxide, hydrogen selenide, charcoal, coal, sodium borate, alkalies, cyclopentadiene, glycerine, cyanides (potassium, cyanide, sodium cyanide), nitrogen compounds.. Caused to decompose catalytically by metals (in order of decreasing effectiveness): Osmium, Palladium, Platinum, Iridium, Gold, Silver, Manganese, Cobalt, Copper, Lead. Concentrated hydrogen peroxide may decompose violently or explosively in contact with iron, copper, chromium, and most other metals and their salts, and dust. (Hydrogen Peroxide)

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact.

Toxicity to Animals:
Acute oral toxicity (LD50): 6667 mg/kg (Mouse) (Calculated value for the mixture). Acute dermal toxicity (LD50): 6667 mg/kg (pig) (Calculated value for the mixture).

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH [Hydrogen Peroxide]. Classified 3 (Not classifiable for human.) by IARC [Hydrogen Peroxide]. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. [Hydrogen Peroxide]. Mutagenic for bacteria and/or yeast. [Hydrogen Peroxide]. Contains material which may cause damage to the following organs: blood, upper respiratory tract, skin, eyes, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant). Hazardous in case of skin contact (corrosive), of eye contact (corrosive), of ingestion, of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause cancer and may affect genetic material based on animal data. May be tumorigenic. (Hydrogen Peroxide)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes severe skin irritation and possible burns. Absorption into skin may affect behavior/central nervous system (tremor, ataxia, convulsions), respiration (dyspnea, pulmonary emboli), brain. Eyes: Causes severe eye irritation, superficial clouding, corneal edema, and may cause burns. Inhalation: Causes respiratory tract irritation with coughing, lacrimation. May cause chemical burns to the respiratory tract. May affect behavior/Central nervous system (insomnia, headache, ataxia, nervous tremors with numb extremities) and may cause ulceration of nasal tissue, and , chemical pneumonia, unconciousness, and possible death. At high concentrations, respiratory effects may include acute lung damage, and delayed pulmonary edema. May affect blood. Ingestion: Causes gastrointestional tract irritation with nausea, vomiting, hypermotility, and diarrhea. Causes gastrointestional tract burns. May affect cardiovascular system and cause vascular collapse and damage. May affect blood (change in leukocyte count, pigmented or nucleated red blood cells). May cause difficulty in swallowing, stomach distension and possible cerebal swelling. May affect behavior/central nervous system (tetany, excitement). Chronic Potential Health Effects: Prolonged or repeated skin contact may cause dermatitis. Repeated contact may also cause corneal damage. Prolonged or repeated ingestion may affect metabolism (weight loss). Prolonged or repeated inhalation may affect respiration, blood. (Hydrogen Peroxide)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation: Possibly hazardous short/long term degradation products are to be expected.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 5.1: Oxidizing material.

Identification: : Hydrogen peroxide, aqueous solution UNNA: 2014 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
New York acutely hazardous substances: Hydrogen Peroxide Rhode Island RTK hazardous substances: Hydrogen Peroxide Pennsylvania RTK: Hydrogen Peroxide Florida: Hydrogen Peroxide Minnesota: Hydrogen Peroxide Massachusetts RTK: Hydrogen Peroxide New Jersey: Hydrogen Peroxide TSCA 8(b) inventory: Hydrogen Peroxide SARA 302/304/311/312 extremely hazardous substances: Hydrogen Peroxide CERCLA: Hazardous substances.: Hydrogen Peroxide: 1 lbs. (0.4536 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS C: Oxidizing material. CLASS E: Corrosive liquid. CLASS F: Dangerously reactive material.

DSCL (EEC):

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:46 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

MILLSPERSE 802 ANTISCALANT

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material Identity
Product Name: MILLSPERSE 802 ANTISCALANT
Product Code:
General or Generic ID: ANTISCALANT

Company

Ashland
Ashland Distribution Co. &
Ashland Specialty Chemical Co.
P. O. Box 2219
Columbus, OH 43216
614-790-3333

Emergency Telephone Number:
1-800-ASHLAND (1-800-274-5263)
24 hours everyday

Regulatory Information Number:
1-800-325-3751

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient(s)	CAS Number	% (by weight)
POLY(MALEIC ACID)	26099-09-2	5.0- 15.0
ORGANIC ACID		1.0- 10.0

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye
Can cause permanent eye injury. Symptoms include stinging, tearing, redness, and swelling of eyes. Can injure the cornea and cause blindness.

Skin
Can cause permanent skin damage. Symptoms may include redness, burning, and swelling of skin, burns, and other skin damage.

Swallowing
Swallowing this material may be harmful or fatal. Symptoms may include severe stomach and intestinal irritation (nausea, vomiting, diarrhea), abdominal pain, and vomiting of blood. Swallowing this material may cause burns and destroy tissue in the mouth, throat, and digestive tract. Low blood pressure and shock may occur as a result of severe tissue injury.

Inhalation
Breathing this material may be harmful or fatal. Symptoms may include severe irritation and burns to the nose, throat, and respiratory tract.

Symptoms of Exposure
Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include: stomach or intestinal upset (nausea, vomiting, diarrhea), irritation (nose, throat, airways), lung edema (fluid buildup in the lung tissue).

Continued on next page

Target Organ Effects
No data

Developmental Information
Based on the available information, risk to the fetus from maternal exposure to this material cannot be assessed.

Cancer Information
This material is not expected to cause cancer in humans since it did not cause cancer in laboratory animals. This material is not listed as a carcinogen by the International Agency for Research on Cancer, the National Toxicology Program, or the Occupational Safety and Health Administration.

Other Health Effects
No data

Primary Route(s) of Entry
Inhalation, Skin contact, Eye contact, Ingestion - Industrial products are not meant to be swallowed.

4. FIRST AID MEASURES

Eyes
If material gets into the eyes, immediately flush eyes gently with water for at least 15 minutes while holding eyelids apart. If symptoms develop as a result of vapor exposure, immediately move individual away from exposure and into fresh air before flushing as recommended above. Seek immediate medical attention.

Skin
Immediately flush skin with water for at least 15 minutes while removing contaminated clothing and shoes. Seek immediate medical attention. Wash clothing before reuse and discard contaminated shoes.

Swallowing
Seek immediate medical attention. Do not induce vomiting. Vomiting will cause further damage to the mouth and throat. If individual is conscious and alert, immediately rinse mouth with water and give milk or water to drink. If possible, do not leave individual unattended.

Inhalation
If symptoms develop, immediately move individual away from exposure and into fresh air. Seek immediate medical attention; keep person warm and quiet. If person is not breathing, begin artificial respiration. If breathing is difficult, administer oxygen.

Note to Physicians
Preexisting disorders of the following organs (or organ systems) may be aggravated by exposure to this material: skin, lung (for example, asthma-like conditions), eye.

5. FIRE FIGHTING MEASURES

Flash Point
Not applicable

Continued on next page

Explosive Limit
Not applicable

Autoignition Temperature
No data

Hazardous Products of Combustion
May form: carbon dioxide and carbon monoxide.

Fire and Explosion Hazards
No special fire hazards are known to be associated with this product.

Extinguishing Media
Use an extinguishing media appropriate for surrounding fire.

Fire Fighting Instructions
Use water spray to cool fire exposed containers and structures until fire is out if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes. Wear full firefighting turn-out gear (full Bunker gear), and respiratory protection (SCBA).

NFPA Rating
Health - 3, Flammability - 0, Reactivity - 1

6. ACCIDENTAL RELEASE MEASURES

Small Spill
Absorb liquid on vermiculite, floor absorbent or other absorbent material. Scoop or scrape up. Put in container for recovery or disposal. May be neutralized with soda ash, TSP, or bicarbonate of soda.

Large Spill
Persons not wearing protective equipment should be excluded from area of spill. Stop spill at source. Dike to prevent spreading. Carefully add lime or sodium carbonate to neutralize acid. Place residue in a container for disposal.

7. HANDLING AND STORAGE

Handling
Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed.

Storage
Product solutions are corrosive to many commonly used materials of construction such as steel, galvanized iron, aluminum, tin and zinc. These solutions can be stored and handled in baked phenolic-lined steel, polyethylene, stainless steel, or reinforced epoxy-plastic equipment. Store in closed containers in a dry, well-ventilated area.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection
Chemical splash goggles and face shield (8" min.) in compliance with OSHA regulations are advised; however, OSHA regulations also permit other type safety glasses. (Consult your industrial hygienist.)

Continued on next page

Skin Protection
Wear resistant gloves such as: nitrile rubber, polyvinyl chloride, To prevent repeated or prolonged skin contact, wear impervious clothing and boots. Wear acid-resistant apron, or in emergency conditions, acid-resistant clothing and boots.

Respiratory Protections
If overexposure has been determined or documented, a NIOSH/MSHA jointly approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators under specified conditions. (See your safety equipment supplier.) Engineering or administrative controls should be implemented to reduce exposure.

Engineering Controls
Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below level of overexposure (from known, suspected or apparent adverse effects).

Exposure Guidelines
Component

POLY(MALEIC ACID) (26099-09-2)
No exposure limits established

ORGANIC ACID
No exposure limits established

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point
(for component) 212.0 F (100.0 C)

Vapor Pressure
(for component) 17.500 mmHg

Specific Vapor Density
< 1.000 @ AIR=1

Specific Gravity
1.040 @ 77.00 F

Liquid Density
8.654 lbs/gal @ 77.00 F
1.040 kg/l @ 25.00 C

Percent Volatiles
85.0 - 100.0 %

Evaporation Rate
SLOWER THAN ETHYL ETHER

Continued on next page

Appearance
CLEAR, STRAW YELLOW LIQUID

State
LIQUID

Physical Form
HOMOGENEOUS SOLUTION

Color
CLEAR, STRAW YELLOW

Odor
No data

pH
1.4 - 2.2

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Product will not undergo hazardous polymerization.

Hazardous Decomposition
May form: carbon dioxide and carbon monoxide.

Chemical Stability
Stable.

Incompatibility
Avoid contact with: nitrites, strong alkalis, strong oxidizing agents, sulphites.

11. TOXICOLOGICAL INFORMATION

This mixture has not been specifically tested.

12. ECOLOGICAL INFORMATION

Ecotoxicological Information
This mixture has not been specifically tested.

13. DISPOSAL CONSIDERATION

Waste Management Information
Dispose of in accordance with all applicable local, state and federal regulations. For assistance with your waste management needs - including disposal, recycling and waste stream reduction, contact Ashland Distribution Company, IC&S Environmental Services Group at 800-531-7106.

Continued on next page

14. TRANSPORT INFORMATION

DOT Information - 49 CFR 172.101

DOT Description:
NON-REGULATED BY D.O.T.

Container/Mode:
55 GAL DRUM/TRUCK PACKAGE

NOS Component:
None

RQ (Reportable Quantity) - 49 CFR 172.101
Not applicable

Other Transportation Information
The Transport Information may vary with the container and mode of shipment.

15. REGULATORY INFORMATION

US Federal Regulations

TSCA (Toxic Substances Control Act) Status
TSCA (UNITED STATES) The intentional ingredients of this product are listed

CERCLA RQ - 40 CFR 302.4(a)
None

CERCLA RQ - 40 CFR 302.4(b)
This material has a RQ of 100 lbs as a D002 Corrosive unlisted hazardous substance.

SARA 302 Components - 40 CFR 355 Appendix A
None

Section 311/312 Hazard Class - 40 CFR 370.2
Immediate(X) Delayed( ) Fire( ) Reactive( ) Sudden Release of Pressure( )

SARA 313 Components - 40 CFR 372.65
None

OSHA Process Safety Management 29 CFR 1910
None listed

EPA Accidental Release Prevention 40 CFR 68
None listed

International Regulations

Inventory Status
DSL (CANADA) The intentional ingredients of this product are listed.

State and Local Regulations

California Proposition 65
None

Continued on next page

16. OTHER INFORMATION

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

Material Safety Data Sheet

Section 1: PRODUCT AND COMPANY INFORMATION

Product Name(s): Lafarge Hydrated Lime

Product Identifiers: Hydrated Lime, Slaked Lime, Dolomitic Hydrated Lime, Lime, Caustic Lime, Lime Hydrate, Calcium Hydroxide, Calcium Dihydroxide, Calcium Magnesium Hydroxide, Type N Lime, Type S Lime

Manufacturer:

Lafarge North America Inc.
12018 Sunrise Valley Drive, Suite 500
Reston, VA 20191

Information Telephone Number:
703-480-3600 (9am to 5pm EST)

Emergency Telephone Number:
1-800-451-8346 (3E Hotline)

Product Use: Hydrated lime is used as an additive for mortar, cement, concrete and concrete products. It is also used in soil stabilization, as an anti-stripping agent in asphalt, for pH adjustment, and in other products that are widely used in construction.

Note: This MSDS covers many types of hydrated lime. Individual composition of hazardous constituents will vary between types of hydrated lime.

Section 2: COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percent (By Weight)	CAS Number	OSHA PEL -TWA (mg/m^3)	ACGIH TLV-TWA (mg/m^3)	LD_{50} (mouse)	LC_{50}
Calcium Hydroxide	50-95	1305-62-0	15 (T); 5 (R)	5 (T)	7300mg/kg, oral	NA
Magnesium Hydroxide	0-50	1309-42-8	NA	NA	8500mg/kg, oral	NA
Calcium Oxide	0-5	1305-78-8	5 (T)	2 (T)	3059 mg/kg, intraperitoneal	NA
Magnesium Oxide	0-5	1309-48-4	15 (T)	10 (T)	NA	NA
Calcium Carbonate*	0-3	1317-65-3	15 (T), 5 (R)	3 (R); 10 (T)	NA	NA
Crystalline Silica	0-1	14808-60-7	[(10) / (%SiO_2+2)] (R); [(30) / (%SiO_2+2)] (T)	0.025 (R)	NA	NA

Note: Exposure limits for components noted with an * contain no asbestos and <1% crystalline silica

Hydrated lime is produced from the slow addition of water to crushed or ground quicklime (calcium oxide) which is produced by burning various forms of limestone. Trace amounts of chemicals may be detected during chemical analysis. For example, hydrated lime may contain trace amounts of iron oxide, aluminum oxide, fluoride compounds, and other trace compounds.

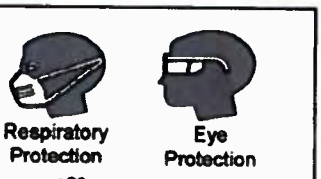
Section 3: HAZARD IDENTIFICATION

WARNING

Corrosive - Causes severe burns.
Toxic - Harmful by inhalation.
(Contains crystalline silica)

Use proper engineering controls, work practices, and personal protective equipment to prevent exposure to wet or dry product.

Read MSDS for details.



Section 3: HAZARD IDENTIFICATION (continued)

Emergency Overview: Hydrated lime is a granular, white or grey, odorless powder. It is not combustible or explosive. A single, short-term exposure to the dry powder presents little or no hazard. Exposure of sufficient duration to hydrated lime can cause serious, potentially irreversible tissue (skin, eye, respiratory tract) damage due to chemical (caustic) burns, including third degree burns.

Potential Health Effects:

Eye Contact: Airborne dust may cause immediate or delayed irritation or inflammation. Eye contact with large amounts of dry powder or with wet hydrated lime can cause moderate eye irritation, chemical burns and blindness. Eye exposures require immediate first aid and medical attention to prevent significant damage to the eye.

Skin Contact: Hydrated lime may cause dry skin, discomfort, irritation, and severe burns.

Burns: Exposure of sufficient duration to wet hydrated lime, or to dry hydrated lime on moist areas of the body, can cause serious, potentially irreversible damage to skin, eye, respiratory and digestive tracts due to chemical (caustic) burns, including third degree burns. A skin exposure may be hazardous even if there is no pain or discomfort.

Inhalation (acute): Breathing dust may cause nose, throat or lung irritation, including choking, depending on the degree of exposure. Inhalation of high levels of dust can cause chemical burns to the nose, throat and lungs.

Inhalation (chronic): Risk of injury depends on duration and level of exposure.

Silicosis: This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease. See Note to Physicians in Section 4 for further information.

Carcinogenicity: Hydrated lime is not listed as a carcinogen by IARC or NTP; however, hydrated lime contains trace amounts of crystalline silica which is classified by IARC and NTP as known human carcinogen.

Autoimmune Disease: Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys.

Tuberculosis: Silicosis increases the risk of tuberculosis.

Renal Disease: Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.

Ingestion: Do not ingest hydrated lime. Although ingestion of small quantities of hydrated lime is not known to be harmful, large quantities can cause chemical burns in the mouth, throat, stomach, and digestive tract.

Medical Conditions Aggravated by Exposure: Individuals with lung disease (e.g. bronchitis, emphysema, COPD, pulmonary disease) can be aggravated by exposure.

Section 4: FIRST AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids, to remove all particles. Seek medical attention for abrasions and burns.

Skin Contact: Wash with cool water and a pH neutral soap or a mild skin detergent. Seek medical attention for rash, burns, irritation, and prolonged unprotected exposures to wet hydrated lime, cement, cement mixtures or liquids from wet cement.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control center immediately.

Note to Physician: The three types of silicosis include:

- Simple chronic silicosis – which results from long-term exposure (more than 20 years) to low amounts of respirable crystalline silica. Nodules of chronic inflammation and scarring provoked by the respirable crystalline silica form in the lungs and chest lymph nodes. This disease may feature breathlessness and may resemble chronic obstructive pulmonary disease (COPD).
- Accelerated silicosis – occurs after exposure to larger amounts of respirable crystalline silica over a shorter period of time (5-15 years). Inflammation, scarring, and symptoms progress faster in accelerated silicosis than in simple silicosis.
- Acute silicosis – results from short-term exposure to very large amounts of respirable crystalline silica. The lungs become very inflamed and may fill with fluid, causing severe shortness of breath and low blood oxygen levels.

Progressive massive fibrosis may occur in simple or accelerated silicosis, but is more common in the accelerated form. Progressive massive fibrosis results from severe scarring and leads to the destruction of normal lung structures.

Section 5: FIREFIGHTING MEASURES

Flashpoint & Method: Non-combustible

General Hazard: Avoid breathing dust. Hydrated lime is caustic.

Extinguishing Media: Use extinguishing media appropriate for surrounding fire.

Firefighting Equipment: Hydrated lime poses no fire-related hazard. A SCBA is recommended to limit exposures to combustion products when fighting any fire.

Combustion Products: None.

Section 6: ACCIDENTAL RELEASE MEASURES

General: Place spilled material into a container. Avoid actions that cause the hydrated lime to become airborne. Avoid inhalation of hydrated lime and contact with skin. Wear appropriate protective equipment as described in Section 8. Scrape wet hydrated lime and place in container. Allow material to dry or solidify before disposal. Do not wash hydrated lime down sewage and drainage systems or into bodies of water (e.g. streams).

Waste Disposal Method: Dispose of hydrated lime according to Federal, State, Provincial and Local regulations.

Section 7: HANDLING AND STORAGE

General: Keep bulk and bagged hydrated lime dry until used. Stack bagged material in a secure manner to prevent falling. Bagged material is heavy and poses risks such as sprains and strains to the back, arms, shoulders and legs during lifting and mixing. Handle with care and use appropriate control measures.

Engulfment hazard. To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains hydrated lime. Hydrated lime can buildup or adhere to the walls of a confined space. The hydrated lime can release, collapse or fall unexpectedly.

Usage: Cutting, crushing or grinding hardened cement, concrete or other crystalline silica-bearing materials will release respirable crystalline silica. Use all appropriate measures of dust control or suppression, and Personal Protective Equipment (PPE) described in Section 8 below.

Housekeeping: Avoid actions that cause the hydrated lime to become airborne during clean-up such as dry sweeping or using compressed air. Use HEPA vacuum to clean-up dust. Use PPE described in Section 8 below.

Storage Temperature: Unlimited. **Storage Pressure:** Unlimited.

Storage: Sore in a cool, dry and well ventilated location. Do not store near incompatible materials. Keep away from moisture. Do not store or ship in aluminum containers.

Clothing: Promptly remove and launder clothing that is dusty or wet with hydrated lime. Thoroughly wash skin after exposure to dust or wet hydrated lime.

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls: Use local exhaust or general dilution ventilation or other suppression methods to maintain dust levels below exposure limits.

Personal Protective Equipment (PPE):

Respiratory Protection: Under ordinary conditions no respiratory protection is required. Wear a NIOSH approved respirator that is properly fitted and is in good condition when exposed to dust above exposure limits.

Eye Protection: Wear ANSI approved glasses or safety goggles when handling dust or wet hydrated lime to prevent contact with eyes. Wearing contact lenses when using hydrated lime, under dusty conditions, is not recommended.

Skin Protection: Wear gloves, boot covers and protective clothing impervious to water to prevent skin contact. Do not rely on barrier creams, in place of impervious gloves. Remove clothing and protective equipment that becomes saturated with wet hydrated lime and immediately wash exposed areas.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid (powder).	**Evaporation Rate:**	NA.
Appearance:	White or grey powder.	**pH (in water):**	12-13
Odor:	None.	**Boiling Point:**	>1000° C
Vapor Pressure:	NA.	**Freezing Point:**	None, solid.
Vapor Density:	NA.	**Viscosity:**	None, solid.
Specific Gravity:	2-3	**Solubility in Water:**	Negligible

Section 10: STABILITY AND REACTIVITY

Stability: Stable, but reacts slowly with carbon dioxide to form calcium and magnesium carbonate. Keep dry until use. Hydrated lime may react with water, resulting in a slight release of heat, depending on the amount of lime (Calcium oxide) present. Avoid contact with incompatible materials.

Incompatibility: Wet hydrated lime and cement is alkaline and is incompatible with acids, ammonium salts and aluminum metal. Hydrated lime and cement dissolves in hydrofluoric acid, producing corrosive silicon tetrafluoride gas. Hydrated lime and cement reacts with water to form silicates and calcium hydroxide. Silicates react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride.

Hazardous Polymerization: None.

Hazardous Decomposition: Hydrated lime will decompose at 540°C to produce calcium oxide (quicklime), magnesium oxide, and water.

Section 11 and 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with applicable Federal, State, Provincial and Local regulations.

Section 14: TRANSPORT INFORMATION

This product is not classified as a Hazardous Material under U.S. DOT or Canadian TDG regulations.

Section 15: REGULATORY INFORMATION

OSHA/MSHA Hazard Communication: This product is considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer's hazard communication program.

CERCLA/SUPERFUND: This product is not listed as a CERCLA hazardous substance.

EPCRA SARA Title III: This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a hazardous chemical and a delayed health hazard.

EPRCA SARA Section 313: This product contains none of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

RCRA: If discarded in its purchased form, this product would not be a hazardous waste either by listing or characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.

TSCA: Hydrated lime and crystalline silica are exempt from reporting under the inventory update rule.

California Proposition 65: Crystalline silica (airborne particulates of respirable size) is known by the State of California to cause cancer.

Section 15: REGULATORY INFORMATION (continued)

WHMIS/DSL:

Products containing crystalline silica and calcium carbonate are classified as D2A, E and are subject to WHMIS requirements.

Section 16: OTHER INFORMATION

Abbreviations:

>	Greater than	NA	Not Applicable
ACGIH	American Conference of Governmental Industrial Hygienists	NFPA	National Fire Protection Association
CAS No	Chemical Abstract Service number	NIOSH	National Institute for Occupational Safety and Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CFR	Code for Federal Regulations	PEL	Permissible Exposure Limit
CL	Ceiling Limit	pH	Negative log of hydrogen ion
DOT	U.S. Department of Transportation	PPE	Personal Protective Equipment
EST	Eastern Standard Time	R	Respirable Particulate
HEPA	High-Efficiency Particulate Air	RCRA	Resource Conservation and Recovery Act
HMIS	Hazardous Materials Identification System	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	T	Total Particulate
		TDG	Transportation of Dangerous Goods
LC_{50}	Lethal Concentration	TLV	Threshold Limit Value
LD_{50}	Lethal Dose	TWA	Time Weighted Average (8 hour)
mg/m^3	Milligrams per cubic meter	WHMIS	Workplace Hazardous Materials Information System
MSHA	Mine Safety and Health Administration		

This MSDS (Sections 1-16) was revised on March 1, 2011.

An electronic version of this MSDS is available at: www.lafarge-na.com under the Sustainability section.

Lafarge North America Inc. (LNA) believes the information contained herein is accurate; however, LNA makes no guarantees with respect to such accuracy and assumes no liability in connection with the use of the information contained herein which is not intended to be and should not be construed as legal advice or as insuring compliance with any federal, state or local laws or regulations. Any party using this product should review all such laws, rules, or regulations prior to use, including but not limited to US and Canada Federal, Provincial and State regulations.

NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

Propane (Canada)

Safety Data Sheet

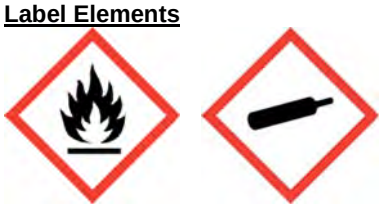
Section 1: Identification of the substance or mixture and of the supplier

Product Name:	Propane (Canada)
SDS Number:	775185
Synonyms/Other Means of Identification:	Petroleum Hydrocarbon
Intended Use:	Fuel
Manufacturer:	ConocoPhillips Canada Limited or its Affiliates PO Box 130, 401 9th Ave. SW Calgary, Alberta T2P 2H7 Canada
Emergency Health and Safety Number:	Chemtrec: 800-424-9300 (24 Hours) CANUTEC (613) 996-6666
Customer Service:	403-233-4000
Technical Information:	403-233-4000
SDS Information:	Phone: 855-244-0762 Email: SDS@conocophillips.com URL: www.conocophillips.com

Section 2: Hazard(s) Identification

Classification
H220 -- Flammable gases -- Category 1
H280 -- Gases under pressure -- Liquefied gas

Label Elements



DANGER
Extremely flammable gas. (H220)*
Gas may reduce oxygen in confined spaces
Contains gas under pressure. May explode if heated. (H280)*

Precautionary Statement(s):
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. (P210)*
Leaking gas fire: Do not extinguish, unless leak can be stopped safely. (P377)*
Eliminate all ignition sources if safe to do so. (P381)*
Protect from sunlight. Store in a well ventilated place. (P410+P403)*

* *(Applicable GHS hazard code.)*

Section 3: Composition / Information on Ingredients

Component	CASRN	Concentration[1]
Propane	74-98-6	95-100
Propylene	115-07-1	0-5
Ethyl Mercaptan	75-08-1	0-0.02

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Odorized products contain small quantities (<0.1%) ethyl mercaptan as an olfactory indicator.

Section 4: First Aid Measures

Eye Contact: For contact with the liquefied gas, remove contact lenses if present and easy to do, hold eyelids apart and gently flush the affected eye(s) with lukewarm water. Seek immediate medical attention.

Skin Contact: Liquefied gases may cause cryogenic burns or injury. Treat burned or frostbitten skin by flushing or immersing the affected area(s) in lukewarm water. Do not rub affected area. Do not remove clothing that adheres due to freezing. After sensation has returned to the frostbitten skin, keep skin warm, dry, and clean. If blistering occurs, apply a sterile dressing. Seek immediate medical attention.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. If breathing is difficult, oxygen or artificial respiration should be administered by qualified personnel. If symptoms persist, seek medical attention.

Ingestion (Swallowing): This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Most important symptoms and effects

Acute: Anesthetic effects at high concentrations.

Delayed: None known or anticipated. See Section 11 for information on effects from chronic exposure, if any.

Notes to Physician: Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of hydrocarbon solvents (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for the development of cardiac arrhythmias.

Section 5: Fire-Fighting Measures

NFPA 704 Hazard Class

Health: 2 **Flammability:** 4 **Instability:** 0 (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

Unusual Fire & Explosion Hazards: Extremely flammable. Contents under pressure. This material can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. If container is not properly cooled, it can rupture in the heat of a fire. Drains can be plugged and valves made inoperable by the formation of ice if rapid evaporation of large quantities of the liquefied gas occurs. Do not allow run-off from fire fighting to enter drains or water courses – may cause explosion hazard in drains and may reignite.

Extinguishing Media: Dry chemical or carbon dioxide is recommended. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. If this cannot be done, allow fire to burn. Move undamaged containers from immediate hazard area if it can be done safely. Stay away from ends of container. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of nitrogen and sulfur may also be formed.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

Section 6: Accidental Release Measures

Personal Precautions: Extremely flammable. Spillages of liquid product will create a fire hazard and may form an explosive atmosphere. Keep all sources of ignition and hot metal surfaces away from spill/release if safe to do so. The use of explosion-proof electrical equipment is recommended. Beware of accumulation of gas in low areas or contained areas, where explosive concentrations may occur. Prevent from entering drains or any place where accumulation may occur. Ventilate area and allow to evaporate. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop spill/release if it can be done safely. Water spray may be useful in minimizing or dispersing vapors. If spill occurs on water notify appropriate authorities and advise shipping of any hazard.

Methods for Containment and Clean-Up: Notify relevant authorities in accordance with all applicable regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken.

Section 7: Handling and Storage

Precautions for safe handling: Keep away from ignition sources such as heat/sparks/open flame – No smoking. Take precautionary measures against static discharge. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

Contents under pressure. Gas can accumulate in confined spaces and limit oxygen available for breathing. Use only with adequate ventilation. The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-70 and/or API RP 2003 for specific bonding/grounding requirements. Electrostatic charge may accumulate and create a hazardous condition when handling or processing this material. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Cold burns may occur during filling operations. Containers and delivery lines may become cold enough to present cold burn hazard.

The use of hydrocarbon fuel in an area without adequate ventilation may result in hazardous levels of incomplete combustion products (e.g. carbon monoxide, oxides of sulfur and nitrogen, benzene and other hydrocarbons) and/or dangerously low oxygen levels.

Propane and odorant are heavier than air and will collect and pool along the ground or floor. Odorant, therefore, may not be detectable above the location of propane storage or service (for example, odorant in propane released or leaked into the basement of a dwelling may not be detected above the basement).

WARNING - The intensity of the odorant may fade over prolonged storage or in the presence of rust, when placed initially in new or freshly-cleaned storage vessels, or when exposed to masonry.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Store only in approved containers. Post area "No Smoking or Open Flame." Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. Avoid exposing any part of a compressed-gas cylinder to temperatures above 125F(51.6C). Gas cylinders should be stored outdoors or in well ventilated storerooms at no lower than ground level and should be quickly removable in an emergency.

Section 8: Exposure Controls / Personal Protection

Component	ACGIH	OSHA	Other
Propane	TWA: 1000 ppm as Aliphatic Hydrocarbon Gases: Alkane (C1-C4)	TWA: 1000 ppm TWA: 1800 mg/m^3	---
Propylene	TWA: 500 ppm	---	---
Ethyl Mercaptan	TWA: 0.5 ppm	Ceiling: 10 ppm Ceiling: 25 mg/m^3	---

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye/Face Protection: The use of eye protection (such as splash goggles) that meets or exceeds ANSI Z.87.1 is recommended when there is potential liquid contact to the eye. Depending on conditions of use, a face shield may be necessary.

Skin/Hand Protection: Wear thermal insulating gloves and face shield or eye protection when working with materials that present thermal hazards (hot or cold).

Respiratory Protection: A NIOSH approved, self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode should be used in situations of oxygen deficiency (oxygen content less than 19.5 percent), unknown exposure concentrations, or situations that are immediately dangerous to life or health (IDLH).

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

Section 9: Physical and Chemical Properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance:	Colorless
Physical Form:	Liquefied Gas
Odor:	Rotten egg / sulfurous
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure:	10000 mm Hg / 200 psia (Reid VP) @ 100°F / 37.8°C
Vapor Density (air=1):	>1
Initial Boiling Point/Range:	-54 to -44 °F / -48 to -42 °C
Melting/Freezing Point:	-303 °F / -186 °C
Solubility in Water:	Slight
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity (water=1):	0.5-0.6 @ 60ºF (15.6ºC)

VOC Content(%):	100%
Evaporation Rate (nBuAc=1):	>1
Flash Point:	-163 °F / -108 °C
Test Method:	Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
Lower Explosive Limits (vol % in air):	2.1
Upper Explosive Limits (vol % in air):	9.5
Auto-ignition Temperature:	851 °F / 455 °C

Section 10: Stability and Reactivity

Stability: Stable under normal ambient and anticipated conditions of use.

Conditions to Avoid: Avoid all possible sources of ignition. Heat will increase pressure in the storage tank.

Materials to Avoid (Incompatible Materials): Avoid contact with acids, aluminum chloride, chlorine, chlorine dioxide, halogens and oxidizing agents.

Hazardous Decomposition Products: Not anticipated under normal conditions of use.

Hazardous Polymerization: Not known to occur.

Section 11: Toxicological Information

Information on Toxicological Effects of Substance/Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful	Asphyxiant. High concentrations in confined spaces may limit oxygen available for breathing. See Signs and Symptoms.	> 20,000 ppm (gas, estimated)
Skin Absorption	Skin absorption is not anticipated		Not Applicable
Ingestion (Swallowing)	Ingestion is not anticipated		Not Applicable

Aspiration Hazard: Not applicable

Skin Corrosion/Irritation: Not expected to be irritating. Contact with the liquefied or pressurized gas may cause frostbite ("cold" burn).

Serious Eye Damage/Irritation: Not expected to be irritating. Contact with the liquefied or pressurized gas may cause momentary freezing followed by swelling and eye damage.

Signs and Symptoms: Light hydrocarbon gases are simple asphyxiants and can cause anesthetic effects at high concentrations. Symptoms of overexposure, which are reversible if exposure is stopped, can include shortness of breath, drowsiness, headaches, confusion, decreased coordination, visual disturbances and vomiting. Continued exposure can lead to hypoxia (inadequate oxygen), rapid breathing, cyanosis (bluish discoloration of the skin), numbness of the extremities, unconsciousness and death.

Skin Sensitization: Skin contact is not anticipated.

Respiratory Sensitization: Not expected to be a respiratory sensitizer.

Specific Target Organ Toxicity (Single Exposure): Not expected to cause organ effects from single exposure.

Specific Target Organ Toxicity (Repeated Exposure): Not expected to cause organ effects from repeated exposure.

Carcinogenicity: Not expected to cause cancer. This substance is not listed as a carcinogen by IARC, NTP or OSHA.

Germ Cell Mutagenicity: Not expected to cause heritable genetic effects.

Reproductive Toxicity: Not expected to cause reproductive toxicity.

Other Comments: High concentrations may reduce the amount of oxygen available for breathing, especially in confined spaces. Hypoxia (inadequate oxygen) during pregnancy may have adverse effects on the developing fetus.

The odorant, ethyl mercaptan, can be irritating to the eyes, skin and respiratory tract. At high concentrations, a person can temporarily lose the ability to smell ethyl mercaptan. In addition, some individuals may have an impaired sense of smell, which inhibits the detection of the odorant.

Information on Toxicological Effects of Components

Propane

Target Organs: No systemic or neurotoxic effects were noted in rats exposed to concentrations of propane as high as 12,000 ppm for 28 days.

Reproductive Toxicity: No adverse reproductive or developmental effects were observed in rats exposed to propane; no observed adverse effect level = 12,000 ppm.

Section 12: Ecological Information

Toxicity: Petroleum gases will readily evaporate from the surface and would not be expected to have significant adverse effects in the aquatic environment. Classification: No classified hazards.

Persistence and Degradability: The hydrocarbons in this material are expected to be inherently biodegradable. In practice, hydrocarbon gases are not likely to remain in solution long enough for biodegradation to be a significant loss process.

Bioaccumulative Potential: Log Kow values measured for the hydrocarbon gases range from 2.3 for propane to 2.8 for butane and are not regarded as having the potential to bioaccumulate.

Mobility in Soil: Due to the extreme volatility of petroleum gases, air is the only environmental compartment in which these hydrocarbons will be found. In air, these hydrocarbons undergo photodegradation by reaction with hydroxyl radicals with half-lives ranging from 3.2 days for n-butane to 7 days for propane.

Other Adverse Effects: None anticipated.

Section 13: Disposal Considerations

This material is a gas and would not typically be managed as a waste.

Section 14: Transport Information

Canadian (TDG)

Shipping Description: UN1978, Propane, 2.1

Small Means of Containment

Package Marking: Propane, UN1978

Package Labeling: Flammable gas

Large Means of Containment

Package Placard/Marking: Flammable gas / 1978

ERAP Index: 3000

Emergency Response Guide: 115

Note: ***These dangerous goods may be handled, offered for transport or transported under the UN number and shipping name UN1075, LIQUEFIED PETROLEUM GASES or GAZ DE PETROLE LIQUEFIES. [TDG Regulations - Schedule 2 - Special Provision 29] For a liquefied petroleum gas that is not odorized the words "Not Odorized" or "Not Odourized" or "Sans odorisant" shall be included in the shipping description immediately after the shipping name. [TDG 3.5(1)(c)(i)(B)]***

U.S. Department of Transportation (DOT)

Shipping Description: UN1978, Propane, 2.1,
Non-Bulk Package Marking: Propane, UN1978
Non-Bulk Package Labeling: Flammable gas
Bulk Package/Placard Marking: Flammable gas / 1978
Packaging - References: 49 CFR: 173.306; 173.304; 173.314 & .315 ***(Exceptions; Non-bulk; Bulk)***
Hazardous Substance: See Section 15 for RQ`s
Emergency Response Guide: 115
Note: ***For domestic transportation only, UN1075 may be substituted for the UN number shown as long as the substitution is consistent on package markings, shipping papers, and emergency response information. See 49 CFR 172.102 Special Provision 19.***
Containers of NON-ODORIZED liquefied petroleum gas must be marked either NON-ODORIZED or NOT ODORIZED as of September 30, 2006. [49 CFR 172.301(f), 326(d), 330(c) and 338(e)]
The following alternate shipping description order may be used until January 1, 2013:
Proper Shipping name, Hazard Class or Division, (Subsidiary Hazard if any), UN or NA number, Packing Group
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: *Not applicable*
Other shipping description elements may be required for DOT compliance.

International Maritime Dangerous Goods (IMDG)

Shipping Description: UN1978, Propane, 2.1
Non-Bulk Package Marking: Propane, UN1978
Labels: Flammable gas
Placards/Marking (Bulk): Flammable gas / 1978
Packaging - Non-Bulk: P200
EMS: F-D, S-U

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #: UN1978
Proper Shipping Name: Propane
Hazard Class/Division: 2.1
Non-Bulk Package Marking: Propane, UN1978
Labels: Flammable gas
ERG Code: 10L
Note: ***Special provision A1 applies to this product.***

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	*Forbidden*	*Forbidden*	200
Max. Net Qty. Per Package:	*Forbidden*	*Forbidden*	150 kg

Section 15: Regulatory Information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):
This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health: Yes
Chronic Health: No
Fire Hazard: Yes
Pressure Hazard: No
Reactive Hazard: No

CERCLA/SARA - Section 313 and 40 CFR 372:
This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

Component	Concentration[1]	de minimis
Propylene	0-5	1.0%

EPA (CERCLA) Reportable Quantity (in pounds):
EPA's Petroleum Exclusion applies to this material - (CERCLA 101(14)).

California Proposition 65:
This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

WARNING: Chemicals known to the State of California to cause cancer, birth defects or other reproductive harm are created by the combustion of Propane.

International Hazard Classification

Canada:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class:
A - Compressed Gas
B1 - Flammable Gases

National Chemical Inventories
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA
All components are either on the DSL, or are exempt from DSL listing requirements

U.S. Export Control Classification Number: EAR99

Section 16: Other Information

Date of Issue:	17-Aug-2012
Status:	FINAL
Previous Issue Date:	03-Apr-2012
Revised Sections or Basis for Revision:	Regulatory information (Section 15)
SDS Number:	775185

Guide to Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:
The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Anachemia

255 Norman.
Lachine (Montreal), Que
H8R 1A3

Material Safety Data Sheet

EMERGENCY NUMBERS:

(USA) CHEMTREC : 1(800) 424-9300 (24hrs)
(CAN) CANUTEC : 1(613) 996-6666 (24hrs)
(USA) Anachemia : 1(518) 297-4444
(CAN) Anachemia : 1(514) 489-5711

WHMIS	Protective Clothing	TDG Road/Rail
WHMIS CLASS: D-2A		Not controlled under TDG (Canada). PIN: Not applicable. PG: Not applicable.
		

Section I. Product Identification and Uses

Product name	**SODIUM BORATE, ANHYDROUS**
Chemical formula	Na2B4O7
Synonyms	Sodium tetraborate, Sodium borate anhydrous, Sodium pyroborate, Borax glass, AC-8266T, MR-103, 80950, 029-940-01, 029-940-02, 029-940-03
Supplier	Anachemia Canada. 255 Norman. Lachine (Montreal), Que H8R 1A3
Material uses	For laboratory use only.

CI#	Not available.
CAS#	1330-43-4
Code	AC-8266T
Formula weight	201.27
Supersedes	

Section II. Ingredients

Name	CAS #	%	TLV
1) SODIUM BORATE	1330-43-4	98-100	Exposure limit: ACGIH TWA 2 mg/m3; STEL 6 mg/m3

Toxicity values of the hazardous ingredients

SODIUM BORATE DECAHYDRATE:
ORAL (LD50): Acute: 2660 mg/kg (Rat). 2000 mg/kg (Mouse). 5330 mg/kg (Guinea pig).
ORAL (LDLo): Acute: 709 mg/kg (Man).

Section III. Physical Data

Physical state and appearance / Odor	Solid. (White crystalline solid. Odorless.)
pH (1% soln/water)	9.3
Odor threshold	Not available.
Percent volatile	0% at 21°C
Freezing point	742°C
Boiling point	Not applicable.
Specific gravity	2.367 (Water = 1)
Vapor density	Not applicable.
Vapor pressure	Not applicable.
Water/oil dist. coeff.	Not applicable.
Evaporation rate	Not applicable.
Solubility	3.1 to 5.8% @ 25°C (in H2O)

Section IV. Fire and Explosion Data

Flash point	Not applicable.
Flammable limits	Not applicable.
Auto-ignition temperature	Not applicable.
Fire degradation products	Oxides of sodium.
Fire extinguishing procedures	Use extinguishing media suitable for surrounding materials. Wear adequate personal protection to prevent contact with material or its combustion products. Self contained breathing apparatus with a full facepiece operated in a pressure demand or other positive pressure mode.
Fire and Explosion Hazards	The product is not sensitive to impact. The product is not sensitive to static discharge. Emits toxic fumes under fire conditions.

Section V. Toxicological Properties

Routes of entry	Inhalation and ingestion. Eye contact. Skin contact. Skin absorption.
Effects of Acute Exposure	Harmful by ingestion, inhalation or skin absorption. Irritant. Target organs: respiratory system, eyes, skin.
Eye	Causes irritation. May cause slight burning sensation due to heat of hydration.
Skin	Causes skin irritation. May cause desquamation. Can be absorbed through damaged skin causing symptoms similar to ingestion.
Inhalation	Material is irritating to mucous membranes and upper respiratory tract. See ingestion.
Ingestion	Causes gastrointestinal irritation. May cause central nervous system depression (headache, nausea, vomiting, dizziness, abdominal pain, etc...), diarrhea, oliguria, anuria, erythema, macular rash, kidney damage, cardiovascular collapse, shock and death if ingested in large amounts. Toxic effects may be delayed.

Section V. Toxicological Properties

Effects of Chronic Overexposure	May cause nose irritation, dyspnea, abdominal pain, reversible erythema and/or rash, central nervous system effects, dizziness, macular rash and lung damage. Animal studies show that ingestion of large amounts of borates over prolonged periods of time cause a decrease in sperm production and testicle size in male laboratory animals and developmental effects if fetuses of pregnant female laboratory animals. Carcinogenic effects: Not available. Mutagenic effects: Not available. To the best of our knowledge, the chemical, physical, and toxicity of this substance has not been fully investigated.

Section VI. First Aid Measures

Eye contact	Immediately flush eyes with copious quantities of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface. Call a physician.
Skin contact	Immediately flush skin with plenty of water and soap for at least 15 minutes while removing contaminated clothing and shoes. If irritation occurs or persists seek medical attention. Wash contaminated clothing before reusing.
Inhalation	Remove patient to fresh air. Administer approved oxygen supply if breathing is difficult. Administer artificial respiration or CPR if breathing has ceased. Call a physician.
Ingestion	If conscious, wash out mouth with water. Have conscious person drink several glasses of water or milk. Seek immediate medical attention. Never give anything by mouth to an unconscious or convulsing person.

Section VII. Reactivity Data

Stability	Stable. Conditions to avoid: High temperatures, sparks, open flames and all other sources of ignition, contamination.
Hazardous decomp. products	Not available.
Incompatibility	Strong oxidizing agents, acids, metallic salts, alkaloids, zirconium, reducing agents (alkali metals, metals hydrides, etc...).
Reaction Products	Product dissolves slowly in water with evolution of heat. Hazardous polymerization will not occur.

Section VIII. Preventive Measures

Protective Clothing in case of spill and leak	Wear self-contained breathing apparatus, rubber boots and heavy rubber gloves.
Spill and leak	Evacuate the area. Sweep up and place in container for disposal. Avoid raising dust. Ventilate area and wash spill site after material pick up is complete. DO NOT empty into drains. DO NOT touch spilled material.
Waste disposal	According to all applicable regulations. Harmful to aquatic life at low concentrations. Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.
Storage and Handling	Store in a cool place away from heated areas, sparks, and flame. Store in a well ventilated area. Store away from incompatible materials. Do not add any other material to the container. Do not wash down the drain. Do not breathe dust. Keep container tightly closed and dry. Manipulate under an adequate fume hood. Avoid raising dust. Empty containers may contain a hazardous residue. Handle and open container with care. Minimize dust generation and exposure - use dust mask or appropriate protection. This product must be manipulated by qualified personnel. Do not get in eyes, on skin, or on clothing. Wash well after use. In accordance with good storage and handling practices. Do not allow smoking and food consumption while handling. Product is highly hygroscopic.

Section IX. Protective Measures

Protective clothing	Splash goggles. Impervious gloves, apron, coveralls, and/or other resistant protective clothing. Sufficient to protect skin. A OSHA/MSHA jointly approved respirator is advised in the absence of proper environmental controls. If more than TLV, do not breathe vapor. Wear self-contained breathing apparatus. Do not wear contact lenses. Make eye bath and emergency shower available. Ensure that eyewash station and safety shower is proximal to the work-station location.
Engineering controls	Use in a chemical fume hood to keep airborne levels below recommended exposure limits. Do not use in unventilated spaces.

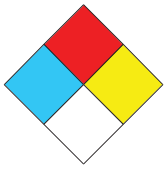
Section X. Other Information

Special Precautions or comments

Teratogen! Reproductive toxin! Irritant! Do not breathe dust. Avoid all contact with the product. Avoid prolonged or repeated exposure. Manipulate in a well ventilated area or under an adequate fume hood. Handle and open container with care. Container should be opened only by a technically qualified person.

NOTES TO PHYSICIAN: Gastric lavage with 5% sodium bicarbonate is suggested. This should be followed by saline catharsis. Assure adequate hydration. Borax is not considered an acute poison. After ingestion or absorption into the bloodstream of large amounts (15 grams or more), symptoms may appear after 24-72 hours. Borates are readily dissipated through the urine (70% in the first 24 hours).

RTECS NO: ED4588000 (Sodium borate).



NFPA

Prepared by MSDS Department/Département de F.S..

Validated 23-Sep-2009

Telephone# (514) 489-5711

While the company believes the data set forth herein are accurate as of the date hereof, the company makes no warranty with respect thereto and expressly disclaims all liability for reliance thereon. Such data are offered solely for your consideration, investigation and verification.

Health	3
Fire	1
Reactivity	0
Personal Protection	J

Material Safety Data Sheet
Sodium Cyanide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Cyanide

Catalog Codes: SLS2314, SLS3736

CAS#: 143-33-9

RTECS: VZ7525000

TSCA: TSCA 8(b) inventory: Sodium Cyanide

CI#: Not available.

Synonym:

Chemical Name: Sodium Cyanide

Chemical Formula: NaCN

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium Cyanide	143-33-9	100

Toxicological Data on Ingredients: Sodium Cyanide: ORAL (LD50): Acute: 6.44 mg/kg [Rat]. DERMAL (LD50): Acute: 10.4 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (permeator). Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to skin, eyes, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of acids, of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Dangerous on contact with acids, acid fumes, water or stream. It will produce toxic and flammable vapors of CN-H and sodium oxide. Contact with acids and acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas. When heated to decomposition it emits toxic fumes hydgrogen cyanide and oxides of nitrogen

Special Remarks on Explosion Hazards: Fusion mixtures of metal cyanides with metal chlorates, perchlorated or nitrates causes a violent explosion

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Corrosive solid. Poisonous solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 24°C (75.2°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
STEL: 5 (mg/m3) from ACGIH (TLV) [United States] SKIN CEIL: 4.7 from NIOSH CEIL: 5 (mg/m3) from NIOSHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Granular solid. Flakes solid.)

Odor:
Faint almond-like odor. Odorless when perfectly dry. Emits odor of hydrogen cyanide when damp.

Taste: Not available.

Molecular Weight: 49.01 g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: 1496°C (2724.8°F)

Melting Point: 563°C (1045.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.595 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Vapor Density of Hydrogen Cyanide gas: 0.941

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:
Soluble in cold water. Slightly soluble in Ethanol

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, moisture, incompatibles.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity:
Corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Violent reaction with fluorine gas, magnesium, nitrates, nitric acid. Dangerous on contact with acids, acid fumes, water or stream. It wil produce toxic and flammable vapors of CN-H and sodium oxide. Cyanide may react with CO2 in ordinary air to form toxic hydrogen cyanide gas. Strong oxidizers such as acids, acid salts, chlorates, and nitrates. Contact with acids and acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas.

Special Remarks on Corrosivity: Corrosive to aluminum

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 6.44 mg/kg [Rat]. Acute dermal toxicity (LD50): 10.4 mg/kg [Rabbit].

Chronic Effects on Humans: May cause damage to the following organs: skin, eyes, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May cause adverse reproductive effects (maternal and paternal fertility) based on animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health effects: Skin: May cause itching and irritation. May be fatal if absorbed through injured skin with symtpoms similar to those noted for inhalation and ingestion. Eyes: May cause eye irritation and eye damage. Inhalation: May cause respiratory tract irritation. May be fatal if inhaled. The substance inhibits cellular respiration causing metabolic asphyxiation. May cause headache, weakness, dizziness, labored breathing, nausea, vomiting. May be followed by cardiovascular effects, unconciousness, convulsions, coma, and death Ingestion: May be fatal if swallowed. May cause

gastrointestinal tract irritation with nausea, vomiting. May affect behavior and nervous systems(seizures, convulsions, change in motor activity, headache, dizziness, confusion, weakness stupor, aniexity, agitation, tremors), cardiovascular system, respiration (hyperventilation, pulmonary edema, breathing difficulty, respiratory failure), cardiovascular system (palpitations, rapid heart beat, hypertension, hypotension). Massive doses by produce sudden loss of conciousness and prompt death from respiratory arrest. Smaller but still lethal doses on the breath or vomitus. Chronic Potential Health Effects: Central Nervous system effects (headaches, vertigo, insomnia, memory loss, tremors, fatigue), fatigue, metabolic effects (poor appetite), cardiovascular effects (chest discomfort, palpitations), nerve damage to the eyes, or dermatitis, respiratory tract irritation, eye irritation, or death can occur. may prolong the illness for 1 or more hours. A bitter almond odor may be noted

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Sodium cyanide UNNA: 1689 PG: I

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut carcinogen reporting list.: Sodium Cyanide Illinois chemical safety act: Sodium Cyanide New York release reporting list: Sodium Cyanide Rhode Island RTK hazardous substances: Sodium Cyanide Pennsylvania RTK: Sodium Cyanide Minnesota: Sodium Cyanide Massachusetts RTK: Sodium Cyanide Massachusetts spill list: Sodium Cyanide New Jersey: Sodium Cyanide New Jersey spill list: Sodium Cyanide Louisiana RTK reporting list: Sodium Cyanide Louisiana spill reporting: Sodium Cyanide California Director's List of Hazardous Substances: Sodium Cyanide TSCA 8(b) inventory: Sodium Cyanide TSCA 4(a) final test rules: Sodium Cyanide TSCA 8(a) PAIR: Sodium Cyanide TSCA 8(d) H and S data reporting: Sodium Cyanide TSCA 12(b) one time export: Sodium Cyanide SARA 302/304/311/312 extremely hazardous substances: Sodium Cyanide CERCLA: Hazardous substances.: Sodium Cyanide: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-6: Reactive and very flammable material. CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS E: Corrosive solid.

DSCL (EEC):
R27/28- Very toxic in contact with skin and if swallowed. R41- Risk of serious damage to eyes. S1/2- Keep locked up and out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water S36/37- Wear suitable protective clothing and gloves. S39- Wear eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

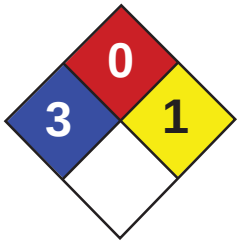
References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 01:58 PM

Last Updated: 06/09/2012 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Material Safety Data Sheet
Sodium hydroxide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium hydroxide

Catalog Codes: SLS3298, SLS1081, SLS2503, SLS3925, SLS1705

CAS#: 1310-73-2

RTECS: WB4900000

TSCA: TSCA 8(b) inventory: Sodium hydroxide

CI#: Not available.

Synonym: Caustic Soda

Chemical Name: Sodium Hydroxide

Chemical Formula: NaOH

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium hydroxide	1310-73-2	100

Toxicological Data on Ingredients: Sodium hydroxide LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, of inhalation. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to mucous membranes, upper respiratory tract, skin, eyes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: metals

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of heat.

Fire Fighting Media and Instructions: Not available

Special Remarks on Fire Hazards:
sodium hydroxide + zinc metal dust causes ignition of the latter. Under proper conditions of temperature, pressure and state of division, it can ignite or react violently with acetaldehyde, ally alcohol, allyl chloride, benzene-1,4-diol, chlorine trifluoride, 1,2 dichlorethylene, nitroethane, nitromethane, nitroparaffins, nitropropane, cinnamaldehyde, 2,2-dichloro-3,3-dimethylbutane. Sodium hydroxide in contact with water may generate enough heat to ignite adjacent combustible materials. Phosphorous boiled with NaOH yields mixed phosphines which may ignite spontanously in air. sodium hydroxide and cinnamaldehyde + heat may cause ignition. Reaction with certain metals releases flammable and explosive hydrogen gas.

Special Remarks on Explosion Hazards:
Sodium hydroxide reacts to form explosive products with ammonia + silver nitrate. Benzene extract of allyl benzenesulfonate prepared from allyl alcohol, and benzene sulfonyl chloride in presence of aquesous sodium hydroxide, under vacuum distillation, residue darkened and exploded. Sodium Hydroxde + impure tetrahydrofuran, which can contain peroxides, can

cause serious explosions. Dry mixtures of sodium hydroxide and sodium tetrahydroborate liberate hydrogen explosively at 230-270 deg. C. Sodium Hydroxide reacts with sodium salt of trichlorophenol + methyl alcohol + trichlorobenzene + heat to cause an explosion.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid.

Large Spill:
Corrosive solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep container dry. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, metals, acids, alkalis, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Hygroscopic. Deliquescent.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
STEL: 2 (mg/m3) from ACGIH (TLV) [United States] TWA: 2 CEIL: 2 (mg/m3) from OSHA (PEL) [United States] CEIL: 2 (mg/m3) from NIOSHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Deliquescent solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 40 g/mole

Color: White.

pH (1% soln/water): 13.5 [Basic.]

Boiling Point: 1388°C (2530.4°F)

Melting Point: 323°C (613.4°F)

Critical Temperature: Not available.

Specific Gravity: 2.13 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, moisture, moist air

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, reducing agents, acids, alkalis, moisture.

Corrosivity: Not available.

Special Remarks on Reactivity:
Hygroscopic. Much heat is evolved when solid material is dissolved in water. Therefore cold water and caution must be used for this process. Sodium hydroxide solution and octanol + diborane during a work-up of a reaction mixture of oxime and diborane in tetrahyrofuran is very exothermic, a mild explosion being noted on one occassion. Reactive with water, acids (mineral, non-oxidizing, e.g. hydrochloric, hydrofluoric acid, muriatic acid, phosphoric), acids (mineral, oxidizing e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), acids (organic e.g. acetic acid, benzoic acid, formic acid, methanoic acid, oxalic acid), aldehydes (e.g. acetaldehyde, acrolein, chloral hydrate, foraldehyde), carbamates (e.g. carbanolate, carbofuran), esters (e.g. butyl acetate, ethyl acetate, propyl formate), halogenated organics (dibromoethane, hexachlorobenzene, methyl chloride, trichloroethylene), isocyanates (e.g. methyl isocyanate), ketones (acetone, acetophenone, MEK, MIBK), acid chlorides, strong bases, strong oxidizing agents, strong reducing agents, flammable liquids, powdered metals and metals (i.e aluminum, tin, zinc, hafnium, raney nickel), metals (alkali and alkaline e.g. cesium, potassium, sodium), metal compounds (toxic e.g. berylium, lead acetate, nickel carbonyl, tetraethyl lead), mitrides (e.g. potassium nitride, sodium nitride), nitriles (e.g. acetonitrile, methyl cyanide), nitro compounds (organic e.g. nitrobenzene, nitromethane), acetic anhydride, chlorohydrin, chlorosulfonic acid, ethylene cyanohydrin, glyoxal, hydrosulfuric acid, oleum, propiolactone, acylonitrile, phorosous pentoxide, chloroethanol, chloroform-methanol, tetrahydroborate, cyanogen azide, 1,2,4,5 tetrachlorobenzene, cinnamaldehyde. Reacts with formaldehyde hydroxide to yield formic acid, and hydrogen.

Special Remarks on Corrosivity: Very caustic to aluminum and other metals in presence of moisture.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. May cause damage to the following organs: mucous membranes, upper respiratory tract, skin, eyes.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Rabbit] - Route: Oral; Dose: 500 mg/kg

Special Remarks on Chronic Effects on Humans: May affect genetic material. Investigation as a mutagen (cytogenetic analysis)

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Sodium hydroxide, solid UNNA: 1823 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Illinois toxic substances disclosure to employee act: Sodium hydroxide Illinois chemical safety act: Sodium hydroxide New York release reporting list: Sodium hydroxide Rhode Island RTK hazardous substances: Sodium hydroxide Pennsylvania RTK: Sodium hydroxide Minnesota: Sodium hydroxide Massachusetts RTK: Sodium hydroxide New Jersey: Sodium hydroxide Louisiana spill reporting: Sodium hydroxide California Director's List of Hazardous Substances: Sodium hydroxide TSCA 8(b) inventory: Sodium hydroxide CERCLA: Hazardous substances.: Sodium hydroxide: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS E: Corrosive solid.

DSCL (EEC):
R35- Causes severe burns. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37/39- Wear suitable gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 2

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:32 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

CLEARTECH

MATERIAL SAFETY DATA SHEET

Sodium Hypochlorite 5-20%

Section 01 - Chemical And Product And Company Information

Product Identifier ..... Sodium Hypochlorite (5-20%)

Product Use ..... Disinfectant, bleaching agent, source of available chlorine, deodorizer.

Supplier Name..... ClearTech Industries Inc.
2302 Hanselman Avenue
Saskatoon, SK. Canada
S7L 5Z3

Prepared By..... ClearTech Industries Inc. Technical Department
Phone: (306)664-2522

Preparation Date..... December 22, 2010

24-Hour Emergency Phone..... 306-664-2522

Section 02 - Composition / Information on Ingredients

Hazardous Ingredients.....	Sodium Hypochlorite	4.90-16.80%
CAS Number.....	Sodium Hypochlorite	7681-52-9

Synonym (s).....Industrial bleach, hypo, bleach, Javel water, household bleach

Section 03 - Hazard Identification

Inhalation..... Irritant of the nose and throat, causing coughing, difficulty breathing, and pulmonary edema.

Skin Contact / Absorption..... Causes severe skin irritation with blistering and ulceration.

Eye Contact..... Causes severe irritation of the mucous membranes of the eyes. May cause severe eye damage.

Ingestion..... Burning of the mouth and throat, abdominal cramps, nausea, vomiting, diarrhea, shock. May lead to convulsions, coma, and even death.

Exposure Limits..... ACGIH/TLV-TWA: 0.5ppm (chlorine)

Section 04 - First Aid Measures

Inhalation..... Remove victim to fresh air. Give artificial respiration only if breathing has stopped. If breathing is difficult, give oxygen. Seek immediate medical attention.

Skin Contact / Absorption..... Remove contaminated clothing. Wash affected area with soap and water. Seek medical attention if irritation occurs or persists.

Eye Contact..... Flush immediately with water for at least 20 minutes. Forcibly hold eyelids apart to ensure complete irrigation of eye tissue. Seek immediate medical attention.

Ingestion..... Do not induce vomiting. If vomiting occurs, lean victim forward to prevent breathing in vomitus. Give large amounts of water. Do not give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention.

Additional Information..... Not available

Section 05 - Fire Fighting

Conditions of Flammability..... Non-flammable

Means of Extinction..... Product does not burn. Use appropriate extinguishing media for material that is supplying the fuel to the fire.

Flash Point..... Not applicable

Auto-ignition Temperature..... Not applicable

Upper Flammable Limit ..... Not applicable

Lower Flammable Limit..... Not applicable

Hazardous Combustible Products... Decomposition may produce chlorine gas and/or hydrogen chloride gas.

Special Fire Fighting Procedures..... Wear NIOSH-approved self-contained breathing apparatus and protective clothing.

Explosion Hazards..... Pressure buildup in containers could result in an explosion when heated or in contact with acidic fumes. Vigorous reaction with oxidizable organic materials may result in a fire.

Section 06 - Accidental Release Measures

Leak / Spill..... Wear appropriate personal protective equipment. Ventilate area. Stop or reduce leak if safe to do so. Restrict access to spill area until clean up is complete. Prevent material from entering sewers, waterways or confined spaces. Soak up smaller spills with absorbent material that does not react with spilled material. Flush with water to remove any residue.

Deactivating Materials..... Spills can be carefully neutralized first with sodium sulphite, sodium metabisulphite or other dechlorination agent for no chlorine residual, then a pH adjustment may be required with hydrochloric acid until the pH is 7. Note neutralization reactions may produce heat so necessary precautions must be taken. Local regulatory agencies should also be contacted for proper disposal.

Section 07 - Handling and Storage

Handling Procedures..... Use proper equipment for lifting and transporting all containers. Use sensible industrial hygiene and housekeeping practices. Wash thoroughly after handling. Avoid all situations that could lead to harmful exposure.

Storage Requirements..... Store in a cool, dry, well-ventilated place. Keep container tightly closed, and away from incompatible materials. Venting of containers is advisable.

Section 08 - Personal Protection and Exposure Controls

Protective Equipment

Eyes..... Chemical goggles, full-face shield, or a full-face respirator is to be worn at all times when product is handled. Contact lenses should not be worn; they may contribute to severe eye injury.

Respiratory..... A NIOSH-approved respirator suitable for chlorine is recommended. Where a higher level of protection is required, use a self-contained breathing apparatus.

Gloves..... Impervious gloves of chemically resistant material (rubber or PVC) should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.

Clothing..... Body suits, aprons, and/or coveralls of chemical resistant material should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.

Footwear..... Impervious boots of chemically resistant material should be worn at all times.

Engineering Controls

Ventilation Requirements..... Mechanical ventilation (dilution or local exhaust), process or personnel enclosure and control of process conditions should be provided. Supply sufficient replacement air to make up for air removed by exhaust systems.

Other..... Emergency shower and eyewash should be in close proximity.

Section 09 - Physical and Chemical Properties

Physical State..... Liquid

Odor and Appearance..... Strong chlorine odour. Clear, greenish-yellow solution.

Odor Threshold..... Not available

Specific Gravity (Water=1)..... 1.17 at 20°C (12% trade)

Vapor Pressure (mm Hg, 20C)..... 12.1mm Hg at 20°C (12.5 wt %)

Vapor Density (Air=1)..... Not available

Evaporation Rate..... Not available

Boiling Point..... Slowly decomposes above 40°C.

Freeze/Melting Point..... ~ -15°C (12% trade)

pH..... < 12

Water/Oil Distribution Coefficient.... Not available

Bulk Density..... Not available

% Volatiles by Volume..... Not available

Solubility in Water..... Complete

Molecular Formula..... NaOCl

Molecular Weight..... 74.44

Section 10 - Stability and Reactivity

Stability..... Unstable at temperatures above 40°C, in sunlight, and in contact with acid.

Incompatibility..... Incompatible with strong acids, ammonia, oxidizable materials, nickel, copper, tin, manganese, and iron.

Hazardous Products of Decomposition.. Chlorine (by reaction with acids), oxygen (by reaction with nickel, copper, tin, manganese, iron), sodium chloride, sodium chlorate, with increased temperature.

Polymerization..... Will not occur

Section 11 - Toxicological Information

Irritancy..... Strong irritant

Sensitization..... Not available

Chronic/Acute Effects..... If over-exposed to the solution, there will be constant irritation of the eyes, nose, and throat.

Synergistic Materials..... Not available

Animal Toxicity Data..... LD_{50}(oral,rat): 8910mg/kg (undiluted sodium hypochlorite)

Carcinogenicity..... Not considered to be carcinogenic (IARC and ACGIH).

Reproductive Toxicity..... Not available

Teratogenicity..... Not available

Mutagenicity..... Not available

Section 12 - Ecological Information

Fish Toxicity..... Not available

Biodegradability..... Not available

Environmental Effects..... Not available

Section 13 - Disposal Consideration

Waste Disposal..... Dispose in accordance with all federal, provincial, and/or local regulations including the Canadian Environmental Protection Act.

Section 14 - Transportation Information

TDG Classification

Class..... 8 (not regulated at solutions below 7%)

Group..... III (not regulated at solutions below 7%)

PIN Number..... UN 1791(not regulated at solutions below 7%)

Other..... Secure containers (full and/or empty) with suitable hold down devises during shipment.

Section 15 - Regulatory Information

WHMIS Classification.....E

NOTE: THE PRODUCT LISTED ON THIS MSDS HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CANADIAN CONTROLLED PRODUCTS REGULATIONS. THIS MSDS CONTAINS ALL INFORMATION REQUIRED BY THOSE REGULATIONS.

NSF Certification.....Product is certified under NSF/ANSI Standard 60 for disinfection and oxidation at a maximum dosage for the following:

sodium hypochlorite 5%: 200mg/L
sodium hypochlorite 6%: 175mg/L
sodium hypochlorite 7%: 161mg/L
sodium hypochlorite 8%: 146mg/L
sodium hypochlorite 9%: 131mg/L
sodium hypochlorite 10%: 116mg/L
sodium hypochlorite 11%: 101mg/L
sodium hypochlorite 12%: 87mg/L
sodium hypochlorite 13%: 82mg/L
sodium hypochlorite 14%: 76mg/L
sodium hypochlorite 15%: 70mg/L
sodium hypochlorite 16%: 66mg/L
sodium hypochlorite 17%: 62mg/L
sodium hypochlorite 18%: 58mg/L
sodium hypochlorite 19%: 54mg/L
sodium hypochlorite 20%: 50mg/L

Sanitizer Use: to obtain 10 liters of a 200 mg/L solution as available chlorine, use 16.7 mL of Hypochlor-12 for each 10 liters of clean, potable water.

Section 16 - Other Information

Note: The responsibility to provide a safe workplace remains with the user. The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment. The information contained herein is, to the best of our knowledge and belief, accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material. It is the responsibility of the user to comply with all applicable laws and regulations.

Attention: Receiver of the chemical goods / MSDS coordinator

As part of our commitment to the Canadian Association of Chemical Distributors (CACD) Responsible Distribution® initiative, ClearTech Industries Inc. and its associated companies require, as a condition of sale, that you forward the attached Material Safety Data Sheet(s) to all affected employees, customers, and end-users. ClearTech will send any available supplementary handling, health, and safety information to you at your request.

If you have any questions or concerns please call our customer service or technical service department.

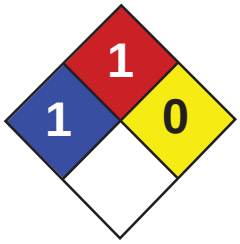
ClearTech Industries Inc. - Locations

Corporate Head Office: 2302 Hanselman Avenue, Saskatoon, SK, S7L 5Z3
Phone: 306-664-2522
Fax: 306-665-6216

www.ClearTech.ca

Location	Address	Postal Code	Phone Number	Fax Number
Richmond, B.C.	12431 Horseshoe Way	V7A 4X6	604-272-4000	604-272-4596
Calgary, AB.	5516E - 40th St. S.E.	T2C 2A1	403-279-1096	403-236-0989
Edmonton, AB.	11750 - 180th Street	T5S 1N7	780-452-6000	780-452-4600
Saskatoon, SK.	2302 Hanselman Avenue	S7L 5Z3	306-933-0177	306-933-3282
Regina, SK.	555 Henderson Drive	S42 5X2	306-721-7737	306-721-8611
Winnipeg, MB.	340 Saulteaux Crescent	R3J 3T2	204-987-9777	204-987-9770
Mississauga, ON.	7480 Bath Road	L4T 1L2	905-612-0566	905-612-0575

24 Hour Emergency Number - All Locations - 306-664-2522



Health	1
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Ethylenediaminetetraacetic Acid Tetrasodium Salt MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylenediaminetetraacetic Acid Tetrasodium Salt

Catalog Codes: SLE2284

CAS#: 10378-23-1

RTECS: AH5075000 (For CAS no. 64-02-8 known as EDTA Tetrasodium salt , anhydrous)

TSCA: TSCA 8(b) inventory: No products were found.

CI#: Not available.

Synonym: Versene, Kalex, Hampene, Dissolvine; EDTA tetrasodium salt dihydrate; Tetrasodium EDTA dihydrate; Tetrasodium salt EDTA dihydrate; Tetrasodium salt of EDTA, dihydrate; Tetrasodium salt of ethylenediaminetetraacetic acid, dihydrate; Sodium salt of ethylenediaminetetraacetic acid, dihydrate; Sodium ethylenediaminetetraacetate, dihydrate; Sodium ethylenediaminetetraacetic acid, dihydrate; Sodium EDTA, dihydrate; Edetate sodium dihydrate; Edetic acid tetrasodium salt, dihydrate; Endrate tetrasodium; Ethylenebis(iminodiacetic acid) tetrasodium salt, dihydrate; Ethylenediaminetetraacetic acid, tetrasodium salt, dihydrate ; Edathaniltetrasodium , dihydrate ; N , N'-Ethylenediaminediacetic acid tetrasodium salt.

Chemical Name: Acetic acid, (etrhylenedinitrilo)tetra-, tetrasodium salt, dihydrate

Chemical Formula: C10H12N2Na4O8.2H2O

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylenediaminetetraacetic acid tetrasodium salt	10378-23-1	100

Toxicological Data on Ingredients: Ethylenediaminetetraacetic acid tetrasodium salt: ORAL (LD50): Acute: >2000 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects: CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to upper respiratory tract, skin, eyes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Serious Skin Contact: Not available.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: CLOSED CUP: Higher than 93.3°C (200°F).

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO2), nitrogen oxides (NO, NO2...). Some metallic oxides.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances: Slightly explosive in presence of open flames and sparks. Non-explosive in presence of shocks.

Fire Fighting Media and Instructions: SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: As with most organic solids, fire is possible at elevated temperatures

Special Remarks on Explosion Hazards: Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill: Use a shovel to put the material into a convenient waste disposal container. Neutralize the residue with a dilute solution of acetic acid. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions: Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls: Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 416.23 g/mole

Color: White.

pH (1% soln/water): 11.3 [Basic.]

Boiling Point: Not available.

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: Bulk Density: 0.77 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, metals.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Avoid contact with aluminum, copper, copper alloys, zinc, and nickel, and strong oxidizers.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): >2000 mg/kg [Rat].

Chronic Effects on Humans: May cause damage to the following organs: upper respiratory tract, skin, eyes.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Acute Potential Health effects: Skin: May cause skin irritation. Eyes: May cause eye irritation. Inhalation: May cause irritation of the respiratory tract. Ingestion: May cause gastrointestinal tract irritation. The toxicological properties of this substance have not been fully investigated.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 760 mg/l 96 hours [Bull gill sunfish]. 59.8 mg/l 96 hours [Fathead Minnow].

BOD5 and COD: Not available.

Products of Biodegradation: Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: No products were found.

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC): This product is not classified according to the EU regulations. Not applicable.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment: Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:29 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

Material Safety Data Sheet
Sulfuric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sulfuric acid

Catalog Codes: SLS2539, SLS1741, SLS3166, SLS2371, SLS3793

CAS#: 7664-93-9

RTECS: WS5600000

TSCA: TSCA 8(b) inventory: Sulfuric acid

CI#: Not applicable.

Synonym: Oil of Vitriol; Sulfuric Acid

Chemical Name: Hydrogen sulfate

Chemical Formula: H2-SO4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sulfuric acid	7664-93-9	95 - 98

Toxicological Data on Ingredients: Sulfuric acid: ORAL (LD50): Acute: 2140 mg/kg [Rat.]. VAPOR (LC50): Acute: 510 mg/m 2 hours [Rat]. 320 mg/m 2 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, of inhalation. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA. Classified A2 (Suspected for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, lungs, heart, cardiovascular system, upper respiratory tract, eyes, teeth. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged

contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion:
Products of combustion are not available since material is non-flammable. However, products of decompostion include fumes of oxides of sulfur. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas. Reacts with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

Fire Hazards in Presence of Various Substances: Combustible materials

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Metal acetylides (Monocesium and Monorubidium), and carbides ignite with concentrated sulfuric acid. White Phosphorous + boiling Sulfuric acid or its vapor ignites on contact. May ignite other combustible materials. May cause fire when sulfuric acid is mixed with Cyclopentadiene, cyclopentanone oxime, nitroaryl amines, hexalithium disilicide, phorphorous (III) oxide, and oxidizing agents such as chlorates, halogens, permanganates.

Special Remarks on Explosion Hazards:
Mixturesofsulfuricacidandanyofthefollowingcanexplode: p-nitrotoluene, pentasilver trihydroxydiaminophosphate, perchlorates, alcohols with strong hydrogen peroxide, ammonium tetraperoxychromate, mercuric nitrite, potassium chlorate, potassium permanganate with potassium chloride, carbides, nitro compounds, nitrates, carbides, phosphorous, iodides, picratres, fulminats, dienes, alcohols (when heated) Nitramide decomposes explosively on contact with concentrated sulfuric acid. 1,3,5-Trinitrosohexahydro-1,3,5-triazine + sulfuric acid causes explosive decompositon.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage:
Hygroscopic. Reacts. violently with water. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 23°C (73.4°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 STEL: 3 (mg/m3) [Australia] Inhalation TWA: 1 (mg/m3) from OSHA (PEL) [United States] Inhalation TWA: 1 STEL: 3 (mg/m3) from ACGIH (TLV) [United States] [1999] Inhalation TWA: 1 (mg/m3) from NIOSH [United States] Inhalation TWA: 1 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Thick oily liquid.)

Odor: Odorless, but has a choking odor when hot.

Taste: Marked acid taste. (Strong.)

Molecular Weight: 98.08 g/mole

Color: Colorless.

pH (1% soln/water): Acidic.

Boiling Point:
270°C (518°F) - 340 deg. C Decomposes at 340 deg. C

Melting Point: -35°C (-31°F) to 10.36 deg. C (93% to 100% purity)

Critical Temperature: Not available.

Specific Gravity: 1.84 (Water = 1)

Vapor Pressure: Not available.

Vapor Density: 3.4 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:
Easily soluble in cold water. Sulfuric is soluble in water with liberation of much heat. Soluble in ethyl alcohol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability:
Conditions to Avoid: Incompatible materials, excess heat, combustible material materials, organic materials, exposure to moist air or water, oxidizers, amines, bases. Always add the acid to water, never the reverse.

Incompatibility with various substances:
Reactive with oxidizing agents, reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(316). Highly corrosive in presence of stainless steel(304). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Hygroscopic. Strong oxidizer. Reacts violently with water and alcohol especially when water is added to the product. Incompatible (can react explosively or dangerously) with the following: ACETIC ACID, ACRYLIC ACID, AMMONIUM HYDROXIDE, CRESOL, CUMENE, DICHLOROETHYL ETHER, ETHYLENE CYANOHYDRIN, ETHYLENEIMINE, NITRIC ACID, 2-NITROPROPANE, PROPYLENE OXIDE, SULFOLANE, VINYLIDENE CHLORIDE, DIETHYLENE GLYCOL MONOMETHYL ETHER, ETHYL ACETATE, ETHYLENE CYANOHYDRIN, ETHYLENE GLYCOL MONOETHYL ETHER ACETATE, GLYOXAL, METHYL ETHYL KETONE, dehydrating agents, organic materials, moisture (water), Acetic anhydride, Acetone, cyanohydrin, Acetone+nitric acid, Acetone + potassium dichromate, Acetonitrile, Acrolein, Acrylonitrile, Acrylonitrile +water, Alcohols + hydrogen peroxide, ally compounds such as Allyl alcohol, and Allyl Chloride, 2-Aminoethanol, Ammonium hydroxide, Ammonium triperchromate, Aniline, Bromate + metals, Bromine pentafluoride, n-Butyraldehyde, Carbides, Cesium acetylene carbide, Chlorates, Cyclopentanone oxime, chlorinates, Chlorates + metals, Chlorine trifluoride, Chlorosulfonic acid, 2-cyano-4-nitrobenzenediazonium hydrogen sulfate, Cuprous nitride, p-chloronitrobenzene, 1,5-Dinitronaphthlene +

sulfur, Diisobutylene, p-dimethylaminobenzaldehyde, 1,3-Diazidobenzene, Dimethylbenzylcarbinol + hydrogen peroxide, Epichlorohydrin, Ethyl alcohol + hydrogen peroxide, Ethylene diamine, Ethylene glycol and other glycols, , Ethylenimine, Fulminates, hydrogen peroxide, Hydrochloric acid, Hydrofluoric acid, Iodine heptafluoride, Indane + nitric acid, Iron, Isoprene, Lithium silicide, Mercuric nitride, Mesityl oxide, Mercury nitride, Metals (powdered), Nitromethane, Nitric acid + glycerides, p-Nitrotoluene, Pentasilver trihydroxydiaminophosphate, Perchlorates, Perchloric acid, Permanganates + benzene, 1-Phenyl-2-methylpropyl alcohol + hydrogen peroxide, Phosphorus, Phosphorus isocyanate, Picrates, Potassium tert-butoxide, Potassium chlorate, Potassium Permanganate and other permanganates, halogens, amines, Potassium Permanganate + Potassium chloride, Potassium Permanganate + water, Propiolactone (beta)-, Pyridine, Rubidium aceteylene carbide, Silver permanganate, Sodium, Sodium carbonate, sodium hydroxide, Steel, styrene monomer, toluene + nitric acid, Vinyl acetate, Thalium (I) azidodithiocarbonate, Zinc chlorate, Zinc Iodide, azides, carbonates, cyanides, sulfides, sulfites, alkali hydrides, carboxylic acid anhydrides, nitriles, olefinic organics, aqueous acids, cyclopentadiene, cyano-alcohols, metal acetylides, Hydrogen gas is generated by the action of the acid on most metals (i.e. lead, copper, tin, zinc, aluminum, etc.). Concentrated sulfuric acid oxidizes, dehydrates, or sulfonates most organic compounds.

Special Remarks on Corrosivity:
Non-corrosive to lead and mild steel, but dillute acid attacks most metals. Attacks many metals releasing hydrogen. Minor corrosive effect on bronze. No corrosion data on brass or zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2140 mg/kg [Rat.]. Acute toxicity of the vapor (LC50): 320 mg/m3 2 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA. Classified A2 (Suspected for human.) by ACGIH. May cause damage to the following organs: kidneys, lungs, heart, cardiovascular system, upper respiratory tract, eyes, teeth.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
Mutagenicity: Cytogenetic Analysis: Hamster, ovary = 4mmol/L Reproductive effects: May cause adverse reproductive effects based on animal data. Developmental abnormalities (musculoskeletal) in rabbits at a dose of 20 mg/m3 for 7 hrs.(RTECS) Teratogenecity: neither embryotoxic, fetoxic, nor teratogenetic in mice or rabbits at inhaled doses producing some maternal toxicity

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes severe skin irritation and burns. Continued contact can cause tissue necrosis. Eye: Causes severe eye irritation and burns. May cause irreversible eye injury. Ingestion: Harmful if swallowed. May cause permanent damage to the digestive tract. Causes gastrointestial tract burns. May cause perforation of the stomach, GI bleeding, edema of the glottis, necrosis and scarring, and sudden circulatory collapse(similar to acute inhalation). It may also cause systemic toxicity with acidosis. Inhalation: May cause severe irritation of the respiratory tract and mucous membranes with sore throat, coughing, shortness of breath, and delayed lung edema. Causes chemical burns to the repiratory tract. Inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Cause corrosive action on mucous membranes. May affect cardiovascular system (hypotension, depressed cardiac output, bradycardia). Circulatory collapse with clammy skin, weak and rapid pulse, shallow respiration, and scanty urine may follow. Circulatory shock is often the immediate cause of death. May also affect teeth(changes in teeth and supporting structures - erosion, discoloration). Chronic Potential Health Effects: Inhalation: Prolonged or repeated inhalation may affect behavior (muscle contraction or spasticity), urinary system (kidney damage), and cardiovascular system, heart (ischemic heart leisons), and respiratory system/lungs(pulmonary edema, lung damage), teeth (dental discoloration, erosion). Skin: Prolonged or repeated skin contact may cause dermatitis, an allergic skin reaction.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 49 mg/l 48 hours [bluegill/sunfish].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Sulfuric acid may be placed in sealed container or absorbed in vermiculite, dry sand, earth, or a similar material. It may also be diluted and neutralized. Be sure to consult with local or regional authorities (waste regulators) prior to any disposal. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Sulfuric acid UNNA: 1830 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Illinois toxic substances disclosure to employee act: Sulfuric acid New York release reporting list: Sulfuric acid Rhode Island RTK hazardous substances: Sulfuric acid Pennsylvania RTK: Sulfuric acid Minnesota: Sulfuric acid Massachusetts RTK: Sulfuric acid New Jersey: Sulfuric acid California Director's List of Hazardous Substances (8 CCR 339): Sulfuric acid Tennessee RTK: Sulfuric acid TSCA 8(b) inventory: Sulfuric acid SARA 302/304/311/312 extremely hazardous substances: Sulfuric acid SARA 313 toxic chemical notification and release reporting: Sulfuric acid CERCLA: Hazardous substances.: Sulfuric acid: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R35- Causes severe burns. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S30- Never add water to this product. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 2

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:
-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.

Other Special Considerations: Not available.

Created: 10/09/2005 11:58 PM

Last Updated: 06/09/2012 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

Material Safety Data Sheet

LUMINOL ™ TR (Type I Trace-Inhibited)

1 . Product and company identification

Product name : LUMINOL ™ TR (Type I Trace-Inhibited)

Code : LUMTR

Material uses : Premium trace-inhibited (Type I) insulating oil for use in electrical transformers, circuit breakers and switches.

Manufacturer : Petro-Canada Lubricants Inc.
2310 Lakeshore Road West
Mississauga, Ontario
Canada L5J 1K2

In case of emergency : Suncor Energy: 403-296-3000
Canutec Transportation: 613-996-6666
Poison Control Centre: Consult local telephone directory for emergency number(s).

2 . Hazards identification

Physical state : Viscous liquid.

Odour : Slight naphthalene like odour.

WHMIS (Canada) : Not controlled under WHMIS (Canada).

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Emergency overview : No specific hazard.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Inhalation : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Skin : Slightly irritating to the skin.

Eyes : Slightly irritating to the eyes.

Potential chronic health effects

Chronic effects : No known significant effects or critical hazards.

Carcinogenicity : Not listed as carcinogenic by OSHA, NTP or IARC.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Medical conditions aggravated by over-exposure : Repeated or prolonged contact with spray or mist may produce chronic eye irritation and severe skin irritation. Repeated skin exposure can produce local skin destruction or dermatitis.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Mixture of severely hydrotreated and hydrocracked base oil (petroleum).	Mixture	-

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

The base oil may be a mixture of the following CAS#s: 8042-47-5, 64742-46-7, 64742-47-8, 64742-53-6, 64742-54-7, 64742-55-8, 72623-84-8, 72623-85-9, 72623-86-0, 72623-87-1, 178603-64-0, 178603-65-1, 178603-66-2, 445411-73-4

4 . First-aid measures

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognised skin cleanser. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Notes to physician : No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5 . Fire-fighting measures

Flammability of the product : May be combustible at high temperature.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Products of combustion : Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), hydrocarbons, smoke and irritating vapours as products of incomplete combustion.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Special remarks on fire hazards : Low fire hazard. This material must be heated before ignition will occur.

Special remarks on explosion hazards : Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Petro-Canada is a Suncor Energy business *™ Trademark of Suncor Energy Inc. Used under licence.*

6 . Accidental release measures

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Ingredient	Exposure limits
Mixture of severely hydrotreated and hydrocracked base oil (petroleum).	**ACGIH TLV (United States). Notes: (Mineral oil)** TWA: 5 mg/m³, (Inhalable fraction) 8 hour(s).

Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants. If this product contains ingredients with exposure limits, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protection

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Recommended: organic vapour filter

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Recommended: nitrile, neoprene, polyvinyl alcohol (PVA), Viton®.

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Petro-Canada is a Suncor Energy business *™ Trademark of Suncor Energy Inc. Used under licence.*

8 . Exposure controls/personal protection

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9 . Physical and chemical properties

Physical state : Viscous liquid.

Flash point : Open cup: 170°C (338°F) [Cleveland.]

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Colour : Clear and bright

Odour : Slight naphthalene like odour.

Odour threshold : Not available.

pH : Not available.

Boiling/condensation point : Not available.

Melting/freezing point : Not available.

Relative density : 0.84 kg/L @ 15°C (59°F)

Vapour pressure : Not available.

Vapour density : Not available.

Volatility : Not available.

Evaporation rate : Not available.

Viscosity : 9.4 cSt @ 40°C (104°F), 2.6 cSt @ 100°C (212°F)

Pour point : -60°C (-76°F)

Solubility : Insoluble in water.

10 . Stability and reactivity

Chemical stability : The product is stable.

Hazardous polymerisation : Under normal conditions of storage and use, hazardous polymerisation will not occur.

Materials to avoid : Reactive with oxidising agents and acids.

Hazardous decomposition products : May release COx, NOx, SOx, hydrocarbons, smoke and irritating vapours when heated to decomposition.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Mixture of severely hydrotreated and hydrocracked base oil (petroleum).	LD50 Dermal	Rabbit	>2000 mg/kg	-
	LD50 Oral	Rat	>5000 mg/kg	-
	LC50 Inhalation Dusts and mists	Rat	>5.2 mg/l	4 hours

Conclusion/Summary : Not available.

Chronic toxicity

Conclusion/Summary : Not available.

Irritation/Corrosion

Conclusion/Summary : Not available.

Sensitiser

Petro-Canada is a Suncor Energy business *™ Trademark of Suncor Energy Inc. Used under licence.*

11 . Toxicological information

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Not available.

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Mixture of severely hydrotreated and hydrocracked base oil (petroleum).	A4	-	-	-	-	-

Mutagenicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Conclusion/Summary : Not available.

12 . Ecological information

Environmental effects : This product is inherently biodegradable.

Aquatic ecotoxicity

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

Other adverse effects : No known significant effects or critical hazards.

13 . Disposal considerations

Waste disposal : The generation of waste should be avoided or minimised wherever possible. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
TDG Classification	Not regulated.	-	-	-		-
DOT Classification	Not available.	Not available.	Not available.	-		-

PG* : Packing group

15 . Regulatory information

United States

HCS Classification : Not regulated.

Canada

WHMIS (Canada) : Not controlled under WHMIS (Canada).

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

International regulations

Canada inventory : All components are listed or exempted.

United States inventory (TSCA 8b) : All components are listed or exempted.

Europe inventory : All components are listed or exempted.

16 . Other information

Hazardous Material Information System (U.S.A.) :

Health	1
Flammability	1
Physical hazards	0
Personal protection	B

National Fire Protection Association (U.S.A.) :

References : Available upon request.
™ Trademark of Suncor Energy Inc. Used under licence.

Date of printing : **2/8/2012.**

Date of issue : 8 February 2012

Date of previous issue : No previous validation.

Responsible name : **Product Safety - JDW**

Indicates information that has changed from previously issued version.

For Copy of (M)SDS : The Canadian Controlled Products Regulations (CPR) (Under the Hazardous Products Act, part of the WHMIS legislation) only apply to WHMIS Controlled (i.e., hazardous) products. Therefore, the CPR and the 3-year update rule specified therein do not apply to WHMIS Non-Controlled products. Although this is true, customarily Petro-Canada reviews and updates Non-Controlled product MSDS if a customer requests such an update. These Non-Controlled product updates are given a lower priority than Controlled products but are handled as soon as practicable. If you would like to verify if the MSDS you have is the most current, or you require any further information, please contact:

Internet: lubricants.petro-canada.ca/msds

Lubricants:
Western Canada, telephone: 1-800-661-1199; fax: 1-800-378-4518
Ontario & Central Canada, telephone: 1-800-268-5850; fax: 1-800-201-6285
Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 1-800-201-6285

For Product Safety Information: (905) 804-4752

Notice to reader

16 . Other information

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Petro-Canada is a Suncor Energy business *™ Trademark of Suncor Energy Inc. Used under licence.*

Material Safety Data Sheet

Preparation Date: 31-Jul-2006 **Revision Date:** 24-Aug-2009 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name:	**Fortan™ Advantage, Fortis™ Advantage & Fortis™ Advantage ANE (USA)**
Product Code:	2310
Alternate Name(s):	Apex™ Clear
UN-No:	UN3139
Recommended Use:	Can be sensitized to become a booster sensitive emulsion explosive.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
May cause skin irritation and/or dermatitis. Irritating to eyes. Harmful if swallowed. Oxidizing agent. May cause methemoglobinemia. May cause liver damage. May cause kidney damage.

Appearance:	**Physical State:**	**Odor:**
Opaque, viscous liquid	Viscous, liquid	Vinegar

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Ammonium Nitrate	6484-52-2	60-75
Mineral Oil	64742-53-6	1-6
Diesel Fuel Oil	68476-34-6	1-6

SECTION 4 – FIRST AID MEASURES

General Advice:	In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible).
Eye Contact:	Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.
Skin Contact:	Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.
Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Ingestion:	Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.
Notes to physician:	Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Not itself combustible but assists fire in burning materials. The product does not flash. Rate of burning: attempts to smother a fire involving this product will be ineffective as it is its own oxygen source.

Suitable extinguishing media: Use Water only, in as much volume as possible to cool the burning mass quickly. Chemical extinguishers will not work. Fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: Chemical extinguishers will not work. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could lead to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: Toxic gases and vapours will be released by the thermal decomposition of this material. At higher temperatures, decomposition may be explosive, especially if confined. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Contain or absorb leaking liquid with sand or earth or other suitable substance.

Methods for cleaning up: Avoid the use of metal tools containing iron and/or copper. Be careful to avoid shock, friction, and contact with grit. Collect product for recovery or disposal. For release to land, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Collect contaminated soil and water, and absorbent for proper disposal. Notify applicable government authority if release is reportable or could adversely affect the environment.

Other information: Deactivating chemicals: Detergents will break up emulsions if mixed in.

SECTION 7 – HANDLING AND STORAGE

Handling: Avoid contact with eyes or skin. Wash thoroughly with soap and water after handling. Wash clothing before re-use. Locate safety shower and eyewash station closest to chemical handling area. The use of coveralls is recommended. Use good industrial hygiene and housekeeping practices. Keep away from open flames, hot surfaces and sources of ignition

Storage: Store in a cool, well-ventilated area. Keep away from heat, sparks, and flames. Keep storage containers closed. Store at 10-27°C (50-80°F). Do not expose closed containers to temperatures above 40°C (104°F). Product is mildly corrosive to concrete and steel. Stainless steel and aluminium are adequate. Avoid materials made of copper, iron, or bronze.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Mineral oil	5 mg/m³	5 mg/ m³	
Diesel Fuel	TWA: 100 mg/m³ Skin		

Other exposure guidelines: Ammonium Nitrate: ORICA Guideline 5 mg/m^3 (internal TWA)

Engineering Measures: No information available.

Personal Protective Equipment

Eye/Face Protection: Tightly fitting safety goggles.

Skin Protection: User should verify impermeability under normal conditions of use prior to general use. Impervious butyl rubber gloves.

Respiratory Protection: In case of insufficient ventilation wear suitable respiratory equipment. A NIOSH-approved respirator, if required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice. Recommendations listed in this section indicate the type of equipment, which will provide protection against over

exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Opaque, viscous liquid	**Odor:**	Vinegar
Physical State:	Viscous, liquid	**Viscosity:**	No information available
pH:	3 - 6	**Flash Point:**	Not applicable
Autoignition Temperature:	230-265°C/ 446-509°F	**Boiling Point/Range:**	None
Melting Point/Range:	Not available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	1.20 – 1.35 g/cc	**Water Solubility:**	Slightly soluble
Other Solubility:	Slightly soluble in standard organic solvents.	**Vapor Pressure:**	0 mmHg @ 20°C
Oxidizing Properties:	Oxidizer	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Decomposition Temperature: Ammonium Nitrate will spontaneously decompose at 210°C (410°F).

Conditions to avoid: Keep away from open flames, hot surfaces and sources of ignition. Not expected to be sensitive to static discharge. Not expected to be sensitive to mechanical impact.

Incompatible materials: Avoid oxidizable materials, metal powder, bronze & copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorate, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles. Strong oxidizing and reducing agents.

Hazardous decomposition products: The following toxic decomposition products may be released. At temperatures above 210°C (410°F), decomposition may be explosive, especially if confined. Nitrogen oxides (NOx). Carbon oxide. Hydrocarbons.

Hazardous Polymerization: None under normal processing. Hazardous polymerization does not occur. Explosive material under shock conditions.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ammonium Nitrate	2217 mg/kg Rat	3000 mg/kg Rabbit	88.8 mg/L Rat 4 h
Mineral Oil	4300 mg/kg Rat		
Diesel Fuel	>5000 mg/kg (rabbit)		

Subchronic Toxicity (28 Days): Ammonium Nitrate: Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy lips, tongue and mucous membranes, with skin color being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly shock.

Chronic Toxicity: May cause methemoglobinemia.

Carcinogenicity: The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical name	ACGIH	IARC	NTP	OSHA
Diesel Fuel	A3			

Legend: A3: Confirmed as an animal carcinogen.

Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.

Reproductive effects: No information is available and no adverse reproductive effects are anticipated.

Developmental effects: No information is available and no adverse developmental effects are anticipated.

Target Organ: Eyes, skin, respiratory system, blood, liver, urinary tract, gastrointestinal tract (GI), endocrine system, & immune system.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Persistence/Degradability: Some water resistance but soluble with extended time periods.

Mobility in Environmental media: Dissolves slowly in water.

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name: Oxidizing substance, liquid, N.O.S. (Ammonium Nitrate)
Hazard Class: 5.1
UN-No: UN3139
Packing group: II

Transportation Emergency Telephone Number: 1-877-561-3636 or CHEMTREC: 1-800-424-9300

SECTION 15 – REGULATORY INFORMATION

USA CLASSIFICATION:
SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements, Ammonium Nitrate (6484-52-2).
SARA 311/312 Hazardous Categorization
Acute Heath Hazard: Yes
Chronic Health Hazard: Yes
Fire Hazard: Yes
Reactive Hazard: No
Sudden Release of Pressure Hazard: Yes
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents
Other Regulations/Legislations which apply to this product: New Jersey Right-to-Know, Pennsylvania Right-to-Know, Massachusetts Right-to-Know, Rhode Island Right-to-Know, Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, California Proposition 65.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

The components in the product are on the following international inventory lists:

Chemical Name	TSCA	DSL	NDSL	ENCS	EINECS	ELINCS	CHINA	KECL	PICCS	AICS
Ammonium Nitrate	X	X	-	X	X	-	X	X	X	X
Mineral Oil	X	X	-	-	X	-	X	X	X	X
Diesel Fuel	X	X	-	-	X	-	X	X	X	X

Legend: X – Listed

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 31-Jul-2006
Revision Date: 24-Aug-2009

The information contained herein is offered only as guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Safety Data Sheet

The Armor All/STP Products Company
44 Old Ridgebury Road
Suite 300
Danbury, CT 06810
Tel. 1-203-205-2900

1. Product And Company Identification

Product Name: ARMOR ALL® Original Protectant

Responsible Party: The Armor All/STP Products Company
44 Old Ridgebury Road
Suite 300
Danbury, CT 06810

Information Phone Number: +1 203-205-2900
Emergency Phone Number:
For Medical Emergencies, call 1-866-949-6465 / +1 303-389-1332 (Outside US and Canada)
For Transportation Emergencies, call 1-800-424-9300 (Chemtrec) +1-703-527-3887 for Outside US and Canada (call collect)
SDS Date Of Preparation: 01/31/2015
Product Use and Uses Advised Against: Automotive maintenance product – For consumer and professional use

2. Hazards Identification

Note: This product is a consumer product and is labeled in accordance with the Consumer Product Safety Commission regulations and not OSHA regulations. The requirements for the labeling of consumer products take precedence over OSHA labeling so the actual product label will differ from the OSHA information shown below.

GHS Classification:

Physical:	**Health:**
Not Hazardous	Not Hazardous

GHS Label Elements: None

Hazards not otherwise specified: None

Percentage of unknown toxicity: N/a

3. Composition/Information On Ingredients

Component	**CAS No.**	**Amount**
Non-Hazardous Ingredients	Mixture	95> - 100%
Mineral Oil	8042-47-5	< 5%

The specific identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

4. First Aid Measures

Inhalation: If symptoms of exposure develop, remove to fresh air. Seek medical attention if symptoms persist.

Skin Contact: Rinse skin with plenty of water. If skin irritation or redness develops, seek medical attention.

Eye Contact: Flush eyes with plenty of water. If irritation or other symptoms persist, seek medical attention.

Ingestion: Do not induce vomiting unless directed to by doctor or physician. If the victim is fully conscious, have them drink a glass of water. Get medical assistance by calling a doctor or poison center. Never give anything by mouth to a person who is unconscious or drowsy.

Most Important Symptoms: Direct eye contact may cause mild irritation.

Indication of Immediate Medical Attention/Special Treatment: Immediate medical attention should not be required.

5. Firefighting Measures

Suitable (and Unsuitable) Extinguishing Media: Use dry chemical, carbon dioxide, foam, or water spray.

Specific Hazards Arising from the Chemical: Closed containers may rupture if exposed to extreme heat. Thermal decomposition will generate oxides of carbon and silicon and formaldehyde.

Special Protective Equipment and Precautions for Fire-fighters: Firefighters should wear positive pressure self-contained breathing apparatus and full protective clothing for fires in areas where chemicals are used or stored.

6: Accidental Release Measures

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate protective equipment.

Environmental Precautions: Prevent entry in storm sewers and waterways. Report spill as required by local and national regulations.

Methods for Containment and Clean-Up: Absorb with an inert material. Collect into a suitable container for disposal. Rinse area with water.

7. Handling and Storage

Precautions for Safe Handling: Avoid contact with eyes. Avoid prolonged contact with skin and clothing. Wash hands after use. Keep out of the reach of children.

Conditions for Safe Storage, Including any Incompatibilities: No special storage required.

8. Exposure Controls / Personal Protection

Exposure Guidelines:

CHEMICAL	EXPOSURE LIMIT
Non-Hazardous Ingredients	None Established
Mineral Oil	5.0 mg/m3 inhalable TWA ACGIH TLV 5.0 mg/m3 TWA OSHA PEL

Engineering Controls: General ventilation should be adequate for all normal use.

Personal Protective Equipment

Respiratory Protection: None required under normal use conditions.

Gloves: None required under normal use conditions.

Eye Protection: None required for normal use. Avoid eye contact.

Other Protective Equipment/Clothing: None required under normal use conditions.

9. Physical and Chemical Properties

Appearance and Odor: Opaque, white viscous liquid with a slight odor.

Physical State: Liquid	**Odor Threshold:** Not available
pH: 7.5 - 9.0	**Specific Gravity:** ~1
Initial Boiling Point/Range: Not determined	**Vapor Pressure:** Not determined
Melting/Freezing Point: Not determined	**Vapor Density:** Not determined
Solubility In Water: Easily soluble	**Percent Volatile:** >80%
Viscosity: ~ 3,000 cP	**Evaporation Rate:** Not determined
Coefficient Of Water/Oil Distribution: Not determined	**VOC Content:** Not determined
Flash Point: >212°F (>100°C)	**Autoignition Temp:** Not determined
Decomposition Temperature: Not determined	**Flammability Limits:** LEL: Not determined UEL: Not determined
Flammability (solid, gas): Not applicable	

10. Stability and Reactivity

Reactivity: Not normally reactive
Chemical Stability: Stable.
Possibility of Hazardous Reactions: None known
Conditions To Avoid: None known
Incompatible Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Thermal decomposition will generate oxides of carbon, silicon dioxide, and formaldehyde.

11. Toxicological Information

POTENTIAL HEALTH EFFECTS:

Acute Hazards:

Inhalation: No adverse effects expected from the normal use of this product.

Skin Contact: No adverse effects expected from the normal use of this product.

Eye Contact: Direct contact may cause slight eye irritation.

Ingestion: Swallowing may cause gastrointestinal disturbances.

Chronic Hazards: None currently known.

Carcinogenicity Listing: None of the components is listed as a carcinogen or potential carcinogen by IARC, NTP, ACGIH or OSHA.

Acute Toxicity Values:

No data available for product.
Mineral Oil: LD50 Rat oral > 5,000 mg/kg
LD50 Rabbit dermal > 2,000 mg/ kg
LC50 Rat inhalation > 5,000 mg/L/4 hr.

12. Ecological Information

Ecotoxicity:
No ecotoxicity data is currently available for product.
Mineral Oil: NOEL Oncorhynchus mykiss >= 100 mg/L/96 hr.
NOEL Daphnia magna>= 100 mg/L/96 hr.

Persistence and Degradability: No data available

Bio accumulative Potential: No data available

Mobility in Soil: No data available

Other Adverse Effects: No data available

13. Disposal Considerations

Dispose of in accordance with all local, state/provincial and federal regulations. Offer empty containers for recycling.

14. Transport Information

DOT Hazardous Materials Description: Not Regulated

Canadian TDG Hazardous Materials Description: Not Regulated

IMDG Dangerous Goods Description: Not Regulated

15. Regulatory Information

United States:

EPA TSCA INVENTORY: All of the components of this material are listed on the Toxic Substances Control Act (TSCA) Chemical Substances Inventory.

The Armor All/STP Products Company
44 Old Ridgebury Road
Suite 300
Danbury, CT 06810
Tel. 1-203-205-2900

CERCLA Section 103: This product has no RQ, however, oil spills must be reported to the National Response Center. Many states have more stringent release reporting requirements. Report spills required under federal, state and local regulations.

SARA Hazard Category (311/312): Not hazardous

SARA 313: This product contains the following chemicals subject to Annual Release Reporting Requirements Under SARA Title III, Section 313 (40 CFR 372): None

Canada:

Canadian WHMIS Classification: Not a controlled product.

Canadian Environmental Protection Act: All of the ingredients are listed on the Canadian DSL.

This SDS has been prepared according to the criteria of the Controlled Products Regulation (CPR) and the SDS contains all of the information required by the CPR.

16. Other Information

NFPA Rating (NFPA 704):	Health: 0	Fire: 0	Instability: 0
HMIS Rating:	Health: 0	Fire: 0	Physical Hazard: 0

REVISION SUMMARY: January 31, 2015 Update to GHS SDS format and name change: Changes to all sections.

DATA SUPPLIED IS FOR USE ONLY IN CONNECTION WITH OCCUPATIONAL SAFETY AND HEALTH

SAFETY DATA SHEET

PETRO-CANADA ATF D3M

000003001076

Version 5.1 Revision Date 2017/01/27 Print Date 2017/02/03

SECTION 1. IDENTIFICATION

Product name	:	PETRO-CANADA ATF D3M
Synonyms	:	RDL 2746
Product code	:	ATFD3MP5R, ATFD3MP20, ATFD3MICT, ATFD3MIBC, ATFD3MDRR, ATFD3MDRM, ATFD3MDCT, ATFD3MC12, ATFD3M, ATFD3MBLK
Manufacturer or supplier's details		Petro-Canada Lubricants Inc. 2310 Lakeshore Road West Mississauga ON L5J 1K2 Canada
Emergency telephone number		Petro-Canada Lubricants Inc.: +1 905-403-5770; CHEMTREC Transport Emergency: 1-800-424-9300; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Automatic transmission fluid for most North American automobiles and for off-highway torque converters requiring C-4 type transmission fluid. It is also suitable as a hydraulic fluid and as a top-up in power steering systems. Not to be used in conditions where aerosols could be generated.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	viscous liquid
Colour	dark red
Odour	Mild petroleum oil like.

GHS Classification

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion

TM Owned or used under license by Petro-Canada Lubricants Inc.

Inhalation
Skin contact

Aggravated Medical Condition : None known.

Other hazards

None known.

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	72623-87-1	30 - 50 %
lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	40 - 60 %
Methacrylate copolymers		1 - 3 %

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.

™ Owned or used under license by Petro-Canada Lubricants Inc.

DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Never give anything by mouth to an unconscious person.
Seek medical advice.

Most important symptoms and effects, both acute and delayed : First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media : No information available.

Specific hazards during firefighting : Cool closed containers exposed to fire with water spray.

Hazardous combustion products : Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), phosphorus oxides (POx), hydrocarbons, smoke and irritating vapours as products of incomplete combustion.

Further information : Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Use personal protective equipment.
Ensure adequate ventilation.
Evacuate personnel to safe areas.
Material can create slippery conditions.

Environmental precautions : Do not allow uncontrolled discharge of product into the environment.

Methods and materials for containment and cleaning up : Prevent further leakage or spillage if safe to do so.
Remove all sources of ignition.
Soak up with inert absorbent material.
Non-sparking tools should be used.
Ensure adequate ventilation.
Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling : For personal protection see section 8.
Smoking, eating and drinking should be prohibited in the application area.

™ Owned or used under license by Petro-Canada Lubricants Inc.

Use only with adequate ventilation.
In case of insufficient ventilation, wear suitable respiratory equipment.
Avoid contact with skin, eyes and clothing.
Do not ingest.
Keep away from heat and sources of ignition.
Keep container closed when not in use.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	72623-87-1	TWA (Mist)	5 mg/m3	CA AB OEL
		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhalable fraction)	5 mg/m3	ACGIH
lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	TWA (Mist)	5 mg/m3	CA AB OEL
		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhalable fraction)	5 mg/m3	ACGIH

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

™ Owned or used under license by Petro-Canada Lubricants Inc.

Filter type	:	organic vapour filter
Hand protection		
Material	:	neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R).
Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield and protective suit for abnormal processing problems.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	viscous liquid
Colour	:	dark red
Odour	:	Mild petroleum oil like.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	-51 °C (-60 °F)
Boiling point/boiling range	:	No data available
Flash point	:	185 °C (365 °F) Method: Cleveland open cup
Fire Point	:	205 °C (401 °F)
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available
Flammability	:	Low fire hazard. This material must be heated before ignition will occur.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available

™ Owned or used under license by Petro-Canada Lubricants Inc.

Vapour pressure	:	No data available
Relative vapour density	:	No data available
Density	:	0.855 kg/l (15 °C / 59 °F)
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	34.26 cSt (40 °C / 104 °F)
		7.7 cSt (100 °C / 212 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	No data available
Incompatible materials	:	Reactive with oxidising agents, reducing agents and acids.
Hazardous decomposition products	:	May release COx, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Ingestion
Inhalation
Skin contact

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Assessment: The substance or mixture has no acute dermal toxicity

TM Owned or used under license by Petro-Canada Lubricants Inc.

Components:

lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

™ Owned or used under license by Petro-Canada Lubricants Inc.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish : Remarks: No data available

Toxicity to daphnia and other aquatic invertebrates : Remarks: No data available

Toxicity to algae : Remarks: No data available

Toxicity to bacteria : Remarks: No data available

Persistence and degradability

Product:

Biodegradability : Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : The product should not be allowed to enter drains, water courses or the soil.
Offer surplus and non-recyclable solutions to a licensed disposal company.
Waste must be classified and labelled prior to recycling or disposal.
Send to a licensed waste management company.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

Not regulated as a dangerous good

IMDG-Code

™ Owned or used under license by Petro-Canada Lubricants Inc.

Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

National Regulations

TDG

Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

The components of this product are reported in the following inventories:

DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
IECSC	On the inventory, or in compliance with the inventory
EINECS	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

For Copy of SDS : Internet: lubricants.petro-canada.com/sds
Western Canada, telephone: 1-800-661-1199; fax: 1-800-378-4518
Ontario & Central Canada, telephone: 1-800-268-5850; fax: 1-800-201-6285
Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 1-800-201-6285
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

Revision Date : 2017/01/27

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

™ Owned or used under license by Petro-Canada Lubricants Inc.

Brake Fluid DOT 3

SECTION 1. IDENTIFICATION

Product Identifier	Brake Fluid DOT 3
Other Means of Identification	15-810, 15-811, 15-813, 15-814, 15-818, 35-810AS, 35-810CQ, 35-810PC, 35-810PRES, 35-811AS, 35-811CQ, 35-811PRES, 35-811SO, 35-811WM, 35-813AS, 35-813CQ, 35-813SO, 35-813WM, 35-814AS, 35-814CQ, 35-814PRES, 35-814SO, 35-816C, 35-818AS, 35-818CQ, 85-818
Recommended Use	Please refer to Product label.
Restrictions on Use	None known.
Manufacturer / Supplier	Recochem Inc., 850 Montee de Liesse, Montreal, QC, H4T 1P4, Compliance and Regulatory Department, 905-878-5544, www.recochem.com
Emergency Phone No.	CANUTEC, 613-996-6666, 24 Hours
SDS No.	1515
Date of Preparation	August 11, 2015

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Acute toxicity (Oral) - Category 4; Acute toxicity (Dermal) - Category 4; Serious eye damage/eye irritation - Category 2A; Reproductive Toxicity - Category 2

GHS Label Elements

Signal Word:
Warning

Hazard Statement(s):

H302	Harmful if swallowed.
H312	Harmful in contact with skin.
H319	Causes serious eye irritation.
H361	Suspected of damaging fertility or the unborn child if inhaled, following skin contact and/or if swallowed.

Precautionary Statement(s):

Prevention:

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P264	Wash hands and skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear protective gloves/protective clothing.

Response:
P301 + P312 IF SWALLOWED: Call a POISON CENTRE/doctor if you feel unwell.
P330 Rinse mouth.
P302 + P352 IF ON SKIN: Wash with plenty of water.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P312 Call a POISON CENTRE/doctor if you feel unwell.
P321 Specific treatment (see supplemental first aid instruction on this label).
P337 + P313 If eye irritation persists: Get medical advice/attention.
P362 + P364 Take off contaminated clothing and wash it before reuse.

Storage:
Store in a well ventilated place. Keep cool. Keep container tightly closed. Store locked up.

Disposal:
Dispose of contents/container in accordance with applicable regional, national and local laws and regulations.

Note:
3-7
% of the mixture consists of ingredient(s) of unknown acute toxicity.
Other Hazards
None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture:

Chemical Name	CAS No.	%	Other Identifiers
Diethylene glycol	111-46-6	10-30	
Poly(oxy-1,2-ethanediyl), alpha-butyl- omega -hydroxy-	9004-77-7	10-30	
3,6,9,12-Tetraoxahexadecan-1-ol	1559-34-8	7-13	
Diethylene glycol monobutyl ether	112-34-5	7-13	
Poly(oxy-1,2-ethanediyl), alpha-methyl-omega-hydroxy-	9004-74-4	3-7	
Diethylene glycol monoethyl ether	111-90-0	1-5	
Diethylene glycol monomethyl ether	111-77-3	1-5	

Notes
The specific chemical identity and/or exact percentage of composition (concentration) has been withheld as a trade secret.

SECTION 4. FIRST-AID MEASURES

First-aid Measures

Inhalation

Remove source of exposure or move to fresh air. Get medical advice/attention if you feel unwell or are concerned.

Skin Contact

Avoid direct contact. Wear chemical protective clothing if necessary. Take off contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Rinse with lukewarm, gently flowing water for 5 minutes.

Eye Contact

Quickly and gently blot or brush chemical off the face. Immediately rinse the contaminated eye(s) with lukewarm, gently flowing water for 15-20 minutes, while holding the eyelid(s) open. Remove contact lenses, if present and easy to do. Take care not to rinse contaminated water into the unaffected eye or onto the face. If eye irritation persists, get medical advice/attention.

Ingestion

Rinse mouth with water. Get medical advice/attention if you feel unwell or are concerned.

Most Important Symptoms and Effects, Acute and Delayed

No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Immediate Medical Attention and Special Treatment

Special Instructions

No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

SECTION 5. FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media

Not combustible. Use extinguishing agent suitable for surrounding fire.

Unsuitable Extinguishing Media

None known.

Specific Hazards Arising from the Chemical

Does not burn.
In a fire, the following hazardous materials may be generated: toxic chemicals.

Special Protective Equipment and Precautions for Fire-fighters

Review Section 6 (Accidental Release Measures) for important information on responding to leaks/spills.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures

No special precautions are necessary. Use the personal protective equipment recommended in Section 8 of this safety data sheet.

Environmental Precautions

It is good practice to prevent releases into the environment. Do not allow into any sewer, on the ground or into any waterway.

Methods and Materials for Containment and Cleaning Up

Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Other Information

Report spills to local health, safety and environmental authorities, as required.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling

Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in

areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Conditions for Safe Storage

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

	ACGIH TLV®		OSHA PEL		AIHA WEEL	
Chemical Name	TWA	STEL	TWA	Ceiling	8-hr TWA	TWA
Diethylene glycol					10 mg/m3	
Diethylene glycol monobutyl ether	10 ppm					
Diethylene glycol monoethyl ether					25 ppm	

Appropriate Engineering Controls

General ventilation is usually adequate.

Individual Protection Measures

Eye/Face Protection

Not required but it is good practice to wear safety glasses or chemical safety goggles.

Skin Protection

Not required, if used as directed.

Respiratory Protection

Not normally required if product is used as directed.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Basic Physical and Chemical Properties

Appearance	Light amber. Particle Size: Not applicable
Odour	Not available
Odour Threshold	Not available
pH	Not applicable
Melting Point/Freezing Point	Not available (melting); Not available (freezing)
Initial Boiling Point/Range	Not available
Flash Point	132 ºC (270 ºF) (closed cup)
Evaporation Rate	Not available
Flammability (solid, gas)	Not applicable
Upper/Lower Flammability or Explosive Limit	Not available (upper); Not available (lower)
Vapour Pressure	< 0.013 kPa (0.098 mm Hg)
Vapour Density (air = 1)	Not available

Relative Density (water = 1)	1.038 - 1.040
Solubility	Practically insoluble in water
Partition Coefficient, n-Octanol/Water (Log Kow)	Not available
Auto-ignition Temperature	Not available
Decomposition Temperature	Not available
Viscosity	Not available (kinematic); Not available (dynamic)

Other Information

Physical State	Liquid
Molecular Formula	Not available
Molecular Weight	Not available
Surface Tension	Not available
Critical Temperature	Not available
Electrical Conductivity	Not available
Vapour Pressure at 50 deg C	Not available
Saturated Vapour Concentration	Not available

SECTION 10. STABILITY AND REACTIVITY

Reactivity

Not reactive under normal conditions of use.

Chemical Stability

Normally stable.

Possibility of Hazardous Reactions

None expected under normal conditions of storage and use.

Conditions to Avoid

Water, moisture or humidity.

Incompatible Materials

Slightly reactive or incompatible with the following materials: oxidizing agents (e.g. peroxides).

Hazardous Decomposition Products

Very toxic carbon monoxide, carbon dioxide.

SECTION 11. TOXICOLOGICAL INFORMATION

Likely Routes of Exposure

Skin contact; eye contact.

Acute Toxicity

Chemical Name	LC50	LD50 (oral)	LD50 (dermal)
Diethylene glycol	4600 mg/m3 (rat) (30-minute exposure)	12565 mg/kg (rat)	11890 mg/kg (rabbit)
3,6,9, 12-Tetraoxahexadecan-1-ol	Not available	5300 mg/kg (rat)	
Diethylene glycol monobutyl ether		6560 mg/kg (rat)	2764 mg/kg (rabbit)
Poly(oxy-1,2-ethanediyl), alpha-methyl-omega-hydroxy-		39800 mg/kg (rat)	> 20000 mg/kg (rabbit)

Diethylene glycol monoethyl ether	5240 mg/m3 (rat)	10502 mg/kg (rat)	9143 mg/kg (rabbit)
Diethylene glycol monomethyl ether	> 50000 mg/m3 (rat) (4-hour exposure)	6830 mg/kg (rat)	9404 mg/kg (rabbit)
Poly(oxy-1,2-ethanediyl), alpha-butyl- omega -hydroxy-	Not available	Not available	Not available

LC50: Not applicable.

LD50 (oral): Not applicable.

LD50 (dermal): Not applicable.

Skin Corrosion/Irritation

May cause mild irritation based on information for closely related chemicals.

Serious Eye Damage/Irritation

Causes serious eye damage based on skin corrosion information.

STOT (Specific Target Organ Toxicity) - Single Exposure

Inhalation

No information was located.

Skin Absorption

No information was located.

Ingestion

May be harmful based on information for closely related materials. May cause depression of the central nervous system.

Aspiration Hazard

Not known to be an aspiration hazard.

STOT (Specific Target Organ Toxicity) - Repeated Exposure

No information was located.

Respiratory and/or Skin Sensitization

Not a respiratory sensitizer.

Carcinogenicity

Chemical Name	IARC	ACGIH®	NTP	OSHA
Diethylene glycol	Not Listed	Not designated	Not Listed	Not Listed
3,6,9, 12-Tetraoxahexadecan-1-ol	Not Listed	Not designated	Not Listed	Not Listed
Diethylene glycol monobutyl ether	Not Listed	Not designated	Not Listed	Not Listed
Poly(oxy-1,2-ethanediyl), alpha-methyl-omega-hydroxy -	Not Listed	Not designated	Not Listed	Not Listed
Diethylene glycol monoethyl ether	Not Listed	Not designated	Not Listed	Not Listed
Diethylene glycol monomethyl ether	Not Listed	Not designated	Not Listed	Not Listed
Poly(oxy-1,2-ethanediyl), alpha-butyl- omega -hydroxy-	Not Listed	Not designated	Not Listed	Not Listed

Reproductive Toxicity

Development of Offspring

Not known to harm the unborn child.

Sexual Function and Fertility

May cause effects on sexual function and/or fertility based on limited evidence.

Effects on or via Lactation

Not known to cause effects on or via lactation.

Germ Cell Mutagenicity

No information was located.

Interactive Effects

No information was located.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity

Acute Aquatic Toxicity

Chemical Name	LC50 Fish	EC50 Crustacea	ErC50 Aquatic Plants	ErC50 Algae
Diethylene glycol	75200 mg/L (Pimephales promelas (fathead minnow); 96-hour; fresh water)	10000 mg/L (Daphnia magna (water flea); 48-hour)		Not available
3,6,9, 12-Tetraoxahexadecan-1-ol	2400 mg/L (Pimephales promelas (fathead minnow); 96-hour)	2210 mg/L (Daphnia magna (water flea); 48-hour)		
Diethylene glycol monobutyl ether	1300 mg/L (Lepomis macrochirus (bluegill); 96-hour)	100 mg/L (Daphnia magna (water flea); 48-hour)		
Poly(oxy-1,2-ethanediyl), alpha-methyl-omega-hydroxy-	10000 mg/L (Pimephales promelas (fathead minnow); 96-hour)	Not available		
Diethylene glycol monoethyl ether	9650 mg/L (Pimephales promelas (fathead minnow); 96-hour)			
Diethylene glycol monomethyl ether	5741 mg/L (Pimephales promelas (fathead minnow); 96-hour)	1191 mg/L (Daphnia magna (water flea); 48-hour)		
Poly(oxy-1,2-ethanediyl), alpha-butyl- omega -hydroxy-	Not available			

Chronic Aquatic Toxicity

Chemical Name	NOEC Fish	EC50 Fish	NOEC Crustacea	EC50 Crustacea
Diethylene glycol	Not available		Not available	Not available
3,6,9, 12-Tetraoxahexadecan-1-	Not available		Not available	

ol				
Diethylene glycol monobutyl ether	Not available		Not available	
Poly(oxy-1,2-ethanediyl), alpha-methyl-omega-hydroxy-	Not available		Not available	
Diethylene glycol monoethyl ether	Not available		Not available	
Diethylene glycol monomethyl ether	Not available		Not available	
Poly(oxy-1,2-ethanediyl), alpha-butyl- omega -hydroxy-	Not available		Not available	

Persistence and Degradability

No information was located.

Bioaccumulative Potential

No information was located.

Mobility in Soil

No information was located.

Other Adverse Effects

There is no information available.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal Methods

The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14. TRANSPORT INFORMATION

Not regulated under Canadian TDG Regulations. Not regulated under US DOT Regulations.

Environmental Hazards	Potential Marine Pollutant
Special Precautions for User	Not applicable

Transport in Bulk According to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15. REGULATORY INFORMATION

SECTION 16. OTHER INFORMATION

SDS Prepared By	Compliance and Regulatory Department
Phone No.	905-878-5544
Additional Information	We are committed to uphold the Industry Consumer Ingredient Communication Voluntary Initiative. Please send us your request by visiting our website at www.recochem.com.

	Ingredients present (intentionally added ingredients) at a concentration of greater than one percent (1%) shall be listed in descending order of predominance. Ingredients present at a concentration of not more than one percent shall be listed but may be disclosed without respect to order of predominance.
Disclaimer	Notice to reader: To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

1. Identification

Product identifier	**Brakleen® Brake Parts Cleaner - Non-Chlorinated**
Other means of identification	
Product code	05088
Recommended use	Brake parts cleaner
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Manufactured or sold by:

Company name	CRC Industries, Inc.
Address	885 Louis Dr. Warminster, PA 18974 US
Telephone	
General Information	215-674-4300
Technical Assistance	800-521-3168
Customer Service	800-272-4620
24-Hour Emergency (CHEMTREC)	800-424-9300 (US) 703-527-3887 (International)
Website	www.crcindustries.com

2. Hazard(s) identification

Physical hazards	Flammable aerosols	Category 1
	Gases under pressure	Compressed gas
Health hazards	Acute toxicity, oral	Category 3
	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 2A
	Reproductive toxicity	Category 2
	Specific target organ toxicity, single exposure	Category 1
	Specific target organ toxicity, single exposure	Category 3 narcotic effects
	Specific target organ toxicity, repeated exposure	Category 2
	Aspiration hazard	Category 1
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 2
	Hazardous to the aquatic environment, long-term hazard	Category 2
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	Extremely flammable aerosol. Contains gas under pressure; may explode if heated. Toxic if swallowed. May be fatal if swallowed and enters airways. Causes skin irritation. Causes serious eye irritation. May cause drowsiness or dizziness. May cause damage to organs (liver, kidneys, lungs, brain) through prolonged or repeated exposure. Suspected of damaging the unborn child. Causes damage to organs (eyes) by ingestion. Toxic to aquatic life. Toxic to aquatic life with long lasting effects.

Precautionary statement

Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Do not spray on an open flame or other ignition source. Do not apply while equipment is energized. Pressurized container: Do not pierce or burn, even after use. Extinguish all flames, pilot lights and heaters. Vapors will accumulate readily and may ignite. Do not breathe gas. Use only with adequate ventilation; maintain ventilation during use and until all vapors are gone. Open doors and windows or use other means to ensure a fresh air supply during use and while product is drying. If you experience any symptoms listed on this label, increase ventilation or leave the area. Do not breathe mist or vapor. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing/eye protection/face protection. Avoid release to the environment.
Response	If swallowed: Immediately call a poison center/doctor. Rinse mouth. Do NOT induce vomiting. If on skin: Wash with plenty of water. If skin irritation occurs: Get medical attention. Take off contaminated clothing and wash before reuse. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention. If exposed: Call a poison center/doctor. If exposed or concerned: Get medical attention. Collect spillage.
Storage	Store in a well-ventilated place. Store locked up. Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Exposure to high temperature may cause can to burst.
Disposal	Dispose of contents/container in accordance with local/regional/national regulations.
Hazard(s) not otherwise classified (HNOC)	Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite liquid and vapor. May cause flash fire or explosion.

Supplemental information

16.8% of the mixture consists of component(s) of unknown acute oral toxicity. 66.2% of the mixture consists of component(s) of unknown acute hazards to the aquatic environment. 62% of the mixture consists of component(s) of unknown long-term hazards to the aquatic environment.
When exposed to extreme heat or hot surfaces, vapors may decompose to harmful or fatal corrosive gases such as formaldehyde.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Methanol		67-56-1	40 - 50
Toluene		108-88-3	10 - 20
Acetone		67-64-1	5 - 15
3-Methylhexane		589-34-4	5 - 10
Carbon dioxide		124-38-9	5 - 10
n-Heptane		142-82-5	5 - 10
Methylcyclohexane		108-87-2	3 - 5
Naphtha (petroleum), hydrotreated light		64742-49-0	3 - 5
Cyclohexane		110-82-7	1 - 3
Ethylbenzene		100-41-4	< 0.2

Specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Do not use mouth-to-mouth method if victim ingested the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

Most important symptoms/effects, acute and delayed	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Irritation of nose and throat. Aspiration may cause pulmonary edema and pneumonitis. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Upper respiratory tract irritation. Skin irritation. May cause redness and pain. Prolonged exposure may cause chronic effects.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Thermal burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media	Alcohol resistant foam. Water fog. Carbon dioxide (CO2). Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable extinguishing media	None known.
Specific hazards arising from the chemical	Contents under pressure. Pressurized container may rupture when exposed to heat or flame. This product is a poor conductor of electricity and can become electrostatically charged. If sufficient charge is accumulated, ignition of flammable mixtures can occur. Static electricity accumulation may be significantly increased by the presence of small quantities of water or other contaminants. Material will float and may ignite on surface of water. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.
Fire-fighting equipment/instructions	In case of fire: Stop leak if safe to do so. Move containers from fire area if you can do so without risk. Containers should be cooled with water to prevent vapor pressure build up.
General fire hazards	Extremely flammable aerosol. Contents under pressure. Pressurized container may rupture when exposed to heat or flame.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Remove all possible sources of ignition in the surrounding area. Many vapors are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Wear appropriate protective equipment and clothing during clean-up. Do not breathe mist or vapor. Do not breathe gas. Emergency personnel need self-contained breathing equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Use appropriate containment to avoid environmental contamination. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. This product is miscible in water. Stop the flow of material, if this is without risk. Prevent product from entering drains. Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground. Inform appropriate managerial or supervisory personnel of all environmental releases. Use appropriate containment to avoid environmental contamination.

7. Handling and storage

Precautions for safe handling

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Minimize fire risks from flammable and combustible materials (including combustible dust and static accumulating liquids) or dangerous reactions with incompatible materials. Pressurized container: Do not pierce or burn, even after use. Do not use if spray button is missing or defective. Do not spray on a naked flame or any other incandescent material. Do not smoke while using or until sprayed surface is thoroughly dry. Do not cut, weld, solder, drill, grind, or expose containers to heat, flame, sparks, or other sources of ignition. Use caution around energized equipment. The metal container will conduct electricity if it contacts a live source. This may result in injury to the user from electrical shock and/or flash fire. Do not breathe mist or vapor. Do not breathe gas. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Do not taste or swallow. When using, do not eat, drink or smoke. Pregnant or breastfeeding women must not handle this product. Should be handled in closed systems, if possible. Use only in well-ventilated areas. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices. Avoid release to the environment. For product usage instructions, please see the product label.

Conditions for safe storage, including any incompatibilities

Level 3 Aerosol.

Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50°C/122 °F. Do not puncture, incinerate or crush. Do not handle or store near an open flame, heat or other sources of ignition. This material can accumulate static charge which may cause spark and become an ignition source. Avoid spark promoters. These alone may be insufficient to remove static electricity. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Acetone (CAS 67-64-1)	PEL	2400 mg/m3 1000 ppm
Carbon dioxide (CAS 124-38-9)	PEL	9000 mg/m3 5000 ppm
Cyclohexane (CAS 110-82-7)	PEL	1050 mg/m3 300 ppm
Ethylbenzene (CAS 100-41-4)	PEL	435 mg/m3 100 ppm
Methanol (CAS 67-56-1)	PEL	260 mg/m3 200 ppm
Methylcyclohexane (CAS 108-87-2)	PEL	2000 mg/m3 500 ppm
n-Heptane (CAS 142-82-5)	PEL	2000 mg/m3 500 ppm

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value
Toluene (CAS 108-88-3)	Ceiling	300 ppm
	TWA	200 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
3-Methylhexane (CAS 589-34-4)	STEL	500 ppm
	TWA	400 ppm
Acetone (CAS 67-64-1)	STEL	500 ppm
	TWA	250 ppm
Carbon dioxide (CAS 124-38-9)	STEL	30000 ppm
	TWA	5000 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
Cyclohexane (CAS 110-82-7)	TWA	100 ppm
Ethylbenzene (CAS 100-41-4)	TWA	20 ppm
Methanol (CAS 67-56-1)	STEL	250 ppm
	TWA	200 ppm
Methylcyclohexane (CAS 108-87-2)	STEL	500 ppm
	TWA	400 ppm
n-Heptane (CAS 142-82-5)	STEL	500 ppm
	TWA	400 ppm
Toluene (CAS 108-88-3)	TWA	20 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Acetone (CAS 67-64-1)	TWA	590 mg/m3
		250 ppm
Carbon dioxide (CAS 124-38-9)	STEL	54000 mg/m3
		30000 ppm
	TWA	9000 mg/m3
		5000 ppm
Cyclohexane (CAS 110-82-7)	TWA	1050 mg/m3
		300 ppm
Ethylbenzene (CAS 100-41-4)	STEL	545 mg/m3
		125 ppm
	TWA	435 mg/m3
		100 ppm
Methanol (CAS 67-56-1)	STEL	325 mg/m3
		250 ppm
	TWA	260 mg/m3
		200 ppm
Methylcyclohexane (CAS 108-87-2)	TWA	1600 mg/m3
		400 ppm
n-Heptane (CAS 142-82-5)	Ceiling	1800 mg/m3
		440 ppm
	TWA	350 mg/m3
		85 ppm
Toluene (CAS 108-88-3)	STEL	560 mg/m3
		150 ppm
	TWA	375 mg/m3
		100 ppm

Biological limit values

ACGIH Biological Exposure Indices

Components	Value	Determinant	Specimen	Sampling Time
Acetone (CAS 67-64-1)	25 mg/l	Acetone	Urine	*
Ethylbenzene (CAS 100-41-4)	0.15 g/g	Sum of mandelic acid and phenylglyoxylic acid	Creatinine in urine	*
Methanol (CAS 67-56-1)	15 mg/l	Methanol	Urine	*
Toluene (CAS 108-88-3)	0.3 mg/g	o-Cresol, with hydrolysis	Creatinine in urine	*
	0.03 mg/l	Toluene	Urine	*

ACGIH Biological Exposure Indices

Components	Value	Determinant	Specimen	Sampling Time
	0.02 mg/l	Toluene	Blood	*

* - For sampling details, please see the source document.

Exposure guidelines

US - California OELs: Skin designation

Methanol (CAS 67-56-1) Can be absorbed through the skin.
Toluene (CAS 108-88-3) Can be absorbed through the skin.

US - Minnesota Haz Subs: Skin designation applies

Methanol (CAS 67-56-1) Skin designation applies.
Toluene (CAS 108-88-3) Skin designation applies.

US - Tennessee OELs: Skin designation

Methanol (CAS 67-56-1) Can be absorbed through the skin.

US ACGIH Threshold Limit Values: Skin designation

Methanol (CAS 67-56-1) Can be absorbed through the skin.

US NIOSH Pocket Guide to Chemical Hazards: Skin designation

Methanol (CAS 67-56-1) Can be absorbed through the skin.

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower should be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Wear protective gloves such as: Nitrile. Neoprene. Polyvinyl alcohol (PVA).

Other Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls are not feasible or if exposure exceeds the applicable exposure limits, use a NIOSH-approved cartridge respirator with an organic vapor cartridge. Use a self-contained breathing apparatus in confined spaces and for emergencies. Air monitoring is needed to determine actual employee exposure levels.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations When using do not smoke. Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Aerosol.

Color Clear.

Odor Solvent.

Odor threshold Not available.

pH Not available.

Melting point/freezing point -195.9 °F (-126.6 °C) estimated

Initial boiling point and boiling range 132.9 °F (56.1 °C) estimated

Flash point 0 °F (-17.8 °C) Tag Closed Cup

Evaporation rate Fast.

Flammability (solid, gas) Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) 1 % estimated

Flammability limit - upper (%)	36 % estimated
Vapor pressure	4438 hPa estimated
Vapor density	> 1 (air = 1)
Relative density	0.84 estimated
Solubility (water)	Slightly soluble.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	539.6 °F (282 °C) estimated
Decomposition temperature	Not available.
Viscosity (kinematic)	Not available.
Percent volatile	92.4 % estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources. Contact with incompatible materials. When exposed to extreme heat or hot surfaces, vapors may decompose to harmful or fatal corrosive gases such as formaldehyde.
Incompatible materials	Acids. Alkalies. Reducing agents. Strong oxidizing agents. Hypochlorites. Peroxides. Aluminum. Magnesium. Sodium. Zinc.
Hazardous decomposition products	Carbon oxides. Formaldehyde.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause damage to organs through prolonged or repeated exposure by inhalation. May cause drowsiness and dizziness. Headache. Nausea, vomiting.
Skin contact	Causes skin irritation.
Eye contact	Causes serious eye irritation.
Ingestion	Toxic if swallowed. Even small amounts (30-250 ml methanol) may be fatal. Symptoms are stomach ache, nausea, vomiting, dullness, visual disorder and blindness. Droplets of the product aspirated into the lungs through ingestion or vomiting may cause a serious chemical pneumonia.
Symptoms related to the physical, chemical and toxicological characteristics	Headache. May cause drowsiness and dizziness. Nausea, vomiting. Aspiration may cause pulmonary edema and pneumonitis. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain.

Information on toxicological effects

Acute toxicity May be fatal if swallowed and enters airways. Narcotic effects.

Product	Species	Test Results
Brakleen® Brake Parts Cleaner - Non-Chlorinated		
Acute		
Dermal		
LD50	Rabbit	6702 mg/kg estimated
Inhalation		
LC50	Rat	58 mg/l, 4 Hours estimated
Oral		
LD50	Human	110 mg/kg estimated
	Rat	5943 mg/kg estimated

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes serious eye irritation.

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Based on available data, the classification criteria are not met.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not available.

US. National Toxicology Program (NTP) Report on Carcinogens

Not available.

Reproductive toxicity Suspected of damaging the unborn child.

Specific target organ toxicity - single exposure Causes damage to organs (eyes) by ingestion. May cause drowsiness and dizziness.

Specific target organ toxicity - repeated exposure May cause damage to organs through prolonged or repeated exposure: Liver. Kidneys. Lungs. Brain.

Aspiration hazard May be fatal if swallowed and enters airways. If aspirated into lungs during swallowing or vomiting, may cause chemical pneumonia, pulmonary injury or death.

Chronic effects May cause damage to organs through prolonged or repeated exposure. Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity Toxic to aquatic life with long lasting effects.

Components		Species	Test Results
Acetone (CAS 67-64-1)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	10294 - 17704 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	4740 - 6330 mg/l, 96 hours
Cyclohexane (CAS 110-82-7)			
Aquatic			
Fish	LC50	Fathead minnow (Pimephales promelas)	23.03 - 42.07 mg/l, 96 hours
Ethylbenzene (CAS 100-41-4)			
Aquatic			
Acute			
Crustacea	EC50	Water flea (Daphnia magna)	2.1 mg/l, 48 hours
Fish	LC50	Fathead minnow (Pimephales promelas)	12.1 mg/l, 96 hours
Methanol (CAS 67-56-1)			
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	18000 - 20000 mg/l, 96 hours
Acute			
Crustacea	EC50	Water flea (Daphnia magna)	> 10000 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	18000 - 20000 mg/l, 96 hours
Methylcyclohexane (CAS 108-87-2)			
Aquatic			
Fish	LC50	Striped bass (Morone saxatilis)	5.8 mg/l, 96 hours
n-Heptane (CAS 142-82-5)			
Aquatic			
Acute			
Fish	LC50	Fathead minnow (Pimephales promelas)	2.1 - 2.98 mg/l, 96 hours
Toluene (CAS 108-88-3)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	5.46 - 9.83 mg/l, 48 hours

Components		Species	Test Results
Fish	LC50	Coho salmon,silver salmon (Oncorhynchus kisutch)	8.11 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

Acetone	-0.24
Cyclohexane	3.44
Ethylbenzene	3.15
Methanol	-0.77
Methylcyclohexane	3.61
n-Heptane	4.66
Toluene	2.73

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal of waste from residues / unused products This material and its container must be disposed of as hazardous waste. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Contents under pressure. Do not puncture, incinerate or crush. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose in accordance with all applicable regulations.

Hazardous waste code D001: Waste Flammable material with a flash point <140 F
F005: Waste Non-halogenated Solvent - Spent Non-halogenated Solvent

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number UN1950
UN proper shipping name Aerosols, flammable, Limited Quantity
Transport hazard class(es)
Class 2.1
Subsidiary risk 6.1(PGIII)
Label(s) 2.1
Packing group Not applicable.
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.
Special provisions N82
Packaging exceptions 306
Packaging non bulk None
Packaging bulk None

IATA

UN number UN1950
UN proper shipping name Aerosols, flammable, containing substances in Division 6.1, Packing Group III
Transport hazard class(es)
Class 2.1
Subsidiary risk 6.1(PGIII)
Packing group Not applicable.
Environmental hazards No.
ERG Code 10P
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.
Other information
Passenger and cargo aircraft Allowed with restrictions.
Cargo aircraft only Allowed with restrictions.

IMDG

UN number	UN1950
UN proper shipping name	AEROSOLS
Transport hazard class(es)	
Class	2
Subsidiary risk	6.1(PGIII)
Packing group	Not applicable.
Environmental hazards	No.
EmS	Not available.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

SARA 304 Emergency release notification

Not regulated.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

Cyclohexane (CAS 110-82-7)
Ethylbenzene (CAS 100-41-4)
Methanol (CAS 67-56-1)
Toluene (CAS 108-88-3)

CERCLA Hazardous Substance List (40 CFR 302.4)

Acetone (CAS 67-64-1)
Cyclohexane (CAS 110-82-7)
Ethylbenzene (CAS 100-41-4)
Methanol (CAS 67-56-1)
Toluene (CAS 108-88-3)

CERCLA Hazardous Substances: Reportable quantity

Acetone (CAS 67-64-1)	5000 LBS
Cyclohexane (CAS 110-82-7)	1000 LBS
Ethylbenzene (CAS 100-41-4)	1000 LBS
Methanol (CAS 67-56-1)	5000 LBS
Toluene (CAS 108-88-3)	1000 LBS

Spills or releases resulting in the loss of any ingredient at or above its RQ require immediate notification to the National Response Center (800-424-8802) and to your Local Emergency Planning Committee.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Methanol (CAS 67-56-1)
Toluene (CAS 108-88-3)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2) and Chemical Code Number

Acetone (CAS 67-64-1)	6532
Toluene (CAS 108-88-3)	6594

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

Acetone (CAS 67-64-1)	35 %WV
Toluene (CAS 108-88-3)	35 %WV

DEA Exempt Chemical Mixtures Code Number

Acetone (CAS 67-64-1)	6532
Toluene (CAS 108-88-3)	594

FEMA Priority Substances Respiratory Health and Safety in the Flavor Manufacturing Workplace

Acetone (CAS 67-64-1)	Low priority

Food and Drug Administration (FDA)	Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Section 311/312 Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - Yes Pressure Hazard - Yes Reactivity Hazard - No
SARA 302 Extremely hazardous substance	No

US state regulations

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Acetone (CAS 67-64-1)
Ethylbenzene (CAS 100-41-4)
Methanol (CAS 67-56-1)
Naphtha (petroleum), hydrotreated light (CAS 64742-49-0)
Toluene (CAS 108-88-3)

US. New Jersey Worker and Community Right-to-Know Act

3-Methylhexane (CAS 589-34-4)
Acetone (CAS 67-64-1)
Carbon dioxide (CAS 124-38-9)
Methylcyclohexane (CAS 108-87-2)
n-Heptane (CAS 142-82-5)

US. Massachusetts RTK - Substance List

3-Methylhexane (CAS 589-34-4)
Acetone (CAS 67-64-1)
Carbon dioxide (CAS 124-38-9)
Cyclohexane (CAS 110-82-7)
Methanol (CAS 67-56-1)
Methylcyclohexane (CAS 108-87-2)
n-Heptane (CAS 142-82-5)
Toluene (CAS 108-88-3)

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. Rhode Island RTK

Acetone (CAS 67-64-1)
Cyclohexane (CAS 110-82-7)
Methanol (CAS 67-56-1)
Toluene (CAS 108-88-3)

US. New Jersey Worker and Community Right-to-Know Act

Cyclohexane (CAS 110-82-7)
Methanol (CAS 67-56-1)
Toluene (CAS 108-88-3)

US. Pennsylvania Worker and Community Right-to-Know Law

Acetone (CAS 67-64-1)
Cyclohexane (CAS 110-82-7)
Methanol (CAS 67-56-1)
Toluene (CAS 108-88-3)
Benzene (CAS 71-43-2)
Ethylbenzene (CAS 100-41-4)
Xylene (CAS 1330-20-7)
3-Methylhexane (CAS 589-34-4)
Carbon dioxide (CAS 124-38-9)
Methylcyclohexane (CAS 108-87-2)
n-Heptane (CAS 142-82-5)

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Benzene (CAS 71-43-2)	Listed: February 27, 1987
Cumene (CAS 98-82-8)	Listed: April 6, 2010

Ethanal (CAS 75-07-0)	Listed: April 1, 1988
Ethylbenzene (CAS 100-41-4)	Listed: June 11, 2004
Naphthalene (CAS 91-20-3)	Listed: April 19, 2002

US - California Proposition 65 - CRT: Listed date/Developmental toxin

Benzene (CAS 71-43-2)	Listed: December 26, 1997
Methanol (CAS 67-56-1)	Listed: March 16, 2012
Toluene (CAS 108-88-3)	Listed: January 1, 1991

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

Benzene (CAS 71-43-2)	Listed: December 26, 1997

Volatile organic compounds (VOC) regulations

EPA

VOC content (40 CFR 51.100(s))	84 %
Consumer products (40 CFR 59, Subpt. C)	Not regulated

State

Consumer products	This product is regulated as a Brake Cleaner. This product is not compliant to be sold for use in California, Connecticut, Delaware, the District of Columbia, Illinois, Indiana, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island and parts of Utah and Virginia.
VOC content (CA)	84 %
VOC content (OTC)	84 %

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	05-13-2015
Revision date	01-13-2016
Prepared by	Allison Cho
Version #	02
Further information	CRC # 483A
HMIS® ratings	Health: 3* Flammability: 4 Physical hazard: 0 Personal protection: B
NFPA ratings	Health: 3 Flammability: 4 Instability: 0

NFPA ratings

Disclaimer

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. This information is accurate to the best of CRC Industries' knowledge or obtained from sources believed by CRC to be accurate. Before using any product, read all warnings and directions on the label. For further clarification of any information contained on this (M)SDS consult your supervisor, a health & safety professional, or CRC Industries.

JELMAR
MATERIAL SAFETY DATA SHEET
CLR CALCIUM LIME & RUST REMOVER
ENHANCED FORMULA

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Manufacturer: Jelmar
Address: 5550 W. Touhy Ave.
Skokie, IL 60077

Emergency Phone Number: 1(800) 323-5497 (USA)
Monday – Friday 8:30 A.M. – 4:30 P.M. CST
Emergency Contact: Chemtrec 1(800) 424-9300

Product Name: CLR Calcium Lime & Rust Remover (Enhanced Formula)
MSDS ID: 031004
Chemical Family: Aqueous Acidic Cleaner
Formula: Proprietary Mixture

SECTION 2 – HAZARDS IDENTIFICATION

PHYSICAL STATE: Liquid
COLOR: Crystal clear, lime green
ODOR: Slightly sour

WARNING OVERVIEW: Irritating to eyes, skin, respiratory tract and mucous membranes. Risk of burns to eyes, skin, and respiratory tract. May be harmful or fatal if swallowed. Use with adequate ventilation. Avoid breathing mist or dust. Keep container closed when not in use.

POTENTIAL HEALTH EFFECTS
ROUTES OF EXPOSURE: Eyes. Skin. Inhalation. Ingestion.
TARGET ORGANS: No data.
EYE CONTACT: Severe irritation and blurred vision. Effects may vary depending on length of exposure, solution concentration, and first aid measures. Prolonged contact may cause permanent damage.
SKIN CONTACT: Causes skin irritation. Prolonged contact may cause dermatitis, and itching.
INHALATION: Irritation, breathing difficulties, headaches, dizziness.
INGESTION: Oral burns, vomiting, and gastrointestinal disturbance.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE TO PRODUCT: Eye, skin, and respiratory disorders.
CANCER INFORMATION: This product does not contain >0.10% of the known potential carcinogens listed in NTP, IRAC, or OSHA.

DO NOT MIX WITH BLEACH, OR ANY OTHER PRODUCT AS TOXIC FUMES MAY RESULT. KEEP OUT OF REACH OF CHILDREN.

SECTION 3 - COMPOSITION /INFORMATION ON INGREDIENTS

Component	CAS#	Osha Hazard	% by Weight
1. Water	7732-18-5	NO	70-81
2. Lactic Acid	79-33-4	YES	15-20
3. Gluconic Acid	526-95-4	N0	2-4
4. Lauryldimethyl Hydroxysultaine	13197-76-7	N0	1-4
5. Propylene Glycol Normal Butyl Ether	5131-66-8	YES	1-2

SECTION 4 – FIRST AID MEASURES

EYE CONTACT: In case of eye contact, immediately rinse eye thoroughly with plenty of water. Remove contact lenses, and continue rinsing for at least 15 minutes. Get immediate medical attention.

SKIN CONTACT: Can be irritating to skin, prolonged contact can be more severe, no adverse effects during normal usage. In case of skin contact, rinse area for at least 15 minutes. Remove contaminated clothing and shoes, wash thoroughly before reuse. Get immediate medical attention if irritation persists.
INHALATION: Not a significant route of exposure. Remove to fresh air. If breathing is difficult, GET MEDICAL ATTENTION IMMEDIATELY.
INGESTION: DO NOT induce vomiting. If fully conscious, drink 16 ounces of water. CALL A PHYSCIAN OR POISON CONTROL CENTER IMMEDIATELY. NEVER give an unconscious person anything to ingest.

SECTION 5 – FIRE FIGHTING MEASURES

FLAMMABILTY: Not flammable
FLASH POINT: None (100º C / 212º F): Method: TOC
EXPLOSIVE LIMITS IN AIR: Not available
EXTINGUISHING MEDIA: Not flammable. Use appropriate media for area. Water spray, dry chemical, alcohol foam or carbon dioxide.
FIRE FIGHTING METHODS: Evacuate area of personnel. Wear protective NIOSH-approved self-contained breathing apparatus. Remain upwind of fire to avoid hazardous vapors and decomposition products. Use water spray to cool fire-exposed containers. Run-off of large quantities of product from fire control may cause pollution. Contact appropriate agencies.
HAZARDOUS COMBUSTION PRODUCTS: Carbon Monoxide. Thermal decomposition can lead to irritating gases and vapors.
FIRE AND EXPLOSION HAZARDS: None known.

SECTION 6 – ACCIDENTAL RELEASES MEASURES

Steps to be taken in Case Material is Released or Spilled: Avoid contact with skin and eyes
Small Spill: No special clean-up procedure is necessary for small (less than 1 gallon) spills. Flush spill area with water. Wear rubber gloves.
Large Spill: Use personal protection recommended in Section 8. Isolate area, and deny entry to unnecessary and unprotected personnel. Dam spill, and absorb with earth, sand or similar material. Place in non-leaking containers. Dispose of collected material according to local, state, and federal regulations. Flush residue with large amount of water. Avoid direct discharge to sewers and surface waters.

SECTION 7- HANDLING AND STORAGE

STORAGE: Store in cool, well-ventilated area, away from heat. Keep containers tightly closed. Avoid contact with combustible materials, wood, and organic materials. Store in original container in a secure area away from children and pets.
HANDLING: Avoid contact with eyes, skin or clothing. May be harmful or fatal if swallowed. Use with adequate ventilation. Avoid breathing vapors or mist. Do not eat, drink, or smoke in work area. Wash hand thoroughly after use. Consumer size containers (14, 28, and 42 fluid ounces and gallon containers), should be rinsed and recycled. Empty 5gallon containers and 55gallon drums, may contain product residue in form of vapor, dried product, or liquid, and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE THESE CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY.

DO NOT MIX WITH BLEACH, OR ANY OTHER PRODUCTS AS TOXIC FUMES MAY RESULT. KEEP OUT OF REACH OF CHILDREN.

JELMAR
MATERIAL SAFETY DATA SHEET
CLR CALCIUM LIME & RUST REMOVER
ENHANCED FORMULA

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

VENTILATION REQUIREMENT: Avoid prolonged breathing mists or dusts of this product. Use with adequate ventilation. Do not use in closed or confined spaces.
RESPIRATORY PROTECTION: None required during normal household use. If product is used in an industrial setting, respiratory protection must be worn if ventilation does not eliminate symptoms or keep levels below recommended exposure limits. If mist or dust is present, wear NIOSH-Approved respirator for dusts and mists, NIOSH-Approved self-contained breathing apparatus, NIOSH-Approved full-face piece positive-pressure, air-supplied respirator. DO NOT exceed limits established by respirator manufacturer. Emergency responders should wear self-contained breathing apparatus (SCBA) to avoid inhalation of product.
EYE PROTECTION: Not required during normal household usage. Industrial users wear safety goggles. Do not wear contact lenses. Emergency responders should wear full eye and face protection.
SKIN PROTECTION: Rubber gloves with protective cuff. Emergency responders should wear impermeable gloves.
OTHER PROTECTION: Emergency responders should wear chemical type (impermeable) protective clothing and footwear where direct contact with chemicals in this product is possible.
WORK/HYGIENIC PRACTICES: Wash thoroughly with soap and water after use or handling.

EXPOSURE GUIDELINES:	**OSHA**		**ACGIH**	
COMPONENT	**PEL**	**STEL/C**	**TWA**	**STEL/C**
1. Water	N.E.	N.E.	N.E.	N.E.
2. Lactic Acid	N.E	N.E.	N.E.	N.E.
3. Gluconic Acid	N.E.	N.E.	N.E.	N.E.
4. Lauryldimethyl Hydroxysultaine	N.E.	N.E.	N.E.	N.E.
5. Propylene Glycol Normal Butyl Ether	N.E.	N.E.	N.E.	N.E.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Boiling point:	100º C / 212º F	**Specific Gravity:**	1.05 – 1.06
Vapor Pressure:	N.D.	**Percent Volatiles:**	~78.6% (Calculated)
Freezing Point:	N.D.	**Evaporation Rate:**	N.D. (nBuAc=1)
Melting Point:	N.D.	**VOC (Wt%):**	<1.5 (Calculated)
Vapor Density (mm Hg):	N.D.	**VOC (LBS/GAL):**	<0.13 (Calculated)
pH:	1.30-1.50	**Solubility in Water:**	100%

SECTION 10 – STABILITY AND REACTIVITY

STABILITY: Stable under normal conditions.
CONDITIONS TO AVOID: Avoid elevated temperatures.
INCOMPATIBLE MATERIALS: Strong oxidizing agents, metals, acids, and bases.
HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition can lead to release of irritating gases and vapors and carbon oxides.
POSSIBILITY OF HAZARDOUS REACTIONS: No data.

SECTION 11 – TOXICOLOGICAL INFORMATION

LD_{50} ORAL: N.E.
LD_{50} SKIN: N.E.
LC_{50} INHALHATION: N. E.

JELMAR
MATERIAL SAFETY DATA SHEET
CLR CALCIUM LIME & RUST REMOVER
ENHANCED FORMULA

SECTION 12- ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION: No data available.
CHEMICAL FATE INFORMATION: 28-day biodegradation = 60%. The matter is biodegradable.

SECTION 13 – DISPOSAL CONSIDERATIONS

HAZARDOUS WASTE NUMBER: D002
DISPOSAL METHOD: Dispose of in a permitted hazardous waste management facility following all local, state, and federal regulations.

DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION.
Follow label warnings, since containers may retain some reside of the product.
Processing, use or contamination of this product may change the waste management options. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations. State and local disposal regulations may differ from federal disposal regulations.

SECTION 14 - TRANSPORTATION INFORMATION

DOT (Department of Transportation Proper Shipping Name): Not regulated by DOT.
Identification Number: N.A.
Packaging Group: N.A.
UN Number: N.A.
TDG Classification: Not Regulated
IMDG Classification: Not Regulated
IATA Classification: Passenger – Not Regulated
WHIMS (Canada): This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by CPR.

SECTION 15 – REGULATORY INFORMATION

FEDERAL REGULATIONS:
TSCA INVENTORY STATUS: All components of this product are listed on the TSCA Inventory or are exempt from TSCA Inventory requirements.

SARA TITTLE III SECTION 311/312 CATEGORY:

IMMEDIATE (ACUTE) HEALTH HAZARARD:	YES
DELAYED (CHRONIC) HEALTH HAZARD:	YES
FIRE HAZARD:	NO
SUDDEN RELEASE OF PRESSURE:	NO
REACTIVE HAZARD:	NO

SARA SECTIONS 302/304/313/HAP:

COMPENT	RQ (LBS) (1*)	RQ (LBS) (2*)	TPQ (LBS) (3*)	SEC 313 (4*)	HAP (5*)
1. Water	N.A.	N.A.	N.A.	NO	NO
2. Lactic Acid	N.A.	N.A.	N.A.	NO	NO
3. Gluconic Acid	N.A.	N.A.	N.A.	NO	NO
4. Lauryldimethyl Hydroxysultaine	N.A.	N.A.	N.A.	NO	NO
5. Propylene Glycol Normal Butyl Ether	N.A.	N.A.	N.A.	NO	NO

JELMAR
MATERIAL SAFETY DATA SHEET
CLR CALCIUM LIME & RUST REMOVER
ENHANCED FORMULA

REGULATORY AGENCIES

*1: CERCLA Reportable Quantity
*2: SARA Reportable Quantity
*3: SARA EHS Threshold Planning Quantity
*4: SARA 313 Toxic Chemical / Category
*5: U. S. EPA Hazardous Air Pollutant

INTERNATIONAL CHEMICAL INVENTORY STATUS:

EUROPEAN UNION (EINECS)	YES
JAPAN (METI)	YES
AUSTRALIA (ACIS)	YES
KOREA (KECL)	YES
CANADA (DSL)	YES
CANADA (NDSL)	NO
PHILIPPINES	YES

STATES RIGHT TO KNOW: California, New Jersey, Pennsylvania, Minnesota, Massachusetts, and Wisconsin. None.

The following statement is made in order to comply with the California State Drinking Water Act. California Proposition 65: This product does not contain any chemicals known to the State of California to cause cancer and/or to cause birth defects and other reproductive harm.

SECTION 16 – OTHER INFORMATION

NFPA Rating System: Health - 1 / Flammability - 0 / Reactivity - 0 / Special Hazard - None
Precautions to be taken in Handling and Storing: Avoid exposure to excess heat, and prevent from freezing.
Other Precautions: None required.
MSDS ABBREVIATIONS:

N. A.:	Not Applicable
N. D.:	Not Determined
N.E.:	Not Established
C:	Ceiling Limit
HAP:	Hazardous Air Pollutant
VOC:	Volatile Organic Compound

Revision: Format Change ANSI Z400.1-2004 October 2004 R. A. Gaudreault

Although the information and recommendations set forth herein are presented in good faith and believed to be correct as of the date hereof, JELMAR offers no representations as to the completeness or accuracy thereof. Information is provided upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will JELMAR be responsible for damages of any nature whatsoever resulting from use of or reliance upon said information.

NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION HEREIN REFERS.

SAFETY DATA SHEET

COMPRESSOR OIL RP 268

000003001349

Version 5.1 Revision Date 2017/01/27 Print Date 2017/01/27

SECTION 1. IDENTIFICATION

Product name	:	COMPRESSOR OIL RP 268
Product code	:	CRP268CBE, CRP268DRP, CRP268DRM, CRP268, CRP268BLK
Manufacturer or supplier's details		Petro-Canada Lubricants Inc. 2310 Lakeshore Road West Mississauga ON L5J 1K2 Canada
Emergency telephone number		Petro-Canada Lubricants Inc.: +1 905-403-5770; CHEMTREC Transport Emergency: 1-800-424-9300; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Compressor Oil RP 268 is used for the lubrication of cylinders and rod packings in natural gas compressors having force-feed lubrication systems. It is recommended for use in compressing sour, wet or contaminated natural gas. It should NEVER be used in equipment compressing pure oxygen or other chemically active gases such as chlorine or hydrogen chloride.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	viscous liquid
Colour	dark green
Odour	Mild petroleum oil like.

GHS Classification

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion Inhalation

™ Owned or used under license by Petro-Canada Lubricants Inc.

Skin contact

Aggravated Medical Condition : None known.

Other hazards

None known.

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high viscosity	72623-85-9	30 - 50 %

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.
DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Never give anything by mouth to an unconscious person.
Seek medical advice.

™ Owned or used under license by Petro-Canada Lubricants Inc.

Most important symptoms and effects, both acute and delayed	:	First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	No information available.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), sulphur oxides (SOx), phosphorus oxides (POx), calcium oxides (CaOx), aldehydes, hydrocarbons, metal oxides, smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest.

™ Owned or used under license by Petro-Canada Lubricants Inc.

Keep away from heat and sources of ignition.
Keep container closed when not in use.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high viscosity	72623-85-9	TWA (Mist)	5 mg/m3	CA AB OEL
		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhalable fraction)	5 mg/m3	ACGIH

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : organic vapour filter

Hand protection
Material : neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R).

Remarks : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eye protection : Wear face-shield and protective suit for abnormal processing

™ Owned or used under license by Petro-Canada Lubricants Inc.

problems.

Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash hands and face before breaks and immediately after handling the product. Wash contaminated clothing before re-use. Ensure that eyewash station and safety shower are proximal to the work-station location.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	viscous liquid
Colour	:	dark green
Odour	:	Mild petroleum oil like.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	-18 °C (-0.40 °F)
Boiling point/boiling range	:	No data available
Flash point	:	278 °C (532 °F) Method: Cleveland open cup
Fire Point	:	292 °C (558 °F)
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available
Flammability	:	Low fire hazard. This material must be heated before ignition will occur.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	No data available
Relative vapour density	:	No data available
Density	:	0.8951 kg/l (15 °C / 59 °F)
Solubility(ies)		
Water solubility	:	insoluble

™ Owned or used under license by Petro-Canada Lubricants Inc.

Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	269 cSt (40 °C / 104 °F)
		21.9 cSt (100 °C / 212 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	No data available
Incompatible materials	:	Reactive with oxidising agents, acids, halogens and halogenated compounds.
Hazardous decomposition products	:	May release COx, SOx, SiOx, POx, methacrylate monomers, aldehydes, hydrocarbons, formaldehyde, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Ingestion
Inhalation
Skin contact

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Remarks: No data available

Components:

lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based, high viscosity:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist

™ Owned or used under license by Petro-Canada Lubricants Inc.

Acute dermal toxicity : LD50 (Rabbit): > 2,000 mg/kg,

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish : Remarks: No data available

Toxicity to daphnia and other aquatic invertebrates : Remarks: No data available

Toxicity to algae : Remarks: No data available

Toxicity to bacteria : Remarks: No data available

™ Owned or used under license by Petro-Canada Lubricants Inc.

Persistence and degradability

Product:

Biodegradability : Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : The product should not be allowed to enter drains, water courses or the soil.
Offer surplus and non-recyclable solutions to a licensed disposal company.
Waste must be classified and labelled prior to recycling or disposal.
Send to a licensed waste management company.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

Not regulated as a dangerous good

IMDG-Code

Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

National Regulations

TDG

Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

The components of this product are reported in the following inventories:

TM Owned or used under license by Petro-Canada Lubricants Inc.

DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
IECSC	On the inventory, or in compliance with the inventory
EINECS	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

For Copy of SDS	:	Internet: lubricants.petro-canada.com/sds Western Canada, telephone: 1-800-661-1199; fax: 1-800-378-4518 Ontario & Central Canada, telephone: 1-800-268-5850; fax: 1-800-201-6285 Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 1-800-201-6285 For Product Safety Information: 1 905-804-4752
Prepared by	:	Product Safety: +1 905-804-4752
Revision Date	:	2017/01/27

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

™ Owned or used under license by Petro-Canada Lubricants Inc.

SAFETY DATA SHEET

1. Identification

Product identifier	**Copper Anti-Seize & Lubricating Compound**
Other means of identification	
Product code	14095
Recommended use	Anti-seize and lubricating compound
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Manufactured or sold by:

Company name	CRC Industries, Inc.
Address	885 Louis Dr. Warminster, PA 18974 US
Telephone	
General Information	215-674-4300
Technical Assistance	800-521-3168
Customer Service	800-272-4620
24-Hour Emergency (CHEMTREC)	800-424-9300 (US) 703-527-3887 (International)
Website	www.crcindustries.com

2. Hazard(s) identification

Physical hazards	Flammable aerosols	Category 1
	Gases under pressure	Liquefied gas
Health hazards	Not classified.	
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	Extremely flammable aerosol. Contains gas under pressure; may explode if heated.
Precautionary statement	
Prevention	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Do not spray on an open flame or other ignition source. Pressurized container: Do not pierce or burn, even after use. Do not apply while equipment is energized. Extinguish all flames, pilot lights and heaters. Vapors will accumulate readily and may ignite. Use only with adequate ventilation; maintain ventilation during use and until all vapors are gone. Open doors and windows or use other means to ensure a fresh air supply during use and while product is drying. Avoid release to the environment.
Response	Wash hands after handling.
Storage	Store in a well-ventilated place. Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Exposure to high temperature may cause can to burst.
Disposal	Dispose of contents/container in accordance with local/regional/national regulations.
Hazard(s) not otherwise classified (HNOC)	None known.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
distillates (petroleum), hydrotreated heavy naphthenic		64742-52-5	30 - 40
liquefied petroleum gas		68476-86-8	20 - 30
calcium carbonate		1317-65-3	5 - 10
residual oils (petroleum), hydrotreated		64742-57-0	5 - 10
talc (not containing asbestos fibers)		14807-96-6	5 - 10
aluminium, benzoate fatty acids (C=16-18) hydroxy complexes		82980-54-9	3 - 5
copper		7440-50-8	3 - 5

Specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation
Move to fresh air. If not breathing, give artificial respiration. Call a physician if symptoms develop or persist.

Skin contact
Wash off immediately with plenty of water. Take off contaminated clothing and wash before reuse. Get medical attention if irritation develops and persists.

Eye contact
Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Ingestion
Do not induce vomiting. Call a physician immediately. Never give anything by mouth to a victim who is unconscious or is having convulsions.

Most important symptoms/effects, acute and delayed
Direct contact with eyes may cause temporary irritation.

Indication of immediate medical attention and special treatment needed
Provide general supportive measures and treat symptomatically.

General information
Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media
Water fog. Dry chemical powder. Carbon dioxide (CO2).

Unsuitable extinguishing media
Do not use a solid water stream as it may scatter and spread fire.

Specific hazards arising from the chemical
Contents under pressure. Pressurized container may rupture when exposed to heat or flame. During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters
Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

Fire-fighting equipment/instructions
In case of fire: Stop leak if safe to do so. Move containers from fire area if you can do so without risk. Containers should be cooled with water to prevent vapor pressure build up.

General fire hazards
Extremely flammable aerosol. Contents under pressure. Pressurized container may rupture when exposed to heat or flame.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures
Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Wear appropriate protective equipment and clothing during clean-up. Emergency personnel need self-contained breathing equipment. Vapors are heavier than air and may spread along floors. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. This product is miscible in water. Prevent product from entering drains. Stop the flow of material, if this is without risk. Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Pressurized container: Do not pierce or burn, even after use. Do not use if spray button is missing or defective. Do not spray on a naked flame or any other incandescent material. Do not smoke while using or until sprayed surface is thoroughly dry. Do not cut, weld, solder, drill, grind, or expose containers to heat, flame, sparks, or other sources of ignition. Use caution around energized equipment. The metal container will conduct electricity if it contacts a live source. This may result in injury to the user from electrical shock and/or flash fire. Avoid contact with eyes, skin, and clothing. Use only in well-ventilated areas. Wear appropriate personal protective equipment. Avoid release to the environment. Observe good industrial hygiene practices. For product usage instructions, please see the product label.
Conditions for safe storage, including any incompatibilities	Level 1 Aerosol. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50°C/122 °F. Do not puncture, incinerate or crush. Do not handle or store near an open flame, heat or other sources of ignition. This material can accumulate static charge which may cause spark and become an ignition source. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
calcium carbonate (CAS 1317-65-3)	PEL	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
copper (CAS 7440-50-8)	PEL	1 mg/m3	Dust and mist.
		0.1 mg/m3	Fume.
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)	PEL	5 mg/m3	Mist.
		2000 mg/m3 500 ppm	
residual oils (petroleum), hydrotreated (CAS 64742-57-0)	PEL	5 mg/m3	Mist.

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
talc (not containing asbestos fibers) (CAS 14807-96-6)	TWA	0.3 mg/m3	Total dust.
		0.1 mg/m3	Respirable.
		20 mppcf	
		2.4 mppcf	Respirable.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
copper (CAS 7440-50-8)	TWA	1 mg/m3	Dust and mist.
		0.2 mg/m3	Fume.
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)	TWA	5 mg/m3	Inhalable fraction.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
residual oils (petroleum), hydrotreated (CAS 64742-57-0)	TWA	5 mg/m3	Inhalable fraction.
talc (not containing asbestos fibers) (CAS 14807-96-6)	TWA	2 mg/m3	Respirable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
calcium carbonate (CAS 1317-65-3)	TWA	5 mg/m3	Respirable.
		10 mg/m3	Total
copper (CAS 7440-50-8)	TWA	1 mg/m3	Dust and mist.
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)	Ceiling	1800 mg/m3	
	STEL	10 mg/m3	Mist.
	TWA	5 mg/m3	Mist.
residual oils (petroleum), hydrotreated (CAS 64742-57-0)	STEL	10 mg/m3	Mist.
	TWA	5 mg/m3	Mist.
talc (not containing asbestos fibers) (CAS 14807-96-6)	TWA	2 mg/m3	Respirable.

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines Occupational Exposure Limits are not relevant to the current physical form of the product.

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Wear protective gloves such as: Nitrile. Polyvinyl chloride (PVC).

Other Wear suitable protective clothing.

Respiratory protection If engineering controls are not feasible or if exposure exceeds the applicable exposure limits, use a NIOSH-approved cartridge respirator with an organic vapor cartridge. Use a self-contained breathing apparatus in confined spaces and for emergencies. Air monitoring is needed to determine actual employee exposure levels.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations When using do not smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Aerosol.

Color Copper.

Odor Solvent.

Odor threshold Not available.

pH Not available.

Melting point/freezing point Not available.

Initial boiling point and boiling range 680 °F (360 °C) estimated

Flash point	> 429.8 °F (> 221 °C)
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Vapor pressure	3249.3 hPa estimated
Vapor density	Not available.
Relative density	1.06
Solubility (water)	Negligible.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	500 °F (260 °C) estimated
Decomposition temperature	Not available.
Viscosity (kinematic)	Not available.
Percent volatile	68 % estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Heat, flames and sparks. Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong acids. Strong bases. Strong oxidizing agents.
Hazardous decomposition products	Carbon oxides.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Prolonged or excessive inhalation may cause respiratory tract irritation.
Skin contact	Prolonged skin contact may cause temporary irritation.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Health injuries are not known or expected under normal use.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity

Product	Species	Test Results
Copper Anti-Seize & Lubricating Compound		
Acute		
Dermal		
LD50	Rabbit	9949 mg/kg calculated
Inhalation		
Mist		
LC50	Rat	72.4 mg/l, 4 hours calculated
Oral		
LD50	Rat	5309 mg/kg calculated

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

residual oils (petroleum), hydrotreated (CAS 64742-57-0) 3 Not classifiable as to carcinogenicity to humans.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Based on available data, the classification criteria are not met.
Chronic effects	Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity Very toxic to aquatic life with long lasting effects.

Components		Species	Test Results
copper (CAS 7440-50-8)			
Aquatic			
Acute			
Crustacea	EC50	Water flea (Daphnia magna)	0.03 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	0.052 mg/l, 96 hours
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	1000 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	5000 mg/l, 96 hours
talc (not containing asbestos fibers) (CAS 14807-96-6)			
Aquatic			
Acute			
Fish	LC50	Zebra danio (Danio rerio)	> 100 g/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal of waste from residues / unused products	This product is not a RCRA hazardous waste (See 40 CFR Part 261.20 – 261.33). Empty containers may be recycled. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Contents under pressure. Do not puncture, incinerate or crush. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose in accordance with all applicable regulations.
Hazardous waste code	Not regulated.

Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN1950
UN proper shipping name	Aerosols, flammable, Limited Quantity
Transport hazard class(es)	
Class	2.1
Subsidiary risk	-
Label(s)	2.1
Packing group	Not applicable.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	N82
Packaging exceptions	306
Packaging non bulk	None
Packaging bulk	None

IATA

UN number	UN1950
UN proper shipping name	Aerosols, flammable, Limited Quantity
Transport hazard class(es)	
Class	2.1
Subsidiary risk	-
Packing group	Not applicable.
ERG Code	10L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed with restrictions.
Cargo aircraft only	Allowed with restrictions.

IMDG

UN number	UN1950
UN proper shipping name	AEROSOLS, LIMITED QUANTITY
Transport hazard class(es)	
Class	2
Subsidiary risk	-
Packing group	Not applicable.
Environmental hazards	
Marine pollutant	No.
EmS	Not available.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

copper (CAS 7440-50-8)

CERCLA Hazardous Substance List (40 CFR 302.4)

copper (CAS 7440-50-8) Listed.

CERCLA Hazardous Substances: Reportable quantity

copper (CAS 7440-50-8) 5000 LBS

Spills or releases resulting in the loss of any ingredient at or above its RQ require immediate notification to the National Response Center (800-424-8802) and to your Local Emergency Planning Committee.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

Food and Drug Administration (FDA) Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Section 311/312 Hazard categories Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - Yes
Pressure Hazard - Yes
Reactivity Hazard - No

SARA 302 Extremely hazardous substance No

US state regulations

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

copper (CAS 7440-50-8)
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)
liquefied petroleum gas (CAS 68476-86-8)
residual oils (petroleum), hydrotreated (CAS 64742-57-0)
talc (not containing asbestos fibers) (CAS 14807-96-6)

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. Massachusetts RTK - Substance List

calcium carbonate (CAS 1317-65-3)
copper (CAS 7440-50-8)
residual oils (petroleum), hydrotreated (CAS 64742-57-0)
talc (not containing asbestos fibers) (CAS 14807-96-6)

US. New Jersey Worker and Community Right-to-Know Act

calcium carbonate (CAS 1317-65-3)
talc (not containing asbestos fibers) (CAS 14807-96-6)
copper (CAS 7440-50-8)

US. Rhode Island RTK

copper (CAS 7440-50-8)

US. Pennsylvania Worker and Community Right-to-Know Law

copper (CAS 7440-50-8)
calcium carbonate (CAS 1317-65-3)
residual oils (petroleum), hydrotreated (CAS 64742-57-0)
talc (not containing asbestos fibers) (CAS 14807-96-6)

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

Volatile organic compounds (VOC) regulations

EPA

VOC content (40 CFR 51.100(s)) 28.1 %

Consumer products (40 CFR 59, Subpt. C) Not regulated

State

Consumer products This product is regulated as an Anti-seize Lubricant (aerosol). This product is compliant for use in all 50 states.

VOC content (CA) 28.1 %

VOC content (OTC) 28.1 %

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 04-21-2015

Revision date 07-19-2016

Prepared by Allison Cho

Version # 03

Further information Not available.

HMIS® ratings
Health: 2
Flammability: 3
Physical hazard: 0
Personal protection: B

NFPA ratings
Health: 2
Flammability: 3
Instability: 0

NFPA ratings

Disclaimer The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. This information is accurate to the best of CRC Industries' knowledge or obtained from sources believed by CRC to be accurate. Before using any product, read all warnings and directions on the label. For further clarification of any information contained on this (M)SDS consult your supervisor, a health & safety professional, or CRC Industries.

Revision Information This document has undergone significant changes and should be reviewed in its entirety.

OFF!® DEEP WOODS® INSECT REPELLENT - DRY (REG. NO. 30097 P.C.P. ACT)

Version *2.1* Print Date 10/06/2014

Revision Date 09/29/2014 MSDS Number 350000015104

1. PRODUCT AND COMPANY IDENTIFICATION

Product information

Trade name	:	OFF! DEEP WOODS DRY INSECT REPELLENT - AEROSOL
Use of the Substance/Mixture	:	Insect Repellent
Company	:	S.C. Johnson and Son, Limited 1 Webster Street Brantford ON N3T 5R1
Emergency telephone number	:	24 Hour Transport & Medical Emergency Phone (866) 231-5406 24 Hour International Emergency Phone (952) 852-4647 24 Hour Canadian Transport Emergency Phone (CANUTEC) (613) 996-6666

2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance / Odor	:	white / aerosol / pleasant
Immediate Concerns	:	Warning FLAMMABLE: CAUSES EYE IRRITATION. Keep away from heat, sparks and flame. Harmful if swallowed. Contents under pressure. Do not puncture or incinerate. Do not store at temperatures above 120 Deg. F (50 Deg C), as container may burst. Avoid contact with eyes and lips.

Potential Health Effects

Exposure routes	:	Eye, Skin, Inhalation, Ingestion.
Eyes	:	Causes: Moderate eye irritation
Skin	:	May cause skin reactions in rare cases.
Inhalation	:	May cause nose, throat, and lung irritation. Inhalation may cause central nervous system effects.
Ingestion	:	Causes headache, drowsiness or other effects to the central nervous system. Harmful if swallowed.

Aggravated Medical Condition	:	Do not apply to cuts or irritated skin. Individuals with chronic respiratory disorders such as asthma, chronic bronchitis, emphysema, etc. may be more susceptible to irritating effects

3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous chemicals present at or above reportable levels as defined by OSHA 29 CFR 1910.1200 or the Canadian Controlled Products Regulations are listed in this table:

Chemical Name	CAS-No.	Weight percent
N,N-Diethyl-m-toluamide	134-62-3	10.00 - 30.00
Ethyl alcohol	64-17-5	10.00 - 30.00
Butane	106-97-8	10.00 - 30.00
Corn starch	9005-25-8	10.00 - 30.00
Propane	74-98-6	5.00 - 10.00
Isobutane	75-28-5	5.00 - 10.00
Magnesium carbonate	546-93-0	1.00 - 5.00

For additional information on product ingredients, see www.whatsinsidescjohnson.com.

4. FIRST AID MEASURES

Eye contact	:	Remove contact lenses. Flush immediately with plenty of water for at least 15 to 20 minutes. Get medical attention if irritation develops and persists.
Skin contact	:	Wash off immediately with plenty of water. Get medical attention if irritation develops and persists. If you suspect a reaction to this product, discontinue use and remove contaminated clothing.
Inhalation	:	Remove to fresh air. If breathing is affected, get medical attention.
Ingestion	:	If swallowed, DO NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Specific hazards during	:	Aerosol Product - Containers may rocket or explode in heat of

firefighting		fire. Do not allow run-off from fire fighting to enter drains or water courses. Burns with colourless flame.
Further information	:	Fight fire from maximum distance or protected area. Cool and use caution when approaching or handling fire-exposed containers. For large quantities of flammable liquids, consider containment to prevent the spread of fire. Wear full protective clothing and positive pressure self-contained breathing apparatus. In case of fire and/or explosion do not breathe fumes.
Flash point	:	< -7 °C < 19.4 °F Note: Propellant
Lower explosion limit	:	Note: No data available
Upper explosion limit	:	Note: No data available
NFPA Classification	:	NFPA Level 2 Aerosol

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Remove all sources of ignition. Wear personal protective equipment.
Environmental precautions	:	Do not flush into surface water or sanitary sewer system. Use appropriate containment to avoid environmental contamination. Outside of normal use, avoid release to the environment.
Methods for cleaning up	:	If damage occurs to aerosol can: Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13). Use only non-sparking equipment. Dike large spills. Clean residue from spill site.

7. HANDLING AND STORAGE

Handling

Advice on safe handling	:	Do not puncture or incinerate. Avoid contact with eyes and lips. Avoid breathing vapours, mist or gas. For personal protection see section 8. Do not spray toward face. Do not use in areas without adequate ventilation.

Use only as directed.
KEEP OUT OF REACH OF CHILDREN AND PETS.
Smoking, eating and drinking should be prohibited in the application area.

Advice on protection against fire and explosion : Keep away from heat and sources of ignition.
Take measures to prevent the build up of electrostatic charge.

Storage

Requirements for storage areas and containers : Do not store at temperatures above 120 Deg. F (50 Deg C), as container may burst.
Keep away from food, drink and animal feedingstuffs.
Keep in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits

Components	CAS-No.	mg/m3	ppm	Non-standard units	Basis
Ethyl alcohol	64-17-5	-	1,000 ppm	-	ACGIH STEL
Butane	106-97-8	-	1,000 ppm	-	ACGIH STEL
Butane	106-97-8	-	1,000 ppm	-	ACGIH STEL
Corn starch	9005-25-8	10 mg/m3	-	-	ACGIH TWA
Propane	74-98-6	-	1,000 ppm	-	ACGIH TWA
Isobutane	75-28-5	-	1,000 ppm	-	ACGIH STEL

Personal protective equipment

Respiratory protection Use only with adequate ventilation.
Do not spray in enclosed areas.

Hand protection : No special requirements.

Eye protection Safety glasses with side-shields

Skin and body protection	:	No special requirements.
Hygiene measures	:	Handle in accordance with good industrial hygiene and safety practice. Wash thoroughly after handling. Smoking, eating and drinking should be prohibited in the application area.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form	:	aerosol
Color	:	white
Odor	:	pleasant
pH	:	10.3 (as aqueous solution)
Boiling point	:	No data available
Freezing point	:	No data available
Flash point	:	< -7 °C < 19.4 °F Propellant
Evaporation rate	:	No data available
Flammability (solid, gas)	:	Sustains combustion
Auto-ignition temperature	:	No data available
Lower explosion limit	:	No data available
Upper explosion limit	:	No data available
Vapour pressure	:	No data available
Density	:	0.82 g/cm3
Water solubility	:	dispersible
Viscosity, dynamic	:	No data available
Volatile Organic Compounds Total VOC (wt. %)*	:	52.6 % - additional exemptions may apply *as defined by US Federal and State Consumer Product Regulations

10. STABILITY AND REACTIVITY

Conditions to avoid	:	Heat, flames and sparks.
Materials to avoid	:	Strong oxidizing agents Do not mix with bleach or any other household cleaners. Strong bases
Hazardous decomposition products	:	Thermal decomposition can lead to release of irritating gases and vapours.
Hazardous reactions	:	If accidental mixing occurs and toxic gas is formed, exit area immediately. Do not return until well ventilated.

11. TOXICOLOGICAL INFORMATION

Acute oral toxicity	:	LD50 estimated Male: > 5,000 mg/kg Female: >3,735 mg/kg
Acute inhalation toxicity	:	LC50 estimated > 2.79 mg/l
Acute dermal toxicity	:	LD50 estimated > 2,000 mg/kg

Chronic effects

Carcinogenicity	:	None Anticipated
Mutagenicity	:	None Anticipated
Reproductive effects	:	None Anticipated
Teratogenicity	:	None Anticipated
Sensitisation	:	No data available

12. ECOLOGICAL INFORMATION

Ecotoxicity effects : No data available

13. DISPOSAL CONSIDERATIONS

PESTICIDAL WASTE:
Observe all applicable Federal, Provincial and State regulations and Local/Municipal ordinances regarding disposal.
Consumer may discard empty container in trash, or recycle where facilities exist.

14. TRANSPORT INFORMATION

Land transport

- **U.S. DOT and Canadian TDG Surface Transportation:**

Proper shipping name	AEROSOLS, Flammable, 2.1
Class:	2.1
UN number	1950
Packaging group:	None.
Note:	Limited quantities derogation may be applicable to this product, please check transport documents.

Sea transport

- *IMDG:*

Proper shipping name	AEROSOLS, Flammable, 2.1
Class:	2
UN number:	1950
Packaging group:	None.
EmS:	F-D, S-U
Note:	Limited quantities derogation may be applicable to this product, please check transport documents.

Air transport

- *ICAO/IATA:*

Proper shipping name	AEROSOLS, Flammable, 2.1
Class:	2.1
UN/ID No.:	UN 1950
Packaging group:	None.
Note:	SC Johnson typically does not ship products via air. Refer to IATA/ICAO Dangerous Goods Regulations for detailed instructions when shipping this item by air.

15. REGULATORY INFORMATION

Notification status	:	All ingredients of this product are listed or are excluded from listing on the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.
Notification status	:	All ingredients of this product comply with the New Substances Notification requirements under the Canadian Environmental Protection Act (CEPA).
California Prop. 65	:	This product is not subject to the reporting requirements under California's Proposition 65.
Canada Regulations	:	This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

16. OTHER INFORMATION

HMIS Ratings

Health	2
Flammability	4
Reactivity	0

NFPA Ratings

Health	2
Fire	4
Reactivity	0
Special	-

This information is being provided in accordance with Occupational Safety and Health Administration (OSHA) and Canada's Workplace Hazard Material Information System (WHMIS) regulations. The information supplied is designed for workplaces where product use and frequency of exposure exceeds that established for the labeled consumer use.

Further information
This document has been prepared using data from sources considered to be technically reliable. It does not constitute a warranty, expressed or implied, as to the accuracy of the information contained herein. Actual conditions of use are beyond the seller's control. User is responsible to evaluate all available information when using product for any particular use and to comply with all Federal, State, Provincial and Local laws and regulations.

Prepared by	SC Johnson Global Safety Assessment &

OFF!® DEEP WOODS® INSECT REPELLENT - DRY (REG. NO. 30097 P.C.P. ACT)

Version *2.1* Print Date 10/06/2014

Revision Date 09/29/2014 MSDS Number 350000015104

	Regulatory Affairs (GSARA)

Brenntag Canada Inc.

BRENNTAG

MATERIAL SAFETY DATA SHEET

DIESEL EXHAUST FLUID

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Brenntag Canada Inc.
43 Jutland Rd.
Toronto, ON
M8Z 2G6
(416) 259-8231

Website: http://www.brenntag.ca

WHMIS#: 00070093
Index: HCI9233/14D
Effective Date: 2014 November 10
Date of Revision: 2014 November 10

EMERGENCY TELEPHONE NUMBER (For Emergencies Involving Chemical Spills or Releases)

1 855 273 6824

PRODUCT IDENTIFICATION

Product Name:	Diesel Exhaust Fluid.
Chemical Name:	Not available.
Synonyms:	Diesel Exhaust Fluid, Ultrapure DEF, DEF, AC DELCO DEF.
Chemical Family:	Not available.
Molecular Formula:	Not available.
Product Use:	Not available.

WHMIS Classification / Symbol:

D-2B: Toxic (skin and eye irritant)

READ THE ENTIRE MSDS FOR THE COMPLETE HAZARD EVALUATION OF THIS PRODUCT.

2. COMPOSITION, INFORMATION ON INGREDIENTS (Not Intended As Specifications)

Ingredient	*CAS#*	*ACGIH TLV (TWA)*	*% Concentration*
Urea	57-13-6	---	30 - 60

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:	Can decompose at high temperatures forming toxic gases. Contents may develop pressure on prolonged exposure to heat. See "Other Health Effects" Section.
POTENTIAL HEALTH EFFECTS	
Inhalation:	Prolonged or repeated overexposure to mists may cause mild respiratory irritation. Excessive contact with mist or spray may cause irritation of mucous membranes, coughing and difficulty in breathing. See "Other Health Effects" Section.
Skin Contact:	Skin contact can cause irritation, especially under the finger nails (and other confined spaces such as under rings or watch bands). May cause defatting, drying and cracking of the skin. Prolonged and repeated contact may lead to dermatitis.
Skin Absorption:	Not likely to be absorbed through the skin.
Eye Contact:	Causes eye irritation. Burns can occur if not promptly removed.
Ingestion:	This product causes irritation, a burning sensation of the mouth and throat and abdominal pain.

Other Health Effects:	Effects (irritancy) on the skin and eyes may be delayed, and damage may occur without the sensation or onset of pain. Strict adherence to first aid measures following any exposure is essential. Solutions are corrosive to most metals. Urea forms corrosive solutions when dissolved in water. High blood concentration of urea increases the risk of glaucoma. May induce osmotic diuresis. Osmotic diuresis is a condition caused by a high concentration of osmotically active substances in the renal tubules (Urea, Sodium Sulphate), which limit the reabsorption of water. (8) May cause central nervous system (CNS) depression. CNS depression is characterized by headache, dizziness, drowsiness, nausea, vomiting and incoordination. Severe overexposures may lead to coma and possible death due to respiratory failure. Anecdotal evidence has shown that the development of first and second degree burns to skin may result from delayed implementation of first aid measures, especially if the liquid material is held in close contact with the skin by contaminated clothing for prolonged periods of time. (6) See Section 11, "Other Studies Relevant to Material".

4. FIRST AID MEASURES

FIRST AID PROCEDURES

Inhalation:	If respiratory problems arise, move the victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Skin Contact:	Flush skin with running water for a minimum of 20 minutes. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY.
Eye Contact:	Immediately flush eyes with running water for a minimum of 20 minutes. Hold eyelids open during flushing. Take care not to rinse contaminated water into the unaffected eye or onto the face. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY.
Ingestion:	Do not attempt to give anything by mouth to an unconscious person. If victim is alert and not convulsing, rinse mouth out and give 1/2 to 1 glass of water to dilute material. DO NOT induce vomiting. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water. Obtain medical attention IMMEDIATELY.
Note to Physicians:	This product contains materials that may cause severe pneumonitis if aspirated. If ingestion has occurred less than 2 hours earlier, carry out careful gastric lavage; use endotracheal cuff if available, to prevent aspiration. Observe patient for respiratory difficulty from aspiration pneumonitis. Give artificial resuscitation and appropriate chemotherapy if respiration is depressed. Medical conditions that may be aggravated by exposure to this product include diseases of the skin, eyes or respiratory tract.

5. FIRE-FIGHTING MEASURES

Flashpoint (°C)	***AutoIgnition Temperature (°C)***	**Flammability Limits in Air (%):** ***LEL***	***UEL***
Non-combustible (does not burn).	Not applicable.	Not applicable.	Not applicable.

Flammability Class (WHMIS):	Not regulated.
Hazardous Combustion Products:	Thermal decomposition products are toxic and may include Ammonia, cyanuric acid, biuret, cyanic acid, oxides of carbon, nitrogen and irritating gases.
Unusual Fire or Explosion Hazards:	Closed containers exposed to heat may burst. Spilled material may cause floors and contact surfaces to become slippery. Urea: Hypochlorites may react with primary amines to form nitrogen trichloride which explodes spontaneously in air.
Sensitivity to Mechanical Impact:	Not expected to be sensitive to mechanical impact.
Rate of Burning:	Not available.
Explosive Power:	Not available.
Sensitivity to Static Discharge:	Not expected to be sensitive to static discharge.

EXTINGUISHING MEDIA

Fire Extinguishing Media:	Use media appropriate for surrounding fire and/or materials.
FIRE FIGHTING INSTRUCTIONS	
Instructions to the Fire Fighters:	Isolate materials that are not involved in the fire and protect personnel. Cool containers with flooding quantities of water until well after the fire is out. Spilled material may cause floors and contact surfaces to become slippery.
Fire Fighting Protective Equipment:	Use self-contained breathing apparatus and protective clothing.

6. ACCIDENTAL RELEASE MEASURES

Information in this section is for responding to spills, leaks or releases in order to prevent or minimize the adverse effects on persons, property and the environment. There may be specific reporting requirements associated with spills, leaks or releases, which change from region to region.

Containment and Clean-Up Procedures:	In all cases of leak or spill contact vendor at Emergency Number shown on the front page of this MSDS. Wear protective clothing. Recover spilled material on non-combustible absorbents, such as sand or vermiculite, and place in covered containers for disposal. Collect product for recovery or disposal. For release to land, or storm water runoff, contain discharge by constructing dikes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Ventilate enclosed spaces. Notify applicable government authority if release is reportable or could adversely affect the environment. Spilled material may cause floors and contact surfaces to become slippery.

7. HANDLING AND STORAGE

HANDLING	
Handling Practices:	Use normal "good" industrial hygiene and housekeeping practices. Containers exposed to heat may be under internal pressure. These should be cooled and carefully vented before opening. A face shield and apron should be worn. Vent container frequently, and more often in warm weather, to relieve pressure.
Ventilation Requirements:	See Section 8, "Engineering Controls".
Other Precautions:	Use only with adequate ventilation and avoid breathing aerosols (vapours or mists). Avoid contact with eyes, skin or clothing. Wash thoroughly with soap and water after handling. Wash contaminated clothing thoroughly before re-use.
STORAGE	
Storage Temperature (°C):	See below.
Ventilation Requirements:	General exhaust is acceptable.
Storage Requirements:	Store in a cool, well-ventilated area. Keep away from heat, sparks and flames. Keep containers closed. Do not expose sealed containers to temperatures above 40° C.
Special Materials to be Used for Packaging or Containers:	Confirm suitability of any material before using.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Recommendations listed in this section indicate the type of equipment, which will provide protection against overexposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

ENGINEERING CONTROLS	
Engineering Controls:	General exhaust is acceptable. Local exhaust ventilation preferred. Make up air should be supplied to balance air that is removed by local or general exhaust ventilation. Ventilate low lying areas such as sumps or pits where dense vapours may collect.
PERSONAL PROTECTIVE EQUIPMENT (PPE)	
Eye Protection:	Safety glasses with side shields are recommended to prevent eye contact. Use full face-shield or chemical safety goggles when there is potential for contact. Contact lenses should not be worn when working with this material.
Skin Protection:	Gloves and protective clothing made from butyl rubber, natural rubber, nitrile rubber or PVC should be impervious under conditions of use. Do not use gloves or protective clothing made from leather. Prior to use, user should confirm impermeability. Discard contaminated gloves.

Respiratory Protection:	No specific guidelines available. Respiratory protection should not be necessary unless a mist is created. A NIOSH/MSHA-approved air-purifying respirator equipped with organic vapour cartridges for concentrations up to 1 000 ppm organic vapours. Use an air-supplied respirator if concentrations are high or unknown. If while wearing a respiratory protection, you can smell, taste or otherwise detect anything unusual, or in the case of a full facepiece respirator you experience eye irritation, leave the area immediately. Check to make sure the respirator to face seal is still good. If it is, replace the filter, cartridge or canister. If the seal is no longer good, you may need a new respirator. (6)
Other Personal Protective Equipment:	Wear regular work clothing. The use of coveralls is recommended. Locate safety shower and eyewash station close to chemical handling area. Take all precautions to avoid personal contact.

EXPOSURE GUIDELINES

None established for this product.

9. PHYSICAL AND CHEMICAL PROPERTIES (Not intended as Specifications)

Physical State:	Liquid.
Appearance:	Colourless to slightly hazy liquid.
Odour:	Ammonia odour.
Odour Threshold (ppm):	Not available.
Boiling Range (°C):	104 - 106 (3)
Melting/Freezing Point (°C):	Not available.
Vapour Pressure (mm Hg at 20° C):	Not available.
Vapour Density (Air = 1.0):	Not available.
Relative Density (g/cc):	1.08 - 1.14 (3)
Bulk Density:	Not available.
Viscosity:	Not available.
Evaporation Rate (Butyl Acetate = 1.0):	Not available.
Solubility:	100%
% Volatile by Volume:	Not available.
pH:	9.8 - 10 (3)
Coefficient of Water/Oil Distribution:	Not available.
Volatile Organic Compounds (VOC):	Not available.
Flashpoint (°C):	Non-combustible (does not burn).

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY

Under Normal Conditions:	Stable.
Under Fire Conditions:	Not flammable.
Hazardous Polymerization:	Will not occur.
Conditions to Avoid:	High temperatures, sparks, open flames and all other sources of ignition. Do not evaporate to dryness.
Materials to Avoid:	Strong oxidizers. Reducing agents. Hypochlorites. Halogens. Acids. Alkalies. Acrylonitrile-Butadiene-Styrene. Polyethylene. Iron and its alloys. Copper and its alloys. Aluminum and its alloys. Zinc and its alloys. Mild steel. Sodium Nitrite. Potassium Nitrite. Chromyl Chloride. Nitrosyl Perchlorate. Gallium Perchlorate. Titanium Tetrachloride. Sodium Hypochlorite, Calcium Hypochlorite or Phosphorus Pentachloride reacts with urea to form nitrogen trichloride which explodes spontaneously in air. (4)
Decomposition or Combustion Products:	Thermal decomposition products are toxic and may include Ammonia, cyanuric acid, biuret, cyanic acid, oxides of carbon, nitrogen and irritating gases.

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL DATA:

SUBSTANCE	***LD50 (Oral, Rat)***	***LD50 (Dermal, Rabbit)***	***LC50 (Inhalation, Rat, 4h)***
Urea	8 471 - 14 300 mg/kg (1,3)	---	---

Carcinogenicity Data:	The ingredient(s) of this product is (are) not classed as carcinogenic by ACGIH, IARC, OSHA or NTP.
Reproductive Data:	No adverse reproductive effects are anticipated.
Mutagenicity Data:	No adverse mutagenic effects are anticipated.
Teratogenicity Data:	No adverse teratogenic effects are anticipated.
Respiratory / Skin Sensitization Data:	None known.
Synergistic Materials:	Application of urea to guinea pig skin increased a subsequent sensitization reaction to epoxy resins. (4)
Other Studies Relevant to Material:	Urea: Application of a saturated urea solution to rabbit eyes caused the loss of corneal epithelium after 5 minutes, with slow regeneration. Application of a 10 % solution to human eyes, several times a day, for one year caused no irritation or discomfort. (4) Male and female rats were administered a 0.45 %, 0.9 % or 4.5 % (approximately 225, 450 or 2,250 mg/Kg/day) urea in the diet with no adverse effects. (4) Bacterial reverse mutation assay- Negative ; Chinese Hamster -Chromosomal aberration test - Positive (very high dose); Mouse -positive (very high dose). (3) No toxic effects on mouse gonads up to 6,750-mg/kg day. No toxic effects on rat gonads up to 2,250-mg/kg day. (3)

12. ECOLOGICAL INFORMATION

Ecotoxicity:	Will slowly release ammonia and degrade to nitrate. Ammonia is toxic to fish. However, ammonia release is slow making urea much less toxic than ammonium salts. Non-persistent and non-cumulative when applied using normal agricultural practices. The product itself and its products of degradation are not harmful under normal conditions of careful and responsible use. Urea will promote algae growth and may degrade the quality and taste of water. (3) Urea: 96-hour LC50 (Barillius barna) > 9 100 mg/L. (3) 48-hour EC50 (Daphnia magna) 3 910 mg/L. (3)
Environmental Fate:	Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers. Urea: When released to soil, Urea will hydrolyze into ammonium in a matter of days to several weeks. When released into the soil, Urea may leach into groundwater. When released into water, Urea may biodegrade to a moderate extent. When released into water, Urea is not expected to evaporate significantly. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. Urea is not expected to significantly bioaccumulate. When released into the air, Urea is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, Urea is expected to have a half-life of less than 1 day. (3)

13. DISPOSAL CONSIDERATIONS

Deactivating Chemicals:	None required.
Waste Disposal Methods:	This information applies to the material as manufactured. Reevaluation of the product may be required by the user at the time of disposal since the product uses, transformations, mixtures and processes may influence waste classification. Dispose of waste material at an approved (hazardous) waste treatment/disposal facility in accordance with applicable local, provincial and federal regulations. Do not dispose of waste with normal garbage, or to sewer systems.
Safe Handling of Residues:	See "Waste Disposal Methods".
Disposal of Packaging:	Empty containers retain product residue. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. Do not dispose of package until thoroughly washed out.

14. TRANSPORTATION INFORMATION

CANADIAN TDG ACT SHIPPING DESCRIPTION:

This product is not regulated by TDG.

Label(s): Not applicable. Placard: Not applicable.

ERAP Index: -----. Exemptions: None known.

This product is transported warm (25 to 35 Degrees Celsius). Storage and shipping requires insulated tanks and tank cars to prevent crystallization of urea.

US DOT CLASSIFICATION (49CFR 172.101, 172.102):

This product is not regulated by DOT.

Label(s): Not applicable. Placard: Not applicable.

CERCLA-RQ: Not available. Exemptions: None known.

This product is transported warm (25 to 35 Degrees Celsius). Storage and shipping requires insulated tanks and tank cars to prevent crystallization of urea.

15. REGULATORY INFORMATION

CANADA

CEPA - NSNR: All components of this product are included on the DSL.

CEPA - NPRI: Not included.

Controlled Products Regulations Classification (WHMIS):

D-2B: Toxic (skin and eye irritant)

USA

Environmental Protection Act: All components of this product are included on the TSCA inventory.

OSHA HCS (29CFR 1910.1200): Not regulated.

NFPA: 2 Health, 0 Fire, 0 Reactivity (3)

HMIS: 2 Health, 0 Fire, 0 Reactivity (3)

INTERNATIONAL

Urea is found on the following inventories: EINECS (European Inventory of Existing Commercial Chemical Substances).

16. OTHER INFORMATION

REFERENCES

1. RTECS-Registry of Toxic Effects of Chemical Substances, Canadian Centre for Occupational Health and Safety RTECS database.
2. Clayton, G.D. and Clayton, F.E., Eds., Patty's Industrial Hygiene and Toxicology, 3rd ed., Vol. IIA,B,C, John Wiley and Sons, New York, 1981.
3. Supplier's Material Safety Data Sheet(s).
4. CHEMINFO chemical profile, Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada.
5. Guide to Occupational Exposure Values, 2011, American Conference of Governmental Industrial Hygienists, Cincinnati, 2011.
6. Regulatory Affairs Group, Brenntag Canada Inc.
7. The British Columbia Drug and Poison Information Centre, Poison Managements Manual, Canadian Pharmaceutical Association, Ottawa, 1981.

The information contained herein is offered only as a guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Brenntag Canada Inc. will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein. This Material Safety Data Sheet is valid for three years.

To obtain revised copies of this or other Material Safety Data Sheets, contact your nearest Brenntag Canada Regional office.

British Columbia: 20333-102B Avenue, Langley, BC, V1M 3H1
Phone: (604) 513-9009 Facsimile: (604) 513-9010

Alberta: 6628 - 45 th. Street, Leduc, AB, T9E 7C9
Phone: (780) 986-4544 Facsimile: (780) 986-1070

Manitoba: 681 Plinquet Street, Winnipeg, MB, R2J 2X2
Phone: (204) 233-3416 Facsimile: (204) 233-7005

Ontario: 43 Jutland Road, Toronto, ON, M8Z 2G6
Phone: (416) 259-8231 Facsimile: (416) 259-5333

Quebec: 2900 Jean Baptiste Des., Lachine, PQ, H8T 1C8
Phone: (514) 636-9230 Facsimile: (514) 636-0877

Atlantic: A-105 Akerley Boulevard, Dartmouth, NS, B3B 1R7
Phone: (902) 468-9690 Facsimile: (902) 468-3085

Prepared By: Regulatory Affairs Group, Brenntag Canada Inc., (416) 259-8231.

Winter Treat Plus

Safety Data Sheet

according to the Hazard Communication Standard (CFR29 1910.1200) HazCom 2012

Date of issue: 06/01/2015 Revision date: 06/01/2015 Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name : Winter Treat Plus

Product code : 103051, 103052, 103073

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Motor Fuel Additive

1.3. Details of the supplier of the safety data sheet

R.B. Howes & Co., Inc. / Howes Lubricator
60 Ocean State Drive
North Kingstown, RI
T 401-294-5500, 1-800 GET HOWES (438-4693)

1.4. Emergency telephone number

Emergency number : CHEMTREC 1 (800) 424-9300

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Flammable Liquid 3

Skin Irritation 2

Eye Irritation 2A

Carcinogenicity 2

Specific target organ toxicity - Repeated exposure 1

Aspiration Toxicity 1

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US) :

GHS02 GHS07 GHS08

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) : Flammable liquid and vapor. Causes skin irritation. Causes serious eye irritation. Suspected of causing cancer. Causes damage to organs through prolonged or repeated exposure. May be fatal if swallowed and enters airways.

Precautionary statements (GHS-US) : Keep away from heat/sparks/open flames/hot surfaces.– No smoking. Keep container tightly closed. Ground/Bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wash hands thoroughly after handling. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves/protective clothing/eye protection/face protection. Do not breathe dust/fume/gas/mist/vapors/spray. Do not eat, drink or smoke when using this product. If exposed or concerned: Get medical advice/attention. If on skin (or hair): Take off immediately all contaminated clothing and wash it before reuse. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. If swallowed: Immediately call a poison center/doctor. Do NOT induce vomiting. Store in a well-ventilated place. Keep cool. Store locked up. Dispose of contents/container in accordance with local/regional/national/international regulations.

2.3. Other hazards

No additional information available.

2.4. Unknown acute toxicity (GHS-US)

34 percent of the mixture consists of ingredient(s) of unknown acute toxicity.

NEXREG

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable.

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Distillates, petroleum, hydrotreated middle	(CAS No) 64742-46-7	15 - 40	Flam. Liq. 4 Acute Tox. 4 (Inhalation) Asp. Tox. 1
Stoddard solvent	(CAS No) 8052-41-3	15 – 40	Skin Irrit. 2 STOT RE 1 Asp. Tox. 1
Petroleum distillates, hydrotreated light	(CAS No) 64742-47-8	10 – 30	Flam. Liq. 3 Asp. Tox. 1
Solvent naphtha, petroleum, light aromatic	(CAS No) 64742-95-6	7 – 13	Flam. Liq. 3 Skin Irrit. 2 Eye Irrit. 2A Asp. Tox. 1
Benzene, 1,2,4-trimethyl-	(CAS No) 95-63-6	7 – 13	Flam. Liq. 3 Acute Tox. 4 (Inhalation) Skin Irrit. 2 Eye Irrit. 2A STOT SE 3
Solvent naphtha, petroleum, heavy aromatic	(CAS No) 64742-94-5	1 – 5	Flam. Liq. 3 Asp. Tox. 1
Fatty acid amine reaction product	Trade secret	1 – 5	Skin Irrit. 2 Eye Irrit. 2A
Xylenes (o-, m-, p- isomers)	(CAS No) 1330-20-7	1 – 5	Flam. Liq. 3 Acute Tox. 4 (Dermal) Acute Tox. 4 (Inhalation) Skin Irrit. 2 Eye Irrit. 2A
1,3,5-Trimethylbenzene	(CAS No) 108-67-8	1 – 5	Flam. Liq. 3 Skin Irrit. 2 Eye Irrit. 2A STOT SE 3 Asp. Tox. 1
1,2,3-Trimethylbenzene	(CAS No) 526-73-8	1 - 5	Flam. Liq. 3 Skin Irrit. 2 Eye Irrit. 2A STOT SE 3
Nonane	(CAS No) 111-84-2	1 – 5	Flam. Liq. 3 Acute Tox. 4 (Inhalation) Skin Irrit. 2 STOT SE 3 Asp. Tox. 1
Naphthalene	(CAS No) 91-20-3	0.5 - 1.5	Acute Tox. 4 (Oral) Carc. 2
Ethylbenzene	(CAS No) 100-41-4	0.1 - 1	Flam. Liq. 2 Acute Tox. 4 (Inhalation) Skin Irrit. 2 Eye Irrit. 2B Carc. 2 Asp. Tox. 1
Cumene	(CAS No) 98-82-8	< 0.1	Flam. Liq. 3 Carc. 2 STOT SE 3 Asp. Tox. 1

* The specific chemical identity and exact percentage (concentration) of composition has been withheld as a trade secret in accordance with paragraph (i) of §1910.1200.

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical advice/attention if you feel unwell.

First-aid measures after skin contact : In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Call a physician if irritation develops and persists.

First-aid measures after eye contact : In case of contact, immediately flush eyes with plenty of water. Remove contact lenses, if worn. If irritation persists, get medical attention.

First-aid measures after ingestion : If swallowed, do NOT induce vomiting. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.

NEXREG

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : May cause respiratory tract irritation. Vapours may cause drowsiness and dizziness.

Symptoms/injuries after skin contact : Causes skin irritation. Symptoms may include redness, edema, drying, defatting and cracking of the skin.

Symptoms/injuries after eye contact : Causes serious eye irritation. Symptoms may include discomfort or pain, excess blinking and tear production, with possible redness and swelling.

Symptoms/injuries after ingestion : May be fatal if swallowed and enters airways. This product may be aspirated into the lungs and cause chemical pneumonitis. May cause stomach distress, nausea or vomiting.

4.3. Indication of any immediate medical attention and special treatment needed

Symptoms may not appear immediately. In case of accident or if you feel unwell, seek medical advice immediately (show the label or SDS where possible).

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Powder, water fog, foam, carbon dioxide.

Unsuitable extinguishing media : Do not use water jet.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Products of combustion may include, and are not limited to: oxides of carbon.

5.3. Advice for firefighters

Protection during firefighting : Keep upwind of fire. Wear full fire fighting turn-out gear (full Bunker gear) and respiratory protection (SCBA). Use water spray to keep fire-exposed containers cool.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Eliminate sources of ignition.

6.2. Methods and material for containment and cleaning up

For containment : Contain and/or absorb spill with inert material (e.g. sand, vermiculite), then place in a suitable container. Do not flush to sewer or allow to enter waterways. Use appropriate Personal Protective Equipment (PPE).

Methods for cleaning up : Scoop up material and place in a disposal container. Spilled material may present a slipping hazard. Provide ventilation.

6.3. Reference to other sections

See section 8 for further information on protective clothing and equipment and section 13 for advice on waste disposal.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Keep away from sources of ignition - No smoking. Avoid contact with skin and eyes. Do not breathe dust/fume/gas/mist/vapors/ spray. Do not swallow. Handle and open container with care. When using do not eat, drink or smoke. Use only outdoors or in a well-ventilated area.

Hygiene measures : Launder contaminated clothing before reuse. Wash hands before eating, drinking, or smoking.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Proper grounding procedures to avoid static electricity should be followed.

Storage conditions : Keep locked up and out of reach of children. Keep container tightly closed and in a well-ventilated place. Keep cool.

7.3. Specific end use(s)

Not available.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Distillates, petroleum, hydrotreated middle (64742-46-7)	
ACGIH	Not applicable
OSHA	Not applicable

Stoddard solvent (8052-41-3)		
ACGIH	ACGIH TWA (ppm)	100 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	2900 mg/m³

NEXREG

Stoddard solvent (8052-41-3)		
OSHA	OSHA PEL (TWA) (ppm)	500 ppm

Petroleum distillates, hydrotreated light (64742-47-8)	
ACGIH	Not applicable
OSHA	Not applicable

Solvent naphtha, petroleum, light aromatic (64742-95-6)	
ACGIH	Not applicable
OSHA	Not applicable

Benzene, 1,2,4-trimethyl- (95-63-6)	
ACGIH	Not applicable
OSHA	Not applicable

Solvent naphtha, petroleum, heavy aromatic (64742-94-5)	
ACGIH	Not applicable
OSHA	Not applicable

Fatty acid amine reaction product	
ACGIH	Not applicable
OSHA	Not applicable

Xylenes (o-, m-, p- isomers) (1330-20-7)		
ACGIH	ACGIH TWA (ppm)	100 ppm
ACGIH	ACGIH STEL (ppm)	150 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	435 mg/m³
OSHA	OSHA PEL (TWA) (ppm)	100 ppm

1,3,5-Trimethylbenzene (108-67-8)		
ACGIH	ACGIH TWA (ppm)	25 ppm
OSHA	Not applicable	

1,2,3-Trimethylbenzene (526-73-8)	
ACGIH	Not applicable
OSHA	Not applicable

Nonane (111-84-2)		
ACGIH	ACGIH TWA (ppm)	200 ppm
OSHA	Not applicable	

Naphthalene (91-20-3)		
ACGIH	ACGIH TWA (ppm)	10 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	50 mg/m³
OSHA	OSHA PEL (TWA) (ppm)	10 ppm

Ethylbenzene (100-41-4)		
ACGIH	ACGIH TWA (ppm)	20 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	435 mg/m³
OSHA	OSHA PEL (TWA) (ppm)	100 ppm

Cumene (98-82-8)		
ACGIH	ACGIH TWA (ppm)	50 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	245 mg/m³

NEXREG

Cumene (98-82-8)		
OSHA	OSHA PEL (TWA) (ppm)	50 ppm

8.2. Exposure controls

Appropriate engineering controls : Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapor, etc.) below recommended exposure limits.

Hand protection : Wear chemically resistant protective gloves.

Eye protection : Wear eye protection.

Skin and body protection : Wear suitable protective clothing.

Respiratory protection : In case of insufficient ventilation, wear suitable respiratory equipment. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Environmental exposure controls : Maintain levels below Community environmental protection thresholds.

Other information : Do not eat, smoke or drink where material is handled, processed or stored. Wash hands carefully before eating or smoking. Handle according to established industrial hygiene and safety practices.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Appearance : No data available

Colour : Light amber

Odour : Distinctive

Odour threshold : No data available

pH : No data available

Melting point : No data available

Freezing point : No data available

Boiling point : No data available

Flash point : 54.4 °C (130 °F)

Relative evaporation rate (butylacetate=1) : No data available

Flammability (solid, gas) : Flammable

Explosive limits : No data available

Explosive properties : No data available

Oxidising properties : No data available

Vapour pressure : < 0.1 mm Hg

Relative density : < 0.9 (H2O = 1)

Relative vapour density at 20 °C : > 1 (air = 1)

Solubility : Insoluble.

Partition coefficient: n-octanol/water : No data available

Log Kow : No data available

Auto-ignition temperature : No data available

Decomposition temperature : No data available

Viscosity : No data available

Viscosity, kinematic : < 20.5 cSt @ 40 °C (104 °F)

Viscosity, dynamic : No data available

9.2. Other information

VOC content : 715 g/l

SECTION 10: Stability and reactivity

10.1. Reactivity

No dangerous reaction known under conditions of normal use.

10.2. Chemical stability

Stable under normal storage conditions.

10.3. Possibility of hazardous reactions

No dangerous reaction known under conditions of normal use.

NEXREG

10.4. Conditions to avoid

Heat. Incompatible materials. Sources of ignition.

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

May include, and are not limited to: oxides of carbon.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified.

Winter Treat Plus	
LD50 oral rat	> 2000 mg/kg
LD50 dermal rat	> 2000 mg/kg
LC50 inhalation rat	Not available.

Distillates, petroleum, hydrotreated middle (64742-46-7)	
LD50 oral rat	> 5000 mg/kg
LD50 dermal rabbit	> 2000 mg/kg
LC50 inhalation rat	4.6 mg/l/4h

Petroleum distillates, hydrotreated light (64742-47-8)	
LD50 oral rat	> 5000 mg/kg
LD50 dermal rabbit	> 2000 mg/kg
LC50 inhalation rat	> 5.2 mg/l/4h

Solvent naphtha, petroleum, light aromatic (64742-95-6)	
LD50 oral rat	8400 mg/kg
LD50 dermal rabbit	> 2000 mg/kg
LC50 inhalation rat	3400 ppm/4h

Benzene, 1,2,4-trimethyl- (95-63-6)	
LD50 oral rat	3280 mg/kg
LD50 dermal rabbit	> 3160 mg/kg
LC50 inhalation rat	18 g/m³/4h

Solvent naphtha, petroleum, heavy aromatic (64742-94-5)	
LD50 oral rat	> 5000 mg/kg
LD50 dermal rabbit	> 2 ml/kg
LC50 inhalation rat	> 5.28 mg/l/4h

Fatty acid amine reaction product	
LD50 oral rat	> 3000 mg/kg
LD50 dermal rabbit	> 2000 mg/kg

Xylenes (o-, m-, p- isomers) (1330-20-7)	
LD50 oral rat	4300 mg/kg
LD50 dermal rabbit	1700 mg/kg
LC50 inhalation rat	5000 ppm/4h

1,3,5-Trimethylbenzene (108-67-8)	
LC50 inhalation rat	24 g/m³/4h

Nonane (111-84-2)	
LC50 inhalation rat	3200 ppm/4h

Naphthalene (91-20-3)	
LD50 oral rat	490 mg/kg
LD50 dermal rabbit	>20 g/kg

Ethylbenzene (100-41-4)	
LD50 oral rat	3500 mg/kg
LD50 dermal rabbit	15400 mg/kg

NEXREG

Ethylbenzene (100-41-4)	
LC50 inhalation rat	17.2 mg/l/4h

Cumene (98-82-8)	
LD50 dermal rabbit	12300 µL/kg
LC50 inhalation rat	>3577 ppm/6h

Skin corrosion/irritation : Causes skin irritation.
Serious eye damage/irritation : Causes serious eye irritation.
Respiratory or skin sensitisation : Based on available data, the classification criteria are not met.
Germ cell mutagenicity : Based on available data, the classification criteria are not met.
Carcinogenicity : Suspected of causing cancer.

Xylenes (o-, m-, p- isomers) (1330-20-7)	
IARC group	3 - Not classifiable

Naphthalene (91-20-3)	
IARC group	2B - Possibly carcinogenic to humans
National Toxicology Program (NTP) Status	1 - Evidence of Carcinogenicity, 3 - Reasonably anticipated to be Human Carcinogen

Ethylbenzene (100-41-4)	
IARC group	2B - Possibly carcinogenic to humans
National Toxicology Program (NTP) Status	1 - Evidence of Carcinogenicity

Cumene (98-82-8)	
IARC group	2B - Possibly carcinogenic to humans
National Toxicology Program (NTP) Status	1 - Evidence of Carcinogenicity, 3 - Reasonably anticipated to be Human Carcinogen

Reproductive toxicity : Based on available data, the classification criteria are not met.
Specific target organ toxicity (single exposure) : Based on available data, the classification criteria are not met.
Specific target organ toxicity (repeated exposure) : Causes damage to organs through prolonged or repeated exposure.
Aspiration hazard : May be fatal if swallowed and enters airways.

Symptoms/injuries after inhalation : May cause respiratory tract irritation. Vapours may cause drowsiness and dizziness.
Symptoms/injuries after skin contact : Causes skin irritation. Symptoms may include redness, edema, drying, defatting and cracking of the skin.
Symptoms/injuries after eye contact : Causes serious eye irritation;Symptoms may include discomfort or pain, excess blinking and tear production, with marked redness and swelling of the conjunctiva.
Symptoms/injuries after ingestion : May be fatal if swallowed and enters airways. This product may be aspirated into the lungs and cause chemical pneumonitis. May cause stomach distress, nausea or vomiting.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : May cause long-term adverse effects in the aquatic environment.

12.2. Persistence and degradability

Winter Treat Plus	
Persistence and degradability	Not established.

12.3. Bioaccumulative potential

Winter Treat Plus	
Bioaccumulative potential	Not established.

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Effect on the global warming : No known ecological damage caused by this product.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Additional information : Handle empty containers with care because residual vapours are flammable.

NEXREG

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

UN-No.(DOT)	:	UN1268
Proper Shipping Name (DOT)	:	Petroleum distillates, n.o.s.
Transport hazard class(es) (DOT)	:	3
Hazard labels (DOT)	:	
Packing group (DOT)	:	III

Additional information

Other information	:	No supplementary information available.
Special transport precautions	:	Do not handle until all safety precautions have been read and understood.

SECTION 15: Regulatory information

15.1. US Federal regulations

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory.

Benzene, 1,2,4-trimethyl- (95-63-6)	
Listed on United States SARA Section 313	
SARA Section 313 - Emission Reporting	1.0 %

Nonane (111-84-2)	
EPA TSCA Regulatory Flag	T - T - indicates a substance that is the subject of a Section 4 test rule under TSCA.

Xylenes (o-, m-, p- isomers) (1330-20-7)	
Listed on United States SARA Section 313	
SARA Section 313 - Emission Reporting	1.0 %

Naphthalene (91-20-3)	
Listed on United States SARA Section 313	
EPA TSCA Regulatory Flag	T - T - indicates a substance that is the subject of a Section 4 test rule under TSCA.
SARA Section 313 - Emission Reporting	0.1 %

Ethylbenzene (100-41-4)	
Listed on United States SARA Section 313	
SARA Section 313 - Emission Reporting	0.1 %

15.2. US State regulations

Winter Treat Plus	
State or local regulations	This product contains chemicals known to the State of California to cause cancer.

SECTION 16: Other information

Date of issue	:	06/01/2015
Other information	:	None.

Disclaimer: We believe the statements, technical information and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind. The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for the user's own particular use.

NEXREG

SAFETY DATA SHEET

DEXRON GEAR OIL 75W-90

000003000195

Version 7.1 Revision Date 2017/01/27 Print Date 2017/02/01

SECTION 1. IDENTIFICATION

Product name	:	DEXRON GEAR OIL 75W-90
Product code	:	DEX75IBC, DEX75DRM, DEX75, DEX75BLK

Manufacturer or supplier's details

Petro-Canada Lubricants Inc.
2310 Lakeshore Road West
Mississauga ON L5J 1K2
Canada

Emergency telephone number

Petro-Canada Lubricants Inc.: +1 905-403-5770;
CHEMTREC Transport Emergency: 1-800-424-9300;
Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	A rear axle and differential lubricant for light duty vehicles. Meets General Motors specification 9986285.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	viscous liquid
Colour	dark yellow
Odour	Mild petroleum oil like or no odour.

GHS Classification

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Potential Health Effects

Primary Routes of Entry	:	Eye contact Ingestion Inhalation Skin contact
Aggravated Medical Condition	:	None known.

Other hazards

™ Owned or used under license by Petro-Canada Lubricants Inc.

None known.

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	30 - 50 %
1-Decene, homopolymer, hydrogenated	68037-01-4	30 - 50 %
Methacrylate copolymers		1 - 5 %
Petroleum oil		1 - 5 %
Alkyl phosphate		1 - 5 %
Long-chain alkyl amine with substituted heteromonocyclic		1 - 5 %
Long-chain alkyl amine		0.1 - 1 %

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.
DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Never give anything by mouth to an unconscious person.

TM Owned or used under license by Petro-Canada Lubricants Inc.

Seek medical advice.

Most important symptoms and effects, both acute and delayed	:	First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	No information available.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	Do not allow uncontrolled discharge of product into the environment.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest.

™ Owned or used under license by Petro-Canada Lubricants Inc.

Keep away from heat and sources of ignition.
Keep container closed when not in use.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	72623-86-0	TWA (Mist)	5 mg/m3	CA AB OEL
		STEL (Mist)	10 mg/m3	CA AB OEL
		TWAEV (Mist)	5 mg/m3	CA QC OEL
		STEV (Mist)	10 mg/m3	CA QC OEL
		TWA (Inhalable fraction)	5 mg/m3	ACGIH

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : organic vapour filter

Hand protection
Material : neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R).

Remarks : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eye protection : Wear face-shield and protective suit for abnormal processing

™ Owned or used under license by Petro-Canada Lubricants Inc.

problems.

Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	viscous liquid
Colour	:	dark yellow
Odour	:	Mild petroleum oil like or no odour.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	< -57 °C (< -71 °F)
Boiling point/boiling range	:	No data available
Flash point	:	187 °C (369 °F) Method: Cleveland open cup
Fire Point	:	225 °C (437 °F)
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available
Flammability	:	Low fire hazard. This material must be heated before ignition will occur.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	No data available
Relative vapour density	:	No data available
Density	:	0.8567 kg/l (15 °C / 59 °F)
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		

TM Owned or used under license by Petro-Canada Lubricants Inc.

Viscosity, kinematic	:	88.5 cSt (40 °C / 104 °F)
		15.2 cSt (100 °C / 212 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	No data available
Incompatible materials	:	Reactive with oxidising agents, acids, alkalis and reducing agents.
Hazardous decomposition products	:	May release COx, POx, SOx, NOx, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Ingestion
Inhalation
Skin contact

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Remarks: No data available

Components:

lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

™ Owned or used under license by Petro-Canada Lubricants Inc.

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

™ Owned or used under license by Petro-Canada Lubricants Inc.

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : The product should not be allowed to enter drains, water courses or the soil.
Offer surplus and non-recyclable solutions to a licensed disposal company.
Waste must be classified and labelled prior to recycling or disposal.
Send to a licensed waste management company.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

National Regulations

TDG
Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

The components of this product are reported in the following inventories:

DSL This product contains one or several components that are not on the Canadian DSL nor NDSL lists.

TSCA All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.

TM Owned or used under license by Petro-Canada Lubricants Inc.

SECTION 16. OTHER INFORMATION

For Copy of SDS	:	Internet: lubricants.petro-canada.com/sds Western Canada, telephone: 1-800-661-1199; fax: 1-800-378-4518 Ontario & Central Canada, telephone: 1-800-268-5850; fax: 1-800-201-6285 Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 1-800-201-6285 For Product Safety Information: 1 905-804-4752
Prepared by	:	Product Safety: +1 905-804-4752
Revision Date	:	2017/01/27

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

™ Owned or used under license by Petro-Canada Lubricants Inc.

Revision Number: 009.3

Issue date: 04/26/2017

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: **LOCTITE 271 HS TL known as LOC 6ML 271RED TLOCKER H 12PG**

IDH number: 209741

Product type: Anaerobic Sealant

Item number: 27100

Restriction of Use: None identified

Region: United States

Company address:
Henkel Corporation
One Henkel Way
Rocky Hill, Connecticut 06067

Contact information:
Telephone: (860) 571-5100
MEDICAL EMERGENCY Phone: Poison Control Center
1-877-671-4608 (toll free) or 1-303-592-1711
TRANSPORT EMERGENCY Phone: CHEMTREC
1-800-424-9300 (toll free) or 1-703-527-3887
Internet: www.henkelna.com

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW	
WARNING:	CAUSES SKIN IRRITATION. MAY CAUSE AN ALLERGIC SKIN REACTION. CAUSES SERIOUS EYE IRRITATION.

HAZARD CLASS	HAZARD CATEGORY
SKIN IRRITATION	2
EYE IRRITATION	2A
SKIN SENSITIZATION	1

PICTOGRAM(S)

Precautionary Statements

Prevention: Avoid breathing vapors, mist, or spray. Wash affected area thoroughly after handling. Contaminated work clothing should not be allowed out of the workplace. Wear protective gloves, eye protection, and face protection.

Response: IF ON SKIN: Wash with plenty of water. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If skin irritation or rash occurs: Get medical attention. If eye irritation persists: Get medical attention. Take off contaminated clothing.

Storage: Not prescribed

Disposal: Dispose of contents and/or container according to Federal, State/Provincial and local governmental regulations.

Classification complies with OSHA Hazard Communication Standard (29 CFR 1910.1200) and is consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

See Section 11 for additional toxicological information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Component(s)	CAS Number	Percentage*
Polyglycol dimethacrylate	25852-47-5	60 - 70
Saccharin	81-07-2	1 - 5
Cumene hydroperoxide	80-15-9	1 - 5
Cumene	98-82-8	0.1 - 1

* Exact percentages may vary or are trade secret. Concentration range is provided to assist users in providing appropriate protections.

4. FIRST AID MEASURES

Inhalation: Move to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Skin contact: Immediately flush skin with plenty of water (using soap, if available). Remove contaminated clothing and footwear. Wash clothing before reuse. Get medical attention.

Eye contact: Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Ingestion: DO NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Symptoms: See Section 11.

5. FIRE FIGHTING MEASURES

Extinguishing media: Water spray (fog), foam, dry chemical or carbon dioxide.

Special firefighting procedures: Wear self-contained breathing apparatus and full protective clothing, such as turn-out gear. In case of fire, keep containers cool with water spray.

Unusual fire or explosion hazards: Uncontrolled polymerization may occur at high temperatures resulting in explosions or rupture of storage containers.

Hazardous combustion products: Oxides of carbon. Oxides of sulfur. Oxides of nitrogen. Irritating organic vapours.

6. ACCIDENTAL RELEASE MEASURES

Use personal protection recommended in Section 8, isolate the hazard area and deny entry to unnecessary and unprotected personnel.

Environmental precautions: Do not allow product to enter sewer or waterways.

Clean-up methods: Remove all sources of ignition. Evacuate and ventilate spill area; dike spill to prevent entry into water system; wear full protective equipment during clean-up. Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Scrape up as much material as possible. Store in a partly filled, closed container until disposal. Refer to Section 8 "Exposure Controls / Personal Protection" prior to clean up.

7. HANDLING AND STORAGE

Handling: Use only with adequate ventilation. Prevent contact with eyes, skin and clothing. Do not breathe vapor and mist. Wash thoroughly after handling. Keep container closed. Refer to Section 8.

Storage: For safe storage, store at or below 38 °C (100.4 °F)
Keep in a cool, well ventilated area away from heat, sparks and open flame. Keep container tightly closed until ready for use.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Employers should complete an assessment of all workplaces to determine the need for, and selection of, proper exposure controls and protective equipment for each task performed.

Hazardous Component(s)	ACGIH TLV	OSHA PEL	AIHA WEEL	OTHER
Polyglycol dimethacrylate	None	None	None	None
Saccharin	None	None	None	None
Cumene hydroperoxide	None	None	1 ppm (6 mg/m3) TWA (SKIN)	None
Cumene	50 ppm TWA	50 ppm (245 mg/m3) PEL (SKIN)	None	None

Engineering controls: Provide adequate local exhaust ventilation to maintain worker exposure below exposure limits.

Respiratory protection: Use NIOSH approved respirator if there is potential to exceed exposure limit(s).

Eye/face protection: Safety goggles or safety glasses with side shields. Full face protection should be used if the potential for splashing or spraying of product exists. Safety showers and eye wash stations should be available.

Skin protection: Use chemical resistant, impermeable clothing including gloves and either an apron or body suit to prevent skin contact. Butyl rubber gloves. Natural rubber gloves. Neoprene gloves.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid
Color: Red
Odor: Mild
Odor threshold: Not available.
pH: Not applicable
Vapor pressure: < 5 mm hg (26.7 °C (80.1 °F))
Boiling point/range: > 148.9 °C (> 300°F)
Melting point/ range: Not available.
Specific gravity: 1.1
Vapor density: Not available.
Flash point: > 93.3 °C (> 199.94 °F) Tagliabue closed cup
Flammable/Explosive limits - lower: Not available.
Flammable/Explosive limits - upper: Not available.
Autoignition temperature: Not available.
Flammability: Not applicable
Evaporation rate: Not available.
Solubility in water: Slight
Partition coefficient (n-octanol/water): Not available.
VOC content: 0.82 %; 7.81 g/l
Viscosity: Not available.
Decomposition temperature: Not available.

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions of storage and use.

Hazardous reactions: None under normal processing. Polymerization may occur at elevated temperature or in the presence of incompatible materials.

Hazardous decomposition products: Phenolics. Oxides of sulfur. Oxides of carbon. Oxides of nitrogen. Irritating organic vapours.

Incompatible materials: Strong oxidizing agents. Strong acids. Copper. Iron. Strong reducing agents. Rust.

Reactivity: Not available.

Conditions to avoid: Elevated temperatures. Heat, flames, sparks and other sources of ignition. Store away from incompatible materials.

11. TOXICOLOGICAL INFORMATION

Relevant routes of exposure: Skin, Inhalation, Eyes, Ingestion

Potential Health Effects/Symptoms

Inhalation: Inhalation of vapors or mists of the product may be irritating to the respiratory system.
Skin contact: Causes skin irritation. May cause allergic skin reaction.
Eye contact: Causes serious eye irritation.
Ingestion: May cause gastrointestinal tract irritation if swallowed.

Hazardous Component(s)	LD50s and LC50s	Immediate and Delayed Health Effects
Polyglycol dimethacrylate	None	Allergen, Irritant
Saccharin	Oral LD50 (Mouse) = 17 g/kg	No Target Organs
Cumene hydroperoxide	Inhalation LC50 (Mouse, 4 h) = 200 mg/l	Allergen, Central nervous system, Corrosive, Irritant, Mutagen
Cumene	Oral LD50 (Rat) = 2.91 g/kg Oral LD50 (Rat) = 1,400 mg/kg Inhalation LC50 (Rat, 4 h) = 8000 ppm	Central nervous system, Irritant, Lung

Hazardous Component(s)	NTP Carcinogen	IARC Carcinogen	OSHA Carcinogen (Specifically Regulated)
Polyglycol dimethacrylate	No	No	No
Saccharin	No	No	No
Cumene hydroperoxide	No	No	No
Cumene	Reasonably Anticipated to be a Human Carcinogen.	Group 2B	No

12. ECOLOGICAL INFORMATION

Ecological information: Not available.

13. DISPOSAL CONSIDERATIONS

Information provided is for unused product only.

Recommended method of disposal: Follow all local, state, federal and provincial regulations for disposal.

Hazardous waste number: Not a RCRA hazardous waste.

14. TRANSPORT INFORMATION

The transport information provided in this section only applies to the material/formulation itself, and is not specific to any package/configuration.

U.S. Department of Transportation Ground (49 CFR)

Proper shipping name: RQ, Environmentally hazardous substance, liquid, n.o.s.
Hazard class or division: 9
Identification number: UN 3082
Packing group: III
DOT Hazardous Substance(s): alpha,alpha-Dimethylbenzylhydroperoxide

International Air Transportation (ICAO/IATA)

Proper shipping name: RQ, Environmentally hazardous substance, liquid, n.o.s.
Hazard class or division: 9
Identification number: UN 3082
Packing group: III

Water Transportation (IMO/IMDG)

Proper shipping name: RQ, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.
Hazard class or division: 9
Identification number: UN 3082
Packing group: III

15. REGULATORY INFORMATION

United States Regulatory Information

TSCA 8 (b) Inventory Status: All components are listed or are exempt from listing on the Toxic Substances Control Act Inventory.
TSCA 12 (b) Export Notification: None above reporting de minimis

CERCLA/SARA Section 302 EHS: None above reporting de minimis.
None above reporting de minimis.
CERCLA/SARA Section 311/312: Immediate Health, Delayed Health
CERCLA/SARA Section 313: This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372). Saccharin (CAS# 81-07-2). Cumene hydroperoxide (CAS# 80-15-9).
CERCLA Reportable quantity: Cumene hydroperoxide (CAS# 80-15-9) 10 lbs. (4.54 kg)

California Proposition 65: This product contains a chemical known in the State of California to cause cancer.

Canada Regulatory Information

CEPA DSL/NDSL Status: Contains one or more components listed on the Non-Domestic Substances List. All other components are listed on or are exempt from listing on the Domestic Substances List. Components listed on the NDSL must be tracked by all Canadian Importers of Record as required by Environment Canada. They may be imported into Canada in limited quantities. Please contact Regulatory Affairs for additional details.

16. OTHER INFORMATION

This safety data sheet contains changes from the previous version in sections: Reviewed SDS. Reissued with new date. 3

Prepared by: Sheila Gines, Regulatory Affairs Specialist

Issue date: 04/26/2017

DISCLAIMER: The data contained herein are furnished for information only and are believed to be reliable. However, Henkel Corporation and its affiliates ("Henkel") does not assume responsibility for any results obtained by persons over whose methods Henkel has no control. It is the user's responsibility to determine the suitability of Henkel's products or any production methods mentioned herein for a particular purpose, and to adopt such precautions as may be advisable for the protection of property and persons against any hazards that may be involved in the handling and use of any Henkel's products. In light of the foregoing, Henkel specifically disclaims all warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, arising from sale or use of Henkel's products. Henkel further disclaims any liability for consequential or incidental damages of any kind, including lost profits.

MATERIAL SAFETY DATA SHEET

03702
07 00

DATE OF PREPARATION
May 4, 2015

SECTION 1 — PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NUMBER
03702

PRODUCT NAME
KRYLON® Industrial QUIK-MARK™ Solvent-Based Inverted Marking Paint (Fluorescent), Orange

MANUFACTURER'S NAME
THE SHERWIN-WILLIAMS COMPANY
KRYLON INDUSTRIAL PRODUCTS GROUP
Cleveland, OH 44115

Telephone Numbers and Websites

Product Information	(800) 247-3266 www.kpg-industrial.com
Regulatory Information	(216) 566-2902 www.paintdocs.com
Medical Emergency	(216) 566-2917
Transportation Emergency*	(800) 424-9300
**for Chemical Emergency ONLY (spill, leak, fire, exposure, or accident)*	

SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

% by Weight	CAS Number	Ingredient	Units	Vapor Pressure
14	**74-98-6**	**Propane**		
		ACGIH TLV	1000 PPM	760 mm
		OSHA PEL	1000 PPM	
6	**106-97-8**	**Butane**		
		ACGIH TLV	1000 PPM	760 mm
		OSHA PEL	800 PPM	
8	**110-54-3**	**Hexane**		
		ACGIH TLV	50 PPM	127 mm
		OSHA PEL	50 PPM	
4	**107-83-5**	**2-Methylpentane**		
		ACGIH TLV	Not Available	211 mm
		OSHA PEL	Not Available	
1	**96-14-0**	**3-Methylpentane**		
		ACGIH TLV	500 PPM	211 mm
		OSHA PEL	Not Available	
1	**79-29-8**	**2,3-Dimethylbutane**		
		ACGIH TLV	Not Available	230 mm
		OSHA PEL	Not Available	
9	**142-82-5**	**Heptane**		
		ACGIH TLV	400 PPM	50 mm
		ACGIH TLV	500 PPM STEL	
		OSHA PEL	400 PPM	
		OSHA PEL	500 PPM STEL	
8	**64742-89-8**	**Lt. Aliphatic Hydrocarbon Solvent**		
		ACGIH TLV	300 PPM	12 mm
		OSHA PEL	300 PPM	
0.4	**100-41-4**	**Ethylbenzene**		
		ACGIH TLV	20 PPM	7.1 mm
		OSHA PEL	100 PPM	
		OSHA PEL	125 PPM STEL	
2	**1330-20-7**	**Xylene**		
		ACGIH TLV	100 PPM	5.9 mm
		ACGIH TLV	150 PPM STEL	
		OSHA PEL	100 PPM	
		OSHA PEL	150 PPM STEL	
0.3	**14808-60-7**	**Quartz**		
		ACGIH TLV	0.025 mg/m3 as Resp. Dust	
		OSHA PEL	0.1 mg/m3 as Resp. Dust	
27	**1317-65-3**	**Calcium Carbonate**		
		ACGIH TLV	10 mg/m3 as Dust	
		OSHA PEL	10 mg/m3 Total Dust	
		OSHA PEL	5 mg/m3 Respirable Fraction	

SECTION 3 — HAZARDS IDENTIFICATION

ROUTES OF EXPOSURE

INHALATION of vapor or spray mist.
EYE or SKIN contact with the product, vapor or spray mist.

HMIS Codes

Health	2*
Flammability	3
Reactivity	0

EFFECTS OF OVEREXPOSURE

EYES: Irritation.
SKIN: Prolonged or repeated exposure may cause irritation.
INHALATION: Irritation of the upper respiratory system.

May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death.
Prolonged overexposure to hazardous ingredients in Section 2 may cause adverse chronic effects to the following organs or systems:

- the liver
- the urinary system
- the reproductive system

SIGNS AND SYMPTOMS OF OVEREXPOSURE

Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists.
Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

None generally recognized.

CANCER INFORMATION

For complete discussion of toxicology data refer to Section 11.

SECTION 4 — FIRST AID MEASURES

EYES: Flush eyes with large amounts of water for 15 minutes. Get medical attention.
SKIN: Wash affected area thoroughly with soap and water.
Remove contaminated clothing and launder before re-use.
INHALATION: If affected, remove from exposure. Restore breathing. Keep warm and quiet.
INGESTION: Do not induce vomiting. Get medical attention immediately.

SECTION 5 — FIRE FIGHTING MEASURES

FLASH POINT	LEL	UEL
Propellant < 0 °F	0.9	9.5

EXTINGUISHING MEDIA

Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS

Containers may explode when exposed to extreme heat.
Application to hot surfaces requires special precautions.
During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain medical attention.

SPECIAL FIRE FIGHTING PROCEDURES

Full protective equipment including self-contained breathing apparatus should be used.
Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

SECTION 6 — ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Remove all sources of ignition. Ventilate the area.
Remove with inert absorbent.

SECTION 7 — HANDLING AND STORAGE

STORAGE CATEGORY

Not Available

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Keep away from heat, sparks, and open flame. Vapors will accumulate readily and may ignite explosively.
During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition.
Consult NFPA Code. Use approved Bonding and Grounding procedures.
Contents under pressure. Do not puncture, incinerate, or expose to temperature above 120F. Heat from sunlight, radiators, stoves, hot water, and other heat sources could cause container to burst. Do not take internally. Keep out of the reach of children.

SECTION 8 — EXPOSURE CONTROLS/PERSONAL PROTECTION

PRECAUTIONS TO BE TAKEN IN USE

Use only with adequate ventilation.
Avoid contact with skin and eyes. Avoid breathing vapor and spray mist.
Wash hands after using.
This coating may contain materials classified as nuisance particulates (listed "as Dust" in Section 2) which may be present at hazardous levels only during sanding or abrading of the dried film. If no specific dusts are listed in Section 2, the applicable limits for nuisance dusts are ACGIH TLV 10 mg/m3 (total dust), 3 mg/m3 (respirable fraction), OSHA PEL 15 mg/m3 (total dust), 5 mg/m3 (respirable fraction).

VENTILATION

Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section 2 is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108.

RESPIRATORY PROTECTION

If personal exposure cannot be controlled below applicable limits by ventilation, wear a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section 2.
When sanding or abrading the dried film, wear a dust/mist respirator approved by NIOSH/MSHA for dust which may be generated from this product, underlying paint, or the abrasive.

PROTECTIVE GLOVES

None required for normal application of aerosol products where minimal skin contact is expected. For long or repeated contact, wear chemical resistant gloves.

EYE PROTECTION

Wear safety spectacles with unperforated sideshields.

OTHER PRECAUTIONS

Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT WEIGHT	7.37 lb/gal	883 g/l
SPECIFIC GRAVITY	0.89	
BOILING POINT	<0 - 325 °F	<-18 - 162 °C
MELTING POINT	Not Available	
VOLATILE VOLUME	78%	
EVAPORATION RATE	Faster than ether	
VAPOR DENSITY	Heavier than air	
SOLUBILITY IN WATER	Not Available	
pH	> 2.0, < 11.5	

VOLATILE ORGANIC COMPOUNDS (VOC Theoretical - As Packaged)

Volatile Weight 56.25% Less Water and Federally Exempt Solvents

SECTION 10 — STABILITY AND REACTIVITY

STABILITY — Stable

CONDITIONS TO AVOID

None known.

INCOMPATIBILITY

None known.

HAZARDOUS DECOMPOSITION PRODUCTS

By fire: Carbon Dioxide, Carbon Monoxide

HAZARDOUS POLYMERIZATION

Will not occur

SECTION 11 — TOXICOLOGICAL INFORMATION

CHRONIC HEALTH HAZARDS

Prolonged and repeated exposure to Hexane may cause damage to nerve tissue of the arms and legs (peripheral neuropathy), resulting in muscular weakness and loss of sensation. This effect may be increased by the presence of Methyl Ethyl Ketone.

Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

Ethylbenzene is classified by IARC as possibly carcinogenic to humans (2B) based on inadequate evidence in humans and sufficient evidence in laboratory animals. Lifetime inhalation exposure of rats and mice to high ethylbenzene concentrations resulted in increases in certain types of cancer, including kidney tumors in rats and lung and liver tumors in mice. These effects were not observed in animals exposed to lower concentrations. There is no evidence that ethylbenzene causes cancer in humans.

Crystalline Silica (Quartz, Cristobalite) is listed by IARC and NTP. Long term exposure to high levels of silica dust, which can occur only when sanding or abrading the dry film, may cause lung damage (silicosis) and possibly cancer.

TOXICOLOGY DATA

CAS No.	Ingredient Name			
74-98-6	Propane			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
106-97-8	Butane			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
110-54-3	Hexane			
		LC50 RAT	4HR	Not Available
		LD50 RAT		28700 mg/kg
107-83-5	2-Methylpentane			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
96-14-0	3-Methylpentane			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
79-29-8	2,3-Dimethylbutane			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
142-82-5	Heptane			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
64742-89-8	Lt. Aliphatic Hydrocarbon Solvent			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
100-41-4	Ethylbenzene			
		LC50 RAT	4HR	Not Available
		LD50 RAT		3500 mg/kg
1330-20-7	Xylene			
		LC50 RAT	4HR	5000 ppm
		LD50 RAT		4300 mg/kg
14808-60-7	Quartz			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
1317-65-3	Calcium Carbonate			
		LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available

SECTION 12 — ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION

No data available.

SECTION 13 — DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD

Waste from this product may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261.
Waste must be tested for ignitability to determine the applicable EPA hazardous waste numbers.
Do not incinerate. Depressurize container. Dispose of in accordance with Federal, State/Provincial, and Local regulations regarding pollution.

SECTION 14 — TRANSPORT INFORMATION

Multi-modal shipping descriptions are provided for informational purposes and do not consider container sizes. The presence of a shipping description for a particular mode of transport (ocean, air, etc.), does not indicate that the product is packaged suitably for that mode of transport. All packaging must be reviewed for suitability prior to shipment, and compliance with the applicable regulations is the sole responsibility of the person offering the product for transport.

US Ground (DOT)

May be classed as LTD. QTY. OR ORM-D
UN1950, AEROSOLS, 2.1, LIMITED QUANTITY, (ERG#126)

Canada (TDG)

May be classed as LTD. QTY. OR ORM-D
UN1950, AEROSOLS, CLASS 2.1, LIMITED QUANTITY, (ERG#126)

IMO

May be shipped as Limited Quantity
UN1950, AEROSOLS, CLASS 2.1, LIMITED QUANTITY, EmS F-D, S-U

IATA/ICAO

UN1950, AEROSOLS, FLAMMABLE, 2.1, LIMITED QUANTITY

SECTION 15 — REGULATORY INFORMATION

SARA 313 *(40 CFR 372.65C)* SUPPLIER NOTIFICATION

CAS No.	CHEMICAL/COMPOUND	% by WT	% Element
110-54-3	Hexane	8	
100-41-4	Ethylbenzene	0.3	
1330-20-7	Xylene	2	

CALIFORNIA PROPOSITION 65

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

TSCA CERTIFICATION

All chemicals in this product are listed, or are exempt from listing, on the TSCA Inventory.

SECTION 16 — OTHER INFORMATION

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.

Oxygen

Safety Data Sheet E-4638

according to the Hazardous Products Regulation (February 11, 2015)

Date of issue: 10-15-1979 Revision date: 08-03-2016 Supersedes: 10-15-2013

SECTION 1: Identification

1.1. Product identifier

Product form	:	Substance
Name	:	Oxygen
CAS No	:	7782-44-7
Formula	:	O2
Other means of identification	:	Oxygen, Compressed; Medipure® Oxygen; Aviator's Breathing Oxygen; USP Oxygen; Oxygen - Diving Grade; Dioxygen
Product group	:	Core Products

1.2. Recommended use and restrictions on use

Recommended uses and restrictions	:	Medical applications Industrial use Diving Gas (Underwater Breathing)

1.3. Supplier

Praxair Canada inc.
1200 – 1 City Centre Drive
Mississauga - Canada L5B 1M2
T 1-905-803-1600 - F 1-905-803-1682
www.praxair.ca

1.4. Emergency telephone number

Emergency number	:	1-800-363-0042 Call emergency number 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier or Praxair sales representative.

SECTION 2: Hazard identification

2.1. Classification of the substance or mixture

GHS-CA classification

Ox. Gas 1	H270
Compressed gas	H280

2.2. GHS Label elements, including precautionary statements

GHS-CA labelling

Hazard pictograms :

GHS03 GHS04

Signal word : DANGER

Hazard statements : MAY CAUSE OR INTENSIFY FIRE; OXIDIZER
CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED

Precautionary statements : Do not handle until all safety precautions have been read and understood
Keep away from clothing and other combustible materials
Keep valves and fittings free from oil and grease
In case of fire: Stop leak if safe to do so
Use and store only outdoors or in a well-ventilated area
Protect from sunlight when ambient temperature exceeds 52°C (125°F)
Use a back flow preventive device in the piping
Use only with equipment of compatible materials of construction and rated for cylinder pressure

This document is only controlled while on the Praxair Canada Inc. website and a copy of this controlled version is available for download. Praxair cannot assure the integrity or accuracy of any version of this document after it has been downloaded or removed from our website.

DO NOT change or force fit connections
Avoid spills. Do not walk on or roll equipment over spills
Use only with equipment cleaned for oxygen service
Open valve slowly
Close valve after each use and when empty

2.3. Other hazards

Other hazards not contributing to the classification : Breathing 80 percent or more oxygen at atmospheric pressure for more than a few hours may cause nasal stuffiness, cough, sore throat, chest pain, and breathing difficulty. Breathing oxygen at higher pressure increases the likelihood of adverse effects within a shorter time period. Breathing pure oxygen under pressure may cause lung damage and central nervous system (CNS) effects, resulting in dizziness, poor coordination, tingling sensation, visual and hearing disturbances, muscular twitching, unconsciousness, and convulsions. Breathing oxygen under pressure may cause prolongation of adaptation to darkness and reduced peripheral vision.

2.4. Unknown acute toxicity (GHS-CA)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substances

Name	CAS No.	% (Vol.)	Common Name (synonyms)
Oxygen (Main constituent)	(CAS No) 7782-44-7	> 99.5	

3.2. Mixtures

Not applicable

SECTION 4: First-aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Get medical advice/attention. Remove to fresh air and keep at rest in a position comfortable for breathing.

First-aid measures after skin contact : Adverse effects not expected from this product.

First-aid measures after eye contact : In case of eye irritation: Rinse immediately with plenty of water. Consult an ophthalmologist if irritation persists.

First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects (acute and delayed)

No additional information available

4.3. Immediate medical attention and special treatment, if necessary

Other medical advice or treatment : None.

SECTION 5: Fire-fighting measures

5.1. Suitable extinguishing media

Suitable extinguishing media : Vigorously accelerates combustion. Use media appropriate for surrounding fire. Water (e.g, safety shower) is the preferred extinguishing media for clothing fires.

5.2. Unsuitable extinguishing media

No additional information available

5.3. Specific hazards arising from the hazardous product

Fire hazard : Oxidizing agent; vigorously accelerates combustion. Contact with flammable materials may cause fire or explosion.

Explosion hazard : CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED.

Reactivity : No additional information available.

Reactivity in case of fire : No reactivity hazard other than the effects described in sub-sections below.

This document is only controlled while on the Praxair Canada Inc. website and a copy of this controlled version is available for download. Praxair cannot assure the integrity or accuracy of any version of this document after it has been downloaded or removed from our website.

5.4. Special protective equipment and precautions for fire-fighters

Firefighting instructions	:	High-pressure, oxidizing gas Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with their provincial and local fire code regulations.
Protection during firefighting	:	Self-contained breathing apparatus.
Special protective equipment for fire fighters	:	Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Specific methods	:	Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas containers to rupture. Cool endangered containers with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems Stop flow of product if safe to do so Use water spray or fog to knock down fire fumes if possible.
Other information	:	Heat of fire can build pressure in container and cause it to rupture. Cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by TC.) No part of the container should be subjected to a temperature higher than 125°F (52°C). Smoking, flames, and electric sparks in the presence of enriched oxygen atmospheres are potential explosion hazards.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures	:	Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. Ensure adequate air ventilation. Eliminate ignition sources. Evacuate area. Try to stop release. Monitor concentration of released product. Wear self-contained breathing apparatus when entering area unless atmosphere is proven to be safe. Stop leak if safe to do so.

6.2. Methods and materials for containment and cleaning up

6.3. Reference to other sections

For further information refer to section 8: Exposure controls/personal protection

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	:	Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g, wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.
Safe use of the product	:	**The suitability of this product as a component in underwater breathing gas mixtures** is to be determined by or under the supervision of personnel experienced in the use of underwater breathing gas mixtures and familiar with the physiological effects, methods employed, frequency and duration of use, hazards, side effects, and precautions to be taken.

This document is only controlled while on the Praxair Canada Inc. website and a copy of this controlled version is available for download. Praxair cannot assure the integrity or accuracy of any version of this document after it has been downloaded or removed from our website.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store only where temperature will not exceed 125°F (52°C). Post “No Smoking" or "Open Flames” signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g, NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Appropriate engineering controls

Appropriate engineering controls : Avoid oxygen rich (>23,5%) atmospheres. Use a local exhaust system with sufficient flow velocity to maintain an adequate supply of air in the worker's breathing zone. Mechanical (general): General exhaust ventilation may be acceptable if it can maintain an adequate supply of air.

8.3. Individual protection measures/Personal protective equipment

Personal protective equipment : Safety glasses. Face shield. Gloves.

Hand protection : Wear work gloves when handling containers. Wear heavy rubber gloves where contact with product may occur.

Eye protection : Wear goggles when transfilling or breaking transfer connections. Select in accordance with the current CSA standard Z94.3, "Industrial Eye and Face Protection", and any provincial regulations, local bylaws or guidelines.

Respiratory protection : **Respiratory protection:** Use respirable fume respirator or air supplied respirator when working in confined space or where local exhaust or ventilation does not keep exposure below TLV. Select in accordance with provincial regulations, local bylaws or guidelines. Selection should be based on the current CSA standard Z94.4, "Selection, Care, and Use of Respirators." Respirators should also be approved by NIOSH and MSHA. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).

Environmental exposure controls : **Environmental exposure controls:** Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Other information : **Other protection :** Safety shoes for general handling at customer sites. Metatarsal shoes and cuffless trousers for cylinder handling at packaging and filling plants. Select in accordance with the current CSA standard Z195, "Protective Foot Wear", and any provincial regulations, local bylaws or guidelines. For working with flammable and oxidizing materials, consider the use of flame resistant anti-static safety clothing.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Gas

Appearance : Colourless gas.

Molecular mass : 32 g/mol

Colour	:	Colourless.
Odour	:	No odour warning properties.
Odour threshold	:	No data available
pH	:	Not applicable.
pH solution	:	No data available
Relative evaporation rate (butylacetate=1)	:	No data available
Relative evaporation rate (ether=1)	:	Not applicable.
Melting point	:	>= -219 °C (-362°F)
Freezing point	:	No data available
Boiling point	:	-183 °C (-297°F)
Flash point	:	Not applicable.
Critical temperature	:	-118.6 °C (-181.48°F)
Auto-ignition temperature	:	Not applicable.
Decomposition temperature	:	No data available
Vapour pressure	:	Not applicable.
Vapour pressure at 50 °C	:	No data available
Critical pressure	:	50.4 bar (731.4 psia)
Relative vapour density at 20 °C	:	0.0827 lb/ft3 (1.325 kg/m3) absolute vapour density at 70°F/21.1°C, 1 atm
Relative density	:	1.1
Relative density of saturated gas/air mixture	:	No data available
Density	:	1.4289 kg/m³ (at 21.1 °C)
Relative gas density	:	1.1
Solubility	:	Water: 39 mg/l
Log Pow	:	Not applicable.
Log Kow	:	Not applicable.
Viscosity, kinematic	:	Not applicable.
Viscosity, dynamic	:	Not applicable.
Viscosity, kinematic (calculated value) (40 °C)	:	No data available
Explosive properties	:	Not applicable.
Oxidizing properties	:	Oxidizer.
Flammability (solid, gas)	:	Non flammable Non flammable

9.2. Other information

Gas group	:	Compressed gas
Additional information	:	Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity	:	No additional information available.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	Violently oxidizes organic material.
Conditions to avoid	:	None under recommended storage and handling conditions (see section 7).
Incompatible materials	:	Keep equipment free from oil and grease. Consider the potential toxicity hazard due to the presence of chlorinated or fluorinated polymers in high pressure (> 30 bar) oxygen lines in case of combustion. May react violently with combustible materials. May react violently with reducing agents.
Hazardous decomposition products	:	None.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity (oral)	:	Not classified
Acute toxicity (dermal)	:	Not classified
Acute toxicity (inhalation)	:	Not classified
Skin corrosion/irritation	:	Not classified pH: Not applicable.
Serious eye damage/irritation	:	Not classified pH: Not applicable.
Respiratory or skin sensitization	:	Not classified
Germ cell mutagenicity	:	Not classified
Carcinogenicity	:	Not classified
Reproductive toxicity	:	Not classified
Specific target organ toxicity (single exposure)	:	Not classified
Specific target organ toxicity (repeated exposure)	:	Not classified
Aspiration hazard	:	Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : No ecological damage caused by this product.

12.2. Persistence and degradability

Oxygen (7782-44-7)	
Persistence and degradability	No ecological damage caused by this product.

12.3. Bioaccumulative potential

Oxygen (7782-44-7)	
Log Pow	Not applicable.
Log Kow	Not applicable.
Bioaccumulative potential	No ecological damage caused by this product.

12.4. Mobility in soil

Oxygen (7782-44-7)	
Mobility in soil	No data available.
Log Pow	Not applicable.
Log Kow	Not applicable.
Ecology - soil	No ecological damage caused by this product.

12.5. Other adverse effects

Effect on the ozone layer : None

Effect on global warming : No known effects from this product

SECTION 13: Disposal considerations

13.1. Disposal methods

Waste disposal recommendations : Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

SECTION 14: Transport information

This document is only controlled while on the Praxair Canada Inc. website and a copy of this controlled version is available for download. Praxair cannot assure the integrity or accuracy of any version of this document after it has been downloaded or removed from our website.

14.1. Basic shipping description

In accordance with TDG

TDG

UN-No. (TDG)	:	UN1072
TDG Primary Hazard Classes	:	2.2 - Class 2.2 - Non-Flammable, Non-Toxic Gas.
TDG Subsidiary Classes	:	5.1
Proper shipping name	:	OXYGEN, COMPRESSED
ERAP Index	:	3 000
Explosive Limit and Limited Quantity Index	:	0.125 L (0,125 L)
Passenger Carrying Road Vehicle or Passenger Carrying Railway Vehicle Index	:	75 L

14.3. Air and sea transport

IMDG

UN-No. (IMDG)	:	1072
Proper Shipping Name (IMDG)	:	OXYGEN, COMPRESSED
Class (IMDG)	:	2 - Gases
MFAG-No	:	122

IATA

UN-No. (IATA)	:	1072
Proper Shipping Name (IATA)	:	Oxygen, compressed
Class (IATA)	:	2

SECTION 15: Regulatory information

15.1. National regulations

Oxygen (7782-44-7)
Listed on the Canadian DSL (Domestic Substances List)

15.2. International regulations

Oxygen (7782-44-7)
Listed on the AICS (Australian Inventory of Chemical Substances) Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China) Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances) Listed on the Korean ECL (Existing Chemicals List) Listed on NZIoC (New Zealand Inventory of Chemicals) Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances) Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on INSQ (Mexican national Inventory of Chemical Substances)

SECTION 16: Other information

Date of issue	:	15/10/1979
Revision date	:	03/08/2016
Supersedes	:	15/10/2013

Indication of changes:

Training advice	:	Ensure operators understand the hazard of oxygen enrichment.

This document is only controlled while on the Praxair Canada Inc. website and a copy of this controlled version is available for download. Praxair cannot assure the integrity or accuracy of any version of this document after it has been downloaded or removed from our website.

Other information : Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information

The opinions expressed herein are those of qualified experts within Praxair Canada Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair Canada Inc, it is the user's obligation to determine the conditions of safe use of the product. Praxair Canada Inc, SDSs are furnished on sale or delivery by Praxair Canada Inc, or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from www.praxair.ca. If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write Praxair Canada Inc, (Phone: 1-888-257-5149; Address: Praxair Canada Inc, 1 City Centre Drive, Suite 1200, Mississauga, Ontario, L5B 1M2).

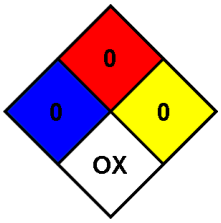
PRAXAIR and the Flowing Airstream design are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and/or other countries.

NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.

NFPA specific hazard : OX - This denotes an oxidizer, a chemical which can greatly increase the rate of combustion/fire.



HMIS III Rating

Health : 0 Minimal Hazard - No significant risk to health

Flammability : 0 Minimal Hazard - Materials that will not burn

Physical : 3 Serious Hazard - Materials that may form explosive mixtures with water and are capable of detonation or explosive reaction in the presence of a strong initiating source. Materials may polymerize, decompose, self-react, or undergo other chemical change at normal temperature and pressure with moderate risk of explosion

SDS Canada (GHS) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

This document is only controlled while on the Praxair Canada Inc. website and a copy of this controlled version is available for download. Praxair cannot assure the integrity or accuracy of any version of this document after it has been downloaded or removed from our website.

Power Steering Fluid

SECTION 1. IDENTIFICATION

Product Identifier	Power Steering Fluid
Other Means of Identification	15-881, 15-883, 15-888, 25-889, 35-870PRES, 35-871PRES, 35-874PRES, 35-881C, 35-881CQ, 35-881SO, 35-883AS, 35-883CQ, 35-883PC, 35-883SO, 15-881OEM
Recommended Use	Please refer to Product label.
Restrictions on Use	None known.
Manufacturer / Supplier	Recochem Inc., 850 Montee de Liesse, Montreal, QC, H4T 1P4, Compliance and Regulatory Department, 905-878-5544, www.recochem.com
Emergency Phone No.	CANUTEC, 613-996-6666, 24 Hours
SDS No.	01290029

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Skin corrosion/irritation - Category 2; Serious eye damage/eye irritation - Category 2B

GHS Label Elements

Signal Word:
Warning

Hazard Statement(s):

H315	Causes skin irritation.
H320	Causes eye irritation.

Precautionary Statement(s):

Prevention:

P264	Wash hands and skin thoroughly after handling.
P280	Wear protective gloves.

Response:

P302 + P352	IF ON SKIN: Wash with plenty of water.
P332 + P313	If skin irritation occurs: Get medical advice/attention.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313	If eye irritation persists: Get medical advice/attention.
P362 + P364	Take off contaminated clothing and wash it before reuse.

Storage:

Store in a well ventilated place. Keep cool. Keep container tightly closed. Store locked up.

Disposal:

Dispose of contents/container in accordance with applicable regional, national and local laws and regulations.

Other Hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture:

Chemical Name	CAS No.	%	Other Identifiers
Highly Refined Mineral Oils (Petroleum)		60-100	

Notes

The specific chemical identity and/or exact percentage of composition (concentration) has been withheld as a trade secret.

SECTION 4. FIRST-AID MEASURES

First-aid Measures

Inhalation

Remove source of exposure or move to fresh air. Get medical advice/attention if you feel unwell or are concerned.

Skin Contact

Avoid direct contact. Wear chemical protective clothing if necessary. Take off contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Quickly and gently blot or brush away excess chemical. Immediately rinse with lukewarm, gently flowing water for 15-20 minutes. Get medical advice/attention if you feel unwell or are concerned. If skin irritation occurs get medical advice/attention. Clean clothing, shoes and leather goods. Injection of pressurized hydrocarbons can cause severe, permanent tissue damage. Initial symptoms may be minor. Injection of petroleum hydrocarbons requires immediate medical attention.

Eye Contact

Avoid direct contact. Wear chemical protective gloves if necessary. Quickly and gently blot or brush chemical off the face. Immediately rinse the contaminated eye(s) with lukewarm, gently flowing water for 15-20 minutes, while holding the eyelid(s) open. Remove contact lenses, if present and easy to do. Take care not to rinse contaminated water into the unaffected eye or onto the face. If eye irritation persists, get medical advice/attention.

Ingestion

Rinse mouth with water. Get medical advice/attention if you feel unwell or are concerned.

Most Important Symptoms and Effects, Acute and Delayed

No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Immediate Medical Attention and Special Treatment

Target Organs

Eyes, skin.

Special Instructions

No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Medical Conditions Aggravated by Exposure

Dermatitis.

SECTION 5. FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media

Not combustible. Use extinguishing agent suitable for surrounding fire.

Unsuitable Extinguishing Media

None known.

Specific Hazards Arising from the Chemical

Can ignite if strongly heated.
In a fire, the following hazardous materials may be generated: very toxic carbon monoxide, carbon dioxide.

Special Protective Equipment and Precautions for Fire-fighters

Review Section 6 (Accidental Release Measures) for important information on responding to leaks/spills.
See Skin Protection in Section 8 (Exposure Controls/Personal Protection) for advice on suitable chemical protective materials.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures

Use the personal protective equipment recommended in Section 8 of this safety data sheet.

Environmental Precautions

Do not allow into any sewer, on the ground or into any waterway.

Methods and Materials for Containment and Cleaning Up

Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling

Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Conditions for Safe Storage

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Not available.

Appropriate Engineering Controls

General ventilation is usually adequate. For large scale use of this product: use local exhaust ventilation, if general ventilation is not adequate to control amount in the air. Provide eyewash in work area, if contact or splash hazard exists.

Individual Protection Measures

Eye/Face Protection

Wear chemical safety goggles.

Skin Protection

Not required, if used as directed.

Respiratory Protection

Not normally required if product is used as directed.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Basic Physical and Chemical Properties

Appearance	Light amber.
Odour	Hydrocarbon
Odour Threshold	Not available
pH	Not applicable
Melting Point/Freezing Point	Not available (melting); Not available (freezing)
Initial Boiling Point/Range	Not available
Flash Point	188 ºC (370 ºF) (closed cup)
Evaporation Rate	Not available
Flammability (solid, gas)	Not applicable
Upper/Lower Flammability or Explosive Limit	Not available (upper); Not available (lower)
Vapour Pressure	< 0.08 mm Hg (0.01 kPa) at 20 ºC
Vapour Density (air = 1)	> 1
Relative Density (water = 1)	0.88
Solubility	Practically insoluble in water; Not available (in other liquids)
Partition Coefficient, n-Octanol/Water (Log Kow)	Not available
Auto-ignition Temperature	Not available
Decomposition Temperature	Not available
Viscosity	46 centistokes at 25 ºC (kinematic); Not available (dynamic)

Other Information

Physical State	Liquid
Molecular Weight	Not applicable

SECTION 10. STABILITY AND REACTIVITY

Reactivity

None known.

Chemical Stability

Normally stable.

Possibility of Hazardous Reactions

None known.

Conditions to Avoid

Prolonged exposure to high temperatures. Open flames, sparks, static discharge, heat and other ignition sources. Temperatures above 188.0 ºC (370.4 ºF)

Incompatible Materials

Strong oxidizing agents (e.g. perchloric acid).

Hazardous Decomposition Products

Very toxic carbon monoxide, carbon dioxide; corrosive sulfur oxides; corrosive phosphorous oxides; corrosive, oxidizing nitrogen oxides.

SECTION 11. TOXICOLOGICAL INFORMATION

Likely Routes of Exposure

Skin contact; eye contact.

Acute Toxicity

LC50: Not applicable.

LD50 (oral): Not applicable.

LD50 (dermal): Not applicable.

Skin Corrosion/Irritation

Human experience and animal tests show moderate or severe irritation.

Serious Eye Damage/Irritation

Human experience and animal tests show serious eye irritation.

STOT (Specific Target Organ Toxicity) - Single Exposure

Inhalation

May be harmful based on limited evidence. As a mist nose and throat irritation.

Skin Absorption

No information was located.

Ingestion

May be harmful based on limited evidence. If large amounts are swallowed depression of the central nervous system. Symptoms may include headache, nausea, dizziness, drowsiness and confusion. A laxative effect if large amounts are swallowed. Symptoms may include nausea, vomiting, stomach cramps and diarrhea.

Aspiration Hazard

No information was located.

STOT (Specific Target Organ Toxicity) - Repeated Exposure

May cause If inhaled: irritation of the respiratory system. Respiratory tract injury has been observed.
May cause Following skin contact: dermatitis. Symptoms may include dry, red, cracked skin (dermatitis).

Respiratory and/or Skin Sensitization

Not known to be a respiratory sensitizer. Not known to be a skin sensitizer.

Carcinogenicity

Not known to cause cancer.

Reproductive Toxicity

Development of Offspring

No information was located.

Sexual Function and Fertility

No information was located.

Effects on or via Lactation

No information was located.

Germ Cell Mutagenicity

No information was located.

Interactive Effects

No information was located.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity

No information was located.

Persistence and Degradability

No information was located.

Bioaccumulative Potential

No information was located.

Mobility in Soil

No information was located.

Other Adverse Effects

There is no information available.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal Methods

The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14. TRANSPORT INFORMATION

Not regulated under Canadian TDG Regulations. Not regulated under US DOT Regulations.

Environmental Hazards	Not applicable
Special Precautions for User	Not applicable

Transport in Bulk According to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15. REGULATORY INFORMATION

Safety, Health and Environmental Regulations

Canada

Domestic Substances List (DSL) / Non-Domestic Substances List (NDSL)

All ingredients are listed on the DSL/NDSL.

USA

Toxic Substances Control Act (TSCA) Section 8(b)

All ingredients are listed on the TSCA Inventory.

SECTION 16. OTHER INFORMATION

SDS Prepared By	Compliance and Regulatory Department
Phone No.	905-878-5544
Date of Preparation	October 29, 2015
Additional Information	We are committed to uphold the Industry Consumer Ingredient Communication Voluntary

Initiative.
Please send us your request by visiting our website at www.recochem.com.

Ingredients present (intentionally added ingredients) at a concentration of greater than one percent (1%) shall be listed in descending order of predominance. Ingredients present at a concentration of not more than one percent shall be listed but may be disclosed without respect to order of predominance.

Disclaimer

Notice to reader: To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

Revision Date 04-Sep-2015 **Version** 3

1. IDENTIFICATION

Product identifier
Product Name Spray Nine® 4L

Other means of identification
Product Code C26804
Synonyms None

Recommended use of the chemical and restrictions on use
Recommended Use Disinfectant Cleaner
Uses advised against No information available

Details of the supplier of the safety data sheet

Manufacturer Address
ITW Permatex
10 Columbus Blvd.
Hartford, CT 06106 USA

Distributor
ITW Permatex Canada
35 Brownridge Road, Unit 1
Halton Hills, ON Canada L7G 0C6
Telephone: (800) 924-6994

Company Phone Number 1-87-Permatex
(877) 376-2839

24 Hour Emergency Phone Number Chem-Tel: 800-255-3924
International Emergency:
00+1+ 813-248-0585
Contract Number: MIS0003453

E-mail address mail@permatex.com

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

NOTE: This product is a consumer product and is labeled in accordance with the US Consumer Product Safety Commission regulations which take precedence over OSHA Hazard Communication labeling. The actual container label will not include the label elements below. The labeling below applies to industrial/professional products.

Label elements

Emergency Overview

The product contains no substances which at their given concentration, are considered to be hazardous to health

Appearance Clear **Physical state** Liquid **Odor** Citrus

Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)
Not applicable

Other Information
- Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

substance(s)

Chemical Name	CAS No	Weight-%	Trade Secret
WATER	7732-18-5	60 - 100	*
ETHOXYLATED C9-C11 ALCOHOLS	68439-46-3	1 - 5	*
DIPROPYLENE GLYCOL MONONBUTYL ETHER	29911-28-2	1 - 5	*

*The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

Description of first aid measures

General advice Get medical advice/attention if you feel unwell.

Eye contact IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Skin contact IF ON SKIN:. Wash skin with soap and water. If skin irritation persists, call a physician. Wash contaminated clothing before reuse.

Inhalation IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If symptoms persist, call a physician.

Ingestion IF SWALLOWED:. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Call a physician.

Self-protection of the first aider Use personal protective equipment as required. Avoid contact with skin, eyes or clothing.

Most important symptoms and effects, both acute and delayed

Symptoms See section 2 for more information.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
Carbon dioxide (CO2), Dry chemical, Foam

Unsuitable extinguishing media
None.

Specific hazards arising from the chemical
None in particular.

Explosion data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Avoid contact with eyes and skin.

Environmental precautions

Environmental precautions Do not flush into surface water or sanitary sewer system. See Section 12 for additional ecological Information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Ensure adequate ventilation. Soak up with inert absorbent material. Sweep up and shovel into suitable containers for disposal.

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep from freezing.

Incompatible materials Strong oxidizing agents

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines .
NIOSH IDLH Immediately Dangerous to Life or Health

Other Information Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Appropriate engineering controls

Engineering Controls Eyewash stations

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear protective gloves and protective clothing.

Respiratory protection Use NIOSH-approved air-purifying respirator with organic vapor cartridge or canister, as

appropriate.

General Hygiene Considerations Handle in accordance with good industrial hygiene and safety practice. Regular cleaning of equipment, work area and clothing is recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Clear
Odor	Citrus
Odor threshold	No information available

Property	**Values**	**Remarks • Method**
pH	No information available	
Melting point / freezing point	No information available	
Boiling point / boiling range	100 °C / 212 °F	
Flash point	> 93 °C / > 200 °F	Tag Closed Cup
Evaporation rate	< 1	Butyl acetate = 1
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	18 mm Hg	
Vapor density	>1	Air = 1
Relative density	1.02 g/ml	
Water solubility	Soluble in water	
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	<0.5%
Density	No information available
Bulk density	No information available

10. STABILITY AND REACTIVITY

Reactivity
No data available

Chemical stability
Stable under recommended storage conditions

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
Excessive heat.

Incompatible materials
Strong oxidizing agents

Hazardous Decomposition Products
Carbon oxides

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation May cause irritation of respiratory tract.

Eye contact Contact with eyes may cause irritation. May cause redness and tearing of the eyes.

Skin contact May cause skin irritation and/or dermatitis.

Ingestion Ingestion may cause irritation to mucous membranes.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
WATER 7732-18-5	> 90 mL/kg (Rat)	-	-
ETHOXYLATED C9-C11 ALCOHOLS 68439-46-3	= 1378 mg/kg (Rat) = 1400 mg/kg (Rat)	> 2 g/kg (Rabbit)	-
DIPROPYLENE GLYCOL MONONBUTYL ETHER 29911-28-2	= 1620 µL/kg (Rat)	= 5860 µL/kg (Rabbit)	= 42.1 ppm (Rat) 4 h

Information on toxicological effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization No information available.
Germ cell mutagenicity No information available.
Carcinogenicity No information available.

The following values are calculated based on chapter 3.1 of the GHS document .
ATEmix (oral) 39421 mg/kg
ATEmix (dermal) 76980 mg/kg

12. ECOLOGICAL INFORMATION

Ecotoxicity

3.17 % of the mixture consists of components(s) of unknown hazards to the aquatic environment

Chemical Name	Algae/aquatic plants	Fish	Crustacea
DIPROPYLENE GLYCOL MONONBUTYL ETHER 29911-28-2	-	841: 96 h Poecilia reticulata mg/L LC50 static	-

Persistence and degradability
No information available.

Bioaccumulation
No information available.

Mobility
No information available.

Other adverse effects
No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging Do not reuse container.

US EPA Waste Number Not applicable

14. TRANSPORT INFORMATION

DOT
Proper shipping name: Not regulated

IATA
Proper shipping name: Not regulated

IMDG
Proper shipping name: Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL/NDSL	Complies
EINECS/ELINCS	Not determined
ENCS	Not determined
IECSC	Complies
KECL	Not determined
PICCS	Not determined
AICS	Not determined

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	Yes
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

US State Regulations

California Proposition 65
This product contains the following Proposition 65 chemicals

Chemical Name	California Proposition 65
ETHANOL - 64-17-5	Carcinogen Developmental

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
SODIUM HYDROXIDE 1310-73-2	X	X	X
ETHANOL 64-17-5	X	X	X

U.S. EPA Label Information
EPA Pesticide Registration Number 6659-3
EPA Statement
This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals.

WHMIS Hazard Class
Non-controlled

NFPA	**Health hazards** 1	**Flammability** 1	**Instability** 0	-
HMIS	**Health hazards** 1	**Flammability** 1	**Physical hazards** 0	**Personal protection** B

NFPA (National Fire Protection Association)
HMIS (Hazardous Material Information System)

Revision Date 04-Sep-2015

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

SAFETY DATA SHEET

1. Identification

Product identifier	**Jump Start® Starting Fluid with Lubricity**
Other means of identification	
Product code	05671
Recommended use	Starting fluid
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Manufactured or sold by:

Company name	CRC Industries, Inc.
Address	885 Louis Dr. Warminster, PA 18974 US
Telephone	
General Information	215-674-4300
Technical Assistance	800-521-3168
Customer Service	800-272-4620
24-Hour Emergency (CHEMTREC)	800-424-9300 (US) 703-527-3887 (International)
Website	www.crcindustries.com

2. Hazard(s) identification

Physical hazards	Flammable aerosols	Category 1
	Gases under pressure	Compressed gas
Health hazards	Skin corrosion/irritation	Category 2
	Carcinogenicity	Category 2
	Specific target organ toxicity, single exposure	Category 3 narcotic effects
	Aspiration hazard	Category 1
Environmental hazards	Hazardous to the aquatic environment, long-term hazard	Category 3
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	Extremely flammable aerosol. Contains gas under pressure; may explode if heated. May be fatal if swallowed and enters airways. Causes skin irritation. May cause drowsiness or dizziness. Suspected of causing cancer. Harmful to aquatic life with long lasting effects.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Do not spray on an open flame or other ignition source. Do not apply while equipment is energized. Pressurized container: Do not pierce or burn, even after use. Extinguish all flames, pilot lights and heaters. Vapors will accumulate readily and may ignite. Use only with adequate ventilation; maintain ventilation during use and until all vapors are gone. Open doors and windows or use other means to ensure a fresh air supply during use and while product is drying. If you experience any symptoms listed on this label, increase ventilation or leave the area. Avoid breathing mist or vapor. Wash thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Avoid release to the environment.

Response	If swallowed: Immediately call a poison center/doctor. Do NOT induce vomiting. If on skin: Wash with plenty of water. If skin irritation occurs: Get medical attention. Take off contaminated clothing and wash before reuse. If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell. If exposed or concerned: Get medical attention.
Storage	Store in a well-ventilated place. Store locked up. Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Exposure to high temperature may cause can to burst.
Disposal	Dispose of contents/container in accordance with local/regional/national regulations.
Hazard(s) not otherwise classified (HNOC)	None known.

Supplemental information

22.5% of the mixture consists of component(s) of unknown long-term hazards to the aquatic environment.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Heptane, branched, cyclic and linear		426260-76-6	70 - 80
Diethyl Ether		60-29-7	10 - 20
Carbon Dioxide		124-38-9	5 - 10
Ethanol		64-17-5	< 1.5
Chloroethane		75-00-3	< 1
Distillates (petroleum), hydrotreated light		64742-47-8	< 1

Specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. If breathing is difficult, give oxygen. Call a POISON CENTER or doctor/physician if you feel unwell.
Skin contact	Remove contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Most important symptoms/effects, acute and delayed	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Aspiration may cause pulmonary edema and pneumonitis. Skin irritation. May cause redness and pain.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General information	IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Foam. Water spray. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	Contents under pressure. Pressurized container may rupture when exposed to heat or flame. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.
Fire-fighting equipment/instructions	In case of fire: Stop leak if safe to do so. Move containers from fire area if you can do so without risk. Containers should be cooled with water to prevent vapor pressure build up.
General fire hazards	Extremely flammable aerosol. Contents under pressure. Pressurized container may rupture when exposed to heat or flame.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Many vapors are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Wear appropriate protective equipment and clothing during clean-up. Avoid breathing mist or vapor. Emergency personnel need self-contained breathing equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up

Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. This product is miscible in water. Stop the flow of material, if this is without risk. Prevent product from entering drains. Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. For waste disposal, see section 13 of the SDS.

Environmental precautions

Avoid release to the environment. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground. Inform appropriate managerial or supervisory personnel of all environmental releases.

7. Handling and storage

Precautions for safe handling

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Pressurized container: Do not pierce or burn, even after use. Do not use if spray button is missing or defective. Do not spray on a naked flame or any other incandescent material. Do not smoke while using or until sprayed surface is thoroughly dry. Do not cut, weld, solder, drill, grind, or expose containers to heat, flame, sparks, or other sources of ignition. Use caution around energized equipment. The metal container will conduct electricity if it contacts a live source. This may result in injury to the user from electrical shock and/or flash fire. Avoid breathing mist or vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Should be handled in closed systems, if possible. Use only in well-ventilated areas. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices. Avoid release to the environment. For product usage instructions, please see the product label.

Conditions for safe storage, including any incompatibilities

Level 3 Aerosol.

Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50°C/122 °F. Do not puncture, incinerate or crush. Do not handle or store near an open flame, heat or other sources of ignition. This material can accumulate static charge which may cause spark and become an ignition source. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Carbon Dioxide (CAS 124-38-9)	PEL	9000 mg/m3
		5000 ppm
Chloroethane (CAS 75-00-3)	PEL	2600 mg/m3
		1000 ppm
Diethyl Ether (CAS 60-29-7)	PEL	1200 mg/m3
		400 ppm
Ethanol (CAS 64-17-5)	PEL	1900 mg/m3
		1000 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
Carbon Dioxide (CAS 124-38-9)	STEL	30000 ppm
	TWA	5000 ppm
Chloroethane (CAS 75-00-3)	TWA	100 ppm
Diethyl Ether (CAS 60-29-7)	STEL	500 ppm
	TWA	400 ppm
Ethanol (CAS 64-17-5)	STEL	1000 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Carbon Dioxide (CAS 124-38-9)	STEL	54000 mg/m3
		30000 ppm
	TWA	9000 mg/m3
		5000 ppm
Distillates (petroleum), hydrotreated light (CAS 64742-47-8)	TWA	100 mg/m3
Ethanol (CAS 64-17-5)	TWA	1900 mg/m3
		1000 ppm

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines

US - California OELs: Skin designation

Chloroethane (CAS 75-00-3) Can be absorbed through the skin.

US ACGIH Threshold Limit Values: Skin designation

Chloroethane (CAS 75-00-3) Can be absorbed through the skin.

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Wear protective gloves such as: Nitrile. Butyl rubber.

Other Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls are not feasible or if exposure exceeds the applicable exposure limits, use a NIOSH-approved cartridge respirator with an organic vapor cartridge. Use a self-contained breathing apparatus in confined spaces and for emergencies. Air monitoring is needed to determine actual employee exposure levels.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations When using do not smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Aerosol.

Color Colorless.

Odor Hydrocarbon-like.

Odor threshold Not available.

pH Not available.

Melting point/freezing point -189.9 °F (-123.3 °C) estimated

Initial boiling point and boiling range 94.3 °F (34.6 °C) estimated

Flash point < 20 °F (< -6.7 °C) Tag Closed Cup

Evaporation rate Fast.

Flammability (solid, gas) Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) 0.5 % estimated

Flammability limit - upper (%) 36.5 % estimated

Vapor pressure	5024.7 hPa estimated
Vapor density	> 1 (air = 1)
Relative density	0.7
Solubility (water)	Slightly soluble.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	320 °F (160 °C) estimated
Decomposition temperature	Not available.
Viscosity (kinematic)	< 20 cSt (104 °F (40 °C))
Percent volatile	100 %

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources. Direct sunlight. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents. Amines. Nitric acids.
Hazardous decomposition products	Carbon oxides. Acrid smoke.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Prolonged inhalation may be harmful.
Skin contact	Causes skin irritation.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Droplets of the product aspirated into the lungs through ingestion or vomiting may cause a serious chemical pneumonia.
Symptoms related to the physical, chemical and toxicological characteristics	Headache. May cause drowsiness and dizziness. Nausea, vomiting. Aspiration may cause pulmonary edema and pneumonitis. Skin irritation. May cause redness and pain.

Information on toxicological effects

Acute toxicity May be fatal if swallowed and enters airways. Narcotic effects.

Product	Species	Test Results
Jump Start® Starting Fluid with Lubricity		
Acute		
Dermal		
LD50	Rabbit	2667 mg/kg estimated
Inhalation		
LC0	Rat	15588 mg/l, 4 hours estimated
LC50	Rat	74 mg/l, 4 hours estimated
Oral		
LD50	Rat	5032 mg/kg estimated

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Causes skin irritation. Repeated exposure may cause skin dryness or cracking.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Suspected of causing cancer.

ACGIH Carcinogens

Chloroethane (CAS 75-00-3)	Confirmed animal carcinogen with unknown relevance to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Chloroethane (CAS 75-00-3)	3 Not classifiable as to carcinogenicity to humans.
Diethyl Ether (CAS 60-29-7)	3 Not classifiable as to carcinogenicity to humans.

US. National Toxicology Program (NTP) Report on Carcinogens

Not available.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure May cause drowsiness and dizziness.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard May be fatal if swallowed and enters airways. If aspirated into lungs during swallowing or vomiting, may cause chemical pneumonia, pulmonary injury or death.

Chronic effects Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity Harmful to aquatic life with long lasting effects.

Product		Species	Test Results
Jump Start® Starting Fluid with Lubricity			
Aquatic			
Fish	LC50	Fish	49850.1406 mg/l, 96 hours estimated
Acute			
Crustacea	EC50	Daphnia	1181.25 mg/l, 48 hours estimated

Components		Species	Test Results
Diethyl Ether (CAS 60-29-7)			
Aquatic			
Fish	LC50	Fathead minnow (Pimephales promelas)	2560 mg/l, 96 hours
Distillates (petroleum), hydrotreated light (CAS 64742-47-8)			
Aquatic			
Acute			
Fish	LC50	Fathead minnow (Pimephales promelas)	45 mg/l, 96 hours
Ethanol (CAS 64-17-5)			
Aquatic			
Acute			
Algae	EC50	Green algae (Chlorella kessleri)	1450 mg/l
Crustacea	EC50	Water flea (Daphnia magna)	11.2 mg/l, 48 hours
			7.7 - 11.2 mg/l, 48 hours
Fish	LC50	Fathead minnow (Pimephales promelas)	15300 mg/l, 96 hours
			> 100 mg/l, 96 hours
			> 100 mg/l, 96 hours
		Rainbow trout,donaldson trout (Oncorhynchus mykiss)	13000 - 15300 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

Chloroethane	1.43
Diethyl Ether	0.89
Ethanol	-0.31

Mobility in soil No data available.

Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal of waste from residues / unused products	If discarded, this product is considered a RCRA ignitable waste, D001. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Contents under pressure. Do not puncture, incinerate or crush. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose in accordance with all applicable regulations.
Hazardous waste code	D001: Waste Flammable material with a flash point <140 F
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN1950
UN proper shipping name	Aerosols, flammable, n.o.s. (engine starting fluid), Limited Quantity
Transport hazard class(es)	
Class	2.1
Subsidiary risk	-
Label(s)	2.1
Packing group	Not applicable.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	N82
Packaging exceptions	306
Packaging non bulk	304
Packaging bulk	None

IATA

UN number	UN1950
UN proper shipping name	Aerosols, flammable (engine starting fluid)
Transport hazard class(es)	
Class	2.1
Subsidiary risk	-
Packing group	Not applicable.
Environmental hazards	No.
ERG Code	10L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Forbidden
Cargo aircraft only	Allowed.

IMDG

UN number	UN1950
UN proper shipping name	AEROSOLS, LIMITED QUANTITY
Transport hazard class(es)	
Class	2
Subsidiary risk	-
Packing group	Not applicable.
Environmental hazards	
Marine pollutant	No.
EmS	F-D, S-U
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

SARA 304 Emergency release notification

Not regulated.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

Chloroethane (CAS 75-00-3)

CERCLA Hazardous Substance List (40 CFR 302.4)

Diethyl Ether (CAS 60-29-7) Listed.

CERCLA Hazardous Substances: Reportable quantity

Diethyl Ether (CAS 60-29-7) 100 LBS

Spills or releases resulting in the loss of any ingredient at or above its RQ require immediate notification to the National Response Center (800-424-8802) and to your Local Emergency Planning Committee.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Chloroethane (CAS 75-00-3)
Diethyl Ether (CAS 60-29-7)

Safe Drinking Water Act (SDWA) Not regulated.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2) and Chemical Code Number

Diethyl Ether (CAS 60-29-7) 6584

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

Diethyl Ether (CAS 60-29-7) 35 %WV

DEA Exempt Chemical Mixtures Code Number

Diethyl Ether (CAS 60-29-7) 6584

Food and Drug Administration (FDA) Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Section 311/312 Hazard categories Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - Yes
Pressure Hazard - Yes
Reactivity Hazard - No

SARA 302 Extremely hazardous substance No

US state regulations

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Chloroethane (CAS 75-00-3)
Distillates (petroleum), hydrotreated light (CAS 64742-47-8)

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. New Jersey Worker and Community Right-to-Know Act

Carbon Dioxide (CAS 124-38-9)
Diethyl Ether (CAS 60-29-7)
Ethanol (CAS 64-17-5)

US. Massachusetts RTK - Substance List

Carbon Dioxide (CAS 124-38-9)
Diethyl Ether (CAS 60-29-7)

US. Pennsylvania Worker and Community Right-to-Know Law

Diethyl Ether (CAS 60-29-7)
Chloroethane (CAS 75-00-3)
Carbon Dioxide (CAS 124-38-9)

US. Rhode Island RTK

Diethyl Ether (CAS 60-29-7)

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Chloroethane (CAS 75-00-3) Listed: July 1, 1990

US - California Proposition 65 - CRT: Listed date/Developmental toxin

Toluene (CAS 108-88-3) Listed: January 1, 1991

US - California Proposition 65 - CRT: Listed date/Female reproductive toxin

Toluene (CAS 108-88-3) Listed: August 7, 2009

Volatile organic compounds (VOC) regulations

EPA

VOC content (40 CFR 51.100(s)) 94.5 %

Consumer products (40 CFR 59, Subpt. C) Not regulated

State

Consumer products Not regulated

VOC content (CA) 94.5 %

VOC content (OTC) 94.5 %

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 07-24-2015

Revision date 08-13-2015

Prepared by Allison Cho

Version # 02

Further information Not available.

HMIS® ratings Health: 1*
Flammability: 4
Physical hazard: 0
Personal protection: B

NFPA ratings Health: 1
Flammability: 4
Instability: 0

NFPA ratings

Disclaimer

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. This information is accurate to the best of CRC Industries' knowledge or obtained from sources believed by CRC to be accurate. Before using any product, read all warnings and directions on the label. For further clarification of any information contained on this (M)SDS consult your supervisor, a health & safety professional, or CRC Industries.

Safety Data Sheet

1 - Identification

Trade Name: WD-40 Aerosol **Product Use:** Lubricant, Penetrant, Drives Out Moisture, Removes and Protects Surfaces From Corrosion **Restrictions on Use:** None identified **SDS Date Of Preparation:** November 15, 2016	**Canadian Office:** WD-40 Products [Canada] Ltd. P.O. Box 220 Toronto, Ontario M9C 4V3 **Information Phone #:** (416) 622-9881 **Emergency Phone # 24 hr:** Canutec: (613) 996-6666 - Designated for use only in the event of chemical emergencies involving a spill, leak, fire exposure or accident involving chemicals

2 – Hazards Identification

WHMIS 2015/GHS Classification:
Flammable Aerosol Category 1
Gas Under Pressure: Compressed Gas
Aspiration Toxicity Category 1
Specific Target Organ Toxicity Single Exposure Category 3 (nervous system effects)

Note: This product is a consumer product and is labeled in accordance with the Consumer Chemicals and Containers Regulations (CCCR) which take precedence over WHMIS 2015 labeling. The actual container label will not include the label elements below. The labeling below applies to industrial/professional products.

Label Elements:

DANGER!
Extremely flammable aerosol.
Contains gas under pressure; may explode if heated.
May be fatal if swallowed and enters airways.
May cause drowsiness or dizziness.

Prevention
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Do not spray on an open flame or other ignition source.
Do not pierce or burn, even after use.
Avoid breathing mist or vapors.
Use only outdoors or in a well-ventilated area.
Response
IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
Call a POISON CENTER or doctor if you fell unwell.
Storage
Store locked up.
Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Store in a well-ventilated place.
Disposal

Dispose of contents and container in accordance with local and national regulations.

3 - Composition/Information on Ingredients

Ingredient	CAS #	Weight Percent	WHMIS 2015/ GHS Classification
Aliphatic Hydrocarbon	64742-47-8	50-70%	Flammable Liquid Category 3 Aspiration Toxicity Category 1 Specific Target Organ Toxicity Single Exposure Category 3 (nervous system effects)
Petroleum Base Oil	64742-56-9 64742-65-0 64742-53-6 64742-54-7 64742-71-8	30-35%	Not Hazardous
Carbon Dioxide	124-38-9	2-3%	Simple Asphyxiant

4 – First Aid Measures

Ingestion (Swallowed): Aspiration Hazard. DO NOT induce vomiting. Call physician, poison control center or the WD-40 Safety Hotline at 1-888-324-7596 immediately.
Eye Contact: Flush thoroughly with water. Remove contact lenses if present after the first 5 minutes and continue flushing for several more minutes. Get medical attention if irritation persists.
Skin Contact: Wash with soap and water. If irritation develops and persists, get medical attention.
Inhalation (Breathing): If irritation is experienced, move to fresh air. Get medical attention if irritation or other symptoms develop and persist.
Signs and Symptoms of Exposure: Harmful or fatal is swallowed. If swallowed, may be aspirated and cause lung damage. May cause eye irritation. Inhalation of mists or vapors may cause nasal and respiratory tract irritation and central nervous system effects such as headache, dizziness and nausea. Skin contact may cause drying of the skin.
Indication of Immediate Medical Attention/Special Treatment Needed: Immediate medical attention is needed for ingestion.

5 – Fire Fighting Measures

Suitable (and unsuitable) Extinguishing Media: Use water fog, dry chemical, carbon dioxide or foam. Do not use water jet or flooding amounts of water. Burning product will float on the surface and spread fire.
Specific Hazards Arising from the Chemical: Contents under pressure. Keep away from ignition sources and open flames. Exposure of containers to extreme heat and flames can cause them to rupture often with violent force. Vapors are heavier than air and may travel along surfaces to remote ignition sources and flash back. Combustion will produce oxides of carbon and hydrocarbons.
Special Protective Equipment and Precautions for Fire-Fighters: Firefighters should always wear positive pressure self-contained breathing apparatus and full protective clothing. Cool fire-exposed containers with water. Use shielding to protect against bursting containers.

6 – Accidental Release Measures

Personal Precautions, Protective Equipment and Emergency Procedures: Wear appropriate protective clothing (see Section 8). Eliminate all sources of ignition and ventilate area.
Methods and Materials for Containment/Cleanup: Leaking cans should be placed in a plastic bag or open pail until the pressure has dissipated. Contain and collect liquid with an inert absorbent and place in a container for disposal. Clean spill area thoroughly. Report spills to authorities as required.

7 – Handling and Storage

Precautions for Safe Handling: Avoid contact with eyes. Avoid prolonged contact with skin. Avoid breathing vapors or aerosols. Use only with adequate ventilation. Keep away from heat, sparks, pilot lights, hot surfaces and open flames. Unplug electrical tools, motors and appliances before spraying or bringing the can near any source of electricity. Electricity can burn a hole in the can and cause contents to burst into flames. To avoid

serious burn injury, do not let the can touch battery terminals, electrical connections on motors or appliances or any other source of electricity. Wash thoroughly with soap and water after handling. Keep containers closed when not in use. Keep out of the reach of children. Do not puncture, crush or incinerate containers, even when empty.
Conditions for Safe Storage: Store in a cool, well-ventilated area, away from incompatible materials Do not store above 120°F or in direct sunlight. U.F.C (NFPA 30B) Level 3 Aerosol. Store away from oxidizers.

8 – Exposure Controls/Personal Protection

Chemical	Occupational Exposure limits
Aliphatic Hydrocarbon	1200 mg/m3 TWA (manufacturer recommended)
Petroleum Base Oil	5 mg/m3 TWA (Inhalable) ACGIH TLV (as mineral oil) 5 mg/m3 TWA, 10 mg/m3 STEL Canada- Québec (as oil mist, mineral) 5 mg/m3 TWA, 10 mg/m3 STEL Canada- Ontario (as oil mist, mineral) 1 mg/m3 TWA British Columbia (as Oil mist-mineral, severely refined)
Carbon Dioxide	5000 ppm TWA, 30000 ppm STEL ACGIH TLV 5000 ppm TWA, 30000 ppm STEL Canada- Ontario 5000 ppm TWA, 30000 ppm STEL Canada- Québec 5000 ppm TWA. 15000 ppm STEL British Columbia

The Following Controls are Recommended for Normal Consumer Use of this Product
Appropriate Engineering Controls: Use in a well-ventilated area.
Personal Protection:
Eye Protection: Avoid eye contact. Always spray away from your face.
Skin Protection: Avoid prolonged skin contact. Chemical resistant gloves recommended for operations where skin contact is likely.
Respiratory Protection: None needed for normal use with adequate ventilation.

For Bulk Processing or Workplace Use the Following Controls are Recommended
Appropriate Engineering Controls: Use adequate general and local exhaust ventilation to maintain exposure levels below that occupational exposure limits.
Personal Protection:
Eye Protection: Safety goggles recommended where eye contact is possible.
Skin Protection: Wear chemical resistant gloves.
Respiratory Protection: None required if ventilation is adequate. If the occupational exposure limits are exceeded, wear a NIOSH approved respirator. Respirator selection and use should be based on contaminant type, form and concentration. Follow applicable regulations and good Industrial Hygiene practice.
Work/Hygiene Practices: Wash with soap and water after handling.

9 – Physical and Chemical Properties

Appearance:	Light amber liquid	Flammable Limits: (Solvent Portion)	LEL: 0.6% UEL: 8%
Odor:	Mild petroleum odor	Vapor Pressure:	95-115 PSI @ 70°F
Odor Threshold:	Not established	Vapor Density:	Greater than 1 (air=1)
pH:	Not Applicable	Relative Density:	0.8 – 0.82 @ 60°F
Melting/Freezing Point:	Not established	Solubilities:	Insoluble in water
Boiling Point/Range:	361 - 369°F (183 - 187°C)	Partition Coefficient; n-octanol/water:	Not established
Flash Point:	122°F (49°C) Tag Open Cup (liquid)	Autoignition Temperature:	Not established
Evaporation Rate:	Not established	Decomposition Temperature:	Not established
Flammability (solid, gas):	Flammable Aerosol	Viscosity:	2.79-2.96 cSt @ 100°F
VOC:	65%	Pour Point:	-63°C (-81.4°F) ASTM D-97

10 – Stability and Reactivity

Reactivity: Not reactive under normal conditions
Chemical Stability: Stable
Possibility of Hazardous Reactions: May react with strong oxidizers generating heat.
Conditions to Avoid: Avoid heat, sparks, flames and other sources of ignition. Do not puncture or incinerate containers.
Incompatible Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide and carbon dioxide.

11 – Toxicological Information

Symptoms of Overexposure:
Inhalation: High concentrations may cause nasal and respiratory irritation and central nervous system effects such as headache, dizziness and nausea. Intentional abuse may be harmful or fatal.
Skin Contact: Prolonged and/or repeated contact may produce mild irritation and defatting with possible dermatitis.
Eye Contact: Contact may be irritating to eyes. May cause redness and tearing.
Ingestion: This product has low oral toxicity. Swallowing may cause gastrointestinal irritation, nausea, vomiting and diarrhea. This product is an aspiration hazard. If swallowed, can enter the lungs and may cause chemical pneumonitis, severe lung damage and death.
Chronic Effects: None expected.
Carcinogen Status: None of the components are listed as a carcinogen or suspect carcinogen by IARC, NTP, ACGIH or OSHA.
Reproductive Toxicity: None of the components is considered a reproductive hazard.

Numerical Measures of Toxicity:
Acute Toxicity Estimates: Oral > 5,000 mg/kg; Dermal >2,000 mg/kg based on an assessment of the ingredients. This product is not classified as toxic by established criteria. It is an aspiration hazard.

12 – Ecological Information

Ecotoxicity: No specific aquatic toxicity data is currently available; however components of this product are not expected to be harmful to aquatic organisms
Persistence and Degradability: Components are readily biodegradable.
Bioaccumulative Potential: Bioaccumulation is not expected based on an assessment of the ingredients.
Mobility in Soil: No data available
Other Adverse Effects: None known

13 - Disposal Considerations

Aerosol containers should not be punctured, compacted in home trash compactors or incinerated. Empty containers may be disposed of through normal waste management options. Dispose of all waste product, absorbents, and other materials in accordance with applicable Federal, state and local regulations.

14 – Transportation Information

DOT Surface Shipping Description: UN1950, Aerosols, 2.1 Ltd. Qty
(Note: Shipping Papers are not required for Limited Quantities unless transported by air or vessel – each package must be marked with the Limited Quantity Mark)
Canadian TDG Classification: Limited Quantity
IMDG Shipping Description: Un1950, Aerosols, 2.1, LTD QTY
ICAO Shipping Description: UN1950, Aerosols, flammable, 2.1

NOTE: WD-40 Company does not test aerosol cans to assure that they meet the pressure and other requirements for transport by air. We do not recommend that our aerosol products be transported by air.

15 – Regulatory Information

National Pollutant Release Inventory (NPRI): This product contains the following chemicals that are listed on the NPRI Substance List: Aliphatic Hydrocarbon (64742-47-8) 50-70%

Canadian Environmental Protection Act: All of the ingredients are listed on the Canadian Domestic Substances List or exempt from notification.

16 – Other Information

HMIS Hazard Rating:
Health – 1 (slight hazard), Fire Hazard – 4 (severe hazard), Physical Hazard – 0 (minimal hazard)

Revision Date: November 15, 2016 Supersedes: March 27, 2014

Prepared by: Industrial Health & Safety Consultants, Inc. Shelton, CT, USA

Reviewed by: I. Kowalski Regulatory Affairs Dept.

1014100/No.0084103

WINDSHIELD WASH -45°C

SECTION 1. IDENTIFICATION

Product Identifier	WINDSHIELD WASH -45°C
Other Means of Identification	15-403SLV, 15-403SLV-PRO, 15-404, 15-408, 35-208SO, 35-306GP, 35-309OPW-1K, 35-404BMW, 35-404E, 35-404LIFE, 35-404MER, 35-404PC, 35-404REF, 35-404U/N, 35-404UFA, 35-408HUS, 35-408SL, 35-404CT
Recommended Use	Please refer to Product label.
Restrictions on Use	None known.
Manufacturer / Supplier	Recochem Inc., 850 Montee de Liesse, Montreal, QC, H4T 1P4, Compliance and Regulatory Department, 905-878-5544, www.recochem.com
Emergency Phone No.	CANUTEC, 613-996-6666, 24 Hours
SDS No.	1575

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Flammable liquid - Category 3; Acute toxicity (Oral) - Category 3; Acute toxicity (Dermal) - Category 3; Acute toxicity (Inhalation) - Category 3; Specific target organ toxicity (single exposure) - Category 1

GHS Label Elements

Signal Word:
Danger

Hazard Statement(s):

H226	Flammable liquid and vapour.
H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H331	Toxic if inhaled.
H370	Causes damage to organs (eyes) if swallowed.

Precautionary Statement(s):

Prevention:

P210	Keep away from heat, sparks, open flames, and hot surfaces. – No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical, ventilating, lighting, and other equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P260	Do not breathe fume, mist, vapours, spray.
P264	Wash hands and skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.

P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/protective clothing.

Response:
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTRE/doctor.
P330 Rinse mouth.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P312 Call a POISON CENTRE/doctor if you feel unwell.
P363 Wash contaminated clothing before reuse.
P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a POISON CENTRE/doctor if you feel unwell.
P321 Specific treatment (see supplemental first aid instruction on this label).
P370 + P378 In case of fire: Use appropriate foam, carbon dioxide, dry chemical powder, water spray or fog to extinguish.

Storage:
Store in a well ventilated place. Keep cool. Keep container tightly closed. Store locked up.

Disposal:
Dispose of contents/container in accordance with applicable regional, national and local laws and regulations.

Other Hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture:

Chemical Name	CAS No.	%	Other Identifiers
Methanol	67-56-1	30-60	

Notes

The specific chemical identity and/or exact percentage of composition (concentration) has been withheld as a trade secret.

SECTION 4. FIRST-AID MEASURES

First-aid Measures

Inhalation

Take precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). Remove source of exposure or move to fresh air. Keep at rest in a position comfortable for breathing. If breathing has stopped, trained personnel should begin rescue breathing. If the heart has stopped, trained personnel should start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED). Avoid mouth-to-mouth contact by using a barrier device. Get medical advice/attention if you feel unwell or are concerned.

Skin Contact

Avoid direct contact. Wear chemical protective clothing if necessary. Take off immediately contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Wash gently and thoroughly with lukewarm, gently flowing water and mild soap for 5 minutes. Get medical advice/attention if you feel unwell or are concerned. Thoroughly clean clothing, shoes and leather goods before reuse or dispose of safely.

Eye Contact

Avoid direct contact. Wear chemical protective gloves if necessary. Immediately rinse the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes, while holding the eyelid(s) open. If eye irritation persists, get medical advice/attention.

Ingestion

Rinse mouth with water. Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Do not induce vomiting. If vomiting occurs naturally, lie on your side in the recovery position. Rinse mouth with water again. If breathing has stopped, trained personnel should immediately begin rescue breathing. If the heart has stopped, trained personnel should start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED). Avoid mouth-to-mouth contact by using a barrier device. Immediately call a Poison Centre or doctor. Treatment is urgently required.

Most Important Symptoms and Effects, Acute and Delayed

No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Immediate Medical Attention and Special Treatment

Target Organs

Eyes, liver, nervous system.

Special Instructions

Acute exposure to methanol, either through ingestion or breathing high airborne concentrations can result in symptoms appearing between 40 minutes and 72 hours after exposure. Symptoms and signs are usually limited to CNS, eyes and gastrointestinal tract. Because of the initial CNS's effects of headache, vertigo, lethargy and confusion, there may be an impression of ethanol intoxication. Blurred vision, decreased acuity and photophobia are common complaints. Treatment with ipecac or lavage is indicated in any patient presenting within two hours of ingestion. A profound metabolic acidosis occurs in severe poisoning and serum bicarbonate levels are a more accurate measure of severity than serum methanol levels. Treatment protocols are available from most major hospitals and early collaboration with appropriate hospitals is recommended.

Medical Conditions Aggravated by Exposure

Respiratory conditions.

SECTION 5. FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media

Carbon dioxide, dry chemical powder or appropriate foam. Special "alcohol resistant fire-fighting foams".

Unsuitable Extinguishing Media

Water is not effective for extinguishing a fire. It may not cool product below its flash point.

Specific Hazards Arising from the Chemical

Highly flammable liquid and vapour. Can ignite at room temperature. Releases vapour that can form explosive mixture with air. Can be ignited by static discharge. Can accumulate static charge by flow, splashing or agitation. Even dilute solutions in water may be flammable. May travel a considerable distance to a source of ignition and flash back to a leak or open container. See Section 9 (Physical and Chemical Properties) for flash point and explosive limits. Burns with an invisible flame. May accumulate in hazardous amounts in low-lying areas especially inside confined spaces, resulting in a fire hazard.
In a fire, the following hazardous materials may be generated: toxic chemicals; very toxic carbon monoxide, carbon dioxide; very toxic, flammable formaldehyde.

Special Protective Equipment and Precautions for Fire-fighters

Review Section 6 (Accidental Release Measures) for important information on responding to leaks/spills.
See Skin Protection in Section 8 (Exposure Controls/Personal Protection) for advice on suitable chemical protective materials.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures

Evacuate the area immediately. Isolate the hazard area. Keep out unnecessary and unprotected personnel. Evacuate downwind locations. Use the personal protective equipment recommended in Section 8 of this safety data sheet. Increase ventilation to area or move leaking container to a well-ventilated and secure area. Eliminate all ignition

sources. Use grounded, explosion-proof equipment. May accumulate in hazardous amounts in low-lying areas especially inside confined spaces, if ventilation is not sufficient. Distant ignition and flashback are possible.

Environmental Precautions

Do not allow into any sewer, on the ground or into any waterway.

Methods and Materials for Containment and Cleaning Up

Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling

Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Conditions for Safe Storage

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

	ACGIH TLV®		OSHA PEL		AIHA WEEL	
Chemical Name	TWA	STEL	TWA	Ceiling	8-hr TWA	TWA
Methanol	200 ppm	250 ppm	200 ppm	250 ppm		

Appropriate Engineering Controls

General ventilation is usually adequate. For large scale use of this product: do not allow product to accumulate in the air in work or storage areas, or in confined spaces. Use local exhaust ventilation, if general ventilation is not adequate to control amount in the air. Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems in areas where this product is used and stored. Control static electricity discharges which includes bonding of equipment to ground. Use only non-combustible, compatible materials for walls, floors, ventilation system, air cleaning devices, pallets, shelving. Provide safety shower in work area, if contact or splash hazard exists.

Individual Protection Measures

Eye/Face Protection

Wear chemical safety goggles.

Skin Protection

Wear chemical protective clothing e.g. gloves, aprons, boots.
Nitrile rubber.

Respiratory Protection

Not normally required if product is used as directed. For non-routine or emergency situations: wear a NIOSH approved air-purifying respirator with an organic vapour cartridge.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Basic Physical and Chemical Properties

Appearance	Clear Purple liquid.
Odour	Pungent
Odour Threshold	Not available
pH	8 - 11 (100% solution)
Melting Point/Freezing Point	Not available (melting); -45 ºC (-49 ºF) (freezing)
Initial Boiling Point/Range	Not available
Flash Point	27.7 ºC (81.9 ºF) (closed cup)
Evaporation Rate	Not available
Flammability (solid, gas)	Not applicable
Upper/Lower Flammability or Explosive Limit	Not available (upper); Not available (lower)
Vapour Pressure	Not available
Vapour Density (air = 1)	Not available
Relative Density (water = 1)	0.90 - 0.97 at 20 ºC
Solubility	Soluble in water; Soluble in all proportions in alcohols (e.g. ethanol).
Partition Coefficient, n-Octanol/Water (Log Kow)	Not available
Auto-ignition Temperature	Not available
Decomposition Temperature	Not available
Viscosity	Not available (kinematic); Not available (dynamic)

Other Information

Physical State	Liquid
Molecular Weight	Not available

SECTION 10. STABILITY AND REACTIVITY

Reactivity

None known.

Chemical Stability

Normally stable.

Possibility of Hazardous Reactions

None known.

Conditions to Avoid

Heat. Open flames, sparks, static discharge, heat and other ignition sources.

Incompatible Materials

Slightly reactive or incompatible with the following materials: oxidizing agents (e.g. peroxides), strong acids (e.g. hydrochloric acid), strong bases (e.g. sodium hydroxide).
Not corrosive to metals.

Hazardous Decomposition Products

Very toxic carbon monoxide, carbon dioxide; very toxic, flammable formaldehyde.

SECTION 11. TOXICOLOGICAL INFORMATION

Likely Routes of Exposure

Ingestion; eye contact; skin contact; inhalation.

Acute Toxicity

Chemical Name	LC50	LD50 (oral)	LD50 (dermal)
Methanol	83867.5 mg/m3 (rat) (4-hour exposure)	5628 mg/kg (rat)	15800 mg/kg (rabbit)

LC50: Not applicable.

LD50 (oral): Not applicable.

LD50 (dermal): Not applicable.

Skin Corrosion/Irritation

Human experience shows very mild irritation.

Serious Eye Damage/Irritation

Animal tests show serious eye irritation.

STOT (Specific Target Organ Toxicity) - Single Exposure

Inhalation

At high concentrations severe nose and throat irritation.

Skin Absorption

May be harmful based on animal tests.

Ingestion

Toxic, can cause death depression of the central nervous system, impaired vision and blindness. In some cases, there may be delayed effects on the nervous system. Symptoms may include headache, nausea, vomiting, dizziness, drowsiness and confusion. A severe exposure may cause stomach pain, muscle pain, difficult breathing and coma. Vision can be impaired and permanent blindness can result. There may be other permanent effects on the nervous system e.g. tremor, seizures.

Aspiration Hazard

Not known to be an aspiration hazard.

STOT (Specific Target Organ Toxicity) - Repeated Exposure

If swallowed: liver function tests may show abnormal results.

Respiratory and/or Skin Sensitization

Not known to be a respiratory sensitizer. Not known to be a skin sensitizer.

Carcinogenicity

Chemical Name	IARC	ACGIH®	NTP	OSHA
Methanol	Not Listed	Not designated	Not Listed	Not Listed

May cause cancer based on animal studies.

Reproductive Toxicity

Development of Offspring

Animal studies show effects on the offspring. If inhaled: known to cause: decreased weight, birth defects. Teratogenic(external, soft tissue and skeletal defects) embryotoxic (late resorptions).

Sexual Function and Fertility

Not known to cause effects on sexual function or fertility.

Effects on or via Lactation

No information was located.

Germ Cell Mutagenicity

Conclusions cannot be drawn from the limited studies available.

Interactive Effects

No information was located.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity

Acute Aquatic Toxicity

Chemical Name	LC50 Fish	EC50 Crustacea	ErC50 Aquatic Plants	ErC50 Algae
Methanol	15400 mg/L (Lepomis macrochirus (bluegill); 96-hour)	10000 mg/L (Daphnia magna (water flea); 48-hour)		

Chronic Aquatic Toxicity

Chemical Name	NOEC Fish	EC50 Fish	NOEC Crustacea	EC50 Crustacea
Methanol	7900 mg/L (Lepomis macrochirus (bluegill); 200-hrs)			

Persistence and Degradability

Degrades rapidly based on quantitative tests.

Bioaccumulative Potential

This product and its degradation products are not expected to bioaccumulate.

Mobility in Soil

No information was located.

Other Adverse Effects

There is no information available.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal Methods

The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

SECTION 14. TRANSPORT INFORMATION

Regulation	UN No.	Proper Shipping Name	Transport Hazard Class(es)	Packing Group
Canadian TDG	1986	ALCOHOLS, FLAMMABLE, TOXIC, N.O.S. (Methanol)	3 (6.1)	III
US DOT	1986	ALCOHOLS, FLAMMABLE, TOXIC, N.O.S. (Methanol)	3 (6.1)	III

Environmental Hazards: Not applicable

Special Precautions for User: Please note: In containers of 450L or less, this product meets the requirements for exemption under TDG regulation special provisions, part 1, section 1.36b: Class 3, Flammable liquids: Alcohol Exemption.

In containers of 5 L (5Kg) capacity or less this product is classified as a "Consumer Commodity" under DOT regulations.

Transport in Bulk According to Annex II of MARPOL 73/78 and the IBC Code

SECTION 15. REGULATORY INFORMATION

Safety, Health and Environmental Regulations

Canada

Domestic Substances List (DSL) / Non-Domestic Substances List (NDSL)

All ingredients are listed on the DSL/NDSL.

USA

Toxic Substances Control Act (TSCA) Section 8(b)

All ingredients are listed on the TSCA Inventory.

Additional USA Regulatory Lists

California Proposition 65: WARNING: This product contains chemicals known to the State of California to cause birth defects.

SECTION 16. OTHER INFORMATION

SDS Prepared By	Compliance and Regulatory Department
Phone No.	905-878-5544
Date of Preparation	October 19, 2015
Additional Information	We are committed to uphold the Industry Consumer Ingredient Communication Voluntary Initiative. Please send us your request by visiting our website at www.recochem.com. Ingredients present (intentionally added ingredients) at a concentration of greater than one percent (1%) shall be listed in descending order of predominance. Ingredients present at a concentration of not more than one percent shall be listed but may be disclosed without respect to order of predominance.
Disclaimer	Notice to reader: To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

APPENDIX P

Technical Memo - Update on Peso Vegetation Plots 2017

THIS PAGE INTENTIONALLY LEFT BLANK

Laberge
ENVIRONMENTAL SERVICES
P.O. Box 21072
Whitehorse, Y.T.
Y1A 6P7

email: laberge@northwestel.net
Office Phone: 867-668-6838
Fax: 867-667-6956

TECHNICAL MEMO

To: Steve Wilbur
Victoria Gold

Date: January 30th, 2018

From: Bonnie Burns
Laberge Environmental Services

Re: **Update on Peso Vegetation Plots**

The fifth annual assessment of the vegetation plots at the Peso mine site was conducted on August 4th, 2017. The details of the assessment have been summarized in Table 1 (Trench sites) and Table 2 (Waste Rock sites).

Figures 1 and 2 demonstrate the estimated vegetative cover for each Plot at the Trench and Waste Rock sites respectively.

Selected photographs are also included with this memo.

Note that details on the methodology and observed results from 2012 to 2014 are included in a previously submitted report (Laberge, 2015). Technical memos outlining the results for the 2015 and 2016 have been submitted to Victoria Gold.

Below are summarized observations and comments on the 2017 assessment:

Trench Site

- The trench plots were seeded with sheep fescue, tufted hairgrass, alpine bluegrass, spike trisetum, hedysarum and alder.
- The seeded plots that received no treatment continued to have minimum to no grass growth/survival. The sparse alder and volunteer plants appeared generally healthy.
- Ticklegrass was not planted at this site but was identified as a volunteer plant on several of the plots. Ticklegrass is a native species throughout the Peso site.
- Non-planted species that were observed growing on some of the trench plots include willows, spruce, Labrador Tea, blueberry and dwarf birch.
- Leaf litter is increasing in several plots.
- There is diverse growth in all of the plots in Block 3.
- Alsike clover, an introduced species to the Yukon, was documented at one of the plots in Block 3 (see Photo #8). Although it is a nitrogen fixer (as is alder), if it appears to be spreading, it will be removed during the next assessment. It was identified in Plot 3-2B in 2016 but was absent in the 2017 assessment. It is suspected that alsike clover originally came in with the compost during the initial seeding.
- Generally the plots treated with compost and biochar exhibited the best growth.

Waste Rock Site

- The waste rock sites were seeded with sheep fescue, tufted hairgrass, glaucous bluegrass, ticklegrass, hedysarum and alder.
- The plots that received no treatment but were seeded at the same rate and with the same species as the others continue to support no growth.
- The alders in Block 1 all appear healthy.

- Alders in Block 2 appeared to have either been browsed and/or subject to defoliation from an insect species (see Photo #13) however they were otherwise robust.
- Non-planted species that were observed growing on some of the waste rock plots include willows, spruce, and dwarf birch.
- Only two plots in Block 3 had live plants.
- The plots containing the healthiest plants with the greatest diversity of growth were generally observed on the plots that had been treated with biochar, compost and dolomite.

Summary

For successful plant growth and survival, some form of amendment is required at the Peso site. The acidic and mineral soils in the area have been very slow to create colonization of the disturbed areas. Peso was last actively mined in 1965. Compost and biochar seems to be sufficient at kick starting the revegetation process.

Grass growth within the plots are gradually decreasing as shrubs take over. Grasses are not the dominant plant type in the area and they were seeded to assist in building up soil conditions and to help retain moisture. Grasses are also seeded in areas to help control erosion although this was not the issue for the Peso study area. As the grasses and shrubs lose their leaves, organic matter builds up, which leads to an increase in soil fertility. The decomposition of alder leaves and plant parts provides available nitrogen.

The Blocks that supported the healthiest and most robust plants were those located closer to the forest margin; Blocks 1 and 3 at the Trench Site and Block 2 at the Waste Rock site. These locations probably provide some protection from the elements and possibly retain greater moisture than the more open sites.

It appears evident at Block 3 on the Waste Rock dump that acid rock drainage (ARD) is seeping in this area (staining on the rock surfaces) and inhibiting growth. Photo #16 shows how the effects of the ARD is corroding the rebar stakes at the plots. The effects of biochar and dolomite used at the plots in Block 3 have essentially been exhausted and now are insufficient to neutralize the soil conditions and allow plant growth. Interestingly, the small willows, alder and dwarf birch observed in Plot 3-4 appeared relatively healthy.

Recommendations

The 2017 assessment provides five years of monitoring at the Peso trail plots. As a final wrap up to this project, it is recommended that in 2018, soil and plant tissue samples are collected and analysed. Soil samples collected in the untreated buffer areas and in the treated plots will give an indication of any changes in pH, metal concentrations and nutrient levels within the 0 to 10 cm depth. Plant tissues (alder leaves and grasses) will be analysed for metal uptake from the plots and compared to those collected from the undisturbed nearby areas. The root depth of plants will also be noted.

References

Laberge Environmental Services. 2015. Revegetation and Bioremediation Trials on the Dublin Gulch Property, 2012 to 2014. Prepared for Victoria Gold Corp.

TABLE 1 ASSESSMENTS OF THE PLOTS AT THE TRENCH SITE, AUGUST 4, 2017

BLOCK #1

Plot #	% Cover	Species, avg height cm and/or # of individuals	Overall Health	Comments
1-1A	<1	5 dwarf birch, very small	good	no grass
1-2A	40	Fescue, several mature and producing seed, dominant tufted harigrass, 1 is mature alpine bluegrass ticklegrass spike trisetum, 1 is mature 10 alder , robust growth unidentified small forbs	good	lots of leaf litter and last year's grasses.
1-3	60	Fescue, several mature, dominant alpine bluegrass tickle grass 25 alder - robust unidentifed small forbs	good	all plants appear healthy lots of leaf litter % cover includes leaf litter, See Photo #2
1-1B	1	14 small alder 1 spruce seedling	good	no grasses
1-2B	60	alpine bluegrass, some mature, dominant grass ticklegrass tufted harigrass, 1 is mature 48 alder 1 spruce seedling a few willow seedlings	good	even coverage of plot lots of leaf litter

TABLE 1 ASSESSMENTS OF THE PLOTS AT THE TRENCH SITE, AUGUST 4, 2017

BLOCK #2

Plot #	% Cover	Species, height cm and/or # of individuals	Overall Health	Comments
2-3A	35	unidentified stressed grasses are dominant grass alpine bluegrass, none mature 4 alder, up to 80 cm labrador tea willow seedlings blueberry several dwarf birch moss spruce seedling	grasses - poor others - good	The grasses are stressed but the alders and the volunteer plants are healthy. See Photo #5
2-1A	<5	labrador tea dwarf birch blueberry spruce seedlings small tufts of dead grass from previous years	good	no live grasses all volunteer plants in plot
2-2	50	fescue, several mature alpine bluegrass 1 large alder - 130 cm, also small ones labrador tea blueberry spruce seedling	good	some leaf litter
2-3B	25	unidentified tufts of grasses alpine bluegrass several willow seedlings labrador tea dwarf birch spruce seedling	fair	leaf litter from grasses
2-1B	1	a few blades of unidentified grass dwarf birch willow seedlings labrador tea spruce seedling	grasses - poor others - good	only 1 tuft of spindly grass volunteer shrubs doing well

TABLE 1 ASSESSMENTS OF THE PLOTS AT THE TRENCH SITE, AUGUST 4, 2017

BLOCK #3

Plot #	% Cover	Species, avg height cm and/or # of individuals	Overall Health	Comments
3-2A	65	unhealthy grasses likely fescue - dominant grass alpine bluegrass, immature ticklegrass, mature 1 large alder, 118 cm 3 smaller alder willow labrador tea dwarf birch 1 large tuft of alsike clover moss	poor to good	most plants appear robust and healthy
3-3A	50	tufted hairgrass, mature ticklegrass, mature alpine bluegrass Calamagrotis canadensis, mature fescues, mature 7 alder up to 88 cm dwarf birch willows, labrador tea spruce	good	good biodiversity healthy growth of all plants
3-1	5 - 10	sparse unhealthy fescue 1 ticklegrass dwarf birch labrador tea willow spruce moss	grasses - poor others - good	grasses appear somewhat stressed, volunteer plants appear to be doing well
3-2B	40	struggling fescue alpine bluegrass 9 robust alder up to 80 cm willows, spruce seedlings moss dwarf birch	fair to good	the fescues appear somewhat stressed. alders appear very healthy
3-3B	20	alpine bluegrass fescues 6 alder up to 44 cm dwarf birch willows spruce moss	stressed to healthy	all grasses appear to be stuggling however, the grasses growing near the alder appear more healthy. Alder and volunteer plants appear healthy

TABLE 2 ASSESSMENTS OF THE PLOTS AT THE WASTE ROCK SITE, AUGUST 4, 2017

BLOCK #1

Plot #	% Cover	Species, height cm and/or # of individuals	Overall Health	Comments
1-1	0			bare plot
1-2	50	fescue, mature 15 alder up to 61 cm spruce willows	good	a live ant was observed walking thru the plot lots of grass litter
1-3	5	live grasses growing next to alders only alder, 2 plants - healthy small dwarf birch	stressed to good	mostly dead grasses or stressed alders - healthy
1-4	40	Fescue and several in seed alders up to 68 cm willows - healthy and growing spruce, growing (see Photo #12)	good	
1-5	30	ticklegrass, immature grass - likely fescue 4 large alder up to 111 cm small willow seedlings	fair to good	lots of grass litter grassess appear stressed

TABLE 2 ASSESSMENTS OF THE PLOTS AT THE WASTE ROCK SITE, AUGUST 4, 2017

BLOCK #2

Plot #	% Cover	Species, height cm and/or # of individuals	Overall Health	Comments
2-1	0	no sign of any growth		bare plot, moose tracks thru plot
2-2	60	ticklegrass, mature plants immature fescue many alder - too numerous to count 2 spruce seedlings willows	good	coverage mostly on east half
2-3	60	numerous alder 5 paper birch 3 spruce willows	good	grass leaf litter some of the alder appear to have suffered from browsers and/or defoliators (see Photo #13)
2-4	90	tufted hairgrass, several in flower sheep fescue, some mature ticklegrass alder, too many to count, thick growth willows	good	some alder seem to have suffered as in Plot 2-3
2-5	75	unhealthy fescue grasses many alders willows spruce seedlings	fair to good	some alder also seem to have the same fate as Plot 2-3

TABLE 2 ASSESSMENTS OF THE PLOTS AT THE WASTE ROCK SITE, AUGUST 4, 2017

BLOCK #3

Plot #	% Cover	Species, height cm and/or # of individuals	Overall Health	Comments
3-1	0	no growth		bare plot
3-2	0	no live growth		only dead plant material from previous years
3-3	0	no growth		bare plot
3-4	5	1 ticklegrass in seed 1 tuft of glaucous bluegrass 2 alder a few willows small dwarf birch small tufts of fescue	fair to good	willows and alder appear healthy most productive plot in block (see Photo #15)
3-5	<5	glaucous bluegrass, mature ticklegrass, mature	fair	

FIGURE 1 Trench Site as Assessed on August 4th, 2017

Treatment Number	Treatment
1	Seed only
2	Seed, biochar, compost
3	Seed, biochar, compost, leonardite

Trench Block #1

1 Plot #1-1A C = <1%		**3** Plot #1-3 C = 60%		**2** Plot #1-2B C = 60%
	2 Plot #1-2A C = 40%		**1** Plot #1-1B C = 1	

Trench Block #2

	1 Plot # 2-1A C = <5%		**3** Plot # 2-3B C = 25%	
3 Plot # 2-3A C = 35%		**2** Plot # 2-2 C = 50%		**1** Plot # 2-1B C = 1%

Trench Block #3

2 Plot #3-2A C = 65%		**1** Plot #3-1 C = 5 - 10%		**3** Plot #3-3B C = 20%
	3 Plot #3-3A C = 50%		**2** Plot #3-2B C = 40%	

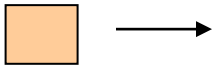
C = Cover  Buffer plots – not seeded or treated.

FIGURE 2 Waste Rock Site as Assessed on August 4th, 2017

Treatment Number	Treatment
1	Seed only
2	Seed, biochar, compost
3	Seed, biochar, compost, leonardite
4	Seed, biochar, compost, dolomite lime
5	Seed, biochar, compost, leonardite, dolomite lime

Waste Rock Block #1

1 Plot # 1-1 C = 0%		**3** Plot # 1-3 C = 5%		**5** Plot # 1-5 C = 30%
	2 Plot # 1-2 C = 50%		**4** Plot # 1-4 C = 40%	

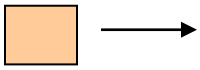
Waste Rock Block #2

	2 Plot # 2-2 C = 60%		**4** Plot # 2-4 C = 90%	
1 Plot # 2-1 C = 0%		**3** Plot # 2-3 C = 60%		5 Plot # 2-5 C = 75%

Waste Rock Block #3

1 Plot # 3-1 C = 0%		**3** Plot # 3-3 C = 0%		**5** Plot # 3-5 C = <5%
	2 Plot # 3-2 C = 0%		**4** Plot # 3-4 C = 5 %	

C = Cover



Buffer plots – not seeded or treated.

Photo #1: Overall view of Block 1 at the Trench site.

Photo #2: Plot 1-3 in Block 1 at the Trench site.

Photo #3: Plot 1-2B in Block 1 at the Trench site.

Photo #4: Overall view of Block 2 at the Trench site.

Photo #5: Plot 2-3A in Block 2 at the Trench site.

Photo #7: Overall view of Block 3 at the Trench site.

Photo #6: Plot 2-2 in Block 2 at the Trench site.

Photo #8: Plot #3-2A in Block 3 of Trench site, alsike clover in foreground.

Photo #9: Plot 3-1 in Block 3 of the Trench site shows small but healthy growth in this untreated plot.

Photo #10: Overall view of Block 1 on the Waste Rock site.

Photo #11: Plot 1-2 in Block 1 at the Waste Rock site.

Photo #13: Overall view of Block 2 on the Waste Rock site. Note moose prints in Plot 2-1.

Photo #12: A thriving healthy spruce plant in Plot 1-4 in Block 1 at the Waste Rock site.

Photo #13: Stripped branches in Plot 2-4 in Block 2 on the Waste Rock. Could be caused by browsers or defoliators.

Photo # 14: Overall view of Block 3 on the Waste Rock site.

Photo #15: Plot #3-4 is the healthiest plot in Block 3 on the Waste Rock site.

Photo #16: Corroded rebar at Block 3 of the Waste Rock site.