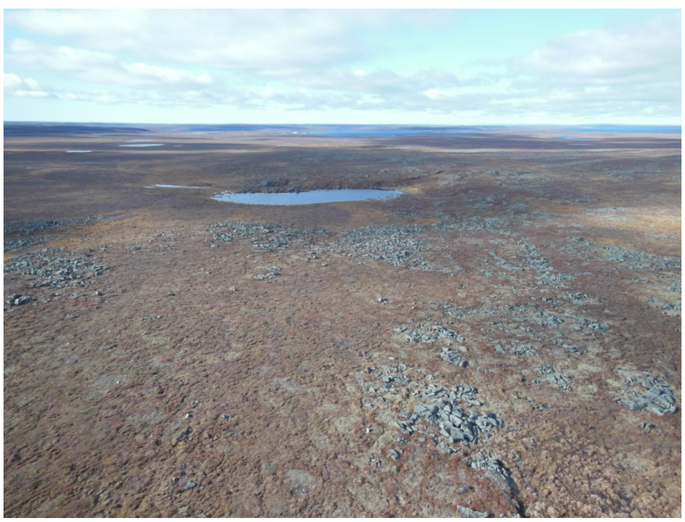
Back River Project Site-Wide Water Management Report

Prepared for

Sabina Gold & Silver Corp.



Prepared by

SRK Consulting (Canada) Inc.
1CS020.008
September 2015

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Executive Summary

SRK Consulting (Canada) Inc. (SRK) was retained by Sabina Gold & Silver Corp. (Sabina) to develop site-wide water management strategies from Construction through Operations, Closure and Post-Closure, as part of the Back River Project Final Environmental Impact Statement (FEIS).

The Property is comprised of two distinct areas; Goose Property and the Marine Laydown Area (MLA). Water management plans were prepared for both Goose Property and MLA, for each phase of the mine life; Construction, Operations, Closure and Post-Closure.

The operational period consists of open pit and underground mining, and will take place over a ten-year period. Three tailings facilities are operated in sequence, which are presented as three stages within the Operations. The Closure period will take place over an additional eight years, at which point the Project enters Post-Closure and all remaining facilities are decommissioned.

Water on the Project is categorized into three types: including contact water, which is impacted by mine workings (waste rock, ore stockpile, pits, tailings, etc.); non-contact water, which is runoff from undisturbed areas; and saline water, which is the groundwater inflows to mining areas. Each type of water is managed separately throughout each Project phase.

Contact water is contained in event ponds and tailings facilities, and is transferred via diversions and pumped pipelines. Non-contact water is diverted off-site through event ponds, pumped pipelines, berms, and culverts. Saline water is pumped from the underground facilities and stored in the Saline Water Pond, which is subsequently pumped back into mined out undergrounds or into the bottom of the Llama Reservoir.

A water treatment plant will be operational in the open water season at the Goose Property in the Construction phase to initially dewater Llama and Umwelt lakes in order to create storage for contact water and saline water, respectively. Treatment is inactive between Years 1 and 5, but begins again year-round from the Goose Main Tailings Facility (Goose Main TF) in Year 6 to reduce metal and suspended solids loading in the facility. Once mining is complete in Year 10, water treatment continues during the open water season from the Goose Main TF, until Year 18, at which point the Property is finally closed.

The MLA does not require any pond or diversion infrastructure for water management purposes, and remains in the same condition for both the Construction and Operations phase. A desalination plant will produce domestic and industrial water, and greywater will be discharged to the tundra.

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1 Introduction

1.1 Background

SRK Consulting (Canada) Inc. (SRK) was retained by Sabina Gold & Silver Corp. (Sabina) to develop site-wide water management plans from Construction through Operations, Closure and Post-Closure, as part of the Back River Project Final Environmental Impact Statement (FEIS).

The Property is located in the territory of Nunavut, 160 km south of Bathurst Inlet and is comprised of two distinct sites; Goose Property and the Marine Laydown Area (MLA). The MLA is located approximately 130 km north of the Goose Property (Figure 1). The George Property is situated roughly midway between these two sites and is an advanced exploration site associated with the Project.

The Goose Property includes four distinct deposit areas, Llama, Umwelt, Goose Main, and Echo. Mining from each of these areas will consist of open pit and underground methods over a ten-year period.

1.2 Scope of Work

The site-wide water management planning includes lake dewatering, contact and non-contact water separation, permanent and temporary diversions, pumping transfer systems, temporary event ponds, and reservoirs. Water management plans were developed for four key phases of the Project: Construction, Operations, Closure, and Post-Closure.

Goals of site-wide water management planning include:

- Adoption of Best Management Practices, recognizing the unique constraints of each project element;
- Ensure reliable water supply to the Goose Process Plant;
- Facilitate mining of the deposits by managing mine inflows whether as a result of groundwater or direct meteoric water;
- Manage contact, non-contact, and saline water separately in order to minimize use of fresh water make-up on site; and
- Collect and treat contact water to ensure site-specific water quality objectives can be met in the receiving environment.

Site-specific design criteria for all water management infrastructure is presented, consistent with these overarching goals. Because of the physical separation, separate site-wide water management plans are prepared for the Goose Property and the MLA.

1.3 Report Layout

Following this introductory chapter, the remainder of this report consist of three chapters. Chapter 2 summarizes the design criteria which were incorporated throughout the development of the site-wide water management plans. The preliminary designs and analysis methodology for each of the water management components are presented in Chapter 3. Chapter 4 presents the water management plans for each phase and stage of the Project at both the Goose Property and the MLA.

The report includes a comprehensive reference list and figures to compliment the information contained herein. The two appendixes contain further supporting details.

2 Design Criteria

2.1 Supporting Information

2.1.1 Hydrology

Hydrologic data used in the design of water management infrastructure was obtained from the Hydrology Report (SRK Consulting (Canada) Inc., 2015b). Reference material includes:

- Rainfall depths for each return period and duration;
- Maximum daily snowmelt; and
- The timing of the open water season; namely, July, August, and September.

2.1.2 Topography and Site Layout Drawings

All topographical information was provided by Sabina, including surface topography from LiDAR (Sabina Gold & Silver Corp., 2012), bathymetry for various nearby lakes (Sabina Gold & Silver Corp., 2011-2013), and open pit shells (JDS Mining, 2014). These surfaces were used to estimate construction quantities (i.e. material take-offs) for the water management infrastructure as well as the stage capacity curves for open pits and lakes.

Overall site layout and infrastructure mapping provided by Sabina (Sabina Gold & Silver Corp., 2015) including haul roads, waste rock storage areas (WRSAs), the tailings storage facility (TSF), tailings facilities (TFs), open pit footprints, ore stockpiles, and all other mine and Process Plant primary and supporting infrastructure.

2.1.3 Water Balance

The site-wide water management described in this report is subservient to, and has been informed entirely by, the site-wide water and load balance for the Project (SRK Consulting (Canada) Inc., 2015a).

2.1.4 Climate Change

Water management infrastructure has a design life of 10+ years, and post-closure water management for the Project is expected to continue for a period of 8 years. In accordance with the Standardized Procedure for Climate Change Integration into Engineering Design adopted for the Project (SRK Consulting (Canada) Inc., 2015e), the primary climate variable that is important from a water management infrastructure design perspective is variability in precipitation patterns. Subsequent climate change analysis (SRK Consulting (Canada) Inc., 2015c) confirmed that the rate of change of rainfall depth over baseline conditions is expected to be less than 10% by the year 2040 (i.e. 3 years after Post-Closure). As a result, rainfall depths from the Hydrology Report (SRK Consulting (Canada) Inc., 2015b) have been increased by 10%, to account for climate change, and are presented in Table 3-2.

2.2 Water Classification

Water on-site is categorized into three types as described in Table 2-1.

Table 2-1: Water Classification

Type	Contact Surface	Management Approach	Discharge Approach
Non-contact water (NCW)	Undisturbed areas	Diverted off-site in diversion channels and pipelines	Directly to environment
Contact water (CW)	WRSAs, TSF, TFs, ore stockpiles, pits, rock pads, haul roads	Contained in diversion channels and event ponds, transferred via pipelines	Various reservoirs, pits, and tailings facilities. Treatment on-site and discharge to Goose Lake
Saline water (SW)	Groundwater inflows to underground and Llama Pit	Contained in pit sumps and underground workings, transferred via pipelines	Stored in Saline Water Pond, and subsequently pumped underground or into bottom of Llama Reservoir

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Each type of site water is managed separately. Non-contact water diversions are put in place to minimize the volume of contact water on site. Saline water from groundwater inflows is pumped via dedicated pipelines and contained in a separate facility to avoid salinizing process reclaim water and minimize the total volume that requires transfer back underground or to Llama Reservoir.

2.3 Component Definition

Water management at the Goose Property entails multiple codependent components which include storage facilities and conveyance facilities. Water storage is done using ponds and reservoirs, where ponds are structures with a finite operational life that will be fully decommissioned at Closure. This includes event ponds and the Saline Water Pond. Event ponds are sized to contain a specific design storm and are operated on a normally empty basis. The Saline Water Pond has a defined storage capacity and will remain operational as a storage facility until such time as the transfer of the saline water to Llama Reservoir and the underground mines are completed.

Long-term (i.e. permanent) water storage facilities are denoted as reservoirs, and include the four pit lakes. Sumps in each of the open pits are used to collect water before it's conveyed to an alternate reservoir via pipeline in accordance with the water management plan.

Diversions are engineered structures that ensure separation of contact and non-contact water. These structures remain operational for only a finite period of time throughout the operational phase of the project before getting completely decommissioned.

2.4 Hydrotechnical Design Criteria

The hydrotechnical design criteria for the Project include a combination of Best Management Practices (BMPs) and specified criteria based on engineering and operational judgement and/or constructability considerations. Four classes of design criteria are presented below:

- Table 2-2 presents the hydrologic design criteria used to formulate peak flows;
- Table 2-3 presents the design criteria used for sizing of pond infrastructure;
- Table 2-4 presents containment dam and diversion berm design criteria; and
- Table 2-5 presents culvert design criteria.

Table 2-2: Hydrologic Design Criteria for Formulating Peak Flows

Item	Value	Unit	Source
SCS Curve Number (Waste Rock)	84	-	(L. George, 2008)
SCS Curve Number (Natural Ground)	72-89	-	(SRK Consulting (Canada) Inc., 2015b)
SCS Curve Number (Pit Walls)	92	-	(L. George, 2008)
Critical Snowmelt Month	June	-	(SRK Consulting (Canada) Inc., 2015b)
June Average Snowmelt Rate	28	mm/day	(SRK Consulting (Canada) Inc., 2015b)
Rainfall Distribution	Type I	-	(USDA, 1986)
Minimum Time of Concentration	10	minutes	Engineering Judgement

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Table 2-3: Pond (Event and Saline Water) Design Criteria

Item		Value	Unit	Source/Comments
Event Ponds	Event Return Period	10-100	Years	BMP. See Table 3-4
	Minimum Dewatering Requirement	2	days	Operational consideration
	Storage Requirement	24-hour total rainfall volume + snowmelt	m^3	BMP
	Minimum Freeboard	0.5	m	Engineering Judgement
Saline Water Pond	Storage Volume	1.1	Mm^3	95th percentile volume from SRK Water Balance (SRK Consulting (Canada) Inc., 2015a)
	Minimum Freeboard	1.0 – 1.3	m	Appendix A: Saline Water Pond Freeboard Memo

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Table 2-4: Containment Dams (Event and Saline Water Ponds) and Diversion Berm Design Criteria

	Item	Value	Unit	Source/Comments
Diversion Berm Design	Event Return Period	10-100	Years	BMP. See Table 3-2 Table 3-2
	Conveyance Capacity	24-hour total rainfall volume + Snowmelt	m^3	BMP
	Manning's Roughness	0.035	-	For minor natural steam with stones and weeds (Chow, 1994)
	Minimum Slope	0.005	m/m	BMP
	Upstream Side Slopes	2:1	(H:V)	Constructability consideration
	Downstream Side Slopes	1.5:1	(H:V)	Engineering judgement
	Berm Top Width	6	m	Constructability consideration
	Minimum Berm Height	2	m	Constructability consideration
	Minimum Berm Freeboard	0.5	m	Engineering judgement
Event Pond Containment Dam Design	Minimum Dam Height	2	m	Constructability consideration
	Bedding Material Thickness around GCL	0.5	m	Engineering judgement
	Liner Tie-Back Length	3	m	Engineering judgement
	Upstream Side Slope (Ponded Water Level > 4m)	3:1	(H:V)	Constructability consideration
	Upstream Side Slope (Ponded Water Level < 4m)	2:1	(H:V)	Constructability consideration
	Downstream Side Slopes	1.5:1	(H:V)	Engineering judgement
Saline Water Pond Containment Dam Design	Bedding Material Thickness around GCL	0.5	m	Engineering judgement
	Dam Top Width	8	m	Constructability consideration
	Minimum Dam Height	2	m	Constructability consideration
	Upstream Side Slope	3:1	(H:V)	Constructability consideration
	Downstream Side Slope	2:1	(H:V)	Engineering Judgement
	Liner Tie-Back Length	3	m	Engineering Judgement
	Key Trench Tie-in Depth	2.2	m	(SRK Consulting (Canada) Inc., 2015g)

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Table 2-5: Culvert Design Criteria

Item	Value	Unit	Source
Event Return Period	100	Years	BMP, (SRK Consulting Inc., 2014)
Conveyance Capacity	24-hour total rainfall volume	m^3	BMP, (SRK Consulting Inc., 2014)
Maximum Velocity during Average June flow for Fish Passage	1.5	m/s	(SRK Consulting Inc., 2014)
Manning’s Roughness for culverts with cobble stone base	0.040	-	(Chow, 1994)
Manning’s Roughness for culverts without cobble stone base	0.024	-	(Chow, 1994)

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3 Preliminary Design

3.1 Catchment Delineation

The Goose Property was delineated into catchments associated with the TSF, each pit (or TF), WRSA, underground pad, event pond, and diversion. The areas for each catchment were used to size water management infrastructure including ponds and pumps, and verify that the diversion structures would not overtop during specified design storm events.

Catchments were delineated in AutoCAD (AutoDesk) using available LiDAR topography. Once delineated, the catchment characteristics, including average slope, total area and head differential, were calculated in Global Mapper™ (Blue Marble Geographics). Figure 2 presents the catchment delineations for the Goose Property and complete details are listed in Table 3-1.

Table 3-1: Goose Property Catchment Area Summary

Catchment ID	Water Type	Surface Area (km^2)	Catchment Description
LD1	NCW	0.41	West Llama Lake diverted
LD2	NCW	0.57	East Llama Lake diverted
LL	NCW	0.64	Llama Lake around Llama Pit diverted
LCP	CW	0.10	Llama WRSA Pond
LP	CW	0.16	Llama Pit
LU	CW	0.07	Llama Underground pad
LWD1	CW	0.18	South Llama WRSA
LWD2	CW	0.19	North Llama WRSA
UWD1	CW	0.30	South Umwelt WRSA
UWD2	CW	0.21	North Umwelt WRSA
UCP1	CW	0.38	Primary Pond
UCP2	CW	0.11	Umwelt WRSA Pond
UP	CW	0.23	Umwelt Pit
UU	CW	0.10	Umwelt Underground pad
ED1	NCW	0.38	West Echo Pit diverted
ED2	NCW	0.19	East Echo Pit diverted
EWD	CW	0.06	Echo WRSA
EU	CW	0.09	Echo Underground pad
ECP	NCW	0.04	Echo WRSA Pond
EP	CW	0.07	Echo Pit
GD1	NCW	1.16	Goose Main Pit diverted
GP	CW	0.28	Goose Main Pit
GU	CW	0.10	Goose Underground pad
TWD1	NCW/CW	1.90	TSF WRSA
TWD2	CW	0.14	TSF WRSA downstream seepage collection

Catchment ID	Water Type	Surface Area (km²)	Catchment Description
OD	CW	0.14	Ore Stockpile Pond
MA	CW	0.45	Goose Plant Site
SWP	SW	0.52	Saline Water Pond

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3.2 Hydrologic Model

3.2.1 Approach

Instantaneous peak flows and volumes for design storm events were generated in HEC-HMS software (US Army Corps of Engineers) using the design criteria summarized in Table 2-3 along with catchment areas presented in Section 3.1. Runoff from snowmelt and the SCS curve number method (USDA, 1986) were used to estimate peak flows for a range of return periods, as described in the SRK Hydrology Report (SRK Consulting (Canada) Inc., 2015b). Peak flows derived for a rain-on-snow event were used to size the required water management infrastructure, and required storage volumes were determined based on the total snowmelt and rainfall accumulation over a 24-hour period.

Rainfall depths are based on the precipitation frequency analysis performed as part of the SRK hydrologic analysis (SRK Consulting (Canada) Inc., 2015b), with a 10% increase to account for climate change (SRK Consulting (Canada) Inc., 2015c).

3.2.2 Return Period Selection

The return period was selected for each catchment area based on the qualitative level of risk associated with overtopping or breaching of the downstream structure, whether it was an event pond, open pit, or diversion. Three levels of risk were selected for the Project, with an associated return period (Table 3-2). The risk was an engineering judgement, taking into consideration the human health and safety, environmental, reputational, and economic consequences of the specified failure events.

Table 3-2: Return Period Selection Criteria

Level of Risk	Type of Facility	Return Period	Rainfall Depth[3] (mm)
Low	• Non-contact water diversions[1] • Pit sumps[2]	10	44.4
Medium	• Contact water diversions • Contact water event ponds with additional water infrastructure downstream	50	64.2
High	• Contact water event ponds without downstream water infrastructure	100	73.4

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Notes:
1. With the exception of non-contact diversions around Echo Open Pit, which has High risk, due to prolonged access to the open pit once mined out.
2. With the exception of Echo Open Pit sump, which is rated as High, due to prolonged access to the open pit once mined out.
3. From SRK Hydrology Report (SRK Consulting (Canada) Inc., 2015b), and increased by 10% to account for climate change (SRK Consulting Inc., 2015c).

Infrastructure which has the potential to overtop and/or breach and discharge to the downstream environment was assigned a “High Risk”. At the Goose Property, this includes the Umwelt and Llama WRSA ponds, the Ore Stockpile Pond, the Saline Water Pond, the Echo WRSA Pond, and the TSF WRSA Diversion berms. The Goose Property infrastructure and corresponding risk level are listed in Table 3-3.

Table 3-3: Level of Risk for Each Item of Goose Infrastructure

Infrastructure	Level of Risk
Umwelt Pit Sump	Low
Umwelt WRSA Containment Dam (Umwelt WRSA Pond)	High
Umwelt WRSA Diversion Berm	Medium
Primary Pond Haul Road Containment Dam (Primary Pond)	Medium
West Llama Reservoir Diversion Berm	Low
East Llama Reservoir Diversion Berm	Low
Southwest Llama Reservoir Diversion Berm	Low
South Llama Reservoir Diversion Berm	Low
Llama WRSA Diversion Berm	Medium
Llama WRSA Containment Dam (Llama WRSA Pond)	High
Llama Pit Sump	Low
Ore Stockpile Containment Dam (Ore Stockpile Pond)	High
Ore Stockpile Diversion Berm	High
Saline Water Pond East and South Containment Dams (Saline Water Pond)	High
Saline Water Pond Diversion Berms	High
Echo Pit Sump	Medium
East Echo Containment Dam (Echo Diversion Pond	Medium
East Echo Diversion Berm	Medium
West Echo Diversion Berm	Medium

Infrastructure	Level of Risk
Echo WRSA Containment Dam (Echo WRSA Pond)	High
Echo WRSA Diversion Berm	Medium
Goose Main Pit Sump	Low
Goose Main Diversion Berm	Medium
TSF WRSA Pond	High
TSF WRSA Diversion Berm	High

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3.2.3 Lag Time

The lag time was estimated as a fraction of the total time of concentration. The time of concentration for each catchment was estimated by averaging results from the following methods: Kirpich, California Culvert Practice, Chow, and Watt and Chow (Ming-Han Li, 2008).

Where the average of the above methods was less than ten minutes, a minimum of ten minutes was selected as the time of concentration, with a corresponding lag time of six minutes.

3.2.4 Curve Number Selection

The primary factors that determine the curve number (CN) are the hydrologic soil group, cover type, and antecedent moisture condition (AMC). The SRK hydrology report provides details on the selection of the curve number for natural catchments (SRK Consulting (Canada) Inc., 2015b).

Mine site catchments (i.e. catchments affected by mining activities and associated infrastructure) were characterized as either being pit walls, waste rock or tailings. The curve numbers for each type of infrastructure were provided in a case study (L. George, 2008) for each of the three AMC conditions. The AMC defines the soil moisture before a precipitation event. For the purpose of the hydrologic model, it was assumed that soils would be saturated (AMC III condition) during the design storm event. Table 2-3 presents the curve numbers applied to each area type.

3.2.5 Snowmelt

The maximum daily snowmelt rate was determined to be 28 mm/day (SRK Consulting (Canada) Inc., 2015b). For mine site catchments, which have associated SCS curve numbers based on land type, snowmelt was accounted for as an additional baseflow that takes place during the rainfall design event. The snowmelt depth was multiplied by catchment area, and evenly distributed over a 24-hour period.

For natural catchments, the snowmelt contribution is already included in the curve number due its calibration with regional, naturally occurring peak flows.

3.3 Pond and Pump Sizing

Table 3-4 summarizes the pond capacities and associated pumping rate requirements for the Goose Property. The locations of each of the ponds and associated pumps are illustrated on Figure 3, based on the Pond ID number listed in Table 3-4.

From a practical operational perspective, the maximum design pumping rate was set at 0.15 m^3/s. As a result, in order to ensure the pond can be emptied within a two day timeframe, the pumps are initiated as a pond capacity less than the full supply level. The percent full listed in Table 3-4 represents the ratio of required capacity with available capacity. This ratio was used to adjust the duration of dewatering. For ponds with additional storage capacity above the design storm requirement, such as the TSF WRSA Pond, Primary Pond, and Echo WRSA Pond, the dewatering duration was increased.

Table 3-4: Goose Property Pond Capacity and Pumping Rate Summary

Pond ID	Description	Design Return Period	Required Capacity (m^3)	Available Capacity (m^3)	% Full	Dewatering Duration (days)	Pumping Rate (m^3/s)
P1	Umwelt Pit Sump	10	18,000	n/a	n/a	2	0.10
P2	Umwelt WRSA Pond	100	27,000	30,100	90%	2	0.15
P3	Ore Stockpile Pond	100	10,000	11,000	91%	2	0.06
P6	TSF WRSA Pond	100	174,000	1,163,100	15%	16	0.13
P7	Primary Pond	50	109,500	316,650	35%	23	0.06
P8	Llama WRSA Pond	100	20,000	26,000	77%	2	0.11
P9	Llama Pit Sump	10	12,000	n/a	n/a	2	0.07
P10	Goose Pit Sump	10	20,000	n/a	n/a	2	0.11
P11	Echo Pit Sump	50	5,000	n/a	n/a	2	0.03
P12	Echo Diversion Pond	50	11,000	18,000	61%	2	0.06
P13	Echo WRSA Pond	100	48,000	61,000	79%	10	0.06

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Notes:
1. Pit sump actual capacities are defined by the open pit design, and as a result are always larger than the required capacity.

3.4 Culvert Sizing

Five culvert crossings are required to maintain drainage patterns across the haul roads and Goose Airstrip at the Goose Property as illustrated on Figure 3. One of these crossings, the Gander Pond outflow stream located north of the Goose Airstrip, is the only one that will require fish passage. All culverts will be circular corrugated steel culverts with a corresponding Manning's roughness of 0.024. The culvert which requires fish passage will contain a 150 mm layer of cobble substrate material (SRK Consulting Inc., 2014) to increase the Manning's roughness to 0.040. Culvert sizing was done using the commercial code HY-8 (Federal Highway Administration, 2015) and the results are summarized in Table 3-5 and Table 3-6 below.

The fish passage culverts meet the 1.5 m/s maximum outlet velocity criteria as described in Table 2-5. The critical flow is during the month of June which is when fish are migrating upstream (SRK Consulting (Canada) Inc., 2015b). All culverts meet the 0.3 m criteria for maximum water depth above the top of culvert. For the Goose Neck outflow, it is expected that a significant portion of the flow will be subsurface flow, which is not accounted for in the peak flow analysis. The subsurface flow will reduce the water depth upstream of the culvert.

Table 3-5: Goose Property Culvert Characteristics – Design Storm

Culvert Description		Goose Diversion	Gander Pond Outflow	Rascal Stream at Airstrip	Echo Stream Outflow	Goose Neck Outflow
Culvert ID		**C1**	**C2**	**C3**	**C4**	**C5**
Characteristics	Slope (%)	1.0	3.6	1.0	1.5	3.5
	Diameter (m)	2.5	2.5	2.5	1.2	2.5
	Culvert Shape	Circ.	Circ.	Circ.	Circ.	Circ.
	Number of Barrels	2	1	2	1	1
	Culvert Material	CSP	CSP	CSP	CSP	CSP
	Embedment Depth (m)	0	0.4	0	0	0
100 Year Event	Total Discharge (m³/s)	19.27	9.64	18.82	1.99	10.47
	Culvert Inlet Elevation (m)	100	100	100	100	100
	Headwater Elevation (m)	102.27	101.89	102.23	101.46	102.39
	Water Depth above Culvert (m)[1]	0	0	0	0.26	0
	Invert Control Depth (m)	2.27	1.49	2.23	1.32	2.39
	Outlet Control Depth (m)	1.31	0	0.23	1.46	1.01
	Normal Depth (m)	1.18	0.98	1.17	1.20	1.06
	Critical Depth (m)	1.41	1.21	1.4	0.77	1.10
	Outlet Depth (m)	1.20	0.99	1.18	0.77	1.47
	Tail Water Depth (m)	0.82	0.54	0.83	0.06	0.12
	Outlet Velocity (m/s)	4.14	4.21	4.12	2.58	5.03
	Tail Water Velocity (m/s)	2/34	1/78	2/27	0.64	0.49

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Notes:

1. Water depth above culvert is equal to the headwater elevation – culvert diameter – culvert inlet elevation. Must be less than 0.3 m, based on criteria outlined in Table 2-5

Table 3-6: Gander Pond Outflow Stream Culvert - Average June Flow Characteristics

Parameter	Value
Total Discharge (m^3/s)	0.065
Headwater Elevation (m)	100.55
Invert Control Depth (m)	0.15
Outlet Control Depth (m)	0
Normal Depth (m)	0.08
Critical Depth (m)	0.12
Outlet Depth (m)	0.11
Tail Water Depth (m)	0.06
Outlet Velocity (m/s)	0.80
Tail Water Velocity (m/s)	0.43

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3.5 Preliminary Designs

3.5.1 Concepts

The drawing set in Appendix A presents plans, profiles, typical cross-sections and details for all conveyance and containment structures, as well as culvert crossings.

The following overarching design concepts have been adopted in developing the preliminary designs presented in Appendix A:

- Because the Property is located in the continuous permafrost region of Canada (SRK Consulting (Canada) Inc., 2015f), excavation into non-bedrock controlled areas should as far as practical be avoided to minimise long term permafrost degradation and associated sediment release consequences.
- None of the reservoirs require containment structures as they have natural outflow control. Best Management Practices will be employed at these outlet locations to ensure proper sediment management.
- All pond containment structures require active seepage management using geosynthetic materials (liners) because there are no suitable fine grained materials on site that would provide adequate seepage control.
- Geosynthetic liners will be keyed into bedrock wherever possible. If bedrock tie-in is not practical, the liner will be keyed into the permafrost foundation. For structures that have a maximum pond elevation of 4 m, the liner will be tied into the active layer, and for ponds with a larger pond elevation, the liner will be tied in below the active layer.
- Diversion berms will not require active seepage management; however they will have a minimum fill thickness of 2 m (SRK Consulting (Canada) Inc., 2015g) to ensure that the active layer develops into the base of the fill creating a frozen bond between the structure and the underlying foundation.

- Construction materials for the structures will be geochemically suitable quarry rock or waste rock sources on site. Suitable material sizing will be by means of crushing and screening.

3.5.2 Conveyance/Diversion Structures

Contact water or non-contact water conveyance/diversion structures are required around WRSAs, ore stockpiles, pits, and lakes to convey water to nearby ponds, reservoirs or lakes. The location of all of these structures are illustrated on Figures 4 and 5 (as well as Drawings A-01 and A-02), and can be summarized as follows:

- Southwest Llama Reservoir Diversion Berm (Drawing A-03)
- West Llama Reservoir Diversion Berm (Drawings A-04, A-05, A-06)
- East Llama Reservoir Diversion Berm (Drawings A-06, A-07, A-08)
- South Llama Reservoir Diversion Berm (Drawing A-10)
- Llama WRSA Diversion Berm (Drawing A-11)
- Umwelt WRSA Diversion Berm (Drawing A-13)
- Ore Stockpile Diversion Berm (Drawings A-14, A-15)
- West Echo Diversion Berm (Drawing A-17)
- East Echo Diversion Berm (Drawing A-18)
- Echo WRSA Diversion Berm (Drawing A-19)
- Goose Main Pit Diversion Berm (Drawing, A-20)
- TSF WRSA Diversion Berm (Drawing A-21, A-22)
- Saline Water Pond Perimeter Berm (Drawings A-24, A-26, A-27, A-28)

The referenced drawings contain detailed plans and profiles of each structure, and the typical cross-section of the diversion berms is provided on Section D on Drawing A-30. Diversion Berms are constructed directly onto the tundra ground surface following stripping of the organic material. The berm is constructed from well graded compacted run-of-mine (ROM) (or run-of-quarry, ROQ) material that contains sufficient fines to ensure conveyance of water. If sufficient fines are not available in the bulk fill material, the upstream shell of the structure must be clad with engineered fill that does contain the necessary fines content. Appropriate filter zones must be included as required to ensure the fines won’t migrate through the fill.

3.5.3 Containment Structures

Since the event ponds are designed to be operated normally empty, they only have to retain water for small periods of time as defined in Table 2-3. For structures with a maximum operational head of water during these infrequent containment periods of less than 4 m, seepage containment will be provided by means of tying in a geosynthetic clay liner (GCL) into the permafrost active layer as illustrated in Section A on Drawing A-29. Where the maximum operational head of water is greater than 4 m, a key trench will be constructed to tie the GCL into permafrost. The key trench depth will be variable, but will generally be the greater of 1 m deep or 50% of the active layer thickness in any given area, as shown in Section B and C on Drawing A-29. The seal between the original ground and the GCL will be by means of a bentonite plug, at least 1 m wide and 0.2 m thick. The bentonite plug and key trench will be backfilled to a final elevation of at least 1 m above the original ground surface prior to key trench excavation.

The bulk of the containment berm will be constructed from well-graded ROM (or ROQ) material similar to that described for the diversion berms. The GCL will be draped along the upstream slope of the containment berm, sandwiched between two 0.5 m thick layers of engineered fill sufficiently fine grained to ensure protection of the liner. Where necessary, appropriate transition fill material will be placed as filter zones between the GCL protection layer and the ROM shell. No riprap is required along the upstream slope of any of the event ponds. All events ponds to be constructed as described above are illustrated on Figures 4 and 5 (as well as Drawings A-01 and A-02), and can be summarized as follows:

- Llama WRSA Containment Dam (Drawing A-09)
- Umwelt Primary Pond Haul Road Containment Dam (Drawing A-12)
- Umwelt WRSA Containment Dam (Drawing A-13)
- Ore Stockpile Containment Dam (Drawing A-15)
- Echo WRSA Containment Dam (Drawing A-16)
- Echo Containment Dam (Drawing A-18)

In order to optimize construction quantities, containment dams are integrated into haul roads wherever practical. If required the haul road height is increased via an upstream containment dam to generate sufficient water storage in the ponds, as shown in Section C on Drawing A-29.

The Saline Water Pond is required to retain water for a number of years and as a result a more robust containment system design is required. The Saline Water Pond has two primary containment dams as follows:

- South Containment Dam (Drawing A-23)
- East Containment Dam (Drawing A-25)

The South Containment Dam will have a similar design to that described above for a maximum water head of less than 4 m; however, based on geotechnical investigations (SRK Consulting (Canada) Inc., 2015f), there is shallow bedrock and as a result the dam key trench will be excavated to bedrock or a minimum depth of 2.2 m (SRK Consulting (Canada) Inc., 2015g) to seal in the GCL to bedrock. The remainder of the design would be identical with the exception of the key trench, and is provided in Section E on Drawing A-31. The thermal analysis for the South Containment Dam is presented in Appendix C.

Deeper foundation conditions at the East Containment Dam location, as well as a maximum pond water head greater than 4 m, necessitates that the upstream toe of the bulk fill structure needs to be at least 6 m from the start of the key trench excavation. A typical cross-section of the proposed design is illustrated in Section F of Drawing A-31.

3.5.4 Culverts

A typical culvert cross section is presented in Drawing A-30. The circular corrugated steel culverts will be placed in compacted fine grained engineered fill according to the appropriate manufacturers specifications.

4 Water Management

4.1 Context

Water management throughout the mine life is represented by a series of phases and stages, as follows:

- Phase 1: Construction (Year -3 to Year -1)
- Phase 2: Operations (Year -1 to Year 10)
- Phase 3: Closure (Year 10 to Year 18)
- Phase 4: Post-Closure (Year 18 +)

These phases are defined by the results of the water and load balance modeling (SRK Consulting (Canada) Inc., 2015a) and are illustrated in Figures 6 through 13. Phase 2 is subdivided into three stages, which are characterized by each of the three tailings deposition locations used throughout the mine life as follows:

- Phase 2, Stage 1: Tailings deposition into the Tailings Storage Facility (TSF) (Year -1 to Year 2)
- Phase 2, Stage 2: Tailings deposition into Umwelt Pit (Umwelt Tailings Facility (TF)) (Year 2 to Year 6)
- Phase 2, Stage 3: Tailings deposition into Goose Main Pit (Goose Main TF) (Year 6 to Year 10)

The following sections describe the details of each phase and stage with respect to water management.

4.2 Goose Property

4.2.1 Phase 1: Construction (Year -3 to Year -1)

The water management activities during this phase are illustrated in Figure 6 and summarized in Table 4-1.

Table 4-1: Summary of Phase 1 Water Management Activities at Goose Property

Year	Open Pits	UG Mines	Dewatering	Active Ponds	Water Treatment
-3	n/a	n/a	Llama & Umwelt lakes	n/a	Llama & Umwelt lakes to Goose Lake
-2	Umwelt	n/a	n/a	Primary Pond Umwelt WRSA Pond Llama Reservoir	Llama Reservoir to Goose Lake
-1	Umwelt	Llama	Llama Reservoir	Primary Pond Umwelt WRSA Pond Llama Reservoir	Llama Reservoir to Goose Lake

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Llama Lake is dewatered to Goose Lake in the open water season of July through September of Year -3 to allow Umwelt Pit development to start in Year -2. Prior to dewatering, the Southwest, West, East, and South Llama Lake diversion berms will be constructed, to divert upstream runoff from entering Llama Lake. Umwelt Lake is similarly dewatered in Year -3 to allow construction of the Saline Water Pond which gets commissioned in Year -2. In both cases, it is assumed that 50% of the lake volume can be discharged directly to Goose Lake, while the remaining 50% will require treatment for total suspended solids (TSS) prior to discharge. Sludge from treatment will be stored in the Umwelt WRSA. A lake may require a regulatory amendment to list the water body on Schedule 2 of the Metal Mining Effluent Regulations (MMER).

The first saline mine water, which will be low in volume and concentration (SRK Consulting (Canada) Inc., 2015h) will be encountered in Year -1 as a result of the Llama underground development, and will be stored in the Saline Water Pond. To minimize surface flows towards the Saline Water Pond, it will be isolated by means of diversion dams. The South and East Containment Dams will be constructed in Year -2, as well as the diversion berms around the pond's perimeter.

Early Construction contact water is pumped to, and stored in, the dewatered Llama Lake, which becomes Llama Reservoir. Contact water during this time includes waste rock runoff from the Umwelt WRSA, runoff from the ore stockpile, and water collected in the Umwelt Pit. The Llama underground portal is built on a pad graded towards Llama Pit to allow runoff to flow directly into the pit. Runoff is diverted via diversion berms around the Umwelt WRSA to the Umwelt WRSA Pond to the south and to the Primary Pond to the north. Diversion berms divert contact water around the ore stockpile to the Ore Stockpile Pond. All contact water is pumped or diverted to the Primary Pond, adjacent to the Umwelt WRSA, at which point it is pumped to Llama Reservoir.

Contact water collected in the Llama Reservoir is treated at the water treatment plant during the open water season of Year -2 and Year -1. The treated water is then discharged into Goose Lake, as shown in Figure 3.

The Goose Airstrip is constructed in Year -1, crossing the Rascal Stream East. A culvert crossing will facilitate drainage through the Goose Airstrip, denoted as the Rascal Stream Airstrip culvert in Figure 6. A second culvert crossing will be installed at the haul road, upstream of the Rascal Stream East discharge into Goose Lake, denoted as the Goose culvert. Three additional culvert crossings along the haul road are constructed in Year -1, including the Goose Neck culvert south of Umwelt Pit, the Echo culvert north of the Echo Pit development area, and the Gander Pond Culvert, northwest of the Goose Airstrip.

4.2.2 Phase 2, Stage 1 - TSF (Year -1 to Year 2)

The water management activities during this phase are illustrated in Figure 7 and summarized in Table 4-2.

Table 4-2: Summary of Activity at Goose Property in Phase 2: Stage 1

Year	Open Pits	UG Mines	Dewatering	Active Ponds	Water Treatment
-1	Umwelt	Llama	n/a	Primary Pond Umwelt WRSA Pond Saline Water Pond Ore Stockpile Pond	n/a
1	Umwelt Llama	Umwelt Llama	n/a	Primary Pond Umwelt WRSA Pond Llama WRSA Pond Saline Water Pond Ore Stockpile Pond	n/a
2	Umwelt Llama	Umwelt Llama	n/a	Primary Pond Umwelt WRSA Pond Llama WRSA Pond Saline Water Pond Ore Stockpile Pond	n/a

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Phase 2 Stage 1 begins in the last quarter of Year -1, when milling begins at the Goose Process Plant. During this stage, tailings are deposited in the TSF.

Freshwater required for the Goose Process Plant is pumped from Goose Lake. Additional freshwater is required from Big Lake for industrial and domestic water usage; this infrastructure will be built in Year -1. Intake lines are presented in Figure 7.

Mining of Llama Pit begins in Year 1. The Llama WRSA Containment Dam is built along the eastern portion of the open pit footprint, creating the Llama WRSA Pond, as shown on Figure 7. Contact water is pumped from the Llama WRSA Pond to the Primary Pond, which is ultimately pumped to the TSF. Additional inflows to the Primary Pond include the Umwelt WRSA Pond, Ore Stockpile Pond, and pit inflows into Llama Pit and Umwelt Pit.

Underground development starts at Umwelt in Year 2, and mining continues in the Llama underground mine throughout this stage. The Umwelt underground portal is built at the beginning of Year 2 on a pad and will be graded towards Umwelt Pit to allow runoff to flow directly into the pit. All saline groundwater inflows are pumped to the Saline Water Pond.

Umwelt Pit mining continues until Year 2, at which point the Umwelt WRSA is closed.

4.2.3 Phase 2, Stage 2: Umwelt TF (Year 2 to 6)

The water management activities during this phase are illustrated in Figure 8 and summarized in Table 4-3.

Table 4-3: Summary of Activity at Goose Property in Phase 2: Stage 2

Year	Open Pits	UG Mines	Dewatering	Active Ponds	Water Treatment
2	Llama Goose Main	Umwelt Llama	n/a	Llama WRSA Pond Saline Water Pond TSF WRSA Pond Echo WRSA Pond Ore Stockpile Pond	n/a
3	Llama Goose Main	Umwelt Llama	n/a	Llama WRSA Pond Saline Water Pond TSF WRSA Pond Echo WRSA Pond Ore Stockpile Pond	n/a
4	Goose Main Echo	Umwelt Llama Goose Main	n/a	Saline Water Pond TSF WRSA Pond Echo WRSA Pond Echo Diversion Pond Ore Stockpile Pond Llama Reservoir	n/a
5	Goose Main Echo	Umwelt Goose Main Echo	Saline Water Pond to Llama U/G	Saline Water Pond TSF WRSA Pond Echo WRSA Pond Echo Diversion Pond Ore Stockpile Pond Llama Reservoir	n/a
6	Goose Main	Umwelt Goose Main Echo	Saline Water Pond to Llama Reservoir	Saline Water Pond TSF WRSA Pond Echo WRSA Pond Echo Diversion Pond Ore Stockpile Pond Llama Reservoir	n/a

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At the end of Year 2, tailings deposition is transitioned from the TSF into Umwelt Pit. At this stage, Umwelt Pit becomes a tailings facility (Umwelt TF). Reclaim water is pumped from the TSF until it is dewatered and reclaim is no longer possible.

The Llama WRSA Pond and Umwelt WRSA Pond continue to pump water to the Primary Pond, which is pumped to the Umwelt TF.

Goose Main Pit mining begins at the end of Year 2. A diversion berm routes non-contact water flows from the Rascal Stream East around the Goose Main Pit and into the Goose culvert. The Goose culvert discharges the non-contact water into a tributary to Goose Lake. Contact water in Goose Main Pit is collected and pumped to the Echo WRSA Pond, which is built at end of Year 2, prior to open pit mining at Echo. As part of progressive reclamation, waste rock from Goose Main Pit is stored in the TSF, which becomes the TSF WRSA. The TSF WRSA diversion berm collects seepage and runoff from the TSF WRSA downstream of the Main TSF dam. Water collected from within the TSF WRSA diversion berms is pumped back into the TSF WRSA Pond. The TSF WRSA Pond will form along the western extents of the Main TSF Dam, and will collect surface runoff and infiltration through the waste rock, which will be pumped to the Echo WRSA Pond, and then to Umwelt TF.

At the end of Year 3, when Llama Pit mining is completed, the Llama Pit returns to being a contact water storage facility, Llama Reservoir. In addition, the Llama WRSA will be closed at the end of Year 3.

Echo Pit mining begins in Year 4 and is completed in Year 5. Contact water in the pit is collected and pumped to the Echo WRSA Pond, which also collects runoff from the Echo WRSA and the Echo underground pad. Runoff from the upstream area south of the Echo Pit is collected in the Echo Diversion Pond, which is contained by the Echo Containment Dam, and the East Echo Diversion berm, built in Year 4. Non-contact water collected in this pond is pumped to the West Echo Diversion berm, which discharges to the Echo stream and culvert, and finally Goose Lake. The Echo WRSA will be closed in Year 5 once open pit mining in Echo Pit is complete.

Goose Main underground mining begins in Year 4, and Echo underground mining begins in Year 5. All groundwater inflows into Goose Main underground facility, as well as Llama and Umwelt underground facilities, are pumped to the Saline Water Pond. Echo underground does not have groundwater inflows. The Goose Main underground pad is graded to drain into the Goose Main Pit. The Echo underground laydown pad drains towards the Echo WRSA Pond.

Llama underground development is expected to be completed at the end of Year 4. In Year 5, 325,000 m^3 of saline water is pumped from the Saline Water Pond into Llama underground mine. From Year 5 onwards, all saline groundwater into the Saline Water Pond will be pumped at a rate of 500 m^3/day to the bottom of the partially flooded Llama Reservoir to create a meromictic lake. In total, just over 1 million cubic meters of saline water will be pumped into the Llama Reservoir over the remaining life of mine.

Goose Main Pit mining continues until the beginning of Year 6, at which point the TSF WRSA is closed.

4.2.4 Phase 2, Stage 3: Goose Main TF (Year 6 to 10)

The water management activities during this phase are illustrated in Figure 9 and summarized in Table 4-4.

Table 4-4: Summary of Activity at Goose Property in Phase 2: Stage 3

Year	Open Pits	UG Mines	Dewatering	Active Ponds	Water Treatment
6	n/a	Umwelt Goose Main Echo	Saline Water Pond to Llama Reservoir	Saline Water Pond TSF WRSA Pond Echo WRSA Pond Echo Diversion Pond Ore Stockpile Pond Llama Reservoir	Goose Main TF recirculation
7	n/a	Umwelt Goose Main Echo	Saline Water Pond to Llama Reservoir	Saline Water Pond TSF WRSA Pond Echo WRSA Pond Echo Diversion Pond Ore Stockpile Pond Llama Reservoir	Goose Main TF recirculation
8	n/a	Umwelt Goose Main Echo	Saline Water Pond to Llama Reservoir	Saline Water Pond TSF WRSA Pond Echo WRSA Pond Echo Diversion Pond Ore Stockpile Pond Llama Reservoir	Goose Main TF recirculation
9	n/a	Umwelt Goose Main Echo	Saline Water Pond to Llama Reservoir	Saline Water Pond TSF WRSA Pond Echo Diversion Pond Echo WRSA Pond Ore Stockpile Pond Llama Reservoir	Goose Main TF recirculation
10	n/a	n/a	Saline Water Pond to Goose Main and Umwelt U/G	TSF WRSA Pond Ore Stockpile Pond Llama Reservoir	Goose Main TF recirculation

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In Year 6, tailings deposition is transitioned from the Umwelt TF to Goose Main Pit, which then becomes Goose Main TF.

Contact water runoff collected in the TSF WRSA Pond, Ore Stockpile Pond, Primary Pond, and Echo, Umwelt and Llama WRSA Ponds are pumped to Goose Main TF. Water treatment begins in Year 6 from the Goose Main TF to reduce copper loading in the facility. The clean water effluent is recirculated back into Goose Main TF to ensure a sufficient water volume is available for reclaim.

Umwelt and Goose Main underground mining continues, until Years 9 and 10, respectively, with all groundwater inflows being pumped to the Saline Water Pond and then on to the bottom of the Llama Reservoir as described previously. Once mining is completed, all remaining saline water from the Saline Water Pond is pumped to Umwelt and Goose Main undergrounds.

4.2.5 Phase 3: Closure (Year 10 to 18)

The water management activities during this phase are illustrated in Figure 10 and summarized in Table 4-5.

Table 4-5: Summary of Activity at Goose Property in Phase 3

Year	Open Pits	UG Mines	Dewatering	Active Ponds	Water Treatment
10 - 18	n/a	n/a	n/a	TSF WRSA Pond	Goose Main TF recirculation

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Milling ends in the second quarter of Year 10. The Saline Water Pond is decommissioned once dewatering is complete, with all dams and berms being breached. Details regarding the closure and reclamation of the area within the Saline Water Pond are presented in the Back River Project Mine Closure and Reclamation Plan (SRK Consulting (Canada) Inc., 2015d).

After the Saline Water Pond closure and reclamation is complete, the diversion berms around the Llama Reservoir are breached, and the reservoir is allowed to fill with non-contact water.

Diversion berms around the Umwelt WRSA and Llama WRSA will remain in place, routing runoff to the Umwelt TF and Llama Reservoir, respectively.

In Year 10, the Echo Diversion Pond, Echo WRSA Pond, Primary Pond, and Ore Stockpile Pond are breached. The Echo Pit will be allowed to fill with non-contact water from the south, and will eventually discharge into the Echo stream and Goose Lake. Umwelt TF will be allowed to fill with water and will be breached at the northern extent of the pit in Year 10, discharging into the Umwelt Lake system.

Water treatment will continue during the open water season months only, with clean water being recirculated back into Goose Main TF. Runoff collected in the TSF WRSA Pond will be pumped to the Goose Main TF.

Llama Reservoir overtops in Year 13 under average hydrologic conditions, discharging towards the south and into the reclaimed Saline Water Pond catchment.

4.2.6 Phase 4: Post-Closure (Year 18+)

The water management activities during this phase are illustrated in Figure 11. In Year 18, water treatment from Goose Main TF will be decommissioned. The Goose Diversion berm, south of the Goose Main TF, will be breached, allowing the Rascal Stream East to discharge into the Goose Main TF. The Goose airstrip culvert will also be removed at this time, and the Goose Airstrip will be breached. The Goose Pit Lake will be allowed to fill with non-contact water, and will be breached to discharge towards the tributary to Goose Lake, along the historical Rascal Stream East alignment.

The TSF WRSA Pond is also breached in Year 18, allowing runoff to flow into Goose Main TF. At this time, all dams and berms on site will be breached, and all culvert crossings removed.

4.3 Marine Laydown Area

4.3.1 Phase 1 and Phase 2: Construction and Operations (Year -2 to Year 10)

The MLA does not require any pond or diversion infrastructure for water management purposes, and remains in the same condition for both the Construction phase and Operations phase. The water management concept is presented in Figure 12.

Runoff from the laydown areas will not be collected, and will discharge towards the Bathurst Inlet along the same flow paths as the predevelopment topography.

A desalination plant will produce the water for domestic and industrial use, with an intake line and saline water concentrate discharge line located to the north and south of the barge, respectively.

Greywater from domestic use will be pumped through an oil and grease separator prior to discharge to the tundra. The discharge line will be located north of the landfarm, and will discharge to a relatively flat, un-channelized area, such that the flow path to the Bathurst Inlet is as long as possible to maximize dilution. The approximate discharge location and flow direction is presented in Figure 12.

4.3.2 Phase 3 and 4: Closure and Post-Closure (Year 10 +)

Infrastructure at the MLA will be decommissioned after Year 10. Intake and discharge pipelines will be left in place to minimize disturbance to the marine area. All pads will be left in place. Figure 13 provides a detailed layout of the MLA at Closure.

This final report, Back River Project Site-Wide Water Management Report, was prepared by SRK Consulting (Canada) Inc.

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Principal Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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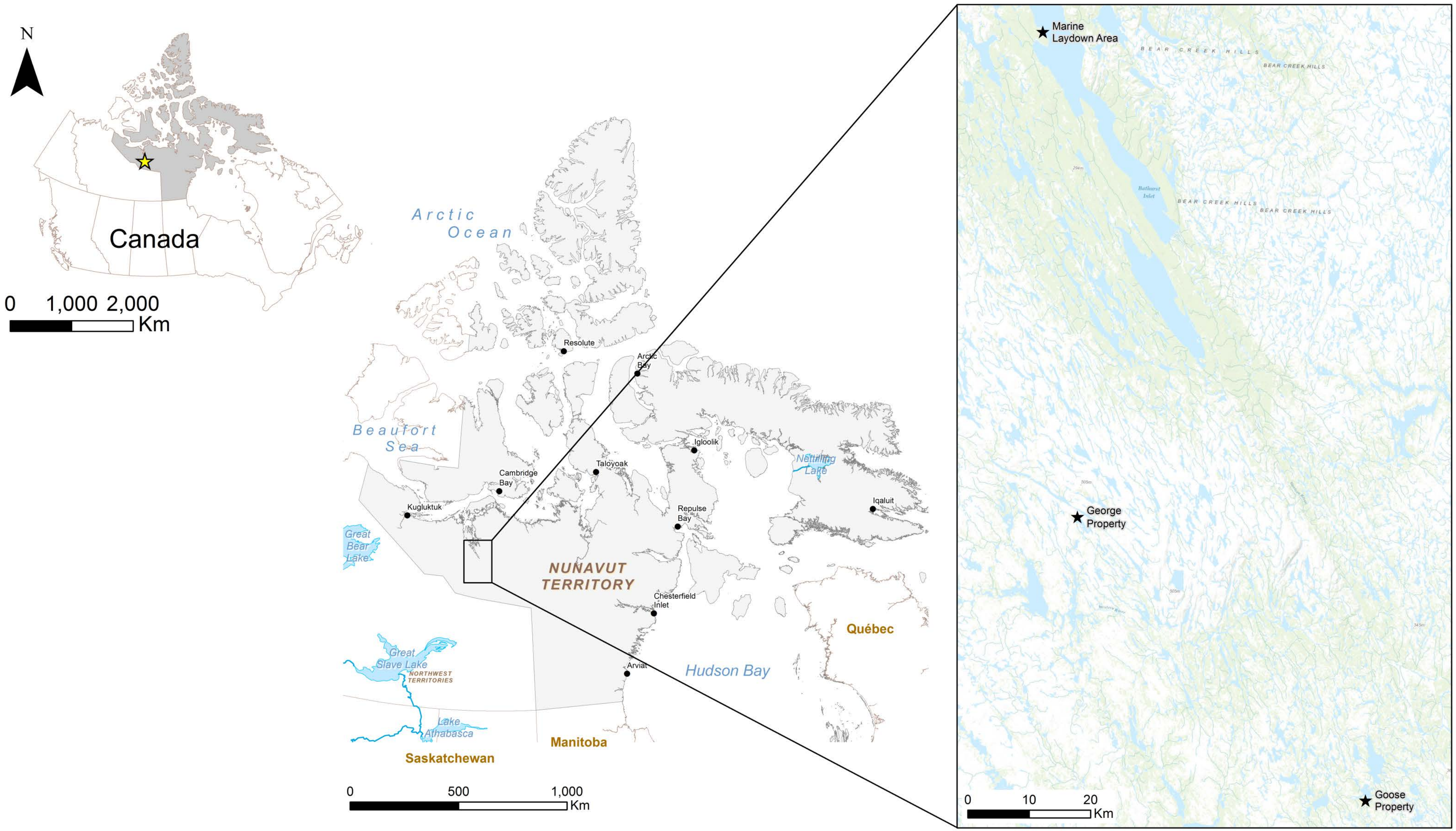
Figures



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Coordinate System: NAD 1983 UTM Zone 13N

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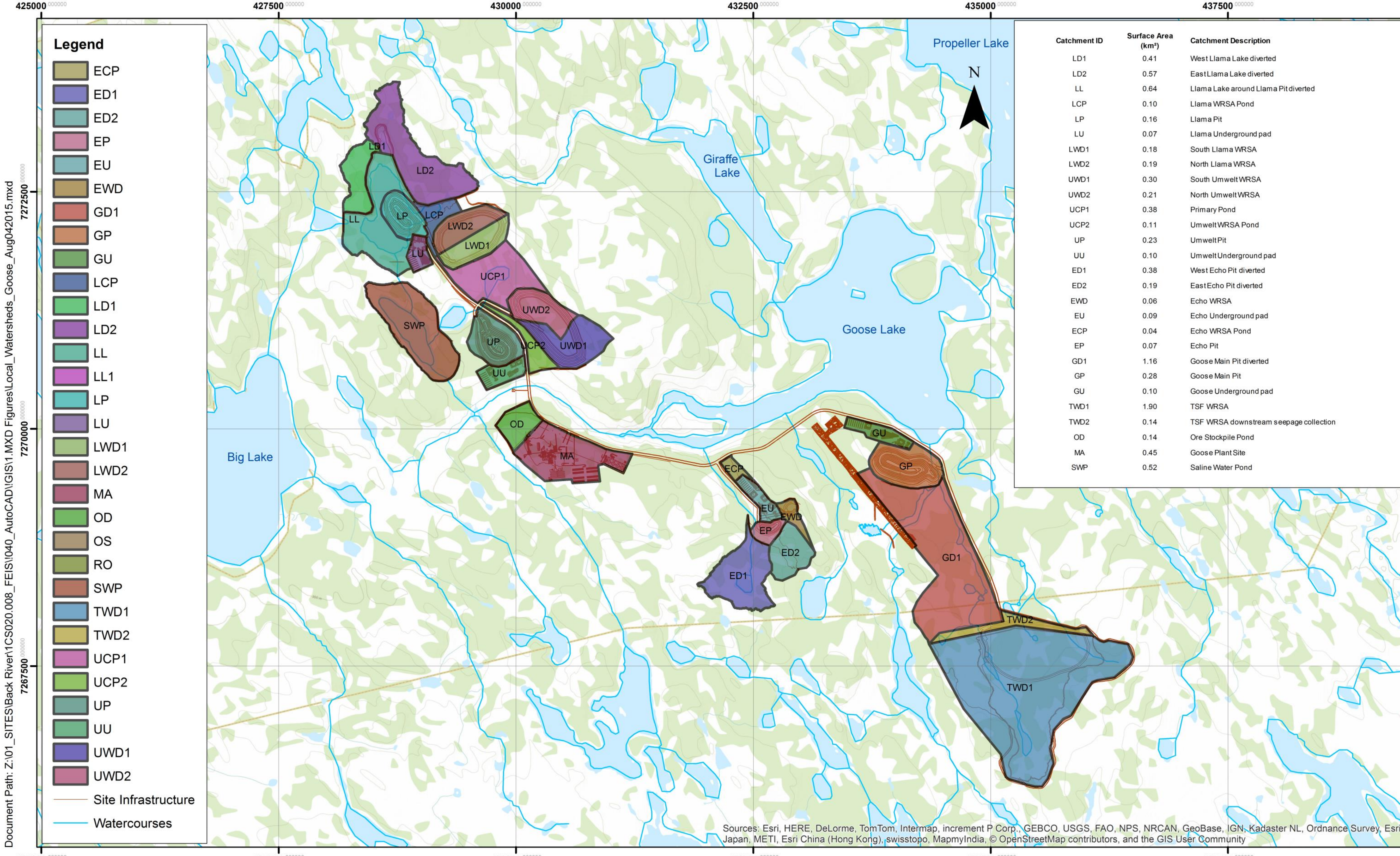
		Location Map
Job No: 1CS020.008	BACK RIVER PROJECT	Date: August 2015
Filename: Fig1_BackRiver_Overview.pptx		Approved: SAB
		Figure: 1



Catchment ID	Surface Area (km²)	Catchment Description
LD1	0.41	West Llama Lake diverted
LD2	0.57	East Llama Lake diverted
LL	0.64	Llama Lake around Llama Pit diverted
LCP	0.10	Llama WRSA Pond
LP	0.16	Llama Pit
LU	0.07	Llama Underground pad
LWD1	0.18	South Llama WRSA
LWD2	0.19	North Llama WRSA
UWD1	0.30	South Umwelt WRSA
UWD2	0.21	North Umwelt WRSA
UCP1	0.38	Primary Pond
UCP2	0.11	Umwelt WRSA Pond
UP	0.23	Umwelt Pit
UU	0.10	Umwelt Underground pad
ED1	0.38	West Echo Pit diverted
ED2	0.19	East Echo Pit diverted
EWD	0.06	Echo WRSA
EU	0.09	Echo Underground pad
ECP	0.04	Echo WRSA Pond
EP	0.07	Echo Pit
GD1	1.16	Goose Main Pit diverted
GP	0.28	Goose Main Pit
GU	0.10	Goose Underground pad
TWD1	1.90	TSF WRSA
TWD2	0.14	TSF WRSA downstream seepage collection
OD	0.14	Ore Stockpile Pond
MA	0.45	Goose Plant Site
SWP	0.52	Saline Water Pond

Coordinate System: NAD 1983 UTM Zone 13N

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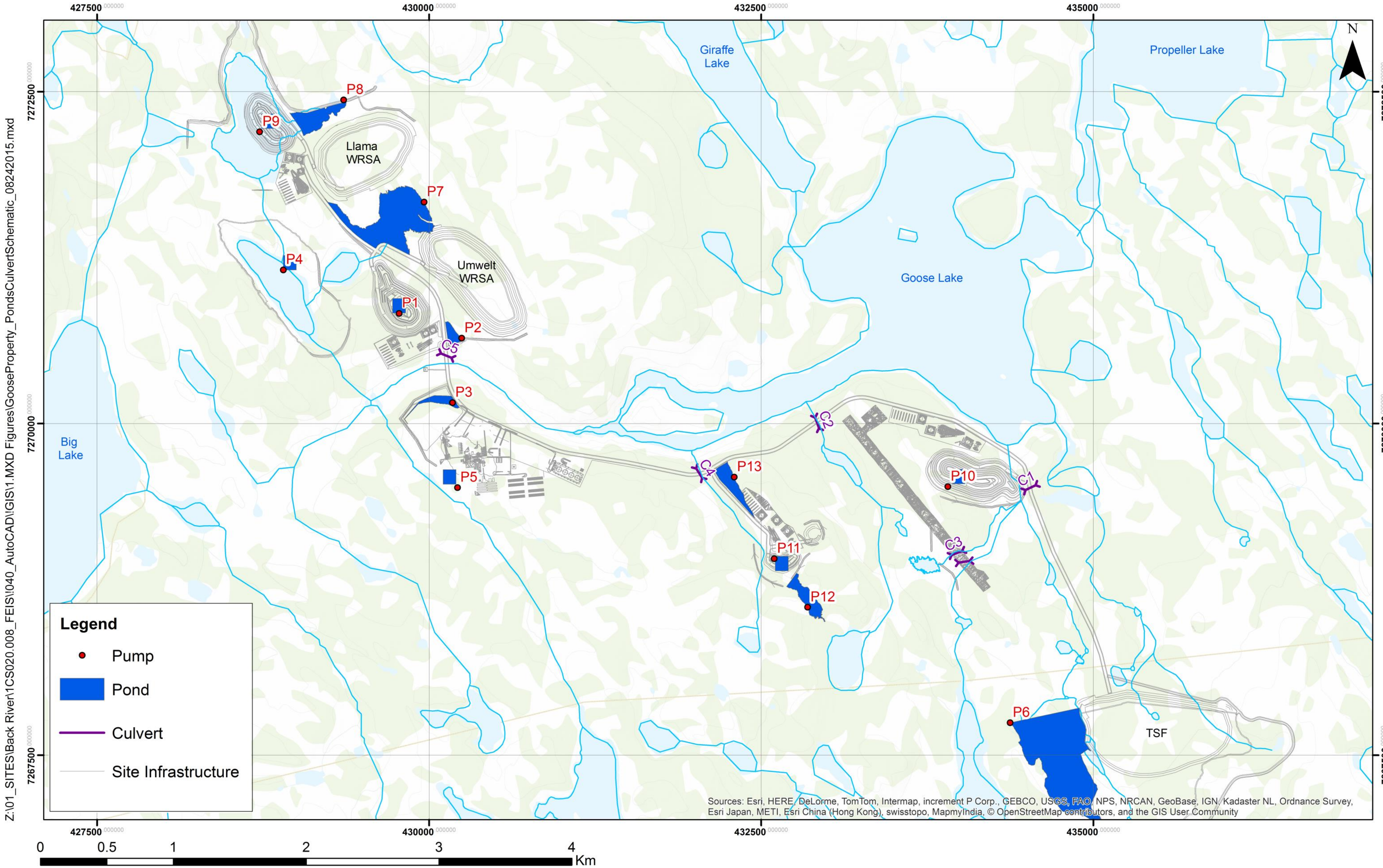
Site Wide Water Management Report

Goose Property Catchments

Job No: 1CS020.008
Filename: Fig2_GoosePropertyCatchments.pptx

BACK RIVER PROJECT

Date: August 2015 | Approved: SAB | Figure: 2



Coordinate System: NAD 1983 UTM Zone 13N

srk consulting

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Site Wide Water Management Report

Goose Property Pumping & Culvert Schematic

Job No: 1CS020.008	BACK RIVER PROJECT	Date: August 2015	Approved: SAB	Figure: 3
Filename: Fig3_Pumping_Culvert_Schematic.pptx				