Arctic Feasibility Study

Alaska, USA

NI 43-101 Technical Report

Report Prepared For:	Trilogy Metals Inc. 609 Granville Street, Suite 1150 Vancouver, BC V7Y 1G5 Canada Tel: 604-638-8088 Fax: 604-638-0644 www.trilogymetals.com
Report Prepared By:	Paul Staples, P.Eng., Ausenco Engineering Canada Inc. Bruce Davis, FAusIMM, BD Resource Consulting, Inc. AJ MacDonald, P.Eng, Integrated Sustainability Consultants Jeffrey B. Austin, P.Eng., International Metallurgical & Environmental Inc. Robert Sim, P.Geo., SIM Geological Inc. Calvin Boese, P.Eng., M.Sc., SRK Consulting (Canada) Inc. Bruce Murphy, P.Eng., SRK Consulting (Canada) Inc. Tom Sharp, PhD, P.Eng., SRK Consulting (Canada) Inc. Antonio Peralta Romero, PhD, P.Eng., Wood.
Effective Date:	August 20, 2020
Release Date:	October 2, 2020

Important Notice

This report was prepared as National Instrument 43-101 Technical Report for Trilogy Metals Inc. (Trilogy Metals or Trilogy) by Ausenco Engineering Canada Inc., BD Resource Consulting, Inc., Integrated Sustainability Consultants, International Metallurgical & Environmental Inc., SIM Geological Inc., SRK Consulting (Canada) Inc and Wood Canada Limited., collectively the "Report Authors". The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in the Report Authors' services, based on i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended for use by Trilogy Metals subject to the respective terms and conditions of its contracts with the individual Report Authors. Except for the purposes legislated under Canadian provincial securities law, any other uses of this report by any third party is at that party's sole risk.

Certificates of Qualified Persons

Paul Staples, P.Eng.

CERTIFICATE OF QUALIFIED PERSON

Paul Staples, P.Eng., Ausenco Engineering Canada Inc.

I, L. Paul Staples, P.Eng., am employed as a Vice President and Global Practice Lead, Minerals and Metals with Ausenco Engineering Canada Inc. with an office address at 855 Homer St., Vancouver, BC, V6B 2W2 and email Paul.Staples@ausenco.com.

This certificate applies to the technical report titled "Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report" that has an effective date of 20 August 2020 (the "technical report").

I am a registered Professional Engineer of British Columbia, membership number 47367. I graduated from Queens University in 1993 with a degree in Materials and Metallurgical Engineering.

I have practiced my profession for 30 years. I have been directly involved in process operation, design and management from over 50 similar studies or projects in Canada, the United States, Mexico, South America, Africa and Asia Pacific.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report that I am responsible for preparing.

My most recent personal inspection of the Arctic site was on July 25, 2017.

I am responsible for Sections 1.1, 1.2, 1.3.1, 1.4 to 1.6, 1.15, 1.16.1 to 1.16.4, 1.17, 1.19 to 1.22, Section 2, Section 3, Section 4, Section 5, Section 6.1 to 6.2.6, 6.2.8, 6.2.9, Section 17, Section 18.1 to 18.7, 18.12 to 18.16, Section 19, Section 21.1.1 to 21.1.6, 21.1.8.3, 21.1.9, 21.1.12, 21.2.1, 21.2.3 to 21.2.5, Section 22, Section 24, Section 25.1, 25.2, 25.9, 25.10, 25.12 to 25.16, 25.17.1, 25.17.2, 25.17.4, and Section 26.1 of the technical report.

I am independent of Trilogy Metals Inc. as independence is described by Section 1.5 of NI 43–101.

I have been involved with the Arctic Project, Northwest Alaska, USA, NI 43-101 Technical Report on Pre-Feasibility Study that had an effective date of 20 February, 2018.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: 2 October 2020

"Signed and Sealed"

L. Paul Staples, P.Eng.

Antonio Peralta Romero, P.Eng.

CERTIFICATE OF QUALIFIED PERSON

Antonio Peralta Romero, PhD, P.Eng., Wood Ltd.

I, Antonio Peralta Romero, P.Eng., am employed as a Principal Mining Engineer with Wood Canada Limited at 400-111 Dunsmuir Street, Vancouver, BC V6B 5W3.

This certificate applies to the technical report titled “Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report” that has an effective date of 20 August 2020 (the “technical report”).

I am a Professional Engineer of Engineers and Geoscientists of British Columbia; License # 45323. I graduated from the University of Guanajuato in 1984 with a B.S. in Mining Engineering, from Queen’s University in 1991 with a M.Sc. in Mining Engineering, and from Colorado School of Mines in 2007 with a Ph.D. in Mining and Earth Systems Engineering.

I have practiced my profession for 36 years. I have been directly involved in mine planning and design, ore control, production forecasting and management, slope stability monitoring, and mineral reserve estimation, mainly for open-pit precious, base metal mines and iron ore mines.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report that I am responsible for preparing.

I visited the Arctic site on July 25, 2017 for one day.

I am responsible for Section 1.3.2, 1.13, 1.14, 1.16.5, Sections 2.3 to 2.6; Section 15; Sections 16.1 to 16.6, 16.8; Sections 21.1.7.1, 21.1.8.1, 21.2.2, 25.7, 25.8, and 26.1.1.

I am independent of Trilogy Metals Inc. as independence is described by Section 1.5 of NI 43–101.

I have been involved with the Arctic Project in the mining engineering work for the pre-feasibility study and the compilation of the corresponding Technical Report: Staples P., Hannon, J., Peralta Romero A., Davis B., DiMarchi J.J., Austin, J.B., Sim R., Boese C., Murphy, B., Sharp T., 2018, Arctic Project, Northwest Alaska, USA, NI 43-101 Technical Report on Pre-Feasibility Study, effective date of February 20, 2018.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated this 2nd day of October 2020

“Signed”

Antonio Peralta Romero, P.Eng.
Principal Mining Engineer
Wood Canada Limited

Dr. Bruce M. Davis, FAusIMM

CERTIFICATE OF QUALIFIED PERSON

Bruce M. Davis, FAusIMM, BD Resource Consulting, Inc.

I, Bruce M. Davis, FAusIMM, am employed as a Geostatistician with BD Resource Consulting, Inc. *(BDRC)*, with an office address at 4253 Cheyenne Dr., Larkspur, Colorado, USA 80118.

This certificate applies to the technical report titled "Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report" that has an effective date of 20 August 2020 (the "technical report").

I am a Fellow of the Australasian Institute of Mining and Metallurgy*; Number 211185*. I have B.S. (1974) and M.S. (1975) degrees from Brigham Young University. I graduated from the University of Wyoming with a Doctor of Philosophy (Geostatistics) in 1978.

I have practiced my profession for 42 years. I have been directly involved in mineral resource and reserve estimations and feasibility studies on numerous open pit and underground base metal and gold deposits in the United States, Canada, Central and South America, Europe, Africa, Asia, and Australia.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report that I am responsible for preparing.

I visited the Arctic site in 2011, 2012, 2015, and 29 August 2019.

I am responsible for sub-sections 1.9, 1.10, 14.2 – 14.16, and 25.4 and sections 11 and 12 of the technical report.

I am independent of Trilogy Metals Inc. as independence is described by Section 1.5 of NI 43–101.

I have been involved with the Arctic property prior to this technical report. I was a coauthor of a previous technical report with an effective data of 25 April 2017.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: 2 October 2020

"Signed"

Bruce M. Davis, FAusIMM

Jeffery B. Austin, P.Eng.

CERTIFICATE OF QUALIFIED PERSON

Jeffery B. Austin, P.Eng., International Metallurgical & Environmental Inc.

I, Jeffrey B. Austin, P.Eng., am employed as an independent consultant of International Metallurgical & Environmental Inc., located at 906 Fairway Crescent, Kelowna, B.C., and incorporated in 1995.

This certificate applies to the technical report titled "Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report" that has an effective date of 7 August 2020 (the "technical report").

I am a member, in good standing, of the Association of Professional Engineers and Geoscientists of British Columbia, license number 15708. I graduated with a B.A.Sc degree from the University of British Columbia in 1984

I have practiced my profession continuously for 33 years and have been involved in the design, evaluation and operation of mineral processing facilities during that time. A majority of my professional practice has been the completion of test work and test work supervision related to feasibility and pre-feasibility studies of projects involving flotation technologies.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 Standards of Disclosure for Mineral Projects (NI 43–101) for those sections of the technical report that I am responsible for preparing.

I have not visited the Arctic site.

I am responsible for Section 1.11, Section 13 and Section 25.5 of the technical report.

I am independent of the issuer applying all of the tests in Section 1.5 of National Instrument 43-101.

I have been involved with the Arctic project since 2011 including supervision of metallurgical test work and input to various engineering studies.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: October 2, 2020

"Signed and sealed"

Jeffrey B. Austin, P.Eng.
International Metallurgical and Environmental Inc.

Robert Sim, P.Geo.

CERTIFICATE OF QUALIFIED PERSON
Robert Sim, P.Geo., SIM Geological Inc.

I, Robert Sim, P.Geo., am an independent consultant of SIM Geological Inc., with an office address at 508 – 1950 Robson St. Vancouver BC, Canada, V6G 1E8.

This certificate applies to the technical report titled "Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report" that has an effective date of 7 August 2020 (the "technical report").

I am a member in good standing of Engineers and Geoscientists British Columbia, License Number 24076. I graduated from Lakehead University with an Honours Bachelor of Science (Geology) in 1984.

I have practiced my profession for 35 years and have been involved in mineral exploration, mine site geology and operations, mineral resource and reserve estimations and feasibility studies on numerous underground and open pit base metal and gold deposits in Canada, the United States, Central and South America, Europe, Asia, Africa and Australia. I have worked on similar VMS-type deposits at Cayeli in Turkey, the Winston Lake mine in Ontario and on several deposits in Rouyn-Noranda, Quebec.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report that I am responsible for preparing.

I visited the Arctic site between September 20-22, 2018.

I am responsible for Sections 7, 8, 9.1 through 9.6, 10, 14 and portions of Sections 1 and 25 of the technical report.

I am independent of Trilogy Metals Inc. as independence is described by Section 1.5 of NI 43–101.

I have had prior involvement with the property that is the subject of the Technical Report. I was an author of a previous technical reports on the Arctic Project, dated November 9, 2017 and April 6, 2018.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: October 2, 2020

"Signed and sealed"

Robert Sim, P.Geo.
SIM Geological Inc.

Calvin Boese, PEng.

CERTIFICATE OF QUALIFIED PERSON
Calvin Boese, P.Eng., M.Sc., SRK Consulting (Canada) Inc.

I, Calvin Boese, PEng., am employed as a Principal Consultant (Geotechnical Engineering) with the firm of SRK Consulting (Canada) Inc. (SRK) with an office at Suite 600, 350 3rd Avenue North, Saskatoon, Saskatchewan.

This certificate applies to the technical report titled "Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report" that has an effective date of 20 August 2020 (the "technical report").

I am a Professional Engineer of the Association of Professional Engineers, Geologists of British Columbia (P.Eng. #29478). I am also a registered Professional Engineer in Alberta and Saskatchewan. I am a Member of the Society for Mining, Metallurgy and Exploration. I am a graduate of the University of Saskatchewan with a B.Sc. in Civil Engineering (1999) and a M.Sc. in Geo-Environmental Engineering (2004).

I have practiced my profession for 20 years. I have been directly involved in geotechnical aspects of mining, including the site selection, design, permitting, operation and closure of mine waste facilities in Canada, the US, Indonesia and Turkey.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report that I am responsible for preparing.

My most recent personal inspection of the Arctic site was from July 10 to July 12, 2018.

I am responsible for Section 1.16.6, 1.16.7 and 1.18, Sections 18.10 and 18.11, Section 20.1.6, 20.1.7, 20.1.8, 20.2, 20.3, 20.4, 20.4.1, 20.4.1.1, 20.4.1.2.1, 20.4.1.2.2, 20.4.1.2.3, 20.4.1.2.4, 20.4.1.2.5, 20.4.1.2.6, 20.4.1.2.8, 20.4.1.3.1, and 20.4.1.4, Section 21.1.10, Section 25.11, and Section 26.1.5 of the technical report.

I am independent of Trilogy Metals Inc. as independence is described by Section 1.5 of NI 43–101.

I was previously involved in the project as the Qualified Person for the "Arctic Project, Northwest Alaska, USA, NI 43-101 Technical Report on Pre-Feasibility Study" dated February 20, 2018.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: October 2, 2020

"Signed"

Calvin Boese, PEng
Principal Consultant
SRK Consulting (Canada) Inc.

Bruce Murphy, PEng.

CERTIFICATE OF QUALIFIED PERSON
Bruce Murphy, P.Eng., SRK Consulting (Canada) Inc.

I, Bruce Murphy, PEng am employed as a Principal Consultant at SRK Consulting (Canada) Inc, located at 2200 -1066 West Hastings Street, Vancouver, BC.

This certificate applies to the technical report titled Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report" that has an effective date of 20 August 2020 (the "technical report")

I am a professional engineer registered with the Association of Professional Engineers of British Columbia – PEng License No.: 44271; I am a graduate of University of the Witwatersrand, Johannesburg, South Africa with a M.Sc. degree in Mining Engineering. I have practiced my profession continuously since graduation (1989) working in the rock engineering field on operating mines till 2002 and then in the consulting field.

I have practiced my profession for 30 years. I have been directly involved in the geotechnical data acquisition, characterization and slope stability evaluation of the deposit.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 Standards of Disclosure for Mineral Projects (NI 43–101) for those sections of the technical report that I am responsible for preparing.

I have visited the Arctic Site August 27 – 29th, 2019.

I am responsible for Sections 6.2.7.1, 9.7.1; 16.7, 21.1.7.2, 21.1.8.2, 26.1.2, 26.1.3 and Section 26.1.4 of the technical report.

I am independent of Trilogy Metals Inc. as independence is described by Section 1.5 of NI 43–101.

I was previously involved in the project as the Qualified Person for the "Arctic Project, Northwest Alaska, USA, NI 43-101 Technical Report on Pre-Feasibility Study" dated February 20, 2018.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: October 2, 2020

"Signed and sealed"

____
Bruce Murphy, PEng
Principal Consultant
SRK Consulting (Canada) Inc

Tom Sharp, PEng.

CERTIFICATE OF QUALIFIED PERSON
Tom Sharp, PhD, P.Eng., SRK Consulting (Canada) Inc.

I, Tom Sharp, PEng, am employed as a Principal Consultant (Water Management and Treatment Engineering) with the firm of SRK Consulting (Canada) Inc. (SRK) with an office at Suite 2200 – 1066 West Hastings Street, Vancouver, British Columbia.

This certificate applies to the technical report titled ""Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report" that has an effective date of 20 August 2020 (the "Technical Report").

I am a Professional Engineer of the Association of Professional Engineers, Geologists of British Columbia (P.Eng. #36988). I am also a registered Professional Engineer in Northwest Territories, Nunavut, Yukon and Montana. I am a Member of the Society for Mining, Metallurgy and Exploration. I graduated from Montana State University and Montana Tech with a B.Sc. and M.Sc. in Biological Sciences (1988 and 1993), M.Sc. in Environmental Engineering (1996) and a Ph.D. in Civil Engineering (1999).

I have practiced my profession for 28 years. I have been directly involved mine water management and treatment on projects in North America, South America, Europe and Asia.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 Standards of Disclosure for Mineral Projects (NI 43–101) for those sections of the technical report that I am responsible for preparing.

I have not visited the Arctic site.

I am responsible for Section 1.16.8, 1.16.9.1; Sections 6.2.7.2; Sections 9.7.2, 9.7.3; Sections 11.3, 11.8.6; Sections 18.8, 18.9; Sections 20.1.1, 20.1.2, 20.1.3, 20.1.4, 20.1.5, 20.1.9, 20.4.1.2.7.1; Section 21.1.11; Section 25.17.3; and Sections 26.1.6, 26.1.7, and 26.1.8.1 of the technical report.

I am independent of Trilogy Metals Inc. as independence is described by Section 1.5 of NI 43–101.

I was previously involved in the project as the Qualified Person for the "Arctic Project, Northwest Alaska, USA, NI 43-101 Technical Report on Pre-Feasibility Study" dated February 20, 2018.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: October 2, 2020

"Signed and sealed"

____

Tom Sharp, PEng
Principal Consultant
SRK Consulting (Canada) Inc.

AJ MacDonald, P.Eng.

CERTIFICATE OF QUALIFIED PERSON

AJ MacDonald, P.Eng., Integrated Sustainability Consultants

I, AJ MacDonald, P.Eng., am employed as a Vice President / Senior Technical Specialist with Integrated Sustainability Ltd., with an office address at 1050 West Pender Street, Vancouver BC, V6C 3S7.

This certificate applies to the technical report titled "Arctic Feasibility Study, Alaska, USA, NI 43-101 Technical Report" that has an effective date of 20 August 2020 (the "technical report").

I am a Professional Engineer of Professional Engineers Yukon, Engineers and Geoscientists British Columbia, Association of Professional Engineers and Geoscientists of Alberta and Professional Engineers Ontario. I graduated from Queen's University in Kingston, Ontario with Bachelor of Science in 2005 and Carleton University in Ottawa, Ontario with Master of Applied Science in 2007.

I have practiced my profession for 15 years. I have been involved or associated with the mining industry since 2007. I have participated in dozens of mining and other resource sector projects, with a particular focus on water treatment process engineering, primarily in Western North America. My experience spans all phases of project delivery including preliminary analysis, conceptual design, detailed design, construction, commissioning and optimization of infrastructure at industrial water treatment facilities in Canada and around the world.

As a result of my experience and qualifications, I am a Qualified Person as defined in National Instrument 43–101 *Standards of Disclosure for Mineral Projects* (NI 43–101) for those sections of the technical report that I am responsible for preparing.

I have not visited the Arctic site.

I am responsible for Sections 1.16.9.2, 20.4.1.2.7.2, 20.4.1.3.2, and 26.1.8.2 of the technical report.

I am independent of Trilogy Metals Inc. as independence is described by Section 1.5 of NI 43–101.

I have had no previous involvement with the Arctic Project.

I have read NI 43–101 and the sections of the technical report for which I am responsible have been prepared in compliance with that Instrument.

As of the effective date of the technical report, to the best of my knowledge, information and belief, the sections of the technical report for which I am responsible contain all scientific and technical information that is required to be disclosed to make those sections of the technical report not misleading.

Dated: October 2, 2020

"Signed"

____

AJ MacDonald, P.Eng.

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Appendix A – List of Claims

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Glossary

Acme Analytical Laboratories Ltd.	AcmeLabs
Alaska Department of Environmental Conservation	ADEC
Alaska Department of Fish and Game	ADFG
Alaska Department of Natural Resources	ADNR
Alaska Department of Transportation	ADOT
Alaska Industrial Development and Export Authority	AIDEA
Alaska Native Claims Settlement Act	ANCSA
Alaska Native Regional Corporations	ANCSA Corporations
Ambler Mining District Industrial Access Project	AMDIAP
Andover Mining Corp.	Andover
Annual Hardrock Exploration Activity	AHEA
atomic absorption	AA
atomic absorption spectroscopy	AAS
atomic emission spectroscopy	ICP_AES
Audio-Frequency Magneto-Telluric	AMT
BD Resource Consulting, Inc.	BDRC
Bear Creek Mining Corporation	BCMC
Arctic Project	the Project
Canadian Institute of Mining, Metallurgy, and Petroleum	CIM
Circular corrugated steel pipes	CSP
complex resistivity induced polarization	CRIP
Controlled Source Audio-frequency Magneto-Telluric	CSAMT
Electromagnetic	EM
Environmental Impact Statement	EIS
Environmental Protection Agency	EPA
Dry Metric Tonne/s	dmt
Exploration Agreement and Option to Lease	NANA Agreement
Fugro Airborne Surveys	Fugro
GeoSpark Consulting Inc.	GeoSpark
General and Administrative.	G&A
Grams per tonne	gpt
High density sludge	HDS
inductively coupled plasma	ICP
inductively coupled plasma-mass	ICP-MS
Internal Rate of Return	IRR
International Organization for Standardization	ISO
Kennecott Exploration Company and Kennecott Arctic Company	Kennecott
Kennecott Research Centre	KRC
LiDAR	Light Detection and Ranging
life of mine	LOM
Mine Development Associates	MDA
meters above sea level	masl
NANA Regional Corporation, Inc.	NANA
National Environmental Policy Act	NEPA
National Instrument 43-101	NI 43-101
natural source audio-magnetotelluric	NSAMT
naturally occurring asbestos	NOA
net present value	NPV
net smelter return	NSR
North American Datum	NAD
Northern Land Use Research Inc.	NLUR Inc.
Northwest Arctic Borough	NWAB
Trilogy Metals Inc.	Trilogy Metals

NovaGold Resources Inc.	NovaGold
Polarized Light Microscopy	PLM
Quality Assurance/Quality Control	QA/QC
Selenium Water Treatment Plant	SeWTP
SIM Geological Inc.	SGI
single point	SP
Teck Resources Ltd.	Teck
Tailings management facility	TMF
Tonnes per annum	t/a
Tonnes per day	tpd
Universal Transverse Mercator	UTM
US Army Corps of Engineers	USACE
US Geological Survey	USGS
volcanogenic massive sulphide	VMS
WH Pacific, Inc.	WHPacific
Waste rock collection pond	WRCP
Waste rock facility	WRF
Water treatment plant	WTP
Wet Metric Tonne/s	wmt
Zonge International Inc.	Zonge

1 Summary

1.1 Introduction

Trilogy Metals Inc. (Trilogy Metals or Trilogy) commissioned Ausenco Engineering Canada Inc. (Ausenco) to compile a Technical Report (the Report) on the Arctic deposit, part of the Arctic Project (the Project) in the Ambler Mining District of northwest Alaska.

1.2 Key Outcomes

The Project demonstrates the financial outcomes summarized below:

- Pre-tax
    - NPV of $1,550.9 million at an 8% discount rate
    - IRR of 30.8%
    - Payback period of 2.4 years
- Post-tax
    - NPV of $1,134.7 million at an 8% discount rate
    - IRR of 27.1%
    - Payback period of 2.6 years
- Total capital costs of $1,224.7 million, comprised of:
    - Initial capital cost of $905.6 million
    - Sustaining capital cost of $113.8 million
    - Closure cost of $205.4 million
- Total onsite operating costs of $2,200.5 million
- Total offsite operating costs of $2,555.5 million

1.3 Terms of Reference

1.3.1 General

The Report supports disclosure by Trilogy Metals in the news release dated August 20, 2020, entitled “Trilogy Metals Announces Positive Feasibility Study Results for the Arctic Project Located in Alaska, USA”.

The firms and consultants who are providing Qualified Persons (QPs) responsible for the content of this Report, which is based on the Feasibility Study completed in 2020 (the 2020 FS) and supporting documents prepared for the 2020 FS, are, in alphabetical order: Ausenco Engineering Canada Inc. (Ausenco); BD Resource Consulting, Inc., (BDRC); Integrated Sustainability Consultants; International Metallurgical & Environmental Inc (IME); SIM Geological Inc. (SIM); SRK Consulting (Canada) Inc. (SRK), and Wood Canada Limited (previously Amec Foster Wheeler Americas Ltd.) (Wood).

The Report presents Mineral Resource and Mineral Reserve estimates for the Project, and an economic assessment based on open pit mining operations and a conventional processing circuit that would produce copper, zinc and lead concentrates.

All units of measurement in this Report are metric, unless otherwise stated. The monetary units are in US dollars, unless otherwise stated.

1.3.2 Mineral Resources and Reserves

Mineral Resources and Mineral Reserves are reported in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Mineral Reserves (May 2014; the 2014 CIM Definition Standards).

1.4 Property Description and Location

The Arctic Project is located in the Ambler mining district (Ambler Mining District) of the southern Brooks Range, in the Northwest Arctic Borough (NWAB) of Alaska. The Property is geographically isolated with no current road access or nearby power infrastructure. The Project is located 270 km east of the town of Kotzebue, 37 km northeast of the village of Kobuk, and 260 km west of the Dalton Highway, an all-weather state-maintained highway.

NovaGold Resources Inc. (NovaGold) acquired the Arctic Project from Kennecott Exploration Company and Kennecott Arctic Company (collectively, Kennecott) in 2004. In 2011, NovaGold transferred all copper projects to NovaCopper Inc. and spun-out NovaCopper to its then existing shareholders in 2012. NovaCopper Inc. subsequently underwent a name change to Trilogy Metals Inc. in 2016. Under the Kennecott Purchase and Termination Agreement, Kennecott retained a 1% net smelter return (NSR) royalty that has been subsequently sold by Kennecott. The 1% NSR runs with the lands and is purchasable at any time from the royalty holder for a one-time payment of $10 million.

The Project is directly held by Ambler Metals LLC (Ambler Metals), a 50/50 joint venture formed between South32 Limited (South32) and Trilogy Metals Inc. (Trilogy Metals) in February 2020. Upon the formation of the joint venture, Trilogy Metals contributed all of its Alaskan assets, including the Project and Trilogy's agreement with NANA (see below), to Ambler Metals in exchange for a 50% membership interest and at the same time, South32 contributed $145 million in cash for a 50% membership interest.

Ambler Metals holds approximately 185,805 acres (75,192 ha) of State of Alaska mining claims and US Federal patented mining claims in the Kotzebue Recording District. The Arctic Project land tenure consists of 1,851 contiguous State mining claims, including 905 40-acre claims, 946 160-acre claims, and 18 Federal patented claims comprising 271.9 acres (110 ha) held in the name of Ambler Metals.

Surface use of the private land held as Federal patented claims is limited only by reservations in the patents and by generally-applicable environmental laws. Surface use of State claims allows the owner of the mining claim to make such use of the surface as is "necessary for prospecting for, extraction of, or basic processing of minerals."

The NANA Regional Corporation, Inc. (NANA) controls lands granted under the Alaska Native Claims Settlement Act (ANCSA) to the south of the Project boundary. Ambler Metals and NANA are parties to an agreement (the NANA Agreement) that consolidates the parties' land holdings into an approximately 172,675 ha land package and provides a framework for the exploration and development of the area. The NANA Agreement has a term of 20 years, with an option in favour of Ambler Metals to extend the term for an additional 10 years. If, following receipt of a feasibility study and the release for public comment of a related draft environmental impact statement, a decision is made to proceed with construction of a mine on the lands subject to the NANA Agreement, NANA will have 120 days to elect to either (a) exercise a non-transferrable back-in-right to acquire between 16% and 25% (as specified by NANA) of that specific project; or (b) not exercise its back-in-right, and instead receive a net proceeds royalty equal to 15% of the net proceeds realized from such project. In the event that NANA elects to exercise its back-in-right, the parties will, as soon as reasonably practicable, form a joint venture with NANA electing to participate between 16% to 25%, and Ambler Metals owning the balance of the interest in the joint venture. If Ambler Metals decides to proceed with construction of a mine on its own lands subject to the NANA Agreement, NANA will enter into a surface use agreement which will afford Ambler Metals access to the project along routes approved by NANA. In consideration for the grant of such surface use rights, NANA will receive a 1% net smelter royalty on production and provide an annual payment on a per acre basis.

1.5 Accessibility, Climate, Local Resources and Infrastructure

Primary access to the Project is by air, using both fixed wing aircraft and helicopters.

There are four well-maintained, approximately 1,500 m-long gravel airstrips located near the Project, capable of accommodating charter fixed wing aircraft. These airstrips are located 64 km west at Ambler, 46 km southwest at Shungnak, 37 km southwest at Kobuk, and 34 km southwest at Dahl Creek. There is daily commercial air service from Kotzebue to the village of Kobuk, the closest community to the Project. During the summer months, the Dahl Creek Camp airstrip is suitable for larger aircraft, such as a C-130 and DC-6.

In addition to the four 1,500 m airstrips, there is a 700 m airstrip located at the Bornite Camp. The airstrip at Bornite is suited to smaller aircraft, which support the Bornite Camp with personnel and supplies. There is also a 450 m airstrip (Arctic airstrip) located at the base of Arctic Ridge that can support smaller aircraft.

A winter trail and a one-lane dirt track suitable for high-clearance vehicles or construction equipment links the Arctic Project's main camp located at Bornite to the Dahl Creek airstrip southwest of the Arctic deposit. An unimproved gravel track connects the Arctic airstrip with the Arctic deposit.

The climate in the region is typical of a sub-arctic environment. Weather conditions on the Project can vary significantly from year to year and can change suddenly. During the summer exploration season, average maximum temperatures range from 10 °C to 20 °C, while average lows range from -2 °C to 7 °C (Western Regional Climate Center: WRCC - Alaska Climate Summaries: Kobuk 1971 to 2000). By early October, unpredictable weather limits safe helicopter travel to the Project. During winter months, the Project can be accessed by snow machine, track vehicle, or fixed wing aircraft. Winter temperatures are routinely below -25 °C and can exceed -50 °C. Annual precipitation in the region varies with elevation.

It is expected that any future mining activity will be conducted on a year-round basis. Exploration activities are generally confined to the period from late May to late September.

Kotzebue is a potential source of limited mining-related supplies and labourers, and is the nearest centre serviced by regularly scheduled, large commercial aircraft (via Nome or Anchorage). In addition, there are seven other villages in the region that will be a potential source of some of the workforce for the Project. Fairbanks (population 31,036; 2010 US Census) has a long mining history along with currently operating mines and can provide most mining-related supplies and support that cannot be sourced closer to the Project area.

Drilling and mapping programs are seasonal and have been supported out of the Bornite Camp and Dahl Creek Camp. The Bornite Camp facilities are located on Ruby Creek on the northern edge of the Cosmos Hills. The camp provides office space and accommodations for the geologists, drillers, pilots, and support staff. Power is supplied by two Caterpillar diesel generators – one 300kW and one 225 kW. Water was supplied by the permitted artesian well located 250 m from camp; however, a water well was drilled in camp during the 2017 field season that was permitted by 2019 to provide all potable water for the Bornite Camp.

1.6 Exploration History

Prior to Trilogy Metals' Project interest, work programs were conducted by Bear Creek Mining Company (BCMC), an exploration subsidiary of Kennecott Exploration (Kennecott) and Anaconda. Exploration activities included geological and reconnaissance mapping, geochemical sampling, airborne and ground geophysical surveys, drilling, metallurgical testwork, petrological and mineralogical studies, and resource estimates.

Trilogy Metals obtained its project interest in 2004, when the Alaska Gold Company, a wholly-owned subsidiary of NovaGold completed an Exploration and Option Agreement with Kennecott to earn an interest in the Ambler land holdings. In 2010, NovaGold acquired a 100% controlling interest by buying out Kennecott's interest, although Kennecott retained an NSR royalty. Work conducted by NovaGold, its successor NovaCopper and Trilogy Metals included geological mapping, soil and silt geochemical sampling, time-domain electromagnetic (TDEM) ground geophysical surveys, airborne DIGHEM geophysical surveys, down-hole geophysics, drilling programs, metallurgical testwork, Mineral Resource and Mineral Reserve estimates, mining studies, and baseline environmental studies.

1.7 Geological Setting and Mineralization

The Arctic deposit is considered to be a volcanogenic massive sulphide (VMS) deposit based on its geologic setting, associated host rocks, stratiform ore morphology, and ore mineralogy.

The Ambler Mining District is located on the southern margin of the Brooks Range. Within the VMS belt, several deposits and prospects (including the Arctic deposit) are hosted in the Ambler Sequence, a group of Middle Devonian to Early Mississippian, metamorphosed, bimodal volcanic rocks with interbedded tuffaceous, graphitic, and calcareous volcaniclastic metasediments. The Ambler Sequence occurs in the upper part of the regional Anirak Schist. VMS-style mineralization is found along the entire 110 km strike length of the Ambler Sequence.

Stratigraphically, the Ambler Sequence consists of variably metamorphosed calc-turbidites, overlain by calcareous schists with irregularly distributed mafic sills and pillow lavas. These are overlain by the Arctic-sulphide host section which consists mainly of fine-grained, carbonaceous siliciclastic rocks which are in turn overlain by reworked silicic volcanic rocks, including meta-rhyolite porphyries and most notably the regionally extensive Button Schist with its characteristically large relic porphyroblasts. Greywacke sandstones, interpreted to be turbidites, occur throughout the section but are concentrated higher in the stratigraphy. Several rock units within the stratigraphy show substantial variation in local thickness as a consequence of basin morphology at the time of deposition and later deformation.

Alteration at the Arctic deposit is characterized by magnesium metasomatism, primarily as talc, Mg-rich chlorite, and phengite alteration products associated with the sulphide-bearing horizons and continuing in the footwall. Stratigraphically above the sulphide-bearing horizons, significant muscovite as paragonite is developed and results in a marked shift in Na/Mg (sodium/magnesium) ratios across the sulphide bearing horizons.

Mineralization occurs as stratiform semi-massive sulphide (SMS) to massive sulphide (MS) beds within primarily graphitic chlorite schists and fine-grained quartz schists. The sulphide beds average 4 m in thickness but vary from less than 1 m up to as much as 18 m in thickness.

The bulk of the mineralization occurs within eight modelled SMS and MS zones lying along the upper and lower limbs of the interpreted Arctic isoclinal anticline. All of the zones are within an area of roughly 1 km^2 with mineralization extending to a depth of approximately 250 m below the surface. Mineralization is predominately coarse-grained sulphides consisting mainly of chalcopyrite, sphalerite, galena, tetrahedrite-tennantite, pyrite, arsenopyrite, and pyrrhotite. Trace amounts of electrum are also present.

1.8 Drilling

Drilling at the Arctic deposit and within the Ambler Mining District has been ongoing since its initial discovery in 1967. Approximately 60,857 m of drilling was completed within the Ambler Mining District, including 42,571 m of drilling in 207 drill holes at the Arctic deposit or on potential extensions in 29 campaigns spanning 52 years. Drill programs were completed by Kennecott and its subsidiaries, Anaconda, and Trilogy Metals and its predecessor companies.

Core recoveries are acceptable. Geological and geotechnical logging is in line with industry generally-accepted practices. Drill collar and downhole survey data were collected using industry-recognized instrumentation and methods at the time the data were collected.

Between 2004 and 2005, NovaGold conducted a systematic drill core re-logging and re-sampling campaign of Kennecott and BCMC era drill holes. NovaGold either took 1 m to 2 m samples every 10 m, or sampled entire lengths of previously un-sampled core within a minimum of 1 m and a maximum of 3 m intervals. During the Trilogy Metals campaigns, sample intervals were determined by the geological relationships observed in the core and limited to a 2.5 m to 3 m maximum length and 0.3 m minimum length. An attempt was made to terminate sample intervals at lithological and mineralization boundaries. Sampling was generally continuous from the top to the bottom of the drill hole. When the hole was in un-mineralized rock, the sample length was generally 3 m, whereas in mineralized units, the sample length was shortened to 1 m to 2 m with a maximum of 2.5 m.

Gold assays were conducted using fire assay fusion followed by an atomic absorption spectroscopy (AAS) finish. An additional 49-element suite was assayed by inductively coupled plasma-mass spectroscopy (ICP-MS) methodology, following a four acid (hydrochloric, nitric, hydrofluoric, and perchloric) digestion. The copper, zinc, lead, and silver analyses were completed by atomic absorption (AA), following a triple acid digest, in 2004 and 2005, and by inductively coupled plasma-atomic emission spectroscopy (ICP-AES) following a triple acid digestion from 2006 to 2019, when overlimits occurred with the ICP-MS methodology.

Standard reference materials, blanks, duplicates, and check samples have been regularly submitted at a combined level of 20% of sampling submissions for all NovaGold/NovaCopper/Trilogy Metals era campaigns. BD Resource Consulting, Inc (BDRC) reviewed the quality assurance and quality control (QA/QC) dataset and reports and found the sample insertion rate and the timeliness of results received and reviewed meets or exceeds industry best practices.

Specific gravity (SG) measurements were conducted on 4,708 samples in the database and range from a minimum of 1.49 to a maximum of 5.35 and average 3.04. The distribution of SG data is considered sufficient to support estimation in the resource model.

Current Mineral Resource estimates and geologic models use topography completed in 2010 by PhotoSat Inc. The resolution of the satellite imagery used was at 0.5 m, and a 1 m contour map and digital elevation model were generated. An aerial light detection and ranging (LiDAR) survey was completed to support feasibility level resource estimation, engineering design, environmental studies, and infrastructure layout evaluations. Agreement between surveyed drill hole collar elevations and a LiDAR topographic surface verifies the correctness of the digital topography for use in estimation.

It was concluded that the drill database and topographic surface for the Arctic deposit is reliable and sufficient to support the current estimate of mineral resources.

1.9 Sample Preparation, Analysis and Security

The data for the Arctic deposit were generated over three primary drilling campaigns: 1966 to 1986 when BCMC, a subsidiary of Kennecott was the primary operator, 1998 when Kennecott resumed work after a long hiatus, and 2004 to present under NovaGold, NovaCopper, and Trilogy Metals.

Between 2004 and 2005, NovaGold conducted a systematic drill core re-logging and re-sampling campaign of Kennecott and BCMC era drill holes AR-09 to AR-74. NovaGold either took 1 to 2 m samples every 10 m, or sampled entire lengths of previously unsampled core within a minimum of 1 m and a maximum or 3 m intervals. The objective of the sampling was to generate a full inductively-coupled plasma (ICP) geochemistry dataset for the Arctic deposit and ensure continuous sampling throughout the deposit.

During NovaGold, NovaCopper, and Trilogy eras, samples were selected based on lithologic contacts, significant mineralization and alteration. Drill core was sampled at no less than 30 cm and no more than 2.5 m when in un-mineralized material, and 2 m maximum intervals when in mineralized material. All samples processed at the logging facility at the Bornite Camp were sawn in half with one half being sent to ALS Minerals in Vancouver, BC for analysis and the other half stored on site at the Bornite Camp. Shipment of core samples from the site occurred on a drill hole by drill hole basis. Rice bags, containing two to four poly-bagged core samples each, were marked and labelled with the ALS Minerals address, project and hole number, bag number, and sample numbers enclosed. Rice bags were secured with a pre-numbered plastic security tie and a twist wire tie and then assembled into standard fish totes for transport by chartered flights on a commercial airline to Fairbanks, where they were met by a contracted expeditor for delivery directly to the ALS Minerals preparation facility in Fairbanks. In addition to the core, control samples are inserted into the shipments at the approximate rate of one standard, one blank and one duplicate per 17 core samples

Samples were logged into a tracking system on arrival at ALS Minerals, and weighed. Samples were then crushed, dried, and a 250 g split pulverized to greater than 85% passing 75 µm.

Gold assays were determined using fire assay fusion followed by an atomic absorption spectroscopy (AAS) finish. The lower detection limit was 0.005 ppm gold; the upper limit was 1,000 ppm gold. An additional 49-element suite was assayed by ICP-MS, following a 4-acid digestion. The copper, zinc, lead, and silver analyses were completed by AA, following a triple acid digest, when over limit results occurred using the ICP-MS assay method.

1.10 Data Verification

Drill hole collars, topography, core logging, and database verification were completed by third party independent contractors. Quality assurance and quality control measures have been in place on an annual basis since 2011 with full data audits of the NovaGold era assay database including retaining independent consultant Caroline Vallat, P.Geo. of GeoSpark Consulting Inc. (GeoSpark) to: 1) re-load 100% of the historical assay certificates, 2) conduct a QA/QC review of paired historical assays and NovaGold era re-assays; 3) monitor an independent check assay program for the 2004 to 2008 and 2011-2019 drill campaigns; and 4) generate QA/QC reports for the NovaGold era 2004 to 2008 and NovaCopper/Trilogy Metals era 2011, 2015, 2016, 2017 and 2019 drill campaigns.

BDRC reviewed the QA/QC dataset and reports and found the sample insertion rate and the timeliness of results analysis met or exceeded industry best practices. The QA/QC results indicate that the assay results collected by Trilogy Metals, and previously by NovaGold and NovaCopper, are reliable and suitable for use in the 2020 FS.

1.11 Mineral Processing and Metallurgical Testing

Since 1970, metallurgical testwork has been conducted to evaluate the ability of the Arctic deposit to produce copper, lead and zinc concentrates. In-general, the samples tested produced similar metallurgical performances and the project has seen the development of a robust metal recovery process to support the current operational plans. Work conducted included mineralogy and flotation testing, locked cycle tests, comminution tests, copper/lead separation testwork, talc optimization testwork, and thickening and filtration testing.

Testwork can be broken into three key time periods:

1. Historical testwork completed prior to 2012, primarily by Kennecott Research Center (KRC) in Utah, and Lakefield Research Ltd., Lakefield, Ontario;
2. Preliminary Trilogy Metals testwork conducted at SGS Mineral Services, Vancouver (SGS Vancouver), in 2012 to 2015; and
3. Detailed Trilogy Metals testwork conducted at ALS Metallurgy in Kamloops, BC (ALS Metallurgy) in 2015 to 2019.

In 2012, SGS Vancouver conducted a metallurgical test program to further study metallurgical responses of the samples produced from Zones 1, 2, 3, and 5 of the Arctic deposit. The flotation test procedures used talc pre-flotation, conventional copper-lead bulk flotation and zinc flotation, followed by copper and lead separation. In general, the 2012-2015 test results indicated that the samples responded well to the flowsheet tested. The average results of the locked cycle tests (without copper and lead separation) were as follows:

- The copper recoveries to the bulk copper-lead concentrates ranged from 89 to 93% excluding the Zone 1 & 2 composite which produced a copper recovery of approximately 84%; the copper grades of the bulk concentrates were 24 to 28%.
- Approximately 92 to 94% of the lead was recovered to the bulk copper–lead concentrates containing 9 to 13% lead.
- The zinc recovery was 84.2% from Composite Zone 1 & 2, 93.0% from Composite Zone 3 and 90.5% from Composite Zone 5. On average, the zinc grades of the concentrates produced were higher than 55%, excluding the concentrate generated from Composite Zone 1 & 2, which contained only 44.5% zinc.
- Gold and silver were predominantly recovered into the bulk copper–lead concentrates. Gold recoveries to this concentrate ranged from 65 to 80%, and silver recoveries ranged from 80 to 86%.

Using an open circuit procedure, the copper and lead separation tests on the bulk copper–lead concentrate produced from the locked cycle tests generated reasonable copper and lead separation. The copper concentrates produced contained approximately 28 to 31% copper, while the grades of the lead concentrates were in the range of 41% to 67% lead. In this testwork program, it appeared that most of the gold reported to the copper concentrate and on average the silver was equally recovered into the copper and lead concentrates. Subsequent testwork to better define the copper and lead separation process was conducted in 2017, including a more detailed evaluation of the precious metal deportment in the copper and lead separation process.

Grindability testing was completed during both the SGS Vancouver and ALS Metallurgy testwork programs to support the design and economics of efficient grinding of the Arctic materials. Semi-autogenous grind (SAG) mill test results included a single JKTech drop-weight test and 19 SAG media competency (SMC) tests using variability samples. Test results show the material is amenable to SAG milling and is relatively soft, with a reported breakage (axb) average value of 189.7. Bond ball mill work index (BWi) tests were completed on 44 samples and values ranged from 5.4 to 13.1 kWhr/t with an average BWi of 8.82 kWhr/t. Abrasion index (Ai) tests were completed on five samples and values fluctuated from 0.017 to 0.072 g for the measured samples. The data indicate that the samples are neither resistant nor abrasive to ball mill grinding. The materials are considered to be soft or very soft in terms of grinding requirements. The grinding testwork was used to support detailed grinding circuit design.

In 2017, ALS Metallurgy conducted detailed copper and lead separation flotation testwork using a bulk sample of copper–lead concentrate produced from the operation of a pilot plant. This testwork confirmed high lead recoveries in locked cycle testing of the copper–lead separation process and confirmed precious metal recoveries into the representative copper and lead concentrates. This testwork indicated a clear tendency of the gold values to follow the lead concentrate, giving it a significant gold grade and value. Detailed mineralogical analysis showed that a majority of gold values were occurring as liberated fine-grained gold particles.

The conclusions of testwork conducted both in 2012 and 2017 indicate that the Arctic materials are well-suited to the production of high-quality copper and zinc concentrates using flotation techniques which are industry standard. Copper and zinc recovery data were reported in the range of 88 to 92%, which reflected the high-grade nature of the deposit as well as the coarse-grained nature of these minerals. Grade variations within the deposit will be observed as indicated by the grade variations observed in variability samples, however mill feed variability is expected to be limited and readily manageable with good plant operational practices. Lead concentrates have the potential to be of good quality and can also be impacted by zones of very high talc. Considerable care will be required to ensure maximum talc recovery to remove talc, which has the potential to dilute lead concentrate grades. The lead concentrate is also shown to be rich in precious metals, which has some advantages in terms of marketability of this material.

An overall metallurgical balance for the project is summarized in Table 1-1. The projected metallurgical recoveries are based on an expected average recovery over the life-of-mine (LOM), and results of metallurgical testwork conducted in 2012 and 2017–2019.

Table 1-1 Summary of Overall Metal Recovery – Arctic Project

		Concentrate Grade					Metal Recoveries				
Process stream	Mass %	Cu %	Pb %	Zn %	Au g/t	Ag g/t	Cu %	Pb %	Zn %	Au %	Ag %
Process Feed	100.0	2.24	0.54	3.12	0.47	34.69					
Copper Conc.	6.65	30.3	0.66	1.6	0.76	138	89.9	8.1	3.4	10.9	26.4
Lead Conc.	0.78	6.9	55.0	1.8	37.3	2806	2.4	79.0	0.4	62.1	63.1
Zinc Conc.	4.78	1.3	0.25	59.2	0.53	24.5	2.7	2.2	90.6	5.4	3.4
Tailings	87.8	0.13	0.07	0.20	0.12	2.81	4.95	10.7	5.56	21.6	7.11

Ancillary testwork was completed by third party consultants on representative concentrate samples, to provide thickening and filtration data for the various concentrates. Settling and filtration rates were observed to be typical for sulphide concentrates and moisture contents in final filter cakes were observed to be lower than expected.

Metallurgical testwork was completed to provide representative tailings samples for use in detailed solids settling and compaction testwork to provide data for tailings design studies.

A detailed study of water treatment chemistry was undertaken to evaluate and confirm the option of destroying cyanide contained in solutions from the proposed copper–lead separation process. The use of an SO2/air process in a small-scale pilot plant demonstrated removal of 99% of the contained cyanide and supported the concept of maintaining low cyanide concentrations within the proposed tailings pond solutions.

1.12 Mineral Resource Estimate

Mineral resource estimates are estimated from a 3D block model based on geostatistical applications using commercial mine planning software (MineSight v11.60-2). The block model has a nominal block size measuring 10 x 10 x 5 m and uses data derived from 152 drill holes in the vicinity of the Arctic deposit. The resource estimate was generated using drill hole sample assay results and the interpretation of a geological model which relates to the spatial distribution of copper, lead, zinc, gold and silver. Interpolation characteristics were defined based on the geology, drill hole spacing, and geostatistical analysis of the data. The effects of potentially anomalous high-grade sample data, composited to 2 m intervals, are controlled by limiting the distance of influence during block grade interpolation. The grade models have been validated using a combination of visual and statistical methods. The resources were classified according to their proximity to the sample data locations and are reported using the 2014 CIM Definition Standards. Model blocks estimated by three or more drill holes spaced at a maximum distance of 100 m are included in the Indicated category. Inferred blocks are within a maximum distance of 150 m from a drill hole.

The estimate of Indicated and Inferred Mineral Resources is constrained within a conceptual pit shell derived using the projected technical and economic parameters in Table 1-2.

Table 1-2 Parameters Used to Generate a Resource-Limiting Pit Shell

Optimization Parameters	
Open Pit Mining Cost	US$3/t
Milling + General and Administrative (G&A) Costs	US$35/t
Pit Slope	43 degrees
Copper Price	US$3.00/lb
Lead Price	US$0.90/lb
Zinc Price	US$1.00/lb
Gold Price	US$1,300/oz
Silver Price	US$18/oz
Metallurgical Recovery: Copper	92%
Lead	77%
Zinc	88%
Gold	63%
Silver	56%

Note: No adjustments for mining recovery or dilution.

The pit shell was generated about copper equivalent (CuEq) grades that incorporate contributions of the five different metals present in the deposit. The formula used to calculate copper equivalent grades is:

CuEq%= (Cu% x 0.92) + (Zn% x 0.290) + (Pb% x 0.231) + (Au g/t x 0.398) + (Ag g/t x 0.005)

The Mineral Resource estimate is listed in Table 1-3. Mineral Resources are reported inclusive of those Mineral Resources that were converted to Mineral Reserves. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Table 1-3 Mineral Resource Estimate for the Arctic Deposit

		Average Grade:					Contained Metal:				
Class	M tonnes	Cu %	Pb %	Zn %	Au g/t	Ag g/t	Cu Mlbs	Pb Mlbs	Zn Mlbs	Au koz	Ag Moz
Indicated	36.0	3.07	0.73	4.23	0.63	47.6	2441	581	3356	728	55
Inferred	3.5	1.71	0.60	2.72	0.36	28.7	131	47	210	40	3

Notes:

1. The Qualified Persons for the estimate are Mr Robert Sim, P.Geo. a SIM employee and Dr. Bruce M. Davis, FAusIMM, a BDRC employee. The estimate is reported using the 2014 CIM Definition Standards. The effective date of the Mineral Resource estimate is April 25, 2017. The results of the 2019 drilling supports the current estimate of mineral resources and the inclusion of these nine new drill holes would have no material impact on the estimate of mineral resources for the Project.
2. Mineral Resources stated are contained within a conceptual pit shell developed using metal prices of US$3.00/lb Cu, US$0.90/lb Pb, US$1.00/lb Zn, US$1,300/oz Au and US$18/oz Ag and metallurgical recoveries of 92% Cu, 77% Pb, 88% Zn, 63% Au and 56% Ag and operating costs of US$3/t mining and US$35/t process and general and administrative costs. The assumed average pit slope angle is 43º.
3. The base case cut-off grade is 0.5% copper equivalent: CuEq = (Cu% x 0.92) + (Zn% x 0.290) + (Pb% x 0.231) + (Au g/t x 0.398) + (Ag g/t x 0.005).
4. The Mineral Resource estimate is reported on a 100% basis without adjustments for metallurgical recoveries. Trilogy Metals holds 50% of Ambler Metals.
5. The Mineral Resource estimate is reported inclusive of those Mineral Resources that were converted to Mineral Reserves. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Mineral Resources have been rounded.

1.13 Mineral Reserve Estimates

Mineral Reserves were classified in accordance with the CIM Definition Standards for Mineral Resources and Mineral Reserves (May 10, 2014). Only Mineral Resources that were classified as Measured and Indicated were given economic attributes in the mine design and when demonstrating economic viability. Mineral Reserves for the Arctic deposit incorporate appropriate mining dilution and mining recovery estimations for the open pit mining method.

Table 1-4 Optimization Inputs

Parameter	Unit	Value
Metal Prices		
Copper	$/lb	3.00
Lead	$/lb	1.00
Zinc	$/lb	1.10
Gold	$/oz	1,300.00
Silver	$/oz	18.00

Parameter	Unit	Value
Discount Rate	%	8
Slope Angles		
Sector 1 (2L-E)	degrees	26
Sector 2 (2L-W)	degrees	40
Sector 3 (2U)	degrees	42
Sector 4 (3)	degrees	30
Sector 5 (4L)	degrees	38
Sector 6 (4U)	degrees	43
Dilution	%	Estimated in a block-by-block basis
Mine Losses	%	Taken into account by block
Mining Cost		
Base Elevation	m	730
Base Cost	$/t	2.78
Incremental Mining Cost		
Uphill	$/t/5m	0.020
Downhill	$/t/5m	0.015
Process Costs		
Operating Cost	$/t milled	15.09
G&A	$/t milled	6.55
Process Sustaining Capital	$/t milled	1.53
Road Toll Cost	$/t milled	4.70
Closure	$/t milled	1.52
Processing Rate	Kt/d	10
Process Recovery		
Copper	%	91.2
Lead	%	80.0
Zinc	%	91.0
Gold	%	58.9
Silver	%	34.9
Treatment & Refining Cost	-	Variable by concentrate type/ metal
Royalties		
NANA Surface Use	%NSR	1.00
NANA[1]	%NP	0.00

Note:

1. NANA may elect to either (a) exercise a non-transferrable back-in-right to acquire between 16% and 25% (as specified by NANA) of the Project; or (b) not exercise its back-in-right, and instead receive a net proceeds royalty equal to 15% of the net proceeds realized by Ambler Metals. Upon the direction of Trilogy, the FS was evaluated on a 100% basis, of which Trilogy's share is 50%, and does not include the impact on Ambler Metals of the NANA options, either purchasing an interest in the Project or receiving a royalty payment.

Dilution was applied to the resource model in two steps: planned dilution and contact dilution.

As the mining cost varies with depth individual blocks captured within the final pit design were tagged as either ore or waste by applying the parameters shown in Table 1-4. Using the partial block percentages within the final pit design the ore tonnage and average grades were calculated.

The Mineral Reserve estimates are shown in Table 1-5. Only Probable Mineral Reserves have been classified.

Table 1-5 Mineral Reserve Statement

Class	Tonnage	Grades				
	t x 1000	Cu (%)	Zn (%)	Pb (%)	Au (g/t)	Ag (g/t)
Proven Mineral Reserves	-	-	-	-	-	-
Probable Mineral Reserves	43,443	2.24	3.12	0.54	0.47	34.7
Proven & Probable Mineral Reserves	43,443	2.24	3.12	0.54	0.47	34.7

Notes:

1. The Qualified Person for the Mineral Reserves estimates is Antonio Peralta Romero P.Eng., a Wood employee. Mineral Reserves have an effective date of January 31, 2020. Mineral Reserves are reported on a 100% basis. Trilogy Metals has a 50% interest in Ambler Metals.
2. Mineral Reserves estimated assuming open pit mining methods and include a combination of planned and contact dilution. Total dilution is expected to be between 30% and 35%. Pit slopes vary by sector and range from 26° to 43°. Cut-off grade is variable and ranges from US$32.83/t NSR to US$33.96/t NSR. Commodity prices used were US$3.00/lb Cu, US$1.00/lb Pb, US$1.10/lb Zn, US$1,300/oz Au and US$18/oz Ag. Fixed process recoveries were assumed to be 91.2% Cu, 80.0% Pb, 91.0% Zn, 58.9% Au and 80.0% Ag. Mining costs were estimated at US$2.78/t incremented at US$0.02/t/5 m and US$0.015/t/5 m below and above 730 m elevation respectively. Processing costs were estimated at US$29.39/t, which includes a process operating cost of US$15.09/t, general and administrative cost of US$6.55/t, sustaining capital cost of US$1.53/t. Closure cost of US$1.52/t, and a road toll cost of US$4.70/t. Treatment costs include US$80/t Cu concentrate, US$180/t Pb concentrate and US$200/t Zn concentrate. Refining costs were estimated at US$0.08/lb Cu, US$10/oz Au, US$0.80/oz Ag. Transport costs were included as US$270.38/t concentrate. There is a fixed royalty percentage of 1%.

Risks that may affect the Mineral Reserve estimates include: commodity price and exchange rate assumptions; changes to the assumptions used to generate the NSR cut-off grades that constrains the estimate; changes in local interpretations of mineralization geometry and continuity of mineralized zones; changes to geological and mineralization shapes, and geological and grade continuity assumptions; density and domain assignments; changes to geotechnical and hydrological assumptions, changes to mining and metallurgical recovery assumptions; changes to the input and design parameter assumptions that pertain to the conceptual pit constraining the estimates; assumptions as to concentrate marketability, payability and penalty terms; assumptions as to the continued ability to access the site, retain mineral and obtain surface rights titles, obtain environment and other regulatory permits, and maintain the social license to operate.

There is a risk to the estimate if the Ambler Mining District Industrial Access Project (AMDIAP) road is not constructed as envisaged, or in the time frame envisaged, or that the toll charges assumed in this Report are not the final charges levied. Other risks include: proper management of groundwater will be important to maintaining pit slope stability; the east wall is highly sensitive to several geotechnical parameters, and talc horizons that may not have been included in the geological model might also affect its stability; the presence of talc layers in the rock could affect recoveries in the process plant and therefore could be a risk to the Mineral Reserves.

1.14 Mining Methods

The Arctic Project is designed as a conventional truck–shovel operation assuming 144 t trucks, and 15 m³ shovels. The pit design includes three nested phases to balance stripping requirements while satisfying the concentrator requirements.

The design parameters include a ramp width of 28.5 m, maximum road grades of 10%, bench height of 5 m, targeted mining width of between 70 and 100 m, berm interval variable by sector, variable slope angles by sector and a minimum mining width of 30 m.

The smoothed final pit design contains approximately 43.4 Mt of ore and 298.3 Mt of waste for a resulting stripping ratio of 6.9:1. Within the 43.4 Mt of ore, the average grades are forecast to be 2.24% Cu, 3.12% Zn, 0.54% Pb, 0.47 g/t Au and 34.7 g/t Ag.

The scheduling constraints set the maximum mining capacity at 36 Mt/a and the maximum process capacity at 10 kt/d. The production schedule results in a LOM of 12 years. The mine will require three years of pre-production before the start of operations in the processing plant.

1.15 Recovery Methods

The 10,000 t/d process plant design is conventional for the industry and will operate two 12-hour shifts per day, 365 d/a with an overall plant availability of 92%. The process plant will produce three concentrates: 1) copper concentrate, 2) zinc concentrate, and 3) lead concentrate. Gold and silver are expected to be payable at a smelter; silver is expected to be payable in the copper and lead concentrates, with gold expected to be payable in the lead concentrate only.

There are several deleterious elements reporting to the concentrates at levels which would incur penalties; however, there are no special processing provisions required to make a readily saleable concentrate.

The mill feed will be hauled from the open pit to a primary crushing facility where the material will be crushed by a jaw crusher to a particle size of 80% passing 80 mm.

The crushed material will be ground by two stages of grinding, consisting of one SAG mill and one ball mill in closed circuit with hydrocyclones (SAB circuit). The hydrocyclone overflow with a grind size of approximately 80% passing 70 µm will first undergo talc pre-flotation, and then be processed by conventional bulk flotation (to recover copper, lead, and associated gold and silver), followed by zinc flotation. The bulk rougher concentrate will be cleaned and followed by copper and lead separation to produce a lead concentrate and a copper concentrate. The final tailings from the zinc flotation circuit will be pumped to a tailings management facility (TMF). Copper, lead, and zinc concentrates will be thickened and pressure-filtered before being transported by truck to a port and shipped to smelters.

Based on the mine plan developed for the 2020 FS and metallurgical testwork results, the LOM average metal recoveries and concentrate grades will be:

- Copper concentrate:
    - Recovery: 89.9% copper; 10.9% gold; 26.4% silver
    - Copper grade: 30.3%
- Lead concentrate:
    - Recovery: 79.0% lead; 62.1% gold; 63.1% silver
    - Lead grade: 55.0%
- Zinc concentrate:
    - Recovery: 90.6% zinc
    - Zinc grade: 59.2%

The average annual dry concentrate production is estimated as:

- Copper concentrate: 241,024 t/a

- Lead concentrate: 28,234 t/a
- Zinc concentrate: 173,093 t/a

The recovery plan includes provision for reagents, and water and power requirements.

1.16 Project Infrastructure

1.16.1 Infrastructure Requirements

The Project site is a remote, Greenfields site that is remote from existing infrastructure. Infrastructure that will be required for the mining and processing operations will include:

- Open pit mine
- Stockpiles and waste rock facility (WRF)
- Truck workshop, truck wash, mine offices, mine dry facility and warehouse
- Administration building
- Mill dry facility
- Plant workshop and warehouse
- Primary crushing building
- Fine ore stockpile building
- Process plant and laboratory
- Concentrate loadout building
- Reagent storage and handling building
- Raw water supply building
- Tailings management facility (TMF)
- Surface water diversion and collection channels, culverts, and containment structures
- Waste rock collection pond (WRCP)
- Water treatment plants (WTPs).

1.16.2 Access

The Project site will be accessed through a combination of State of Alaska-owned highways (existing), an Alaska Industrial Development and Export Authority (AIDEA)-owned private road (proposed) and Trilogy Metals-owned access roads (proposed). The AMDIAP road is proposed by AIDEA to connect the Ambler mining district to the Dalton Highway. The AMDIAP road expected to be permitted as a private road with restricted access for industrial use. To connect the Arctic Project site and the existing exploration camp to the proposed AMDIAP road, a 30.7 km access road (the Arctic access road) will need to be built.

The State of Alaska-owned, public Dahl Creek airport will require upgrades to support the planned regular transportation of crews to and from Fairbanks. The cost of these upgrades has been included in the capital cost estimate.

1.16.3 Power

Power generation will be by five diesel generators, producing a supply voltage of 13.8 kV. The total connected load will be 27.1 MW with a normal running load of 16.0 MW. Diesel will be supplied via existing fuel supply networks in the region and shipped along the AMDIAP road.

1.16.4 Accommodation

The Project will require three different self-contained camps, equipped with their own power and heat generation capabilities, water treatment plant, sewage treatment plant, and garbage incinerator. The existing 90-person exploration camp will be used to start the construction of the Arctic access road. A 185-person construction camp will be constructed at the intersection of the AMDIAP road and Arctic access road and will be decommissioned once construction is complete. The permanent camp will be constructed along the Arctic access road, closer to the planned processing facility. The 400-person permanent camp will be constructed ahead of operations to support the peak accommodation requirements during construction.

1.16.5 Waste Rock Facility

A large waste rock facility (WRF) will be developed north of the Arctic pit in the upper part of the Subarctic Creek valley. The WRF is be designed to store waste rock as well as provide a buttress for the tailings containment in the adjacent footprint. The total volume of waste rock is expected to be 146 Mm^3 (298 Mt); however, there is potential for expanded volume in the waste if placement density is <2.0 t/m^3. The WRF will have a final height of 280 m to an elevation of 930 masl and is planned to be constructed in lifts of either 5, 10 or 20 m height with catch benches every 20 m to achieve an overall slope angle of 2.7H:1V.

Most of the waste rock is anticipated to be potentially acid-generating (PAG) and there will be no separation of waste based on acid generation potential. Rather, seepage from the WRF will be collected and treated.

1.16.6 Overburden Stockpiles

There will also be two small overburden stockpiles to store the stripped topsoil and overburden from the TMF footprint. The topsoil stockpile will be placed between the haul roads with capacity to store up to 325,000 m^3 of material while the overburden stockpile will be located below the lower haul road between the pit and the mill site with capacity to store up to 2,200,000 m^3.

1.16.7 Tailings Management Facility

The TMF will be located at the headwaters of Subarctic Creek, in the upper-most portion of the creek valley. The 58.6 ha footprint of the TMF will be fully lined with an impermeable liner (LLDPE). Tailings containment will be provided by an engineered dam that will be buttressed by the WRF that will be constructed immediately downstream of the TMF and will use the natural topography on the valley sides. A starter dam will be constructed to elevation 830 m. Three subsequent raises will bring the final dam crest elevation to 890 m, which is 40 m lower than the final elevation of the WRF. The TMF is designed to store approximately 34.5 Mm^3 (37.8 Mt) of tailings plus 4.5 Mm^3 of water produced over the 12-year mine life, as well as the probable maximum flood, and still provide 2.5 m of freeboard.

1.16.8 Water Management

The proposed mine development is located in the valley of Subarctic Creek, a tributary to the Shungnak River. A surface water management system will be constructed to segregate contact and non-contact water. Non-contact water will be diverted around mine infrastructure to Subarctic Creek. A groundwater seepage monitoring and collection system will be located down gradient of the WRF and seepage collection pond. Contact water will be conveyed to treatment facilities prior to discharge to the receiving environment.

A WRCP will be located directly below the toe of the WRF and will be used to collect seepage from the WRF, runoff from the WRF and haul road corridor area, and water pumped from the open pit.

The Project water and load balance indicates that during operations excess water from the WRCP will need to be treated prior to discharge to the receiving environment. In the last year of operations and during closure, water from the dewatering of the TMF will also need to be treated prior to discharge to the receiving environment.

1.16.9 Water Treatment Plants

1.16.9.1 High Density Sludge Water Treatment Plant

A high density sludge (HDS) lime-based neutralization and precipitation process will be used to treat effluent from the WRCP. The HDS WTP will operate during the open water season from May through October, during operations through to post-closure. Treated effluent will be discharged via a 12 km pipeline to the Shungnak River. Long-term water treatment at the HDS WTP will be required in perpetuity.

1.16.9.2 Selenium Water Treatment Plant

A selenium WTP (SeWTP) will treat excess water in the TMF that is predicted to have elevated selenium concentrations. The SeWTP is anticipated to commence treatment during operation in mine year 12. A portion of the treated effluent from the HDS WTP will be combined with excess water from the TMF, and treated for selenium such that the selenium water quality standard is met after a mixing zone in the Shungnak River. The SeWTP will cease once the TMF is dewatered (by approximately year 15 of closure).

1.17 Market Studies

Metal pricing was based on combination of two year trailing actual metal prices, market research and bank analyst forward price projections, prepared in July 2020 by Jim Vice of StoneHouse Consulting Inc., who was retained by Trilogy Metals.

The long-term consensus metal price assumptions selected for the 2020 FS were:

- Copper: $3.00/lb
- Zinc: $1.10/lb
- Lead: $1.00/lb
- Gold: $1,300/oz
- Silver: $18.00/oz

Smelter terms were applied for the delivery of copper, zinc and lead concentrate. It was assumed that delivery of all concentrates would be to an East Asian smelter at currently available freight rates. Total transport costs for the concentrate are estimated at $270.98/dmt.

1.18 Environmental Studies, Permitting, Social and Community

1.18.1 Environmental Considerations

The Arctic Project area includes the Ambler lowlands and Subarctic Creek within the Shungnak River drainage. A moderate amount of baseline environmental data collection has occurred in the area including surface and groundwater quality sampling, surface hydrology monitoring, wetlands mapping, aquatic life surveys, avian and mammal habitat surveys, cultural resource surveys, hydrogeology studies, meteorological monitoring, and metal leaching and acid rock drainage (ML/ARD) studies.

1.18.2 Permitting Considerations

Trilogy Metals undertakes its current mineral exploration activities at the Arctic deposit under State of Alaska and Northwest Arctic Borough (NWAB) permits. Trilogy Metals is presently operating under a State of Alaska Miscellaneous Land Use Permit (APMA permit) that expires at the end of 2022, and a NWAB Permit that expires also expires at the end of 2022. Both permits are renewable.

Mine development permitting will be largely driven by the underlying land ownership; regulatory authorities vary depending on land ownership. The Arctic Project area includes patented mining claims (private land under separate ownership by Trilogy), State of Alaska land, and NANA land (private land).

Because the Arctic Project is situated to a large extent on State land, it will be necessary to obtain a Plan of Operation Approval (which includes the Reclamation Plan and Closure Cost Estimate) from the Alaska Department of Natural Resources (ADNR). The Project will also require certificates to construct and then operate a dam(s) (tailings and water storage) from the ADNR (Dam Safety Unit) as well as water use and discharge authorizations, an upland mining lease and a mill site lease, as well as several minor permits including those that authorize access to construction material sites from ADNR.

The Alaska Department of Environmental Conservation (ADEC) would authorize waste management under an integrated waste management permit, air emissions during construction and then operations under an air permit, and an Alaska Pollutant Discharge Elimination System (APDES) permit for any wastewater discharges to surface waters, and a Multi-Sector General Permit for stormwater discharges. The ADEC would also be required to review the US Army Corps of Engineers (USACE) Section 404 permit to certify that it complies with Section 401 of the Clean Water Act (CWA).

The Alaska Department of Fish and Game (ADFG) would have to authorize any culverts or bridges that are required to cross fish-bearing streams or other impacts to fish-bearing streams that result in the altering or affecting fish habitat.

US Army Corps of Engineers (USACE) would require a CWA Section 404 permit for dredging and filling activities in Waters of the United States including jurisdictional wetlands. The USACE Section 404 permitting action would require the USACE to comply with the Natural Environmental Policy Act (NEPA) and, for a project of this magnitude, the development of an Environmental Impact Statement (EIS) is anticipated. The USACE would likely be the lead federal agency for the NEPA process. As part of the Section 404 permitting process, the Arctic Project will have to meet USACE wetlands guidelines to avoid, minimize and mitigate impacts to waters of the US including wetlands.

The Arctic Project will also have to obtain approval for a Master Plan from the NWAB. In addition, actions will have to be taken to change the borough zoning for the Arctic Project area from Subsistence Conservation and General Conservation to Resource Development and transportation.

The overall timeline required for permitting would be largely driven by the time required for the NEPA process, which is triggered by the submission of the Section 404 permit application to the USACE. The timeline includes the development and publication of a draft and final EIS and ends with a Record of Decision, and Section 404-permit issuance. In Alaska, the EIS and other State and Federal permitting processes are generally coordinated so that permitting and environmental review occurs in parallel. The NEPA process could require between two to three years to complete, and could potentially take longer.

1.18.3 Social and Community

The Arctic Project is located approximately 40 km northeast of the villages of Shungnak and Kobuk, and 64 km east-northeast of the native village of Ambler. The population in these villages range from 151 in Kobuk (2010 Census) to 262 in Shungnak (2010 Census). Residents live a largely subsistence lifestyle with incomes supplemented by trapping, guiding, local development projects, government aid and other work in, and outside of, the villages.

The Arctic Project has the potential to significantly improve work opportunities for village residents. Trilogy Metals is working directly with the villages to employ residents in the ongoing exploration program as mechanics, geotechnicians, core cutters, administrative staff, camp-services staff, heavy equipment operators, drill helpers, and environmental technicians. Trilogy Metals and NANA have established a Workforce Development Committee to assist with developing a local workforce. In addition, Trilogy Metals has existing contracts with native-affiliated companies (such as NANA Management Services and KUNA Engineering Inc.) that are providing camp catering and environmental services for the Project, respectively.

Local community concerns will also be formally recognized during the development of the project EIS. Early in the EIS process, the lead federal permitting agency will hold scoping meetings in rural villages to hear and record the concerns of the local communities so that the more significant of these concerns can be addressed during the development of the EIS. In addition, the lead federal agency would have government-to-government consultations with the Tribal Councils in each of the villages, as part of the EIS process, to discuss the project and hear Council concerns.

1.18.4 Closure Planning

Mine reclamation and closure are largely driven by State regulations that specify that a mine must be reclaimed concurrent with mining operations to the greatest extent possible and then closed in a way that leaves the site stable in terms of erosion and avoids degradation of water quality from acid rock drainage or metal leaching on the site. A detailed Reclamation Plan and Closure Cost Estimate will be submitted to the State agencies for review and approval in the future, during the formal mine permitting process.

Owing to the fact that the Arctic Project is likely to have facilities on a combination of private (patented mining claims and native land) and State land, it is likely that the Reclamation Plan will be submitted and approved as part of the plan of operations, which is approved by the ADNR. However, since the reclamation plan must meet regulations of both ADNR and the ADEC, both agencies will review and approve the Reclamation Plan and Closure Cost Estimate. In addition, private land owners must formally concur with the portion of the Reclamation Plan for their lands so that it is compatible with their intended post-mining land use.

1.19 Capital and Operating Cost Estimates

1.19.1 Capital Costs

The capital cost estimate has an estimated accuracy of ±15% and uses quarter 4, 2019 US dollars as the base currency. The total estimated initial capital cost for the design, construction, installation, and commissioning of the Arctic Project is estimated to be $905.6 million. A summary of the estimated capital cost is shown in Table 1-6.

Table 1-6 Initial Capital Costs

Cost Type	Description	US$M
Direct	Mine	280.1
	Crushing	28.3
	Process	116.6
	Tailings	70.0
	On-Site Infrastructure	109.3
	Off-Site Infrastructure	53.7
	Direct Subtotal	**656.9**
Indirect	Indirects	130.7
	Contingency	94.5
	Owners Costs	23.4
	Indirect Total	**248.7**
Project Total		**905.6**

The total sustaining capital cost estimate is $113.8 million for the 12-year LOM which includes equipment, tailings and other items. Closure costs were estimated to be $205.4 million. These costs are summarized in Table 1-7.

Table 1-7 Sustaining Capital and Closure Costs

Cost Type	Description	US$M
Direct	Mining	15.1
	Process	1.3
	Tailings	25.1
	Onsite Infrastructure	50.4
Indirect	Indirects	13.8
	Contingency	8.0
	Total Sustaining Capital	**113.8**
	Closure Costs	**205.4**

1.19.2 Operating Costs

The operating cost estimates use US dollars as the base currency and have an accuracy of ±15%. An average operating cost was estimated for the Arctic Project based on the proposed mining schedule. These costs included mining, processing, G&A, surface services, and road toll costs. The average LOM operating cost for the Arctic Project is estimated to be $50.65/ t milled. The breakdown of costs in Table 1-8 is estimated based on the LOM average mill feed rate.

All pre-production costs have been included in capital costs.

Table 1-8 Operating Costs

Description	LOM Average Unit Operating Cost ($/ t milled)	Percentage of Total Annual Operating Costs
Mining*	18.48	36%
Processing	18.31	36%
G&A	5.15	10%
Surface Operations	0.68	1%
Road Toll	8.04	16%
Total Operating Cost	**50.65**	**100%**

*Excludes pre-production costs

1.20 Economic Analysis

The results of this economic analysis represent forward looking information. The results depend on the inputs that are subject to several known and unknown risks, uncertainties, and other factors that may cause actual results to differ materially from those presented in this section. Information that is forward looking includes mineral reserve estimates, commodity prices, the proposed mine production plan, construction schedule, projected recovery rates, proposed capital and operating cost estimates, closure cost estimates, toll road cost estimates, and assumptions on geotechnical, environmental, permitting, royalties, and hydrogeological information.

An economic analysis was undertaken on a 100% basis to determine the internal rate of return (IRR), net present value (NPV) and payback on initial investment of the Arctic Project. Trilogy Metals holds 50% of Ambler Metals. The Project consists of a three-year pre-production construction period, followed by 12 years of production.

Ausenco developed a pre-tax cash flow model for the Arctic Project and the NPV and IRR were calculated at the beginning of the construction period in Year -3.

The pre-tax financial model incorporated the production schedule and smelter term assumptions to produce annual recovered payable metal, or gross revenue, in each concentrate stream by year. Off-site costs, including the applicable refining and treatment costs, penalties, concentrate transportation charges, marketing and representation fees, and royalties were then deducted from gross revenue to determine the NSR. The operating cash flow was then produced by deducting annual mining, processing, G&A, surface services, and road toll charges from the NSR. Initial and sustaining capital was deducted from the operating cash flow in the years they occur, to determine the net cash flow before taxes. Initial capital cost includes all estimated expenditures in the construction period, from Year -3 to Year -1 inclusive. First production occurs at the beginning of Year 1. Sustaining capital expenditure includes all capital expenditures purchased after first production, including mine closure and rehabilitation. The model includes an allocation of a 1% NSR attributable to NANA.

The pre-tax financial results are:

- 30.8% IRR
- $1,550.9 million NPV at an 8% discount rate
- 2.4 year payback period, on the initial capital costs of $905.6 million.

The following tax regimes were incorporated in the post-tax analysis: US Federal Income Tax, Alaska State Income Tax (AST), and Alaska Mining License Tax (AMLT). Taxes are calculated based on currently enacted United States and State of Alaska tax laws and regulations, including the US Federal enactment of the Tax Cuts & Jobs Act (TCJA) on December 22, 2017. At the base case metal prices used for this study, the total estimated taxes payable on the Arctic Project profits are $924.7 million over the 12-year mine life.

The post-tax financial results are:

- 27.1% IRR
- $ 1,134.7 million NPV at an 8% discount rate
- 2.6 year payback period, on the initial capital costs of $905.6 million.

1.21 Interpretations and Conclusions

The Arctic deposit will be mined at an annual rate of 36 million tonnes per annum (Mt/a), with an overall stripping ratio of 6.9:1. Ore will be processed by conventional methods to annually produce 241,024 tonnes of copper, 28,234 tonnes of lead, and 173,093 tonnes of Zn, all in concentrates for provision to third party refiners. Waste and tailings materials will be stored in surface facilities, which will be closed and reclaimed at the end of the mine; contact water will be treated and discharged to the environment throughout the life of mine. Precious metals attendant with the concentrates will be largely payable. While there are expected to be several deleterious elements in the concentrates at levels that may incur penalties, there are no special processing requirements.

Under the assumptions presented in this Report, the Project shows positive economics.

The financial analysis excludes consideration of the NANA Agreement, whereby NANA has the right, following a construction decision, to elect to purchase a 16% to 25% direct interest in the Arctic Project or, alternatively, to receive a 15% Net Proceeds Royalty.

The financial analysis excludes consideration of the new joint venture formed between South32 and Trilogy Metals.

The cost assumptions for the AMDIAP road are estimates provided by Trilogy Metals. There is a risk to the capital and operating cost estimates, the financial analysis, and the Mineral Reserves if the toll road is not built in the time frame required for the Arctic Project, or if the toll charges are significantly different from what was assumed.

In terms of project execution, the mine requires nominally two years of pre-strip operations, tailings pond starter dam development and water accumulation before actual production mining operations can commence.

For that pre-strip work to start, the Arctic access road from the AMDIAP intersection to the mine site will have to be constructed to at least a pioneer road condition that will to allow the mine fleet and the support facilities to be delivered, built and made operational.

1.22 Recommendations

A single-phase work program is recommended, which will include:

- Additional drilling program to upgrade a portion of the Indicated Resource to Measured Resource.
- Drill and blast study.

- Geotechnical investigations and studies.
- Further geohazards assessment.
- Site specific seismic hazard assessment.
- Updating of hydrogeological models and groundwater management plans.
- Optimization of the plant and related service facilities and evaluation of the power supply.
- Examination of water management, water treatment, WRF and TMF designs.
- Baseline studies and environmental permitting activities.
- Additional metallurgical testwork.

The budget for this work is estimated at approximately $7.0 million.

2 Introduction

2.1 Introduction

Trilogy Metals Inc. (Trilogy Metals or Trilogy) commissioned Ausenco Engineering Canada Inc. (Ausenco) to compile a Technical Report (the Report) on the Arctic deposit, part of the Arctic Project (the Project) in the Ambler Mining District of Northwest Alaska (Figure 2-1).

The Project is directly held by Ambler Metals LLC (Ambler Metals), a 50/50 joint venture formed between South32 Limited (South32) and Trilogy Metals Inc. (Trilogy Metals) in February 2020. Upon the formation of the joint venture, Trilogy Metals contributed all of its Alaskan assets, including the Project and Trilogy's agreement with NANA (see below), to Ambler Metals in exchange for a 50% membership interest and at the same time, South32 contributed $145 million in cash for a 50% membership interest.

2.2 Terms of Reference

Figure 2-1 Property Location Map (Tetra Tech, 2013)

The Report supports disclosure by Trilogy Metals in the news release dated August 20, 2020, entitled "Trilogy Metals Announces Positive Feasibility Study Results for the Arctic Project Located in Alaska, USA".

The firms and consultants who are providing Qualified Persons (QPs) responsible for the content of this Report are, in alphabetical order, Ausenco (Ausenco); BD Resource Consulting, Inc., (BDRC); International Metallurgical & Environmental Inc (IME); SIM Geological Inc. (SIM); SRK Consulting (Canada) Inc. (SRK), and Wood (previously Amec Foster Wheeler Americas Ltd.).

The Report presents Mineral Resource and Mineral Reserve estimates for the Project, and an economic assessment based on open pit mining operations and a conventional processing circuit that would produce copper, zinc and lead concentrates.

All units of measurement in this Report are metric, unless otherwise stated.

The monetary units are in US dollars, unless otherwise stated.

Mineral Resources and Mineral Reserves are reported in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Mineral Reserves (May 2014; the 2014 CIM Definition Standards).

2.3 Qualified Persons

The following serve as the qualified persons for this Technical Report as defined in National Instrument 43-101, Standards of Disclosure for Mineral Projects, and in accordance with Form 43-101F1:

- Mr. L. Paul Staples, P.Eng., Vice President and Global Practice Lead, Ausenco
- Dr. Antonio Peralta Romero, P.Eng, Principal Mining Engineer, Wood
- Dr. Bruce Davis, FAusIMM, BDRC
- Mr. Jeffrey B. Austin, P.Eng, IME
- Mr. Robert Sim, P.Geo, SIM
- Mr. Calvin Boese, P.Eng, Principal Consultant, Geotechnical Engineering, SRK
- Mr. Bruce Murphy, P.Eng., Principal Consultant, Rock Mechanics, SRK
- Dr. Tom Sharp, P.Eng, Principal Consultant, Water Management and Treatment Engineering, SRK
- Mr. AJ MacDonald, P.Eng, Integrated Sustainability Consultants

2.4 Site Visit

Dr. Peralta visited the Arctic Project site on July 25, 2017. During the visit, he inspected the property access and viewed the surface topography in the areas proposed for the locations of the open pit, mine infrastructure and waste rock facility are to be located; inspected lithologies in selected drill cores that would support the pit walls; and observed structural features in outcrop that could affect pit slope stability. The site visit is considered current as there has been no material change to the information on the site since the personal inspection was conducted.

Mr. Staples visited the Arctic Project site on July 25, 2017. During the visit, he inspected the property access, viewed the surface topography in the area proposed for the process plant and supporting infrastructure.

Mr. Boese visited the Arctic Project site from July 24 – 25, 2017 and July 10-12, 2018. He inspected property access and surface topography where the waste rock facility and tailings management facilities are to be located, as well as available space for other mine facilities.

Dr. Davis conducted a site visit to the Project from July 26 - 27, 2011, on September 25, 2012, from August 10-12, 2015, and again on August 29, 2019. The site visit included a review of: drilling procedures, site facilities, historic and recent drill core, logging procedures, data capture, and sample handling. During the 2015 Arctic site visit, Dr. Davis undertook a helicopter traverse along proposed access corridors and potential site layouts. During the 2019 visit, he visited two drill sites at the Arctic deposit and inspected a talc outcrop with Mr. Murphy.

Bruce Murphy visited the Arctic Project site August 27 – 29, 2019. During the visit he reviewed selected drill core, and inspected the Arctic deposit discovery outcrop, 2019 drill pads at Arctic, and a talc outcrop.

2.5 Effective Dates

The Report has a number of effective dates as follows:

- The effective date of the Mineral Resource estimate is April 25, 2017.
- The effective date of the Mineral Reserve estimate is January 31, 2020.
- The effective date of the financial analysis is August 20, 2020.

The overall effective date of the Report is taken to be the date of the financial analysis and is August 20, 2020.

2.6 Information Sources

Reports and documents listed in Section 2.7, Section 3, and Section 27 were used to support the preparation of the Report. Additional information was sought from Trilogy Metals personnel where required.

2.7 Previous Technical Reports

Technical reports filed by Trilogy Metals, and its predecessor companies, NovaCopper and NovaGold include:

- Staples, P., Hannon, J., Peralta Romero, A., Davis, B., DiMarchi, J., Austin, J., Sim, R., Boese, C., Murphy, B., and Sharp, T., 2018: Arctic Project, Northwest Alaska, USA, NI 43-101 Technical Report on Pre-Feasibility Study, report prepared by Ausenco Engineering Canada Inc. for Trilogy Metals, effective date February 20, 2018.
- Davis, B., Sim, R., and Austin, J., 2017: NI 43-101 Technical Report on the Arctic Project, Northwest Alaska, USA: report prepared by BD Resource Consulting, Inc., SIM Geological Inc., and International Metallurgical & Environmental Inc. for Trilogy Metals Inc., effective date April 25, 2017.
- Wilkins, G., Stoyko, H.W., Ghaffari, H., DiMarchi, J., Huang, J., Silva, M., O'Brien, M.F., Chin, M., and Hafez, S.A., 2013: Preliminary Economic Assessment Report on the Arctic Project, Ambler Mining District, Northwest Alaska: report prepared by Tetra Tech for Nova Copper, effective date September 12, 2013.

- Rigby, N., White, R., Volk, J., Braun, T., and Olin, E.J., 2012: NI 43-101 Preliminary Economic Assessment Ambler Project Kobuk, AK: report prepared by SRK Consulting (US) Inc. for Nova Copper, effective date February 1, 2012.
- Rigby, N., and White, R., 2011: NI 43-101 Preliminary Economic Assessment Ambler Project Kobuk, AK: report prepared by SRK Consulting (US) Inc. for Nova Copper, effective date May 9, 2011.
- Rigby, N., and White, R., 2008: NI 43-101 Technical Report on Resources Ambler Project Arctic Deposit, Alaska: report prepared by SRK Consulting (US) Inc. for Nova Copper, effective date January 31, 2008.

3 Reliance on Other Experts

3.1 Introduction

The QPs have relied upon the following expert reports, which provided information regarding mineral rights, surface rights, property agreements, royalties, legal assumptions and taxation and this Report.

3.2 Legal Considerations

The QPs have not independently reviewed ownership of the Project area and any underlying property agreements, mineral tenure, surface rights, or royalties. The QPs have fully relied upon, and disclaim responsibility for, information derived from Trilogy Metals and legal experts retained by Trilogy Metals for this information through the following documents.

- Kennecott Exploration Company, Kennecott Arctic Company, Alaska Gold Company and NovaGold Resources Inc., 2010: Net Smelter Returns Royalty Agreement dated effective January 7, 2010: 51 p.
- NovaCopper US Inc. and NANA Regional Corporation Inc., 2011: Exploration Agreement and Option to Lease, dated effective October 19, 2011: 144 p.
- NovaCopper US Inc. and NANA Regional Corporation Inc., 2012: Amending Agreement, dated effective May 10, 2012: 7 p.
- Reeves, J.N., 2018: Arctic Project: legal opinion prepared by Holmes Weddell & Barcott for Trilogy Metals Inc., 4 April 2018, 58 p.
- NovaCopper US Inc, Trilogy Metals Inc. and Ambler Metals LLC, 2020: Contribution Agreement, effective as of February 11, 2020: 39 p.

This information is used in Section 4 of the Report. The information is also used in support of the Mineral Resource estimate in Section 14, the Mineral Reserve estimate in Section 15, and the financial analysis in Section 22.

3.3 Taxation

The QPs have fully relied upon, and disclaim responsibility for, information supplied by Trilogy Metals staff and experts retained by Trilogy Metals for information related to taxation as applied to the financial model as follows:

- Ernst & Young LLP, 2020: Provisions of income tax and mineral tax portions of economic analysis for the Feasibility technical study report on Trilogy's Arctic Project, July 14, 2020.

This information is used in the financial analysis in Section 22 of the Report.

3.4 Marketing and Contracts

The QPs have fully relied upon, and disclaim responsibility for, information supplied by Trilogy Metals staff and information supplied by experts retained by Trilogy Metals for information related to market assumptions as applied to the financial model as follows:

- StoneHouse Consulting Inc.: Arctic Concentrate Marketing, prepared for Trilogy Metals Inc., dated July 14, 2020.

This information is used in support of the marketing assumptions in Section 19, the financial analysis in Section 22, and the Mineral Reserve estimate in Section 15.

The QPs consider it reasonable to rely upon the information provided by StoneHouse Consulting for copper, lead and zinc concentrate marketing and market assumptions. Mr. Vice, who prepared the report for StoneHouse Consulting, is a global base metal concentrate consultant, with previous significant experience in sales and marketing for Teck Resources. Mr. Vice has been involved with sales and marketing of metals and concentrate in European, Chinese, North American and globally-developing markets. The QPs were able to review Stonehouse Consulting's report.

3.5 Metal Prices and Exchange Rates

The QPs have fully relied upon, and disclaim responsibility for, information supplied by Trilogy Metals staff and experts retained by Trilogy Metals for information related to metal price and exchange rate assumptions as applied to the financial model:

Stonehouse Consulting Inc, 2020, Reliance Letter for Metal Pricing Content of the 2020 Trilogy NI 43-101 Technical Report, prepared for Ausenco, dated September 14 2020.

Metals price and exchange rate forecasting is a specialized business requiring knowledge of supply and demand, economic activity and other factors that are highly specialized and requires an extensive global database that is outside of the purview of a QP. The QPs consider it reasonable to rely upon Stonehouse Consulting as the company provides up-to-date, in-depth insight and analysis into all facets of the metals industry, including production supply and consumption demand, and metal price and exchange rate forecasts.

This information is used in support of the metal price and exchange rate assumptions in Section 19, the financial analysis in Section 22, the Mineral Reserve Estimate in Section 15 and the Mineral Resource estimate in Section 14; and the exchange rate assumptions for the capital cost estimates in Section 21.

4 Property Description and Location

4.1 Location

The Project is situated in the Ambler mining district of the southern Brooks Range, in the Northwest Arctic Borough (NWAB) of Alaska. The Project is located in Ambler River A-2 quadrangle, Kateel River Meridian T 20N, R 11E, section 2 and T 21N, R 11E, sections 34 and 35.

The Arctic Project is about 270 km east of the town of Kotzebue, 37 km northeast of the village of Kobuk, and 260 km west of the Dalton Highway, an all-weather State maintained public road, at geographic coordinates N67.17° latitude and W156.39° longitude and Universal Transverse Mercator (UTM) North American Datum (NAD) 83, Zone 4 coordinates 7453080N, 613110E.

4.2 Ownership

The Project is directly held by Ambler Metals, a 50/50 joint venture formed between South32 and Trilogy Metals in February 2020. Upon the formation of the joint venture, Trilogy Metals contributed all of its Alaskan assets, including the Project to Ambler Metals in exchange for a 50% membership interest and at the same time, South32 contributed $145 million in cash for a 50% membership interest.

Prior to the joint venture formation, the Project was held 100% by a wholly-owned subsidiary of Trilogy Metals. Trilogy Metals acquired the Property from NovaGold in 2011. In 2011, NovaGold transferred all copper projects to Trilogy and subsequently spun-out Trilogy to its then existing shareholders by way of a Plan of Arrangement in 2012.

4.3 Mineral Tenure

The Project comprises approximately 185,805 acres (75,192 ha) of State of Alaska mining claims and US Federal patented mining claims in the Kotzebue Recording District. The land tenure consists of 1,851 contiguous State claims totaling 185,436 acres (75,043 ha), including 905 40-acre claims, 946 160-acre claims, and 18 Federal patented claims comprising 271.9 acres (110 ha) held in the name of NovaCopper, a wholly owned subsidiary of Trilogy Metals. Claim locations are shown in Figure 4-1 to Figure 4-3 and listed in Appendix A. The Arctic deposit is located near the southern edge of the centre of the claim block shown in Figure 4-4, primarily within the Federal patented claims.

The Federal patented claim corners were located by the US Geological Survey (USGS). In Appendix A, the Federal patented claims are reported using the completed mineral surveys, USMS2245-1 and USMS2245-2. USMS2245-2 covers the Arctic 10 and Arctic 495 Federal patented claims and is included in Appendix A under 50-83-0174. USMS2245-1 covers the remaining 16 Federal patented claims (Arctic 1, 2, 4, 9, 11, 13, 15, 17, 19, 23, 24, 25, 26, 27, 28, and 29), and is included Appendix A under 50-81-0127. Figure 4-4 included the locations of the Federal patented claims. There is no expiration date or labour requirement on the Federal patented claims.

Rent for each State claim is paid annually to the ADNR. An Annual Labour Statement must be submitted to maintain the State claims in good standing. The legal opinion provided to Trilogy Metals supports that the State mining claims are in "active" status and in good standing with the ADNR.

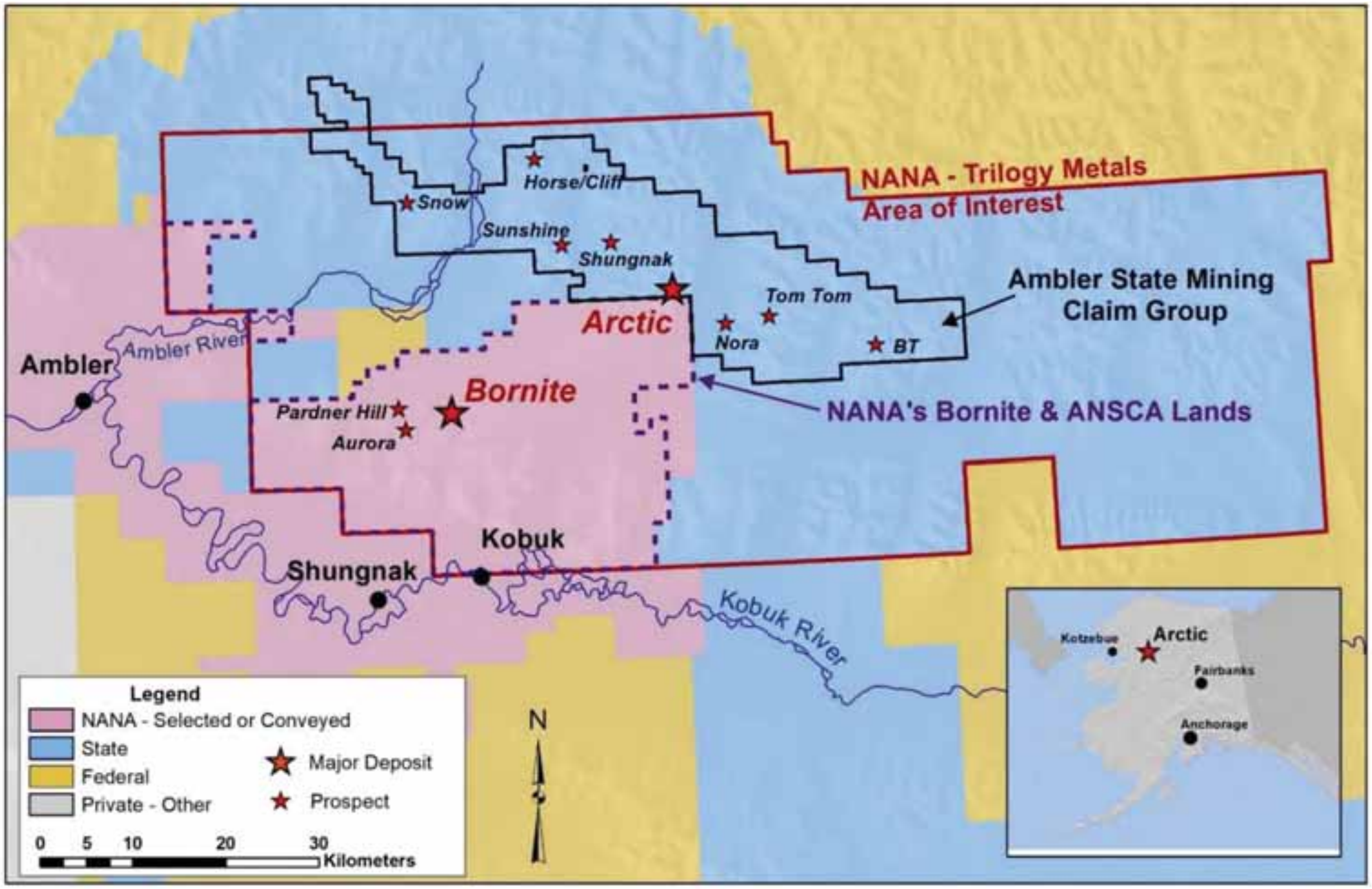


Figure 4-1 Upper Kobuk Mineral Projects Lands (Trilogy Metals, 2019)

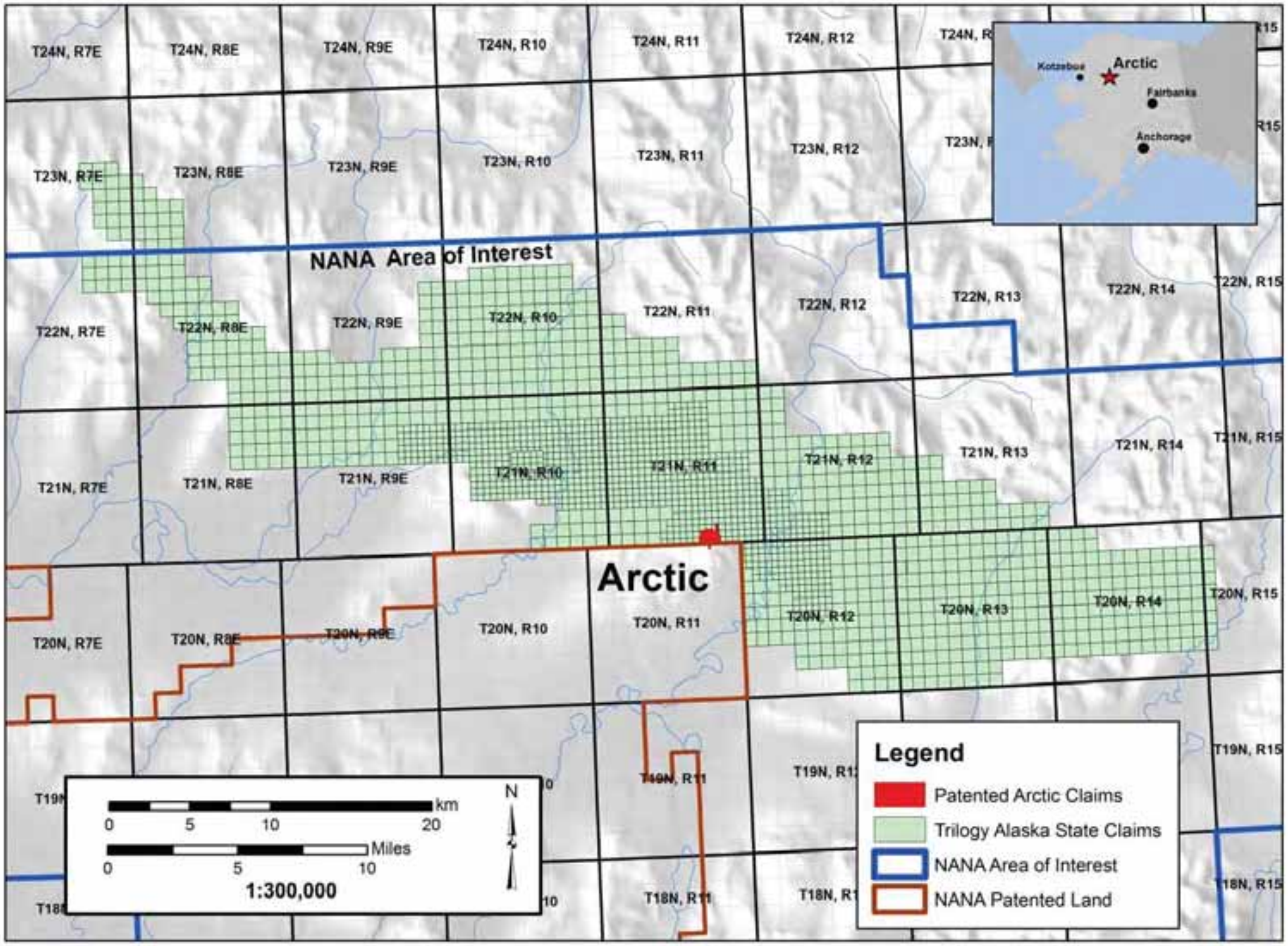


Figure 4-2 Arctic Project Mineral Tenure Plan (Trilogy Metals, 2019)

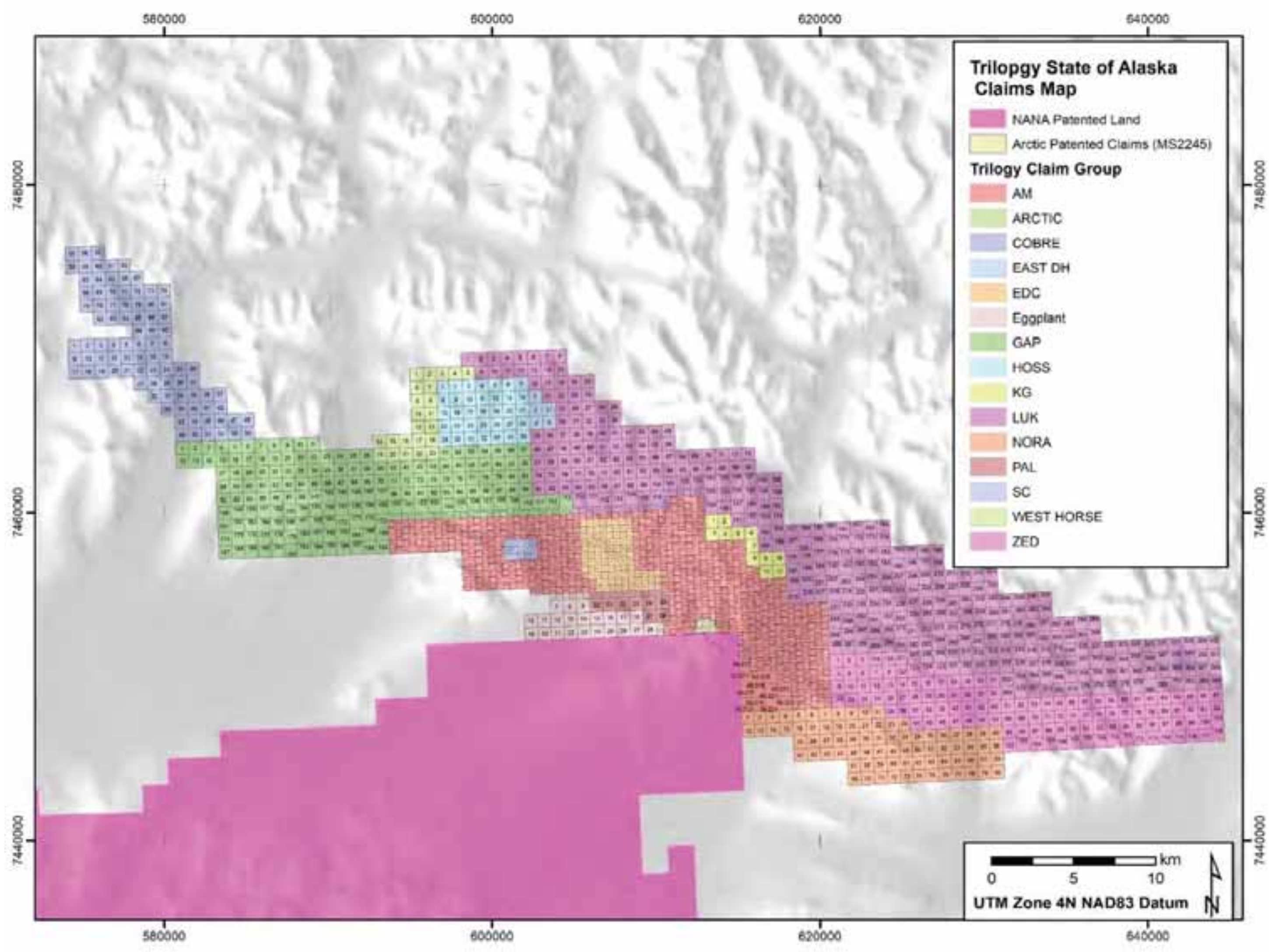


Figure 4-3 Mineral Tenure Layout Plan (Trilogy Metals, 2019)

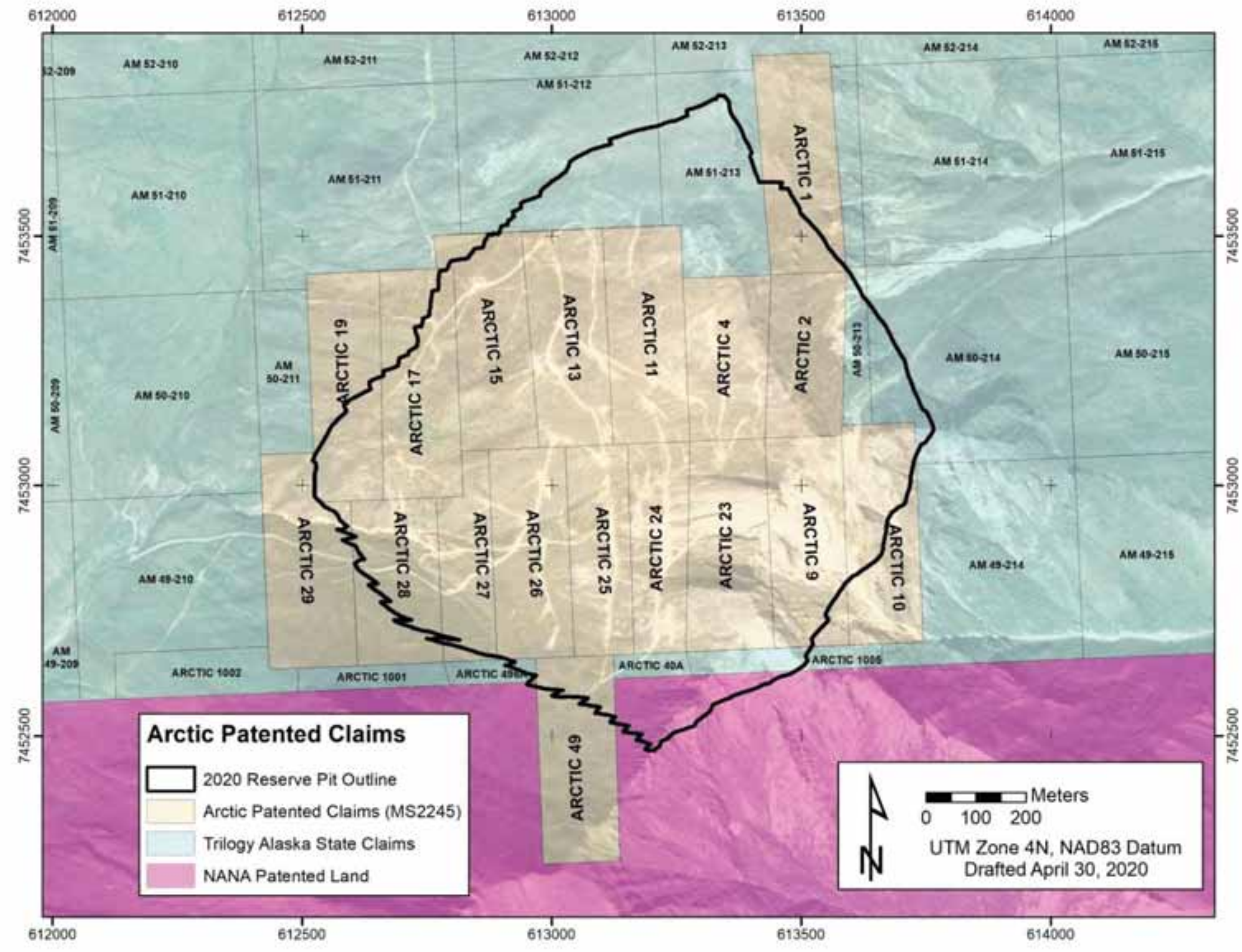


Figure 4-4 Arctic Deposit Location (Trilogy Metals, 2019)

4.4 Royalties, Agreements and Encumbrances

4.4.1 Kennecott Agreements

The Kennecott Royalty Agreement dated effective January 7, 2010 was entered into by and among Kennecott, Alaska Gold Company and NovaGold. A copy of the Kennecott Agreement was recorded in the Kotzebue Recording District on January 8, 2010, as document no. 2010-000013-0.

The Kennecott Royalty Agreement documents a net smelter returns royalty that was reserved to Kennecott in a Purchase and Sale Agreement dated December 18, 2009 whereby Alaska Gold Company and NovaGold acquired mining properties from Kennecott. The mining properties referenced in the Kennecott Royalty Agreement consist of the Federal patented mining claims and many, but not all, of the State mining claims that are the subject of this Report.

The Kennecott Royalty Agreement provides for the payment of a 1% royalty on net smelter returns from production from the properties to which it applies. The Kennecott Royalty Agreement gives the Grantors (Alaska Gold Company and NovaGold) an option to purchase the royalty for a payment of $10,000,000. By operation of the enurement clause of the Kennecott Royalty Agreement, this option may be exercised by a successor owner, such as NovaCopper US Inc.

4.4.2 NANA Agreement

In 1971, the US Congress passed the ANCSA which settled land and financial claims made by the Alaska Natives and provided for the establishment of 13 regional corporations to administer those claims. These 13 corporations are known as the Alaska Native Regional Corporations (ANCSA Corporations). One of these 13 regional corporations is NANA. ANCSA Lands controlled by NANA bound the southern border of the Project claim block (refer to Figure 4-1).

On October 19, 2011, Trilogy Metals and NANA entered into the NANA Agreement for the cooperative development of their respective resource interests in the Ambler mining district. The NANA Agreement consolidates Trilogy Metals' and NANA's land holdings into an approximately 142,831 ha land package and provides a framework for the exploration and development of the area. The NANA Agreement provides that NANA will grant Trilogy Metals the nonexclusive right to enter on, and the exclusive right to explore, the Bornite Lands and the ANCSA Lands (each as defined in the NANA Agreement) and in connection therewith, to construct and use temporary access roads, camps, airstrips and other incidental works.

The NANA Agreement has a term of 20 years, with an option in favour of Trilogy Metals to extend the term for an additional 10 years. The NANA Agreement may be terminated by mutual agreement of the parties or by NANA if Trilogy Metals does not meet certain expenditure requirements on NANA's lands.

If, following receipt of a feasibility study and the release for public comment of a related draft EIS, Trilogy Metals decides to proceed with construction of a mine on the lands subject to the NANA Agreement, Trilogy Metals will notify NANA in writing and NANA will have 120 days to elect to either (a) exercise a non-transferrable back-in-right to acquire between 16% and 25% (as specified by NANA) of that specific project; or (b) not exercise its back-in-right, and instead receive a net proceeds royalty equal to 15% of the net proceeds realized by Trilogy Metals from such project. The cost to exercise such back-in-right is equal to the percentage interest in the Project multiplied by the difference between (i) all costs incurred by Trilogy Metals or its affiliates on the project, including historical costs incurred prior to the date of the NANA Agreement together with interest on the historical costs; and (ii) $40 million (subject to exceptions). This amount will be payable by NANA to Trilogy Metals in cash at the time the parties enter into a joint venture agreement and in no event will the amount be less than zero.

In the event that NANA elects to exercise its back-in-right, the parties will, as soon as reasonably practicable, form a joint venture with NANA electing to participate between 16% to 25%, and Trilogy Metals owning the balance of the interest in the joint venture. Upon formation of the joint venture, the joint venture will assume all of the obligations of Trilogy Metals and be entitled to all the benefits of Trilogy Metals under the NANA Agreement in connection with the mine to be developed and the related lands. A party's failure to pay its proportionate share of costs in connection with the joint venture will result in dilution of its interest. Each party will have a right of first refusal over any proposed transfer of the other party's interest in the joint venture other than to an affiliate or for the purposes of granting security. A transfer by either party of a net smelter royalty return on the project or any net proceeds royalty interest in a project other than for financing purposes will also be subject to a first right of refusal.

In connection with possible development on the Bornite Lands or ANCSA Lands, Trilogy Metals and NANA will execute a mining lease (the Mining Lease) to allow Trilogy Metals or a joint venture vehicle to construct and operate a mine on the Bornite Lands or ANCSA Lands. The Mining Lease will provide NANA with a 2% net smelter royalty (NSR) as to production from the Bornite Lands and a 2.5% NSR as to production from the ANCSA Lands.

If Trilogy Metals decides to proceed with construction of a mine on its own lands subject to the NANA Agreement, NANA will enter into a surface use agreement with Trilogy Metals which will afford Trilogy Metals access to the Project along routes approved by NANA (the Surface Use Agreement). In consideration for the grant of such surface use rights, Trilogy Metals will grant NANA a 1% NSR on production and an annual payment of $755 per acre (as adjusted for inflation each year beginning with the second anniversary of the effective date of the NANA Agreement) and for each of the first 400 acres and $100 for each additional acre, of the lands owned by NANA and used for access which are disturbed and not reclaimed.

The NANA Agreement has been assigned by Trilogy Metals to Ambler Metals.

Figure 4-1 showed the locations of the Bornite and ANCSA Lands that are included in the NANA Agreement. The Bornite Lands are not considered to be part of the Arctic Project, because the mineralization styles identified to date in the Bornite Lands are distinctly different to the mineralization styles in the Ambler claims, and it is expected that any mining operation in the Bornite Lands would be developed as a stand-alone operation using different infrastructure.

4.5 State Royalty

The owner of a State mining claim or lease will be obligated to pay a production royalty to the State of Alaska in the amount of 3% of net income received from minerals produced from the State mining claims.

This royalty does not apply to patented federal mining claims.

4.6 Surface Rights

Surface use of the private land held as Federal patented claims is limited only by reservations in the patents and by generally applicable environmental laws.

Surface use of State claims allows the owner of the mining claim to make such use of the surface as is "necessary for prospecting for, extraction of, or basic processing of minerals."

4.7 Environmental Considerations

Environmental considerations are discussed in Section 20.

There may be some environmental liabilities associated with sites explored during the 1950s and 1960s. The exploration camp would require rehabilitation if the Project is closed.

4.8 Permits

Permitting considerations for the Project are discussed in Section 20.

4.9 Social Considerations

Social considerations for the Project are discussed in Section 20.

4.10 Comment on Section 4

To the extent known, Trilogy Metals has advised Ausenco that there are no other significant factors and risks that may affect access, title, or the right or ability to perform work on the property that have not been discussed in this Report.

5 Accessibility, Climate, Local Resources, Infrastructure and Physiography

5.1 Accessibility

5.1.1 Air

Primary access to the Project is by air, using both fixed wing aircraft and helicopters.

There are four well-maintained, approximately 1,500 m-long gravel airstrips located near the Project, capable of accommodating charter fixed wing aircraft. These airstrips are located 64 km west at Ambler, 46 km southwest at Shungnak, 37 km southwest at Kobuk, and 34 km southwest at Dahl Creek. There is daily commercial air service from Kotzebue to the village of Kobuk, the closest community to the Project. During the summer months, the Dahl Creek Camp airstrip is suitable for larger aircraft, such as a C-130 and DC-6.

In addition to the four 1,500 m airstrips, there is a 700 m airstrip located at the Bornite Camp. The airstrip at Bornite is suited to smaller aircraft, which support the Bornite Camp with personnel and supplies. There is also a 450 m airstrip (Arctic airstrip) located at the base of Arctic Ridge that can support smaller aircraft.

5.1.2 Road

A winter trail and a one-lane dirt track suitable for high-clearance vehicles or construction equipment links the Bornite Camp to the Dahl Creek airstrip southwest of the Arctic deposit. An unimproved gravel track connects the Arctic airstrip with the Arctic deposit.

5.1.3 Water

There is no direct water access to the Project. During spring runoff, river access is possible by barge from Kotzebue Sound to Ambler, Shungnak, and Kobuk via the Kobuk River.

5.2 Climate

The climate in the region is typical of a sub-arctic environment. Weather conditions on the Project can vary significantly from year to year and can change suddenly. During the summer exploration season, average maximum temperatures range from 10 °C to 20 °C, while average lows range from -2 °C to 7 °C (Western Regional Climate Center: WRCC - Alaska Climate Summaries: Kobuk 1971 to 2000). By early October, unpredictable weather limits safe helicopter travel to the Project. During winter months, the Project can be accessed by snow machine, track vehicle, or fixed wing aircraft. Winter temperatures are routinely below -25 °C and can exceed -50 °C. Annual precipitation in the region averages at 500 mm for elevations lower than 600 m above sea level ("masl") with the most rainfall occurring from June through September, and the most snowfall occurring from November through January.

It is expected that any future mining activity will be conducted on a year-round basis. Past exploration activities are generally confined to the period from late May to late September.

5.3 Local Resources and Infrastructure

The Project is currently isolated from major public infrastructure. Infrastructure assumptions and the proposed infrastructure layout for the Project are discussed in Section 18 of the Report.

The Project is approximately 270 km east of the town of Kotzebue, on the edge of Kotzebue Sound, 37 km northeast of the village of Kobuk, 260 km west of the Dalton Highway, and 470 km northwest of Fairbanks. Kobuk (population 151; 2010 US Census) is the location of one of the airstrips near the Project. Several other villages are also near the Project, including Shungnak located 46 km to the southwest with a population of 262 (2010 US Census) and Ambler, 64 km to the west with a population of 258 (2010 US Census). Kotzebue has a population of 3,201 (2010 US Census) and is the largest population centre in the Northwest Arctic Borough. Kotzebue is a potential source of limited mining-related supplies and labourers, and is the nearest centre serviced by regularly scheduled, large commercial aircraft (via Nome or Anchorage). In addition, there are seven other villages in the region that will be a potential source of some of the workforce for the Project. Fairbanks (population 31,036; 2010 US Census) has a long mining history and can provide most mining-related supplies and support that cannot be sourced closer to the Property.

Drilling and mapping programs are seasonal and have been supported out of the Bornite Camp and Dahl Creek Camp. The Bornite Camp facilities are located on Ruby Creek on the northern edge of the Cosmos Hills. The camp provides office space and accommodations for the geologists, drillers, pilots, and support staff. Power is supplied by two Caterpillar diesel generators. Water was supplied by the permitted artesian well located 250 m from camp; however, a water well was drilled in camp during the 2017 field season that was permitted by 2019 to provide all potable water for the Bornite Camp.

5.4 Physiography

The Arctic Project is located along the south slope of the Brooks Range, which separates the Arctic region from the interior of Alaska. Nearby surface water includes Subarctic Creek, the Shungnak and Kogoluktuk Rivers, the Kobuk River, and numerous small lakes. The Arctic Project is located at the eastern end of Subarctic Creek, a tributary of the Shungnak River to the west, along a ridge between Subarctic Creek and the Kogoluktuk River Valley. The Property area is marked by steep and rugged terrain with high topographic relief. Elevations range from 30 masl along the Kobuk River to 1,180 masl on a peak immediately north of the Arctic Project area. The divide between the Shungnak and Kogoluktuk Rivers in the Ambler Lowlands is approximately 220 masl.

The Kobuk Valley is located at the transition between boreal forest and Arctic tundra. Spruce, birch, and poplar are found in portions of the valley, with a ground cover of lichens (reindeer moss). Willow and alder thickets and isolated cottonwoods follow drainages, and alpine tundra is found at higher elevations. Tussock tundra and low, heath-type vegetation covers most of the valley floor. Intermittent permafrost exists on the Property.

Permafrost is a layer of soil at variable depths beneath the surface where the temperature has been below freezing continuously from a few to several thousands of years (Climate of Alaska 2007). Permafrost exists where summer heating fails to penetrate to the base of the layer of frozen ground and occurs in most of the northern third of Alaska as well as in discontinuous or isolated patches in the central portion of the State.

Wildlife in the Project area is typical of Arctic and subartic fauna (Kobuk Valley National Park 2007). Larger animals include caribou, moose, Dall sheep, bears (grizzly and black), wolves, wolverines, coyotes, lynx and foxes. There are no anadromous fish species in the upper reaches of the Shungnak and Kogoluktuk Rivers due to natural fish barriers. Other fish species such as trout, sculpin, and grayling are common. The caribou seen on the Project belong to the Western Arctic herd that migrate once a year heading south in late August through October from their summer range north of the Brooks Range. The caribou migrate north in March from their winter range along the Buckland River to the north slope of the Brooks Range, a more westerly route and do not cross the Project during that migration.

5.5 Comment on Section 5

In the opinion of the QP:

- The planned infrastructure, availability of staff, power, water, and communications facilities, the design and budget for such facilities, and the methods whereby goods could be transported to the proposed mine, and any planned modifications or supporting studies are reasonably well-established, or the requirements to establish such, are reasonably well understood by Trilogy Metals, and can support the declaration of Mineral Resources and Mineral Reserves.
- There is sufficient area within the Project to host an open pit mining operation, including mine and plant infrastructure, and waste rock and tailings management facilities.
- It is a reasonable expectation that any additional surface rights that would be required to support Project development and operations can be obtained through appropriate negotiation.
- It is expected that any future mining operations will be able to be conducted year-round.

6 History

Prospectors first arrived in the Ambler Mining District around 1900, shortly after the discovery of the Nome and Fairbanks gold districts. Several years later, small gold placer deposits were located in the southern Cosmos Hills south of the Arctic deposit and worked intermittently over ensuing decades for gold and nephrite. During this time copper mineralization was observed at Ruby Creek in the northern Cosmos Hills; however, no exploration was undertaken until 1947 when local prospector Rhinehart “Rhiny” Berg located outcropping copper mineralization along Ruby Creek. Berg subsequently staked claims over the Ruby Creek showings and constructed an airstrip for access (alaskamininghalloffame.org 2012).

BCMC, an exploration subsidiary of Kennecott, optioned the property from Berg in 1957. The prospect became known as Bornite and Kennecott conducted extensive exploration over the next decade, culminating in the discovery of the high-grade No. 1 zone and the sinking of an exploration shaft to conduct underground drilling.

In conjunction with the discovery of the Bornite deposit, BCMC greatly expanded their regional reconnaissance exploration in the Cosmos Hills and the southern Brooks Range. Stream silt sampling in 1965 revealed a significant copper anomaly in Subarctic Creek roughly 27 km northeast of Bornite. The area was subsequently staked and, in 1967, eight core holes were drilled at the Arctic deposit yielding massive sulphide intercepts over an almost 500-m strike length.

BCMC conducted intensive exploration on the property until 1977 and then intermittently through 1998. No drilling or additional exploration was conducted on the Arctic Project between 1999 and 2003.

In addition to drilling and exploration at the Arctic deposit, BCMC also conducted exploration at numerous other prospects in the Ambler Mining District (most notably Dead Creek, Sunshine, Cliff, and Horse). The abundance of VMS prospects in the district resulted in a series of competing companies in the area, including Sunshine Mining Company, Anaconda Company, Noranda Exploration Company, GCO Minerals Company, Cominco American Resource Inc. (Cominco), Teck Cominco, Resource Associates of Alaska (RAA), Watts, Griffis and McOuat Ltd. (WGM), and Houston Oil and Minerals Company, culminating into a claim staking war in the district in 1973. Falconbridge and Union Carbide also conducted work later in the district.

District exploration by Sunshine Mining Company and Anaconda resulted in two additional significant discoveries in the district; the Sun deposit located 60 km east of the Arctic deposit, and the Smucker deposit located 36 km west of the Arctic deposit. These two deposits are outside the current Project area.

District exploration continued until the early 1980s on the four larger deposits in the district (Arctic, Bornite, Smucker and Sun) when the district fell into a hiatus due to depressed metal prices.

In 1987, Cominco acquired the claims covering the Sun and Smucker deposits from Anaconda. Teck Resources Limited, as Cominco’s successor company, continues to hold the Smucker deposit. In 2007, Andover Mining Corporation purchased a 100% interest in the Sun deposit for US$13 million and explored the property through 2013. The sun deposit and adjacent lands were acquired by Valhalla Metals Inc., a private company, staked over the Sun deposit in 2017 after the creditors for the bankrupt Andover Mining Corporation failed to pay the annual rent of the state claims and submit the Annual Labour Statement.

In 1981 and 1983, Kennecott received three US Mineral Survey patents (MS2245 totaling 240 acres over the Arctic deposit – later amended to include another 32 acres; and MS2233 and MS2234 for 25 claims totaling 516.5 acres at Bornite). The Bornite patented claims and surface development were subsequently sold to NANA Regional Corporation, Inc. in 1986.

No production has occurred at the Arctic deposit or at any of the other deposits within the Ambler Mining District

6.1 Prior Ownership and Ownership Changes – Arctic Deposit and the Ambler Lands

BCMC initially staked federal mining claims covering the Arctic deposit area beginning in 1966. The success of the 1960's drill programs defined a significant high-grade polymetallic resource at the Arctic deposit and, in the early 1970s, Kennecott began the patent process to obtain complete legal title to the Arctic deposit. In 1981, Kennecott received US Mineral Survey patent M2245 covering 16 mining claims totalling 240.018 acres. In 1983, US Mineral Survey patent M2245 was amended to include two additional claims totalling 31.91 acres.

With the passage of the Alaska National Interest Lands Conservation Act (ANILCA) in 1980, which expedited native land claims outlined in the ANSCA and State lands claims under the Alaska Statehood Act, both the State of Alaska and NANA selected significant areas of land within the Ambler Mining District. State selections covered much of the Ambler schist belt, host to the volcanogenic massive sulphide (VMS) deposits including the Arctic deposit, while NANA selected significant portions of the Ambler Lowlands to the immediate south of the Arctic deposit as well as much of the Cosmos Hills including the area immediately around Bornite.

In 1995, Kennecott renewed exploration in the Ambler schist belt containing the Arctic deposit patented claims by staking an additional 48 state claims at Nora and 15 state claims at Sunshine Creek. In the fall of 1997, Kennecott staked 2,035 state claims in the belt consolidating their entire land position and acquiring the majority of the remaining prospective terrain in the VMS belt. Five more claims were subsequently added in 1998. After a short period of exploration which focused on geophysics and geochemistry combined with limited drilling, exploration work on the Arctic Project again entered a hiatus.

On March 22, 2004, Alaska Gold Company, a wholly-owned subsidiary of NovaGold completed an Exploration and Option Agreement with Kennecott to earn an interest in the Ambler land holdings.

6.2 Previous Exploration and Development Results – Arctic Deposit

6.2.1 Introduction

Kennecott's ownership of the Arctic Project saw two periods of intensive work from 1965 to 1985 and from 1993 to 1998, before optioning the property to NovaGold in 2004.

Though reports, memos, and files exist in Kennecott's Salt Lake City office, only limited digital compilation of the data exists for the earliest generation of exploration at the Arctic deposit and within the VMS belt. Beginning in 1993, Kennecott initiated a re-evaluation of the Arctic deposit and assembled a computer database of previous work at the Arctic deposit and in the district. A computer-generated block model was constructed in 1995 and an updated resource estimate was preformed using from block model. Subsequently, Kennecott staked a total of 2,035 State of Alaska claims in 1997 and, in 1998 undertook the first field program since 1985.

Due to the number of companies and the patchwork exploration that occurred as a result of the 1973 staking war, much of the earliest exploration work on what now constitutes the Ambler Schist belt was lost during the post-1980 hiatus in district exploration. The following subsections outline the best documented data at the Arctic deposit as summarized in the 1998 Kennecott exploration report, including the assembled computer database; however, this outline is not considered to be either exhaustive or in-depth.

In 1982, geologists with Kennecott, Anaconda and the State of Alaska published the definitive geologic map of the Ambler schist belt (Hitzman et al. 1982).

Table 6-1 lists known exploration mapping, geochemical, and geophysical programs conducted for VMS targets in the Ambler Mining District.

Table 6-1 Known Mapping, Geochemical, and Geophysical Programs Targeting VMS Prospects in the Ambler Mining District

Area	Prospects	Company	Mineralization	Mapping	Soil Geochem	Geophysics	Reports
Arctic Center of the Universe (COU) Back Door	Arctic	BCMC-KEX	Two (or more) sulfide bands with thickness up to ~40 m with Zn, Cu, Pb, Ag, Au, ±Ba mineralization.	Proffett 1998; Lindberg and others 2004, 2005; NG personnel 2008 at 1:2,000 scale	Extensive 2006 NG program (>670 samples)	Numerous surveys including the 1998 Dighem EM and Mag aerial surveys, 1998 CSAMT survey, TEM downhole and surface surveys in 2005, TDEM ground survey in 2006	Numerous
	COU Back Door, 4th of July Creek	NG-Anaconda	No exposed or drilled mineralization, target is the projection of the Arctic horizon	NG 1:2,000 mapping in 2006	Extensive 2006 NG program	4 TDEM ground surveys in 2005 and 2006	2005 and 2006 NG Progress Reports; Lindberg's 2005 report
Sunshine Bud CS	Sunshine Creek	BCMC and BCMC-Noranda	Disseminated to semi-massive lens up to 18 m thick. Upper mineralized limb is Ba-rich	BCMC 1983; Paul Lindberg 2006; NG 2011	Numerous eras of soil sampling, most recent 1998 by Kennecott (Have data) and 2006 by NG	BCMC completed Recon IP survey and Crone vertical shoot back EM in 1977, 2 TDEM surveys to the NW	Various BCMC reports; Lindberg's 2006 Sunshine progress report; 2006 NG Progress report
	Bud-CS	SMC and TAC	Au-rich gossan and 3+ m intercept of 1.7% Cu, 0.4% Pb, 1.5% Zn, 2 oz/ton Ag, 0.017 oz/ton Au	Anaconda (TAC) and Sunshine (SMC)	SMC soil sampling	Anaconda completed downhole resistivity survey in 1981 on Bud 7	1981 through 1983 Anaconda Progress reports
Dead Creek Shungnak SK	Shungnak (Dead Creek)	BCMC, Cominco	Thin (0.1 to 3 m) disseminated to semi-massive lenses of Cu, Zn, Pb, Ag mineralization	Bruce Otto and others 2006; Proffett 1998	NG in 2006 (355 samples); KEX in 1998 (~240 samples)	2 CEM surveys by BCMC at DH with no anomalous responses (do not have data)	2006 NG report; 1982 and 1983 Anaconda Ambler Progress reports
	SK	GCO and BCMC/GCO-HOMEX JV	Mineralized float up to 0.4% Cu, 4.8% Pb, 8.7% Zn, 5 oz/ton Ag	BCMC	BCMC 1982 soil grid	CEM and Max-min completed by BCMC (do not have data)	1982 Annual Progress Report, BCMC; Bruce Otto 2006 Memo

Area	Prospects	Company	Mineralization	Mapping	Soil Geochem	Geophysics	Reports
Horse Cliff DH	Horse-Cliff DH	Horse - BCMC, Cliff SMC, DH - BCMC and BCMC/GCO-HOMEX	Disseminate to semi-massive with local massive lens, thicknesses up to tens of feet.	KEX 1983 1:1000 prospect map	SMC soil surveys 1976-1978 and 1980	No known ground-based survey; occurrences within a large resistivity high	1985 Progress Report BCMC-GCO-Homex J; 1980 Summary of Ambler Field Investigations - Sunshine Mining, Horse Creek Memo - Robinson 1981; 1978 Ellis Geologic Evaluation and Assessment of the Northern Belt Claims
Snow Ambler RB Nani Frost	Snow	Cominco	Ag-Pb-Zn mineralization as massive and semi-massive bands hosted within thin bands of graphitic schist (GS).	Noranda-Cominco scanned map with no georeference; Prospect scale	KEX Soil gird in 1997 or 1998	No known ground-based survey; Anaconda completed downhole resistivity survey in 1981 on Ambler-4	"Snow Prospect Miscellaneous Notes and Maps.pdf" is only known report
	Ambler	Anaconda TAC	Massive disseminated chalcopyrite and pyrite associated with chert	Numerous Anaconda geologists; no digitized maps	Only scattered soils in database	Max-min surveys, no data is available	1983 Ambler River Memo (Sunshine Progress Report); 1982 Anaconda Progress Report
	Nani-Frost	BCMC and BCMC-Noranda	Outcrops of 2-3 m of 0.8% Cu, 0.4% Pb, 1.2% Zn, 0.05 oz/ton Ag within felsic schist	BCMC (do not have data)	BCMC identified numerous weak soil anomalies (do not have data)	CEM, Max-min, and PEM completed by BCMC (do not have data)	1982 Annual Progress Report, BCMC
Red Nora	Nora	BCMC/GCO-HOMEX	Disseminated chalcopyrite within chlorite altered volcanics in two zones (Sulphide Gulch and Northern Horizon)	Generalized geologic map created by WGM for BCMC-GCO-HOMEX	No known data	Two PEM over the Sulphide Gulch horizon	1984 and 1985 Progress Report BCMC-GCO-Homex JV

Area	Prospects	Company	Mineralization	Mapping	Soil Geochem	Geophysics	Reports
	Red	BCMC	Thin discordant bands of sphalerite, chalcopyrite, galena, and pyrrhotite with calcite and fluorite cutting 'siltites' and metacarbonates	None	KEX soil lines 1998	KEX identified EM anomalies 1998, follow-up gravity and Max-min EM; TDEM survey in 2006; DIGHEM helicopter EM and radiometric survey in 2006	Kennecott's final 1998 field report; 2006 NG Progress Report
Other	BT, Jerri Creek	Anaconda, AMC	Massive sulphide bands up to 1.5 m thick extend nearly 2.3 km along an E-W strike	Hitzman and others	Historic soils at Jerri Creek	No known surveys.	Hitzman thesis and Anaconda (BT) and Bear Creek (Jerri) Assessment reports; 1982 and 1983 Anaconda Ambler Progress reports
	Kogo-White Creek	Bud - SMC or AMC	Discovered by hydrochemistry of high Cu ions in White Creek.	SMC?	Soil geochem surveys by SMC in 1978 and KEX in 1998	Recon IP survey in 1977; Max-Min Mag survey in 1980; Follow-up Max-Min and gravity by KEX in 1998; TDEM by NG in 2006.	1980 Summary of Ambler Field Investigations, SMC; Kennecott's Final 1998 Field Report
	Pipe	BCMC and SMC	Podiform zones of sulphide mineralization within calc-schists and QMS	Schmidt in 1978, SMC in 1982	Kennecott soil grid in 1997-1998	Not known	Schmidt's 1978 report (Part IV) for Anaconda's (?) annual report
	Tom Tom	Anaconda and SMC	1982 'Discovery' trench by SMC uncovered massive sulphide boulders with up to 6 oz/ton Ag, 5.4% Pb, 6.3% Zn, only 0.2% Cu	Sunshine in 1982 (?)	SMC soils in 1982	Gamma mag survey by SMC in 1982; TDEM by NG in 2006.	1982 Sunshine Mining Company Memo by E.R. Modroo; Schmidt's 1978 report (Part IV) for Anaconda's (?) annual report

Area	Prospects	Company	Mineralization	Mapping	Soil Geochem	Geophysics	Reports
Sun	Sun-Picnic Creek	Anaconda - AMC-Cominco; Valhalla Metals is current owner	Three (?) zones of sulphide mineralization varying from 1 to 10 m; Upper zone is Zn-Pb-Ag rich while the two lower zones are Cu rich	Various Anaconda geologists	Not known, but most likely extensive	Not known, but most likely extensive	1981 Anaconda progress report; Anaconda 1977 prefeasibility study (not in NG possession)
Smucker	Smucker-Charlie-Puzzle-4B-Patti	Anaconda, Cominco, and Bear Creek; now owned by Teck	A single mineralized Ag-Zn-Pb-Cu horizon varying from 1 to 8 m in thickness	Detailed mapping by Anaconda and BCMC geologists	Strong soil geochem anomalies in lowlands SE of Smucker horizon; Kennecott soil grid in 1997 or 1998	Not known	1985 Progress Report BCMC-GCO-Homex JV

Note: EM = electromagnetic; TDEM = time domain electromagnetic; CSAMT = Controlled Source Audio Magnetotelluric

6.2.2 Geochemistry

Historic geochemistry for the district, compiled in the 1998 Kennecott database, includes 2,255 soil samples, 922 stream silt samples, 363 rock samples, and 37 panned concentrate samples. Data have been sourced from several companies including Kennecott, Sunshine Mining, RAA, and NANA. Sourcing of much of the data had been poorly documented in the database.

During 1998, Kennecott renewed its effort in the district, and, as a follow-up to the 1998 EM survey, undertook soil and rock chip sampling in and around EM anomalies generated in the geophysical targeting effort. During this period Kennecott collected 962 soils and 107 rocks and for the first time used extensive multi-element inductively coupled plasma (ICP) analysis.

6.2.3 Geophysics

Prior to 1998, Kennecott conducted a series of geophysical surveys which are poorly documented or are unavailable to Trilogy Metals. With the renewed interest in the belt, Kennecott mounted a largely geophysically-driven program to assess the district for Arctic-sized targets. Based on an initial review of earlier geophysical techniques employed at the Arctic deposit, Kennecott initiated an extensive helicopter-supported airborne EM and magnetic survey covering the entire VMS belt in March 1998. The survey was conducted on 400 m line spacing with selective 200 m line spacing at the Arctic deposit and covered 2,509 total line kilometres. The Arctic deposit presented a strong 900 Hz EM conductive signature.

Forty-six additional discrete EM conductors were identified, of which, 17 were further evaluated in the field. Eight of the EM anomalies were coincident with anomalous geochemistry and prospective geology, and were considered to have significant mineralization potential. As a follow-up, each anomaly was located on the ground using a Maxmin 2 horizontal loop EM system. Gravity lines were subsequently completed using a LaCoste and Romberg Model G gravimeter over each of the eight anomalies.

In addition to the EM and gravity surveys in 1998, five lines of CSAMT data were collected in the Subarctic Valley. The Arctic deposit showed an equally strong conductive response in the CSAMT data as was seen in the EM data. As a result of the survey, Kennecott recommended additional CSAMT for the deposit area.

Field targeting work in 1998 prompted Kennecott to drill one exploration hole on anomaly 98-3, located approximately 6 km northwest of the Arctic deposit and 2 km east-northeast of the Dead Creek prospect. Hole 98-03-01 was drilled to test the sub-cropping gossan and was roughly coincident with the centre of the geophysical anomaly as defined by airborne and ground EM data. Scattered mineralization was encountered throughout the hole with intervals of chalcopyrite and sphalerite.

Based on the results of the 1998 geophysical program, Kennecott made the following recommendations:

- Anomaly 98-3 Required Further Drilling.
- Anomalies 98-7 and 98-22 were Drill Ready.
- Anomalies 98-8, -9, -14, -35, and -38 Required Additional Ground Targeting.

Kennecott conducted no further field exploration in the district after 1998 and subsequently optioned the property to NovaGold in 2004.

6.2.4 Drilling

Between 1967 and July 1985, Kennecott (BCMC) completed 86 holes (including 14 large diameter metallurgical test holes) totalling 16,080 m. In 1998, Kennecott drilled an additional six core holes totalling 1,492 m to test for:

1. Extensions of the known Arctic mineralization.
2. Grade and thickness continuity.
3. EM anomaly 98-3.

Drilling for all BCMC/Kennecott campaigns in the Arctic deposit area (1966 to 1998) totals 92 core holes for a combined 17,572 m (refer to Section 10 for additional information).

6.2.5 Specific Gravity

Prior to 1998, no specific gravity (SG) measurements were available for the Arctic deposit rocks. A "factored" average bulk density was used to calculate a tonnage factor for resource estimations. A total of 38 samples from the 1998 drilling at the Arctic deposit were measured for SG determinations. Additional information on density determinations is provided in Section 11.

6.2.6 Petrology, Mineralogy, and Research Studies

There have been numerous internal studies done by Kennecott on the petrology and mineralogy of the Arctic deposit that exist as internal memos, file notes, and reports from as early as 1967. These data have been used in support of geological and mineralogical interpretations.

D. Schmandt completed an undergraduate thesis at Smith College in 2009 entitled "Mineralogy and origin of Zn-rich horizons within the Arctic Volcanogenic Massive Sulfide deposit, Ambler District, Alaska". Jeanine Schmidt completed a doctoral dissertation at Stanford University in 1983 entitled "The Geology and Geochemistry of the Arctic Prospect, Ambler District, Alaska"; and Bonnie Broman completed a master's thesis at University of Alaska, Fairbanks in 2014 entitled "Metamorphism and Element Redistribution: Investigations of Ag-bearing and associated minerals in the Arctic Volcanogenic Massive Sulfide deposit, SW Brooks Range, NW Alaska". These studies have provided additional information on geological and mineralogical settings in the Project area.

6.2.7 Geotechnical, Hydrogeological and Acid-Base Accounting Studies

A series of geotechnical, hydrological, hydrogeological and acid-base accounting (ABA) studies were conducted prior to the 2020 FS. Rock geotechnical and hydrogeological studies completed after 1998 are listed in Table 6-2. ABA studies completed after 1998 are listed in Section 9.7.2.

6.2.7.1 Geotechnical and Hydrogeological Studies

In December 1998, URSA Engineering prepared a geotechnical study for Kennecott titled "Arctic Project – 1998 Rock Mass Characterization". Though general in scope, the report summarized some of the basic rock characteristics as follows:

- Compressive strengths average 6,500 psi for the quartz mica schists, 14,500 psi for the graphitic schists, and 4,000 psi for talc schists.

- Rock mass quality can be described as average to good quality, massive with continuous jointing except the talc schist, which was characterized as poor quality. The rock mass rating (RMR) averages 40 to 50 for most units except the talc schist which averages 30.

In 1998, Robertson Geoconsultants Inc. (Robertson) of Vancouver prepared a report for Kennecott titled “Initial Assessment of Geochemical and Hydrological Conditions at Kennecott’s Arctic Project”. The report presented the results of the acid generation potential of mine waste and wall rock for the Arctic Project in the context of a hydrological assessment of the climate, hydrology and water balance analyses at the Arctic deposit. Climatic studies at the time were limited to regional analyses as no climatic data had been collected at the Arctic Project site prior to the review. Regional data, most specifically a government installed gauging station about 20 miles to the southwest at Dahl Creek, provided information in assessing the hydrology of the Arctic Project at the time. A total of nine regional gauges were utilized to evaluate the overall potential runoff in the area.

Table 6-2 Summary of Previous Geotechnical and Hydrogeological Work Completed After 1998

	Rock Geotechnical	Hydrogeological
Field Investigations	SRK 2017 Completed staged geotechnical field investigation programs in 2015 and 2016. Five HQ3 drill holes were completed for combined geotechnical and hydrogeological data acquisition purposes. Thirteen drill holes were surveyed using acoustic televiewer. Laboratory testing was conducted.	SRK 2017 Completed staged geotechnical field investigation programs in 2015 and 2016. Five HQ3 drill holes were completed for combined geotechnical and hydrogeological data acquisition purposes. Conducted downhole hydraulic conductivity tests and installed standpipe and vibrating wire piezometers.
	Tetra Tech 2013 No geotechnical field investigations completed. Review of historical geotechnical studies suggests work completed to a high standard.	Tetra Tech 2013 No hydrogeological field investigations completed.
	BGC 2012 Underground focus. Completed five HQ3 drill holes with lab testing, core logging and lithology descriptions (see Section 3.2). Completed structural geology mapping. Completed laboratory strength testing.	BGC 2012 Installed seven (7) vibe wires in five holes (see Section 3.2 for drill hole locations). Completed hydraulic conductivity testing for various geotechnical units. Installed one thermistor. Hydraulic head measurements at selected drill holes.
	URSA 1998 Mapping of major geological structures, faults and joints. Completed structural lab strength testing and collected geotechnical data from resource drill holes.	URSA 1998 No hydrogeological work completed.

	Rock Geotechnical	Hydrogeological
Technical Findings	SRK 2017 Established six geotechnical domains based on the rock mass characteristics and structural orientations. Kinematic and 2-D numerical stability analyses were conducted to provide the recommended slope configurations. The slope design for the east walls that are sub-parallel to the foliation consisted of 60 m high slopes that are stripped along the dip of the foliation fabric. The recommended IRA in the east walls were 26°-30°. Slope design of other areas of the proposed open pit were controlled by kinematic failure mechanisms.	SRK 2017 Two alternative conceptual hydrogeological models were established – a multiple water system model (regional shallow perched water table in northeast, deeper water table over the pit footprint), and compartmentalized water system model (water levels compartmentalized by faults, talc, and/or permafrost). A conservative pore pressure conditions were estimated for slope stability analysis.
	Tetra Tech 2013 Considers 7 lithogeochemical units; modeled as 3-D volumes (as supplied by Trilogy) PEA pit with OSA = 43°, triple benched with 5 m benches, 8 m catch berms (single domain/design sector)	Tetra Tech 2013 Assumes groundwater levels will follow topography. No continuous permafrost in area.
	BGC 2012 Two-dimensional geotechnical model using six (6) units combining lithological units of similar rock mass properties (RMR and other criteria defined for each unit). No 3-D structural model, plan view map only with two regional thrust faults (West Fault at 50° dipping south-southeast and WSFC at 40° dipping to the south). Mapped strong foliation sets dipping shallowly to the west and moderately to the southwest.	BGC 2012 Conceptual model of ground water flow. High flow rates in fault zones should be expected, groundwater flow follows topography. Not enough information to comment on recharge rate due to uncertainty in permafrost. Permeability data for main geotechnical units ranging from 3×10^{-9} to 6×10^{-7} m/s.
	URSA 1998 Developed six (6) geotechnical units based on drill holes and mapping, classified rocks as weak to moderately strong, talc mica schist is worst unit with RMR = 31. Mapped E-W trending faults with gouge of muscovite and talc and south dipping thrust fault. Two sets of joint/foliation present that intersect at 25°.	URSA 1998 No hydrogeological analyses completed. Suggests permafrost not present based on down hole observations.

6.2.7.2 Acid-Base Accounting Studies

The 1998 Robertson study documented acid-base accounting results based on the selection of 60 representative core samples from the deposit. Results of the study are summarized as follows:

- Roughly 70% of the waste rock material was deemed to be potentially acid generating.
- Mitigation of the acid generating capacity could be affected by submersion of the waste rock. Mitigation of the high wall and pit geometries would make potential pit flooding unlikely and could present a long-term mitigation issue.
- Characteristics of the mine tailings were not assessed.
- Based on the study, Robertson recommended underground mining scenarios, or aggressive study including site water balance.

6.2.8 Metallurgical Studies

Kennecott undertook an extensive series of studies regarding the metallurgy and processing of the Arctic mineralization (refer to summary in Section 13 of this Report).

6.2.9 Development Studies

A number of mining and technical studies have been completed over the Project history, as summarized in Table 6-3.

Table 6-3 Mining and Technical Studies

Company	Year	Consultant	Study
Kennecott	1974	internal	Ambler District Evaluation
	1976	internal	Arctic Deposit Order of Magnitude Evaluation
	1978	internal	Arctic Prospect Summary File Report Arctic Deposit
	1981	internal	Evaluation of the Arctic and Ruby Creek
	1984	internal	Evaluation Update
	1985	internal	Pre-AFD Report
	1990	internal	Re-Evaluation
	1997	internal	Arctic Project Mining Potential
	1999	internal	Interim Report Conceptual Level Economic Evaluations of the Arctic Resource
	1998	SRK	Preliminary Arctic Scoping Study
NovaGold	2011	SRK	Preliminary Economic Assessment
Trilogy (previously, NovaCopper)	2012	SRK	Preliminary Economic Assessment
	2013	Tetra Tech	Preliminary Economic Assessment
	2018	Ausenco	Pre-Feasibility Report

7 Geological Setting and Mineralization

7.1 Regional Geology – Southern Brooks Range

The Ambler Mining District occurs along the southern margin of the Brooks Range within an east-west trending zone of Devonian to Jurassic age submarine volcanic and sedimentary rocks (Hitzman et al., 1986). The district covers both: 1) VMS-like deposits and prospects hosted in the Devonian age Ambler Sequence (or Ambler Schist belt), a group of metamorphosed bimodal volcanic rocks with interbedded tuffaceous, graphitic and calcareous volcaniclastic metasediments; and 2) epigenetic carbonate-hosted copper deposits occurring in Silurian to Devonian age carbonate and phyllitic rocks of the Bornite Carbonate Sequence. The Ambler Sequence occurs in the upper part of the Anirak Schist, the thickest member of the Schist belt or Coldfoot subterrane (Moore et al., 1994). VMS-like stratabound mineralization can be found along the entire 110 km strike length of the district. Immediately south of the Schist belt in the Cosmos Hills, a time equivalent section of the Anirak Schist that includes the approximately 1 km thick Bornite Carbonate Sequence. Mineralization of both the VMS-like deposits of the Schist belt and the carbonate-hosted deposits of the Cosmos Hills has been dated at 375 to 387 Ma (Selby et al., 2009; McClelland et al., 2006).

In addition, the Ambler Mining District is characterized by increasing metamorphic grade north perpendicular to the strike of the east-west trending units. The district shows isoclinal folding in the northern portion and thrust faulting to south (Schmidt, 1983). The Devonian to Late Jurassic age Angayucham basalt and the Triassic to Jurassic age mafic volcanic rocks are in low-angle over thrust contact with various units of the Ambler Schist belt and Bornite Carbonate Sequence along the northern edge of the Ambler Lowlands.

7.1.1 Terrane Descriptions

The terminology used to describe the terranes in the southern Brooks Range evolved during the 1980s because of the region’s complex juxtaposition of rocks of various compositions, ages and metamorphic grade. Hitzman et al. (1986) divided the Ambler Mining District into the Ambler and Angayucham terranes. Further work (Till et al., 1988; Silberling et al., 1992; Moore et al., 1994) includes the rocks of the previously-defined Ambler terrane as part of the regionally extensive Schist belt or Coldfoot subterrane along the southern flank of the Arctic Alaska terrane as shown in Figure 7-1 (Moore et al., 1994). In general, the southern Brooks Range is composed of east-west trending structurally bound allochthons of variable metasedimentary and volcanogenic rocks of Paleozoic age.

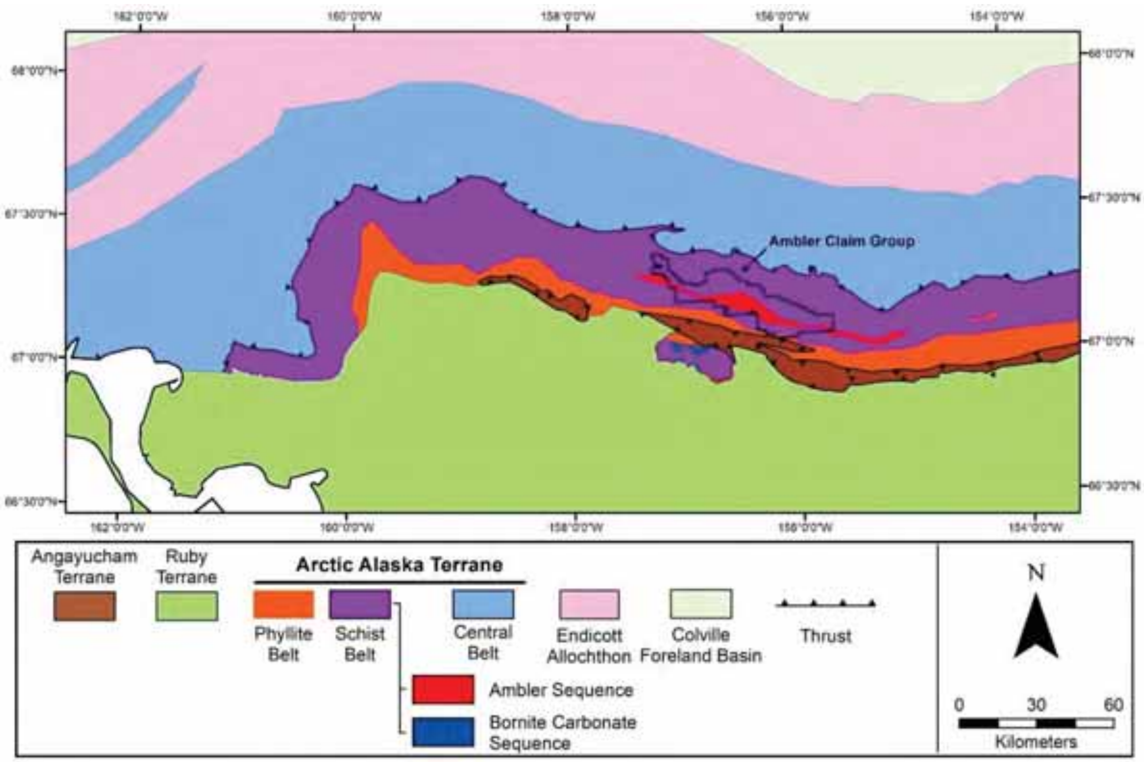


Figure 7-1 **Geologic Terranes of the Southern Brooks Range (Trilogy Metals, 2019)**

The Angayucham terrane, which lies along southern margin of the Brooks Range, is locally preserved as a klippen within the eastern Cosmos Hills and is composed of weakly metamorphosed to unmetamorphosed massive-to-pillowed basalt rocks with minor radiolarian cherts, marble lenses and isolated ultramafic rocks. This package of Devonian to Late Jurassic age (Plafker et al., 1977) mafic and ultramafic rocks is interpreted to represent portions of an obducted and structurally dismembered ophiolite that formed in an ocean basin south of the present-day Brooks Range (Hitzman et al., 1986; Gottschalk and Oldow, 1988). Locally, the Angayucham terrane overlies the schist belt to the north along a poorly exposed south-dipping structure.

Gottschalk and Oldow (1988) describe the Schist belt as a composite of structurally bound packages composed of dominantly greenschist facies rocks, including pelitic to semi-pelitic quartz-mica schist with associated mafic schists, metagabbro and marbles. Locally, the Schist belt includes the Upper Silurian to middle Devonian age Bornite Carbonate Sequence, the lower Paleozoic age Anirak pelitic, variably siliceous and graphic schists, and the mineralized Devonian age Ambler sequence consisting of volcanogenic and siliciclastic rocks variably associated with marbles, calc-schists, metabasites and mafic schists (Hitzman et al., 1982; Hitzman et al., 1986). The lithologic assemblage of the Schist belt is consistent with an extensional, epicontinental tectonic origin.

Structurally overlaying the Schist belt to the north is the Central belt. The Central belt is in unconformable contact with the Schist belt along a north-dipping low-angle structure (Till et al., 1988). The Central belt consists of lower Paleozoic age metaclastic and carbonate rocks, and Proterozoic age schists (Dillon et al., 1980). Both the Central belt and Schist belt are intruded by meta-to-peraluminous orthogneisses, which locally yield a slightly discordant U-Pb thermal ionization mass spectrometry zircon crystallization age of middle to late Devonian (Dillon et al., 1980; Dillon et al., 1987). This igneous protolith age is supported by Devonian orthogneiss ages obtained along the Dalton Highway, 161 km to the east of the Ambler Mining District (Aleinikoff et al., 1993).

Overlaying the Schist belt to the south is the Phyllite belt, characterized in the Ambler mining district as phyllitic black carbonaceous schists of the Beaver Creek Phyllite which is assumed to underlie much of the Ambler Lowlands between the Brooks Range and the Arctic deposit to the north and the Cosmos Hills and the Bornite deposit to the south. The recessive weathering nature of the Beaver Creek Phyllite limits the exposure, but the unit is assumed to occur as a thrust sheet overlying the main Schist belt rocks.

7.1.2 Regional Tectonic Setting

Rocks exposed along the southern Brooks Range consist of structurally bound imbricate allochthons that have experienced an intense and complex history of deformation and metamorphism. Shortening in the fold and thrust belt has been estimated by some workers to exceed 500 km (Oldow et al., 1987), based on balanced cross sections across the central Brooks Range. In general, the metamorphic grade and tectonism in the Brooks Range increases to the south and is greatest in the Schist belt. The tectonic character and metamorphic grade decreases south of the Schist belt in the overlaying Angayucham terrane.

In the late Jurassic to early Cretaceous age, the Schist belt experienced penetrative thrust-related deformation accompanied by recrystallization under high-pressure and low-temperature metamorphic conditions (Till et al., 1988). The northward directed compressional tectonics were likely related to crustal thickening caused by obduction of the Angayucham ophiolitic section over a south-facing passive margin. Thermobarometry of schists from the structurally deepest section of the northern Schist belt yield relict metamorphic temperatures of 475°C, ±35°C, and pressures from 7.6 to 9.8 kb (Gottschalk and Oldow, 1988). Metamorphism in the Schist belt grades from lowest greenschist facies in the southern Cosmos Hills to upper greenschist facies, locally overprinting blueschist mineral assemblages in the northern belt (Hitzman et al., 1986).

Compressional tectonics, which typically place older rocks on younger, does not adequately explain the relationship of young, low-metamorphic-grade over older and higher-grade metamorphic rocks observed in the southern Brooks Range hinterland. Mull (1982) interpreted the Schist belt as a late antiformal uplift of the basement to the fold and thrust belt. More recent models propose that the uplift of the structurally deep Schist belt occurred along duplexed, north-directed, thin-skinned thrust faults, followed by post-compressional south-dipping low angle normal faults along the south flank of the Schist belt, accommodating for an over-steepened imbricate thrust stack (Gottschalk and Oldow, 1988; Moore et al., 1994). Rapid cooling and exhumation of the Schist belt began at the end of the early Cretaceous age at 105 to 103 Ma, based on Ar^{40}/Ar^{39} cooling ages of hornblende and white mica near Mount Igikpak, and lasted only a few million years (Vogl et al., 2003). Additional post-extension compressive events during the Paleocene age further complicate the southern Brooks Range (Mull, 1985).

7.2 Ambler Sequence Geology

Rocks that form the Ambler Sequence consist of a lithologically diverse sequence of lower Devonian age carbonate and siliciclastic strata with interlayered mafic lava flows and sills. The clastic strata, derived from terrigenous continental and volcanic sources, were deposited primarily by mass-gravity flow into the sub-wavebase environment of an extending marginal basin.

The Ambler Sequence underwent two periods of intense, penetrative deformation. Sustained upper greenschist-facies metamorphism with coincident formation of a penetrative schistosity and isoclinal transposition of bedding marks the first deformation period. Pervasive similar-style folds on all scales deform the transposed bedding and schistosity, defining the subsequent event. At least two later non-penetrative compressional events deform these earlier fabrics. Observations of the structural and metamorphic history of the Ambler Mining District are consistent with current tectonic evolution models for the Schist belt, based on the work of others elsewhere in the southern Brooks Range (Gottschalk and Oldow, 1988; Till et al., 1988; Vogl et al., 2002).

Figure 7-2 shows the location and geology of the Ambler mining district and the Schist belt terrane including the Anirak Schist, the Kogoluktuk Schist and the Ambler Sequence, the contemporaneous Bornite Carbonate Sequence in the Cosmos Hills to the south, and the allochthonous overthrust Cretaceous sedimentary rocks and Devonian Angayucham Terrane volcanic rocks.

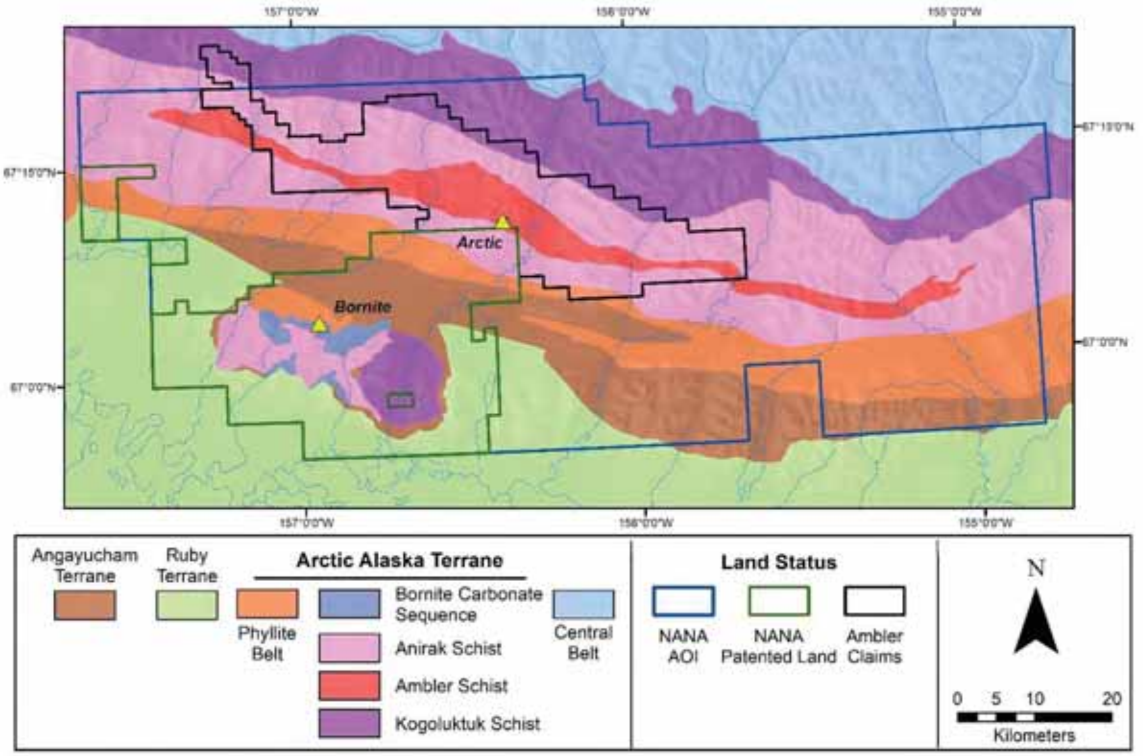


Figure 7-2 Geology of the Ambler Mining District (Trilogy Metals, 2019)

7.2.1 General Stratigraphy of the Ambler Sequence

Though the Ambler Sequence is exposed over 110 km of strike length, the following descriptions and comments refer to an area between the Kogoluktuk River on the east and the Shungnak River on the west where Trilogy Metals has focused the majority of its exploration efforts over the last decade.

The local base of the Ambler Sequence consists of variably metamorphosed carbonates historically referred to as the Gnurgle Gneiss. Trilogy Metals interprets these strata as calc-turbidites, perhaps deposited in a sub-wavebase environment adjacent to a carbonate bank. Calcareous schists overlies the Gnurgle Gneiss and hosts sporadically distributed mafic sills and pillowed lavas. These fine-grained clastic strata indicate a progressively quieter depositional environment up section, and the presence of pillowed lavas indicates a rifting, basinal environment.

Overlying these basal carbonates and pillowed basalts is a section of predominantly fine-grained carbonaceous siliciclastic rocks that host a significant portion of the mineralization in the district including the Arctic deposit. This quiescent section indicates further isolation from a terrigenous source terrain.

The section above the stratigraphy that hosts the Arctic deposit contains voluminous reworked silicic volcanic strata with the Button Schist at its base. The Button Schist is a regionally continuous and distinctive K-feldspar porphyroblastic unit that serves as an excellent marker above the main mineralized stratigraphy. The paucity of volcanically derived strata below the Arctic deposit host section, and abundance of volcanically derived material above, indicates that the basin and surrounding hinterlands underwent major tectonic reorganization during deposition of the Arctic deposit section. Greywacke sands that Trilogy Metals interprets as channeled high-energy turbidites occur throughout the section but concentrate high in the local stratigraphy. Figure 7-3 shows idealized sections for several different areas in and around the Arctic deposit.

Several rock units show substantial change in thickness and distribution in the vicinity of the Arctic deposit that may have resulted from the basin architecture existing at the time of deposition. Between the Arctic Ridge, geographically above the Arctic deposit, and the Riley Ridge to the west several significant differences have been documented including:

- The Gnurgle Gneiss is thickest in exposures along the northern extension of Arctic Ridge and appears to thin to the west.
- Mafic lavas and sills thicken from east to west. They occur as thick units in upper Subarctic Creek and to the west but are sparsely distributed to the east.
- The quartzite section within and above the Arctic sulphide horizon does not occur in abundance east of Arctic Ridge; it is thicker and occurs voluminously to the west.
- Button Schist thickens dramatically to the west from exposures on Arctic Ridge; exposures to the east are virtually nonexistent.
- Greywacke sands do not exist east of Subarctic Creek but occur in abundance as massive, channeled accumulations to the west, centered on Riley Ridge.

These data are interpreted by Trilogy Metals to define a generally north-northwest-trending depocentre through the central Ambler Mining District. Volcanic debris flow occurrences as well as these formational changes suggest that the depocentre had a fault-controlled eastern margin. The basin deepened to the west; the Riley Ridge section was deposited along a high-energy axis, and the COU section lies to the west-southwest distally from a depositional energy point of view. This original basin architecture appears to have controlled mineralization of the sulphide systems at Arctic and Shungnak (Dead Creek), concentrating fluid flow along structures on the eastern basin margin.

Figure 7-4 is a simplified geologic map of the area between the Kogoluktuk and the Shungnak Rivers.

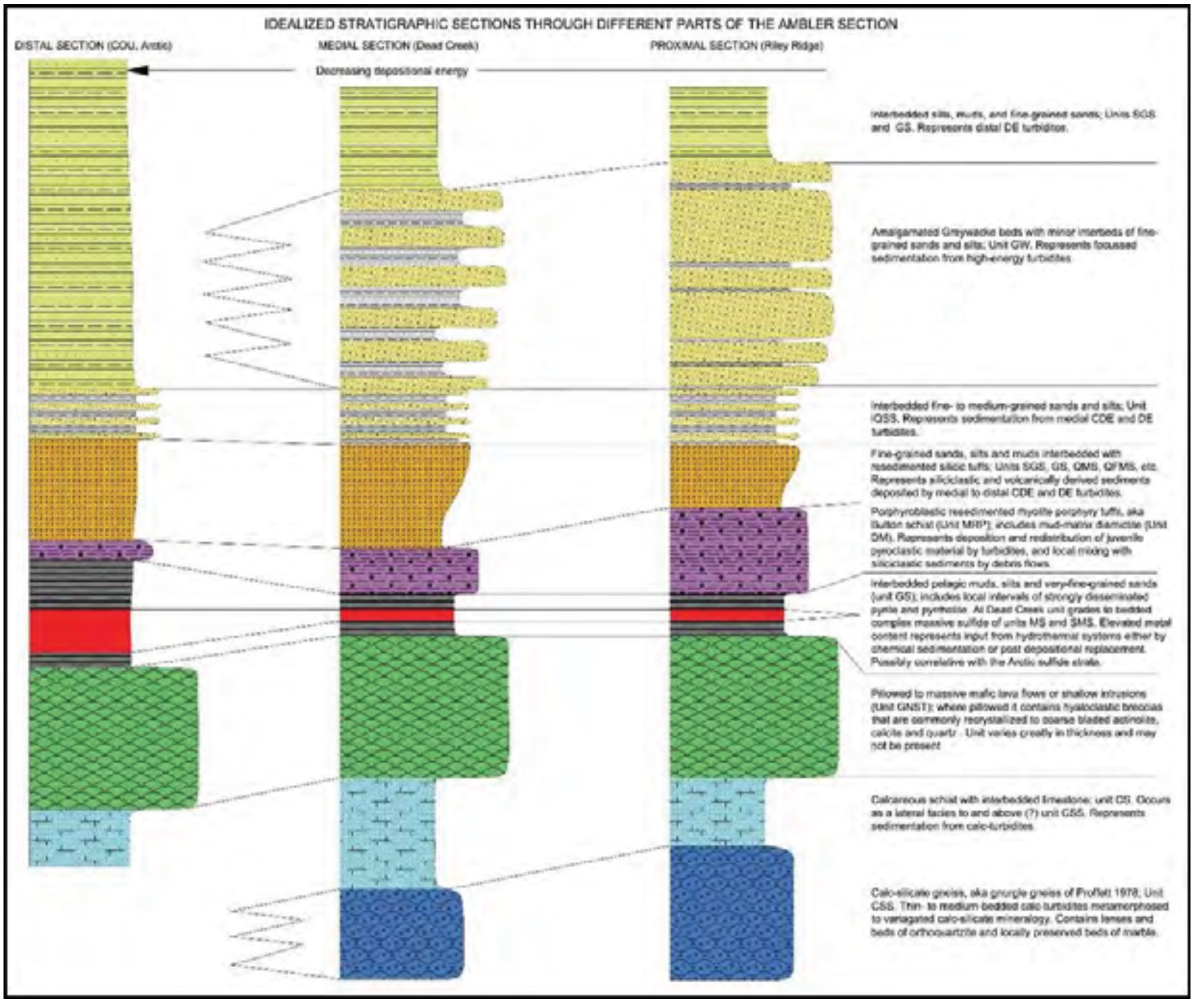


Figure 7-3 Ambler Sequence Stratigraphy in the Arctic Deposit Area (Trilogy Metals, 2019)

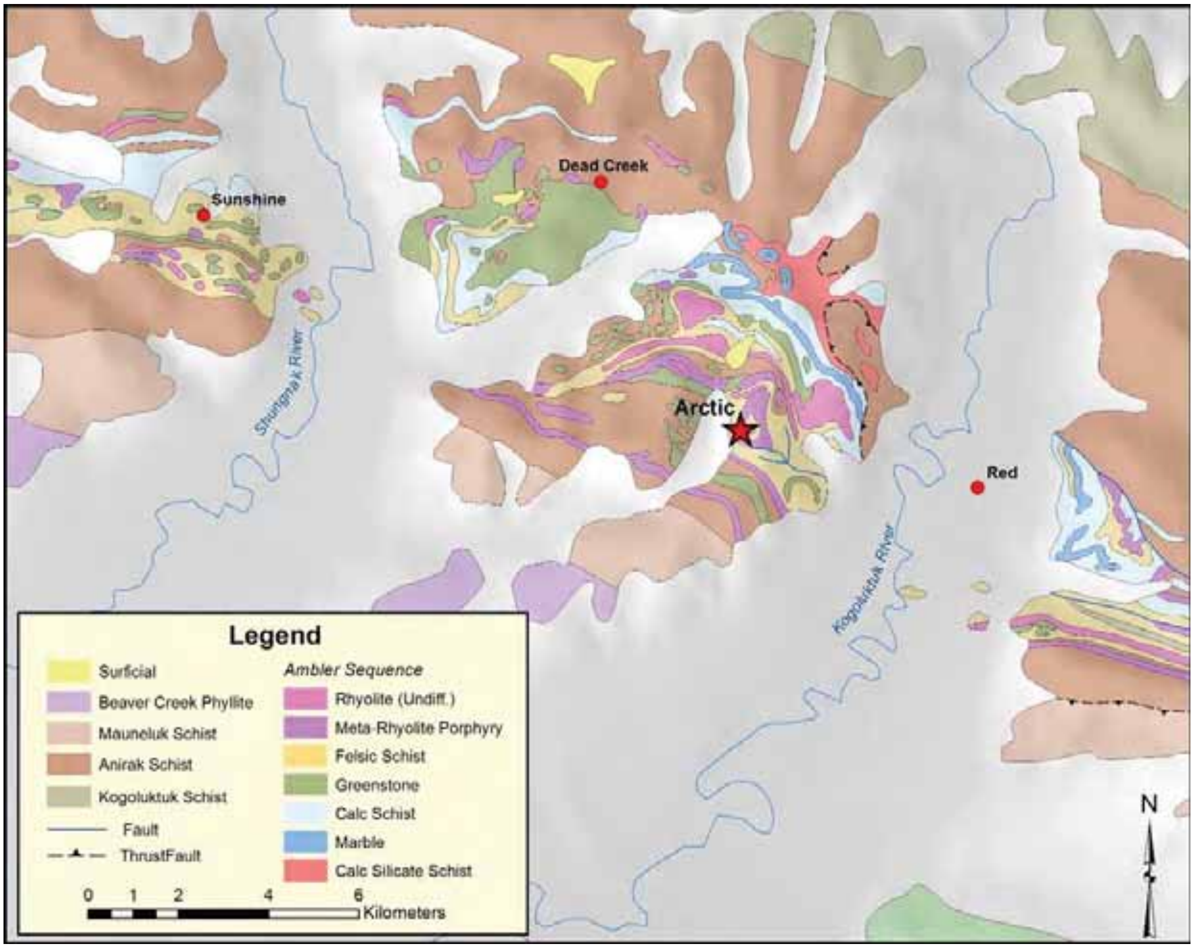


Figure 7-4 Generalized Geology of the Central Ambler Mining District (Trilogy Metals, 2019)

7.2.2 Structural Framework of the Ambler Mining District

In addition to the underlying pre-deformational structural framework of the district suggested by the stratigraphic thickening of various facies around the Arctic deposit, the Ambler Sequence is deformed by two penetrative deformational events that significantly complicate the distribution and spatial arrangement of the local stratigraphy.

7.2.2.1 F1 Deformation

The earliest penetrative deformation event is associated with greenschist metamorphism and the development of regional schistosity. True isoclinal folds are developed, and fold noses typically are thickened. The most notable F1 fold is the Arctic antiform that defines the upper and lower limbs of the Arctic deposit. The fold closes along a north-northeast- trending fold axis roughly mimicking the trace of Subarctic Creek and opening to the east. Importantly, the overturned lower limb implies that the permissive stratigraphy should be repeated on a lower synformal isocline beneath the currently explored limbs and would connect with the permissive mineralized stratigraphy to the northwest at Shungnak (Dead Creek). Figure 7-5 shows typical F1 folds developed in calcareous Gnurgle Gneiss.

Figure 7-5 Typical F1 Isoclinal Folds Developed in Calcareous Gnurgle Gneiss (Trilogy Metals, 2019)

7.2.2.2 F2 Deformation

The earlier F1 schistosity is in turn deformed by an F2 deformational event that resulted in the local development of an axial planar cleavage. The deformational event is well defined throughout the Schist belt and results in a series of south-verging, open to moderately overturned folds that define a series of east-west trending folds of similar vergence across the entire Schist belt stratigraphy.

This event is likely temporally related to the emplacement of the Devonian Angayucham volcanics sequences, the obducted Jurassic ophiolites and Cretaceous sediments within the Schist belt stratigraphy.

In addition to the earlier penetrative deformation events, a series of poorly defined non-penetrative deformation events, likely as a consequence of Cretaceous extension are seen as a series of warps or arches across the district.

The interplay between the complex local stratigraphy, the isoclinal F1 event, the overturned south verging F2 event and the series of post-penetrative deformational events often makes district geological interpretation extremely difficult at a local scale.

7.3 Arctic Deposit Geology

Previous workers at the Arctic deposit (Russell 1995 and Schmidt 1983) describe three mineralized horizons: the Main Sulphide Horizon, the Upper South Horizon and the Warm Springs Horizon. The Main Sulphide Horizon was further subdivided into three zones: the southeast zone, the central zone and the northwest zone. Previous deposit modelling was grade-based resulting in numerous individual mineralized zones representing relatively thin sulphide horizons.

Recent work by Trilogy Metals defines the Arctic deposit as two or more discrete horizons of sulphide mineralization contained in a complexly deformed isoclinal fold with an upright upper limb and an overturned lower limb hosting the main mineralization. Nearby drilling suggests that a third upright lower limb, likely occurs beneath the currently explored stratigraphy. Figure 7-6 is a generalized geologic map of the immediate Arctic deposit area.

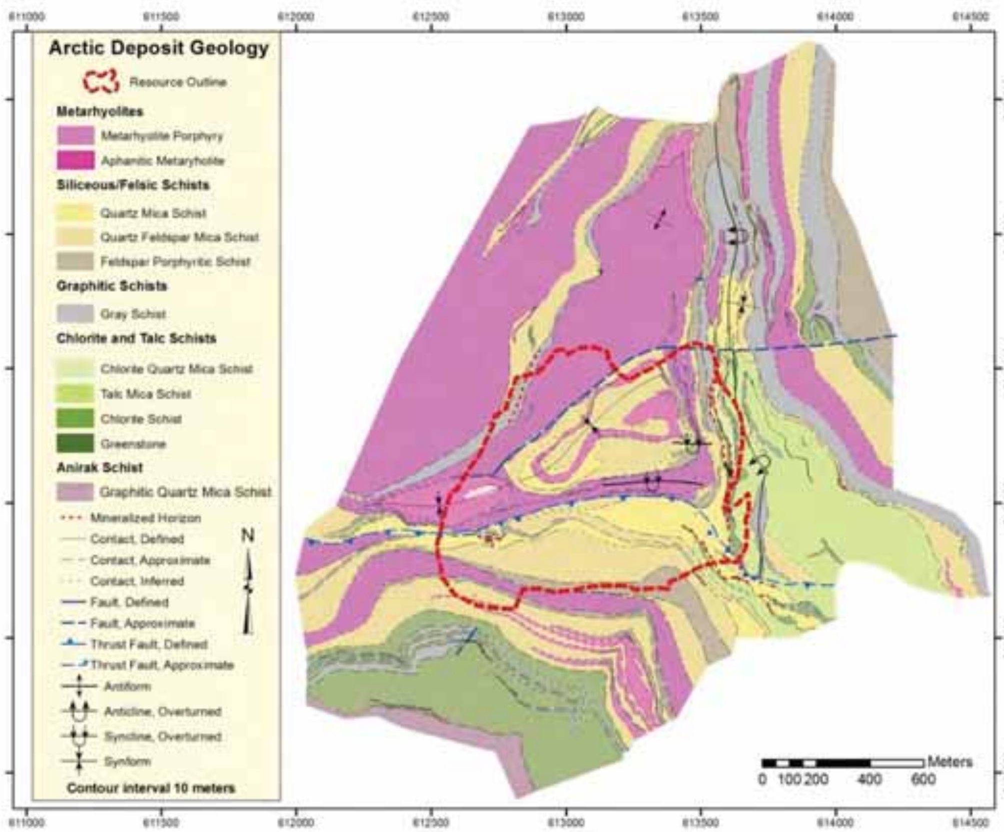


Figure 7-6 **Generalized Geologic Map of the Arctic Deposit (Trilogy Metals, 2019)**

7.3.1 Lithologies and Lithologic Domain Descriptions

Historically, five lithologic groupings were used by Kennecott (URSA Engineering, 1998 and Russell, 1995) to describe the local stratigraphy of the deposit. These groupings of rock types and protoliths include: 1) metarhyolite (Button Schist) or porphyroblastic quartz feldspar porphyry and rhyolitic volcaniclastic and tuffaceous rocks; 2) quartz mica schists composed of tuffaceous and volcaniclastic sediments; 3) graphitic schists composed of carbonaceous sedimentary rocks; 4) base metal sulphide bearing schists; and 5) talc schists composed of talc altered volcanic and sedimentary rocks. Trilogy Metals has subsequently re-interpreted and modified the lithological groupings.

The principal lithologic units captured in logging and mapping by Trilogy Metals are summarized and described in the following subsections, in broadly chronologically order from oldest to youngest.

7.3.1.1 Greenstone (GNST)

Greenstones consists of massive dark-green amphibole and garnet-bearing rocks, differentiated by their low quartz content and dark green color. Textural and colour similarities along with similar garnet components and textures often cause confusion with some metasedimentary greywackes within the Ambler Sequence stratigraphy. Intervals of greenstone range up to 80 m in thickness and are identified as pillowed flows, sills and dikes. Multiple ages of deposition are implied by the presence of both basal pillowed units as well as intrusive sill and dike-like bodies higher in the local stratigraphy.

7.3.1.2 Chlorite Schist (ChS)

This unit is likely alteration-related, but has been used for rocks where more than half of the sheet silicates are composed of chlorite. In the field, some samples of chlorite schist showed a distinctive dark green to blue-green colour, but in drill core the chlorite schists commonly have a lighter green colour. Some intervals of chlorite schist are associated with talc-rich units.

7.3.1.3 Talc Schist (TS)

Talc-bearing schists are often in contact with chlorite-rich units, and reflect units which contain trace to as much as 30% talc, often occurring on partings. Like the chlorite schist this unit is likely alteration related.

7.3.1.4 Black to Grey Schist (GS)

Black or grey schists appear in many stratigraphic locations particularly higher in the stratigraphy but principally constitute the mineralized permissive stratigraphy of the Arctic deposit lying immediately below the Button Schist (MRP). The schist is typically composed of muscovite, quartz, feldspar, graphite, pyrite and/or pyrrhotite, and sometimes chlorite and/or biotite. The texture is phyllitic, variably crenulated, and suggests a pelitic protolith, likely deposited in a basin that was progressively filled with terrigenous fine sediment. This unit is host to the massive sulphide (MS) and semi-massive sulphide (SMS) horizons that constitute the Arctic deposit.

7.3.1.5 Button Schist (MRP)

This rock type consists of quartz-muscovite-feldspar schists with abundant distinctive 1 to 3 cm K-feldspar porphyroblasts of metamorphic origin and occasional 0.5 to 2 cm blue quartz phenocrysts of likely igneous origin. The unit shows a commonly massive to weakly foliated texture, although locally the rocks have a well-developed foliation with elongate feldspars.

7.3.1.6 Quartz-Mica-(Feldspar) Schist (QMS/QFMS)

This schistose rock contains variable proportions of quartz, muscovite, and sometimes feldspar. The schist usually contains high amounts of interstitial silica, and sometimes have feldspar or quartz porphyroblasts. The texture of the unit shows significant variability and likely represents both altered and texturally distinct felsic tuffs and other volcaniclastic lithologies.

7.3.1.7 Debris Flow (DM)

This unit contains a range of unsorted, matrix supported polylithic clasts including the Button Schist occurring in black to dark grey, very fine-grained graphitic schist. The unit occurs as lenses within other stratigraphic units, and likely represents locally-derived debris flows or slumps.

7.3.1.8 Greywacke (GW)

This unit consists of massive green rocks with quartz, chlorite, probably amphibole, feldspar, muscovite, and accessory garnet, biotite, and calcite/carbonate. Voluminous accumulations of medium-grained greywacke occur within, but generally above, the quartz mica schist and are differentiated from texturally similar greenstones by the presence of detrital quartz, fine-grained interbeds, graded bedding and flute casts.

7.3.1.9 Lithogeochemistry of Immobile Trace Elements

In 2007, work by NovaGold suggested that many of the nondescript felsic metavolcanic lithologies were simply alteration and textural variants of the felsic rock units and logging was not adequately capturing true compositional lithological differences between units. Twelker (2008) demonstrated that the use of lithogeochemistry used immobile trace elements specifically Al_2O_3:TiO_2 (aluminum oxide:titanium dioxide) ratios could be used to effectively differentiate between different felsic volcanic and sedimentary suites of rocks at the Arctic deposit.

Lithogeochemistry shows three major felsic rock suites in the Arctic deposit area: a rhyolite suite; and intermediate volcanic suite and a volcaniclastic suite. These suites are partially in agreement with the logged lithology but in some instances the lithogeochemistry showed that alteration in texture and composition masked actual lithologic differences.

Results of the lithogeochemistry have led to a better understanding of the stratigraphic continuity of the various units and have been utilized to more accurately model the lithologic domains of the Arctic deposit.

7.3.1.10 Lithologic Domains

Though a variety of detailed lithologies are logged during data capture, Trilogy Metals models the deposit area as two distinct structural plates, an Upper Plate and a Lower Plate separated by the Warm Springs Fault. The Upper and Lower Plates contain similar lithologic domains that are primarily defined by lithogeochemical characteristics, but are also consistent with their respective acid-generating capacities and spatial distribution around the fold axes. The domains include the following units: the Button Schist (a meta-rhyolite porphyry - MRP), aphanitic meta-rhyolite (AMR), a series of felsic quartz mica schists (QMS), and carbonaceous schists of the Grey Schist unit (GS). An alteration model was built to adequately characterize the chlorite and talc schists found within the deposit (ChS, ChTS, and TS). The mineralization is modelled as eight distinct zones (Zones 1–8) found both in the Upper and Lower Plates and range from massive sulphide to semi-massive sulphide layers (MS and SMS).

7.3.2 Structure

Earlier studies (Russell, 1977, 1995; Schmidt, 1983) concluded mineralization at the Arctic deposit was part of a normal stratigraphic sequence striking northeast and dipping gently southwest. Subsequent reinterpretation by Kennecott in 1998 and 1999 suggested the entire Ambler Sequence could be overturned. Proffett (1999) reviewed the Arctic deposit geology and suggested that a folded model with mineralization as part of an isoclinal anticline opening east and closing west could account for the mapped and logged geology. His interpretation called for an F2 fold superimposed on a north-trending F1 fabric.

Lindberg (2004) supported a folded model similar to Proffett, though he considered that the main fold at Arctic was northwest-closing and southeast-opening. Lindberg named this feature the Arctic ntiform and interpreted it to be an F1 fold.

Lindberg believed the majority of folding within the mineralized horizons occured in the central part of the deposit within a southwest plunging “cascade zone.” The increased thicknesses of mineralized intervals in this part of the property can in part be explained by the multiple folding of two main mineralized horizons as opposed to numerous individual mineralized beds as shown in the 1995 geologic model. The cascade zone appears to be confined to the upper sulphide limbs of the Arctic antiform.

Continuity drilling on closer spacing in 2008 across the “cascade” zone confirmed the continuity of the two mineralized horizons but did not support the complexity proposed by Lindberg. Dodd et al. (2004) suggested that some of the complexity might be related to minor thrusting. Results of 2006 mapping supported the interpretation that an F2 fold event may fold the lower Button Schist back to the north under the deposit in this area (Otto, 2006). Deep drilling in 2007 just to the north of the deposit to test the concept drilled the appropriate upright stratigraphy at depth. Though the target horizon was not reached due to the drill rig limitations the hole did encounter significant mineralization below the Button Schist immediately above the sulphide-bearing permissive stratigraphy.

7.3.3 Arctic Deposit Alteration

Schmidt (1988) defined three main zones of hydrothermal alteration occurring at the Arctic deposit:

- A main chloritic zone occurring within the footwall of the deposit consisting of phengite and magnesium-chlorite.
- A mixed alteration zone occurring below and lateral to sulphide mineralization consisting of phengite and phlogopite together with talc, calcite, dolomite and quartz.
- A pyritic zone overlying the sulphide mineralization.

Field observations conducted by Trilogy Metals in 2004 and 2005 supported by logging and short-wave infrared (SWIR) spectrometry only partially support Schmidt’s observations.

Talc and magnesium chlorite are the dominant alteration products associated with the sulphide-bearing horizons. Talc alteration grades downward and outward to mixed talc-magnesium chlorite with minor phlogopite, into zones of dominantly magnesium chlorite, then into mixed magnesium chlorite-phengite with outer phengite-albite alteration zones. Thickness of alteration zones vary with stratigraphic interpretation, but tens of metres for the outer zones is likely, as seen in phengite-albite exposures on the east side of Arctic Ridge.

Stratigraphically above the sulphide-bearing horizons significant muscovite as paragonite is developed and results in a marked shift in sodium/magnesium ratios across the sulphide bearing horizons.

Visual and quantitative determination of many of the alteration products is difficult at best due to their light colours and the well-developed micaceous habit of many of the alteration species. Logging in general has poorly captured the alteration products and the SWIR methodology though far more effective in capturing the presence or absence of various alteration minerals adds little in any quantitative assessment.

Of particular note are the barium species including barite, cymrite (a high-pressure barium phyllosilicate), and barium-bearing muscovite, phlogopite and biotite. These mineral species are associated with both alteration and mineralization and demonstrate local remobilization during metamorphism (Schmandt, 2009). Though little has been done to document their distribution to date, they do have a significant impact on bulk density measurements (refer to discussions in Section 13 and Section 14).

Talc is of particular importance at the Arctic deposit due to its potential negative impact on flotation characteristics during metallurgical processing, and on pit slope stability. The majority of the talc zones occur between the upper, stratigraphically up-right mineralized zones and the lower, overturned mineralized zones

7.4 Arctic Deposit Mineralization

Mineralization occurs as stratiform SMS to MS beds within primarily graphitic schists and fine-grained quartz mica schists. The sulphide beds average 4 m in thickness but vary from less than 1 m up to as much as 18 m in thickness. The sulphide mineralization occurs within eight modelled zones lying along the upper and lower limbs of the Arctic isoclinal anticline. The zones are all within an area of roughly 1 km^2 with mineralization extending to a depth of approximately 250 m below the surface. There are five zones of MS and SMS that occur at specific pseudo-stratigraphic levels which make up the bulk of the Mineral Resource estimate. The other three zones also occur at specific pseudo-stratigraphic levels, but are too discontinuous.

Unlike more typical VMS deposits, mineralization is not characterized by steep metal zonation or massive pyritic zones. Mineralization dominantly consists of sheet-like zones of base metal sulphides with variable pyrite and only minor zonation, usually on an small scale.

Mineralization is predominately coarse-grained sulphides comprising chalcopyrite, sphalerite, galena, tetrahedrite-tennantite, pyrite, arsenopyrite, and pyrrhotite. Sulphides occur as disseminated (<30%), semi-massive (30 to 50% sulphide) to massive (greater than 50% sulphide) layers. Trace amounts of electrum are also present. Gangue minerals associated with the mineralized horizons include quartz, barite, white mica, chlorite, stilpnomelane, talc, calcite, dolomite and cymrite.

7.5 Prospects

In addition to the Arctic deposit, numerous other VMS-like occurrences are present on the Trilogy Metals land package. The most notable of these occurrences are the Dead Creek (also known as Shungnak), Sunshine, Cliff, Horse, and the Snow prospects to the west of the Arctic deposit and the Red, Nora, Tom-Tom and BT prospects to the east. Figure 7-7 shows the Trilogy Metals land package and the prospect locations. Figure 7-7 also shows: 1) the Smucker deposit on the far west end of the Ambler Sequence which is currently controlled by Teck Alaska Inc.; 2) the Sun deposit at the eastern end of the Ambler Sequence and controlled by Valhalla Metals Inc, and 3) carbonate-hosted deposits and prospects in the Bornite Carbonate Sequence controlled by Trilogy Metals/NANA.

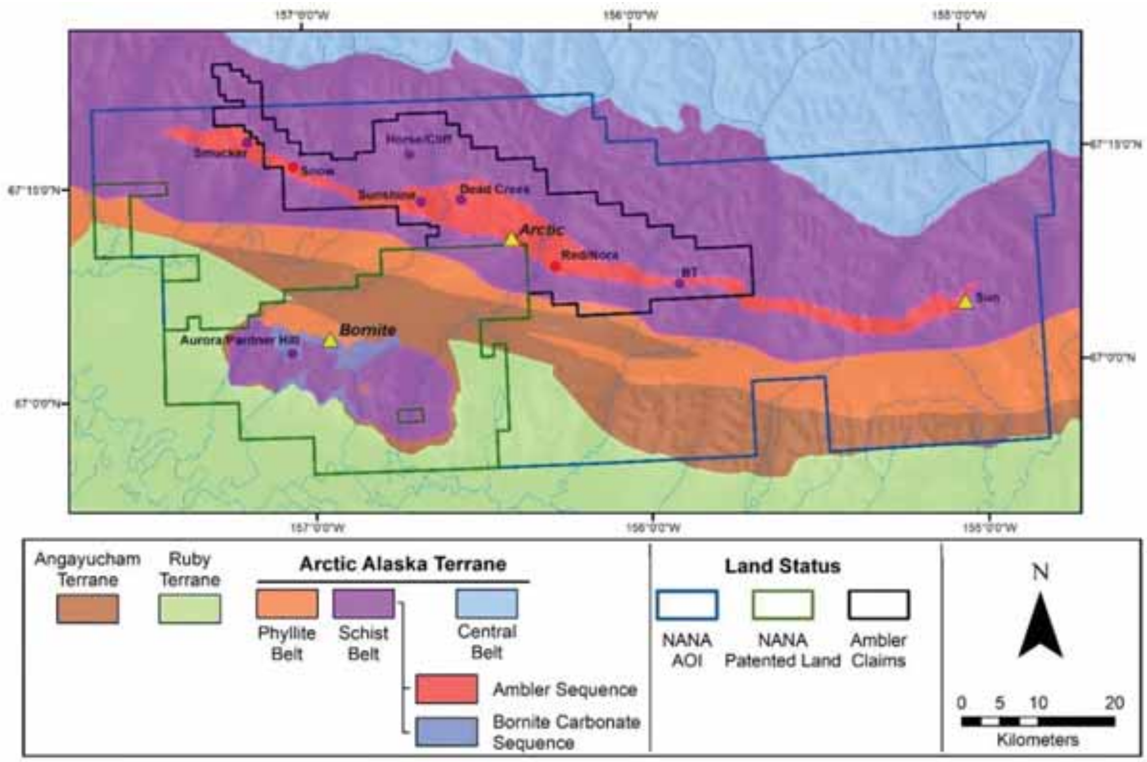


Figure 7-7 **Major Prospects of the Ambler Mining District (Trilogy Metals, 2019)**

8 Deposit Types

8.1 Deposit Type

The mineralization at the Arctic deposit and at several other known occurrences within the Ambler Sequence stratigraphy of the Ambler Mining District consists of Devonian age, polymetallic (zinc-copper-lead-silver-gold) VMS-like occurrences.

8.2 Overview

VMS deposits are formed by and associated with sub-marine volcanic-related hydrothermal events. These events are related to spreading centres such as fore arc, back arc or mid-ocean ridges. VMS deposits are often stratiform accumulations of sulphide minerals that precipitate from hydrothermal fluids on or below the seafloor. These deposits are found in association with volcanic, volcaniclastic and/or siliciclastic rocks. They are classified by their depositional environment and associated proportions of mafic and/or felsic igneous rocks to sedimentary rocks. There are five general classifications (Franklin et al., 2005) based on rock type and depositional environment:

- Mafic rock dominated often with ophiolite sequences, often called Cyprus type.
- Bimodal-mafic type with up to 25% felsic volcanic rocks.
- Mafic-siliciclastic type with approximately equal parts mafic and siliciclastic rocks, which can have minor felsic rocks and are often called Besshi type.
- Felsic-siliciclastic type with abundant felsic rocks, less than 10% mafic rocks and shale rich.
- Bimodal-felsic type where felsic rocks are more abundant than mafic rocks with minor sedimentary rocks also referred to as Kuroko type.

Prior to any subsequent deformation and/or metamorphism, these deposits are often bowl- or mound-shaped with stockworks and stringers of sulphide minerals found near vent zones. These types of deposit exhibit an idealized zoning pattern as follows:

- Pyrite and chalcopyrite near vents.
- A halo around the vents consisting of chalcopyrite, sphalerite and pyrite.
- A more distal zone of sphalerite and galena and metals such as manganese.
- Increasing manganese with oxides such as hematite and chert more distal to the vent.

Alteration halos associated with VMS deposits often contain sericite, ankerite, chlorite, hematite and magnetite close to the VMS with weak sericite, carbonate, zeolite, prehnite and chert more distal. These alteration assemblages and relationships are dependent on degree of post deposition deformation and metamorphism. A modern analogue of this type of deposit is found around fumaroles or black smokers in association with rift zones.

8.3 Comment on Section 8

In the Ambler Mining District, VMS-like mineralization occurs in the Ambler Sequence schists over a strike length of approximately 110 km. These deposits are hosted in volcaniclastic, siliciclastic and calcareous metasedimentary rocks interlayered with mafic and felsic metavolcanic rocks. Sulphide mineralization occurs above the mafic metavolcanic rocks but below the Button schist, a distinctive district wide felsic unit characterized by large K-feldspar porphyroblasts after relic phenocrysts. The presence of the mafic and felsic metavolcanic units is used as evidence to suggest formation in a rift-related environment, possibly proximal to a continental margin. Based on these characteristics, the Arctic deposit is similar to Kuroko-type VMS deposits.

Historic interpretation of the genesis of the Ambler Schist belt deposits has called for a syngenetic VMS origin with steep thermal gradients in and around seafloor hydrothermal vents resulting in metal deposition due to the rapid cooling of chloride-complexed base metals. A variety of VMS types have been well documented in the literature (Franklin et al., 2005) with the Ambler Schist belt deposits most similar to deposits associated with bimodal felsic dominant volcanism related to incipient rifting.

The majority of field observations broadly support such a scenario at the Arctic deposit and include: 1) the tectonic setting with Devonian volcanism in an evolving continental rift; 2) the geologic setting with bimodal volcanic rocks including pillow basalts and felsic volcanic tuffs; 3) an alteration assemblage with well-defined magnesium-rich footwall alteration and sodium-rich hanging wall alteration; and 4) typical polymetallic base-metal mineralization with massive and semi-massive sulphides.

A preserved sulphide-smoker occurrence has been tentatively identified near Dead Creek, northwest of the Arctic deposit and suggests local hydrothermal venting during deposition. However, the lack of stockworks and stringer-type mineralization at the Arctic deposit suggest that the deposit may not be a proximal vent-type VMS. Although the deposit is stratiform in nature, it exhibits characteristics and textures common to replacement-style mineralization. At least some of the mineralization may have formed as a diagenetic replacement.

A VMS model is considered applicable for use in exploration targeting in the Project area.

9 Exploration

9.1 Introduction

Table 9-1 summarizes the exploration work conducted by NovaGold and Trilogy Metals from 2004 to the present. Field exploration was largely conducted during the period between 2004 to 2007 with associated engineering and characterization studies between 2008 and the present.

Table 9-1 Summary of Trilogy/NovaGold Exploration Activities Targeting VMS-style Mineralization in the Ambler Sequence Stratigraphy and the Arctic Deposit

Work Completed	Year	Details	Focus
Geological Mapping			
-	2004	-	Arctic deposit surface geology
-	2005	-	Ambler Sequence west of the Arctic deposit
-	2006	-	COU, Dead Creek, Sunshine, Red
-	2015, 2016	SRK	Geotechnical Structural Mapping
-	2016	-	Arctic deposit surface geology
Geophysical Surveys			
SWIR Spectrometry	2004	2004 drill holes	Alteration characterization
TDEM	2005	2 loops	Follow-up of Kennecott DIGHEM EM survey
	2006	13 loops	District targets
	2007	6 loops	Arctic extensions
Downhole EM	2007	4 drill holes	Arctic deposit
VTEM Plus (Versatile Time Domain Electromagnetic) airborne helicopter geophysical	2019	400m line spacing with 200m infill with tie lines 4000m spacing	Ambler Mining District and Cosmos Hills with infill over Arctic, Sunshine and Horse-Cliff
ZTEM (Z-Axis Tipper Electromagnetic) airborne helicopter geophysical	2019	400m line spacing with tie lines 4000m spacing	Ambler Mining District and Cosmos Hills with infill over Arctic, Sunshine and Horse-Cliff
Geochemistry			
-	2005	-	Stream silts – core area prospects
-	2006	-	Soils – core area prospects
-		-	Stream silts – core area prospects
-	2007	-	Soils – Arctic deposit area
Survey			
Collar	2004 to 2011, 2018, 2019	DGPS	All 2004 to 2019 NovaCopper drill holes
	2004, 2008	Resurveys	Historical Kennecott drill holes
Photography/Topography	2010	-	Photography/topography
LiDAR Survey	2015, 2016	-	LiDAR over Arctic Deposit
Technical Studies			
Geotechnical	2010	BGC	Preliminary geotechnical and hazards
ML/ARD	2011	SRK	Preliminary ML and ARD
Metallurgy	2012	SGS	Preliminary mineralogy and metallurgy
Geotechnical and Hydrology	2012	BGC	Preliminary rock mechanics and hydrology

Work Completed	Year	Details	Focus
Geotechnical and Hydrology	2015, 2016, 2018, 2019	SRK	Arctic P FS and FS slope design
ML/ARD	2015, 2016, 2017, 2018, 2019	SRK	Static kinetic tests and ABA update - ongoing
Metallurgy	2015, 2016, 2017, 2018, 2019	SGS, ALS	Cu-Pb Separation Testwork; Flotation and Variability Testwork; SAG Mill Comminution (SMC) Testwork, filtration Testwork, thickener Testwork, and tailings settling testing
Project Evaluation			
Resource Estimation	2008	SRK	Resource estimation
PEA	2011	SRK	PEA - Underground
	2012	Tetra Tech	PEA – Open Pit
PFS	2018	Ausenco	Pre-Feasibility Study

Note: SWIR = short wave infrared; LiDAR = light detection and ranging; ML = metal leaching; BGC = BGC Engineering Inc.; SGS = SGS Canada; ALS = ALS Metallurgy; PEA = preliminary economic assessment

9.2 Grids and Surveys

Survey and data capture during the Kennecott's programs' used the UTM coordinates system Zone 4, NAD27 datum. In 2010, NovaGold converted all historical geology and topographic data for the Arctic deposit into the NAD83 datum for consistency. At that time NovaGold contracted WH Pacific, Inc. (WHPacific) to re-establish project-wide survey control and benchmarks for the Arctic deposit. Current Mineral Resource estimate and geologic models use topography completed in 2010 by PhotoSat Inc. The resolution of the satellite imagery used was at 0.5 m and a 1 m contour map and digital elevation model were generated.

Trilogy Metals retained WHPacific (and sub-consultant Quantum Spatial, Inc.) to conduct an aerial LiDAR survey over the Upper Kobuk area during 2015. Due to scheduling difficulties and poor weather conditions only 70% of the survey was completed in 2015. The remaining 30% of the aerial survey, as well as the final post-processing work, was completed between June and October 2016.

9.3 Geological Mapping

NovaGold focused its exploration mapping efforts on an area covering approximately 18 km of strike length of the permissive Ambler Sequence rocks of the Schist belt stratigraphy. This area is centered on the Arctic deposit and covers the thickest portion of the Ambler Sequence rocks. The area covers many of the most notable mineralized occurrences including the Red prospect east of the Kogoluktuk River, the Arctic deposit, and the nearby occurrences at the West Dead Creek and Dead Creek prospects, and the CS, Bud and Sunshine prospects west of the Shungnak River.

In 2004, mapping focused on the surface geology in and around the Arctic deposit while exploration in 2005 extended the Ambler Sequence stratigraphy to the west. In 2006 with expansion of the exploration focus to encompass the immediate district and to support a major TDEM geophysical program, mapping was extended to include the area between the Sunshine prospect on the west and the Red prospect on the east. Figure 9-1 shows areas mapped by successive campaigns, which resulted in the geological interpretation shown in Figure 7-4.

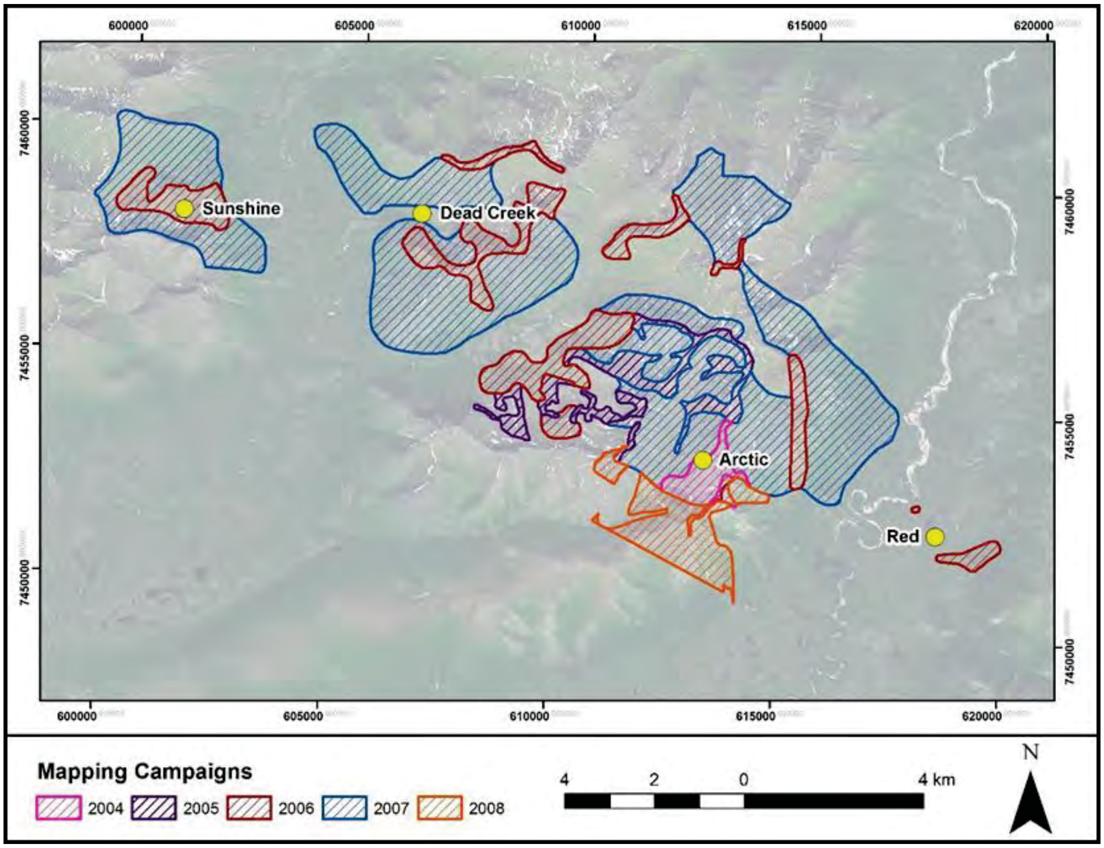


Figure 9-1 **Mapping Campaigns in and around the Arctic Deposit (Trilogy Metals, 2019)**

SRK was contracted in 2015 to create a structural geology model primarily based on brittle structures of the Arctic deposit for pit design and mine scheduling. The majority of the structural mapping took place along the north-south trending Arctic Ridge, and along the northwest trending ridge above a cirque to the south of the deposit, both of which provided the greatest exposure.

Geologic and structural mapping were completed by Trilogy Metals geologists during the 2016 field season. The objectives of the mapping project were threefold; 1) to ground-truth the northeast and north-south trending fault structures identified by SRK in 2015 and to otherwise support SRK's 2016 geotechnical mapping efforts, 2) field check the outcrops mapped in 2006 and 2008 recorded in the current GIS database, and 3) determine the nature of the Warm Springs Fault by mapping in the immediate hangingwall of this apparent structural feature. The first objective was successfully accomplished and the pending SRK geotechnical structural model was considered to be robust. The two other objectives were partly met during the short field season.

9.4 Geochemistry

Soil and silt geochemical sampling was used to target many of the VMS prospects in the Ambler Sequence particularly in the core area around the Arctic deposit. Between 2005 and 2007, NovaGold collected 2,272 soils and 278 silt samples. Much of the reconnaissance soil sampling used gridding layouts of 200 m lines and 50 m sample intervals oriented perpendicular to stratigraphy. Results of the sampling were used to refine areas for geophysical surveying, and to define drill targets.

Soil and silt samples were submitted directly to either ALS Minerals in Fairbanks (a division of ALS Global, formerly ALS Chemex) or Alaska Assay Labs in Fairbanks for sample preparation. The samples were dried and sieved to 80 mesh and forwarded to ALS Minerals for analysis. The samples were analyzed using the ME-ICP61 method and a four acid near total digestion with 27 elements measured (silver, aluminum, arsenic, barium, beryllium, bismuth, calcium, cadmium, cobalt, copper, chromium, iron, potassium, magnesium, manganese, molybdenum, sodium, nickel, phosphorus, lead, sulphur, antimony, strontium, titanium, vanadium, tungsten, and zinc).

9.5 Geophysics

During NovaCopper's tenure, the geophysical methodology was largely focused on ground and downhole EM methods to follow-up on the 1998 DIGHEM airborne EM survey conducted by Kennecott.

From 2005 to 2007, NovaCopper conducted TDEM surveys and completed 21 different loops targeting the Arctic deposit, extensions to the Arctic deposit and a series of DIGHEM airborne anomalies in and around known prospects and permissive stratigraphy. Table 9-2 summarizes the TDEM loops and locations.

Frontier Geosciences of Vancouver, BC completed all of the geophysical programs using a Geonics PROTEM 37 transmitter, a TEM-57 receiver and either a single channel surface coil or a three component BH43-3D downhole probe.

Table 9-2 TDEM Loops and Locations

Area	2005	2006	2007
Arctic	1	-	6
COU	1	3	-
Dead Creek	-	4	-
Sunshine	-	2	-
Red	-	1	-
Tom Tom	-	1	-
Kogo/Pipe	-	2	-
Total	**2**	13	6

In addition to the TDEM surveys, Frontier Geosciences surveyed four drill holes (AR05-89, AR07-110, AR07-111, and AR07-112). All of the drill holes produced off-hole anomalies, notably AR07-111, which showed evidence of a strong EM conductor north of the hole. Follow-up of this conductor is warranted.

In 2019, Trilogy Metals contracted GeoTech Ltd. of Aurora, Ontario to complete VTEM Plus (Versatile Time Domain Electromagnetic) and ZTEM (Z-Axis Tipper Electromagnetic) airborne helicopter geophysical surveys over the Cosmos Hills and the Ambler VMS belt. These survey methods are a significant upgrade over the previous DIGHEM survey flown by Kennecott in 1998 over the VMS belt and the DIGHEM survey flown by NovaGold over the Bornite Sequence in 2006 due to the greater resolution and deeper penetration ability. The magnetic field was also measured using a cesium vapor sensor, though radiometric data were not collected due to snow cover.

The program was designed, managed, and results interpreted by Resource Potential, a geophysical consulting company based out of Perth, Australia.

The VTEM survey was flown at a 400 m line spacing over the Ambler VMS Belt along lines oriented at 20°-200° azimuths for the western portion of the belt and along north-south lines for the eastern portion (see Figure 9-2). In-fill lines at 200 m spacing were flown over the Arctic, Sunshine, and Horse-Cliff areas to provide greater resolution in those high priority areas. Tie lines at ~4 km spacing were flown perpendicular to the EM flight lines to provide control for the magnetic survey.

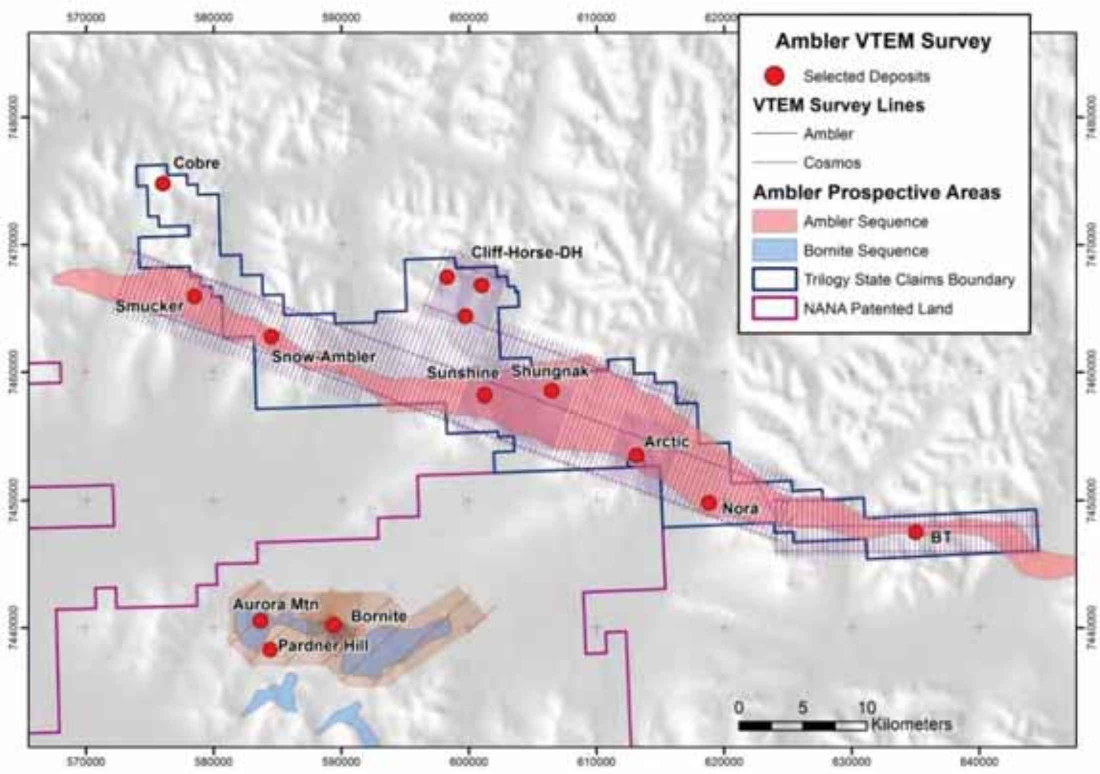


Figure 9-2 **VTEM flight lines over the Ambler Belt and Cosmos Hill prospective areas (Trilogy Metals, 2019)**

The ZTEM survey was flown along lines with the same orientation as the VTEM survey at 400m line spacing, with tie lines at every 4 km. (Figure 9-3). Resource Potential re-processed the data from GeoTech and provided a 3D EM block model and both plan view depth slices and sectional EM images for the ZTEM survey. Several anomalies from both the VTEM and ZTEM surveys were identified that need further evaluation.

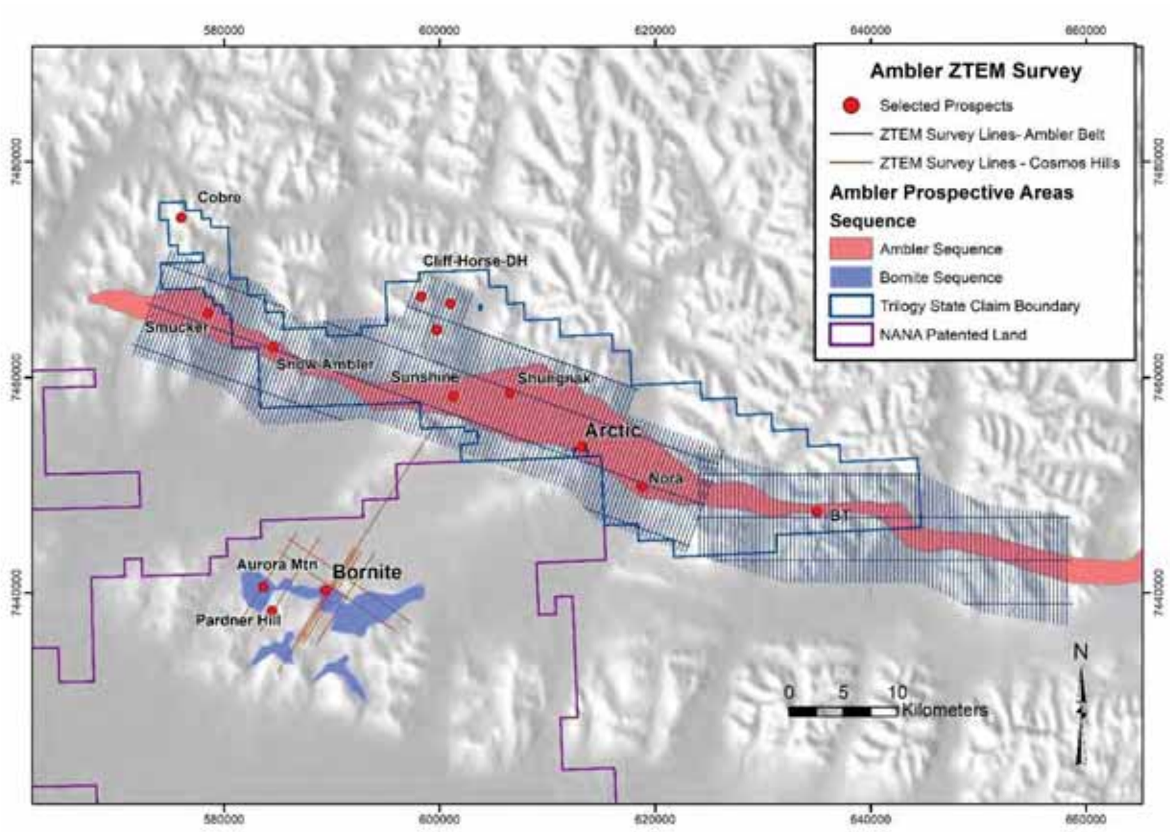


Figure 9-3 **ZTEM flight lines over the Ambler VMS Belt and the Bornite deposit (Trilogy Metals, 2019)**

9.6 Petrology, Mineralogy and Research Studies

Trilogy Metals supported a series of academic studies of the Arctic deposit. In 2009, Danielle Schmandt completed an undergraduate thesis entitled “Mineralogy and Origin of Zn-rich Horizons within the Arctic Volcanogenic Massive Sulphide deposit, Ambler District, Alaska” for Smith College. The Schmandt thesis focused on a structural and depositional reconstruction of the Arctic deposit with the goal of locating the hydrothermal vents to aid in exploration vectoring.

Bonnie Broman, a Trilogy Metals geologist, completed a Master of Science thesis for in 2014 at the University of Alaska-Fairbanks, focusing on the nature and distribution of the silver-bearing mineral species within the Arctic deposit. The thesis is titled “Metamorphism and Element Redistribution: Investigations of Ag-bearing and associated minerals in the Arctic Volcanogenic Massive Sulfide deposit, SW Brooks Range, NW Alaska”.

9.7 Geotechnical, Hydrogeological and Geochemical Acid Base Accounting Studies

9.7.1 Geotechnical and Hydrogeological Assessments

SRK reviewed the previous work and recommendations, identified potential risks and opportunities and designed a field program to update the structural, geotechnical and hydrogeological models to support the 2020 FS. Phase 2 involved the completion of the designed field program, which allowed for the structural, hydrogeological and geotechnical models to be updated. After these updates had been completed the bench, inter-ramp and overall slope design criteria for the planned Arctic open pit were updated and evaluated with a focus on the interaction with the talc exposures and foliation fabric during construction.

9.7.1.1 Data Sources

Five dedicated geotechnical-hydrogeological drill holes were completed during the 2015 and 2016 field seasons, and geotechnical logging was completed on a further 15 resource drill holes. Nine dedicated geotechnical-hydrogeological drill holes were completed in 2019. This work was complemented by structural mapping, acoustic televiewer surveys, and hydrogeological installations. Laboratory strength testing was completed on resource and geotechnical-hydrogeological drill holes.

9.7.1.2 Geology and Structure

The talc alteration occurs as continuous to semi-continuous massive bands that locally host economic mineralization many metres thick to much thinner (2 to 20 cm) bands parallel to the dominant foliation within more competent quartz-mica and quartz-chlorite mica schists. Both occurrences represent potential weak or slip foliation surfaces. Trilogy Metals developed talc wireframes delineating the spatial distribution and extent of the main talc-rich horizons (Figure 9-4). These wireframes were used in the geotechnical and hydrogeological assessments.

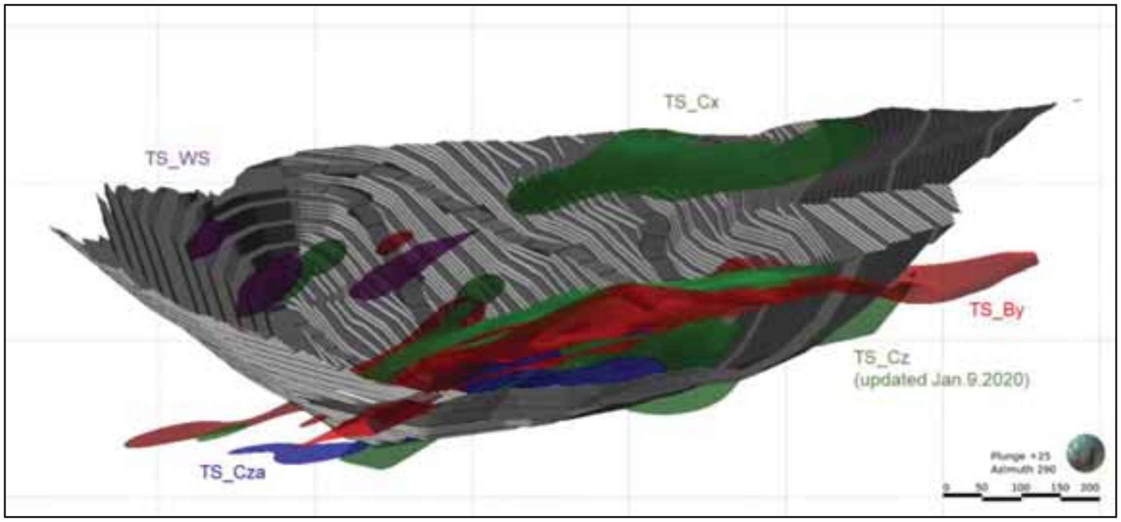


Figure 9-4 **Isometric view (looking West) of Talc Zone domain modeled by Trilogy (2020) using Leapfrog on the EoY12 design pit (Wood, 2019).**

Pervasive weathering is present in the upper levels of the Arctic deposit. SRK has reviewed the geotechnical data and core photographs in order to define a base of weathering isosurface that represented the boundary of the upper, more pervasive weathering.

SRK updated the 3-D structural model by integrating new structural drill hole data into the model, refining existing structures and modelling additional faults. The “structural matrix”, which provides information on the physical properties and confidence of major and minor structural features, was also updated. The final structural model is shown in Figure 9-5.

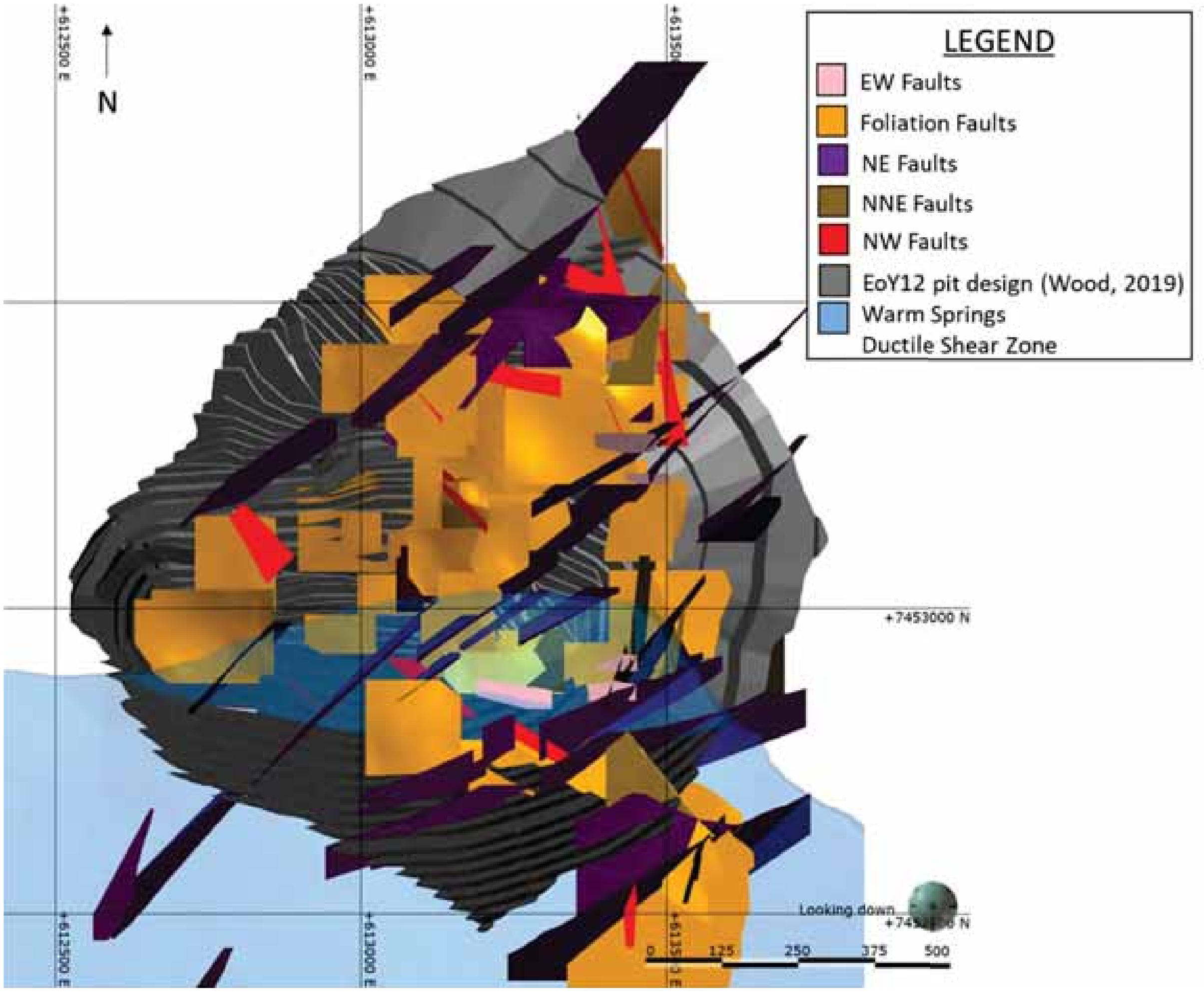


Figure 9-5 SRK Structural Model used in the Slope Stability Analysis on the EoY12 design pit (Wood, 2019).

Six structural and geomechanical domains were identified (Figure 9-6). These domains, each containing discontinuity sets and major structures, formed the basis of a kinematic assessment.

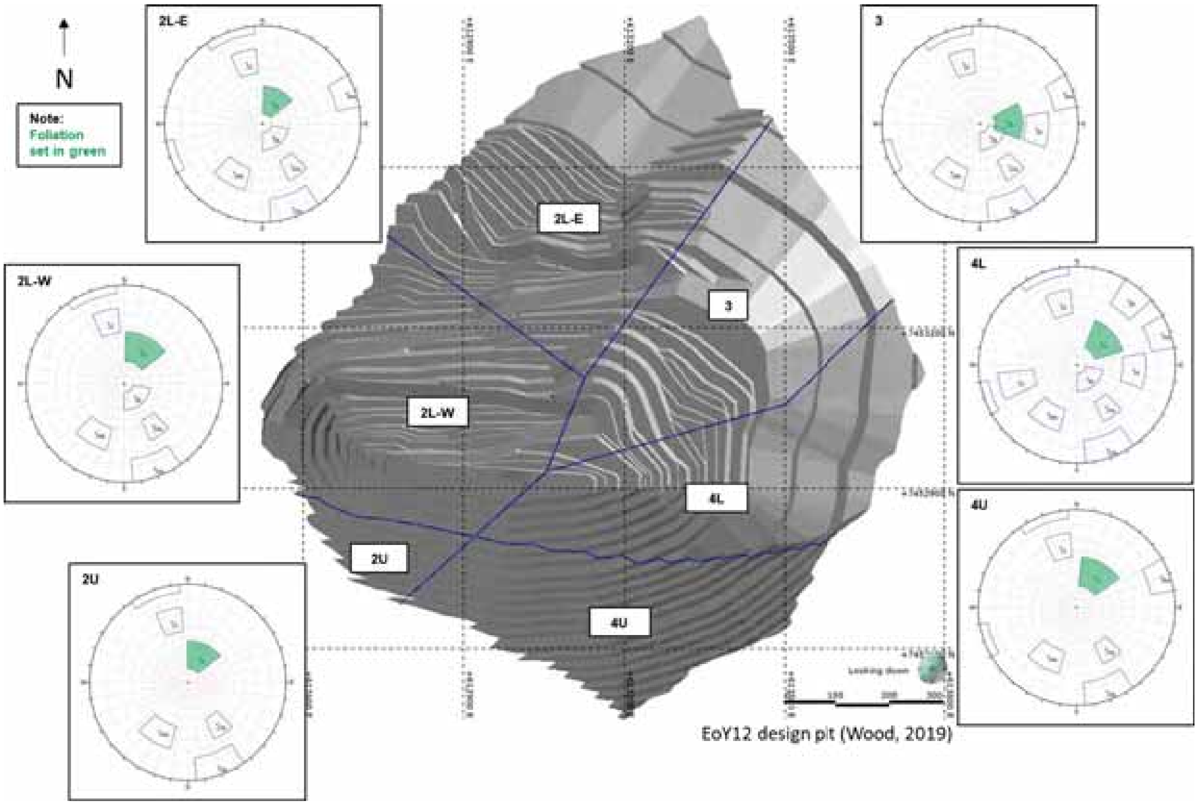


Figure 9-6 Location Plan, Structural and Geomechanical Domains (Wood, 2019)

9.7.1.3 Rock Mass Assessment

Based on similar geotechnical conditions, most lithological units have been grouped together into broad domains represented by the Upper and Lower Plates (separated by the Warm Springs Fault). The exceptions to these groupings are the weaker talc units, shallow weathered material, and fault zones. The following rock mass domains were defined:

- Upper Plate
- Lower Plate
- Weathered
- Talc zone
- Fault zones

Mean rock mass parameter values and ranges were defined for each rock mass domain (e.g., fracture frequency, rock mass rating). Particular attention was paid to the assessment of intact rock strength within the defined rock mass domains. Laboratory strength testing, supported by point load testing and empirical field estimates, suggests that strength within the various lithological groups of the Upper and Lower Plates is reasonably homogeneous (Table 9-3).

Table 9-3 Summary of derived rock mass parameter values per rock mass domain.

Domain	RQD (%)	FF/m	UCS MPa	RMR_{89} Joint Condition (0-30)	RMR_{89}	GSI	E_i (GPa)	m_i
Upper Plate	85-95	1-4	50-60	20	60-70	55-65	18	18
Lower Plate	75-85	2-5	50-60	19	55-65	50-60	18	18
Weathered	45-55	10-20	40-50	16	40-50	35-45	18*	13**
Talc Zone	20-40	25-40	1-5	10	20-30	15-25	4	6
Faults	0-20	> 40	30-40	16	30-40	25-35	ND	ND

**estimated parameter **after BGC (2012)*
ND – no data available; estimated for numerical modelling

The Talc zone domain consisting of talc schist (TS) and chlorite-talc schist (ChTS), represents the weakest rock type (outside of fault zones) observed at the Arctic deposit. The domain is characterized by low intact rock strength, well developed S_1/S_0 fabric and low shear strength discontinuity surfaces. The extent and persistence of the unit is of concern for pit slope stability.

9.7.1.4 Kinematic Stability Assessment

A complete assessment of bench and inter-ramp kinematic stability was undertaken. Full descriptions of toppling, planar, and wedge instability risks were provided per geomechanical domain and design sector.

The most significant discontinuity sets, in terms of limiting slope angles, are related to shallow to intermediate dipping S_1/S_0 fabric, which impacts the northeast, east and southeast slopes.

9.7.1.5 Hydrogeology

Pit water management is discussed in Section 16.8.

Hydrogeological investigations and assessments were completed for both the open pit and valley bottom water/waste management areas.

Hydrogeological data are available from 39 boreholes; 15 in the area of the open pit area and 24 in the valley bottom area, comprising;

- Hydrogeologic testing data from 50 packer-based hydraulic tests; 11 slug tests; two pumping tests in valley bottom, each with an observation well; three injection tests in pit area, one of six hours duration and two greater than 24 hours, each with monitoring at nearby vibrating wire piezometers (VWPs); 122 particle size distributions from test pits in valley floor.
- Water level data from 24 VWPs in pit area; 12 water level dataloggers in valley bottom.
- Dedicated ground temperature cables at six locations in valley floor; temperature from all VWP sensors, including those in the open pit area.
- 22 monitoring wells and two pumping wells in valley bottom; three standpipe piezometers in pit area.

Data have been used to develop conceptual models for the project area and hydrostratigraphic units:

- Overburden is thickest in the valley bottom, typically ranging between 10 m to 20 m with localized areas of 25 m or more. It is comprised of colluvium and glacial till. On the valley sides, and in the area of the pit, overburden thickness is relatively minor, typically around 5 m or less.
- Weathered bedrock, defined as bedrock with enhanced permeability due to weathering or isostatic rebound post-glaciation, typically ranges between 0 m to 60 m thickness based on available drill hole data. Specific testing of weathered bedrock was completed in valley bottom drill holes; presence of weathered bedrock in the pit area was inferred from logging.
- Competent bedrock encompasses all lithologic units, in both the valley bottom and pit areas, with sub-units that include: upper and lower fractured bedrock (upper and lower are relative to talc position); talc unit; fault barriers; fault conduits

The talc unit is present in the pit area, with relatively low hydraulic conductivity and is considered an aquitard, but the aquitard is likely discontinuous based on talc distribution and thickness.

Testing of specific geological structures was completed in the pit area. Results range from similar to surrounding bedrock to higher or lower permability (K). No continuous, relatively high or relatively low permeability structures were identified.

The hydrogeological conceptual model for valley bottoms is relatively simple. Overall water flow directions are similar to the topography, with the majority of water flow at relatively shallow depth in overburden or weathered bedrock flowing towards valley bottoms. In the valley bottom, overburden heterogeneity exists, with flow occurring within relatively coarser grained, higher hydraulic conductivity units and weathered bedrock. The majority of groundwater flow in the Subarctic Creek watershed is assumed to discharge to Subarctic Creek. Flow within competent bedrock is much lower in magnitude.

Figure 9-7 presents the conceptual hydrogeological model for the pit area. Overall flow directions follow topography, with flow systems all within the competent bedrock hydrostratigraphic unit, with the talc, upper and lower fractured bedrock and structures sub-units present. Hydraulic gradients are downwards from the upper fractured bedrock sub-unit to the lower fractured bedrock unit, separated by the talc aquitard. The lower fractured bedrock unit is confined at lower elevations, with the potentiometric surface above the talc sub-unit.

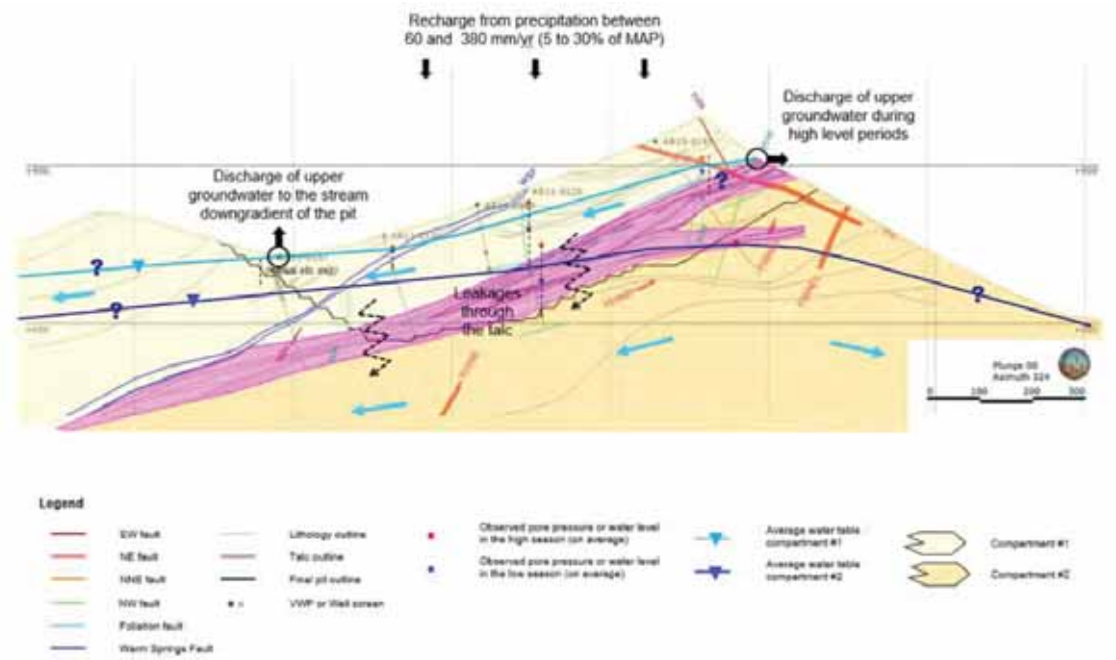


Figure 9-7 Summarized Hydrogeological Conceptual Model for Pit Area (Wood, 2019)

Pit inflow and pore pressure conditions were assessed using numerical and analytical tools. Table 9-4 summarizes estimated pit inflow for three cases reflecting the range of hydraulic conductivity and groundwater recharge that could be expected based on data and modelling. The “Base Case” estimate reflects groundwater model runs with parameters calibrated to average stream baseflow conditions. “Low Case” and “High Case” estimates reflect model runs with parameters calibrated to minimum and maximum baseflow conditions, respectively. Estimates of pit wall runoff, reflecting direct precipitation on the pit, were obtained from the site wide water balance model, using a runoff coefficient of 0.9. The presented values are annual averages; shorter duration higher peak flows and periods of lower inflow can be expected to occur.

Table 9-4 **Estimated Pit Inflow**

Mining Year	Average Yearly Pit Groundwater Inflow (m^3/d)			Pit Wall Runoff (m^3/d)	Base Case Total Inflow (m^3/d)
	Low Case	Base Case	High Case		
02	130	300	650	1890	2190
04	150	350	770	2410	2760
06	160	370	830	2830	3200
08	160	400	900	3140	3540
10	170	420	950	3320	3740
12	180	440	990	3320	3760

Pore pressure influences on slope stability analyses were assessed through combinations of hydrogeological modelling and geotechnical stability modelling. Pore pressures were estimated with four 2-D cross-sectional models that represented the four geotechnical sections used to evaluate slope stability. Conservative model assumptions were used considering the risks posed by the low shear strength of the talc, and uncertainties with hydrogeological conditions (i.e., lateral extent of the hydrostratigraphic zones above the talc, vertical leakage rates between units above and below the talc, and presence of geological structures acting as barriers or conduits).

Sensitivity to model assumptions were tested including variations to hydraulic conductivity of the fractured rock, specific storage, specific yield, as well as to anisotropy within the fractured rock and presence of impermeable geological structures. Results suggested highest sensitivity (as measured via changes in water table distribution and hydraulic head) related to anisotropy and the addition of impermeable geological structures.

Pore pressure modelling results were used in slope stability modelling and pore pressure management is discussed in Section 16.7.2.

9.7.1.6 Stability Modelling

The minimum acceptable factor of safety (FoS) for the planned Arctic open pit varies depending on the pit slope component. Based upon the current plans, there is no major infrastructure set to be constructed proximal to any pit walls. If this were to change, it would be necessary to examine the selected acceptance criteria.

Table 9-5 summarizes the selected acceptance criteria for the Arctic pit slope design.

Table 9-5 Selected slope stability acceptance criteria

Slope Component	Acceptance Criteria [1]			
	Static		Dynamic	
	Minimum FoS	Maximum PoF Displayed as Probability of FoS ≤ 1 (%)	Minimum FoS	Maximum PoF Displayed as Probability of FoS ≤ 1 (%)
Bench	1.1	50%	NA	50%
Inter-ramp	1.3	10%	1.1	10%
Overall	1.3	5%	1.1	5%

(1) FoS = Factor of Safety and PoF = Probability of Failure

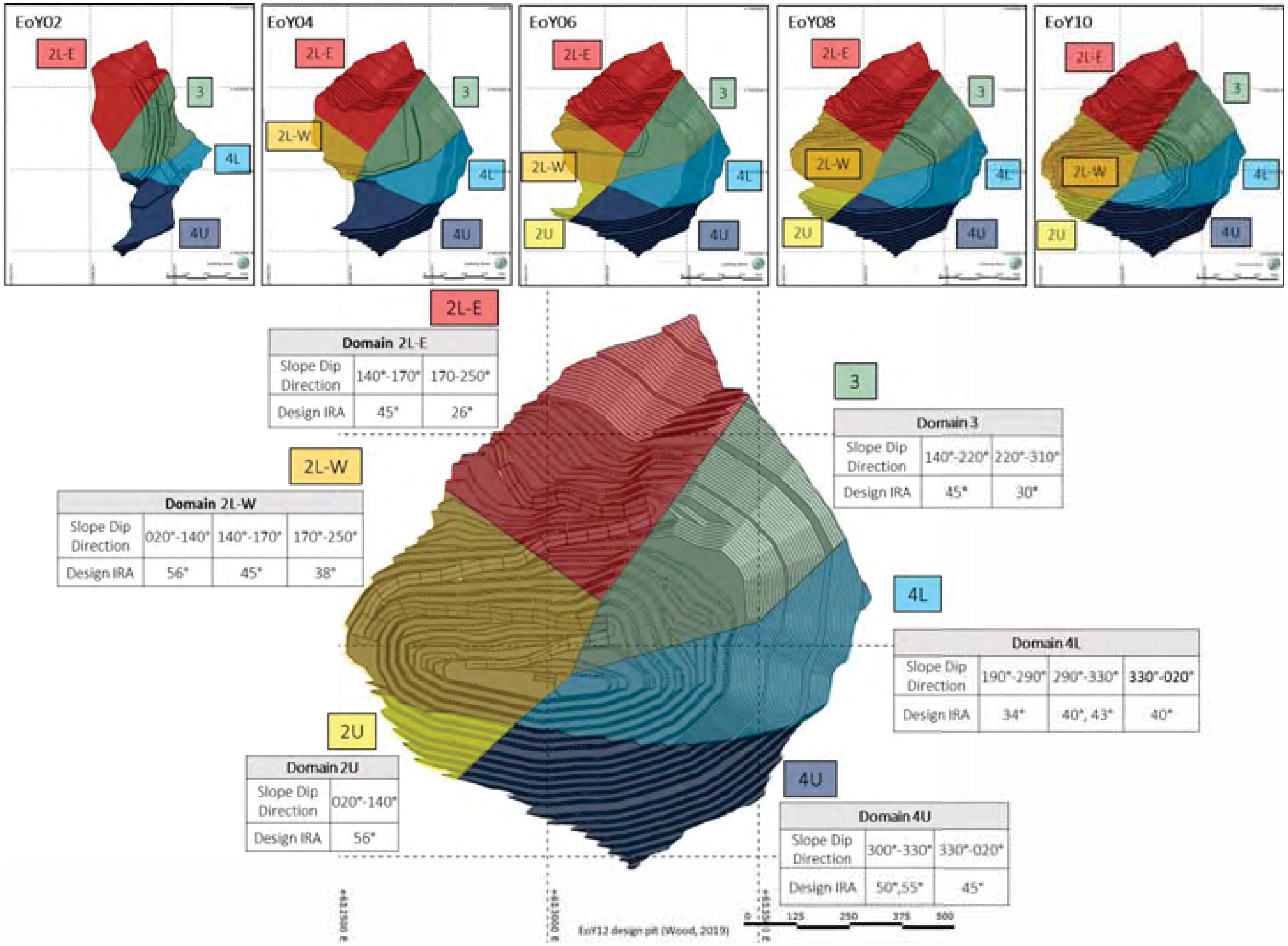
Two dimensional (2-D) RS2 modelling results, carried out on four sections around the pit, validated the findings from the kinematic assessment and suggest that final pit wall slopes are sensitive to the pore pressure when the talc layers are exposed in the pit walls and relatively insensitive to pore pressure in other scenarios. A seismic hazard assessment was incorporated considering the annual exceedance probability of 10% chance of being exceeded in 50 years indicating a peak ground acceleration of 0.26 g for the region of the proposed Artic Pit. The peak ground acceleration used to evaluate the 2-D sections was a conservative 66% of the estimated regional peak ground acceleration for this region, or 0.17.

Three dimensional (3-D) RS3 modelling focused on analyzing the stability of the east and northeast walls that are designed to be mined to foliation fabric and contain talc layers. These slope areas did not meet the stability design criteria in 2-D but it was anticipated that confinement in 3D would improve slope performance. The effect of pore pressures was not analyzed in 3-D due to limitations with the software when modelling complex groundwater conditions. As with the results of the 2-D findings, the absence of pore pressure in the 3-D model was assumed to be representative if the pore pressure management plan successfully drains the groundwater above the talc zones.

The 3-D analysis result suggests that the area in the northeast wall above the Cz Talc Zone is, in terms of stability, the most sensitive slope to shear strength reduction. The resulting SRF of 1.3, although meeting the design criteria, represents an optimistic estimation of the factor of safety as the strengths of the talc zone and foliation could be lower.

9.7.1.7 Slope Design

Slope design recommendations were based on the findings of the kinematic evaluation, with additional adjustments from the numerical modelling analyses. Hydrogeological influences were considered in the 2-D numerical stability analyses using the predictions of phreatic surfaces in the interim and final pit phases. The models suggested that stability of the north east and east wall was dependent on successful management of the pore water pressures. Slope angles were determined for each slope design sector as seen in Figure 9-8.



Domain 2L-E		
Slope Dip Direction	140°-170°	170-250°
Design IRA	45°	26°

Domain 2L-W			
Slope Dip Direction	020°-140°	140°-170°	170°-250°
Design IRA	56°	45°	38°

Domain 2U	
Slope Dip Direction	020°-140°
Design IRA	56°

Domain 3		
Slope Dip Direction	140°-220°	220°-310°
Design IRA	45°	30°

Domain 4L			
Slope Dip Direction	190°-290°	290°-330°	330°-020°
Design IRA	34°	40°, 43°	40°

Domain 4U		
Slope Dip Direction	300°-330°	330°-020°
Design IRA	50°,55°	45°

Figure 9-8 Recommended Inter-Ramp Angles by Slope Design Sector (Wood, 2019)

9.7.2 Acid Base Accounting Studies

Five geochemical sampling campaigns in 1998, 2010, 2013, 2015 and 2016 resulted in accumulation of a dataset of 1,557 samples tested using various methods. In January 2017, following a large (1004 sample) infill sampling campaign in 2016, Trilogy Metals consolidated the databases, which enabled SRK to use the geochemical database and mineralogical data to develop site-specific methods for acid potential (AP) and neutralization potential (NP) (SRK 2019).

About 75% of samples were classified as potentially acid generating (PAG), which is defined as total sulfur content > 0.1% and NP/AP<2 where NP and AP are calculated using site-specific methods. Acid rock drainage (ARD) potential occurs in all rock types to varying degrees. Ore and the associated Gray Schist have the strongest ARD potential, followed by felsic schists. The rock types with weaker ARD potential are chlorite talc schist and metarhyolite porphyry.

In 2017 and 2019, tailings generated by metallurgical testing were tested for acid-base accounting (ABA) methods and found to have potential for acid generation.

9.7.3 Geochemical Kinetic Studies

9.7.3.1 Waste Rock Program

Geochemical kinetic testing using six rock type composites was initiated in 2015. The composites were used to fill seven barrels (including one duplicate) at the site with 240 to 270 kg of waste rock in each test. Leachates from the barrels were collected and tested once in 2015 and three to five times during each summer from 2016 through 2019. Parallel laboratory humidity cells were also initiated in 2015 and are evaluating the weathering behaviour of the composites. The humidity cells had been operating for 232 weeks as of April 8, 2020.

An additional 10 waste rock humidity cell tests (HCTs) were initiated in 2019. While the tests initiated in 2015 generally represented typical compositions of the main waste rock types in terms of sulfur content, the tests initiated in 2019 were designed to represent the range of compositions present for key parameters such as selenium and sulfur, including some tests that would represent “worst case” conditions. These humidity cells had been operating for 48 weeks as of April 6, 2020.

All of the kinetic samples (from both the 2015 and 2019 programs) have the potential to generate acid. To date, five HCTs have generated acid (pH<5) including two samples of Gray Schist, and one sample each of metarhyolite porphyry, quartz mica schist, and aphanitic metarhyolite. A further five tests (of Gray Schist, metarhyolite porphyry, chlorite-talc schist, and two quartz-mica schist tests) had declining pHs that were most recently between pH 6.0 and 6.5 indicating that carbonate minerals have likely been exhausted and acid generation is buffered by silicate minerals. pH is expected to continue declining in the tests. The remaining tests had recent pHs of 7.0 to 7.3 and were likely still buffered by carbonate minerals. The test work has provided data on metal release rates under acidic and non-acidic conditions which have been used to estimate waste rock contact water composition.

9.7.3.2 Tailings Program

Kinetic testing of tailings from the 2017 and 2019 metallurgical test programs has been in operation for 156 weeks and 36 weeks respectively (as of early April 2020). Both sets of tailings are undergoing testing in HCTs, and the 2019 tailings are also undergoing subaqueous column testing. None of the tests have generated acid and recent pHs are in the range from 7.0 to 7.3. The HCT testwork has provided data on metal release rates under non-acidic conditions which have been used to estimate contact water composition of tailings upon exposure to subaerial weathering. Subaqueous column results will be used for predicting tailings water chemistry during operations and for refining predictions of tailings water upon closure as water is drawn down in the tailings management facility (TMF) and porewater is released during tailings consolidation.

9.7.3.3 Ore Program

Kinetic testing of an ore composite was initiated in 2019. The HCT had been operating for 48 weeks as of April 6, 2020. The sample had not generated acid and recent pHs are in the range of 7.3 to 7.4. The test work has provided data on metal release rates under non-acidic conditions which have been used to estimate the ore contact water composition.

10 Drilling

10.1 Introduction

Drilling at the Arctic deposit and within the Ambler Mining District has been ongoing since the initial discovery of mineralization in 1967. Approximately 60,857 m of drilling has been completed within the Ambler Mining District, including 42,571 m of drilling in 207 drill holes at the Arctic deposit or on potential extensions in 29 campaigns spanning 52 years. Drilling outside the Arctic deposit area is discussed in Section 10.8.

All of the drill campaigns at the Arctic deposit have been run under the supervision of either: 1) Kennecott and its subsidiaries (BCMC), 2) Anaconda, or 3) Trilogy Metals and its predecessor companies, NovaGold and NovaCopper. Table 10-1 summarizes operators, campaigns, holes and metres drilled on the Arctic deposit. All drill holes listed in Table 10-1, except five holes drilled in 2017 for metallurgical purposes, 24 holes drilled in 2018 for geotechnical parameters at the proposed site facilities, and nine holes drilled in 2019 which were to support the geotechnical and hydrogeological studies, were considered for use in the estimate of Mineral Resources described in Section 14.

Table 10-1 Companies, Campaigns, Drill Holes and Metres Drilled at the Arctic Deposit

Year	Company	No. of Holes	Metres
1967	BCMC	7	752
1968	BCMC	18	3,836
1969	BCMC	3	712
1970	BCMC	3	831
1971	BCMC	1	257
1972	BCMC	1	407
1973	BCMC	2	557
1974	BCMC	3	900
1975	BCMC	26	4,942
1976	BCMC, Anaconda	10	805
1977	BCMC, Anaconda	4	645
1979	BCMC, Anaconda	3	586
1980	Anaconda	1	183
1981	BCMC, Anaconda	2	632
1982	BCMC, Anaconda	5	677
1983	BCMC	1	153
1984	BCMC	2	253
1986	BCMC	1	184
1998	Kennecott	6	1,523
2004	NovaGold	11	2,996
2005	NovaGold	9	3,393
2007	NovaGold	4	2,606
2008	NovaGold	14	3,306
2011	NovaGold	5	1,193

Year	Company	No. of Holes	Metres
2015	NovaCopper	14	3,055
2016	Trilogy Metals	13	3,058
2017	Trilogy Metals	5	790
2018	Trilogy Metals	24	906
2019	Trilogy Metals	9	2,433
Total	**-**	**207**	**42,571**

Figure 10-1 shows the locations of drill holes in the vicinity of the Arctic deposit.

Trilogy Metals and its predecessor company NovaGold drilled 29,531 m in 108 drill holes targeting the Arctic deposit and several other prospects within the Ambler Schist belt. Table 10-2 summarizes all the Trilogy Metals/NovaGold tenure drilling on the Project.

Table 10-2 Summary of Trilogy/NovaGold Arctic Deposit Drilling

Year	Metres	No. of Drill Holes	Sequence	Purpose of Drilling
2004	2,996	11	AR04-78 to 88	Deposit scoping and verification
2005	3,030	9	AR05-89 to 97	Extensions to the Arctic deposit
2006[***]	3,100	12	AR06-98 to 109	Property-wide exploration drilling
2007	2,606	4	AR07-110 to 113	Deep extensions of the Arctic deposit
2008[*]	3,306	14	AR08-114 to 126	Grade continuity and metallurgy
2011	1,193	5	AR11-127 to 131	Geotechnical studies
2012[***]	1,752	4	SC12-014 to 017	Exploration drilling – Sunshine
2015	3,055	14	AR15-132 to 145	Geotechnical-hydrogeological studies, resource infill
2016	3,058	13	AR16-146 to 158	Geotechnical-hydrogeological studies, resource infill
2017[**]	790	5	AR17-159 to 163	Ore sorting studies
2018**	906	24	GT18-AR-01 to 19 MS18-AR-01 to 05	Geotechnical studies for site facilities
2019**	2,433	9	AR19-0164 to 172	Geotechnical and hydrogeological studies for 2020 FS

Notes:

[**] Holes drilled in 2017, 2018, and 2019 are not included in the current resource estimate as they were completed for metallurgical purposes, geotechnical site facilities studies, and geotechnical-hydrogeological studies for feasibility.

[***] Drilling in 2006 and 2012 targeted exploration targets elsewhere in the VMS belt.

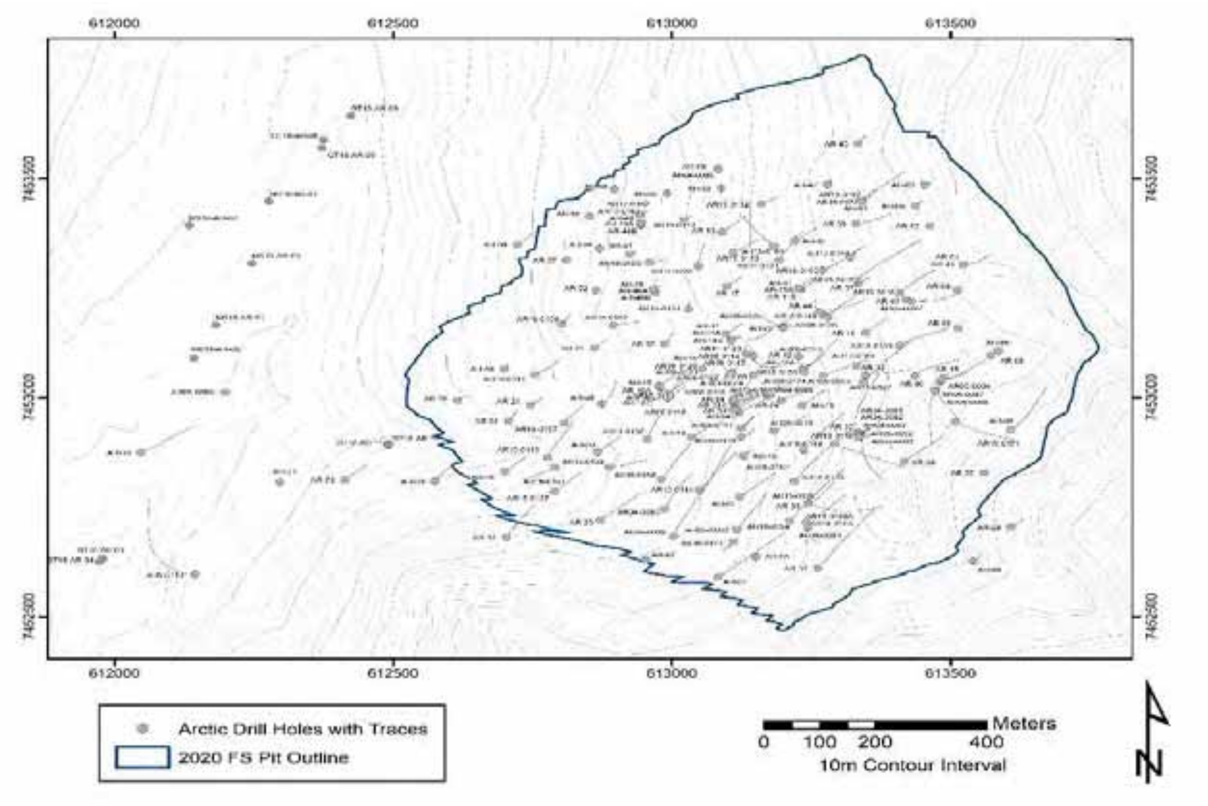


Figure 10-1 Plan Map of Drill Holes in the Vicinity of the Arctic Deposit (Trilogy Metals, 2020)

10.2 Drill Companies

Over the Arctic Project's history, a relatively limited number of drill companies have been used by both Kennecott and Trilogy/NovaGold at the Arctic deposit. During Kennecott's work programs, Sprague and Henwood, a Pennsylvania-based drilling company was the principal contractor. Tonto Drilling provided services to Kennecott during Kennecott's short return to the district in the late 1990s. NovaCopper and NovaGold used Boart Longyear as their only drill contractor. Trilogy Metals has used Major or Tuug Drilling. Table 10-3 summarizes drill companies and core sizes used.

Table 10-3 Drill Contractors, Drill Holes, Meterage and Core Sizes by Drill Campaign at the Arctic Deposit

Year	Company	No. of Drill Holes	Metres	Core Size	Drill Contractor
1967	Bear Creek	7	4,752	BX	Sprague and Henwood
1968	Bear Creek	18	3,782	BX	Sprague and Henwood
1969	Bear Creek	3	712	BX	Sprague and Henwood
1970	Bear Creek	3	831	BX	Sprague and Henwood
1971	Bear Creek	2	257	BX?	Sprague and Henwood
1972	Bear Creek	1	407	BX?	Sprague and Henwood
1973	Bear Creek	2	557	BX?	Sprague and Henwood
1974	Bear Creek	3	900	NX and BX	Sprague and Henwood

Year	Company	No. of Drill Holes	Metres	Core Size	Drill Contractor
1975	Bear Creek	26	4,942	NX and BX	Sprague and Henwood
1976	Bear Creek	8	479	NXWL and BXWL	Sprague and Henwood
1977	Bear Creek	3	497	NXWL and BXWL?	Sprague and Henwood
1979	Bear Creek	2	371	NXWL and BXWL?	Sprague and Henwood
1981	Bear Creek	1	458	NXWL and BXWL?	Sprague and Henwood
1982	Bear Creek	4	494	NXWL and BXWL?	Sprague and Henwood
1983	Bear Creek	1	153	NXWL and BXWL?	Sprague and Henwood
1984	Bear Creek	2	253	NXWL and BXWL?	Sprague and Henwood
1986	Bear Creek	1	184	NXWL and BXWL?	Sprague and Henwood
1998	Kennecott	6	1,523	HQ	Tonto
2004	NovaGold	11	2,996	NQ and HQ	Boart Longyear
2005	NovaGold	9	3,393	NQ and HQ	Boart Longyear
2007	NovaGold	4	2,606	NQ and HQ	Boart Longyear
2008	NovaGold	14	3,306	NQ and HQ	Boart Longyear
2011	NovaGold	5	1,193	NQ3 and HQ3	Boart Longyear
2015	Trilogy Metals	14	3,055	NQ and HQ	Boart Longyear
2016	Trilogy Metals	13	3,058	NQ and HQ	Boart Longyear
2017	Trilogy Metals	5	790	PQ	Major Drilling/Tuuq Drilling
2018	Trilogy Metals	24	906	PQ	Tuuq Drilling
2019	Trilogy Metals	9	2,433	PQ and HQ3	Tuuq Drilling

Sprague and Henwood used company-manufactured drill rigs during their work programs on the Project. Many of their rigs remain at the Bornite deposit and constitute a historical inventory of 1950s and 1960s exploration artifacts. The 2004 to 2011 Trilogy Metals/NovaGold drill programs used a single skid-mounted LF-70 core rig, drilling HQ (63.5 mm core diameter) or NQ (47.6 mm) core. The drill was transported by skid to the various drill pads using a D-8 bulldozer located on site. The D-8 was also used in road and site preparation. Fuel, supplies and personnel were transported by helicopter. The 2015 and 2016 NovaCopper/Trilogy Metals drill programs used two helicopter-portable LF-70 core rigs, drilling HQ or NQ core. The drill was transported by helicopter to various drill pads. The 2017 Trilogy Metals metallurgical drill program used a helicopter-portable LF-90 core rig, drilling PQ (85 mm) core to be used in future metallurgical testwork. The drill was transported by helicopter to various drill pads. In 2018, Trilogy Metals used a helicopter-portable Durallite 1400N, drilling PQ core to be used for geotechnical studies in plant site facilities. Drilling during 2019 consisted of two helicopter-portable Duralite 1400N core rigs, drilling PQ and HQ core used for geotechnical and hydrogeological studies to support 2020 FS.

10.3 Drill Core Procedures

10.3.1 Kennecott

There is only partial knowledge of specific drill core handling procedures used by Kennecott during their drill programs at the Arctic deposit. The drill data collected during the Kennecott drilling programs (1965 to 1998) were logged on paper drill logs, copies of which are stored in the Kennecott office in Salt Lake City, Utah. Electronic scanned copies of the paper logs, in PDF format, are held by Trilogy Metals. Drill core was hydraulically split or cut with half core submitted to various assay laboratories and the remainder stored in Kennecott's core storage facility at the Bornite Camp. In 1995, Kennecott entered the drill assay data, information from the geologic core logs, and the downhole collar survey data into an electronic format. In 2006, NovaGold geologists verified the geologic data from the original paper logs against the Kennecott electronic format, and then merged the data into a Microsoft SQL database.

ALS Minerals was used for analyses submitted by Kennecott. Analyses were conducted primarily by Union Assay Office Inc. of Salt Lake City, Utah. At least six other labs were used during that time period, but mostly as check labs or for special analytical work.

10.3.2 NovaGold/NovaCopper/Trilogy Metals

Throughout Trilogy Metals' work programs, the following standardized core handling procedures have been implemented. Core is slung by helicopter to either the Dahl Creek (2004 to 2008) or Bornite (2011 to 2019) Camp core-logging facilities. Upon receiving a basket of core, geologists and geotechnicians first mark the location of each drilling block on the core box, and then convert footages on the blocks into metres. All further data capture is then based on metric measurements. Geotechnicians or geologists measure the intervals (or "from/to") for each box of core using the drilling blocks and written measurements on the boxes.

Geotechnicians fill out metal tags with the hole ID, box number and "from/to", and staple them to each core box. Geotechnicians then measure the core to calculate percent recovery and rock quality designation (RQD).

Geologists then mark sample intervals to capture each lithology or other geologically appropriate intervals. Geologists staple sample tags on the core boxes at the start of each sample interval and mark the core itself with a wax pencil to designate sample intervals. Sample intervals used are well within the width of the average mineralized zones in the resource area. This sampling approach is considered appropriate for the style of mineralization and alteration.

Core is logged with lithology and visual alteration features captured on observed interval breaks. Geological and geotechnical parameters are recorded based on defined sample intervals and/or drill run intervals (defined by the placement of a wooden block at the end of a core run). Logged parameters are reviewed annually and slight modifications have been made between campaigns, but generally include rock type, mineral abundance, major structures, SG, point load testing, recovery and rock quality designation measurements, and magnetic susceptibility. Mineralization data, including total sulfide (recorded as percent), sulfide type (recorded as an absolute amount), gangue and vein mineralogy are collected for each sample interval with an average interval of approximately 2 m. Structural data are collected as point data. Geotechnical data (core recovery, RQD) are collected over drill run intervals.

Drill hole data are recorded in a digital format and, after a QA/QC step, are forwarded to the Database Manager once QA/QC'd, who then imports them into the master database.

After logging, the core is digitally photographed and cut in half using diamond core saws. Specific attention to core orientation is maintained during core sawing to ensure the most representative sampling. Not all core is oriented; however, core that has been oriented is identified to samplers by a line drawn down the core stick. If core was not competent, it was split by using a spoon to transfer half of the core into the sample bag.

One-half of the core is returned to the core box for storage on site and the other half is bagged and labelled for sample processing and analysis. Select specific gravity measurements are also taken (refer to Section 11.4).

10.4 Geotechnical Drill Hole Procedures

Five HQ3 (61.1 mm) drill holes were completed during NovaCopper's 2011 geotechnical site investigation program. The holes were drilled using an LF 70 Boart-Longyear drill and were supervised by BGC on a 24-hour basis. Oriented core measurements were obtained using an ACT II tool. Constant rate injection and falling head packer tests were completed and vibrating wire piezometers (VWPs) equipped with single channel dataloggers (RST Instruments Ltd. DT2011 model) were installed. Geotechnical logging was completed at the drill site by BGC. Point load testing was completed by NovaCopper once the core had been flown by helicopter back to the Bornite Camp. Core sampling for laboratory testing was completed by both BGC and NovaCopper.

All drill holes received either a single or a nest of two VWPs with single channel dataloggers. The VWPs were lowered to a pre-selected depth attached to a string of polyvinyl chloride pipes, which was then used as a tremie tube to backfill the hole with cement-bentonite grout. Data from each VWP was recorded by a single channel datalogger with a storage capacity and battery life exceeding one year. Knowledge of the barometric pressure was required for accurate conversion of the vibrating wire piezometer data. A Solinst barologger was installed at AR11-0128 for this purpose. The barologger recorded continuously and downloaded at the same time as the VWP dataloggers. A thermistor was installed at AR11-0129 to monitor ground temperatures. A datalogger was not attached to this instrument, and therefore manual reading was required.

Geotechnical and hydrological drilling was completed as summarized in Section 9.7.

10.5 Collar Surveys

10.5.1 Kennecott

Kennecott provided NovaGold with collar coordinates for all historical holes in UTM coordinates using the NAD27 datum. NovaGold re-surveyed collars of selected historical holes in 2004 and again in 2008. The re-surveys showed little variation compared to the historical surveys.

10.5.2 NovaGold/NovaCopper/Trilogy Metals

Collar location coordinates were determined for the 2004 to 2016 NovaGold/Trilogy Metals drill campaigns with two Ashtech ProMark 2 GPS units using the Riley Vertical Angle Bench Mark (VABM; 611120.442E, 7453467.486N) as the base station for all surveys. Raw GPS data were processed with Ashtech Solutions 2.60 software. All surveyed data were collected in the NAD27 datum and later converted to NAD83.

A 2010 survey by a Registered Land Surveyor from WHPa observed differences between the 2010 and historical coordinates used for the Riley VABM, which were of the same magnitude (0.5 m east, 0.1 m north and 1.0 m down) as other Arctic drill collars that were re-surveyed for the third time. A correction was applied to all Arctic drill holes based upon the newly established coordinates for the Riley VABM, together with converting from NAD27 to NAD83 datums. All post 2010 surveys are completed in NAD83.

During Tetra Tech's 2013 site visit, nine drill collars were located using a Garmin™ Etrex 20 GPS unit. The difference between reported and measured positions ranged between 3.4 and 7.8 m with an average discrepancy of 4.8 m. These differences are within the tolerances expected for GPS verification.

A Registered Land Surveyor, Eric Cousino of Windy Creek Surveys, completed collar coordinate survey locations of the 2019 drilling in August 2019. The Horizontal Datum used on this project for point position determinations was NAD_83(CORS96)(EPOCH 2003), and the Vertical Datum is NAVD88 computed using Geiod09. Data were output into NAD83 Zone 4N (meters) using JAVAD Justin post-processing software.

10.6 Downhole Surveys

BCMC did not perform downhole surveys prior to 1971 (drill hole AR-32). In 1971, BCMC began to survey selected (mineralized) drill holes using a Sperry-Sun downhole survey camera usually at 30.5 m (100 ft) intervals. BCMC was able to re-enter and survey a few of the older drill holes. BCMC, and later Kennecott, applied a single azimuth (49°) and uniform dip deviation every 15.24 m (50 ft) that flattens with depth to all holes collared vertically that were not surveyed.

Downhole surveys from 2004 to 2017 were collected using either a Reflex EZ-shot camera or a Ranger single-shot tool with individual survey readings collected at the drill rig on approximately 30 to 60 m intervals. During the 2019 drill program, downhole surveys were collected using a continuous north seeking gyroscope with readings collected at the drill rig on roughly 30m intervals. The downhole survey data show a pronounced deviation of the drill holes toward an orientation more normal to the foliation.

10.7 Recovery

10.7.1 Kennecott

Incomplete Kennecott data exist with regards to overall core recovery but based on 917 intervals of 3.05 m or less in the historical database, the average recovery was 92%. Kennecott RQD measurements in the 1998 program averaged 87.0%. There has been no systematic evaluation of recovery by rock type.

10.7.2 NovaGold/NovaCopper/Trilogy Metals

Core recovery during NovaGold/NovaCopper/Trilogy Metals drill programs were good to excellent, resulting in quality samples with little to no bias. There are no other known drilling and/or recovery factors that could materially impact accuracy of the samples during this period.

Table 10-4 shows recoveries and RQD for each of the NovaGold/Trilogy Metals campaigns exclusive of the geotechnical drill holes in 2011.

Table 10-4 Recovery and RQD 2004 to 2008 Arctic Drill Campaigns

Year	Metres	Recovery (%)	RQD (%)
2004	2,996	98.0	73.4
2005	3,030	96.0	74.4
2007	2,606	95.7	73.1
2008	3,306	98.0	80.1
2011	1,193	96.0	68.8
2015	3,055	91.3	69.0
2016	3,058	91.5	69.7
2017	790	95.5	75.0
2019	2,433	96.3	77.1

10.8 Drill Intercepts

All drill holes at the Arctic deposit are collared on surface and are generally vertically oriented, or steeply inclined in a northeast direction. The majority of drill holes are spaced at 75 m to 100 m intervals, but there are rare instances where drill holes are located within 10 m of one another. Drill holes typically intersect the generally shallow-dipping mineralized horizon at approximately right angles.

10.9 Prospect Drilling

Significant exploration drilling has been carried out elsewhere on the Project targeting numerous occurrences along the Ambler Schist belt. Table 10-5 summarizes the drilling on the Project other than that completed on the Arctic deposit.

Figure 10-2 shows the locations of known major prospects and drill collar locations for the Ambler Mining District including the Trilogy Metals-controlled Ambler and Bornite sequence targets. Note that some of the drill holes are located outside the current land package held by Trilogy Metals.

Table 10-5 Drill, Meterage and Average Drill Depth for Trilogy Ambler Sequence VMS Targets

Area	Drill Holes (number)	Metres	Average Depth (m)
Dead Creek/West Dead Creek	21	3,470	165
Sunshine/Bud	42	8,468	201
Snow/Ambler	11	1,527	139
Horse/Cliff/DH	22	2,277	104
Red/Nora/BT	18	2,399	133
Total	114	18,141	148

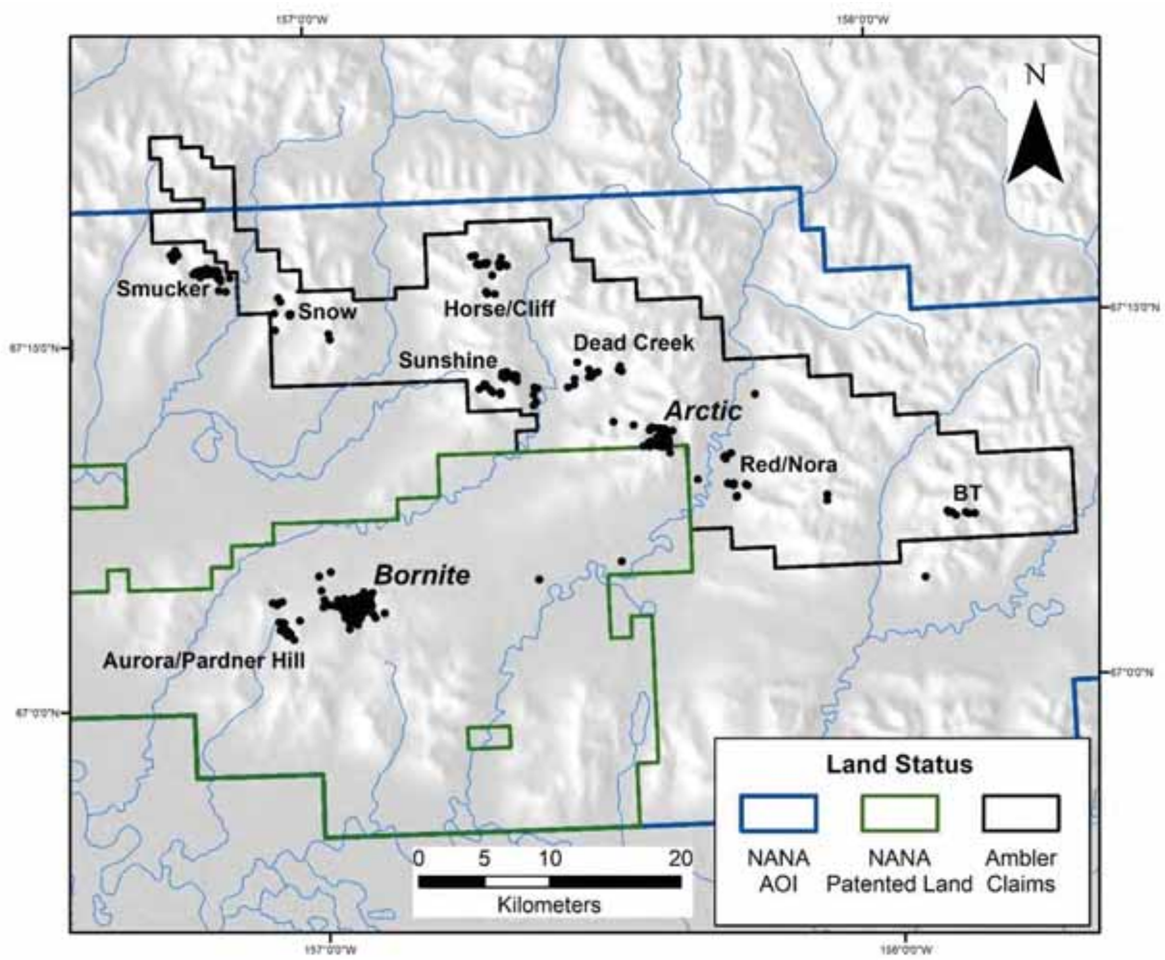


Figure 10-2 Collar Locations and Principal Target Areas – Ambler Mining District (Trilogy Metals, 2020)

There have only been three drill campaigns (2006, 2012, and 2019) as shown in Table 10-2 by Trilogy Metals targeting additional prospects beyond the Arctic deposit in the Ambler Schist belt.

Exploration in 2006 investigated a series of geophysical anomalies in the central portion of the Ambler Schist belt near the Arctic deposit. Twelve holes totalling 3,100 m were drilled. In 2012, Trilogy Metals drilled an additional four holes totalling 1,752 m to explore the down dip extension of the Sunshine prospect. In 2019, Trilogy Metals drilled six holes totalling 1,357 m to infill around the main deposit of the Sunshine prospect. All programs are summarized in Table 10-6 and Figure 10-3 shows the Sunshine prospect drill hole collar locations.

Table 10-6 Trilogy Metals Exploration Drilling – Ambler Schist Belt

Hole ID	Area	Target	UTM East	UTM North	Azimuth (°)	Dip (°)	Depth (m)
AR06-98	COU	EM Anomaly	609490	7454374	0	-90	712.6
AR06-99	98-3	EM Anomaly	610111	7458248	0	-90	420.0
AR06-100	98-3	EM Anomaly	609989	7458633	0	-90	225.6
AR06-101	Red	EM Anomaly	618083	7451673	0	-90	141.7
AR06-102	Sunshine	West Extension	601176	7457834	30	-65	97.8

Hole ID	Area	Target	UTM East	UTM North	Azimuth (°)	Dip (°)	Depth (m)
AR06-103	Red	EM Anomaly	618073	7451806	0	-90	209.7
AR06-104	Red	EM Anomaly	617926	7451693	0	-90	183.2
AR06-105	Red	EM Anomaly	618074	7451537	0	-90	136.6
AR06-106	Red	EM Anomaly	618083	7451677	310	-60	185.0
AR06-107	Sunshine	West Extension	601018	7458119	30	-60	294.4
AR06-108	Dead Creek	Downdip Extension	607618	7458406	0	-90	289.0
SC12-014	Sunshine	Sunshine Extension	601948	7457759	20	-57	537.8
SC12-015	Sunshine	Sunshine Extension	601860	7457637	20	-65	477.0
SC12-016	Sunshine	Sunshine Extension	601649	7457637	45	-77	386.2
SC12-017	Sunshine	Sunshine Extension	602063	7457701	20	-60	351.1
SC19-018	Sunshine	Sunshine Infill	601748	7457922	15	-52	296.3
SC19-019	Sunshine	Sunshine Infill	601748.2	7457923	0	-90	160.6
SC19-020	Sunshine	Sunshine Infill	601863.2	7457873	70	-48	230.4
SC19-021	Sunshine	Sunshine Infill	601862.2	7457872	70	-48	212.8
SC19-022	Sunshine	Sunshine Infill	601692.2	7457866	345	-80	203.6
SC19-023	Sunshine	Sunshine Infill	601691.6	7457868	345	-45	253.0

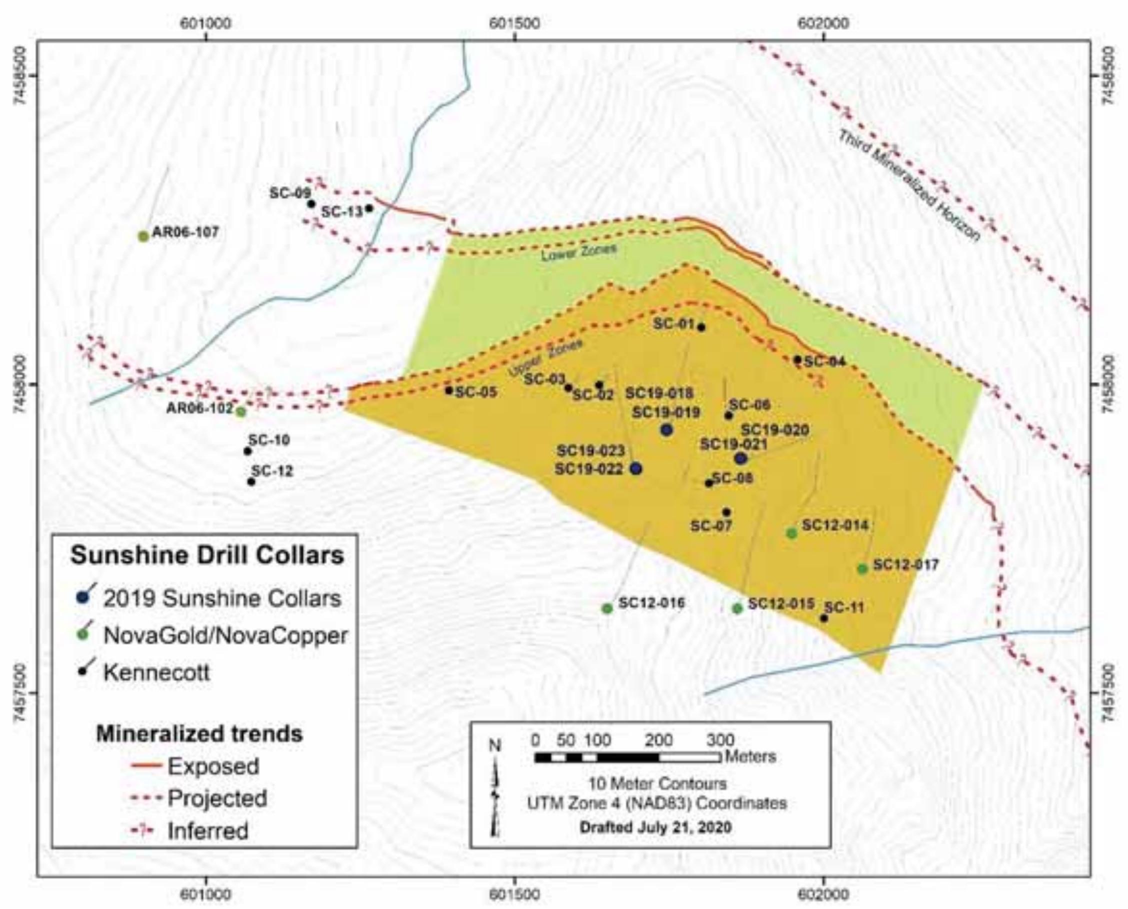


Figure 10-3 Sunshine Prospect and Drill Hole Locations (Trilogy Metals, 2020)

11 Sample Preparation, Analyses, and Security

11.1 Sample Preparation

11.2 Core

The data for the Arctic deposit were generated over three primary drilling campaigns: 1966 to 1986 when BCMC, a subsidiary of Kennecott was the primary operator, 1998 when Kennecott resumed work after a long hiatus, and 2004 to present under NovaGold. NovaCopper, and Trilogy Metals.

11.2.1 Kennecott and BCMC

Sampling of drill core prior to 1998 focused primarily on the mineralized zones; numerous intervals of weak to moderate mineralization were not sampled during this period. During the 1998 campaign, Kennecott did sample some broad zones of alteration and weak mineralization, but much of the unaltered and unmineralized drill core was left unsampled. Little documentation on historic sampling procedures is available.

11.2.2 NovaGold/NovaCopper/Trilogy Metals

Between 2004 and 2005, NovaGold conducted a systematic drill core re-logging and re-sampling campaign of Kennecott and BCMC era drill holes AR-09 to AR-74. NovaGold either took 1 to 2 m samples every 10 m, or sampled entire lengths of previously unsampled core within a minimum of 1 m and a maximum or 3 m intervals. The objectives of the sampling were to generate a full (ICP) geochemistry dataset for the Arctic deposit and ensure continuous sampling throughout the deposit.

From 2011 to the present, sample intervals are determined by the geological relationships observed in the core and limited to a 2.5 m maximum length and 1 m minimum length. Sample intervals terminate at lithological and mineralization boundaries. Sampling is generally continuous from the top to the bottom of the drill hole unless otherwise directed by the Exploration Manager. Occasionally, if warranted by the need for better resolution of geology or mineralization, smaller sample intervals may be employed. When the hole is in unmineralized rock, the sample length is generally 2.5 m, whereas in mineralized units, the sample lengths are shortened to 1 to 2 m.

Once the core is sawn, half is sent to ALS Minerals Laboratories (formerly ALS Chemex) in Vancouver for analysis, via the (ALS preparation facility in Fairbanks Alaska) and the other half is located in the core storage facility at the Bornite Camp facilities or at the Trilogy Metals warehouse in Fairbanks.

Control samples are inserted into the shipments at the approximate rate of one standard reference material (standard), one blank and one duplicate per 17 core samples:

- Standards: four standards per a drill campaign were used at the Arctic deposit. The core cutter inserted a sachet of the appropriate standard, as well as the sample tag, into the sample bag.
- Blanks: consist of an unmineralized landscape aggregate from 2004 to 2011 and unmineralized marble drill core from the Beaver Creek formation from 2015 to 2019. The core cutter inserted approximately 150 g of blank, as well as the sample tag, into the sample bag.

- Duplicates: the assay laboratory preforms an additional 250 g split from the crushed samples and runs both splits. The core cutter inserted a sample tag into an empty sample bag.

11.3 Acid-Base Accounting Sampling

In 2010, SRK collected 148 samples from drill core based on their position relative to the massive and semi-massive sulphide mineralization (SRK 2011). Samples were targeted within, immediately adjacent to, adjacent to, and between lenses of mineralization; the sampling program focused on characterization for a potential underground development scenario. Samples were shipped to SGS Canada Inc., Burnaby, BC, for sample preparation and analysis. Samples were analyzed for acid base accounting (ABA) and metals. ABA tests were conducted using the Sobek method with sulphur speciation and total inorganic carbon (TIC) analysis. Metal concentrations were determined using aqua regia digestion followed by ICP-MS analysis. In addition, barium and fluorine were analyzed by X-ray fluorescence (XRF) following a lithium metaborate fusion.

In 2015, Trilogy Metals retained SRK to provide metal leaching (ML) and ARD characterization services for the Arctic deposit. Activities focused on three objectives: 1) construction of on-site barrel tests and parallel humidity cells, 2) expansion of the ABA database to support future evaluation for ARD potential management for open pit mining, and 3) evaluation of the use of proxies for ABA parameters in the exploration database with the purpose of being able to use the exploration database for block modelling of ML/ARD potential, if needed. Barrel test samples were collected during July and August 2015 and eight on-site barrel tests (including two QC tests) were constructed and initiated in late August 2015. Following the set-up of the on-site barrel tests, representative composite rock samples were shipped to Maxxam Analytics of Burnaby, British Columbia and parallel humidity cells were initiated in late October 2015. Trilogy Metals and SRK selected 321 samples to be analyzed for a conventional static ABA package with a trace element scan using the same method as the exploration database (four-acid digestion). Samples were analyzed by Global ARD Testing Services of Burnaby, British Columbia.

In 2016, Trilogy Metals evaluated the distribution of the existing samples to select additional samples in preparation for block modelling of ML/ARD potential. A drill program was designed, and infill samples were collected from holes drilled in 2015 and 2016. This program was completed with 1004 samples analyzed for a conventional static ABA package with a trace element scan using the same method as the exploration database. Samples were analyzed by Global ARD Testing Services of Burnaby, British Columbia. The resulting data were combined with the previous datasets.

In 2018, the kinetic test program was expanded to further characterize ML/ARD potential. Samples were selected using the exploration geochemistry database, to target drill core with geochemical characteristics representing the range of compositions present in the database for key parameters such as sulfur and selenium. Kinetic testing was initiated in 2019 at Maxxam Analytics of Burnaby, BC, and the kinetic samples were also analyzed by static methods at Maxxam Analytics for ABA and metals by the same methods as the 2015 and 2016 programs, in addition to metal concentrations determined using aqua regia digestion followed by ICP-MS analysis.

As described above, several laboratories were used for acid base accounting studies and associated kinetic testwork as summarized in Table 11-1. Accreditations, where known, are listed below. All the labs are independent of NovaGold, NovaCopper, and Trilogy Metals.

Table 11-1 Analytical Laboratories used for Acid Base Accounting and Kinetic Studies for the Arctic Project

Laboratory Name	Laboratory Location	Years Used	Accreditation	Comment
SGS Canada Inc.	Burnaby, BC	2010	ISO 90001 and ISO/IEC 17025.	ABA samples
Global ARD Testing Services	Burnaby, BC	2015, 2016	ISO/IEC 17025	ABA samples
ARS Aleut Analytical	Anchorage and Fairbanks, AK	2015, 2016, 2017, 2018	Accreditations are not known.	Barrel test leachate samples
Maxxam Analytics (now Bureau Veritas)	Burnaby, BC	2015, 2016, 2017, 2018, 2019, 2020	ISO/IEC 17025	ABA samples (2015 and 2019), HCTs (2015 to 2020), and barrel test leachate samples (2019)

11.4 Density Determinations

Representative (SG) determinations conducted before 1998 for the Arctic deposit are lacking. Little information regarding sample size, sample distribution and SG analytical methodology are recorded for determinations during this period.

In 1998, Kennecott collected 38 core samples from that year's drill core, of which 22 were from mineralized zones and 16 from non-mineralized lithologies. Mineralized samples were defined as MS (more than 50% total sulphides), SMS (less than 50% total sulphides) or lithology samples (non-mineralized country rock containing up to 10% sulphides). SG determinations were conducted by ALS Minerals and Golder and Associates, and were based on short (6 to 12 cm) whole core samples. SG was determined based on the water displacement method.

In 1999, Kennecott collected 231 samples from pre-1998 drill core for SG analysis. The samples were from NQ- and BQ-sized core and averaged 7.27 cm in length. The samples were shipped to Anchorage but were not forwarded to a laboratory.

In 2004, NovaGold forwarded the 231 samples from the pre-1998 drill campaigns, stored in Kennecott's Anchorage warehouse, as well as 33 new samples from the 2004 drill program, to ALS Minerals for SG determination.

Additionally, in 2004 NovaGold collected 127 usable field SG measurements. Samples were collected from HQ-sized core and averaged 9.05 cm in length. An Ohaus Triple Beam Balance was used to determine a weight-in-air value for dried core, followed by a weight-in-water value. The wet-value was determined by suspending the sample by a wire into a water-filled bucket. The SG value was then calculated using the following formula:

$$\frac{\text{Weight in air}}{[\text{Weight in air} - \text{Weight in water}]}$$

In 2011, NovaGold geologists stopped collecting short interval "point data" (as described above) within the mineralized zone, and instead collected "full-sample-width" determinations from existing 2008 split core and all of the sampled 2011 whole core. The samples averaged 1.69 m in length. Samples were collected continuously within mineralized zones and within a 2 to 3 m buffer adjacent to mineralized zones. A total of 266 sample pulps were also submitted to ALS Minerals for SG determination by pycnometer analysis. In total, 459 valid SG determinations were collected, ranging from 2.64 to 4.99.

Between 2015 and 2019, Trilogy Metal geologists collected SG data consistent with the 2011 campaign. A total of 2,406 specific gravity measurements were collected, with SG values ranging from 2.01 to 4.96. The samples averaged 1.49 m in length. Samples were collected continuously within mineralized zones and within a 2 to 3 m buffer adjacent to mineralized zones.

11.5 Sample Security

Security measures taken during historical Kennecott and BCMC programs are unknown to NovaGold or Trilogy Metals. Trilogy Metals is not aware of any reason to suspect that any of these samples have been tampered with.

The 2004 to 2019 samples were either in the custody of NovaGold personnel or the assay laboratories at all times, and the chain of custody of the samples is well documented.

Shipment of core samples from site occurred on a drill hole by drill hole basis. Rice bags, containing two to four poly-bagged core samples each, were marked and labelled with the ALS Minerals address, project and hole number, bag number, and sample numbers enclosed. Rice bags were secured with a pre-numbered plastic security tie and a twist wire tie and then assembled into standard fish totes for transport by chartered flights on a commercial airline to Fairbanks, where they were met by a contracted expeditor for delivery directly to the ALS Minerals preparation facility in Fairbanks.

11.6 Assay Laboratories

At least six laboratories were used during the Kennecott/BCMC time period, but mostly as check laboratories or for special analytical work. Accreditations are not known. The laboratories were independent of Kennecott/BCMC. Bondar Clegg, now ALS Minerals, was used for analyses conducted by Kennecott. During the BCMC work, analyses were conducted primarily by Union Assay Office Inc. of Salt Lake City, Utah.

ALS Minerals is accredited for a number of specific test procedures including fire assay of gold by atomic absorption (AA), ICP, or gravimetric finish, multi-element ICP and AA assays for silver, copper, lead and zinc. ALS Minerals is independent of NovaGold, NovaCopper, and Trilogy Metals.

The laboratories used during the various exploration, infill, and step-out drill analytical programs completed on the Arctic Project are summarized in Table 11-2.

Table 11-2 Analytical Laboratories Used by Operators of the Arctic Project

Laboratory Name	Laboratory Location	Years Used	Accreditation	Comment
Union Assay Office, Inc.	Salt Lake City, Utah	1968	Accreditations are not known.	Primary Assay laboratory
Rocky Mountain Geochemical Corp.	South Midvale, Utah	1973	Accreditations are not known.	Primary and secondary assays
Resource Associates of Alaska, Inc.	College, Alaska	1973, 1974	Accreditations are not known.	Primary and secondary assays
Georesearch Laboratories, Inc.	Salt Lake City, Utah	1975, 1976	Accreditations are not known.	Primary and secondary assays
Bondar-Clegg & Company Ltd.	North Vancouver BC	1981, 1982	Accreditations are not known.	Primary and secondary assays
Acme Analytical Laboratories Ltd. (AcmeLabs)	Vancouver, BC	1998, 2011,	Accreditations are not known.	2012 and 2013 secondary check sample lab
SGS Canada Inc.	Burnaby, BC	2010	ISO 90001 and ISO/IEC 17025.	2015 to 2019 secondary check lab

Laboratory Name	Laboratory Location	Years Used	Accreditation	Comment
ALS Analytical Lab	Fairbanks, Alaska (prep) and Vancouver, BC (analytical)	1998, 2004, 2005, 2006, 2007, 2008, 2011, 2012, 2013 2015, 2016, 2017, 2018, 2019	In 2004, ALS Minerals held ISO 9002 accreditations but updated to ISO 9001 accreditations in late 2004. ISO/International Electrotechnical Commission (IEC) 17025 accreditation was obtained in 2005.	2004 - 2019 primary assay laboratory

11.7 Sample Preparation and Analytical Methods

Samples from the NovaGold/Trilogy Metals programs were logged into a tracking system on arrival at ALS Minerals, and weighed. Samples were crushed to 70% passing 2mm, dried, and a 250 g split pulverized to greater than 85% passing 75 µm.

Gold assays were determined using fire assay fusion followed by an atomic absorption spectroscopy (AAS) finish. The lower detection limit is 0.005 ppm gold; the upper limit is 1,000 ppm gold. An additional 49-element suite is assayed by inductively coupled plasma-mass spectroscopy (ICP-MS) methodology, following 4-acid digestion. The copper, zinc, lead, and silver analyses were completed by atomic absorption (AA), following a triple acid digest, when overlimits occur in the ICP-MS analysis. Barium is completed by Fusion XRF where requested.

11.8 Quality Assurance/Quality Control

11.8.1 Core Drilling Sampling QA/QC

Previous data verification campaigns were limited in scope and documentation and are described by SRK (2012).

During 2013, Trilogy Metals conducted a 26% audit of the NovaGold era assay database fields: sample interval, gold, silver, copper, zinc, and lead. This audit is documented in a series of memoranda (West 2013). Trilogy Metals staff did not identify and/or correct any transcription and/or coding errors in the database prior to resource estimation. Trilogy Metals also retained independent consultant Caroline Vallat, P.Geo. of GeoSpark Consulting Inc. (GeoSpark) to: 1) re-load 100% of the historical assay certificates, 2) conduct a QA/QC review of paired historical assays and NovaGold era re-assays; 3) monitor an independent check assay program for the 2004 to 2008 and 2011 drill campaigns; and 4) generate QA/QC reports for the NovaGold era 2004 to 2008 and NovaCopper/Trilogy Metals era 2011, 2015, 2016, 2017, and 2019 drill campaigns. The following subsections provide a summary of the results and conclusions of the GeoSpark QA/QC review.

11.8.2 NovaGold QA/QC Review of Historical Analytical Results

During 2004 and 2005, NovaGold conducted a large rerun program and check sampling campaign on pre-NovaGold (pre-2004) drill core. The 2004 and 2005 ALS Minerals primary sample results were assigned as the primary assay results in the database, amounting to 1,287 of the total 3,186 primary samples related to pre-NovaGold drill holes.

During 2013, GeoSpark conducted a QA/QC review of available QA/QC data, including sample pair data amounting to 422 data pairs which is 11% relative to the primary sample quantity. The sample pairs included original duplicates, original repeat assays, 2004 rerun assays on original sample pulps analyzed secondarily at ALS Minerals, and check samples from 2004 on original samples analyzed at ALS Minerals.

The review found that the available QA/QC data is related to drill holes that are spatially well distributed over the historic drill hole locations (Figure 11-1).

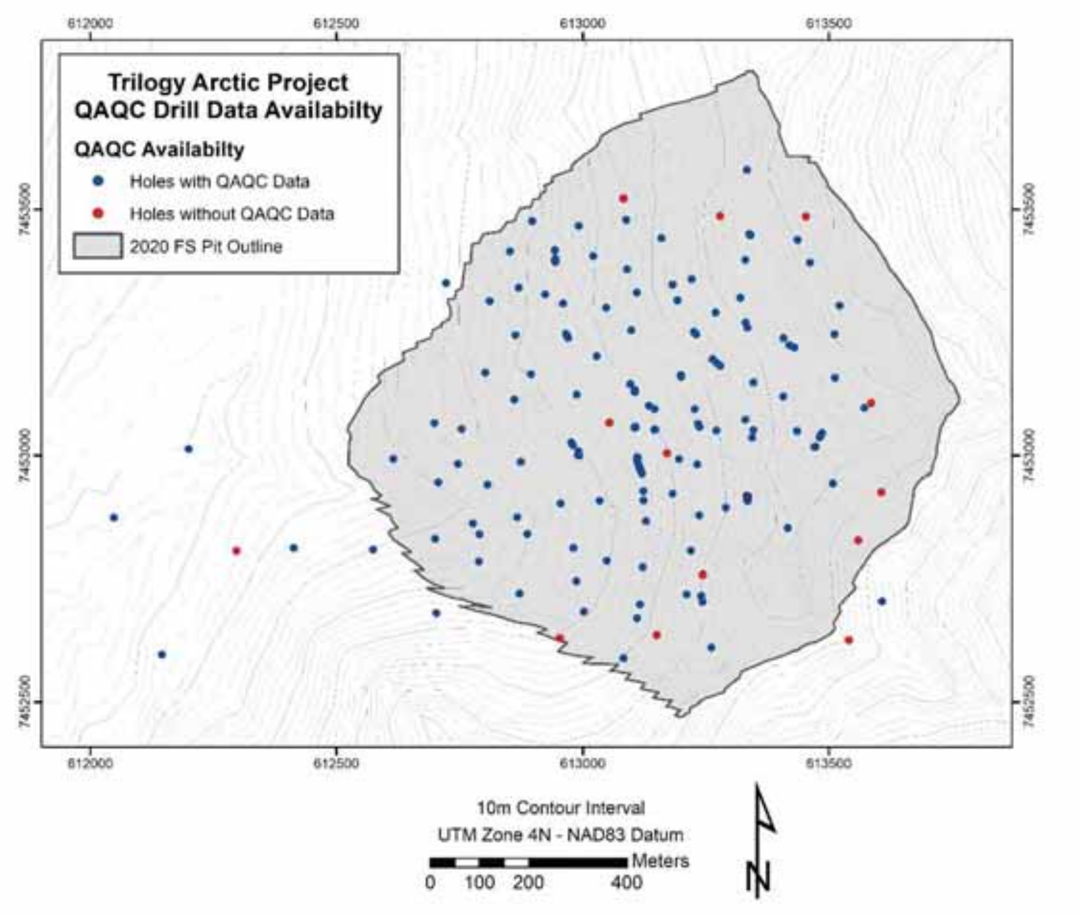


Figure 11-1 Spatial Availability of QA/QC Data (Trilogy Metals, 2019)

11.8.2.1 Review of Precision

A comparison of the original analytical results with the secondary results serves to infer the level of precision within the original results. The 2004 rerun sample results and the check sample pair results from 2004 and 2005 were compared to the original assays to infer the level of repeatability or precision within the original results.

The result of the average relative difference (AD) review on sample pairs found satisfactory to good inferred precision levels for all of the sample pairs and elements except for the 2004 rerun sample lead results. For the lead 2004 rerun sample pairs there were 66.85% of the pairs less than the 1 AD limit, inferring poor precision in the original results. Overall, the lead values were found to pass the AD criteria for the original duplicates, original repeats, and check sample reviews. More insight was made regarding the lead precision upon review of the data pairs graphically within scatter plots and Thompson-Howarth precision versus concentration (THPVC) plots. The 2004 rerun sample lead values were found to infer a poor-to-moderate level of precision and there was an indication that the original results might bhave a negative bias because the original results reported on average 0.2% less than their true values for grades of 0.5% lead and higher. However, the original duplicate, original repeats, and check samples inferred that there was a moderate or satisfactory level of correlation within the lead values. Furthermore, the overall inference of precision in the lead values has been defined as moderate.

The detailed review of the gold pairs inferred an overall moderate level of precision within the original analytical results.

The silver, copper, and zinc analytical pair review found overall inferred strong precision in the original analytical results.

It was GeoSpark's opinion that the detailed review of analytical pair values reported for gold, silver, copper, lead and zinc has inferred an overall acceptable level of precision within the original sample analytical results for the pre-NovaGold data.

11.8.2.2 Review of Accuracy

The rerun sample program of 2004 included analysis of 53 QA/QC materials comprising 20 standards and 33 blanks. These standards and blanks were reviewed in order to indirectly infer the accuracy within the original sample data.

The 2004 rerun samples on original pulps also included analysis of standards and blanks with the primary samples. These results have been reviewed using control charts for review of the inferred accuracy within the 2004 rerun sample results; in addition, the inferred rerun sample accuracy is related to the accuracy of the original results in that comparison of the original results to the 2004 reruns and has been shown to be acceptable overall.

The blank results were reviewed for gold, silver, copper, lead, and zinc values and it has been inferred that there is good accuracy within the results and that there was no significant issue with sample contamination or instrument calibration during the analysis.

The standard results were reviewed for gold, silver, copper, lead, and zinc values. The reported control limits were available for silver, copper, lead, and zinc. The gold control limits were calculated for the review.

In addition, upon initial review, the zinc control limits were also calculated from the available data to provide a more realistic range of control values for the results. The gold, silver, and copper results were inferred to be of strong accuracy. The lead and zinc results were inferred to be of moderate accuracy overall.

It was GeoSpark’s opinion that the review for accuracy has found an acceptable level of inferred accuracy within the gold, silver, copper, lead, and zinc results reported for the 2004 rerun samples and indirectly within the original results.

11.8.2.3 Review of Bias

There were 35 check samples on original samples re-assayed at ALS Minerals during 2004. These were reviewed for an indication of bias in the original results. Additionally, the 2004 rerun sample results have been reviewed for inference of bias in the original results.

Overall, the detailed review of the check sample pair gold concentrations has found minor positive bias in the 2004 pairs and minor positive bias in the 2005 pairs. The level of bias is inferred to be at very near zero with the original being reported approximately 0.005% greater than the 2004 results reported by ALS Minerals. The 2004 rerun samples compared to the originals has inferred negligible bias in the original gold results. It was GeoSpark's opinion that these levels of inferred bias are not significant to merit concern with the overall quality of gold values reported for the pre-NovaGold Arctic Project.

The detailed review of the check sample silver pairs has found minor negative bias implied by the 2004 check sample pairs. The 2004 rerun samples have shown a negligible amount of bias in the original results. It was GeoSpark’s opinion that overall, the bias in original silver concentrations is inferred to be negligible to minor negative but not significant to merit concern of the overall quality of the silver results.

The copper check samples reported in 2004 were found to have a few anomalous results that were implying significant positive bias. However, a more detailed review found that the exclusion of the anomalous pairs resulted in a minor positive bias overall. The 2004 rerun sample copper results have shown that there is a possibility for positive bias in the original copper grades at concentrations greater than 5%. Overall, it was GeoSpark’s opinion that the bias inferred within the original copper results is not significant to merit concern with the original assay quality.

The 2004 check sample review inferred overall small negative bias in the original lead results. The 2004 rerun sample data also inferred that there was a small negative bias in the original results for lead grades over 0.5%. Overall, it was GeoSpark’s opinion that this detailed review has inferred that the levels of inferred bias within the lead concentrations are not significant enough to merit concern over the original result quality.

The original zinc results have been inferred to be of very minor positive bias when the 2004 check sample pairs (excluding three anomalous pairs) are reviewed. The 2004 rerun sample zinc values have been shown to be very comparable with the originals and a negligible amount of bias can be inferred in the original zinc concentrations. Furthermore, this detailed bias review has inferred that there is no significant bias in the original zinc results for the pre-NovaGold Arctic Project.

11.8.2.4 Conclusion

The pre-NovaGold database analytical results were verified and updated to provide a good level of confidence in the database records.

It was GeoSpark’s opinion that with consideration of the historic nature of the data, a sufficient amount of QA/QC data and information has been reviewed to make a statement on the overall pre-NovaGold analytical result quality.

It was GeoSpark’s opinion that this detailed review has inferred that the pre-NovaGold Arctic Project analytical results are of overall acceptable quality.

11.8.3 QA/QC Review, NovaGold/NovaCopper/Trilogy Metals (2004 to 2013) Analytical Results

During 2013, GeoSpark conducted a series of QA/QC reviews on analytical results collected between 2004 and 2013. These QA/QC reviews serve to infer the precision of the analytical results through a detailed analytical and statistical review of field duplicate samples; serve to infer the accuracy of the analytical results through a review of the standards and blanks inserted throughout the Trilogy Metals programs; and serve to define any bias in the primary sample results through a review of secondary laboratory checks at Acme.

The QA/QC reviews are documented in a series of memoanda (Vallat 2013c, 2013d, 2013e, 2013f, 2013g, 2013h). The reviews are summarized in the following subsections by year of campaign.

11.8.3.1 2004

The 2004 exploration program included drilling and sampling of 11 drill holes AR04-0078 through AR04-0088, amounting to 989 primary samples assayed within 61 assay certificates reported by ALS Minerals.

The pulp duplicate pairs were reviewed analytically using an AD guideline to gauge the inferred level of precision within the results. This review found that the gold, silver, copper, lead and zinc grades were reported with less than 0.3 AD for at least 75% of the sample pairs. This showed acceptable repeatability or precision throughout.

Scatter plots and THPVC plots were reviewed. The scatter plots showed moderate to good precision within the gold grades, and acceptable precision within the silver, copper, lead, and zinc grades reported by ALS Minerals during 2004. The THPVC review found an inferred poor level of repeatability within the gold results, but further review showed that the precision percent was exaggerated due to the low gold grades reported for the samples. It was GeoSpark’s opinion that the THPVC review of the gold was an unreliable measure of the precision due to the low grades and that the earlier analytical tests and scatter plot results were more representative of the inferred precision for the gold results.

The THPVC review found acceptable repeatability of precision within the silver, copper, lead, and zinc concentrations reported by ALS Minerals during 2004.

Overall, the precision were inferred to be good for the gold, silver, copper, lead, and zinc concentrations reported by ALS Minerals during 2004.

The gold analytical results reported by ALS Minerals for the 2004 were inferred to be of acceptable accuracy. The silver, copper, lead, and zinc values have been inferred to have moderate or satisfactory accuracy. In addition, the review showed no significant ongoing issues with sample contamination or instrument calibration.

The check sample review found no bias inferred within the gold and silver grades reported for the 2004 program. A small level of positive bias was inferred within the copper, lead, and zinc results reported from high-grade samples. The copper and lead bias may be attributable to the assay methodology. The zinc bias is more likely a reflection of a lack of repeatability at high grades. It was GeoSpark’s opinion that the levels of bias were not significant enough overall to merit concern with the sample result quality.

11.8.3.2 2005

The 2005 exploration program included drilling and sampling of nine drill holes, AR05-0089 through AR05-0097, amounting to 1,228 primary samples assayed within 36 assay certificates reported by ALS Minerals.

The review of pulp duplicates, blanks and standards, and check samples during allowed for inference of a reasonable level of precision, good accuracy, and insignificant levels of bias within the primary sample results reported by ALS Minerals related to the 2005 data.

This detailed QA/QC review on the analytical results reported during 2005 allowed for overall confidence in the analytical result quality.

The analytical results can be inferred to be of sufficient quality to represent the support Mineral Resource estimation.

11.8.3.3 2006

The 2006 exploration program included drilling and sampling of 12 drill holes, AR06-98 through AR06-109, amounting to 1,175 primary samples analyzed at ALS Minerals.

The review of pulp duplicates, blanks and standards, and check samples for the 2006 program allowed for inference of a good level of precision, good accuracy, and insignificant levels of bias within the primary 2006 sample results reported by ALS Minerals.

The analytical results can be inferred to be of sufficient quality to support Mineral Resource estimation.

11.8.3.4 2007

The 2007 exploration program included drilling and sampling related to four drill holes, AR07-110 through AR07-113, amounting to 950 primary samples analyzed at ALS Minerals.

The review of pulp duplicates, blanks and standards, and check samples for the 2007 program allowed for inference of a good level of precision, good accuracy, and insignificant levels of bias within the primary sample results reported by ALS Minerals.

The analytical results can be inferred to be of sufficient quality to Mineral Resource estimation.

11.8.3.5 2008

The 2008 exploration program included drilling and sampling related to 14 drill holes, AR08-0114 through AR08-0126 and also drill hole AR08-0117w, amounting to 1,406 primary samples assayed within 44 assay certificates reported by ALS Minerals.

The review of pulp duplicates, blanks and standards, and check samples for the 2008 program allowed for inference of a reasonable level of precision, good accuracy, and insignificant levels of bias within the primary sample results reported by ALS Minerals.

The analytical results can be inferred to be of sufficient quality to Mineral Resource estimation.

11.8.3.6 2011 (analyzed in 2013)

Laboratory assay certificates FA13021131, FA13021132, FA13021133, FA13021134, and FA13021135 included results for six pulp duplicate pairs, six blank instances, and three standards. There were analyzed by Geospark.

The duplicates for gold, silver, copper, lead, and zinc were found to correlate well with the primary sample results and it can be inferred that the primary results are of good precision.

Each of the blanks was analytical values within the control limits for the material. There are no issues with sample contamination and instrumentation difficulties. In addition, the accuracy can be inferred to be acceptable.

Each standard returned within the acceptable range for gold, silver, copper, lead, and zinc values; it is inferred that there is strong accuracy within the reported primary sample assay results.

A detailed review of secondary laboratory check sample results reported by ALS Minerals for the 2011 drill holes assayed in 2013 showed that the gold, silver, copper, lead, and zinc results indication of material bias.

The assays within the laboratory certificates that were reviewed by GeoSpark were inferred to be suitable to support Mineral Resource estimation.

11.8.4 QA/QC Review, Trilogy Metals (2015 to date) Analytical Results

11.8.4.1 2015

Analytical results from 29 analytical certificates from ALS Minerals were added to the NovaCopper Inc. database. Each of the analytical batches in the ALS Minerals analytical certificates was checked for inferred precision and inferred accuracy through detailed review of pulp duplicate, blank, and standard assay results that were reported within the sample batches.

The pulp duplicate sample pairs were statistically reviewed using an AD comparison. The pulp duplicate pairs were also reviewed within scatter plots displaying the correlation within the sample pairs. Any significant differences within the duplicate pairs resulted in detailed review of the sample assays and any issues were fixed where possible.

This review found that the duplicate pairs were well correlated overall, and it was inferred that there was good precision within the reported copper, silver, gold, lead, and zinc assay results reported by ALS Minerals.

The field standard and blank results were reviewed and defined as failures when results were in excess of plus and minus three standard deviations from the expected mean for the standard. Failing blanks or standards were re-analyzed together with the adjacent samples in order to address potential accuracy deficiencies and to maintain quality assays in the database.

Detailed review of the 67 reported blank issues inferred that with an overall passing rate of 92.5% there is overall acceptable accuracy within the reported low- grade copper, silver, gold, lead, and zinc results. In addition, the review showed that there were no significant or unresolved issues with sample contamination or instrument calibration deficiencies.

The review of the standards found that overall, with 95.65% of the results within the control limits, Geospark considered that good accuracy could be inferred within the reported copper, silver, gold, lead, and zinc assays.

Secondary laboratory check samples were analyzed at SGS Burnaby. The secondary laboratory check samples were carefully selected to represent the data population using a random selection of 5% of the samples within percentile range groups. The check sample assays were compared to the primary laboratory assays to check for bias.

Statistics of the check samples compared to the primary samples demonstrated good correlation within the data pairs.

The average differences were calculated for the check sample pairs. It was inferred that the copper grades reported by ALS Minerals had a negative bias. Results reported by ALS Minerals were, on average 0.02% less than the SGS Burnaby results. A detailed review of the difference plot showed that the inferred bias begins at a copper grade of 4.42% Cu. It appears that the SGS methodology may be reporting slightly higher copper grades above 4.42% Cu. However, the statistics and scatter plot show a strong repeatability at these higher grades. The QP concluded that the ALS Minerals results were acceptable.

The zinc results reported by ALS Minerals at zinc grades >1.07% were inferred to be biased because the AD showed a bias level of 0.068% Zn at these grade levels when compared to SGS Burnaby. The scatter plot also showed this bias, but the correlation within the results was good even at higher zinc grades. An AD chart showed that the samples with zinc grades < 1.07% had negligible bias. Ultimately it appears that the analytical methods used by SGS Burnaby may have produced slightly lower zinc grades compared to of the analytical procedures used by ALS Minerals. Geospark considered that the zinc results reported by ALS Minerals were not significantly biased and the zinc results from ALS Minerals determinations were, overall, of good quality. This opinion was based on by the strong correlation shown within the data statistics and the scatter plot.

Geospark concluded that the silver, gold, and lead check sample assays had insignificant bias levels.

The 2015 data were considered acceptable to support Mineral Resource estimation.

11.8.4.2 2016

Results from 30 laboratory analytical certificates from ALS Minerals were added to the database in 2016.

Each of the analytical batches in the ALS Minerals analytical certificates was reviewed for inferred precision and inferred accuracy through detailed review of field duplicate, blank, and standard assay results that were reported within the sample batches.

One of the assay certificates (VA16159436) was specific to metallurgical samples (MET_WCORE). This certificate was reviewed using the internal laboratory QA/QC data. Geospark found that the internal laboratory QA/QC had all passing duplicates showing good precision within the assays. The review found all blank and standard instances passed the laboratory’s control tests inferring that the assays had acceptable accuracy.

The pulp duplicate sample pairs were statistically reviewed and using an AD comparison. The pulp duplicate pairs were also reviewed using scatter plots.

The duplicate pairs were well correlated overall, and it was inferred that there was strong precision within the reported copper, silver, gold, lead, and zinc assay results reported by ALS Minerals.

The standard and blank instances were reviewed and defined as failing when results were in excess of plus and minus three standard deviations from the expected mean for the standard. Failing blanks or standards were re-analyzed along with the adjacent samples to address potential accuracy deficiencies and to maintain quality assays in the database. Initial review of the assay certificates as they were reported identified a few instances of failing standards; for any fails the adjacent samples were also rerun.

Detailed review of the 58 blanks inferred that with all instances passing control test percentages, there is acceptable accuracy within the reported low-grade copper, silver, gold, lead, and zinc results. In addition, the review showed that there were no significant or unresolved issues with sample contamination or instrument calibration deficiencies.

The standards review found that for all assay certificates where the internal laboratory standards were reviewed the copper, silver, gold, lead, and zinc results were of acceptable accuracy. The internal standards also displayed good accuracy overall within the copper, silver, gold, lead, and zinc primary sample assay results.

Secondary laboratory check samples were analyzed at SGS Burnaby. These secondary laboratory check samples were selected to represent the data population using a random selection of 5% of the samples within percentile range groups. The check sample assays were compared to the primary laboratory assays for bias checks.

Check samples statistics of the compared to the primary samples showed good correlation within the data pairs. The average differences were calculated for the check sample pairs and these do not indicate any significant bias.

Geospark concluded that the copper assays on check sample pairs do not infer any bias.

There is a small level of implied bias (approximately 3.38 g/t lower silver grades in ALS Minerals results) for higher grade (> 12.85 Ag g/t) silver results, but Geospark's opinion was that this was not to an extent where concern was merited.

The gold assays on check sample pairs show overall good correlation and Geospark concluded that there was no indication of bias in the results.

Geospark's opinion was that the review of lead results for the check sample pairs shows no indication of bias.

Considering the entire review of check sample zinc results, Geospark concluded that the level of inferred bias (average of 0.12% Zn higher in ALS results when the over limit analysis methodology was used) does not show any need for concern with the overall primary lab zinc assay result quality.

GeoSpark concluded that the copper, silver, gold, lead, and zinc results for the 2016 exploration program were acceptable for use in Mineral Resource estimation.

11.8.4.3 2017

Five analytical certificates were added to the Arctic database, these were analyzed at ALS in Vancouver, BC following sample preparation by ALS in Fairbanks, Alaska. The analysis of the drill core samples for copper, silver, lead, and zinc was performed using four acid digest ICP-MS analytical methodology. Gold assays were performed using fire assay with an atomic absorption finish.

Duplicate pairs have been reviewed for reported assay precision. It has been inferred that there is strong precision within the reported silver, copper, lead, zinc, and gold results.

The blank instances were reviewed and it has been inferred that there is strong accuracy within the reported low grade assay results and in addition significant issues with sample contamination or instrument calibration have been ruled out.

Each of the standard instances of analysis was reported within the defined control limits for the standards and it is inferred that there is strong accuracy within the reported silver, copper, lead, zinc, and cobalt assay results.

Overall, the certificates under review have passed this QA/QC review and the results can be considered of sufficient quality to represent the Trilogy Metals Inc. Arctic Project.

11.8.4.4 2018

No QC/QA review was not conducted as the 2018 program comprised soil samples that were collected from site facilities locations that were well outside of the resource estimate area.

11.8.4.5 2019

Fifteen analytical certificates from ALS Minerals were added to the database.

The certificates were reviewed for inferred precision and inferred accuracy through detailed review of field duplicate, blank, and standard assays reported within the sample batches.

Sample pair data was compared using scatter plots. In addition, statistical results of the AD were used to define any pair with poor correlation.

The pulp duplicate pairs amounted to 36 total pairs. The data pairs compare well overall and Geospark's opinion was that good precision can be inferred within the primary gold, silver, copper, lead, and zinc assays reported by ALS Minerals.

The field standard and blank instances were reviewed and defined as failing when results were in excess of plus and minus three standard deviations from the expected mean for the standard material. Failing blanks or standards were re-analyzed along with the adjacent samples to address potential accuracy deficiencies and to maintain quality assays in the database. Initial review of the assay certificates as they were reported found a few instances cases of standard failures; for any failed instances the adjacent samples were also rerun.

Detailed review of the 37 blanks inferred that with all instances passing control test percentages there is overall acceptable accuracy within the reported low-grade copper, silver, gold, lead, and zinc results. There were no significant or unresolved issues with sample contamination or instrument calibration deficiencies.

A review of the 34 standards was completed. There were five standard types reviewed allowing for a good range of the assays results to be assessed. Three standard instances were incorrectly identified as inferred by the differences between the reported assay values and the expected results. These standards are 1131017, 1134621, and 1134876. Results were consistent with each other but were not consistent with any identified standards. Geospark concluded that these might be the case of human error resulting in the wrong and unknown material being analyzed. Each of these values has been re-identified in the database as UNKN (implying unknown) standard ID. This has been reviewed with Trilogy Metals staff to ensure that the database is corrected. There was one instance of analysis out of the total 34 that was found to be likely contamination from the previous sample being very high-grade, but since the other elements reviewed passed the control tests Geospark's opinion was that reruns were not required. Overall it was inferred that there was acceptable accuracy within the reported primary assays (gold, silver, copper, lead, and zinc) for the drill holes under review.

Secondary laboratory check samples were analyzed at SGS Burnaby. These secondary laboratory check samples were selected to represent the data population using a random selection of 5% of the samples within percentile range groups. These check sample assays were compared to the primary laboratory assays for bias. GeoSpark states that the secondary lab check samples assayed at SGS in Burnaby, BC, Canada have shown no significant inferred bias inferred within the primary sample gold, silver, copper, lead, and zinc, analytical results reported by ALS Global lab in Vancouver, BC, Canada.

11.8.5 Density Determinations QA/QC

A QA/QC review of the SG dataset for the Arctic deposit was conducted by NovaCopper staff in March 2013

11.8.5.1 Laboratory versus Field Determinations

SG laboratory determinations conducted during 2004 produced significantly lower average SG results for the mineralized zone than the 1998 and 2004 average field determinations. In the same test, lithology samples outside the mineralized zone produced comparable values. The difference between the averaged 1998 and 2004 laboratory results and those from field studies may be the result of selection bias, limited population size, and sample length. Paired laboratory and field determinations from the 2004 program show very low variation.

In 2010, to check the validity of the wet-dry measurements on the Arctic deposit core with respect to possible permeability of the core samples, NovaGold measured 50 unwaxed samples representing a full range of SG values for a variety of lithologies and then submitted the samples to ALS Minerals for wet-dry SG determinations after being sealed in wax. The mean difference between the NovaGold unwaxed and the ALS Minerals waxed SG determinations was 0.01.

In 2011, to check the accuracy of the wet-dry measurements, the SG for 266 pulps was determined by pycnometer by ALS Minerals (ALS code OA-GRA08b). Figure 11-2 shows that the two methods compare favourably, with the wet-dry measurements displaying a very slight low bias. Generally, wet-dry measurements are considered the more acceptable method for accurate SG determinations since they are performed on whole (or split) core that more closely resembles the in-situ rock mass.

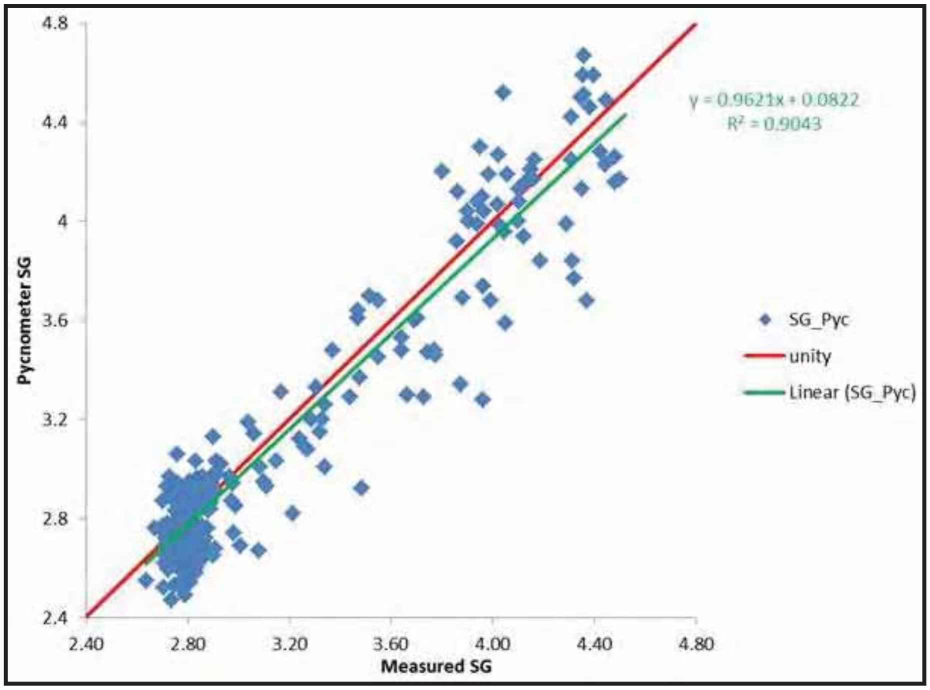


Figure 11-2 **Graph Showing Good Agreement between Wet-dry Measured Specific Gravity and Pycnometer Measured Specific Gravity (West, A., 2014)**

11.8.5.2 Stoichiometric Method

Full sample length determinations can be directly compared to the assay results for copper, zinc, lead, iron, and barium that are the major constituents of the sulphide and sulphate species for the Arctic deposit. This allowed NovaCopper to check the wet-dry measurements by estimating the SG for an ideal stoichiometric distribution of the elements into sulphide and sulphate species.

Stoichiometric SG values were estimated for 279 sample intervals from 2008 drill core that had both measured SG values and total digestion XRF barium values. Figure 11-3 compares the estimated stoichiometric SGs to the measured SGs. Overall, there is a very good correlation between the two SG populations (R2 of 0.9671), although the stoichiometric estimates are slightly lower with increasing SG. Using slightly different compositional values for the assorted sulphide and sulphate species, and assuming a 1:1 ratio of weight percent iron to weight percent copper in chalcopyrite (the molar value is 1:1), the stoichiometric equation yields SGs that have an even better correlation (R2=0.9726), due to partitioning more iron into less dense chalcopyrite which leaves less iron available for more dense pyrite, essentially correcting the bias for the lack of estimated iron-bearing silicates.

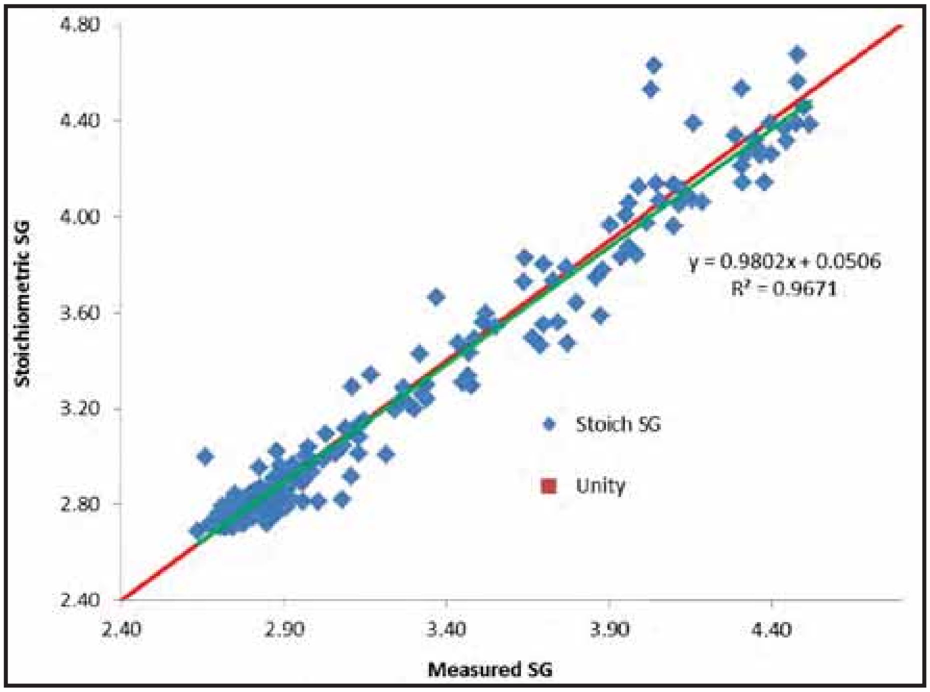


Figure 11-3 Measured versus Stoichiometric Specific Gravities (West, A., 2014)

11.8.5.3 Multiple Regressions Method

The positive comparisons/correlations of the measured SG values to the laboratory determined values and to the stoichiometric estimated values provided high confidence in the wet-dry measurements. As a result, a multiple regression analysis can be performed using the assay data to get a best fit to the measured SGs. This may correct for the varying residencies of iron and barium (and also for the varying density within sphalerite due to the Zn:Fe ratio).

The best fit to the data was achieved by using the multiple regression tool in Microsoft Excel on barium, iron, zinc, and copper for the entire dataset (Figure 11-4). The estimate correlates very well (R2=0.9678) with observed data and has a sinusoidal pattern that fits the low and moderately high SG very well and has high bias for moderate SG values and a low bias for very high SG values. The resultant SG formula is as follows:

$SG_{(Regression)} = 2.567 + 0.0048{*}Cu_{(wt\%)} + 0.045{*}Fe_{(wt\%)} + 0.032{*}Ba_{(wt\%)} + 0.023\%{*}Zn_{(wt\%)}$

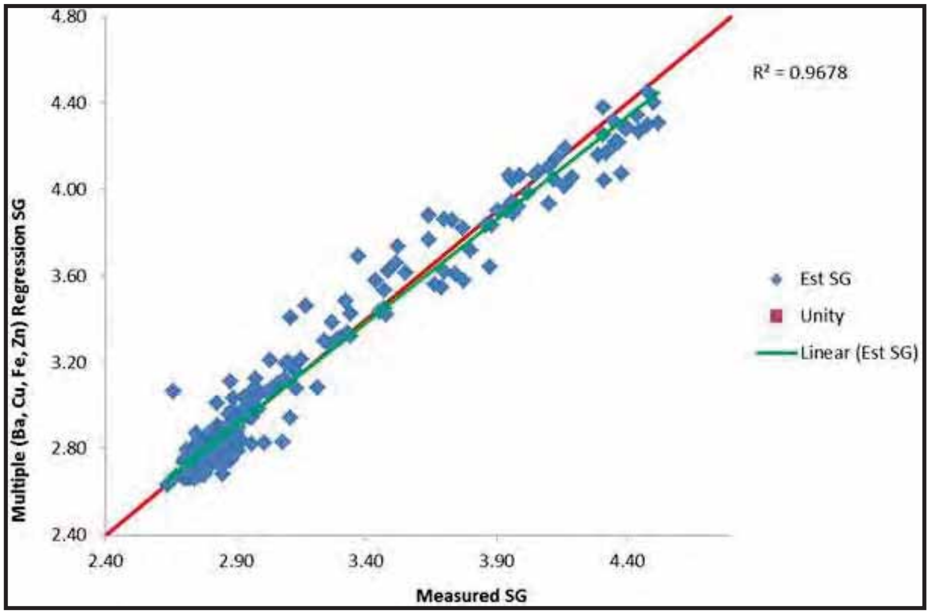


Figure 11-4 Scatter Plot Showing the Measured Specific Gravity versus Multiple (Copper, Iron, Zinc, Barium) Regression Estimate (West, A., 2014)

11.8.5.4 Density Determinations Performance

The SG of a field sample interval can be reproduced in the laboratory or estimated from assay values using either a stoichiometric method which assumes a fixed metal residency in certain sulphide and sulphates or by a multiple regression method that empirically fits measured data. Overall, this QA/QC analysis suggests that the measured SG values can be replicated by various methods, thus supporting the quality of the measured SG data.

11.8.6 Acid Base Accounting Sampling QA/QC

SRK conducted a QA/QC review of the 2010 ABA dataset for the Arctic Project in July 2011 and concluded that data quality was acceptable.

QA/QC of the ABA dataset generated in 2015 and 2016 was conducted by SRK in November 2016 through January 2017 and data quality was concluded to be acceptable. SRK conducted a QA/QC review of the 2019 ABA dataset from kinetic test samples in July 2019 and also concluded that the data quality was acceptable.

SRK conducts monthly QA/QC review of kinetic test leachates for all operating kinetic tests. The kinetic test program also includes duplicate and blank tests. Data are reviewed for ion balance, potential contamination, reproducibility, changes in long-term trends, and anomalous spikes in the data. Where considered necessary by SRK, the laboratory is asked to rerun leachates from kinetic tests to investigate QC concerns.

11.9 Comment on Section 11

BDRC believes the database meets or exceeds industry standards for data quality and integrity. BDRC further believes the sample preparation, security and analytical procedures are adequate to support resource estimation.

12 Data Verification

12.1 Drill Hole Collar Verification

Nine drill hole collars (AR-03, AR-04, AR-10, AR-44, AR-47, AR-64, AR05-0094, AR05-0097 and AR-40) were located by Tetra Tech using a Garmin Etrex 20 global positioning system (GPS) unit. The offset distances between the collar coordinates reflected in the drill hole database provided by Trilogy Metals and the measured positions range from 3.4 to 7.8 m with an average offset of 4.8 m. This range is within the tolerance to be expected from GPS measurements and the collar positions are adequately located to form the basis of resource estimation work.

BDRC checked the locations of holes drilled to infill the PEA drill pattern. Infill holes were correctly located relative to the prior drilling. All holes were compared to the LiDAR survey of the topographic surface and found to be in the correct locations. All holes are adequately located to support resource estimation.

12.2 Topography Verification

Agreement between surveyed drill hole collar elevations and the LiDAR topographic surface verified the correctness of the digital topography.

12.3 Core Logging Verification

Tetra Tech visited the Trilogy Metals core storage facility in Fairbanks in 2013 and reviewed three drill holes for lithology, mineralization and the quality of storage.

Core boxes were found to be in good condition and intervals were easily retrieved for the following drill holes:

- AR05-0092 (129 to 147 m)
- AR08-0117 (128 to 216 m)
- AR08-0126 (144 to 211 m)

Logged descriptions of massive and semi-massive sulphide mineralization and general sampling results corresponded to the appearance of the core for selected intervals.

BDRC made similar observations of the core logging and geology data collection. The core logging information is acceptable for resource estimation purposes.

12.4 Database Verification

The Trilogy Metals drill database was reviewed, and no significant concerns were noted. Nine holes were randomly selected from the Arctic database representing 6% of the data. The assay grades from these holes were extracted from MineSight™ and compared to the values listed in certified assay certificates. No errors were found.

The results of previous data verifications by external QPs (SRK 2012, Tetra Tech 2013), completed for Trilogy Metals, were also reviewed. The previous data verification exercises included extensive reviews of all NovaGold drilling as well as drilling completed by previous operators. Based on the current review, BDRC believes that the data verification completed on the Trilogy Metals dataset is sufficiently robust to support resource estimation.

12.5 QA/QC Review

Standards, blanks, duplicates and check samples were regularly submitted at a combined level of 20% of sampling submissions for all NovaGold/NovaCopper/Trilogy Metals era campaigns. GeoSpark conducted QA/QC reviews of all sampling campaigns which included review for accuracy, precision and bias (see Section 11). In addition to the QA/QC review, GeoSpark was retained to provide ongoing database maintenance and QA/QC support.

BDRC reviewed the QA/QC dataset and reports and found the sample insertion rate and the timeliness of results analysis meets or exceeds industry best practices. The QA/QC results indicate that the assay results collected by Trilogy Metals, and previously by NovaGold and NovaCopper, are reliable and suitable to support Mineral Resource estimation.

12.6 Comment on Section 12

It is BDRC's opinion that the drill database and topographic surface for the Arctic deposit are reliable and sufficient to support the current estimate of Mineral Resources.

13 Metallurgical Testwork Review

13.1 Introduction

Metallurgical studies have spanned over 30 years with metallurgical testwork campaigns undertaken at the Kennecott Research Center (KRC) in Salt Lake City, Utah, Lakefield Research Ltd., Lakefield Ontario (Lakefield); SGS, Vancouver, BC (SGS Vancouver); and ALS Metallurgy, Kamloops, B.C. (ALS Metallurgy). Metallurgical testwork laboratories are typically not accredited. The KRC was not independent of Kennecott at the time the testwork was completed; all other laboratories were and are independent of NovaGold, NovaCopper and Trilogy Metals.

The testwork conducted in 2012 through 2019 was under the technical direction of IME. Testwork prior to 2012 is considered historical in nature and has provided some guidance to the project development, but is not used in any predictive manner or used in the generation of design criteria. The most recent testwork was focused on a conventional process flowsheet employing crushing, grinding, bulk flotation of a copper and lead concentrate, flotation of a zinc concentrate and the subsequent separation of copper and lead values via flotation. A flowsheet for the proposed process is shown in Figure 13-1 and this flowsheet has not changed during the time period from 2012 to 2019.

The LOM average metallurgical performance forecasts, based on testwork completed and expected mine production grades is shown in Table 13-1. This overall project metallurgical accounting is based on locked cycle testwork, conducted on a distribution of samples from the deposit. Since 2012, testwork has been focused on optimizing the performance of the recommended flowsheet.

Table 13-1 Summary of Overall Forecast Metal Recovery - Arctic Deposit

Process Stream	Mass %	Concentrate Grade					Metal Recoveries				
		Cu %	Pb %	Zn %	Au g/t	Ag g/t	Cu %	Pb %	Zn %	Au %	Ag %
Process Feed	100.0	2.24	0.54	3.12	0.47	34.6					
Copper Conc.	6.65	30.3	0.66	1.6	0.76	138	89.9	8.1	3.4	10.9	26.4
Lead Conc.	0.78	6.9	55.0	1.8	37.3	2806	2.4	79.0	0.4	62.1	63.1
Zinc Conc.	4.78	1.3	0.25	59.2	0.53	24.5	2.7	2.2	90.6	5.4	3.4
Tailings	87.8	0.13	0.07	0.20	0.12	2.81	4.95	10.7	5.56	21.6	7.11

A summary of the testwork programs completed for the project, dates of testwork and testwork objectives is shown in Table 13-2

Table 13-2 Summary of Testwork Chronology and Reporting from 2012 to 2019

Laboratory	Project No.	Report date	Testwork Objectives
KRC	-	1970-1976	Preliminary mineralogy and flotation testing

Laboratory	Project No.	Report date	Testwork Objectives
Lakefield	-	1999	Preliminary flotation testwork.
SGS Vancouver	50173-001	Oct. 4, 2012	Flotation scoping and locked cycle testing (LCT), Bond work index, (BWi), using 4 large composite samples
ALS Metallurgy	KM5000	Mar. 27, 2017	Flotation scoping and LC Testing, BWi, using a master composite and 14 variability samples, preliminary copper/lead separation testwork.
ALS Metallurgy	KM5372	July 11, 2017	Additional copper/lead separation testwork and detailed precious metal mineralogy
ALS Metallurgy	KM5567	Feb. 26, 2018	Talc optimization testwork and copper/lead separation testwork.
JKTech	18017/P14	July 2018	Drop Weight testing of Comp. sample
JKTech	19017/P16	Sept. 2019	SMC testing of Variability Samples
Inter. Metallurgy	-	April 22, 2019	Cyanide destruction testwork
Pocock Industrial	-	August 2019	Thickening and filtration testing

Detailed testwork has concluded that the mineralization is well-suited to the production of separate copper, lead and zinc concentrates and no significant metallurgical impediments were observed in the various testwork programs. The presence of naturally hydrophobic talc minerals was consistently observed and talc can be effectively removed from the flotation process prior to base metal flotation. There is little reason to expect concentrates will be impaired by talc contamination. The flotation process is relatively complex with three major rougher flotation stages and two re-grind circuits with associated flotation cleaning stages. Testwork was broken into separate phases, with copper/lead separation being a key distinct phase of testing in the later stages of the program. The full-scale metal recovery and upgrading process can be well-managed with modern process control and ensuring that variability of feed grades, including talc content, can be accommodated.

Ancillary testwork including solid-liquid separation and cyanide detoxification testwork was completed.

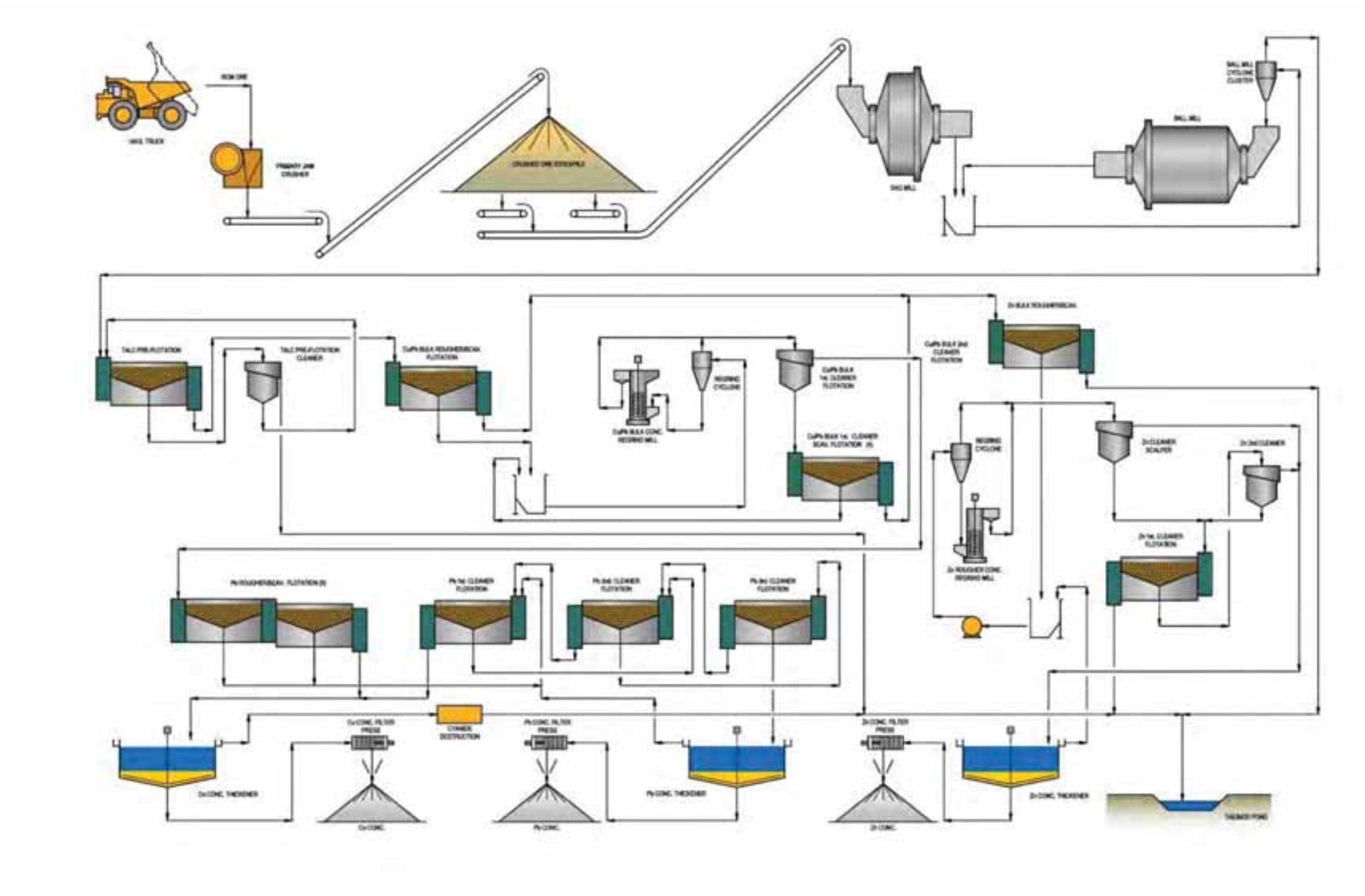


Figure 13-1 Proposed Copper-Lead-Zinc Flowsheet including Talc Pre-float (Ausenco, 2020)

13.2 Historical Testwork Review

13.2.1 Metallurgical Testing – Kennecott Research Center (1968 to 1976)

Between 1970 and 1976, KRC conducted two initial mineralogical studies to evaluate and identify the potential beneficiation or metallurgical options. This early work was a cornerstone of planning later phases of testwork.

In the 1970 mineralogy investigation, KRC reported that the host rock of the mineralization is generally muscovite, chlorite, or talc schist. Principal economic minerals in the deposit were identified as chalcopyrite, sphalerite, and argentiferous galena.

The grain sizes of sulphide mineral particles ranged from submicrometer to a maximum of several centimetres; most of the sulfide particles were relatively large (coarser than 74 µm). KRC noted that the target sulphide minerals should be liberated from gangue at a primary grind size of 100% passing 100 mesh.

In 1976, KRC conducted preliminary comminution testwork using the standard BWi determination procedure (refer to discussion in Section 13.3.4).

Between 1968 and 1976, KRC carried out initial flotation testing. The focus was on selective flotation to provide separate copper, lead, and zinc concentrates for conventional smelting. In 1968, initial amenability testing was conducted on core composites from eight diamond drill holes (which is not available to review). Other tests were conducted in 1972 on four composites from three additional diamond core holes. The laboratory-scale tests conducted between 1968 and 1976 included the conventional selective flotation approach to produce separate lead, copper and zinc concentrates.

The major problem encountered for the tests by KRC was the separation between lead and copper minerals, and the reduction of zinc deportment to the copper and lead concentrates. The copper concentrates produced from open circuit tests contained 30 to 32.4% Cu, 0.45 to 3.48% Zn and 0.15% to 1.31% Pb. The copper recoveries were < 80.7%. The lead concentrate grades were low, ranging from 17.1 to 36.5%.

Sphalerite flotation was generally efficient, producing zinc flotation concentrates grading approximately 55% zinc. Because of the low gold content of the test samples, no appraisal was made of gold recoveries.

From 1975 and 1976, large diameter cores from 14 drill holes were used for more detailed testing. Two composites labelled as Composite No. 1 (Eastern Zone) and Composite No. 2 (Western Zone), were prepared. The test program included bench-scale testing of various process parameters for sequential flotation, including locked cycle tests. A talc flotation step prior to sulfide flotation was considered to be necessary, as previously established. It was determined that chalcopyrite and sphalerite could be recovered into separate commercial grade copper and zinc concentrates. However, the production of a selective high-grade lead concentrate was not successful.

Using zinc sulphate and sodium bisulphate to suppress galena and sphalerite, 90% of the copper was recovered into a concentrate containing 26% Cu, 1.5% Pb, and 6% Zn. KRC indicated that because of close interlocking of chalcopyrite and sphalerite, the zinc content of the copper concentrate could not be reduced to below 6% without sacrifice of copper recovery.

Only low-grade silver-bearing lead concentrates were obtained. Under the best test conditions, approximately 65% of the silver reported to the low-grade lead concentrate. Some of the silver in the mineralization occurred as tetrahedrite, which was recovered to the copper concentrate.

The KRC testwork did not focus on bulk copper and lead flotation and the attempt to focus on a sequential copper-lead-zinc flowsheet is considered a technical error. Subsequent testwork moved to a bulk copper-lead flotation process and subsequent separation of a bulk concentrate into copper and lead concentrates. Metallurgical results have improved with the change to a bulk copper-lead flowsheet in later testwork.

13.2.2 Metallurgical Testwork – Lakefield (1998 to 1999)

In 1998, Lakefield conducted a metallurgical test program to confirm and improve upon the results from the KRC testwork program. The Lakefield work was carried out on test composites prepared from three separate drill holes. The test composite from the upper portion of AR-72 was identified as being low in talc content; however, composites from the lower portion of AR-72 were high in talc content, as were AR-74 and AR-75. The head analyses for the respective resulting test composites are summarized in Table 13-3.

Table 13-3 Head Analyses, Lakefield Research 1999

Composite	Talc	Cu (%)	Zn (%)	Pb (%)	Fe (%)	Au (g/t)	Ag (g/t)	S^T (g/t)
Hole #72 – Upper	Low	5.28	7.16	1.86	15.6	1.14	72.3	23.4
Hole #72 – Lower	High	2.68	5.85	1.34	13.0	1.60	75.9	16.9
Hole #74	High	2.46	4.43	0.90	17.0	1.55	45.1	23.7
Hole #75	High	2.35	8.36	1.95	15.7	1.23	77.3	21.8

Note: S^T = total sulphur

Lakefield conducted a series of five flotation tests using a flowsheet similar to the one adopted in the 2012-2019 testwork and incorporated a bulk copper-lead flotation stage followed by copper and lead separation.

The bulk copper-lead rougher concentrate was reground and subjected to two stages of cleaner flotation and one stage of copper and lead separation, using zinc oxide and sodium cyanide to depress the copper while floating the lead. The resulting lead rougher concentrate was upgraded with two stages of cleaner flotation to produce the final lead concentrate. The lead rougher flotation tailings were the final copper concentrate.

The zinc rougher concentrate was reground and upgraded with two stages of cleaner flotation. The results of the best open circuit flotation test for the low talc composite are summarized in Table 13-4. The test results are indicative of the results obtained later in test programs and optimization of the process would improve these results. Of note, is the high recovery of precious metals to the lead concentrates, which was also confirmed in later testwork programs.

Table 13-4 Flotation Test on Ambler Low Talc Composite

Item	Weight (%)	Assays					Distribution (%)				
		Cu (%)	Pb (%)	Zn (%)	Au (g/t)	Ag (g/t)	Cu	Pb	Zn	Au	Ag
Lead Concentrate	2.22	6.5	58.8	3.43	38.9	1,703	2.7	68.1	1.1	48.7	47.3
Copper Concentrate*	15.76	29.1	1.2	2.61	1.23	73.5	86.8	9.8	5.7	10.9	14.5
Zinc Concentrate	9.91	0.44	0.36	59.1	0.65	14.7	0.8	1.9	81.1	3.6	1.8
Zinc Tailings**	61.6	0.11	0.13	0.22	0.4	3.47	1.2	4.3	1.9	13.7	2.7
Head (Calculation)	100.0	5.28	1.92	7.21	1.78	80.1	100.0	100.0	100.0	100.0	100.0

Notes: *Pb Rougher Tailings
**Does not include intermediate cleaner tailings

Lakefield also conducted flotation tests on each of the high talc composites using a test procedure similar to the one used for the low talc composite, with the exception that carboxymethyl cellulose (CMC) was added as a depressant for talc. The results of these tests showed that the presence of talc had a significant negative impact on the copper and lead mineral recoveries. Lakefield also used talc pre-flotation prior to sulphide flotation in an effort to reduce talc effect on base metal flotation. It appears that the talc pre-flotation improved copper and lead metallurgical performances. However, the test results showed that elevated talc content had a significant effect in copper and lead flotation response.

In the test report, Lakefield also concluded that grind particle size as coarse as approximately 80% passing 74 µm provided good results.

13.3 Mineralogical and Metallurgical Testwork – 2012 to 2019

13.3.1 Introduction

Testwork conducted prior to 2012 is considered relevant to the project, but predictive metallurgical performance is best estimated from testwork conducted on sample materials obtained from exploration work under the direction of Trilogy Metals, conducted from 2012 to 2019 (refer to Table 13-2).

In 2012, SGS Vancouver conducted a test program on the samples produced from mineralization zones 1, 2, 3, and 5. Drill core samples were composited from each of the zones into four different samples for the SGS Vancouver testwork which included process mineralogical examination, grindability and flotation tests.

SGS Vancouver used quantitative evaluation of materials by scanning electron microscopy QEMSCAN™, to develop grade limiting/recovery relationships for the composites.

Standard Bond grindability tests were also conducted on five selected samples to determine the BWi and abrasion index (Ai).

The flotation testwork investigated the effect of various process conditions on copper, lead and zinc recovery using copper-lead bulk flotation and zinc flotation followed by copper and lead separation. The testwork conducted in 2012 at SGS Vancouver forms the basis for predicting metallurgical performance of the mineralized zone in terms of recovery of copper and lead to a bulk concentrate as well as predicting zinc recovery to a zinc concentrate.

In 2017, testwork moved to ALS Metallurgy and was focused on predicting the expected performance of the proposed copper and lead separation process, which required the use of larger test samples. A pilot plant was operated to generate approximately 50 kg of copper and lead concentrate, which became test sample material for use in locked cycle testing of the copper and lead separation process. This testwork allows for the accurate prediction of copper and lead deportment in the process as well as provided detailed analysis of the final copper and lead concentrates, expected from the process. Additional metallurgical testwork in the form of variability samples being subject to grindability and baseline flotation tests was also completed.

13.3.2 Test Samples

The 2012 test program used 90 individual drill core sample intervals totaling 1,100 kg. Individual samples were combined into four composites representing different zones and labelled as Composites Zone 1 & 2, Zone 3, Zone 5, and Zone 3 & 5. The sample materials used in the 2012 test program at SGS Vancouver were specifically obtained for metallurgical test purposes. The drill cores were stored in a freezer to ensure sample degradation and oxidation of sulphide minerals did not occur.

The head grades of the composites from the 2012 SGS Vancouver testwork program are shown in Table 13-5.

Table 13-5 SGS Head Grades - Composite Samples - 2012

Sample	Cu (%)	Pb (%)	Zn (%)	Fe (%)	S (%)	Au (g/t)	Ag (g/t)	MgO (%)
Zone 1 & 2	2.63	0.95	3.43	7.73	8.36	0.79	57.6	5.78
Zone 3	3.56	1.73	8.58	17.5	25.8	0.67	80.4	1.94
Zone 3 & 5	4.41	1.60	7.76	16.7	23.5	0.97	82.0	3.96
Zone 5 B	2.56	1.33	5.68	15.8	21.2	1.16	63.0	0.90

The 2017 test program involved the collection of approximately 4,000 kg of drill core from five drill holes. The core was shipped in its entirety to ALS Metallurgy for use in grinding and flotation testwork. Fifteen separate composites samples were generated by crushing defined intercepts of mineralization. These samples were riffle split to generate 15 individual samples which were separately tested for grindability and flotation response, as well, a large portion of each sample was blended to make a single large composite sample for use in copper-lead separation testwork. The copper-lead separation testwork involved operating a pilot plant for the production of a single sample of copper/lead concentrate which was then used in bench-scale flotation testing, including open circuit flotation tests as well as locked cycle flotation tests.

The feed grades of samples used in the 2017 testwork program at ALS Metallurgy are shown in Table 13-6.

Table 13-6 ALS Metallurgy Head Grades - Composite Samples - 2017

Sample ID	Cu (%)	Pb (%)	Zn (%)	Fe (%)	S (%)	Au (g/t)	Ag (g/t)	Mg (%)
Var. Comp 1	5.05	1.53	7.40	15.0	24.4	0.68	64	2.69
Var. Comp 2	2.06	0.25	1.05	4.6	3.68	0.52	34	11.2
Var. Comp 3	1.67	0.80	2.93	6.6	4.93	0.10	43	7.51
Var. Comp 4	2.25	0.24	3.15	13.1	16.2	0.20	18	6.26
Var. Comp 5	3.68	1.01	5.55	10.6	13.9	0.78	69	7.16
Var. Comp 6	1.02	0.36	1.61	8.0	9.45	0.45	24	1.92
Var. Comp 7	1.75	0.58	2.71	8.9	12.9	0.21	32	3.46
Var. Comp 8	3.00	0.68	4.65	10.0	13.3	0.75	56	9.18
Var. Comp 9	5.46	1.37	6.60	9.2	14.0	0.15	50	5.65
Var. Comp 10	4.16	1.24	5.63	13.4	22.1	0.06	34	3.58
Var. Comp 11	2.78	0.40	4.56	12.7	16.9	0.64	40	6.84
Var. Comp 12	1.53	0.07	0.56	4.4	3.15	0.59	16	10.6
Var. Comp 13	1.98	0.30	1.48	6.2	6.25	0.26	38	9.61
Var. Comp 14	2.37	2.43	9.50	15.1	23.7	0.84	62	0.81
PP Comp.	2.92	0.86	4.66	10.8	13.8	0.56	41	5.93

Shown in Figure 13-2 are the copper and zinc grades of the SGS Vancouver and ALS Metallurgy testwork samples compared to the designed plant feed grades. The ALS Metallurgy samples are more representative of the expected mine production due to the lower range of copper and zinc grades that are available. There is a strong correlation between copper and zinc grades within the test samples. The metallurgical balance shown in Table 13-1 is based on LOM feed grades and is consistent with the LOM data point shown in Figure 13-2.

Shown in Figure 13-3 are the copper and lead grades of the various test samples used in the ALS Metallurgy and SGS Vancouver programs. There is a consistent copper to lead ratio of approximately 3.5-4.5 within the test samples and the LOM grades are shown to be within the distribution of test samples.

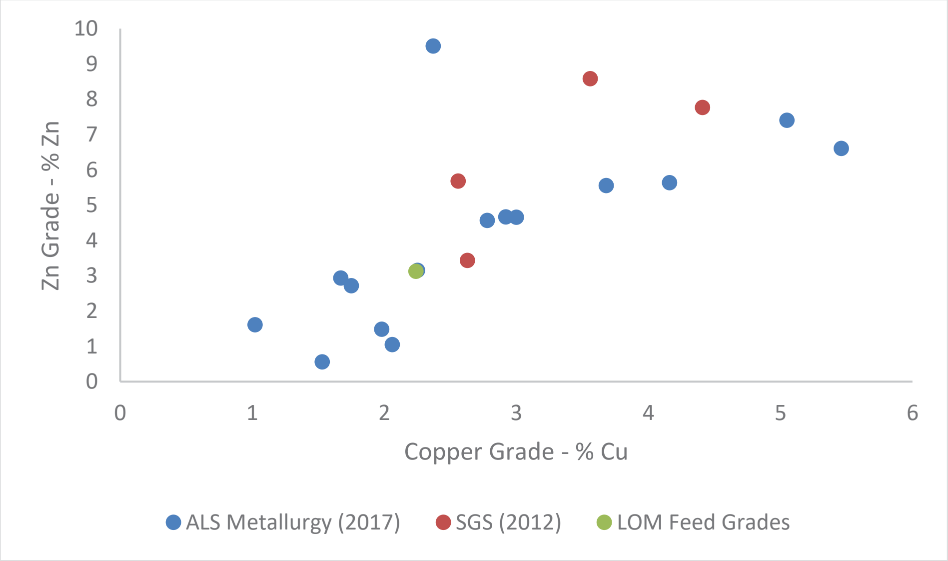


Figure 13-2 Cu and Zn Test Sample Grades for ALS Metallurgy/SGS Programs (Austin, 2020)

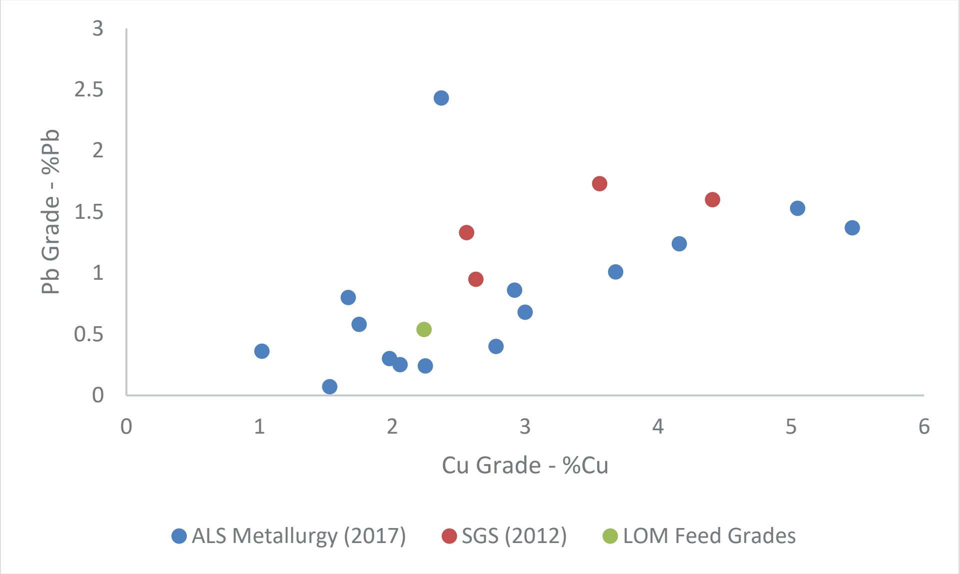


Figure 13-3 **Cu and Pb Test Sample Grades for ALS Metallurgy/SGS Programs (Austin, 2020)**

The volume of talc observed in the various test samples ranged from a low of zero contained talc to a high of 42% by weight floatable talc. Shown in Figure 13-4 is the distribution of talc within both the SGS Vancouver and ALS Metallurgy samples. The estimated LOM talc content is estimated at 5.1%. Only one of the SGS Vancouver test samples exceeded the LOM talc content, while 11 of the 14 ALS Metallurgy samples exceeded the LOM talc content. A composite of the ALS Metallurgy samples was approximately twice the talc content of the expected mine production. Talc, while a significant issue for the flotation process is likely overestimated in terms of its potential negative impact, owing to the large number of high talc samples seen in the ALS Metallurgy sample set. It has also been clearly demonstrated that even high volumes of talc can be effectively removed from the base metal flotation process and remove the impact of talc diluting base metal concentrates.

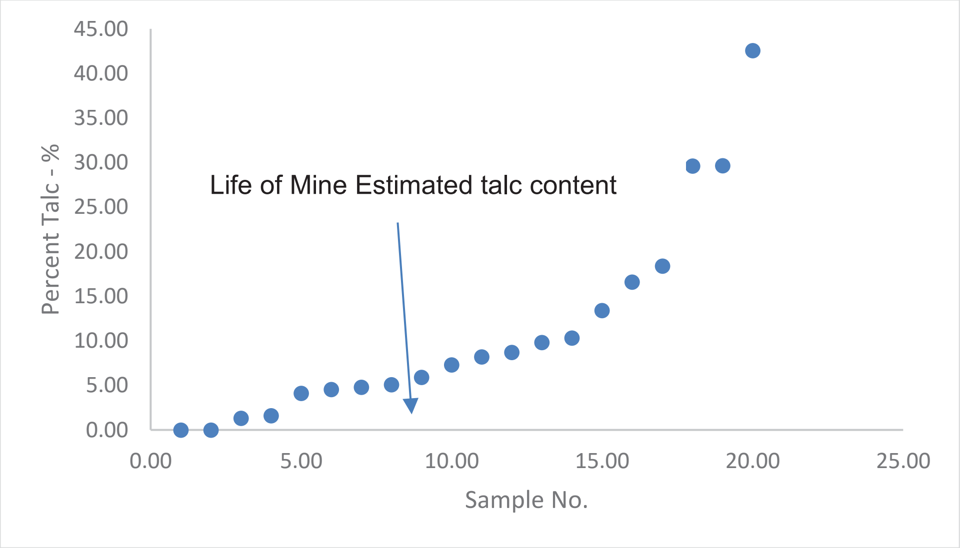


Figure 13-4 **Distribution of Talc content within the 2012 and 2017 Test Samples (Austin, 2020)**

13.3.3 Mineralogical Investigations

SGS Vancouver used QEMSCAN™ to complete a detailed mineralogical study on each composite to identify mineral liberations and associations. The mineral modal abundance for the composites is shown in Table 13-7.

The mineralogical results obtained by SGS Vancouver were typical for the balance of other samples observed in the ALS Metallurgy QEMSCAN analysis and no significant liberation or changes in mineral occurrences were observed in later QEMSCAN work. Metal and talc grades all were observed to be variable in the mineralogical evaluations, but did not significantly impact textural relationships.

Table 13-7 Mineral Modal Abundance for Composite Samples - SGS 2012

Mineral	Mass (%)			
	Zone 1 & 2	Zone 3	Zone 3 & 5	Zone 5
Chalcopyrite	9.2	9.4	12.2	6.4
Bornite	0.02	0.01	0.03	0.4
Tetrahedrite	0.1	0.4	0.2	0.2
Antimony	0.03	0.2	0.005	0.3
Galena	1.3	2.1	2.1	2.1
Sphalerite	7.2	14.6	14.3	11.3
Pyrite	6.7	30.4	23.8	27.8
Pyrrhotite	2.2	0.2	0.2	1.4
Arsenopyrite	0.5	0.1	0.6	2.2
Other Sulphides	0.1	0.1	0.2	0.1
Quartz	30.2	8.6	9.0	16.6
Feldspar	0.9	0.2	0.4	0.3
Magnesium-Chlorite	11.9	3.4	2.8	1.1
Talc	2.0	0.8	6.3	0.1
Micas	14.2	1.9	7.0	9.4
Cymrite	3.5	3.9	1.8	1.9
Clays	0.6	0.05	0.2	0.1
Iron Oxides	0.3	0.3	0.5	0.3
Carbonates	3.4	1.3	4.2	2.0
Barite	3.0	21.8	13.4	14.5
Fluorite	1.7	0.1	0.4	1.2
Other	1.1	0.3	0.4	0.4
Total	**100.0**	**100.0**	**100.0**	**100.0**

The mineralogical study showed that the mineralogy of all four composites was similar, but mineral volumes were highly variable between samples. Each composite was composed mainly of pyrite, quartz, and carbonates. However, Composite Zone 1 & 2 contains approximately 30% quartz, compared to 8.6% for Composite Zone 3, and 16.6% for Composite Zone 5. The study also showed that Composite Zone 1 & 2 had the lowest pyrite content (6.7%) while Composites Zone 3 and Zone 5 contained approximately 30.4% and 27.8% pyrite, respectively.

In all samples, the major floatable gangue minerals were talc and pyrite. Chalcopyrite was the main copper carrier. Combined bornite, tetrahedrite, and other sulphides accounted for less than

5% of the copper contained in the various samples. Galena was the main lead mineral and sphalerite was the main zinc mineral.

All the composites contained a significant amount of talc, which may have the potential to dilute final concentrates. Therefore, SGS Vancouver recommended that talc removal using flotation be employed prior to base metal flotation and this recommendation was carried throughout all testwork.

At a grind size of approximately 80% passing 70 µm, chalcopyrite liberation ranged from approximately 80 to 87% (free and liberated combined) for all composites. The chalcopyrite is mostly free, with 7 to 10% associated with pyrite. For all composites, galena liberation ranged from 54 to 68% (free and liberated combined). Sphalerite liberation varied between 81 to 89%. Sphalerite is mostly free with about 7 to 10% associated with pyrite. Mineral liberation plays a significant role in removing talc during the pre-float stage and finer grinding benefits the removal of talc prior to sulphide flotation and subsequent re-grinding.

13.3.4 Comminution Testwork

KRC completed BWi tests on seven specific samples from the Arctic project in the 1976 testwork program. SGS Vancouver conducted comminution tests on five selected samples during their testwork program in 2012. The SGS Vancouver tests included the BWi tests and Ai tests. ALS Metallurgy also conducted BWi determinations on a number of samples during the 2017 to 2019 testwork program and these results from all three programs are summarized in Table 13-10. The BWi values range from 6.5 to 11 kWh/t for the materials sampled. The data indicates that the samples are relatively soft to ball mill grinding. The Ai ranged from 0.017 to 0.072 g, which indicates that the samples are not abrasive.

Grinding testwork for semi-autogenous grind (SAG) mill characterization was completed in conjunction with the ALS Metallurgy 2017 work. JKTech completed SMC and DWi testing of samples specifically selected for SAG amenability testing. Additional BWi determinations were also completed on the samples selected for SMC testwork; those BWi test results are included in Table 13-9 with the SMC results. Drill core data for the various SMC samples are contained in Table 13-8.

A total of 46 BWi tests were completed.

Table 13-8 Bond Ball Mill Work Index and Abrasion Index Test Results

Sample	Mesh of Grind Size	P_{80} (µm)	BWi (kWh/t)	Ai (g)
1976 KRC samples				
Hole – 11B	150	-	11.96	-
Hole – 34B	150	-	8.33	-
Hole – 34B	150	-	5.71	-
Hole – 34B	150	-	11.3	-
Hole – 34C	150	-	9.98	-
Hole – 48A	150	-	10.5	-
Hole – 48B	150	-	9.60	-
2012 SGS Vancouver samples				
MET – 1105341	150	88	6.7	0.032
MET – 1106043	150	88	6.5	0.019
MET – 1105868	150	85	7.4	0.030
MET – 1106033	150	87	9.3	0.072

Sample	Mesh of Grind Size	P_{80} (µm)	BWi (kWh/t)	Ai (g)
MET – 1105853	150	89	11.1	0.017
2017 ALS Metallurgy samples				
Composite 1	106	106	9.0	-
Composite 2	300	228	8.6	-
Composite 3	300	232	8.1	-
Composite 4	300	226	6.6	-
Composite 5	300	233	7.1	-
Composite 6	300	233	6.1	-
Composite 7	300	223	6.2	-
Composite 8	300	234	9.0	-
Composite 9	300	236	6.4	-
Composite 10	300	237	5.3	-
Composite 11	300	225	7.2	-
Composite 12	300	234	10.3	-
Composite 13	300	229	10.1	-
Composite 14	300	231	6.4	-
PP Composite 1	300	231	7.2	-

ALS Metallurgy, in conjunction with the JKTech completed DWi testing and SMC tests on 19 individual samples.

SMC testwork was also completed by JKTech, including breakage parameters a x b, BWi and autogenous grind/SAG mill specific energy (SCSE). The SMC data show the materials to be soft to very soft in terms of SAG milling characteristics. Test results are provided in Table 13-9.

Table 13-9 Summary of SMC Test Results and Additional BWI Data

Sample	a x b	SCSE kWhr/t	BWi (kWh/t)
SMC - 1	148.9	6.13	10.9
SMC – 2	NA	NA	11.9
SMC – 3	239.9	5.31	7.1
SMC – 4	106.8	6.89	8.5
SMC – 5	203.5	5.56	6.8
SMC – 6	272.7	4.71	5.4
SMC – 7	629.3	3.98	12.5
SMC – 8	301.8	5.09	11.7
SMC – 9	220.5	5.11	8.2
SMC – 10	180.2	5.77	6.4
SMC – 11	143.8	6.25	10.8
SMC – 12	150.7	6.15	11.4
SMC – 13	98.8	7.07	7.6
SMC – 14	115.2	6.68	9.7
SMC – 15	182.5	5.77	9.0
SMC - 16	71.6	8.21	9.9
SMC – 17	86.2	7.27	10.5
SMC – 18	94.2	7.26	10.3

Sample	a x b	SCSE kWhr/t	BWi (kWh/t)
SMC – 19	169.3	5.83	8.4
Average Value	**189.8**	**6.05**	

13.3.5 Flotation Testwork

The predictive metallurgical results for the project are based on locked cycle flotation testwork which mirrors the performance of an operational plant and accounts for circulating loads and intermediate products. Each research program consisted of a large number of open circuit flotation tests that provided guidance to the selection of operating conditions to be used in locked cycle tests.

In the testwork conducted by Trilogy Metals, testwork was focused on the use of the flowsheet shown in Figure 13-1. Historical testwork provided some guidance to the selection of this flowsheet.

In 2012, SGS Vancouver conducted bench-scale flotation testwork to investigate the recovery of copper, lead, zinc, and associated precious metals using bulk copper-lead flotation and zinc flotation, followed by copper and lead separation. Four wide-ranging composite samples were tested for rougher flotation kinetics, cleaner efficiency, and copper and lead separation flotation efficiency. All of the testwork used a phased approach to completing testwork, with a preliminary phase of flotation testwork generating a bulk copper-lead concentrate and a final zinc concentrate. The bulk copper-lead concentrate was typically used in a second phase of testing, which was focused on separation of copper and lead minerals into copper and lead concentrates. The second phase of testwork typically also involved open-circuit flotation tests and locked cycle tests.

All flotation testwork either at SGS Vancouver or ALS Metallurgy had the same froth characteristics.

The froth product is typically light in density and can require extensive flotation time. Very high talc recoveries are required to protect the lead concentrate from contamination as the lead concentrate is the destination for mis-reporting talc. Talc levels in test samples ranged from 0.0 to 40% talc on a weight basis, the LOM average for talc is approximately 5.1%.

The ratio of copper to lead is approximately four in the feed samples tested and within the Mineral Reserve estimates. This copper and lead concentrate is readily upgraded to provide feed to a copper and lead separation circuit. This froth is heavy and flotation rates for copper and lead are considered fast. In all copper and lead flotation, Cytec reagent 3418A was used as a copper and lead collector.

Zinc flotation follows both talc flotation and copper/lead bulk flotation. Zinc is depressed through both stages of talc and copper/lead flotation with the use of zinc sulphate and cyanide. Zinc minerals are activated with the addition of copper sulphate and a xanthate-based collector.

Zinc flotation is relatively fast and froths are generally heavily laden with mineral.

The separation of copper and lead is completed using a high-grade concentrate of copper and lead minerals. The basis of the copper and lead separation is the depression of copper minerals using cyanide to render the copper minerals hydrophilic.

Locked cycle test results form the basis of metallurgical predictions for the Arctic project and are reported within Table 13-12 for the SGS testwork program and within Table 13-13 for the ALS Metallurgy testwork program.

The SGS testwork produced similar metallurgical performances among the composite samples tested and results were consistent with expectations outlined in the various mineralogical examinations and preliminary testwork results. Further optimization testwork would likely have improved the flotation performance of the composite sample for Zone 1&2 (LCT6), sample availability was limited for this composite.

The SGS Vancouver flotation testwork points to high recoveries of copper and lead to a bulk concentrate of copper and lead which would be subsequently separated. Copper recoveries were in the range of 90 to 92%. Zinc recoveries were typically in the range of 89 to 92%. The majority of mis-reporting of copper was to the zinc concentrate and the majority of mis-reporting zinc was to the copper-lead concentrate. On-going optimization of the flotation process will likely reduce the mis-reporting of metals, through changes in reagent additions, grind size optimization and concentrate mass recovery.

Flotation testwork conducted in 2017 at ALS Metallurgy, was focused on a detailed evaluation of the performance of a copper and lead separation process and included open circuit flotation tests and locked cycle flotation testing of the copper-lead separation process.

A master composite was made from 14 variability samples from the deposit. Locked cycle testing for this composite was completed to provide a comparison with the SGS Vancouver test results

A summary of the locked cycle test results for both the SGS Vancouver and ALS Metallurgy test programs in contained in Table 13-10.

Table 13-10 Summary of Locked Cycle Recovery Data for Composite Sample Testing

Sample	Recovery to Bulk Cu/Pb Concentrate or Zinc Concentrate				
	Cu[1] (%)	Pb[1] (%)	Zn[2] (%)	Au[1] (g/t)	Ag[1] (g/t)
SGS Vancouver 2012					
Zone 3	92.5	92.6	93.0	77.6	85.9
Zone 5	91.3	92.0	89.3	70.9	84.2
Zone 3&5	91.7	92.3	91.6	75.8	85.0
Zone 1&2	84.2	94.0	85.7	79.7	84.2
ALS Metallurgy 2017					
Master Comp.	94.1	88.7	87.8	74.4	85.4

Notes:

1. Represents recovery to a bulk concentrate prior to Cu/Pb separation.
2. Represents recovery to a final zinc concentrate

Locked cycle test results for the ALS Metallurgy master composite is contained in Table 13-10 and reports results for the production of a bulk copper-lead concentrate and a zinc concentrate. Table 13-11 provides the results for the SGS Vancouver testwork program and Table 13-12 includes the results for the ALS Metallurgy testwork program

Table 13-11 Locked Cycle Metallurgical Test Results – SGS Vancouver 2012

Test No.	Product	Regrind Size 80% Passing	Weight %	Assays						Distribution (%)					
				Cu (%)	Pb (%)	Zn (%)	Au (g/t)	Ag (g/t)	S (%)	Cu	Pb	Zn	Au	Ag	S
Zone 3 LCT-2	Talc Concentrate	Cu/Pb Rougher Concentrate: 43 µm; Zn Rougher Concentrate: 41 µm	1.6	2.39	2.44	4.05	0.51	105.0	9.97	0.4	0.8	0.3	0.4	0.8	0.2
	Cu/Pb Cleaner 2 Conc.		12.9	24.7	12.4	3.61	4.73	506	30.5	92.5	92.6	5.5	77.6	85.9	15.4
	Zn Cleaner 2 Concentrate		12.9	1.02	0.38	61.4	0.40	41.7	32.9	3.8	2.8	93.0	6.5	7.1	16.5
	Zn Cleaner 1 Sc. Tailings		5.9	0.85	0.33	0.86	0.97	35.0	38.7	1.5	1.1	0.6	7.3	2.7	9.0
	Zn Rougher Tailings		66.7	0.10	0.07	0.09	0.10	4.01	22.5	1.9	2.7	0.7	8.3	3.5	58.9
	Feed		100.0	3.42	1.71	8.43	0.78	75.3	25.4	100.0	100.0	100.0	100.0	100.0	100.0
Zone 5 LCT-3	Talc Concentrate	Cu/Pb Rougher Concentrate: 36 µm; Zn Rougher Concentrate: 35 µm	1.3	7.15	3.71	2.46	1.22	187.0	13.7	1.2	1.2	0.2	0.3	1.4	0.3
	Cu/Pb Cleaner 2 Conc.		9.9	23.8	12.9	5.04	11.2	499	31.5	91.3	92.0	9.1	70.9	84.2	14.7
	Zn Cleaner 2 Concentrate		8.3	0.91	0.56	59.1	0.55	46.4	30.5	2.9	3.4	89.3	2.9	6.6	11.9
	Zn Cleaner 1 Sc. Tailings		7.1	0.80	0.28	0.56	4.55	30.0	32.4	2.2	1.4	0.7	20.5	3.6	10.7
	Zn Rougher Tailings		73.4	0.09	0.04	0.05	0.11	3.38	18.1	2.4	2.0	0.7	5.3	4.2	62.4
	Feed		100.0	2.56	1.37	5.47	1.55	58.2	21.1	100.0	100.0	100.0	100.0	100.0	100.0
Zone 3 & 5 LCT 4	Talc Concentrate	Cu/Pb Rougher Concentrate: 45 µm; Zn Rougher Concentrate: 23 µm	7.3	0.72	0.38	1.37	0.11	17.6	3.01	0.4	0.6	0.4	0.3	0.6	0.3
	Cu/Pb Cleaner 2 Conc.		16.0	25.3	9.25	3.13	4.28	408	29.4	91.7	92.3	6.4	73.8	85.0	21.3
	Zn Cleaner 2 Concentrate		11.8	1.78	0.39	60.9	0.48	50.7	32.5	4.8	2.9	91.6	6.1	7.8	17.4
	Zn Cleaner 1 Sc. Tailings		4.8	1.15	0.38	1.09	2.6	39.8	27.1	1.3	1.1	0.7	13.5	2.5	5.9
	Zn Rougher Tailings		60.2	0.14	0.08	0.13	0.1	5.19	20.2	1.9	3.2	1	6.3	4.1	55.1
	Feed		100.0	4.41	1.6	7.85	0.93	76.6	22.1	100	100	100	100	100	100
Zone 1 & 2 LCT-6	Talc Concentrate	Cu/Pb Rougher Concentrate: 62 µm; Zn Rougher Concentrate: 55 µm	4.8	0.67	0.34	0.90	0.40	13.9	1.88	0.4	0.6	0.4	0.8	0.4	0.3
	Cu/Pb Cleaner 2 Conc.		9.5	23.7	9.54	5.12	6.65	481	30.2	84.2	94.0	14.3	79.7	84.2	32.5
	Zn Cleaner 2 Concentrate		6.4	5.84	0.49	44.5	0.91	101.5	32.8	14.0	3.2	83.7	7.4	12.0	23.9
	Zn Cleaner 1 Sc. Tailings		7.4	0.22	0.06	0.17	0.91	12.3	19.6	0.6	0.5	0.4	8.4	1.7	16.4
	Zn Rougher Tailings		71.8	0.03	0.02	0.06	0.04	1.34	3.30	0.8	1.7	1.2	3.7	1.8	26.8
	Feed		100.0	2.69	0.97	3.42	0.80	54.6	8.8	100.0	100.0	100.0	100.0	100.0	100.0

Note: LCT = locked cycle test

Table 13-12 Locked Cycle Metallurgical Test Results – ALS Metallurgy 2017

Test No.	Product	Regrind Size 80% Passing	Weight %	Assays						Distribution (%)					
				Cu (%)	Pb (%)	Zn (%)	Au (g/t)	Ag (g/t)	S (%)	Cu	Pb	Zn	Au	Ag	S
Zone 3 LCT-2	Talc Concentrate	Cu/Pb Rougher Concentrate: 43 µm; Zn Rougher Concentrate: 41 µm	1.6	2.39	2.44	4.05	0.51	105.0	9.97	0.4	0.8	0.3	0.4	0.8	0.2
	Cu/Pb Cleaner 2 Conc.		12.9	24.7	12.4	3.61	4.73	506	30.5	92.5	92.6	5.5	77.6	85.9	15.4
	Zn Cleaner 2 Concentrate		12.9	1.02	0.38	61.4	0.40	41.7	32.9	3.8	2.8	93.0	6.5	7.1	16.5
	Zn Cleaner 1 Sc. Tailings		5.9	0.85	0.33	0.86	0.97	35.0	38.7	1.5	1.1	0.6	7.3	2.7	9.0
	Zn Rougher Tailings		66.7	0.10	0.07	0.09	0.10	4.01	22.5	1.9	2.7	0.7	8.3	3.5	58.9
	Feed		100.0	3.42	1.71	8.43	0.78	75.3	25.4	100.0	100.0	100.0	100.0	100.0	100.0

13.3.6 Copper/Lead Separation Testwork

SGS Vancouver performed preliminary open-circuit copper and lead separation tests on the bulk copper-lead concentrates produced from the locked cycle tests in open circuit flotation tests. Sodium cyanide was used to suppress copper minerals; 3418A was used as the lead collector and lime was added to adjust the pulp pH to 10. Table 13-13 summarizes the separation test results. These results were obtained using small concentrate samples of approximately 200 g following the production of bulk concentrates in locked cycle testwork. These results also indicated that the separation of copper and lead was feasible using depression of copper and the flotation of lead minerals. Lead concentrate grades as high as 60% lead were obtained in these preliminary open-circuit tests at SGS Vancouver and rougher flotation recoveries for lead were observed in the range of 88 to 95%.

Additional testwork to provide detailed estimates of the performance of the copper and lead flotation process was conducted at ALS Metallurgy. Approximately 50 kg of bulk copper and lead concentrate was produced in a pilot plant program with the specific objective of completing detailed copper and lead separation testwork. The separation testwork performed very well, however, lower than expected lead concentrate grades were obtained due to talc contamination of the final lead concentrate. This contamination was due to non-optimal talc flotation conditions within the pilot plant.

Results for two locked cycle tests using the pilot plant bulk concentrate are shown in Table 13-14. Recovery of lead to a final concentrate was consistent at 88% of the lead contained in the bulk concentrate. Recovery of copper to a final concentrate was consistent at 97.4% of the copper contained in a bulk concentrate.

Table 13-13 SGS Vancouver Open Circuit Copper and Lead Separation Test Results

Test	Product	Weight %	Assays						Distribution (%)					
			Cu (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)	S (%)	Cu	Pb	Zn	Ag	Au	S
Zone 3 & 5 Cu/Pb Separation Feed from LCT-4 (Cycle 2)	Pb 2nd Cleaner Concentrate	8.2	5.99	41.0	2.02	2,330	18.9	13.1	1.9	37.0	6.0	44.7	35.9	3.4
	Pb 1st Cleaner Concentrate	22	6.87	37.5	4.34	1,665	13.6	20.6	5.9	90.8	34.8	85.7	69.5	14.3
	Pb Rougher Concentrate	37.7	16.4	23.0	3.43	1,033	9.17	26.2	24.1	95.5	47.4	91.3	80.3	31.4
	Pb Rougher Tailings (Cu Concentrate)	62.3	31.3	0.65	2.31	59	1.36	34.7	75.9	4.5	52.6	8.7	19.7	68.6
	Cu/Pb 2nd Cleaner Concentrate (Head)	-	25.7	9.07	2.73	4.27	4.31	31.5	-	-	-	-	-	-
Zone 3 Cu/Pb Separation from Open Circuit Test (Test F25)	Pb 2nd Cleaner Concentrate	2.1	2.22	58.8	5.58	1,622	0.3	20.8	1.4	74.9	1.4	44.2	1.0	1.8
	Pb 1st Cleaner Concentrate	2.9	4.51	48.3	6.94	1,369	0.5	24.1	3.8	83.8	2.4	50.9	2.0	2.8
	Pb Rougher Concentrate	4.3	12.4	33.6	6.54	1,026	1.05	26.9	15.3	86.0	3.3	56.3	6.6	4.6
	Pb Rougher Tailings (Cu Concentrate)	8.3	31.5	0.29	4.33	231	5.24	33.3	75.1	1.4	4.2	24.5	63.9	11.0
	Cu/Pb 2nd Cleaner Concentrate (Head)	12.6	25.0	11.6	5.08	502	3.81	31.1	90.4	87.4	7.5	80.8	70.5	15.5
Zone 5 Cu/Pb Separation Feed from LCT-5 (Cycle 2)	Pb 2nd Cleaner Concentrate	6.6	2.42	69.0	2.68	1,230	1.27	15.8	0.6	41.1	3	17.2	1.8	3.3
	Pb 1st Cleaner Concentrate	15.2	3.78	57.6	4.18	993	1.92	20.5	2.3	78.8	11.5	31.9	6.1	9.8
	Pb Rougher Concentrate	25.5	10.3	40.3	4.82	778	6.31	25.1	10.5	92.4	22.1	41.9	33.6	20.1
	Pb Rougher Tailings (Cu Concentrate)	74.5	30.0	1.13	5.79	369	4.26	34.1	89.5	7.58	77.9	58.1	66.4	79.9
	Cu/Pb 2nd Cleaner Concentrate (Head)	-	25.0	11.1	5.54	473	4.78	31.8	100.0	100.0	100.0	100.0	100.0	100.0
Zone 1 & 2 Cu/Pb Separation Feed from LCT-6 (Cycle 2)	Pb 2nd Cleaner Concentrate	7.59	2.4	57.3	5.59	0.54	1,313	15.1	0.76	47.1	8.1	0.7	20.1	3.78
	Pb 1st Cleaner Concentrate	16.4	4.38	45.3	7.96	0.77	1,038	19.9	2.98	80.5	24.9	2.2	34.4	10.8
	Pb Rougher Concentrate	23.6	9.6	34.3	7.19	1.13	849	22.9	9.4	87.7	32.3	4.6	40.4	17.8
	Pb Rougher Tailings (Cu Concentrate)	76.4	28.6	1.49	4.64	7.14	386	32.6	90.6	12.34	67.7	95.4	59.6	82.2
	Cu/Pb 2nd Cleaner Concentrate (Head)	-	24.1	9.23	5.24	5.72	495	30.3	100.0	100.0	100.0	100.0	100.0	100.0

Table 13-14 ALS Metallurgy Locked Cycle Testing of Copper-Lead Separation Process

Test	Product	Weight %	Assays					Distribution (%)				
			Cu (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)	Cu	Pb	Zn	Ag	Au
Test 33 Bulk Conc. From Pilot Plant Operation	Pb 2nd Cleaner Concentrate (Pb Conc.)	22.1	2.68	24.2	1.35	960	6.9	2.6	87.3	11.4	70.5	85.1
	Pb 1st Cleaner Tail	11.3	25.8	1.64	2.08	138	0.39	12.9	3.0	9.0	5.2	2.5
	Pb Rougher Tail	66.6	28.8	0.89	3.11	110	0.33	84.5	9.7	79.5	24.3	12.5
	Combined Tailings (Cu Concentrate)	77.9	28.3	1.00	2.96	144	0.34	97.4	12.7	88.6	29.5	14.9
	Bulk Cleaner Concentrate (Feed)	-	22.7	6.13	2.61	301	1.79	100.0	100.0	100.0	100.0	100.0
Test 34 Bulk Conc. From Pilot Plant Operation	Pb 2nd Cleaner Concentrate (Pb Conc.)	21.9	2.75	23.3	1.29	906	7.33	2.6	86.0	10.8	69.5	85.3
	Pb 1st Cleaner Tail	11.2	26.8	1.76	2.02	132	0.44	12.9	3.3	8.7	5.2	2.6
	Pb Rougher Tail	66.9	29.4	0.95	3.14	106	0.34	84.5	10.7	80.5	25.3	12.1
	Combined Tailings (Cu Concentrate)	78.1	29.4	1.06	2.98	111	0.35	97.4	14.0	89.2	30.5	14.7
	Bulk Cleaner Concentrate (Feed)	-	23.3	5.93	2.61	285	1.88	100.0	100.0	100.0	100.0	100.0

In order to further evaluate the issue of talc contamination of the lead concentrate that was observed in some of the ALS Metallurgy testwork, additional lead concentrate production testwork was undertaken using a variety of samples with moderate to very high talc contents. This testwork was completed as open-circuit tests and involved the production of a bulk concentrate and the subsequent separation of the copper and lead minerals from the bulk concentrate. The objective of this testwork was to demonstrate that when talc recovery was optimized or maximized, the lead concentrate grade target could be readily achieved. These test results are summarized in Table 13-15. The open circuit tests included operating the talc flotation process until no visible talc was being recovered in the talc flotation stage. The results of the locked cycle separation testwork where lead concentrate grades were observed to be low are included in the table. Also shown is the value of the lead concentrate carried in the predictive metallurgical balance for the project.

Table 13-15 Summary of Lead Concentrate Grades for Various Talc Grades in Feed

Sample	Talc Content	Lead Conc Grade	Copper Conc. Grade
	%	% Pb	% Cu
Pilot Plant Comp.	12.7	23.5	29.4
5567-04(test 4)	18.4	61.1	32.3
5567-14(test 5)	0	61.5	30.2
5567-1(test 6)	8.5	46.9	30.8
5567-5(test 7)	30.0	47.1	32.4
5567-7(test 8)	10.5	48.2	29.2
5567-9(test 9)	17.7	63.0	31.4
5567-14(test 10)	0	56.3	29.1
5567-5(test 11)	31.5	49.6	31.8
5567-9(test 12)	19.0	60.2	31.0
LOM Prediction	5.1	55.0	30.3

The lead concentrate grades observed in the testwork summarized in Table 13-15 indicates the ability to manage lead concentrate grades by virtue of the efficiency of the talc removal process. This testwork also indicates that lead concentrate quality can be achieved when talc feed grades are several times higher than the LOM estimated talc grade.

Table 13-16 provides descriptions of the key metallurgical parameters for the operation of the proposed recovery and upgrading of base and precious metals. These have been estimated from numerous tests and will be modulated during the operation as feed grades and metal ratios dictate.

Table 13-16 Summary of Flotation Reagent and Grind Size Objectives

Process Stage	Parameter	Comment
Flotation Feed		
Primary Grind Size	P_{80}	70 µm
Zinc Depressant	$ZnSO_4$	200/100 g/t
Zinc Depressant	NaCN	100 g/t
Talc Flotation		
Frothers	MIBC	10 – 40 g/t
Bulk Cu/Pb Flotation		
Flotation Collector	3418A	25-40 g/t
Frother	MIBC	5 – 10 g/t
Re-grind Size	P_{80}	40 µm
Zinc Flotation		
Zinc Activator	$CuSO_4$	100-200 g/t
Zinc Collector	SIPX	10 - 50 g/t
Re-grind Size	P_{80}	40 µm
Cu/Pb Separation		
Copper Depressant	NaCN	60 - 120 g/t
Lead Collector	3418A	10 g/t

Note: Expected Concentrate Quality

ICP assays were conducted on the copper and lead concentrates produced from the locked cycle tests at ALS Metallurgy and the zinc concentrate from the locked cycle tests at SGS. The samples are thought to represent the expected concentrate quality. The main impurity elements are shown in Table 13-17.

The results indicated that key penalty elements, as well as precious metals are typically concentrated into a lead concentrate, leaving the copper concentrate of higher than expected quality.

Table 13-17 Summary of Lead Concentrate Quality

Lead Conc,	Pb	Zn	Cu	Au	Ag	As	Sb	Bi	F
	%	%	%	g/t	g/t	g/t	g/t	g/t	g/t
Average Value	55.0*	1.8	6.9	37.3*	2805*	2128	1375	3876	3260
Sample Max		2.83				4400	5370	5140	5900
Sample Min		0.74				125	32	3270	160

* Reported to be consistent with predictive balance.

The issue of fluorine in the lead concentrate can be an issue for smelters. The level of fluorine in lead concentrates produced in laboratory tests, has been shown to be the result of small volumes of talc mineral that escape the talc pre-float circuit and will report with the lead concentrates. Talc levels and ultimately fluorine levels will be managed by optimization of the talc pre-float circuit, talc and fluorine will be effectively removed to ensure the quality of the lead concentrate. It is recommended that a value of 1500 g/t F be used in marketing evaluations of the lead concentrate. Bismuth may also be an element that will be an issue with the lead concentrates.

Precious metal deportment into the lead concentrate is very high and should benefit the payable levels of precious metals at a smelter.

Table 13-18 provides the key features expected in the copper concentrate.

Table 13-18 Summary of Copper Concentrate Quality

Copper Conc.	Cu	Zn	Pb	Au	Ag	As	Sb	Bi	F
	%	%	%	g/t	g/t	g/t	g/t	g/t	g/t
Average Value	30.3*	1.6	0.70	0.8*	138*	1996	1163	175	246
Sample Max		2.98	1.52			3350	1675	324	330
Sample Min		0.87	0.53			102	264	115	180

* Reported to be consistent with predictive balance.

Copper concentrates are shown to be of high quality with arsenic levels somewhat elevated, but likely below penalty levels. Sulphur levels in copper concentrates are consistent with the mineralization being chalcopyrite at approximately 30–32% sulphur.

Table 13-19 shows the predicted key features of the zinc concentrate.

Table 13-19 Summary of Zinc Concentrate Quality

Zinc Conc.	Zn	Cu	Pb	Au	Ag	Fe	As	Sb	Cd	Bi	F
	%	%	%	g/t	g/t	%	g/t	g/t	g/t	g/t	g/t
Average Val.	59.2*	1.3	0.25	0.53*	24.5*	5.47	966	115	3514	60	100
Sample Max.		2.98	0.06			12.4	7000	570	4000	351	-
Sample Min.		0.87	0.22			1.93	100	16	2900	11	-

* Reported to be consistent with predictive balance.

Zinc concentrates are high grade but have elevated levels of cadmium that may incur economic penalties. Average iron content for the zinc concentrate is considered very good and further optimization of the rejection of pyrite may further reduce these reported iron levels.

13.4 Comment on Section 13

The materials tested in the metallurgical programmes as described in this Section are representative of the life of mine production.

The flowsheet developed based on the 2012 to 2019 testwork is feasible.

Further metallurgical testwork is recommended using additional representative samples to further confirm the flowsheet and better understand the continuity of the Arctic deposit with respect to the metallurgical response. This testwork is recommended to take the form of locked cycle tests using a variety of samples representing spatial zones within the deposit. A continuation of a phased approach to additional testwork is recommended to ensure that representative testwork is managed properly.

Lead concentrate quality has been shown to be impacted by talc flotation efficiency and a better understanding of the level of talc in an expected process feed is critical in maximizing the value of a lead concentrate. It is recommended that sample selection for future testwork consider the talc content in sample selection to avoid mis-representing the talc content of future samples.

There are no outstanding metallurgical issues related to the production of a copper or zinc concentrate from all of the materials tested.

Additional grinding testwork and concentrate characterization is also recommended for future metallurgical samples in order to bolster the confidence in the design of the proposed grinding plant.

14 Mineral Resource Estimate

14.1 Introduction

During the summers of 2015 and 2016, Trilogy Metals conducted drilling programs designed to upgrade previous in-pit Inferred Mineral Resources to the Indicated category. During the fall of 2016, following the completion of the final drilling program, Trilogy Metals geologists reinterpreted the geologic units present in the vicinity of the Arctic Deposit. The mineral resource estimate described in this report incorporates the new geologic model and all available sample data as of April 25, 2017.

In 2018, Trilogy drilled seven holes designed to collect geotechnical information in the area of the proposed plant site. These holes are far removed from the Arctic deposit and have no impact on the estimate of resources.

In 2019, Trilogy drilled 9 holes in the area of the Arctic deposit designed to collect additional geotechnical and hydrogeological information. Portions of these holes were sampled and analyzed. The data was provided by Trilogy for review. Eight of the nine drill holes are located within the limits of the current mineral resource. Five holes are twins of previous drill holes and the results in the new holes essentially mirror those of the older drill holes. The other three holes are drilled within a maximum distance of 75m from previous drill holes and the results are similar to those found in proximal older drill holes.

In the opinion of the QP, the results of the 2019 drilling supports the current estimate of mineral resources and the inclusion of these nine new drill holes would have no material impact on the estimate of mineral resources at Arctic.

The database used to estimate the Arctic deposit mineral resource was audited by the QPs. The QPs are of the opinion that the current drilling information is sufficiently reliable to confidently interpret the boundaries of the mineralization and the assay data are sufficiently reliable to support mineral resource estimation.

The resource estimate was generated using MineSight v11.60-2. Some non-commercial software, including the Geostatistical Library (GSLib) family of software, was used for geostatistical analyses.

14.2 Sample Database and Other Available Data

Trilogy Metals provided the Arctic database in Excel format, exported from the master database (GeoSpark Core Database System). The files contain collar, survey, assay, lithology, ABA and SG data, and other geological, and geotechnical information.

14.2.1 Sample Data Used in Block Model Development

The drilling database comprises 322 (core) holes totaling 64,260 m, this includes exploration holes that test for satellite deposits for distances up to 40 km from the Arctic deposit and includes information from 40 drill holes located outside of the Trilogy Metals property. There are 152 drill holes (32,699 m) in the immediate vicinity of the Arctic deposit that were used to support the Mineral Resource estimate.

The database contains a total of 12,594 samples, most of which have been analyzed for a variety of elements through a combination of ICP and XRF multi-element packages. Sample data for copper, lead, zinc, gold and silver were extracted from this database for use in the generation of this resource estimate.

Individual sample intervals range from 5 cm to 35.5 m in length and average 2.14 m. The few very long sample intervals represent samples taken in talus and overburden. Sample selection in the majority of drill holes was guided by the visual presence of appreciable amounts of sulphide mineralization. As a result, most core intervals where samples have not been taken are assigned default zero grade values. There are exceptions where samples were purposely not taken, such as wedge holes or holes that were drilled to provide metallurgical test material. In these cases, the un-sampled intervals remain as “missing”.

All drill holes at the Arctic deposit are collared on surface and are generally vertically oriented, or steeply inclined in a northeast direction. The majority of holes are spaced at 75 m to 100 m intervals, but there are rare instances where holes are located within 10 m of one another.

SG measurements were conducted on 3,024 samples in the database and range from a minimum of 2.43 to a maximum of 4.99 and average 3.08. The distribution of SG data is considered sufficient to support block model estimation.

Drill core recovery data are available for 107 holes with an overall average value of 94%. Samples in the interpreted mineralized domains average >95% recovery. There are no apparent relationships between drill core recovery and sample grade. There are no adjustments to the sample database to account for core recovery.

The database also contains lithology information derived during core logging. There are 33 different rock types in this dataset.

Trilogy Metals provided a topographic digital terrain surface, produced from LiDAR data in 2016, measuring approximately 2 km east-west by 2 km north-south that is centred over the Arctic deposit. Drill hole collar locations, surveyed using a differential GPS, correlate very well with the local digital terrain (topographic) surface.

Table 14-1 contains a summary of the sample data used in block model development. Note that the primary and adjusted values for copper, lead, zinc, gold and silver are included in the table (value #1 is initial data and #2 includes zero grade values assigned to select un-sampled intervals).

Table 14-1 Summary of Sample Data Used to Develop the Resource Block Model

Element	Number	Total Length (m)	Minimum	Maximum	Mean	Std. Dev.	Co. Of Variation
Copper1 (%)	12,252	17,551	0.00	31.00	0.50	1.67	3.3
Copper2 (%)	15,662	31,392	0.00	31.00	0.28	1.28	4.5
Lead1 (%)	12,041	17,361	0.00	8.15	0.12	0.50	4.0
Lead2 (%)	15,451	31,202	0.00	8.15	0.07	0.38	5.4
Zinc1 (%)	12,151	17,458	0.00	27.60	0.72	2.56	3.6
Zinc2 (%)	15,561	31,299	0.00	27.60	0.40	1.95	4.8
Gold1 (g/t)	10,986	14,604	0.00	32.800	0.138	0.783	5.7
Gold2 (g/t)	14,396	28,446	0.00	32.800	0.071	0.565	8.0
Silver1 (g/t)	12,154	17,459	0.00	1,155.00	8.20	30.58	3.7

Element	Number	Total Length (m)	Minimum	Maximum	Mean	Std. Dev.	Co. Of Variation
Silver2 (g/t)	15,564	31,300	0.00	1,155.00	4.57	23.20	5.1
Sulphur (%)	8,937	15,450	0.01	10.00	1.37	2.18	1.6
AP	2,261	5,018	0.31	1,307.50	68.19	148.50	2.2
NP	2,261	5,018	0.08	972.75	18.34	50.54	2.8
Talc (%)	9,191	16,114	0.00	82.20	1.53	6.67	4.4
SG	3,100	n/a	2.43	4.99	3.09	0.53	0.2

Notes: Value#1 is initial sample data. Value#2 includes zero grades assigned to select unsampled intervals.

The total core length of drilling is 32,699 m.

The distribution of copper grades in drill holes proximal to the Arctic deposit is shown from two isometric viewpoints in Figure 14-1 and Figure 14-2.

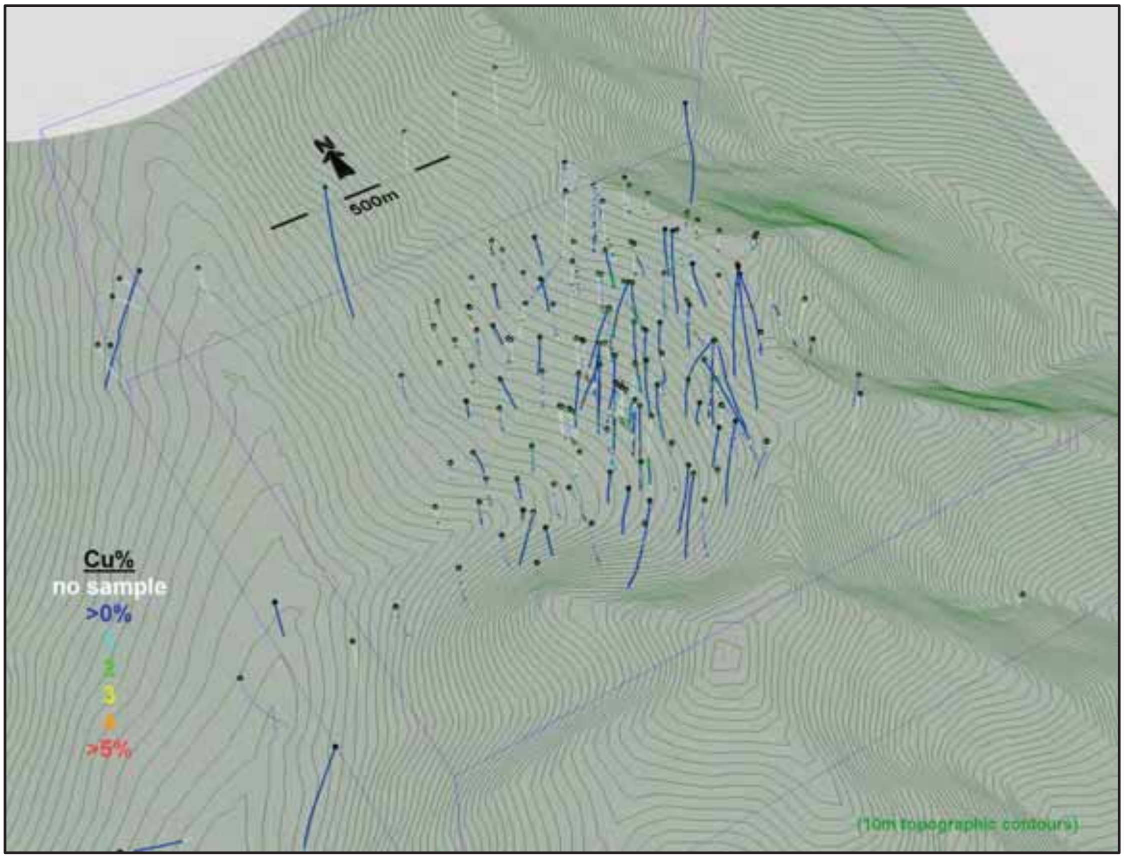


Figure 14-1 Isometric View of Copper Grades in Drill Holes (Sim, 2019)

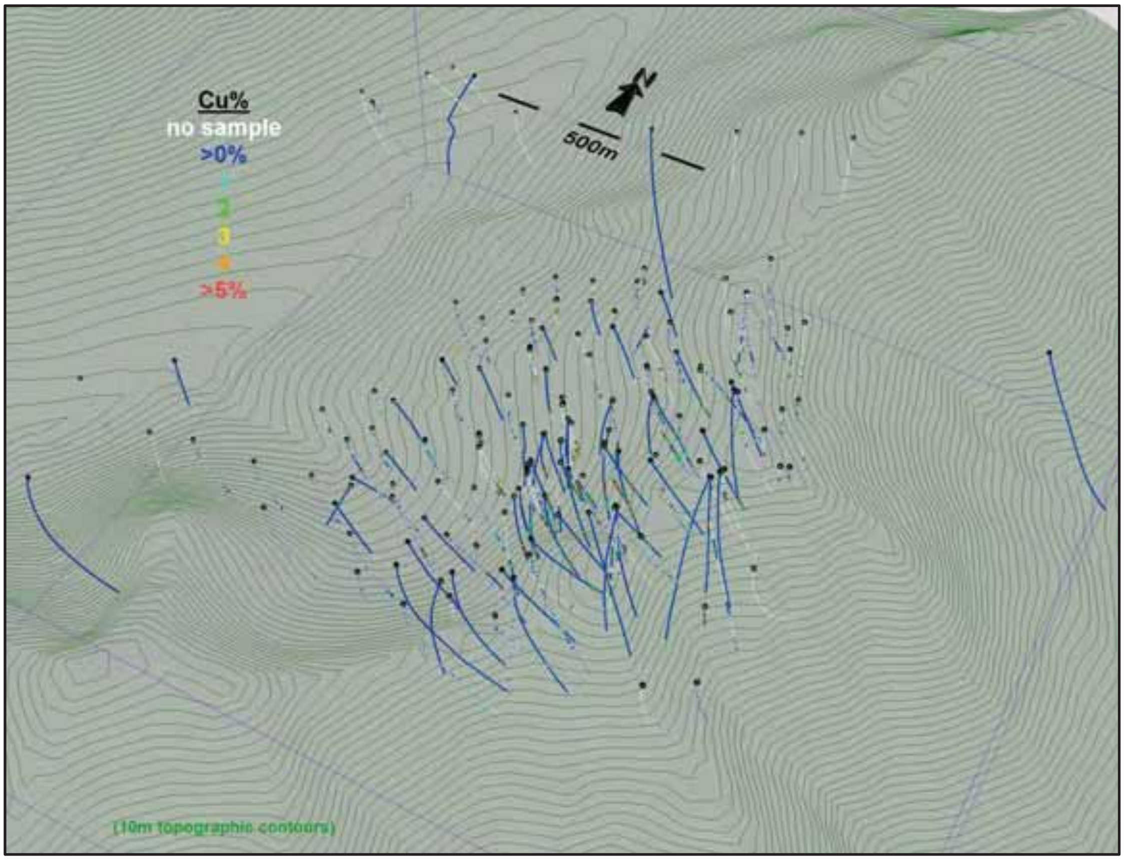


Figure 14-2 **Isometric View of Copper Grades in Drill Holes (Sim, 2019)**

14.2.2 ABA Data

There are 1,557 samples that have been analyzed for AP and NP. The distribution of AP and NP data, shown in Figure 14-3, is somewhat limited due to a lack of available drill core. The majority of the available AP and NP samples are located around the perimeter of the deposit and from rocks in the hanging-wall to the mineralized zones. Although the distribution of these data is not ideal, it is felt there is sufficient information available to provide reasonable estimates of the acid and neutralizing potential of the waste rocks at the Arctic deposit. There have been no adjustments to account for missing AP and NP data.

Estimates of total sulphur content were also generated. There is a total of 9,316 samples that have been analyzed for total sulphur content. Approximately one half of drill holes have sulphur analysis throughout the entire length of the hole and the remainder of the drill holes have sulphur analyses taken on 10 m intervals down the hole. This provides a consistent and extensive distribution of samples that is sufficient to provide reasonable estimates of sulphur content in the block model.

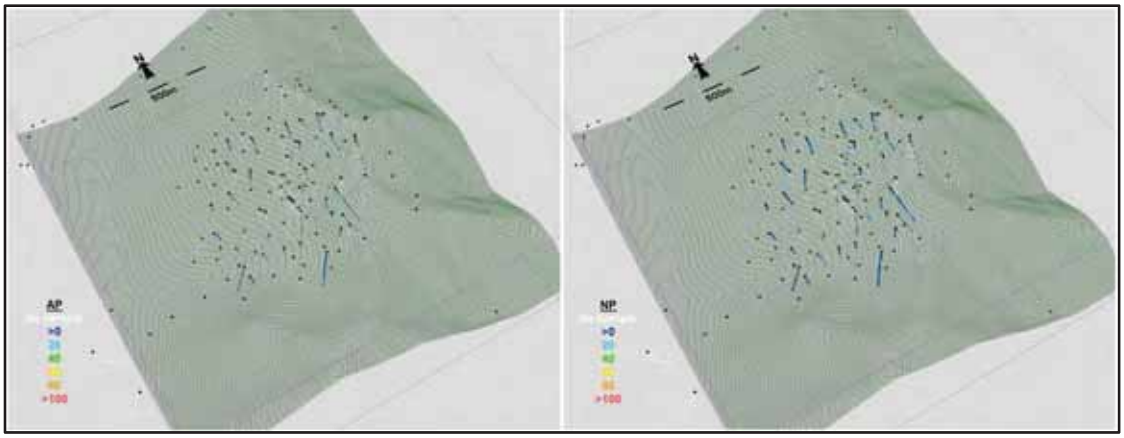


Figure 14-3 Isometric Views of Available AP and NP Data (Sim, 2019)

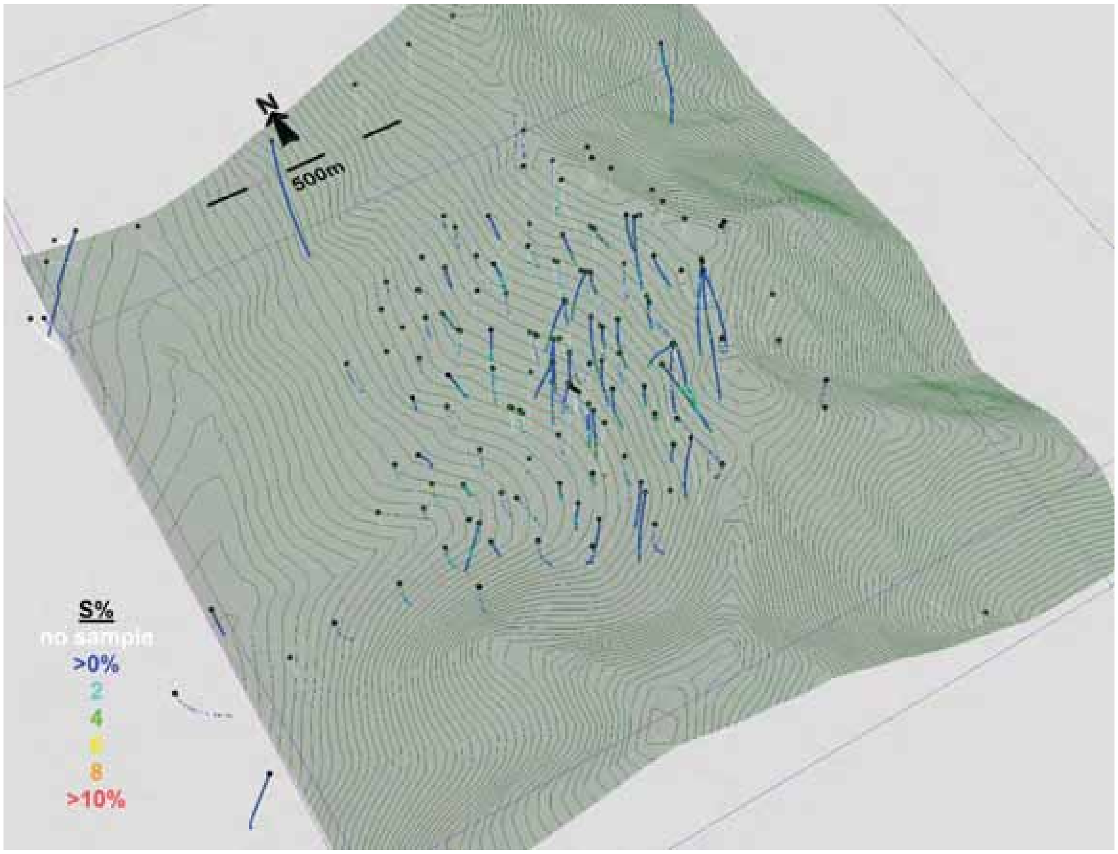


Figure 14-4 Isometric View of Available Sulphur Data (Sim, 2019)

14.2.3 Talc Data

Trilogy Metals provided estimates of talc content, derived from calculations using the four-acid digestion ICP database. Much of the older drilling, conducted by Kennecott, does not have any geochemical data, and, as a result, there are no talc estimates for these historical drill holes. Outside of the main mineralized zones, some holes have continuous geochemical sample data, but many drill holes have geochemical samples (typically 1 m in length) that were collected on

5 to 10 m intervals. As a result, about ½ of the drill hole intervals contain calculated estimates of the percentage of talc. There have been no adjustments or modifications made to the database for intervals where no talc data is present. The distribution of available talc data is shown in Figure 14-5.

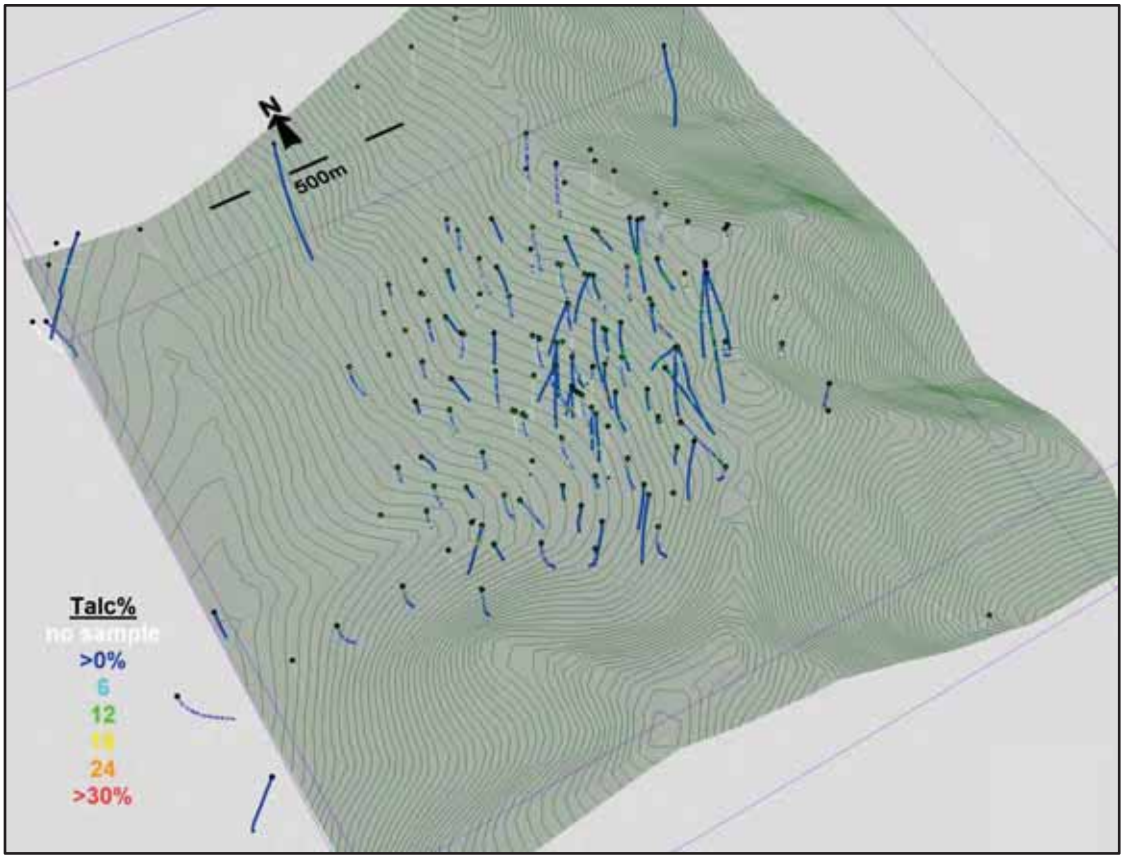


Figure 14-5 Isometric View of Available Talc Data (Sim, 2019)

14.3 Geologic Model

Trilogy Metals geologists interpreted three dimensional domains representing the distributions of various lithologic units, mineral domains, alteration facies, geotechnical domains, talc-rich zones and an area of near surface weathering. All of these domains were evaluated to determine if they should be used to control the estimation of the various elements included in the resource block model.

In order to replicate the stratiform nature of the mineralization in the resource model, a dynamic anisotropy approach relative to the overall trends of sulphide mineralization was applied. Three-dimensional planes were interpreted that represent the trends of the sulphide mineralization, with separate planes interpreted for each of the eight main mineralized domains. These “trend planes” generally represent the centre of each interpreted mineralized domain. The trend planes were used to control search orientations during subsequent interpolations in the model. Variograms were generated using distances relative to the trend planes rather than the true sample elevations. This approach essentially flattened out the zone during interpolation relative to the defined trend plane.

The interpretation of most of the geology domains was derived from a combination of information recorded during surface geologic mapping and the visual logging of drill core as well as properties exhibited by various elements in the ICP database. A series of mineralized zones (MinZone domains) were interpreted by Trilogy Metals that represent zones that exceed a grade of 0.75% copper equivalent (CuEq). The copper equivalent formula used the same metals prices as the resource cut-off grade detailed in Table 13 and Table 14-28 note (2). Of these, there are four or five primary domains and 12 sub-domains. The sub-domains are much smaller and are often interpreted about only one or two drill holes. Essentially all of the Mineral Resource estimate is located within the larger, primary, MinZone domains. Examples of the interpreted lithologic model are shown in Figure 14-6 and Figure 14-7.

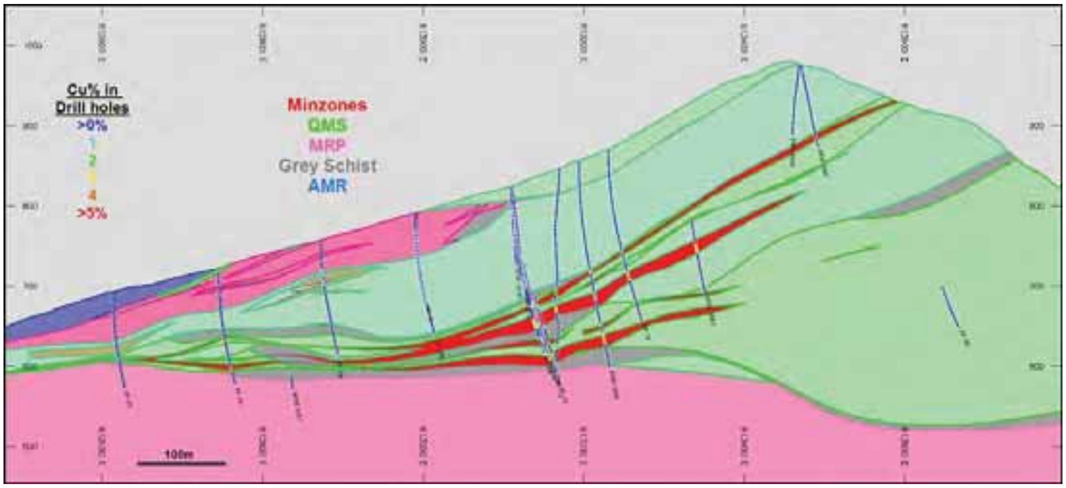


Figure 14-6 Cross Section 613250E Showing Lithology Domains at Arctic (Sim, 2019)

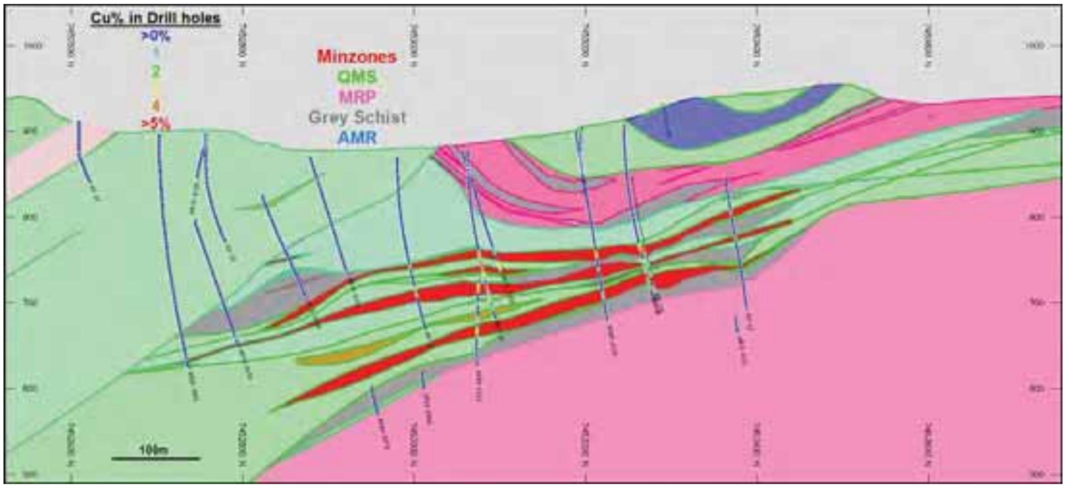


Figure 14-7 Cross Section 7453000N Showing Lithology Domains at Arctic (Sim, 2019)

Six separate geotechnical domains were interpreted by SRK, based on a review of the local geology, alteration, weathering, overburden, major structures, minor structures (discontinuity sets), a rock mass assessment, a kinematic stability assessment and a hydrogeological assessment (see discussion in Section 9.7). These domains define differing slope sectors used in the generation of open pit designs. The domain distribution is shown in Figure 14-8.

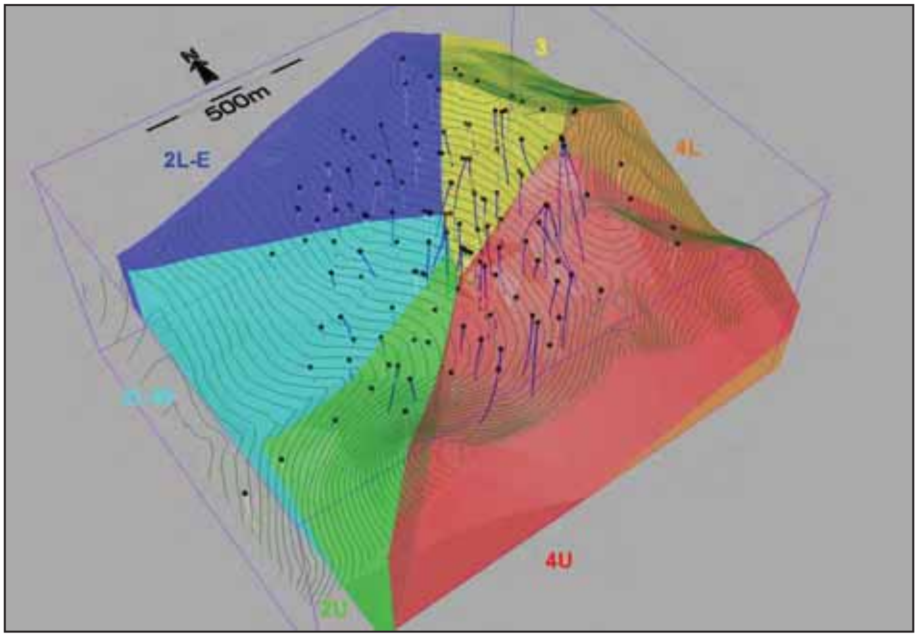


Figure 14-8 Isometric View of Geotechnical Domains (Sim, 2017)

A series of nine separate domains were interpreted that encompass zones where talc has been observed. The shape and distribution of the talc domains are shown in Figure 14-9. The talc domains tend to occur in the immediate stratigraphic footwall of the mineralized zones, resulting from hydrothermal alteration during the development of the semi-massive to massive sulphide zones.

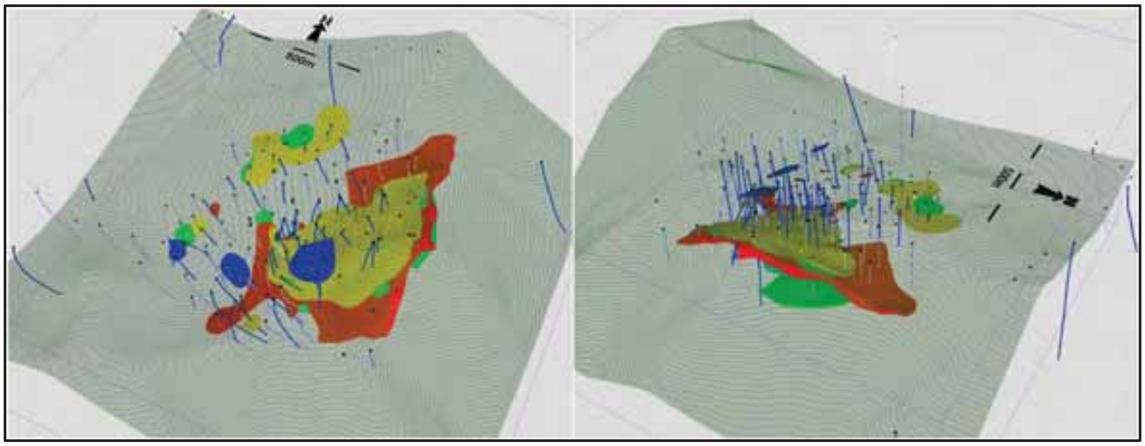


Figure 14-9 Isometric Views of Talc Domains (Sim, 2019)

Four alteration domains were interpreted as shown in Figure 14-10. These tend to mimic the general mineralization trends of in the deposit. These domains are locally patchy and discontinuous, reflecting a lack of continuity of these alteration assemblages.

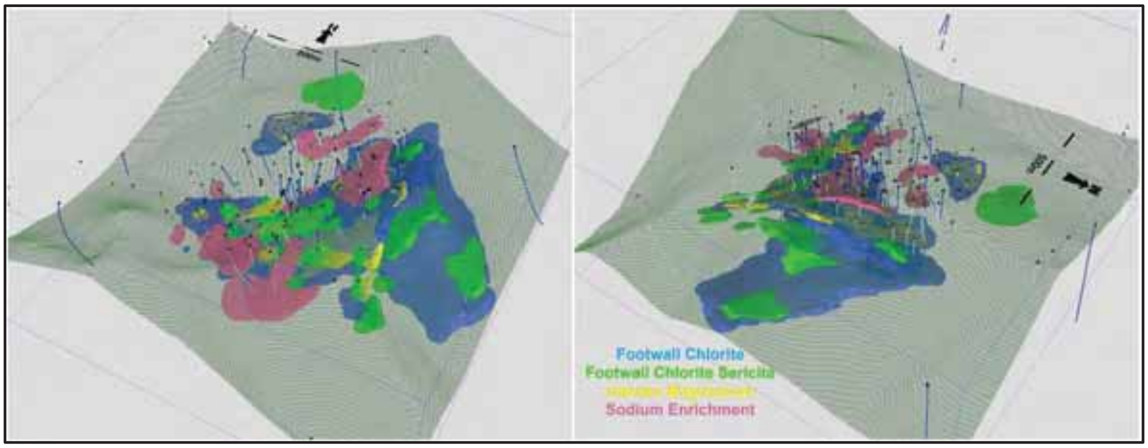


Figure 14-10 Isometric Views of Alteration Domains (Sim, 2019)

14.3.1 Summary of Geologic Domains

The interpreted lithology domains are summarized in Table 14-2. The lithology domains have been segregated into five general groups as follows:

- LTHDM 1-8: Somewhat generalized representation of the mineralized domains (MinZone domains) that host the majority of the mineralization.
- LTHDM 100-series: Meta-Rhyolite Porphyry (MRP).
- LTHDM 200-series: Grey Schist (GS).
- LTHDM 300-series: Quartz Mica Schist (QMS).
- LTHDM 400-series: Aphanitic Meta-Rhyolite (AMR).

Table 14-2 Summary of Lithology Domains

Lithology Unit	LTHDM	Lithology Unit	LTHDM	Lithology Unit	LTHDM	MinZone Domain	LTHDM
AMR 2A	401	GS WS	209	MRP WS	104	1	1
QMS 2WS	309	GS 2C	208	MRP WSsub	103	2, 2.5	2
QMS WS	308	GS 2B	207	MRP 2A	102	3, 3sub	3
QMS 2B	307	GS 2A	206	MRP 1A	101	4	4
QMS 2A	306	GS 2	205			5	5
QMS 1A	305	GS WX	204			7a, b, bHW, c	7
QMS 1CX	304	GS X	203			8a, b, c, cHW, d	8
QMS 1BY	303	GS Y	202				
QMS 1CZ, 1C	302	GS Z	201				

In order to retain the detail between the various MinZone domains, distinct codes were assigned using the individual interpreted MinZone domains as listed in Table 14-3.

Table 14-3 Summary of Mineralized Zone (MinZone) Domains

MinZone Domain	MNZNE code	MinZone Domain	MNZNE code
1	10	7b	73
2	20	7bHW	74
2.5	25	7c	75
3	30	7cHW	76
3sub	35	8a	81
4	40	8b	82
5	50	8c	83
7a	71	8cHW	84
7aHW	72	8d	85

The remaining interpreted geotechnical, alteration, talc and weathered domains are summarized in Table 14-4.

Table 14-4 Summary of Geotech, Alteration, Talc and Weathering Domains

Geotech Domain	GTECH Code	Alteration Domain	ALTDM Code	Talc Domain	TALC Code	Weathered Domain	Weathered Code
2L-E	1	FW Chlorite	701	Talc	1	Weathered	1
2L-W	2	FW Chlorite-Sericite	702	No Talc	2	Fresh	2
2U	3	Intense Magnesium	703				
3	4	Sodium Enrichment	704				
4L	5	Sodium Enrichment HW	705				
4U	6	Other	706				

14.4 Compositing

The average sample length of all samples is 1.45 m but inside the MinZone domains samples tend to be much shorter, with an average of 0.68 m. A composite length of 1 m was selected for use in the estimate of mineral resources.

Drill hole composites were length-weighted and generated down-the-hole, meaning composites began at the top of each drill hole and were generated at constant intervals down the length of the hole. The drill hole composites honoured the MinZone domain boundaries, meaning individual composites were broken at the boundary between the MinZone domain and the surrounding rocks.

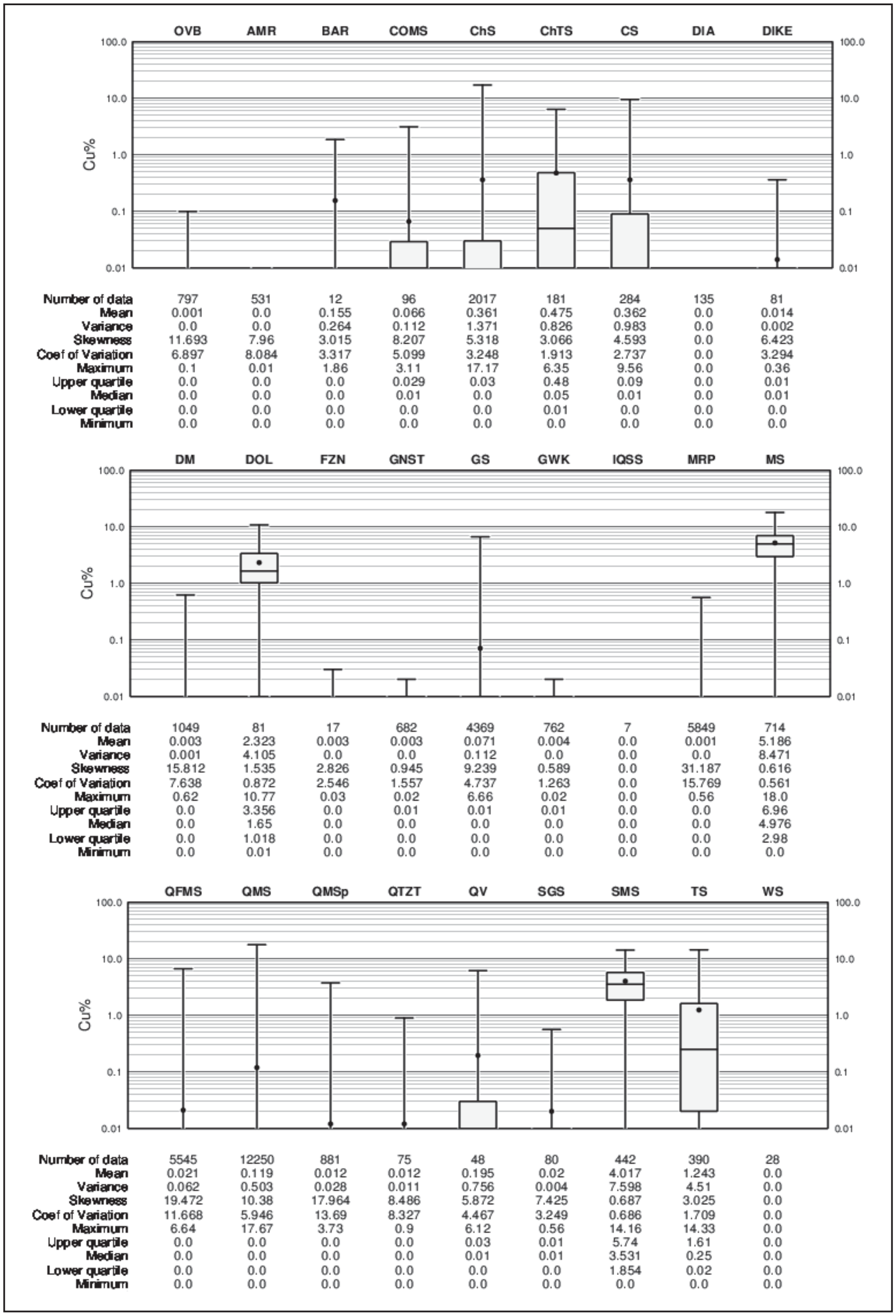
14.5 Exploratory Data Analysis

Composited samples were captured in the various interpreted domains including the lithology domains (including the Minzones), alteration domains, talc domains and the near-surface weathered domain.

14.5.1 As-Logged Geology and Domain Statistics

The drill core was examined and logged for lithology type and geo-technical characteristics. The geotechnical groups were not related to grade and are, therefore, not included in this discussion.

Twenty-seven lithology designations with associated grades occur in the database. The frequency distributions for the grades of each metal by as-logged lithology were compared using boxplots. An example for copper is included as Figure 14-5. The boxplots show that significantly high grades occur, as expected, in massive and semi-massive sulphides but they also show that high grades may occur in almost any lithology. These results suggest that individual lithology type is not a strong controlling factor on the distribution of metal in the deposit.



	OVB	AMR	BAR	COMS	ChS	ChTS	CS	DIA	DIKE
Number of data	797	531	12	96	2017	181	284	135	81
Mean	0.001	0.0	0.155	0.066	0.361	0.475	0.362	0.0	0.014
Variance	0.0	0.0	0.264	0.112	1.371	0.826	0.983	0.0	0.002
Skewness	11.693	7.96	3.015	8.207	5.318	3.066	4.593	0.0	6.423
Coef of Variation	6.897	8.084	3.317	5.099	3.248	1.913	2.737	0.0	3.294
Maximum	0.1	0.01	1.86	3.11	17.17	6.35	9.56	0.0	0.36
Upper quartile	0.0	0.0	0.0	0.029	0.03	0.48	0.09	0.0	0.01
Median	0.0	0.0	0.0	0.01	0.0	0.05	0.01	0.0	0.01
Lower quartile	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	DM	DOL	FZN	GNST	GS	GWK	IQSS	MRP	MS
Number of data	1049	81	17	682	4369	762	7	5849	714
Mean	0.003	2.323	0.003	0.003	0.071	0.004	0.0	0.001	5.186
Variance	0.001	4.105	0.0	0.0	0.112	0.0	0.0	0.0	8.471
Skewness	15.812	1.535	2.826	0.945	9.239	0.589	0.0	31.187	0.616
Coef of Variation	7.638	0.872	2.546	1.557	4.737	1.263	0.0	15.769	0.561
Maximum	0.62	10.77	0.03	0.02	6.66	0.02	0.0	0.56	18.0
Upper quartile	0.0	3.356	0.0	0.01	0.01	0.01	0.0	0.0	6.96
Median	0.0	1.65	0.0	0.0	0.0	0.0	0.0	0.0	4.976
Lower quartile	0.0	1.018	0.0	0.0	0.0	0.0	0.0	0.0	2.98
Minimum	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	QFMS	QMS	QMSp	QTZT	QV	SGS	SMS	TS	WS
Number of data	5545	12250	881	75	48	80	442	390	28
Mean	0.021	0.119	0.012	0.012	0.195	0.02	4.017	1.243	0.0
Variance	0.062	0.503	0.028	0.011	0.756	0.004	7.598	4.51	0.0
Skewness	19.472	10.38	17.964	8.486	5.872	7.425	0.687	3.025	0.0
Coef of Variation	11.668	5.946	13.69	8.327	4.467	3.249	0.686	1.709	0.0
Maximum	6.64	17.67	3.73	0.9	6.12	0.56	14.16	14.33	0.0
Upper quartile	0.0	0.0	0.0	0.0	0.03	0.01	5.74	1.61	0.0
Median	0.0	0.0	0.0	0.0	0.01	0.01	3.531	0.25	0.0
Lower quartile	0.0	0.0	0.0	0.0	0.0	0.0	1.854	0.02	0.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

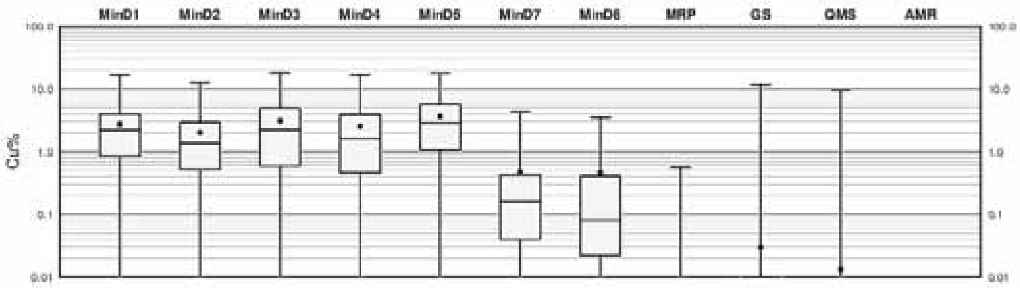
Figure 14-5 Boxplots of Copper by Logged Lithology Type (Sim, 2017)

A matrix was constructed listing the individual logged lithology types within each of the interpreted MinZone domains. This matrix indicated that between 32 and 44% of the mineral domains consisted of massive or semi-massive sulphides. The remainder consisted of as many as 15 other rock types. The Minzone domains encompass rocks that, in general, contain > 0.75% CuEq and, as shown in the boxplot in Figure 14-5, mineralization of this tenor occurs in the majority of rock types.

Trilogy Metals grouped the 27 individual lithology types into four groups (QMS, GS, MRP and AMR). Each of these four groups contains a mix of logged rock types. The matrix of individual lithology by group showed the interpreted MRP group contained 54.7% individually-logged MRP rocks with the remainder from 24 other logged rock types; the interpreted GS group had 76.2% logged as GS and 16 other logged rock types; the interpreted QMS group had 79.5% logged as QMS and 26 other rock types; and the interpreted AMR group had 86.4% logged as AMR and five other rock types. This type of simplification of rock types resulting from the interpretation of lithology domains is not uncommon.

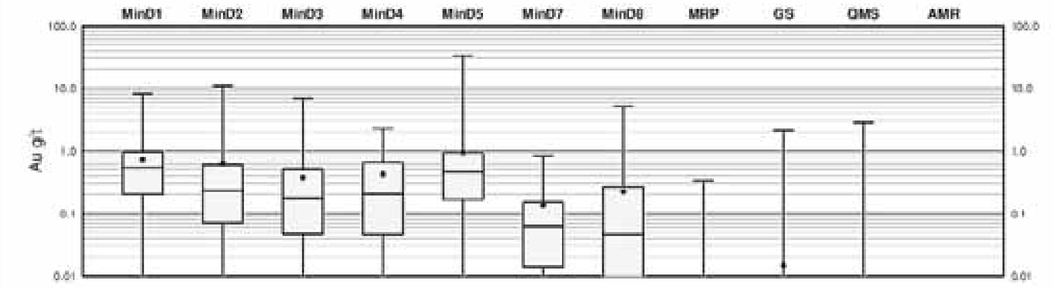
14.5.2 Interpreted Lithology and MinZone Domain Statistics

The composited sample data were assigned distinct lithology domain codes, as listed in Table 14-2, using the domains interpreted by Trilogy Metals. Boxplots describing the distributions of each element by lithology domain were generated. The distributions for copper, zinc, lead, gold, and silver are similar relative to the Minzone domains; the interpreted MinZone domains (lithology domain codes 1 to 8) host the majority of the mineralization where the other lithology domains (100, 200, 300 and 400 series codes) only exhibit a few rare significant grade values of which there is no apparent continuity. Domains 7 and 8 show elevated metal grades compared to the other lithology groups, but the important grade distributions occur in domains 1 to 5. The distributions of copper and gold by lithology domain are shown in Figure 14-6 and Figure 14-7.



MinD1	MinD2	MinD3	MinD4	MinD5	MinD7	MinD8	MRP	GS	QMS	AMR	
715	299	827	171	604	153	115	9832	3959	18914	272	Number of data
2.759	2.039	3.111	2.551	3.649	0.475	0.457	0.001	0.03	0.013	0.0	Mean
5.9	4.612	8.811	8.025	9.81	0.629	0.654	0.0	0.118	0.022	0.0	Variance
1.42	1.728	1.113	1.667	1.052	2.844	2.375	36.394	28.029	38.593	0.0	Skewness
0.88	1.053	0.954	1.111	0.858	1.671	1.771	9.236	11.518	11.18	0.0	Coef of Variation
17.07	12.4	18.0	17.17	17.67	4.29	3.51	0.56	11.76	9.26	0.0	Maximum
4.006	2.946	4.934	3.934	5.644	0.43	0.411	0.0	0.01	0.0	0.0	Upper quartile
2.219	1.34	2.25	1.62	2.847	0.16	0.08	0.0	0.0	0.0	0.0	Median
0.85	0.51	0.582	0.483	1.068	0.04	0.022	0.0	0.0	0.0	0.0	Lower quartile
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Minimum

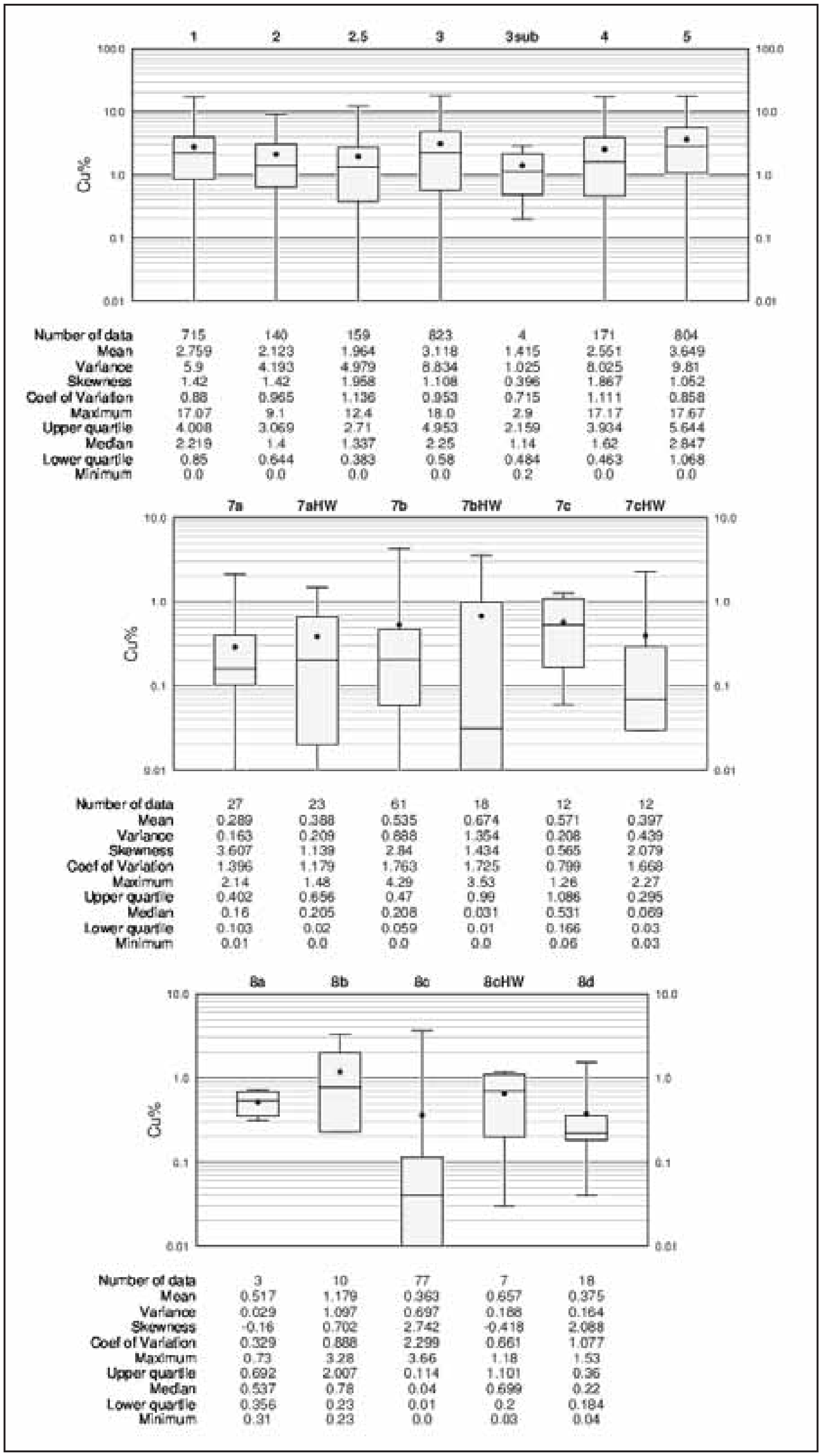
Figure 14-6 Boxplots of Copper by Lithology Domain (Sim, 2017)



MinD1	MinD2	MinD3	MinD4	MinD5	MinD7	MinD8	MRP	GS	QMS	AMR	
715	299	827	171	804	153	115	9832	3959	18914	272	Number of data
0.729	0.635	0.375	0.425	0.946	0.135	0.224	0.002	0.015	0.005	0.0	Mean
0.62	1.743	0.28	0.271	6.725	0.039	0.281	0.0	0.006	0.001	0.0	Variance
3.152	4.771	4.072	1.524	8.417	2.235	6.887	31.515	17.055	42.657	2.004	Skewness
1.08	2.079	1.412	1.225	2.741	1.473	2.365	3.707	5.218	7.913	2.29	Coef of Variation
8.08	10.85	6.857	2.307	32.8	0.832	5.14	0.334	2.118	2.852	0.003	Maximum
0.973	0.603	0.504	0.643	0.925	0.153	0.269	0.003	0.006	0.003	0.0	Upper quartile
0.54	0.24	0.173	0.203	0.468	0.063	0.046	0.0	0.0	0.0	0.0	Median
0.2	0.07	0.047	0.046	0.167	0.014	0.003	0.0	0.0	0.0	0.0	Lower quartile
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Minimum

Figure 14-7 Boxplots of Gold by Lithology Domain (Sim, 2017)

The MinZone domains interpreted by Trilogy Metals were used to assign MinZone domain codes, as listed in Table 14-3, to the composited drill hole samples. A series of boxplots was generated for each of the five metals included in the resource model. There are similar relative distributions exhibited by each of these five metals among or across the Minzone domains. An example showing the distribution of copper by MinZone domain is shown in Figure 14-8. The primary domains are those enclosing appreciable volumes of sample data (domains 1, 2, 2.5, 3, 4 and 5). There are limited numbers of data, and much lower average grades, in the sub-domains (3sub, 7'series and 8'series). For statistical and estimation purposes, the data in MinZone domain 2.5 is combined with domain 2, and the data in domain 3sub has been combined with domain 3. Since the frequency distributions are fairly similar in the 7-series, and there are relatively few samples in each sub-domain in the 8-series, the smaller domain samples were grouped into two domains labeled 7 and 8 for statistical and estimation purposes.



	1	2	2.5	3	3sub	4	5
Number of data	715	140	159	823	4	171	804
Mean	2.759	2.123	1.964	3.118	1.415	2.551	3.649
Variance	5.9	4.193	4.979	8.834	1.025	8.025	9.81
Skewness	1.42	1.42	1.958	1.108	0.396	1.867	1.052
Coef of Variation	0.88	0.965	1.136	0.953	0.715	1.111	0.858
Maximum	17.07	9.1	12.4	18.0	2.9	17.17	17.67
Upper quartile	4.008	3.069	2.71	4.953	2.159	3.934	5.644
Median	2.219	1.4	1.337	2.25	1.14	1.62	2.847
Lower quartile	0.85	0.644	0.383	0.58	0.484	0.463	1.068
Minimum	0.0	0.0	0.0	0.0	0.2	0.0	0.0

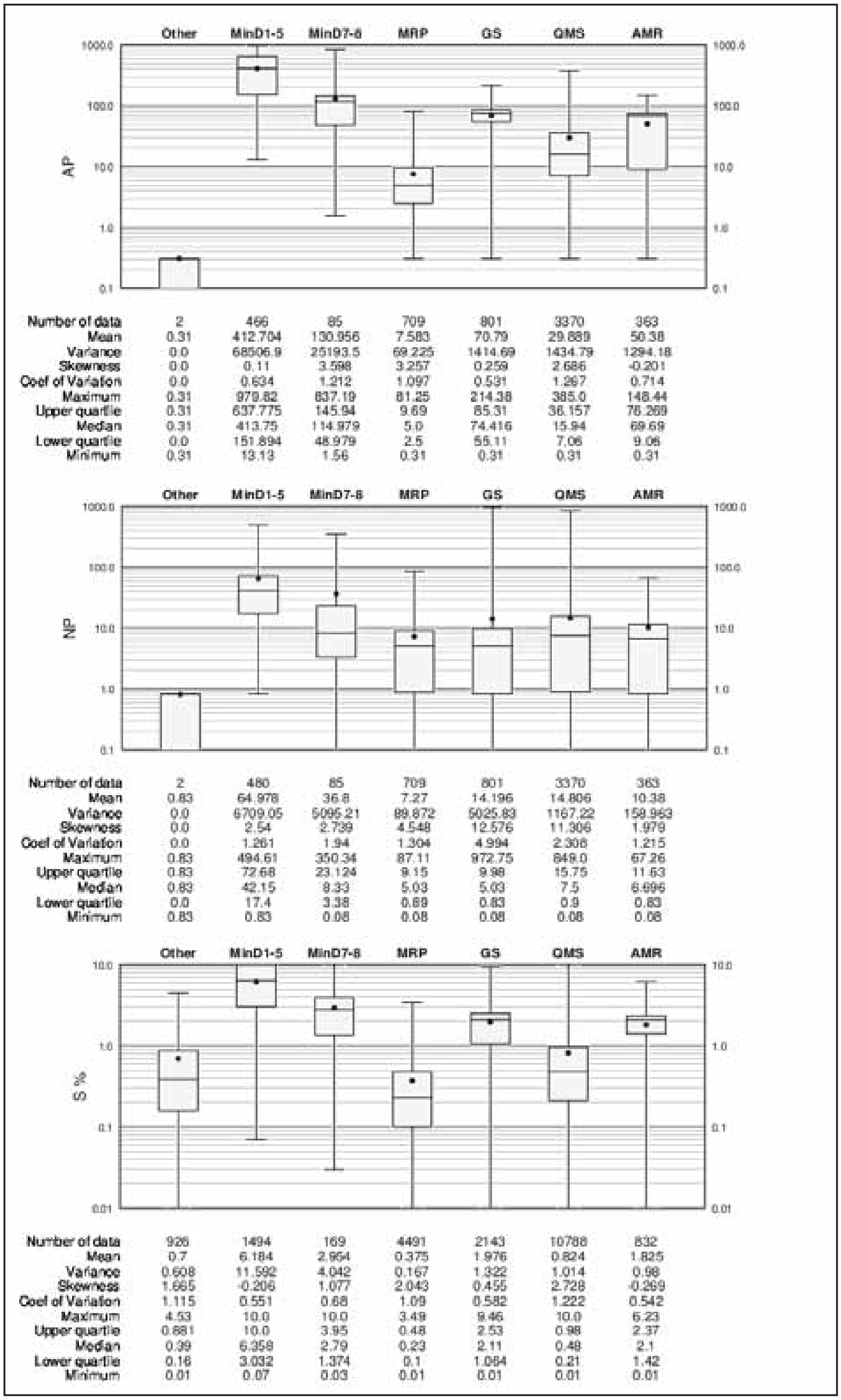
	7a	7aHW	7b	7bHW	7c	7cHW
Number of data	27	23	61	18	12	12
Mean	0.289	0.388	0.535	0.674	0.571	0.397
Variance	0.163	0.209	0.888	1.354	0.208	0.439
Skewness	3.607	1.139	2.84	1.434	0.565	2.079
Coef of Variation	1.396	1.179	1.763	1.725	0.799	1.668
Maximum	2.14	1.48	4.29	3.53	1.26	2.27
Upper quartile	0.402	0.656	0.47	0.99	1.086	0.295
Median	0.16	0.205	0.208	0.031	0.531	0.069
Lower quartile	0.103	0.02	0.059	0.01	0.166	0.03
Minimum	0.01	0.0	0.0	0.0	0.06	0.03

	8a	8b	8c	8cHW	8d
Number of data	3	10	77	7	18
Mean	0.517	1.179	0.363	0.657	0.375
Variance	0.029	1.097	0.697	0.188	0.164
Skewness	-0.16	0.702	2.742	-0.418	2.088
Coef of Variation	0.329	0.888	2.299	0.661	1.077
Maximum	0.73	3.28	3.66	1.18	1.53
Upper quartile	0.692	2.007	0.114	1.101	0.36
Median	0.537	0.78	0.04	0.699	0.22
Lower quartile	0.356	0.23	0.01	0.2	0.184
Minimum	0.31	0.23	0.0	0.03	0.04

Figure 14-8 Boxplots of Copper by MinZone Domain (Sim, 2017)

Evaluations were also made comparing the five main metals relative to the geotechnical, alteration, talc and weathering domains. There are no indications that these domains control the distribution of copper, lead, zinc, gold or silver in the deposit.

A series of boxplots was produced comparing the AP, NP and sulphur sample data in relation to the interpreted MinZone, lithology, alteration, talc and weathered domains. As expected, higher AP and S% values occur in the MinZone domains. Higher NP values in the vicinity of the MinZone domains are likely the result of the talc alteration from a carbonate-rich protolith typically seen in these areas. Outside of the mineralized domains, most lithology groups tend to have similar distributions of AP, NP, and S%. The grey schist has elevated values of AP and S% compared to other domains. The boxplots in Figure 14-9 show the distributions of AP, NP and S% by lithology type.



	Other	MinD1-5	MinD7-8	MRP	GS	QMS	AMR
Number of data	2	466	85	709	801	3370	363
Mean	0.31	412.704	130.956	7.583	70.79	29.889	50.38
Variance	0.0	68506.9	25193.5	69.225	1414.69	1434.79	1294.18
Skewness	0.0	0.11	3.598	3.257	0.259	2.686	-0.201
Coef of Variation	0.0	0.634	1.212	1.097	0.531	1.267	0.714
Maximum	0.31	979.82	837.19	81.25	214.38	385.0	148.44
Upper quartile	0.31	637.775	145.94	9.69	85.31	36.157	76.269
Median	0.31	413.75	114.979	5.0	74.416	15.94	69.69
Lower quartile	0.0	151.894	48.979	2.5	55.11	7.06	9.06
Minimum	0.31	13.13	1.56	0.31	0.31	0.31	0.31

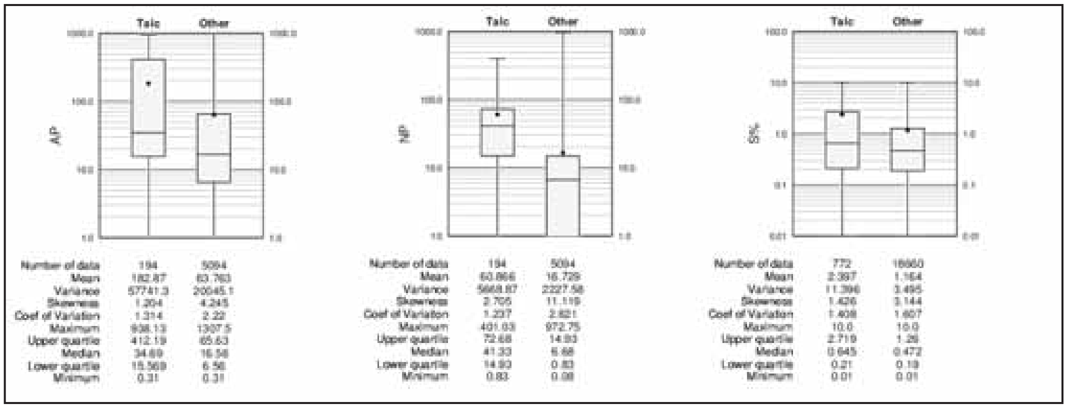
	Other	MinD1-5	MinD7-8	MRP	GS	QMS	AMR
Number of data	2	480	85	709	801	3370	363
Mean	0.83	64.978	36.8	7.27	14.196	14.806	10.38
Variance	0.0	6709.05	5096.21	89.872	5025.83	1167.22	158.963
Skewness	0.0	2.54	2.739	4.548	12.576	11.306	1.979
Coef of Variation	0.0	1.261	1.94	1.304	4.994	2.308	1.215
Maximum	0.83	494.61	350.34	87.11	972.75	849.0	67.26
Upper quartile	0.83	72.68	23.124	9.15	9.98	15.75	11.63
Median	0.83	42.15	8.33	5.03	5.03	7.5	6.696
Lower quartile	0.0	17.4	3.38	0.89	0.83	0.9	0.83
Minimum	0.83	0.83	0.08	0.08	0.08	0.08	0.08

	Other	MinD1-5	MinD7-8	MRP	GS	QMS	AMR
Number of data	926	1494	169	4491	2143	10788	832
Mean	0.7	6.184	2.964	0.375	1.976	0.824	1.825
Variance	0.608	11.592	4.042	0.167	1.322	1.014	0.98
Skewness	1.665	-0.206	1.077	2.043	0.455	2.728	-0.269
Coef of Variation	1.115	0.551	0.68	1.09	0.582	1.222	0.542
Maximum	4.53	10.0	10.0	3.49	9.46	10.0	6.23
Upper quartile	0.881	10.0	3.95	0.48	2.53	0.98	2.37
Median	0.39	6.358	2.79	0.23	2.11	0.48	2.1
Lower quartile	0.16	3.032	1.374	0.1	1.064	0.21	1.42
Minimum	0.01	0.07	0.03	0.01	0.01	0.01	0.01

Figure 14-9 Boxplots of AP (kg $CaCO_3$/t), NP (kg $CaCO_3$/t) and Sulphur by Lithology Domain (Sim, 2017)

The alteration domains show only minor differences between domains. The sodium depletion domain has lower sulphur and AP values, and there are higher NP values in the footwall chlorite and magnesium enrichment domains, but there is significant overlap in the boxplot results between domains suggesting these are not distinct distributions.

There are differences evident in AP, NP, and S% between both talc and the weathered domains as shown in Figure 14-10 and Figure 14-11.

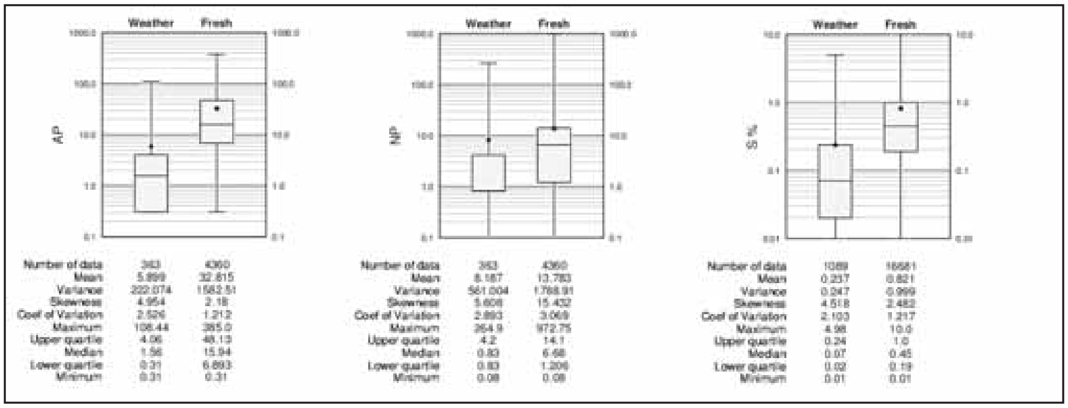


AP	Talc	Other
Number of data	194	5094
Mean	182.87	83.763
Variance	57741.3	20045.1
Skewness	1.204	4.245
Coef of Variation	1.314	2.22
Maximum	938.13	1307.5
Upper quartile	412.19	65.63
Median	34.69	16.58
Lower quartile	15.569	6.56
Minimum	0.31	0.31

NP	Talc	Other
Number of data	194	5094
Mean	60.866	16.729
Variance	5668.87	2227.58
Skewness	2.705	11.119
Coef of Variation	1.237	2.821
Maximum	401.03	972.75
Upper quartile	72.68	14.93
Median	41.33	6.68
Lower quartile	14.93	0.83
Minimum	0.83	0.08

S%	Talc	Other
Number of data	772	18660
Mean	2.397	1.164
Variance	11.396	3.495
Skewness	1.426	3.144
Coef of Variation	1.408	1.607
Maximum	10.0	10.0
Upper quartile	2.719	1.26
Median	0.645	0.472
Lower quartile	0.21	0.19
Minimum	0.01	0.01

Figure 14-10 Boxplots of AP (kg $CaCO_3$/t), NP (kg $CaCO_3$/t) and Sulphur by Talc Domain (Sim, 2017)



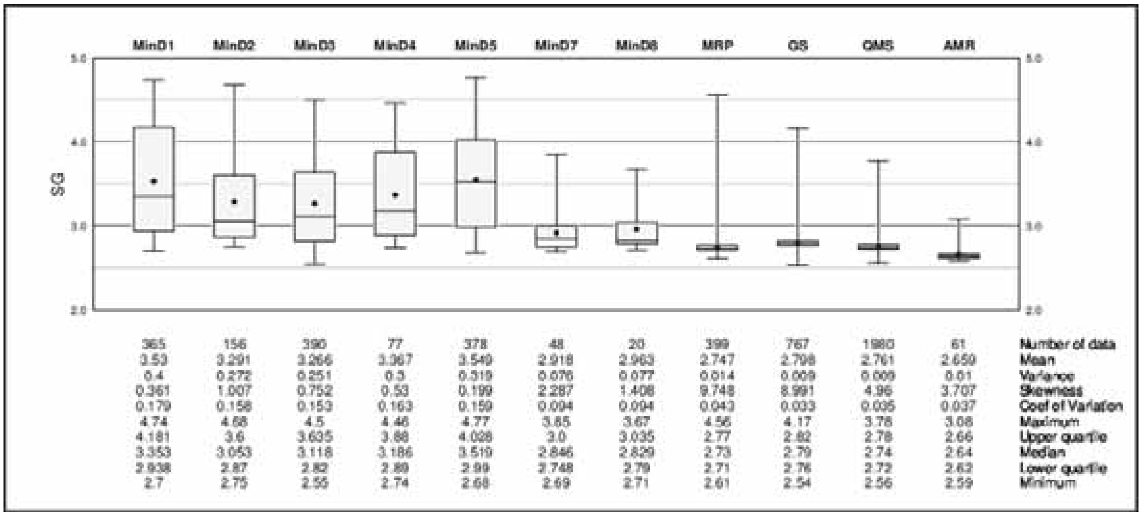
AP	Weather	Fresh
Number of data	363	4360
Mean	5.899	32.815
Variance	222.074	1582.51
Skewness	4.954	2.18
Coef of Variation	2.526	1.212
Maximum	108.44	385.0
Upper quartile	4.06	48.13
Median	1.56	15.94
Lower quartile	0.31	6.893
Minimum	0.31	0.31

NP	Weather	Fresh
Number of data	363	4360
Mean	8.187	13.783
Variance	561.004	1768.91
Skewness	5.608	15.432
Coef of Variation	2.893	3.069
Maximum	264.9	972.75
Upper quartile	4.2	14.1
Median	0.83	6.68
Lower quartile	0.83	1.206
Minimum	0.08	0.08

S %	Weather	Fresh
Number of data	1089	18681
Mean	0.237	0.821
Variance	0.247	0.999
Skewness	4.518	2.482
Coef of Variation	2.103	1.217
Maximum	4.98	10.0
Upper quartile	0.24	1.0
Median	0.07	0.45
Lower quartile	0.02	0.19
Minimum	0.01	0.01

Figure 14-11 Boxplots of AP (kg $CaCO_3$/t), NP (kg $CaCO_3$/t) and Sulphur by Weathered Domain (Sim, 2017)

SG samples were evaluated between the various interpreted domains. Only the MinZone domains contain samples that significantly differ from SG samples in the surrounding rocks. The boxplot in Figure 14-12 shows the distribution of SG data between the various MinZone domains and the lithology groups. There is weak correlation evident between SG and copper and zinc grade in some MinZone domains but there is scatter due to the variable presence of chalcopyrite, sphalerite, barite, and galena as well as arsenopyrite, pyrite and pyrrhotite.



MinD1	MinD2	MinD3	MinD4	MinD5	MinD7	MinD8	MRP	GS	QMS	AMR	
365	156	390	77	378	48	20	399	767	1980	61	Number of data
3.53	3.291	3.266	3.367	3.549	2.918	2.963	2.747	2.798	2.761	2.659	Mean
0.4	0.272	0.251	0.3	0.319	0.076	0.077	0.014	0.009	0.009	0.01	Variance
0.361	1.007	0.752	0.53	0.199	2.287	1.408	9.748	8.991	4.96	3.707	Skewness
0.179	0.158	0.153	0.163	0.159	0.094	0.094	0.043	0.033	0.035	0.037	Coef of Variation
4.74	4.68	4.5	4.46	4.77	3.85	3.67	4.56	4.17	3.78	3.08	Maximum
4.181	3.6	3.635	3.88	4.028	3.0	3.035	2.77	2.82	2.78	2.66	Upper quartile
3.353	3.053	3.118	3.186	3.519	2.846	2.829	2.73	2.79	2.74	2.64	Median
2.938	2.87	2.82	2.89	2.99	2.748	2.79	2.71	2.76	2.72	2.62	Lower quartile
2.7	2.75	2.55	2.74	2.68	2.69	2.71	2.61	2.54	2.56	2.59	Minimum

Figure 14-12 **Boxplots of SG by MinZone and Lithology Group Domains (Sim, 2017)**

14.5.3 Contact Profiles

Contact profiles were generated to evaluate the change in grades across prominent lithologic group and MinZone domain boundaries. The results for all metals are similar; a marked change in grade between the MinZone domains and the surrounding host rocks. An example showing the change in copper grade between the (combined) MinZone domains and the three main lithology groups is presented in Figure 14-13.

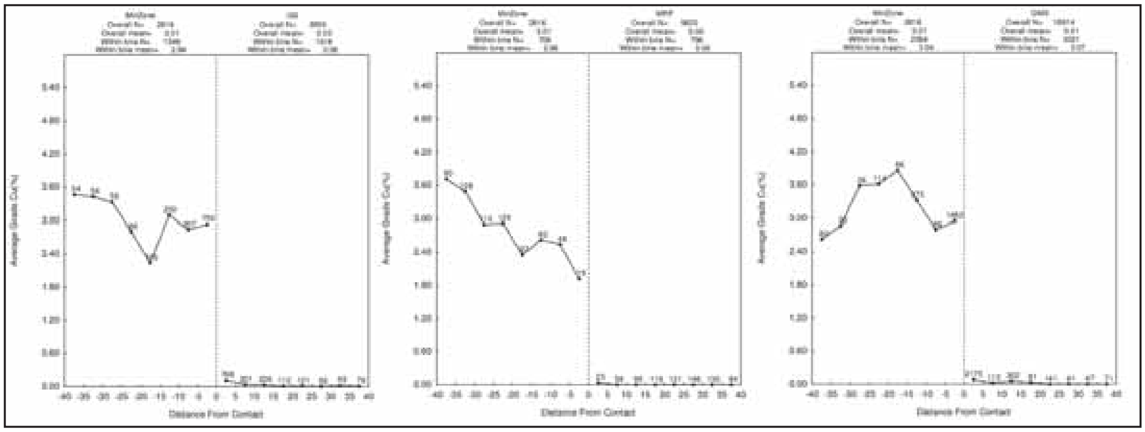


Figure 14-13 **Contact Profiles of Copper Between MinZone and other Lithology Domain Groups (Sim, 2017)**

Contact profiles were generated to evaluate the change in AP, NP, and S% across prominent domain boundaries.

Even though the talc and weathering surface show the frequency distributions of AP, NP, and S% are different inside and outside of the domains, contact profiles show these variables tend to be similar or transition at the boundary. The contact profiles for AP, NP and sulphur for the weathering surface are shown in Figure 14-14 and similar profiles at the talc boundary appear in Figure 14-15.

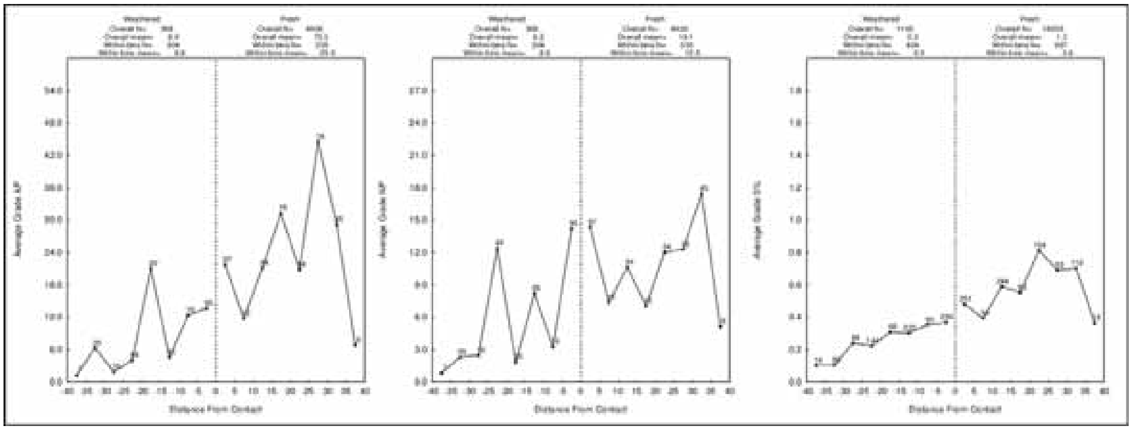


Figure 14-14 Contact Profile of AP (kg $CaCO_3$/t), NP (kg $CaCO_3$/t) and Sulphur Between Weathered and Fresh Rocks (Sim, 2017)

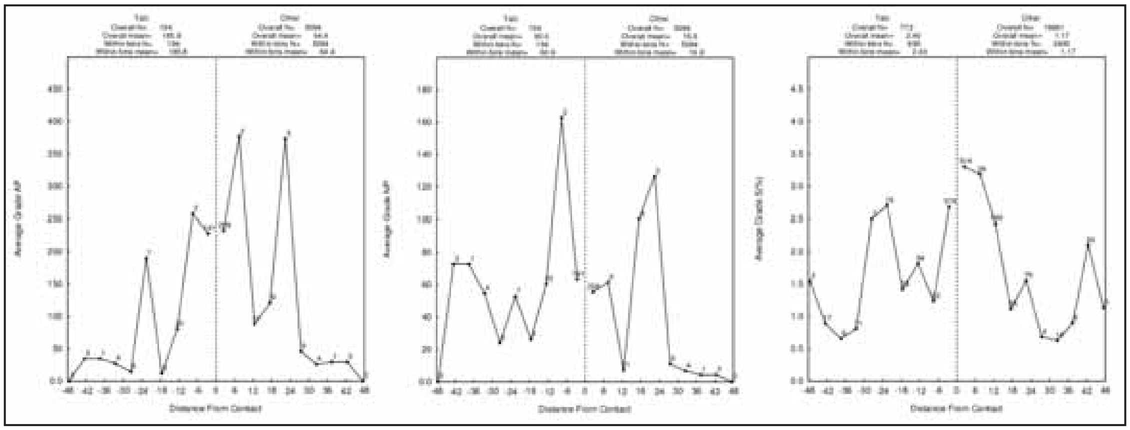


Figure 14-15 Contact Profile of AP (kg $CaCO_3$/t), NP (kg $CaCO_3$/t) and Sulphur Inside / Outside of the Talc Domains (Sim, 2017)

14.5.4 Modeling Implications

The results of the EDA indicate that all metal, ABA and SG samples located inside the MinZone domains distinctly differ from samples outside and these data should not be mixed during estimations in the block model.

The most consistently important metal grades occur in MinZone domains 1 to 5. MinZones 1 to 5 tend to host higher-grades and are continuous over relatively large areas (several hundred metres). MinZones 7 and 8 contain lower grades and there tends to be far less continuity of mineralization.

Although the nature of mineralization may be similar between most of the MinZone domains, they each represent distinct stratigraphic mineralized horizons and, as a result, the contained sample data in each mineralized horizon should remain segregated during the interpolation of block grades in the model. Therefore, “hard” boundary conditions were applied to all MinZone domains for grade estimation purposes (even the individual small domains that comprise MinZones 7 and 8).

The rocks surrounding the MinZone domains are essentially void of appreciable mineralization and, as a result, grade estimates in the model for copper, lead, zinc, gold and silver were restricted only to the MinZone domains. It was assumed that all areas outside of the MinZone domains had zero grade values for these five metals.

The results of the EDA indicate that Grey Schist contains AP and sulphur data that differ from samples in the surrounding rock types and, as a result, this lithology type was segregated during the estimation of these items in the block model. NP does not differ across the GS domain and, as a result, it was not honoured during the estimation of NP in the model.

There are no indications that the talc domains or the weathered zone contain any distinct properties in the distribution of metals, ABA samples or density. These domains were ignored for these elements during the development of the block model.

The talc domains were used as hard domain boundaries for the estimation of talc in the block model. A dynamic search orientation approach is used relative to the trends of the mineralized zones.

There are no distinct differences in the SG of rocks, other than the MinZone domains, between lithologies, alteration types, talc domains or in the weathered zone. Model blocks in the overburden domain were assigned a default SG value of 2.1.

Table 14-5 lists the domains used to estimate the various items in the resource block model.

Table 14-5 Summary of Estimation Domains

Item	MinZone Domain	Lithology Domain
Copper	Hard	na
Lead	Hard	na
Zinc	Hard	na
Gold	Hard	na
Silver	Hard	na
AP	Hard	Hard GS Only
NP	Hard	None
Sulphur	Hard	Hard GS Only
Talc	na	Hard Talc domains
SG	Hard	None

Note: There are no estimates of Cu, Pb, Zn, Au or Ag outside of the MinZone domains.

In order to retain the banded nature of the distributions of items outside of the MinZone domains, the estimations of AP, NP, sulphur and SG were undertaken using the dynamic search orientations relative to the more prominent zones of mineralization. The areas outside of the MinZone domains were combined into four separate trend groups; a lower group parallel MinZone 1, a middle group parallel to MinZone 3, an upper group parallel to MinZone 5 and a fourth group located above the Warm Springs fault.

14.6 Treatment of Outlier Grades

Measures were taken to control the effects of potential outlier sample data for copper, lead, zinc, gold and silver. There was no need for changes in sulphur data, as several maximum values of 10% S in the database were a reflection of the upper detection limit of the ICP technique. There were no modifications to the AP, NP, talc or SG data prior to estimation in the block model.

Histograms and probability plots were generated from 1 m composited sample data to show the distribution of metal in each estimation domain. These were used to identify the existence of anomalous outlier grades in the composite database. The physical locations of these potential outlier samples were reviewed in relation to the surrounding data and it was decided that their effects could be controlled through the use of outlier limitations. With the majority of the drill holes piercing the mineralization at 75 m spacing, samples above the outlier thresholds are limited to a maximum distance of influence of 40 m during block grade interpolation (approximately ½ the distance between drill holes). During the estimation of SG in areas outside of the MinZone domains, samples greater than 3.80 t/m^3 were limited to a maximum distance of influence of 40 m. Table 14-6 summarizes the treatment of outlier sample data.

Table 14-6 Summary of Treatment of Outlier Sample Data

MinZone Domain	Copper %		Lead %		Zinc %		Gold g/t		Silver g/t	
	Max.	Outlier Limit	Max.	Outlier Limit	Max.	Outlier Limit	Max.	Outlier Limit	Max.	Outlier Limit
1	17.07	10	7.84	5	25.60	20	8.080	3	501.0	300
2	9.10	6	3.27	2	15.10	10	10.850	5	141.0	100
2.5	12.40	8	5.65	4	20.30	14	6.960	3.5	285.0	200
3	18.00	12	5.84	4	20.80	17	6.857	3	542.1	200
4	17.17	8	4.56	3	17.89	16	2.307	2	467.9	150
5	17.67	15	5.00	3.8	20.90	17	32.800	15	967.5	350
7	4.29	1.5	6.65	5	25.84	10	0.832	0.7	159.0	100
8	3.66	2.5	2.47	1.5	15.00	7	5.140	0.8	341.8	100

The proportion of metal lost, calculated in model blocks in the combined Indicated and Inferred categories, is 3% copper, 5% lead, 4% zinc, 9% gold and 6% silver. The proportion of lost metal is a function of drill hole spacing and the nature of the underlying sample data—the more skewed distributions show higher losses, as seen in the gold model. The proportions of metal lost due to the treatment of outlier sample data are considered appropriate for a project with this level of delineation drilling.

14.7 Specific Gravity Data

Approximately 45% of the available SG data occurs inside the interpreted MinZone domains ranging from a minimum of 2.55 to a maximum of 4.99 and average 3.46. Outside of the MinZone domains, SG values range from a minimum of 2.43 to a maximum of 4.56 and average 2.78.

The base metal content and SG are moderately correlated. There is little variation in the SG values in the MinZone domains with coefficient-of-variation values that are typically less than 0.2. Outside of the MinZone domains, the coefficient of variation is 0.05.

SG data are available in approximately two-thirds of the drill holes in the vicinity of the Arctic deposit. The distribution of SG samples varies between drill holes; about one-third of the holes have SG measurements for either every sample interval or on 10 m spaced intervals down the hole. The other third of the holes have SG measurements that are primarily restricted to the mineralized intervals.

The distribution of SG data is considered sufficient to support estimation in the resource model. The relatively low variability in the sample data indicates that SG values can be estimated into model blocks using inverse distance-squared (ID2) moving averages. The MinZone domains were used as hard boundaries during the estimation of densities in the model and the trends planes were used to control the dynamic anisotropy during the estimation of SG values in the block model.

14.8 Variography

The spatial evaluation of the data was conducted using a correlogram instead of the traditional variogram. The correlogram is normalized to the variance of the data and is less sensitive to outlier values; this generally gives cleaner results.

Many of the individual estimation domains do not contain sufficient sample data from which to generate reasonable correlograms. As a result, separate correlograms were generated for samples inside MinZone domains 1, 3 and 5. The remaining MinZone domains (2, 2.5, 4, 7 and 8) use correlograms that were generated using combined data from those five zones. Correlograms were generated using 1 m composited drill hole data that were been top-cut to reduce the effects of rare anomalous high-grade composites.

Correlograms were generated using the commercial software package SAGE2001. Correlograms were generated using elevations relative to the trend planes described in Section 14.3. This ensured that the local undulations of the typically banded mineralization were replicated in the block model. The correlograms are summarized in Table 14-7 to Table 14-14.

Table 14-7 Copper Correlogram Parameters

MinZone Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
1	0.121	0.686	0.193	17	62	0	361	133	0
	Spherical			4	332	0	220	43	0
				4	90	90	8	90	90
3	0.300	0.504	0.196	20	22	0	3,316	272	0
	Spherical			8	112	0	135	2	0
				6	90	90	6	90	90
5	0.140	0.352	0.509	272	50	0	97	67	0
	Spherical			16	320	0	6	90	90
				3	90	90	3	157	0
2, 2.5, 4, 7 & 8	0.033	0.800	0.167	30	67	0	449	85	0
	Spherical			5	157	0	180	355	0
				5	90	90	5	90	90

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

Table 14-8 Lead Correlogram Parameters

MinZone Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
1	0.141	0.737	0.121	96	26	0	2,589	356	0
	Spherical			16	116	0	138	86	0
				5	90	90	6	90	90
3	0.275	0.393	0.332	10	90	90	405	66	0
	Spherical			10	43	0	112	336	0
				7	133	0	10	90	90
5	0.300	0.551	0.149	6	60	0	4,159	44	0
	Spherical			5	90	90	136	314	0
				5	330	0	8	90	90
2, 2.5, 4, 7 & 8	0.107	0.597	0.296	11	67	0	803	54	0
	Spherical			10	90	90	153	324	0
				5	157	0	4	90	90

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

Table 14-9 Zinc Correlogram Parameters

MinZone Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
1	0.102	0.737	0.162	40	346	0	461	339	0
	Spherical			16	76	0	185	69	0
				5	90	90	5	90	90
3	0.108	0.583	0.309	53	37	0	330	91	0
	Spherical			8	127	0	195	1	0
				5	90	90	10	90	90
5	0.020	0.869	0.111	14	62	0	5,151	173	0
	Spherical			8	332	0	246	83	0
				3	90	90	8	90	90
2, 2.5, 4, 7 & 8	0.203	0.530	0.267	11	71	0	313	55	0
	Spherical			11	90	90	225	145	0
				5	341	0	3	90	90

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

Table 14-10 Gold Correlogram Parameters

MinZone Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
1	0.065	0.804	0.131	31	122	0	754	17	0
	Spherical			7	32	0	116	107	0
				5	90	90	8	90	90
3	0.072	0.502	0.426	58	47	0	348	26	0
	Spherical			6	90	90	268	296	0
				5	137	0	6	90	90
5	0.275	0.602	0.123	117	49	0	279	103	0
	Spherical			5	90	90	58	13	0
				3	319	0	5	90	90
2, 2.5, 4, 7 & 8	0.016	0.764	0.220	23	78	0	392	14	0
	Spherical			4	90	90	279	104	0
				3	168	0	5	90	90

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

Table 14-11 Silver Correlogram Parameters

MinZone Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
1	0.194	0.647	0.159	65	358	0	364	122	0
	Spherical			4	88	0	150	32	0
				4	90	90	5	90	90
3	0.228	0.400	0.372	29	58	0	373	87	0
	Spherical			12	90	90	183	357	0
				5	148	0	10	90	90
5	0.176	0.468	0.356	155	46	0	120	79	0
	Spherical			4	316	0	9	90	90
				3	90	90	4	169	0
2, 2.5, 4, 7 & 8	0.011	0.774	0.214	31	76	0	338	67	0
	Spherical			4	90	90	204	337	0
				3	166	0	5	90	90

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

Table 14-12 Sulphur Correlogram Parameters

Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
MinZones	0.200	0.689	0.111	177	13	0	6,956	48	0
	Spherical			19	103	0	808	318	0
				15	90	90	15	90	90
Grey Schist	0.050	0.690	0.260	50	96	0	1360	62	0
	Spherical			12	90	90	607	152	0
				11	6	0	13	90	90
LithGroup1	0.170	0.468	0.363	273	34	0	1,060	41	0
	Spherical			63	124	0	204	311	0
				25	90	90	24	90	90
LithGroup2	0.078	0.390	0.531	169	61	0	469	8	0
	Spherical			60	151	0	347	98	0
				10	90	90	12	90	90
LithGroup3	0.082	0.627	0.291	68	58	0	7,136	73	0
	Spherical			22	90	90	694	343	0
				17	328	0	22	90	90
LithGroup4	0.154	0.539	0.308	135	38	0	561	115	0
	Spherical			41	308	0	209	25	0
				28	90	90	30	90	90

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

Table 14-13 AP Correlogram Parameters

Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
MinZones	0.083	0.210	0.706	168	81	0	182	78	0
	Spherical			75	171	0	72	348	0
				12	90	90	12	90	90
Grey Schist	0.045	0.591	0.363	66	320	0	1,3704	106	0
	Spherical			21	90	90	640	16	0
				19	50	0	20	90	90
LithGroup1	0.079	0.387	0.535	57	66	0	3,322	56	0
	Spherical			14	156	0	169	326	0
				9	90	90	11	90	90
LithGroup2	0.027	0.592	0.381	61	325	0	546	52	0
	Spherical			13	90	90	333	322	0
				6	55	0	14	90	90
LithGroup3	0.109	0.462	0.429	175	85	0	11,311	95	0
	Spherical			26	355	0	674	5	0
				20	90	90	20	90	90
LithGroup4	0.034	0.188	0.778	26	74	0	203	31	0
	Spherical			26	90	90	53	121	0

Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
				6	344	0	26	90	90

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

Table 14-14 NP Correlogram Parameters

Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
MinZones	0.123	0.074	0.802	44	340	0	231	46	0
	Spherical			16	70	0	10	90	90
				10	90	90	7	136	0
LithGroup1	0.079	0.072	0.848	157	80	0	164	13	0
	Spherical			26	350	0	31	103	0
				12	90	90	12	90	90
LithGroup2	0.036	0.562	0.402	136	86	0	93	354	0
	Spherical			18	356	0	12	84	0
				3	90	90	6	90	90
LithGroup3	0.071	0.799	0.131	143	339	0	3,630	43	0
	Spherical			51	69	0	347	133	0
				6	90	90	7	90	90
LithGroup4	0.153	0.716	0.131	263	116	0	105	323	0
	Spherical			37	26	0	30	53	0
				14	90	90	15	90	90

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

Table 14-15 Talc Correlogram Parameters

Domain	Nugget	S1	S2	1st Structure			2nd Structure		
				Range (m)	AZ	Dip	Range (m)	AZ	Dip
Talc	0.100	0.792	0.108	24	162	0	177	318	0
	Spherical			15	90	90	15	90	90
				8	72	0	9	48	0

Note: Correlograms generated from 1 m composited sample data using elevations relative to trend plane of mineralization.

14.9 Model Setup and Limits

A block model was initialized with the dimensions shown in Table 14-16. A nominal block size of 10 x 10 x 5 m was considered appropriate based on current drill hole spacing and relative to the planned scale of open pit extraction. The limits of the block model are represented by the purple rectangles shown in the Figure 14-1 and Figure 14-2.

Table 14-16 Block Model Limits

Direction	Minimum (m)	Maximum (m)	Block size (m)	Number of Blocks
X-axis (W-E)	612,190	614,100	10	191
Y-axis (N-S)	7,452,095	7,454,045	10	195
Elevation	345	1250	5	181

Using the domain wireframes, blocks in the model were assigned MinZone domain code values and the percentage of the block inside the MinZone domain is also stored—this was used to determine the proportion of in-situ resources. Blocks were defined as "overburden" if a majority (>50%) of the block occured within the overburden domain. Similarly, blocks were defined in the Grey Schist domain on a majority basis.

14.10 Interpolation Parameters

Grade estimates were made in model blocks using ordinary kriging (OK). The OK models were evaluated using a series of validation approaches as described in Section 14.11 of this Report. The interpolation parameters were adjusted until the appropriate results were achieved. In general, the OK models were generated using a relatively limited number of composited sample data. This approach reduced the amount of smoothing (also known as averaging) in the model and, while there may be some uncertainty on a localized scale, this approach produced reliable estimates of the potentially recoverable grade and tonnage for the overall deposit.

Interpolation parameters for the various items included in the resource block model are summarized in Table 14-17 through Table 14-21. Estimates for copper, lead, zinc, gold and silver were made only inside the MinZone domains as there are essentially no metals present (zero grade) in the surrounding rocks. All estimates were made using length weighted composites and model blocks are discretized into 4 x 4 x 2 points (L x W x H). Estimations for all items in the model use a dynamic search strategy where search orientations were designed to follow mineralization trend surfaces.

Table 14-17 Interpolation Parameters for Copper

MinZone Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
1, 2, 2.5, 3, 4, 5	200	200	4	3	21	7	1DH per Octant
7 & 8	200	200	10	2	21	7	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Table 14-18 Interpolation Parameters for Lead

MinZone Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
1	200	200	4	3	18	6	1DH per Octant
2, 2.5, 4	200	200	4	3	21	7	1DH per Octant
3	200	200	4	3	28	7	1DH per Octant
5	200	200	4	3	24	8	1DH per Octant
7 & 8	200	200	10	2	21	7	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Table 14-19 Interpolation Parameters for Zinc

MinZone Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
1, 2, 2.5, 3, 4, 5	200	200	4	3	21	7	1DH per Octant
7 & 8	200	200	10	2	21	7	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Table 14-20 Interpolation Parameters for Gold

MinZone Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
1, 2, 2.5, 4, 5	200	200	4	3	21	7	1DH per Octant
3	200	200	4	3	28	7	1DH per Octant
7 & 8	200	200	10	2	21	7	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Table 14-21 Interpolation Parameters for Silver

MinZone Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
1, 2.5, 5	200	200	4	3	21	7	1DH per Octant
2, 3, 4	200	200	4	3	24	7	1DH per Octant
7 & 8	200	200	10	2	21	7	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Separate estimates for sulphur, AP, NP and SG were made for model blocks that were wholly or partially inside the MinZone domains and for blocks that were outside of the MinZone domains. Following estimation, final "whole block" values were calculated using the two estimated values and the proportion of the block inside and outside of the MinZone domains.

Table 14-22 Interpolation Parameters for Sulphur

Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
MinZones	300	300	4	1	15	5	1DH per Octant
Grey Schist	500	500	7	1	15	5	1DH per Octant
LithGroup1-4	500	500	7	1	15	5	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Table 14-23 Interpolation Parameters for AP

Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
MinZones	500	500	5	1	15	5	1DH per Octant
Grey Schist	500	500	7	1	15	5	1DH per Octant
LithGroup1-4	500	500	7	1	15	5	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Table 14-24 Interpolation Parameters for NP

Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
MinZones	500	500	5	1	15	5	1DH per Octant
LithGroup1-4	500	500	7	1	15	5	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Block estimates of SG were undertaken using an ID2 interpolation method. The parameters are listed in Table 14-25. During interpolation outside of the MinZone domains, anomalous high SG values exceeding 3.80 were restricted to a maximum distance of influence of 40 m. Separate SG estimates were made representing areas inside the MinZone domains and for the surrounding unmineralized rocks. The final “whole block” densities were calculated using the two SG estimates and the proportion of blocks inside vs. outside of the MinZone domains.

Table 14-25 Interpolation Parameters for Specific Gravity

Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
MinZones	300	300	5	2	15	5	
LithGroup1-4	500	500	5	2	15	5	
LithGroup1-4	500	500	7	1	15	5	1DH per Octant

(1) Vertical range relative to distances from trend plane of mineralization.

Estimates for talc were made both inside and outside of the interpreted talc domains. The interpolation parameters are listed in Table 14-26.

Table 14-26 Interpolation Parameters for Talc

Domain	Search Ellipse Range (m)			Number of Composites (1 m)			Other
	X	Y	Z (1)	Min/block	Max/block	Max/hole	
Talc	500	500	5	1	21	7	
Outside talc domains	500	500	5	1	21	7	

(1) Vertical range relative to distances from trend plane of mineralization.

14.11 Block Model Validation

The block models were validated using several methods: a thorough visual review of the model grades in relation to the underlying drill hole sample grades; comparisons with the change of support model; comparisons with other estimation methods; and, grade distribution comparisons using swath plots.

14.11.1 Visual Inspection

A detailed visual inspection of the block model was conducted in both section and plan to compare estimated grades against underlying sample data. This included confirmation of the proper coding of blocks within the respective domains. Examples of the distribution of copper grades in the block model are shown in cross section in Figure 14-16 and Figure 14-17.

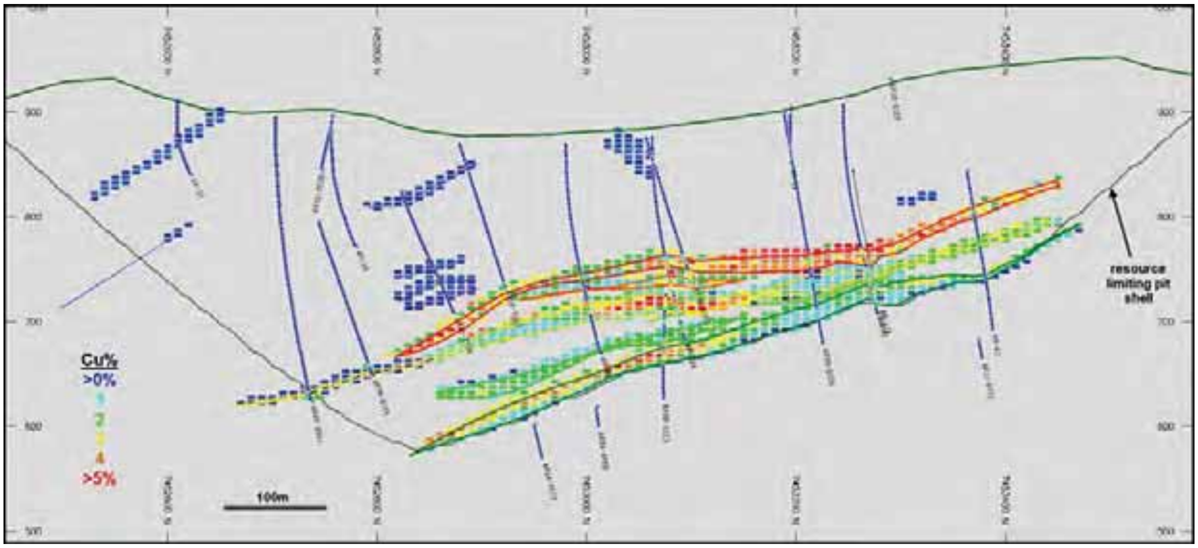


Figure 14-16 North-South Vertical Section of Copper Estimates in the Block Model (Section 613250E) (Sim, 2017)

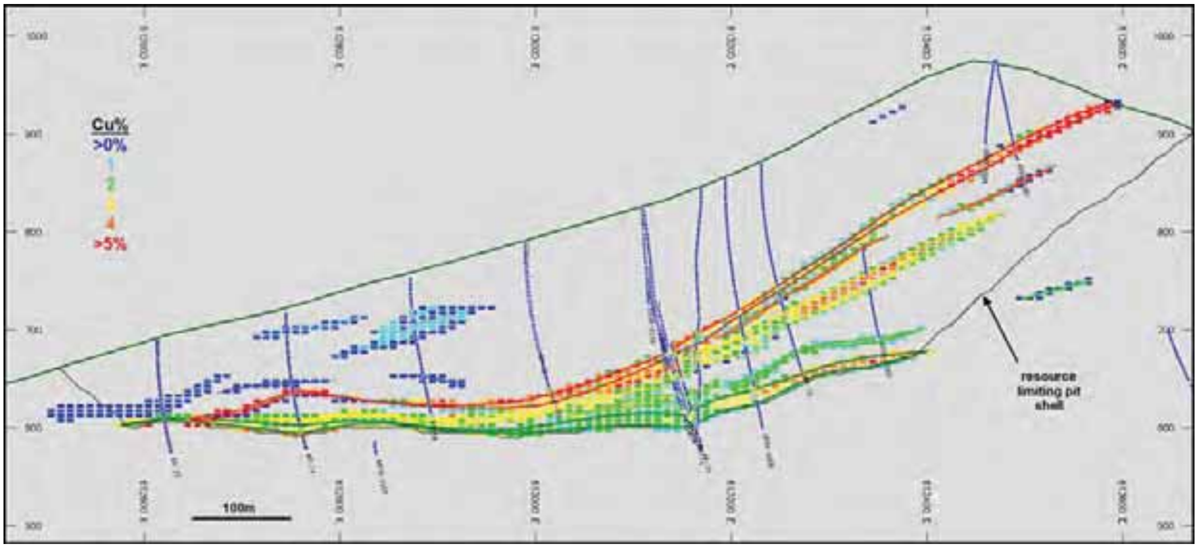


Figure 14-17 West-East Vertical Section of Copper Estimates in the Block Model (Section 7453000N) (Sim, 2017)

14.11.2 Model Checks for Change of Support

The relative degree of smoothing in the block estimates was evaluated using the Hermitian Polynomial Change of Support (Herco) method, also known as the Discrete Gaussian Correction (Journel and Huijbregts, 1978).

The Herco distribution was derived from the declustered composite grades which were adjusted to account for the change in support moving from smaller drill hole composite samples to the larger blocks in the model. The transformation resulted in a less skewed distribution, but with the same mean as the original declustered samples.

Examples of Herco plots calculated for the distributions of metal in the three main MinZone domains, 1, 3 and 5, are shown in Figure 14-18 to Figure 14-22. Note that these change of support calculations were made for individual metals. Ore-waste selection will likely be made based on a NSR using all five metals. Therefore, the change of support calculations for the individual metals only serve as approximations for the distribution of NSR values above cut-off values.

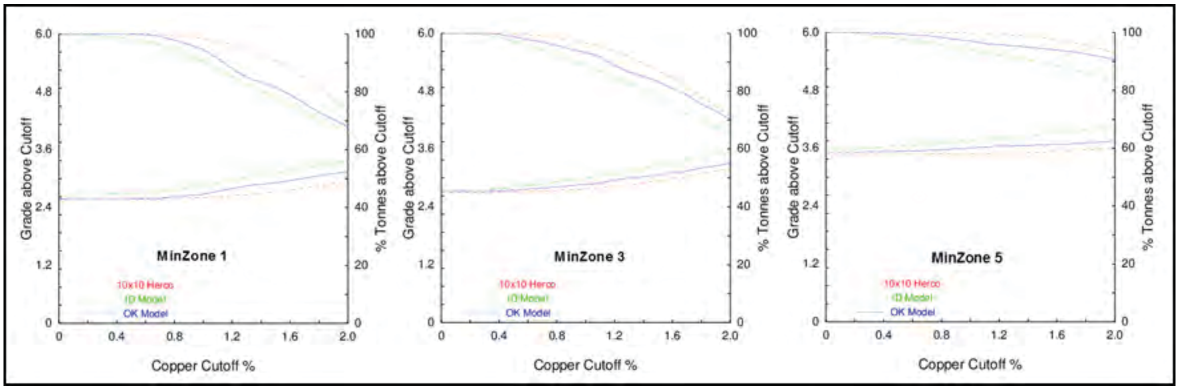


Figure 14-18 Herco and Model Grade / Tonnage Plots for Copper in MinZone Domains 1, 3 and 5 (Sim, 2017)

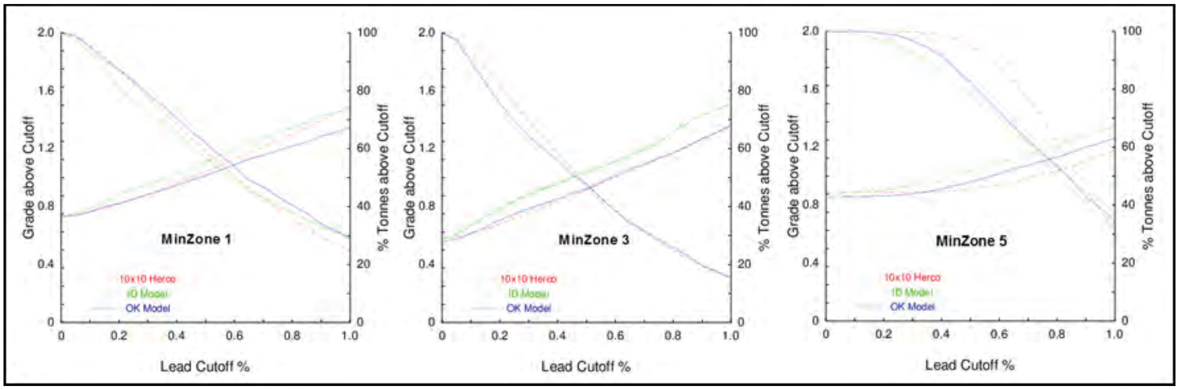


Figure 14-19 Herco and Model Grade / Tonnage Plots for Lead in MinZone Domains 1, 3 and 5 (Sim, 2017)

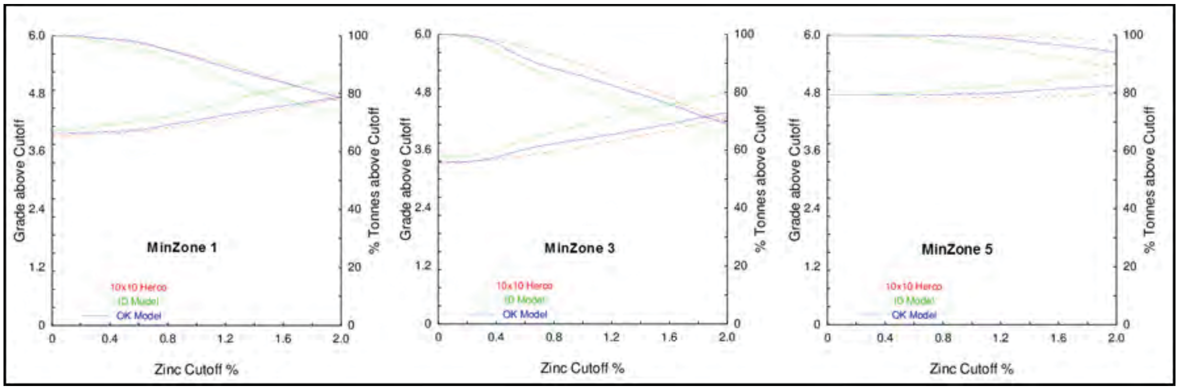


Figure 14-20 Herco and Model Grade / Tonnage Plots for Zinc in MinZone Domains 1, 3 and 5 (Sim, 2017)

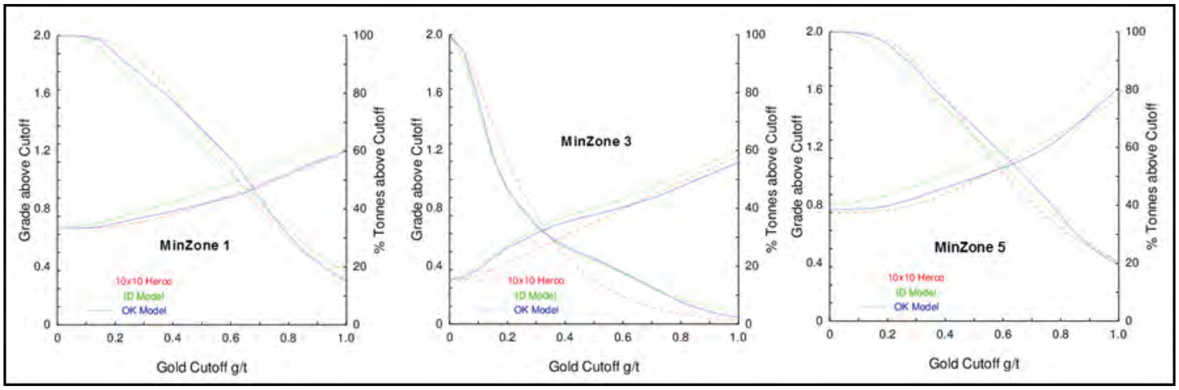


Figure 14-21 **Herco and Model Grade / Tonnage Plots for Gold in MinZone Domains 1, 3 and 5 (Sim, 2017)**

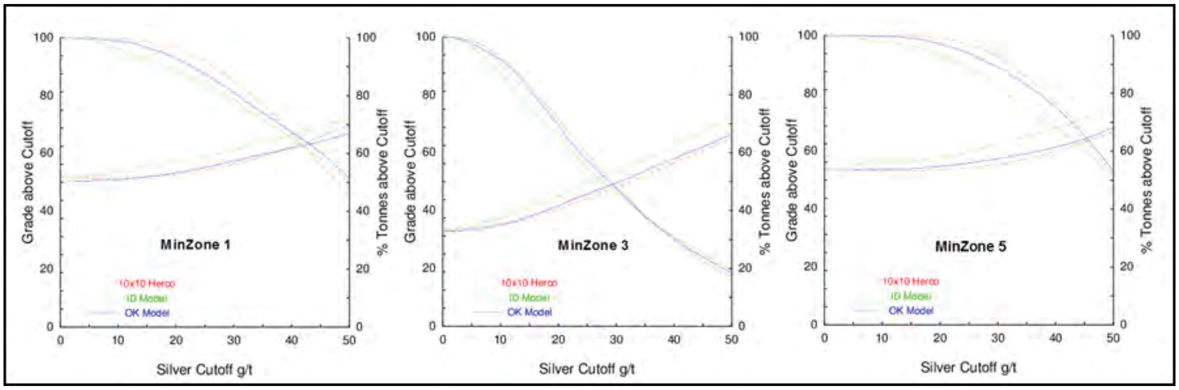


Figure 14-22 **Herco and Model Grade / Tonnage Plots for Silver in MinZone Domains 1, 3 and 5 (Sim, 2017)**

Overall, the desired degree of correspondence between estimation models and change of support models has been achieved. It should be noted that the change of support model is a theoretical tool intended to direct model estimation. There is uncertainty associated with the change of support model, and its results should not be viewed as a final or correct value.

14.11.3 Comparison of Interpolation Methods

For comparison purposes, additional grade models were generated using the inverse distance weighted (ID) and nearest neighbour (NN) interpolation methods. The NN model was created using data composited to 5 m lengths to ensure all sample data are used in the model. The results of these models are compared to the OK models at various cut-off grades using a grade/tonnage graph. Figure 14-23 to Figure 14-27 show comparison of models in the three main MinZone domains (combined 1, 3 and 5).

There is good correlation between model types. The correspondence among the grade tonnage curves is typical for the interpolation methods being compared. The NN interpolation always has the higher grade and lower tonnage. It is an estimate that should produce a value close to the correct global mean at a zero cut-off grade. The NN grades and tonnages above cut-off are correct under the assumption that perfect selection of material above and below the cut-off can be executed at the scale of the composite samples. It is included to show the results of the averaging that takes place in the other two methods. The OK curves show the lowest grades and highest tonnages. The correct amount of averaging for the chosen block size is ensured for the OK estimate by the change of support calculation described in Section 14.11.2.

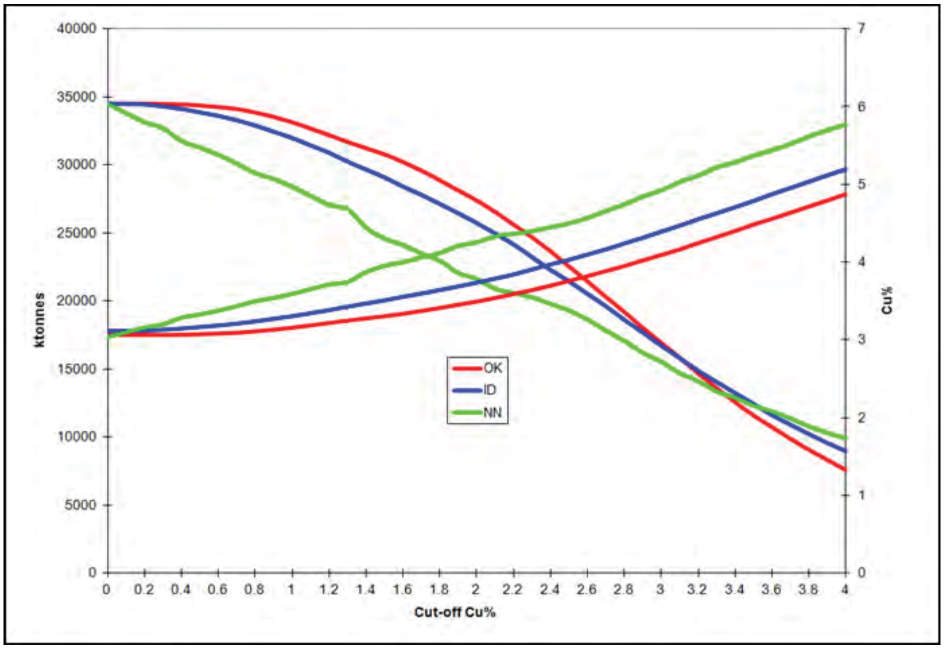


Figure 14-23 Comparison of Copper Model Types in MinZone Domains 1, 3 and 5 (Sim, 2017)

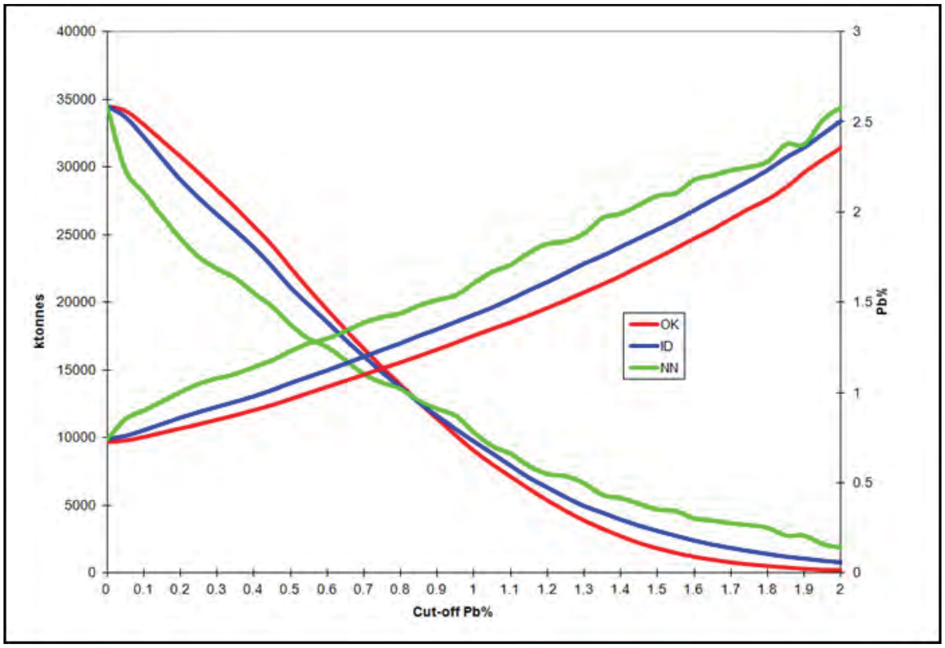


Figure 14-24 Comparison of Lead Model Types in MinZone Domains 1, 3 and 5 (Sim, 2017)

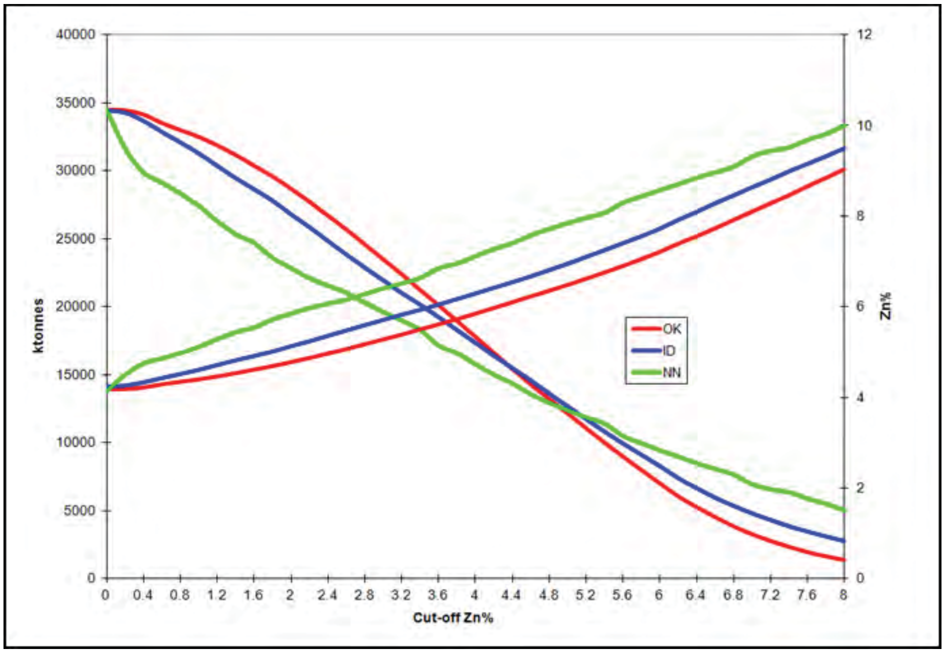


Figure 14-25 Comparison of Zinc Model Types in MinZone Domains 1, 3 and 5 (Sim, 2017)

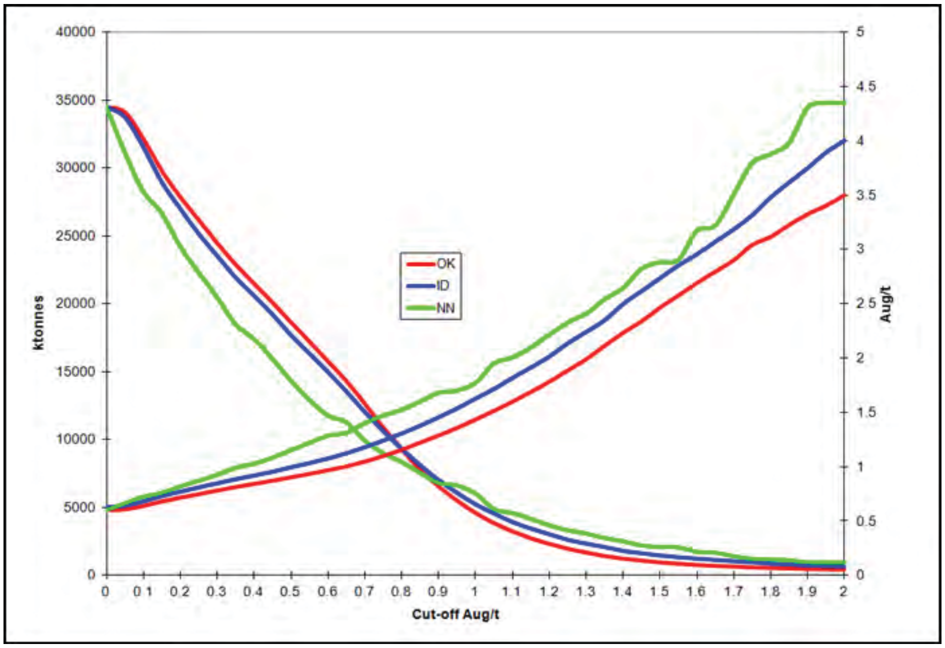


Figure 14-26 Comparison of Gold Model Types in MinZone Domains 1, 3 and 5 (Sim, 2017)

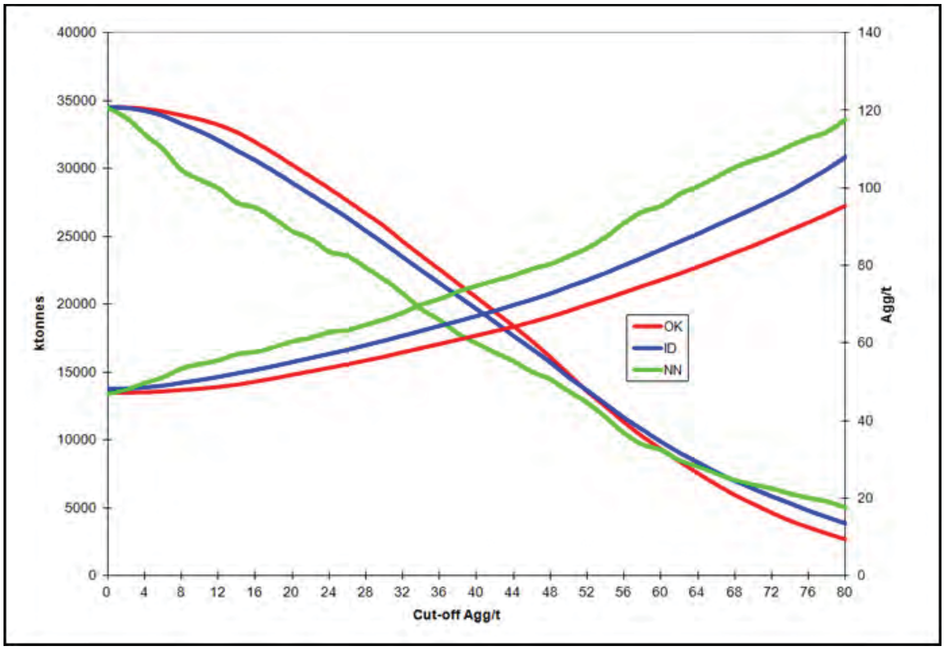


Figure 14-27 Comparison of Silver Model Types in MinZone Domains 1, 3 and 5 (Sim, 2017)

14.11.4 Swath Plots (Drift Analysis)

For validation of the five metals in the model, swath plots were made for each individual MinZone domain and also a series of swaths from the three main domains (combined 1+3+5), as these contain the vast majority of the estimated Mineral Resources. Examples for the five metals in the deposit are shown in Figure 14-28 through Figure 14-35.

There is good correspondence between the models in most areas. The degree of smoothing in the OK model is evident in the peaks and valleys shown in the swath plots. Areas where there are large differences between the models tend to be the result of "edge" effects, where there is less available data to support a comparison. Note that the majority of the resource occurs between 7452750N and 7453450N. The validation results indicate that the OK model is a reasonable reflection of the underlying sample data.

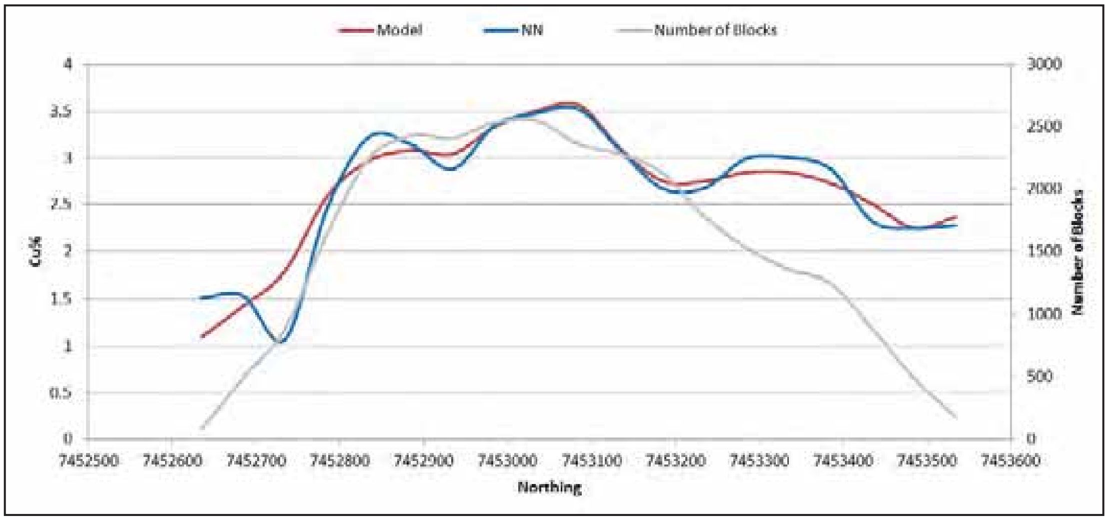


Figure 14-28 Swath Plot of Copper in MinZone Domains 1, 3 and 5 (Sim, 2017)

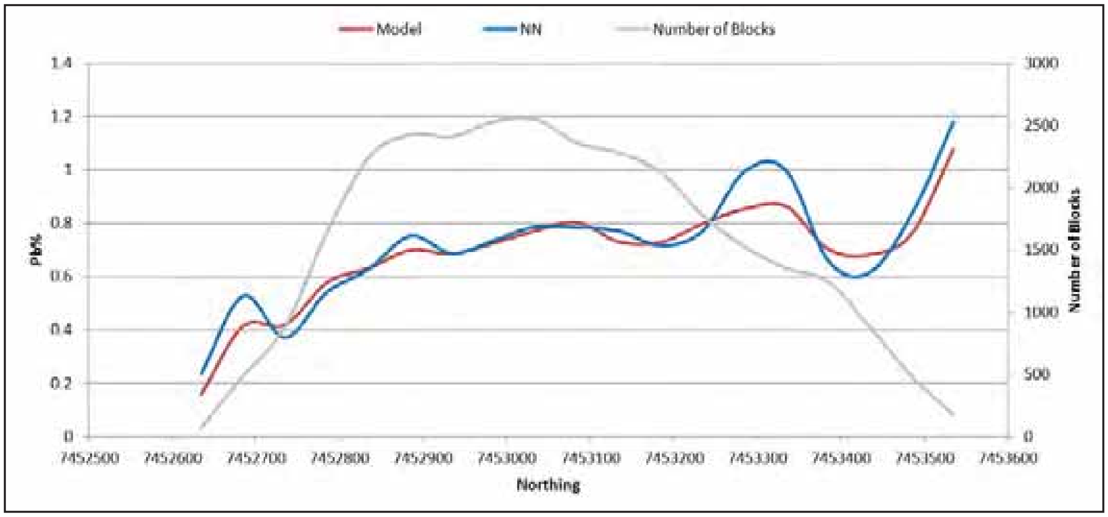


Figure 14-29 Swath Plot of Lead in MinZone Domains 1, 3 and 5 (Sim, 2017)

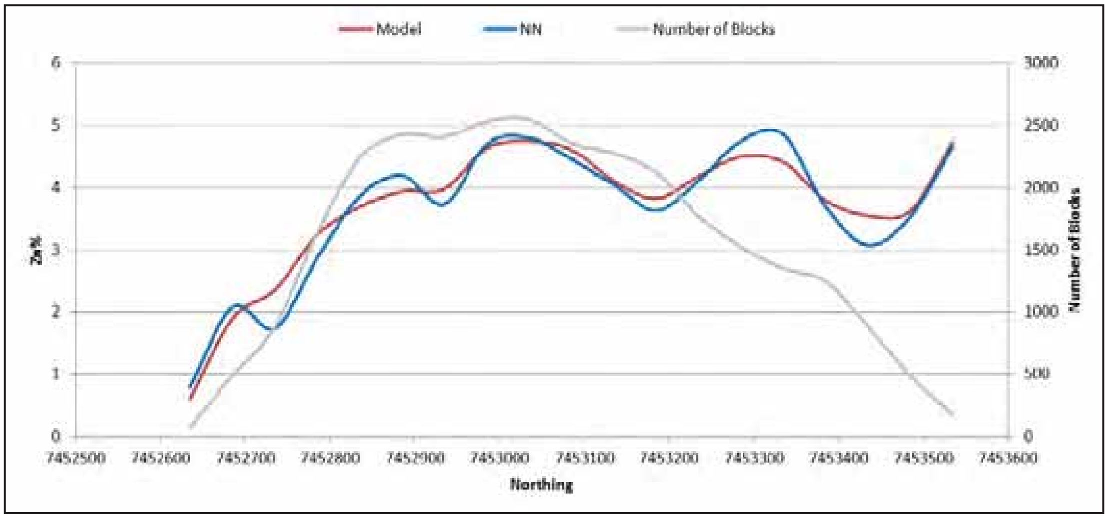


Figure 14-30 Swath Plot of Zinc in MinZone Domains 1, 3 and 5 (Sim, 2017)

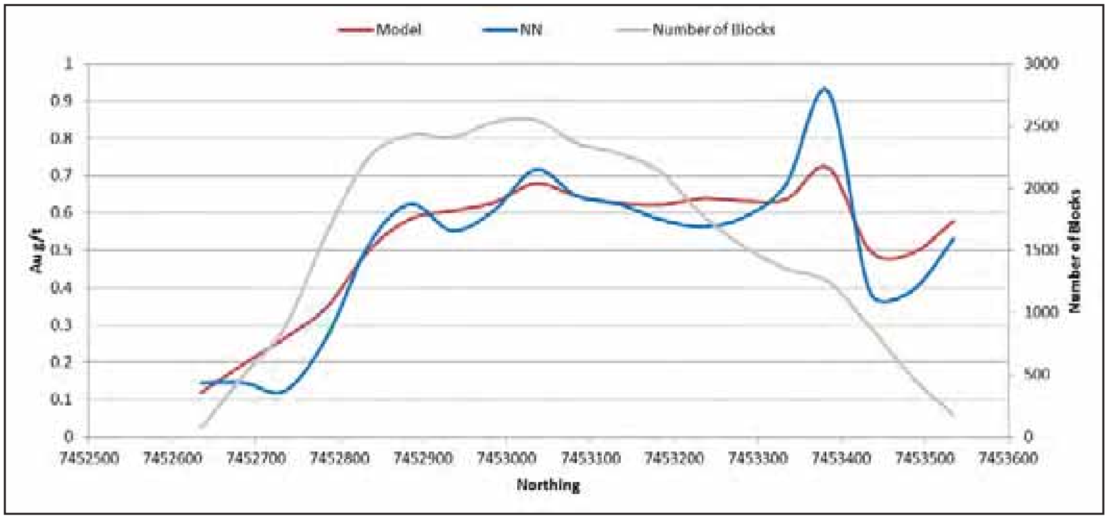


Figure 14-31 Swath Plot of Gold in MinZone Domains 1, 3 and 5 (Sim, 2017)

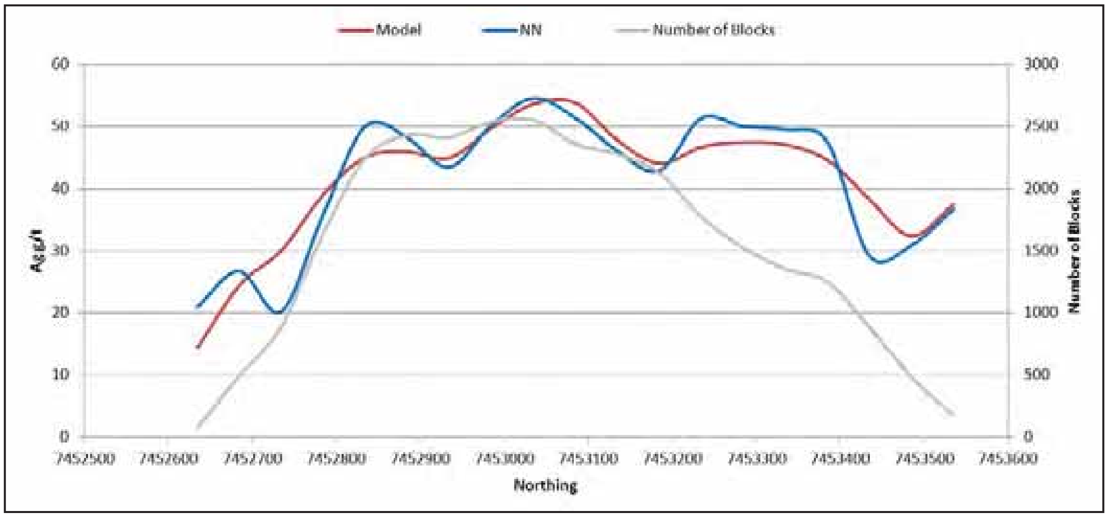


Figure 14-32 Swath Plot of Silver in MinZone Domains 1, 3 and 5 (Sim, 2017)

The swaths plots presented in Figure 14-33 to Figure 14-35 show the ABA items in the rocks that surround the MinZone domains.

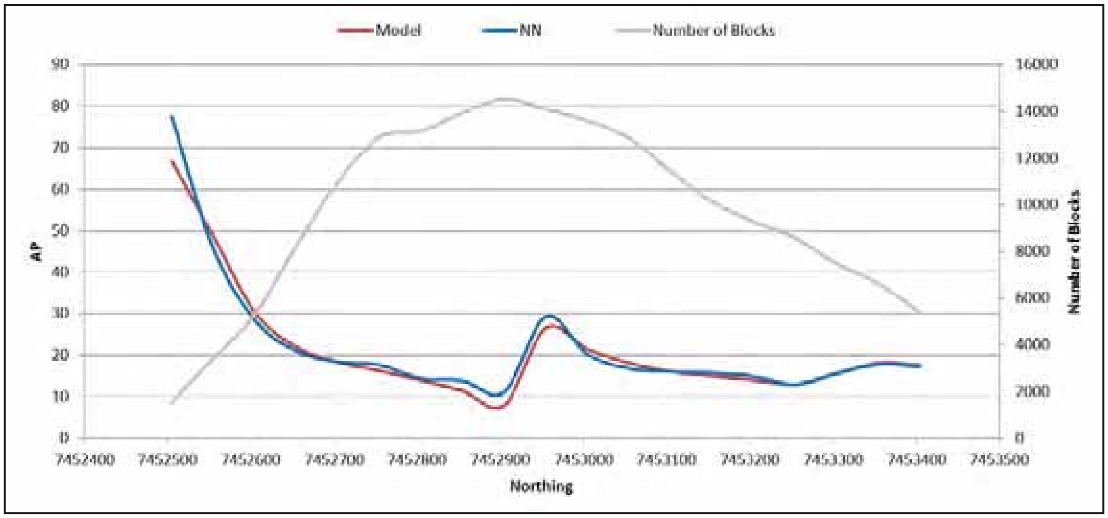


Figure 14-33 Swath Plot of AP (kg $CaCO_3$/t) in Rocks Outside of the MinZone Domains (Sim, 2017)

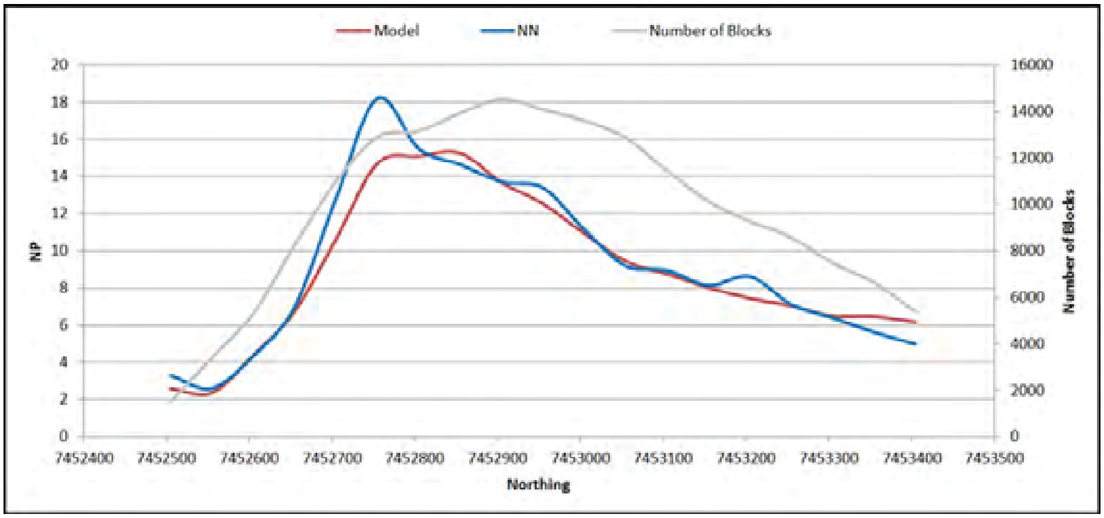


Figure 14-34 Swath Plot of NP (kg $CaCO_3$/t) in Rocks Outside of the MinZone Domains (Sim, 2017)

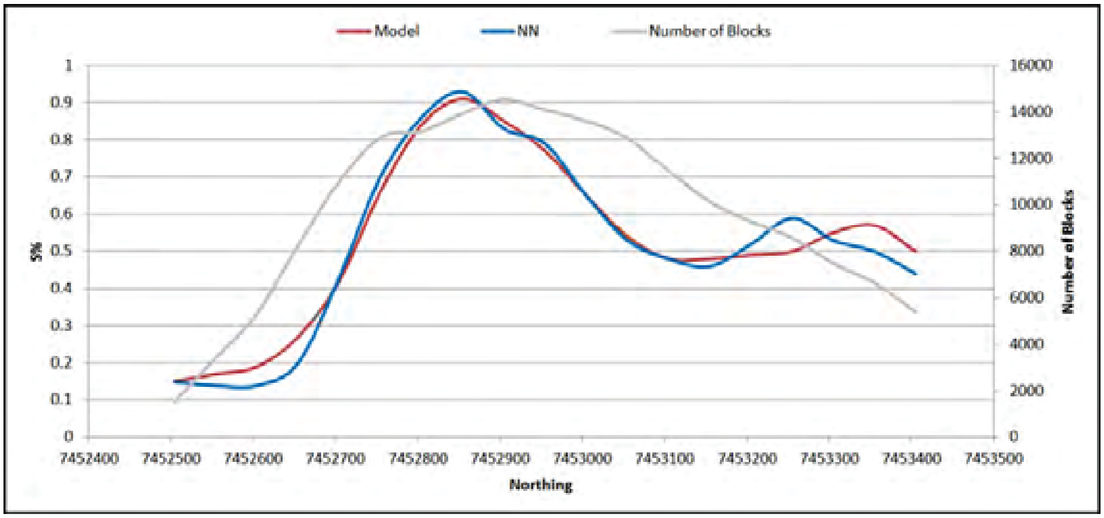


Figure 14-35 **Swath Plot of Sulphur Rocks Outside of the MinZone Domains (Sim, 2017)**

14.12 Resource Classification

The Mineral Resources were classified in accordance with the 2014 CIM Definition Standards. The classification parameters are defined relative to the distance between sample data and are intended to encompass zones of reasonably continuous mineralization that exhibit the desired degree of confidence in the estimate.

Classification parameters are generally linked to the scale of a deposit: a large and relatively low-grade porphyry-type deposit would likely be mined at a much higher daily rate than a narrow, high-grade deposit. The scale of selectivity of these two examples differs significantly and this is reflected in the drill-hole spacing required to achieve the desired level of confidence to define a volume of material that represents, for example, a year of production. Based on engineering studies completed to date, the Arctic Deposit would likely be amenable to open pit extraction methods at a production rate of approximately 10,000 t/d. A drill hole spacing study, which tests the reliability of estimates for a given volume of material at varying drill hole spacing, suggests that drilling on a nominal 100 m grid pattern would provide annual estimates of volume (tonnage) and grade within ±15% accuracy, 90% of the time. These results were combined with grade and indicator variograms and other visual observations of the nature of the deposit in defining the criteria for mineral resource classification as described below. At this stage of exploration, there is insufficient density of drilling information to support the definition of mineral resources in the Measured category.

The following classification criteria are defined for the Arctic deposit:

- Indicated Mineral Resources include blocks in the model with grades estimated by three or more drill holes spaced at a maximum distance of 100 m and exhibit a relatively high degree of confidence in the grade and continuity of mineralization.
- Inferred Mineral Resources require a minimum of one drill hole within a maximum distance of 150 m and exhibit reasonable confidence in the grade and continuity of mineralization.

Some manual “smoothing” of the criteria for Indicated resources was conducted that includes areas where the drill hole spacing locally exceeds the desired grid spacing, but still retains continuity of mineralization or, conversely, excludes areas where the mineralization does not exhibit the required degree of confidence.

14.13 Mineral Resource Estimate

The Arctic deposit comprises several zones of relatively continuous moderate- to high-grade polymetallic mineralization that extends from surface to depths of over 250 m below surface. The deposit is potentially amenable to open pit extraction methods. The “reasonable prospects for eventual economic extraction” was tested using a floating cone pit shell derived based on a series of technical and economic assumptions considered appropriate for a deposit of this type, scale and location. These parameters are summarized in Table 14-27.

Table 14-27 Parameters Used to Generate a Resource-Limiting Pit Shell

Optimization Parameters	
Open Pit Mining Cost	US$3/t
Milling Cost + G&A	US$35/t
Pit Slope	43 degrees
Copper Price	US$3.00/lb
Lead Price	US$0.90/lb
Zinc Price	US$1.00/lb
Gold Price	US$1300/oz
Silver Price	US$18/oz
Metallurgical Recovery: Copper	92%
Lead	77%
Zinc	88%
Gold	63%
Silver	56%

Note: No adjustments for mining recovery or dilution.

The pit shell was generated using copper equivalent grades that incorporate contributions of the five different metals present in the deposit. The formula used to calculate copper equivalent grades is listed as follows:

$$\text{CuEq\%} = (\text{Cu\%} \times 0.92) + (\text{Zn\%} \times 0.290) + (\text{Pb\%} \times 0.231) + (\text{Au g/t} \times 0.398) + (\text{Ag g/t} \times 0.005)$$

Using the parameters defined above, a pit shell was generated about the Arctic deposit that extends to depths approaching 300 m below surface.

14.14 Mineral Resource Statement

The Qualified Persons for the Mineral Resource estimate are Mr Robert Sim, P.Geo. a SIM employee and Dr Bruce M. Davis, FAusIMM, a BDRC employee. The estimate has an effective date of 25 April 2017. Mineral Resources are reported inclusive of those Mineral Resources that were converted to Mineral Reserves. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. Mineral Resources are reported on a 100% basis. Trilogy Metals holds 50% of Ambler Metals.

Table 14-28 lists the estimate of Mineral Resources contained within the conceptual pit shell. Based on the technical and economic factors listed in Table 14-27, a base case cut-off grade of 0.50% CuEq is considered appropriate for this deposit. The distribution of Mineral Resources is shown in Figure 14-36 in a series of isometric views.

Table 14-28 Mineral Resource Estimate for the Arctic Deposit

Class	M tonnes	Average Grade					Contained metal				
		Cu %	Pb %	Zn %	Au g/t	Ag g/t	Cu Mlbs	Pb Mlbs	Zn Mlbs	Au koz	Ag Moz
Indicated	36.0	3.07	0.73	4.23	0.63	47.6	2,441	581	3,356	728	55
Inferred	3.5	1.71	0.60	2.72	0.36	28.7	131	47	210	40	3

Notes:

1. The Qualified Persons for the estimate are Mr Robert Sim, P.Geo. a SIM employee and Dr. Bruce M. Davis, FAusIMM, a BDRC employee. The estimate is reported using the 2014 CIM Definition Standards. The effective date of the Mineral Resource estimate is April 25, 2017. The results of the 2019 drilling supports the current estimate of mineral resources and the inclusion of these nine new drill holes would have no material impact on the estimate of mineral resources for the Project.
2. Mineral Resources stated are contained within a conceptual pit shell developed using metal prices of US$3.00/lb Cu, $0.90/lb Pb, $1.00/lb Zn, $1300/oz Au and $18/oz Ag and metallurgical recoveries of 92% Cu, 77% Pb, 88% Zn, 63% Au and 56% Ag and operating costs of $3/t mining and $35/t process and G&A. The assumed average pit slope angle is 43°.
3. The base case cut-off grade is 0.5% copper equivalent. CuEq = (Cu%x0.92) + (Zn%x0.290) + (Pb%x0.231) + (Au g/tx0.398) + (Ag g/tx0.005).
4. The Mineral Resource estimate is reported on a 100% basis without adjustments for metallurgical recoveries. Trilogy Metals holds 50% of Ambler Metals.
5. The Mineral Resource estimate is reported inclusive of those Mineral Resource that were converted to Mineral Reserves. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
6. Mineral Resource have been rounded.

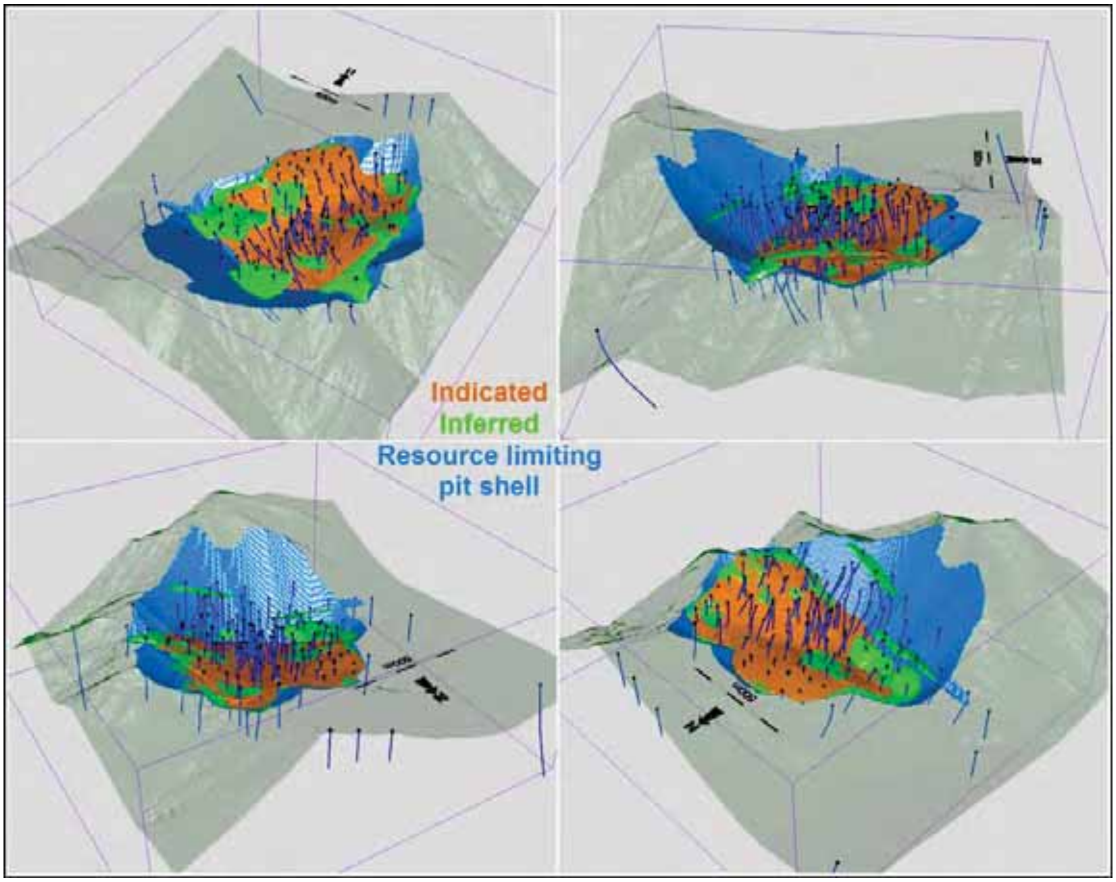


Figure 14-36 Isometric Views of Arctic Mineral Resource (Sim, 2017)

14.15 Grade Sensitivity Analysis

The sensitivity of Mineral Resources, contained within the resource limiting pit shell, to changes in the cut-off grade is demonstrated by listing the estimate at a series of cut-off thresholds as shown in Table 14-29. The base case cut-off grade of 0.5% CuEq is bolded in the table.

Table 14-29 Sensitivity of Mineral Resource to Cut-off Grade

Cut-off CuEq%	M tonnes	Average Grade:					Contained metal:				
		Cu %	Pb%	Zn%	Au g/t	Ag g/t	Cu Mlbs	Pb Mlbs	Zn Mlbs	Au koz	Ag Moz
Indicated											
0.25	36.0	3.07	0.73	4.22	0.63	47.61	2,441	582	3,356	729	55
0.5	**36.0**	**3.07**	**0.73**	**4.23**	**0.63**	**47.62**	**2,441**	**581**	**3,356**	**728**	**55**
0.75	35.9	3.08	0.73	4.23	0.63	47.72	2,440	582	3,355	728	55
1	35.7	3.09	0.74	4.26	0.63	47.97	2,436	581	3,353	728	55
1.5	35.5	3.11	0.74	4.28	0.64	48.22	2,432	580	3,349	727	55

Cut-off CuEq%	M tonnes	Average Grade:					Contained metal:				
		Cu %	Pb%	Zn%	Au g/t	Ag g/t	Cu Mlbs	Pb Mlbs	Zn Mlbs	Au koz	Ag Moz
Inferred											
0.25	3.8	1.58	0.56	2.52	0.34	26.76	133	47	212	42	3
0.5	**3.5**	**1.71**	**0.60**	**2.72**	**0.36**	**28.69**	**131**	**47**	**210**	**40**	**3**
0.75	3.0	1.93	0.65	3.04	0.36	31.99	129	44	203	35	3
1	2.5	2.29	0.73	3.52	0.37	37.04	124	39	192	29	3
1.5	2.3	2.46	0.76	3.71	0.39	39.32	122	38	184	28	3

14.16 Factors that May Affect the Mineral Resource Estimates

Factors that may affect the Mineral Resource estimates include:

- Metal price and exchange rate assumptions.
- Changes to the assumptions used to generate the CuEq cut-off grade.
- Changes in local interpretations of mineralization geometry and continuity of mineralized zones.
- Changes to geological and mineralization shapes, and geological and grade continuity assumptions.
- Density and domain assignments.
- Changes to geotechnical, mining and metallurgical recovery assumptions.
- Change to the input and design parameter assumptions that pertain to the conceptual pit constraining the estimates.
- Assumptions as to concentrate marketability, payability and penalty terms.
- Assumptions as to the continued ability to access the site, retain mineral and obtain surface rights titles, obtain environment and other regulatory permits, and maintain the social license to operate.
- Assumptions as to future site access.

There are no known factors related to environmental, permitting, legal, title, taxation, socio-economic, marketing, or political issues which could materially affect the Mineral Resource estimate that are not discussed in this Report.

15 Mineral Reserve Estimates

15.1 Overview

Mineral Reserves were classified in accordance with the 2014 CIM Definition Standards. Only Mineral Resources that were classified as Indicated were given economic attributes in the mine design and when demonstrating economic viability. Mineral Reserves incorporate appropriate mining dilution and mining recovery estimations for the open pit mining method.

The Mineral Reserve estimate for the Arctic deposit is based on the 2017 resource block model information provided by Trilogy Metals, inputs to this report, and information generated by Wood based on earlier mining studies.

A Mineral Reserve is an estimate of the economically mineable part of a Measured and/or Indicated Mineral Resource. The reference point at which the Mineral Reserves are defined is the point where the ore is delivered to the processing plant. The Mineral Reserves include diluting materials and allowances for mine losses, which occur when the material is mined.

15.2 Pit Optimization

The pit shells that define the ultimate pit limit, as well as the internal phases, were derived using the Lerchs-Grossmann (LG) pit optimization algorithm. This process considers the information stored in the geological block model, the pit slope angles by geotechnical sector, the commodity prices, the mining and processing costs, the process recovery and the sales cost for the metals produced. Table 15-1 provides a summary of the primary optimization inputs.

Table 15-1 Optimization Inputs

Parameter	Unit	Value
Metal Prices		
Copper	$/lb	3.00
Lead	$/lb	1.00
Zinc	$/lb	1.10
Gold	$/oz	1,300.00
Silver	$/oz	18.00
Discount Rate	%	8
Slope Angles		
Sector 1 (2L-E)	degrees	26
Sector 2 (2L-W)	degrees	40
Sector 3 (2U)	degrees	42
Sector 4 (3)	degrees	30
Sector 5 (4L)	degrees	38
Sector 6 (4U)	degrees	43
Dilution	%	Estimated in a block-by-block basis
Mine Losses	%	Considered by block
Mining Cost		
Base Elevation	m	730
Base Cost	$/t	2.78

Parameter	Unit	Value
Incremental Mining Cost		
Uphill	$/t/5m	0.020
Downhill	$/t/5m	0.015
Process Costs		
Operating Cost	$/t milled	15.09
G&A	$/t milled	6.55
Process Sustaining Capital	$/t milled	1.53
Road Toll Cost	$/t milled	4.70
Closure	$/t milled	1.52
Processing Rate	Kt/d	10
Process Recovery		
Copper	%	91.2
Lead	%	80.0
Zinc	%	91.0
Gold	%	58.9
Silver	%	80.0
Treatment & Refining Cost	-	Variable by concentrate type/metal
Royalties		
NANA Surface Use	%NSR	1.00
NANA[1]	%NP	0.00

1 NANA may elect to either (a) exercise a non-transferrable back-in-right to acquire between 16% and 25% (as specified by NANA) of the Project; or (b) not exercise its back-in-right, and instead receive a net proceeds royalty equal to 15% of the net proceeds realized by Ambler Metals. Upon the direction of Trilogy Metals, the 2020 FS was evaluated based on 100% ownership by Ambler Metals, of which Trilogy owns 50%, and does not include the impact on Ambler Metals of the NANA options, either purchasing an interest in the Project or receiving a royalty payment.

Wood imported the resource model, containing grades, block percentages, material density, slope sectors and rock types, and NSR, into the optimization software. The optimization run was carried out only using Indicated Mineral Resources to define the optimal mining limits.

The optimization run included 39 pit shells defined according to different revenue factors, where a revenue factor of 1 was the base case. To select the optimal pit shell that defined the ultimate pit limit, Wood conducted a pit-by-pit analysis to evaluate the contribution of each incremental shell to NPV, assuming a processing plant capacity of 10 kt/d and a discount rate of 8% (Figure 15-2). Following this analysis, the Selected pit shell is usually smaller than the Base Case pit shell. The Selected pit shell is shown in Figure 15-2. Although the NPV is slightly lower in comparison to the Base Case pit shell, the selected pit shell saves 64.5 Mt of waste while only losing 4.4 Mt of ore.

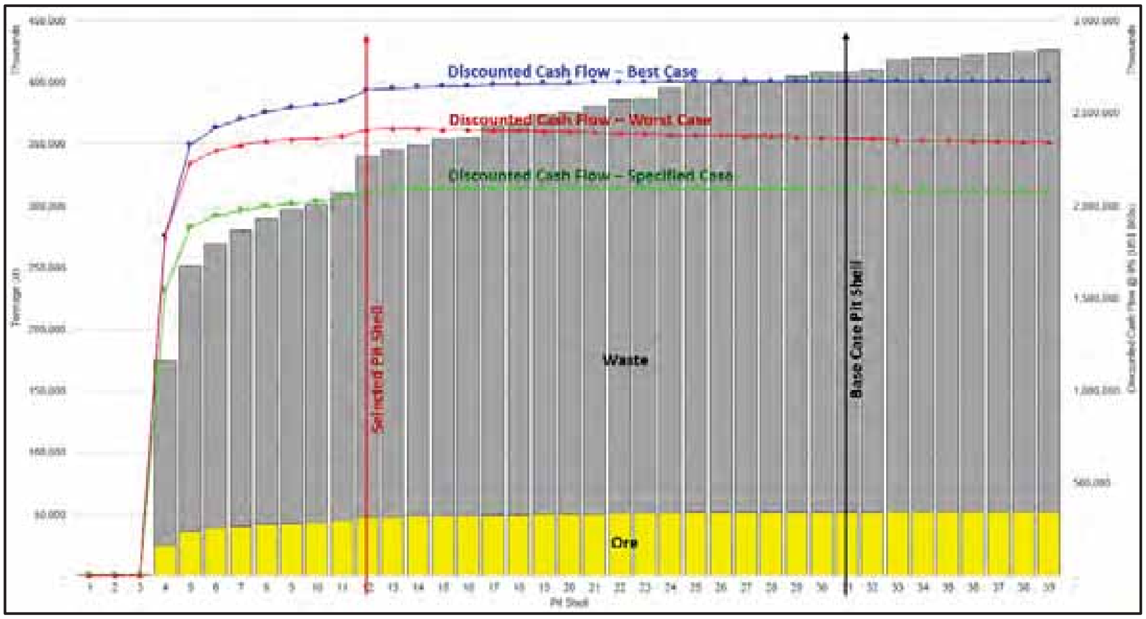


Figure 15-1 Pit-by-Pit Analysis (Wood, 2020)

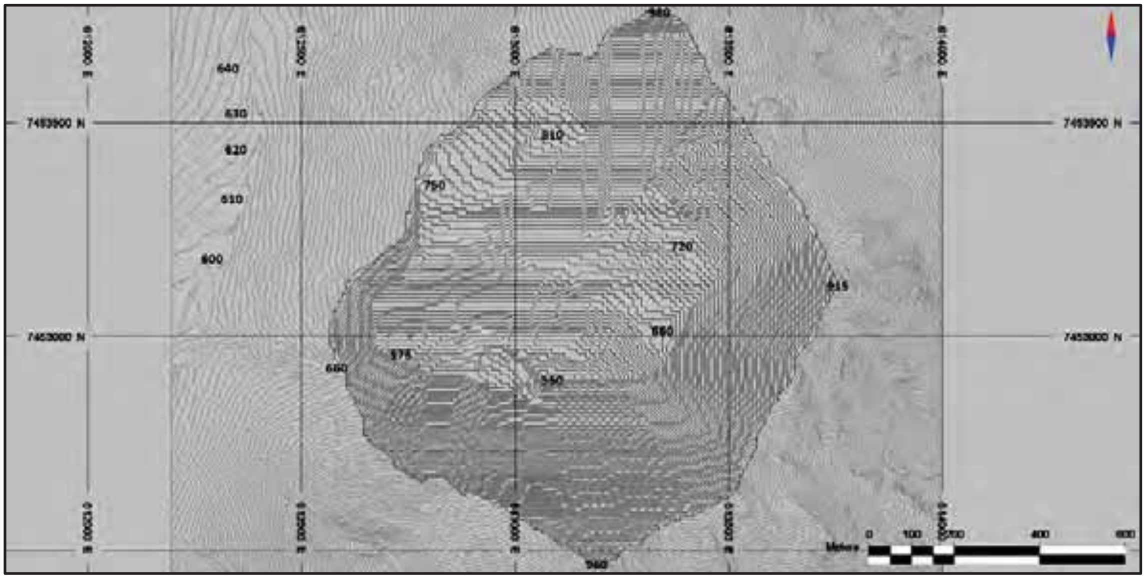


Figure 15-2 Selected Pit Shell (Wood, 2020)

15.3 Dilution and Ore Losses

The Mineral Resources estimate was reported undiluted. To estimate Mineral Reserves, dilution was applied to the resource model in two steps: planned dilution and contact dilution. These procedures include ore losses.

Planned dilution was estimated as follows:

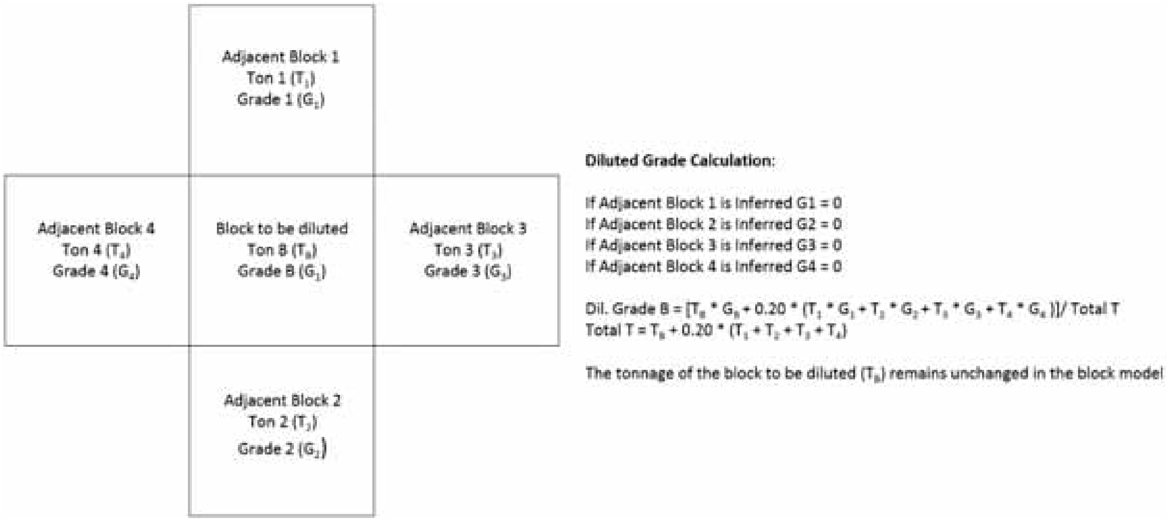
- The resource model was reblocked from a block size of 10 x 10 x 5 m to 5 x 5 x 5 m to better approximate mining selectivity.

- The diluted grades of each block were calculated using the formula:

$$Diluted\ Grade = \frac{Ore\ Grade\ \times Ore\ tonnage + Waste\ Grade\ \times Waste\ Tonnage}{Total\ Tonnage}$$

Contact dilution was estimated as follows:

- The grade of a given block will be diluted by blending 20% of the tonnage from each of the four adjacent blocks.
- If an adjacent block is classified as Inferred Mineral Resource its grade is considered to be zero. If the adjacent block is Measured or Indicated, but below cut-off, dilution is taken at the grade of the adjacent block.
- The procedure is illustrated in Figure 15-3.



Diluted Grade Calculation:

If Adjacent Block 1 is Inferred G1 = 0
If Adjacent Block 2 is Inferred G2 = 0
If Adjacent Block 3 is Inferred G3 = 0
If Adjacent Block 4 is Inferred G4 = 0

Dil. Grade B = $[T_B * G_B + 0.20 * (T_1 * G_1 + T_2 * G_2 + T_3 * G_3 + T_4 * G_4)]$/ Total T
Total T = $T_B + 0.20 * (T_1 + T_2 + T_3 + T_4)$

The tonnage of the block to be diluted (T_B) remains unchanged in the block model

Figure 15-3 Contact Dilution Estimation Procedure (Wood, 2020)

15.4 Mineral Reserve Statement

As the mining cost varies with depth individual blocks captured within the final pit design were tagged as either ore or waste by applying the parameters shown in Table 15-1. Using the partial block percentages within the final pit design the ore tonnage and average grades were estimated. The Mineral Reserves statement is shown in Table 15-2 on a 100% basis. Trilogy Metals has a 50% interest in Ambler Metals.

The Qualified Person for the estimate is Dr Antonio Peralta Romero, P.Eng., a Wood employee. The estimate has an effective date of January 31, 2020.

Table 15-2 Mineral Reserves Statement

Class	Tonnage	Grades				
	t x 1000	Cu (%)	Zn (%)	Pb (%)	Au (g/t)	Ag (g/t)
Proven Mineral Reserves	-	-	-	-	-	-
Probable Mineral Reserves	43,443	2.24	3.12	0.54	0.47	34.7
Proven & Probable Mineral Reserves	43,443	2.24	3.12	0.54	0.47	34.7

Notes:

1. The Qualified Person for the Mineral Reserve estimates is Antonio Peralta Romero P.Eng., a Wood employee. Mineral Reserves have an effective date of January 31, 2020. Mineral reserves are reported on a 100% basis. Trilogy Metals has a 50% interest in Ambler Metals.
2. Mineral Reserves estimated assuming open pit mining methods and include a combination of planned and contact dilution. Total dilution is expected to be between 30% and 35%. Pit slopes vary by sector and range from 26° to 43°. Cut-off grade is variable and ranges from $32.83/t NSR to $33.96/t NSR. Commodity prices used were $3.00/lb Cu, $1.00/lb Pb, $1.10/lb Zn, $1300/oz Au and $18/oz Ag. Fixed process recoveries of 91.2% Cu, 80.0% Pb, 91.0% Zn, 58.9% Au and 80.0% Ag. Mining costs were estimated at $2.78/t incremented at $0.02/t/5 m and $0.015/t/5m below and above 730 m elevation respectively. Processing costs were estimated at $29.39/t. Include process operating cost: $15.09/t, G&A: $6.55/t, sustaining capital: $1.53/t. closure cost: $1.52/t, road toll: $4.70/t. Treatment costs include $80/t Cu concentrate, $180/t Pb concentrate and $200/t Zn concentrate. Refining costs were estimated at $0.08/lb Cu, $10/oz Au, $0.80/oz Ag. Transport costs were included as $270.38/t concentrate. Fixed royalty percentage of 1%.

15.5 Factors Affecting Mineral Reserves

The Arctic Mineral Reserves are subject to the types of risks common to open pit polymetallic mining operations that exist in Alaska and include:

- Metal price and exchange rate assumptions.
- Changes to the assumptions used to generate the cut-off grades.
- Changes in local interpretations of mineralization geometry and continuity of mineralized zones.
- Changes to geological and mineralization shapes, and geological and grade continuity assumptions.
- Density and domain assignments.
- Changes to geotechnical, hydrogeological design assumptions.
- Changes to mining and metallurgical recovery assumptions.
- Change to the input and design parameter assumptions that pertain to the open pit constraining the estimates.
- Assumptions as to concentrate marketability, payability and penalty terms.
- Assumptions as to the continued ability to access the site, retain mineral and obtain surface rights titles, obtain environment and other regulatory permits, and maintain the social license to operate.

Specific factors that may affect the estimate are discussed as follows.

There is currently no developed surface access to the Arctic Project area and beyond. Access to the Arctic Project is proposed to be via the Ambler Mining District Industrial Access Project (AMDIAP), a road approximately 340 km (211 miles) long, extending west from the Dalton Highway where it would connect with the proposed Arctic Project area. The final terminal for the road has not yet been determined. Although the capital costs of the road are not yet final, an estimate of approximately $300 million has been used in the 2020 FS. Although Trilogy has been in discussions with the Alaska Industrial Development and Export Authority (AIDEA) that had been investigating alternatives to reduce the cost to construct the AMDIAP, the final cost of the road could be higher than the assumed $300 million. The working assumption of the 2020 FS is that AIDEA would arrange financing in the form of a public-private partnership to construct and arrange for the construction and maintenance of the access road. AIDEA would charge a toll to multiple mining and industrial users (including the Arctic Project) in order to pay back the costs of financing the AMDIAP. This model is very similar to what AIDEA undertook when the DeLong Mountain Transportation System (also known as the Red Dog Mine Road and Port facilities) were constructed in the 1980s. The amount paid in tolls by any user will be affected by the cost of the road, its financing structure, and the number of mines and other users of the road which could also include commercial transportation of materials and consumer items that would use the AMDIAP to ship concentrates to the Port of Anchorage in Alaska and possibly provide goods and commercial materials to villages in the region.

Proper management of groundwater will be important to maintaining pit slope stability, as well as additional pit slope design verification work to advance the project to the Detailed Engineering Level.

The current pit design meets the recommended IRA geotechnical design criteria established by SRK. However, the east wall is highly sensitive to several geotechnical parameters and talc horizons that may not have been included in the geological model might also affect its stability. Pit slope monitoring during operations will be necessary to ensure stability and avoid potential slope failures related to any variations in the geotechnical model used for design. The geotechnical assumptions used in the pit design may vary in future assessments and could materially affect the strip ratio, or mine access design.

The presence of talc layers in the rock could affect recoveries in the process plant and therefore could be a risk to the Mineral Reserves. Trilogy Metals is aware of this risk and has included a talc recovery circuit in the process plant design to mitigate this risk. Talc content per period was estimated in the mine production schedule.

16 Mining Methods

16.1 Mine Design

The Arctic Project is designed as a conventional truck-shovel operation with 144 t trucks and 15 m^3 shovels. The pit design includes three nested phases to balance stripping requirements while satisfying the concentrator requirements.

The design parameters include a ramp width of 28.5 m, road grades of 10%, bench height of 5 m, targeted mining width between 70 and 100 m, berm interval of 20 m, variable slope angles by sector and a minimum mining width of 30 m. Table 16-1 shows the mine design parameters.

Table 16-1 Mine Design Parameters

				Geotechnical Sector			
Parameter	**Units**	**2L-E**	**2L-W**	**2U**	**3**	**4L**	**4U**
Inter-Ramp Angle	degrees	26	40	45	30	34	45
Bench Face Angle	degrees	27	65	65	32	37	65
Bench Height	m	5	5	5	5	5	5
Catch Bench Spacing	bench	12	4	4	12	12	4
Road Gradient	%	10	10	10	10	10	10
Road Width - Two Lanes	m	28.5	28.5	28.5	28.5	28.5	28.5
Road Width - One Lane	m	18.5	18.5	18.5	18.5	18.5	18.5

The smoothed final pit design contains approximately 43 Mt of ore and 298 Mt of waste for a resulting stripping ratio of 6.9:1. Figure 16-1 shows the ultimate pit design. Figure 16-2 and Figure 16-3 show pit sections comparing the mine design to the selected pit shell.

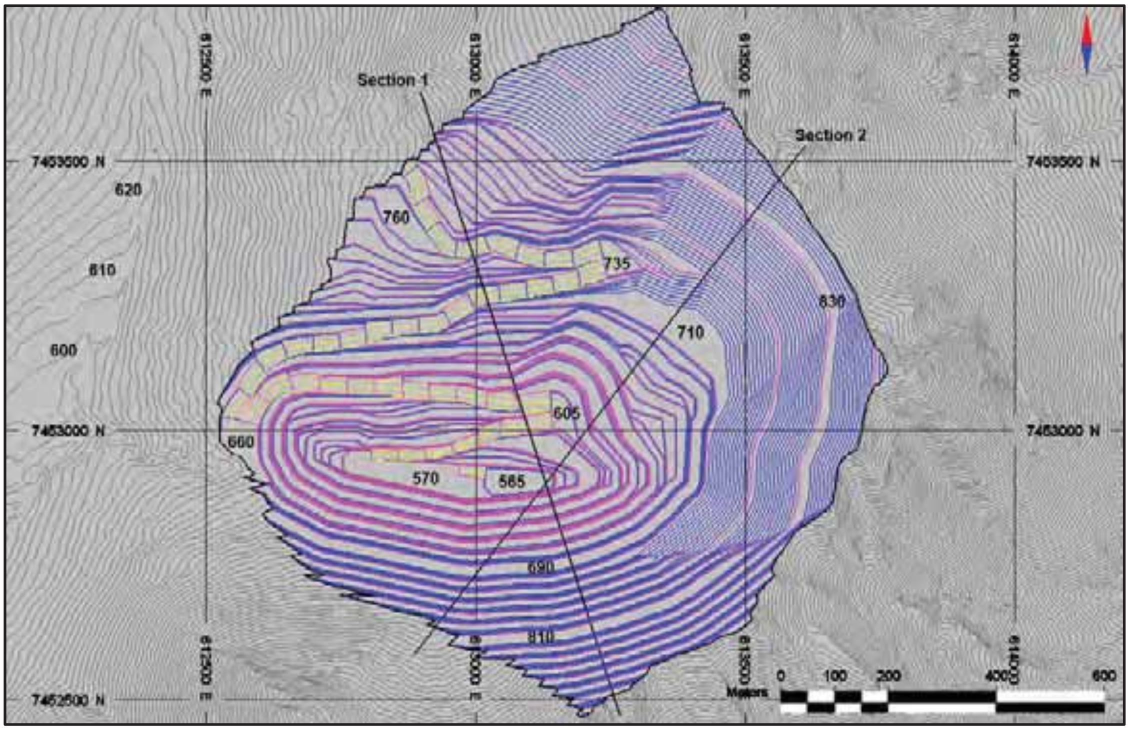


Figure 16-1 Ultimate Pit Design (Wood, 2020)

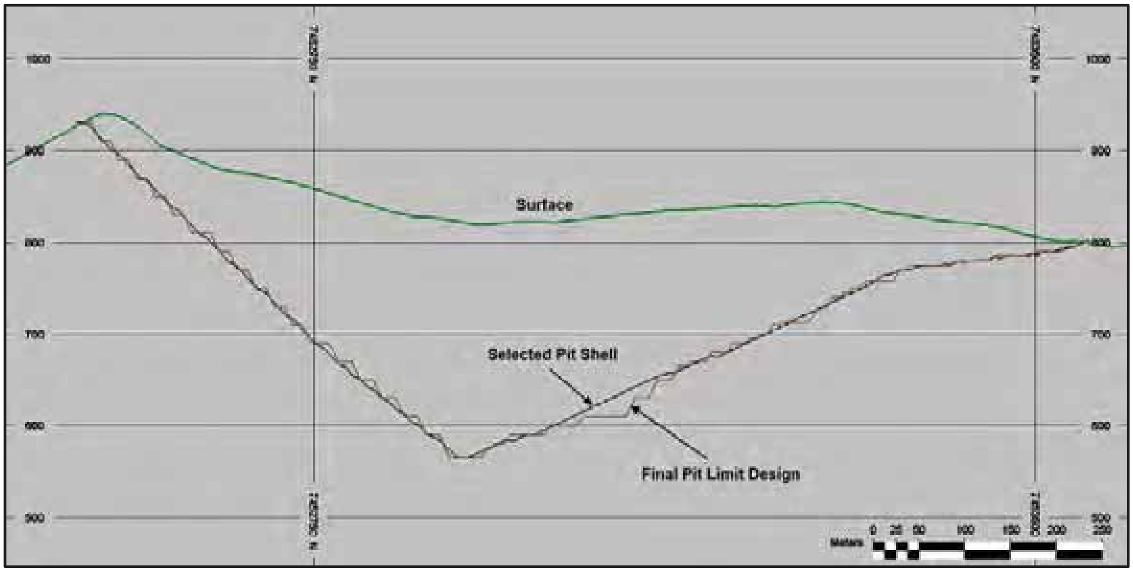


Figure 16-2 Section 1 Showing Mine Design and Selected Pit Shell (looking west) (Wood, 2020)

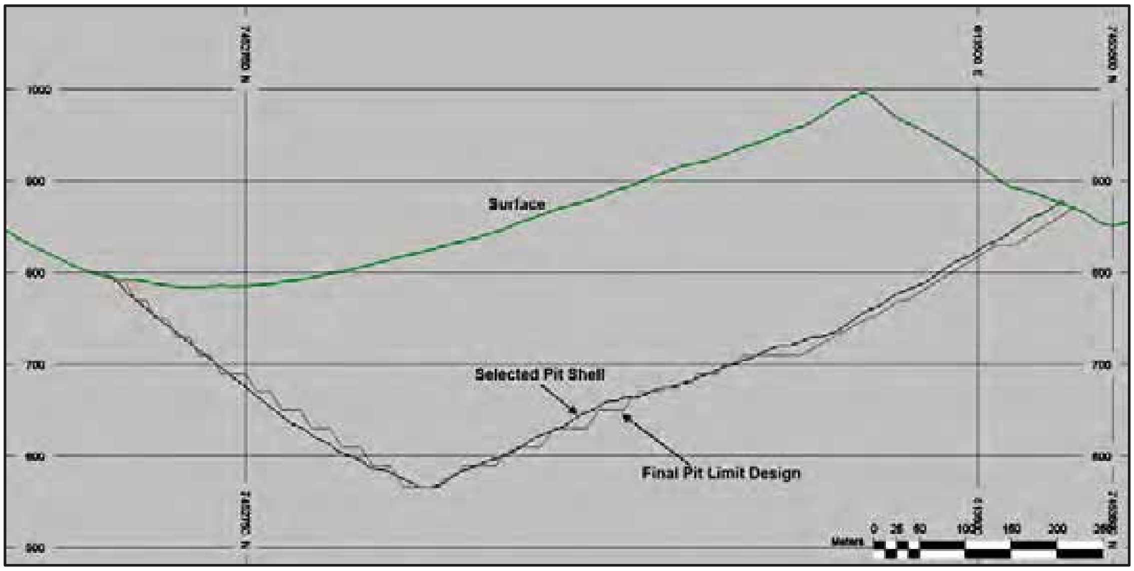


Figure 16-3 Section 2 Showing Mine Design and Selected Pit Shell (looking north-west) (Wood, 2020)

16.2 Waste Rock Facility and Stockpile Designs

The design and construction of the WRF should ensure physical and chemical stability during and after mining activities. To achieve this, the facility areas and stockpiles were designed to account for benching, drainage, geotechnical stability, and concurrent reclamation.

Additional information on the WRF is included in Section 18.11.

The WRF design criteria include 27.5 m wide benches every four lifts, 2.7H:1V overall slopes, 5-m lifts, and a 33% swell factor for estimating volumes. The WRF is planned to be constructed in lifts of either 5, 10 or 20m height with catch benches every 20m to achieve an overall slope angle of 2.7H:1V The overburden mined represent approximately 6% of the total waste and will be encapsulated within the waste rock. Figure 16-4 shows the WRF design.

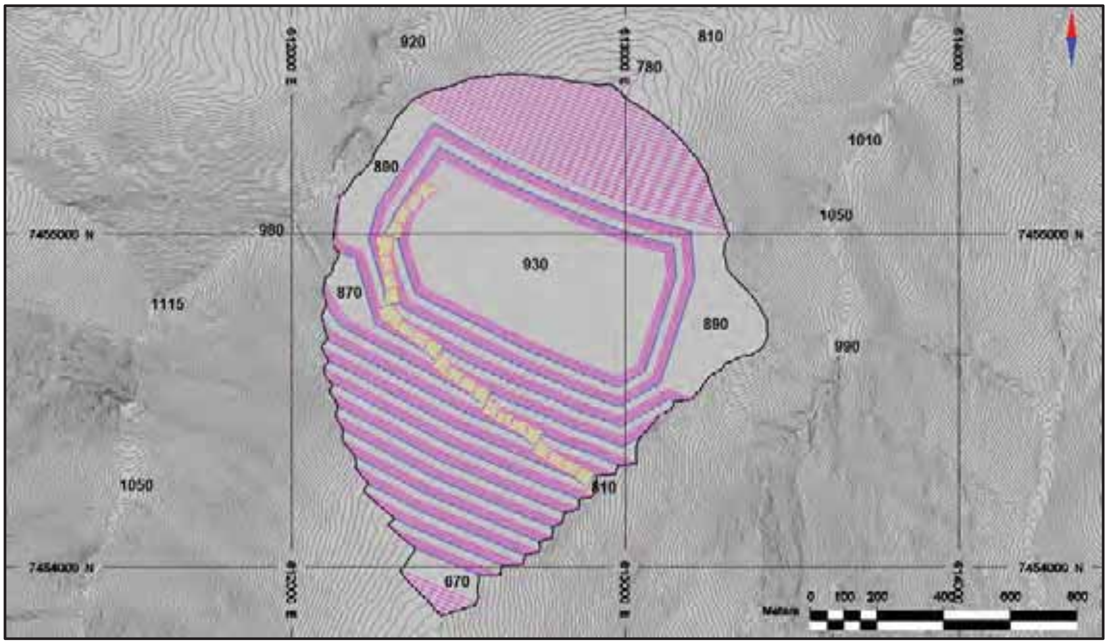


Figure 16-4 Waste Rock Facility (Wood, 2020)

A small stockpile is required to store the ore mined during the pre-production period. Because this stockpile is depleted at the beginning of the operation, it will be located within the WRF footprint and will have a total storage capacity of 130,000 m^3. This volume is sufficient to satisfy the maximum stockpiling capacity of approximately 315 kt. Figure 16-5 shows the stockpile design with respect to the WRF at the end of the pre-production period.

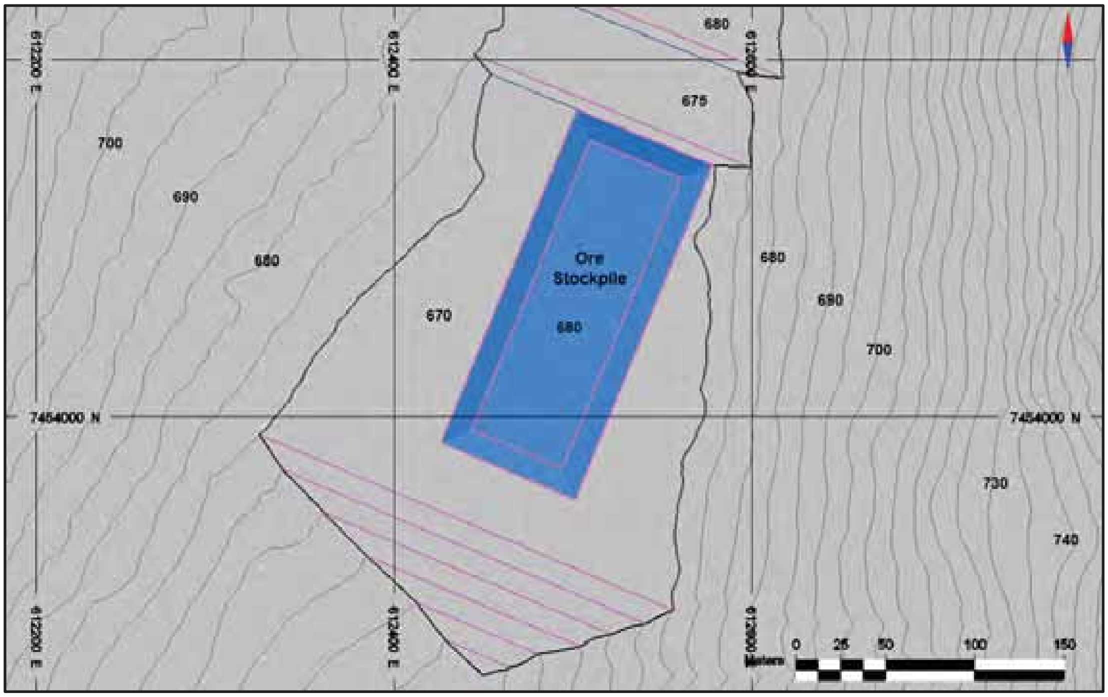


Figure 16-5 Ore Stockpile (Wood, 2020)

16.3 Production Schedule

The production schedule includes the processing ramp up. The processing plant ramp-up considers the normal inefficiencies related to the start of operations, and includes the tonnage processed as well as the associated recoveries, which increase the design capacity during the second quarter of operation. The mine requires two years of pre-production before the start of operations in the processing plant. However, the mine will start operations in Year -3 to produce material to be used on the site construction.

The deposit will be mined in three nested phases, including the ultimate pit limit. The schedule was developed in quarters for the pre-production period and for the first five years of production, then in yearly periods to the end of the LOM. The scheduling constraints set the maximum mining capacity at 36 Mt per year and the maximum number of benches mined per year at 10 in each phase.

The production schedule based on the Probable Mineral Reserves shows a LOM of 12 years. The amount of rehandled mill feed is 315 kt, which is the ore mined during the pre-production period. The average grades to the mill over the LOM are 2.24% Cu, 3.12% Zn, 0.54% Pb, 0.47 g/t Au, 34.7 g/t Ag and 5.1% talc. The yearly LOM schedule is shown in Table 16-2 and Figure 16-6. Figure 16-7 shows the scheduled Cu feed grade.

Table 16-2 Production Schedule

Period	Tonnage (kt)					Feed Grades					
	To Mill			Mine to	Total	Cu	Zn	Pb	Au	Ag	Talc
	Direct	Stockpile	Total	Stockpile	Waste	%	%	%	g/t	g/t	%
Year -2	-	-	-	297	27,903	-	-	-	-	-	-
Year -1	-	-	-	18	36,130	-	-	-	-	-	-
Year 1	3,163	315	3,478	-	33,262	2.49	3.02	0.50	0.40	35.0	7.1
Year 2	3,650	-	3,650	-	30,560	2.15	2.89	0.54	0.46	33.0	6.4
Year 3	3,650	-	3,650	-	27,983	1.99	2.82	0.48	0.35	27.9	6.6
Year 4	3,650	-	3,650	-	23,573	2.08	3.00	0.50	0.39	28.0	6.4
Year 5	3,649	-	3,649	-	22,815	2.10	3.03	0.55	0.45	29.5	5.2
Year 6	3,650	-	3,650	-	21,965	2.17	2.82	0.51	0.46	31.8	5.3
Year 7	3,650	-	3,650	-	20,100	2.26	2.65	0.44	0.45	32.6	6.3
Year 8	3,650	-	3,650	-	16,931	2.28	3.47	0.58	0.51	37.8	5.0
Year 9	3,650	-	3,650	-	13,586	2.61	3.90	0.64	0.56	44.5	4.5
Year 10	3,650	-	3,650	-	11,922	2.43	3.26	0.54	0.55	39.4	4.3
Year 11	3,650	-	3,650	-	8,064	2.30	3.42	0.57	0.52	37.9	3.5
Year 12	3,464	-	3,464	-	3,517	2.07	3.21	0.67	0.52	39.1	0.7
Total	**43,128**	**315**	**43,443**	**315**	**298,311**	**2.24**	**3.12**	**0.54**	**0.47**	**34.7**	**5.1**

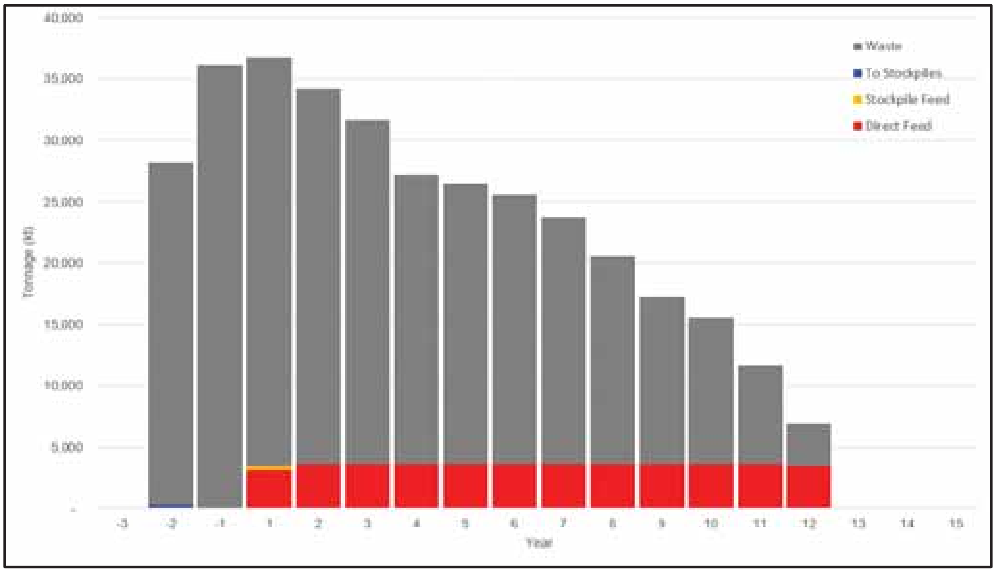


Figure 16-6 Production Schedule (Wood, 2020)

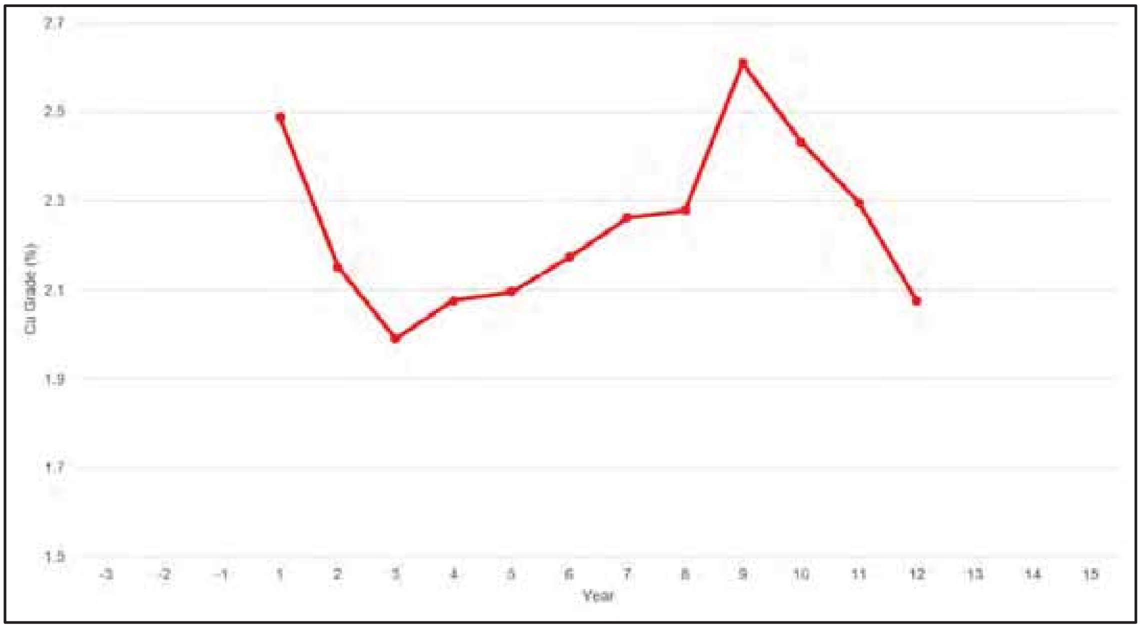


Figure 16-7 Scheduled Cu Feed Grade (Wood, 2020)

16.4 Waste Material Handling

Waste will be hauled to the WRF using 144 t trucks. The construction sequence will start at the bottom of the WRF and is planned to be constructed in lifts of either 5, 10 or 20 m height with catch benches every 20m to achieve an overall slope angle of 2.7H:1V.

16.5 Operating Schedule

The mine is scheduled to operate 24 hours a day, seven days a week using three rotating crews working 12-hour shifts. During the day, there will be two 12-hour shifts scheduled, consisting of a day shift and a night shift. A number of duties only require work during the daylight hours. For these duties, two crews will rotate to provide seven day-a-week day-shift coverage.

For the rotating mine operations crews, approximately 3.5 hours will be lost per day to standby time, inclusive of two hours for breaks, 20 minutes for fuelling (assuming quick coupling for the major equipment), 20 minutes for shift change, 20 minutes for blast delay, and 20 minutes for meetings (Table 16-3).

Over a year, approximately 10 days or 237 hours are assumed lost to poor weather conditions, predominantly in the winter time. It is assumed that the equipment will be manned but delayed during these weather events.

Table 16-3 Gross Operating Hours per Year

Calendar Time	
Days	365
Shifts per day	2
Shift length (h)	12
Calendar Time (h/year)	**8,760**
Available Time	
Availability	86%
Down time (h/year)	1,226
Available Time (h/year)	**7,534**
Gross Operating Time	
Operating Standby	
Internal (minutes/shift)	
Lunch & breaks	60
Blast delay	10
Fueling	10
Shift change	10
Meetings	10
External – Weather	19.5
Operating Standby (h/year)	**1,250**
Gross Operating Hours (h/year)	**6,283**

Accounting for standby time and weather delays, equipment accumulates approximately 6,283 gross operating hours (GOH) per year in the example above. For productivity calculations, it is assumed that following preproduction, the trucks and shovels will be in a productive cycle of approximately 50 minutes each hour, or 83% of the time. For drills, the productive utilization will be lower and in the range of 65% based on benchmarking with similar mines. During the preproduction period, the equipment's productive utilization is de-rated to account for initial site conditions and operator skill level (Table 16-4).

Table 16-4 Productive Utilization Ramp-up

Period	Productive Utilization
PP Q1	67%
PP Q2	83%
PP Q3	83%
PP Q4	83%
PP Q5	83%
PP Q6	83%
PP Q7	83%
PP Q8	83%
Yr1 Q1 plus	83%

As with mine operations, mine maintenance will be scheduled to work a 24/7 schedule to allow for continuous maintenance coverage. However, the majority of planned maintenance work will be done during the day shift with a skeleton crew scheduled for the night shift.

Blasting will only be scheduled utilizing two blasting crews who will rotate on a 12-hour day shift, for seven day-a-week coverage.

16.6 Mining Equipment

A conventional Owner operated truck fleet loaded by a combination of hydraulic shovels and front-end loaders (FELs) is planned. The truck fleet will consist of larger trucks for waste stripping and for mining the ore zones. The trucks will be diesel powered with a combined capacity to mine a maximum of 36 Mt per year operating on a combination of 5 m and 10 m benches. The loading fleet will also be diesel powered. Blasting will be contractor performed with an emulsion plant installed at the site.

Equipment requirements are estimated quarterly during preproduction and the first five years of mining, and annually thereafter. Equipment sizing and numbers are based on the mine plan, the operational factors shown in Table 16-5, and a 24 hour/day, seven day a week work schedule.

Table 16-5 Equipment Utilization and Efficiency

Equipment	Availability	Efficiency
165 mm Production Drill	90%	81%
89 mm Top head hammer track drill	90%	75%
265 t/15 m^3 Hydraulic Face Shovel	87%	83%
124 t/12 m^3 Front End Loader	87%	83%
144 t Haul Truck	87%	83%
41t Articulated Truck	86%	83%
26 t/5 m^3 Front End Loader	86%	83%
68 t/4 m^3 Hydraulic Excavator	86%	83%
35 t/1.4 m^3 Hydraulic Excavator	85%	83%
74 t/455 kW Track Dozer	85%	83%
50 t/419 kW Rubber Tired Dozer	85%	83%
40 t Articulated Sand Truck	85%	83%
33 t/217 kW Motor Grader	85%	83%
35,000 liter water truck	85%	83%
41t Articulated Fuel/Lube Truck	85%	83%

16.6.1 Blasting

Blasting operations will be contracted to a blasting explosives provider who is responsible for shot design, loading, stemming, and initiation. A bulk emulsion plant will be installed at the site. The explosive provider will transport raw explosive material from Fairbanks, Alaska. The explosive will be stored in two explosive silos with 80-ton capacity each: one silo will be for storing ammonium nitrate and the other will be used for storing emulsion that will be produced on site.

In performing the explosive services, the blasting contractor is assumed to provide:

- Two seven person blasting crews providing seven day a week coverage.
- 1 crew/plant pick-up.
- 1 supervisor pick-up.
- Operation of the emulsion plant.

Additionally, two mobile manufacturing unit (MMU) trucks and one stemming truck are provided by the mine. The MMU explosive trucks will deliver a bulk emulsion product down the borehole.

Two types of heavy ANFO blend (HA) were used: 70% emulsion/30% ANFO for wet material, and 30% emulsion/70% ANFO for dry material, with specific gravity of 1.28 g/cm^3 and 1.23 g/cm^3, respectively.

The wall control design patters are based on SRK's recommendations. There are two main types of geotechnical zones within the pit: one group with average bench face angle (BFA) of 65° and with geotechnical berms every 20 m, and other group in the East wall, where the slope design is governed by a shallower foliation, with average BFA of 32° and with geotechnical berms every 60 m. For the zones in the East wall, pre-split blasting will not be used, instead multiple stab trim holes and a bulldozer will be used for face outlining and cleaning.

Table 16-6 shows the design parameters for production and wall control blasting.

Table 16-6 Blasting Design Input

Description	Units	Waste Dry	Ore Dry	Waste Wet	Ore Wet	Trim (1)	Trim (2)	Pre-split (1)
Rock Density	t/m^3	2.76	3.22	2.76	3.22	2.84	2.84	2.76
Explosive		HA37	HA37	HA73	HA73	HA37	HA37	Packaged Emulsion
Explosive Density	kg/m^3	1,230	1,230	1,280	1,280	1,230	1,230	1.30(3)
Bench Height	m	10	10	10	10	10	10	22.1
Hole Diameter	m	0.165	0.165	0.165	0.165	0.165	0.165	0.089
Burden	m	5.1	4.4	5.2	4.5	5.0	5.1	1
Spacing	m	5.9	5.1	6.0	5.2	5.0	5.0	1
Sub drill	m	1.5	1.3	1.6	1.3	0.0	0.0	0.0
Stemming	m	3.6	3.1	3.7	3.1	6.00	5.85	17.30
Drill length per hole	m	11.5	11.3	11.6	11.3	10.0	10.0	22.1
Rock Volume per hole	m^3	300.9	224.4	312.0	234.0	247.5	256.3	22.1
Rock Tonnage per hole	t	830	723	861	753	702	727	61
Rock Tonnage	t/m	72	64	74	67	70	73	3
Explosive Column	m	7.90	8.20	7.90	8.20	4.00	4.15	4.80
Weight of explosive	kg	208	216	216	224	105	109	6.24
Powder Factor (by rock volume)	kg/m^3	0.69	0.96	0.69	0.96	0.43	0.43	0.28
Powder Factor	kg/t	0.25	0.30	0.25	0.30	0.15	0.15	0.10

(1) Geotechnical zones with 65 degrees BFA.

(2) Geotechnical zones with 32 degrees BFA.

(3) Density expressed in Kg/m.

Although material will be mined on a combination of 5 and 10 m benches, all material will be drilled and blasted on 10 m benches.

Based on benchmarking, a powder factor of 0.30 kg/t will be used for ore, and a powder factor of 0.25 kg/t will be used for waste. For trim, a powder factor of 0.15 kg/t will be used. Table 16-7 provides a summary of the material blasted on an annual basis.

Table 16-7 Material Blasted Quantities

Period	P.F. kg/t	Waste Blasted (kt)	Ore Blasted (kt)	Trim Blasted (kt)	Total Blasted (kt)
PP -2	0.25	26,997	297	906	28,200
PP -1	0.24	31,585	18	4,545	36,148
Yr1	0.24	29,611	3,163	3,651	36,425
Yr2	0.24	25,662	3,650	4,898	34,211
Yr3	0.24	23,448	3,650	4,535	31,633
Yr4	0.24	19,869	3,650	3,704	27,223
Yr5	0.25	19,875	3,649	2,940	26,465
Yr6	0.24	18,861	3,650	3,103	25,615
Yr7	0.25	18,230	3,650	1,870	23,750
Yr8	0.25	15,156	3,650	1,775	20,582
Yr9	0.25	11,268	3,650	2,318	17,236
Yr10	0.25	9,920	3,650	2,002	15,572
Yr11	0.24	5,859	3,650	2,205	11,714
Yr12	0.24	1,143	3,464	2,374	6,982
Total	**0.24**	**257,485**	**43,443**	**40,826**	**341,757**

Blasting products that will be consumed on an annual basis are shown in Table 16-8.

Table 16-8 Blasting products consumed

Period	ANFO (t)	Emulsion Bulk (t)	Packaged Emulsion (t)	Detonators Pyrotechnic (Units)	Boosters 0.45kg (Units)
PP-2	3,309	3,471	1	33,727	33,727
PP-1	4,169	4,168	18	46,715	46,715
Yr1	4,290	4,349	35	50,097	50,097
Yr2	4,016	3,983	24	46,141	46,141
Yr3	3,720	3,689	18	42,024	42,024
Yr4	3,216	3,202	18	36,693	36,693
Yr5	3,141	3,169	9	34,025	34,025
Yr6	3,038	3,049	12	33,600	33,600
Yr7	2,842	2,914	17	32,004	32,004
Yr8	2,471	2,525	12	27,234	27,234
Yr9	2,067	2,061	12	23,399	23,399
Yr10	1,877	1,878	11	21,224	21,224
Yr11	1,419	1,378	18	17,944	17,944
Yr12	855	767	12	11,292	11,292
Total	**40,432**	**40,603**	**217**	**456,119**	**456,119**

16.6.2 Drilling

Throughout the Project life, drilling will be required for both ore control and blasting. Rock fragmentation achieved through blasting will be the overriding design criteria for the drill hole pattern design. The blast hole drilling design together with the drill penetration rates described below were used to estimate drilling requirements.

Drill penetration is a function of bit size, bit load, drilling method, and rock strength properties. Wood used the information in SRK's 2017 Feasibility Slope Geotechnical and Hydrogeological report for rock strength properties. SRK completed unconfined compressive testing (UCS) and point load testing on the primary rock types. The results of the uniaxial compressive tests for the primary ore hosting rocks (lithological units) are shown in Table 16-9. Wood calculated a weighted average UCS value for the ore hosting rocks of 88 Mpa. Table 16-9 also shows the representative lithologies used to calculate a weighted average UCS value of 65 Mpa for the waste areas.

SRK finished their 2020 Geotechnical and Hydrogeological Feasibility report after Wood finalized its work in this area. In comparing SRK's previous report to the feasibility report, the differences were minor, therefore the earlier information was used.

Table 16-9 Rock Type Weight and UCS

Lithology	UCS (Mpa)	% of Ore/Waste Hosting
Ore Hosting		
GS	97	75%
MS	56	13%
SMS	68	12%
Average Ore	**88**	**100%**
Waste Hosting		
CHS	20	6%
DM	71	2%
MRP	73	24%
QFMS	60	27%
GS	97	16%
MS	56	3%
SMS	68	3%
QMS	50	12%
QMSp	62	5%
TS	17	2%
Average Waste	**65**	**100%**

According to the Workman Calder Rock classification, the rock is rated as Moderate with a Rock Penetration Factor (RFI) of 125 for waste and 100 for ore, respectively. Table 16-10 shows the calculated penetration rates using the Workman and Calder equation.

Table 16-10 PV271 Drill Penetration Rates

Material Type	Inst. Pen. rate	Tram Time	Setup Time	Sampling Time	Total Cycle	Average
	m/h	min	min	min	min	Pen Rate[1] (m/h)
Ore	60	0.5	3.12	0.30	15.5	28.9
Waste	50	0.5	3.12	0.30	17.5	25.6

Notes:

1 Assumes 81% efficiency.

Table 16-11 shows the projected drill requirements, the meters drilled, the hours operated, and the average penetration rate by period. From the first year of preproduction, mining will require three production drills. Following Year 3, drill requirements will drop to two and after Year 8, drill requirements fall to one, together with a drop in total tonnes mined. Penetration rates will average 27.9 m/h over the LOM.

Table 16-11 Drill Requirements and Performance

Period	Drills Required	Meters Drilled	Operating Hours	Avg. Pen Rate
	#	(m)	(h)	(m/h)
PP -2	3	405,585	15,051	26.9
PP -1	3	520,370	19,976	26.0
Yr1	3	529,501	19,922	26.6
Yr2	3	499,342	19,761	25.3
Yr3	3	462,701	18,155	25.5
Yr4	2	399,302	13,030	30.6
Yr5	2	388,048	12,888	30.1
Yr6	2	375,836	12,888	29.2
Yr7	2	348,709	12,923	27.0
Yr8	2	302,525	8,988	33.7
Yr9	1	254,680	6,372	40.0
Yr10	1	230,732	6,372	36.2
Yr11	1	175,446	6,390	27.5
Yr12	1	107,268	6,420	16.7
Total		5,000,044	179,138	27.9

In addition to the production drills, one top head hammer (THH) drill with a 3 ½ inch (89 mm) bit will be used for pre-split drilling.

16.6.3 Loading

Wood completed an equipment trade-off study based in quantitative and qualitative characteristic of the equipment and vendor's quotations received. From the trade-off study, the primary loading units selected are two 15 m^3 hydraulic shovels. After Year 8, only one shovel will be required. To assist the hydraulic shovels, two 12 m^3 high lift FELs will be scheduled until Year 3 of production, dropping to one until the end of the LOM. The FELs will also be used for stockpile rehandling, all of which is scheduled in Year 1. Forecast loading requirements are shown in Table 16-12.

Table 16-12 Loading Requirements and Performance

	15 m³ shovel		12 m³ FEL	
	Number	Productivity (t/GOH)	Number	Productivity (t/GOH)
PP -2	2	1,562	2	986
PP -1	2	1,821	2	979
Yr1	2	1,809	2	1,065
Yr2	2	1,778	2	899
Yr3	2	1,743	2	1,064
Yr4	2	1,624	1	1,139
Yr5	2	1,600	1	1,115
Yr6	2	1,576	1	1,092
Yr7	2	1,464	1	1,008
Yr8	2	1,300	1	852
Yr9	1	1,751	1	1,139
Yr10	1	1,811	1	800
Yr11	1	1,419	1	539
Yr12	1	935	1	236
Average		1,585		922

The 15 m^3 shovel will five-pass load the 144 t truck in approximately three minutes. The LOM production rate will average 1,585 t_{dry}/GOH. The peak productivity scheduled for the shovel will occur in Years -1, when it is scheduled at 1,821 t_{dry}/GOH.

The FEL will seven-pass load the 144 t truck in approximately three and a half minutes. The LOM production rate will average 922 t_{dry}/GOH. The peak productivity scheduled for the FELs will occurs in Year 9, when the FELs are scheduled at 1,139 t_{dry}/GOH.

In addition to the primary loading units, a 5 m^3 FEL will be paired with two 41 t articulated trucks throughout the mine life for bench development/pioneering work and winter snow removal. A 3.8 m^3 excavator will also be used to maintain haul roads and scale the pit walls as needed.

16.6.4 Hauling

Wood completed an equipment trade-off study based in quantitative and qualitative characteristic of the equipment and vendor’s quotations received. From the trade-off study, the primary hauling unit selected for ore and waste mining is a mechanical drive truck with a payload capacity of 144 t wet, assuming a standard body with a full set of liners. The dry capacity is estimated at 140 t, assuming 3% moisture and carry back.

Wood estimated truck requirements on a period by period basis using travel distances from a road network developed within MineSight. Haul segment distances were reported for each material type from their location on a mining bench to their final destination. Assuming 2% rolling resistance for haul roads, travel speeds were estimated from the manufacture’s performance curves, and applied to each haul segment to estimate travel time.

Projected truck requirements by period are shown in Table 16-13 for the 144 t trucks, together with the average one-way haul distance, average fuel consumption, and average truck productivity. Twelve trucks will be commissioned during pre-production. Over the next year, the fleet will be ramped up to 15. The truck fleet will reach its peak in Year 1 at 18, dropping progressively until it reaches 13 in Year 5 and keeping steady for the next four years. Following Year 9, the 144 t truck requirements will decline with declining mining rates.

Table 16-13 Truck Requirements and Performance

	Trucks Required	Average one-way Haul Distance	Average Fuel Burn	Average Truck Production
	#	(m)	l/GOH	t/GOH
PP -2	12	2,350	69	369
PP -1	15	2,274	77	384
Yr1	18	3,200	83	320
Yr2	17	2,834	83	338
Yr3	16	3,031	86	343
Yr4	14	2,885	92	327
Yr5	13	2,450	92	348
Yr6	13	2,581	95	350
Yr7	13	2,894	100	302
Yr8	13	3,244	105	263
Yr9	12	3,545	108	239
Yr10	10	3,606	109	259
Yr11	8	3,456	109	243
Yr12	4	3,324	107	290
Average	14	2,879	90	325

16.6.5 Support

Support equipment will include excavators, track dozers, rubber-tired dozers (RTDs), sand trucks, graders, water trucks, fuel/lube trucks, and water trucks. The major tasks for the support equipment include:

- Bench and road maintenance
- Shovel support/clean-up
- Blasting support/clean-up
- WRF maintenance
- Stockpile construction/maintenance
- Road building/maintenance
- Pioneering and clearing work
- Field equipment servicing.

Support equipment requirement forecasts are shown in

Table **16-14.**

Table 16-14 Support Equipment

Period	35 t Excavator	Bulldozer - 455 kW	Wheel dozer - 419 kW	Motor grader – 217 kW	Sand Truck - 41 t	Water Truck - 35000 l	Fuel / Lube Truck
PP -2	1	4	2	2	1	2	2
PP -1	1	4	2	2	1	2	2
Yr1	1	4	2	2	1	2	2
Yr2	1	4	2	2	1	2	2
Yr3	1	4	2	2	1	2	2
Yr4	1	3	2	2	1	2	2
Yr5	1	3	2	2	1	2	2
Yr6	1	3	2	2	1	2	2
Yr7	1	3	2	2	1	2	2
Yr8	1	3	2	2	1	2	2
Yr9	1	2	1	2	1	2	2
Yr10	1	2	1	2	1	2	2
Yr11	1	2	1	2	1	2	2
Yr12	1	2	1	1	1	2	2

16.6.6 Auxiliary

To support mine maintenance and mine operation activities, a fleet of auxiliary equipment will be required. The types and numbers of auxiliary equipment anticipated for the LOM are listed in Table 16-15 in five-year increments.

Table 16-15 Auxiliary Equipment

Equipment	Year 1	Year 5	Year 10
Mine Maintenance			
Truck Mounted 40 t Crane	1	1	1
80 t Rough Terrain	1	1	1
5t Rough Terrain Forklift	2	2	2
10t Forklift	2	2	2
Mechanic Service Truck	3	3	3
Small Fuel/Lube truck	1	1	1
55 kW Skid Steer	1	1	1
Flatbed Truck	2	2	2
CAT TL1055 Telehandler	1	1	1
Mine Operations			
106 kW backhoe/loader	1	1	1
Hydraulic hammer/impactor	1	1	1
90 t Lowboy	1	1	1
Compactor	1	1	1
Light Plant	11	8	5
Transport Tractor	1	1	1
Tire Handler Truck	1	1	1

Equipment	Year 1	Year 5	Year 10
3/4 ton Pickup	4	4	4
1 ton Pickup	5	4	3
Crew Bus	5	4	3
Fleet Management System	1	1	1
Mine & Geology Software	10	10	5
Heavy ANFO (blend) Truck	2	2	2
Stemming Truck	1	1	1
Laser Scan	2	2	2
Survey Drones	2	2	2
Total Station System	1	1	1

16.7 Open Pit Water Management

Hydrogeological assessments were completed to assess the quantity and method for dewatering the pit, and pore pressure reduction for slope stability purposes. Assessments were based on available data and conceptual models developed from that data. Numerical and analytical methods were used to calculate estimates of future conditions.

16.7.1 Pit Inflow

Hydrogeological conceptual models and inflow estimation approach is discussed in Section 9.7. Table 16-16 summarizes total pit inflow estimates for the Base Case condition.

Table 16-16 Summary Based Case Cumulative Pit Dewatering Needs

Mining year	Base Case Total Inflow (m3/d)
02	2190
04	2760
06	3200
08	3540
10	3740
12	3760

Pit inflows are expected to be low magnitude, relative to many other projects worldwide, and flows of this magnitude can be handled with in-pit sumps. It was assumed that sumps would be positioned at the lowest elevation points in the pit. Perimeter dewatering wells are not considered necessary for this scale of flow. A trend of increasing hydraulic conductivity with depth appears to occur at this site. As the pit advances into later years and gets deeper, in-pit dewatering wells may be beneficial.

Detailed design of dewatering capacity needs to consider:

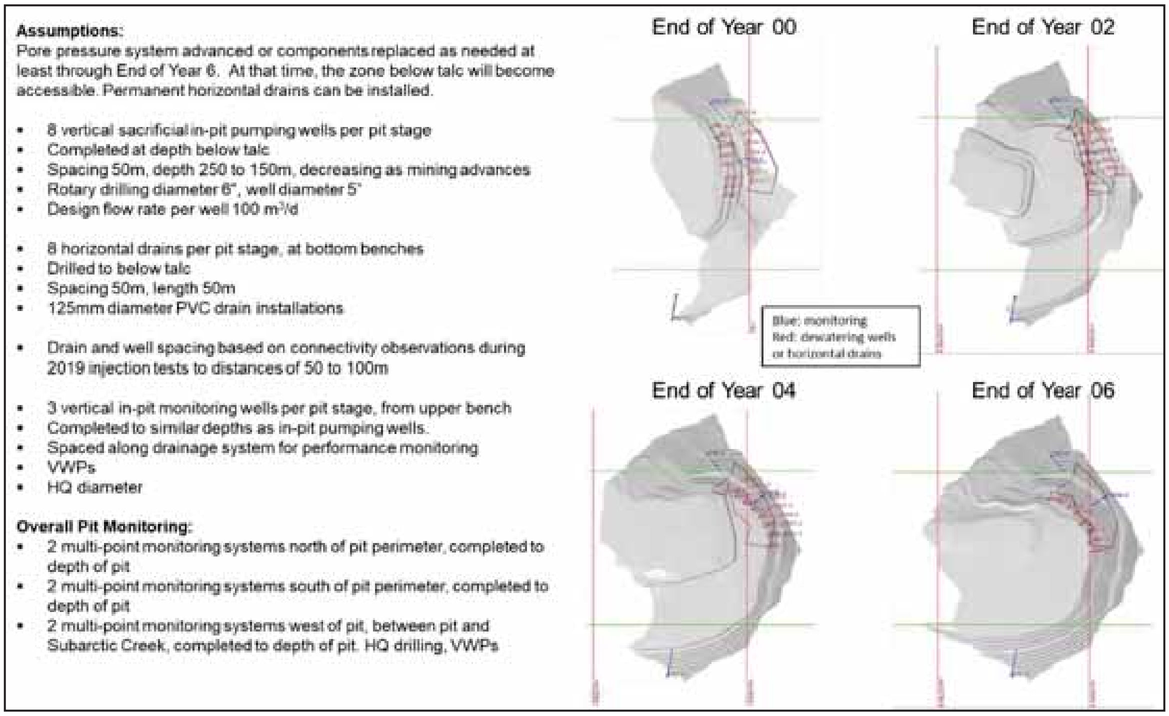
- Normal duty pumping capacity based on estimated pit inflow rates.
- Event pumping capacity based on the highest of design hydrological event (e.g. 1 in 20, 24-hour precipitation), annual freshet flow, or 2x normal duty capacity.
- Pit sumps sized based on event pumping capacity/volume.

16.7.2 Pore Pressure

Based on slope stability assessments, pore pressures could pose stability risks under two conditions:

1. Stability analyses indicate that slopes along geotechnical section B, in the northeast and east walls of the pit are sensitive to potential planar sliding on talc or foliation. Elevated pore pressures in these areas would exacerbate this condition. If pore pressure in these areas does not drain naturally as mining advances, active depressurization should be implemented.
2. Compartmentalization by sub-vertical structures could impede natural drainage of the slopes, potentially leading to localized stability issues. Specific areas where this could occur have not been identified in the available data but are possible. Monitoring programs should be in place to allow determination if and where compartmentalization could be occurring.

A pore pressure monitoring system and mitigation plan for the area of geotechnical section B was developed and is presented in Figure 16-1. Assumptions used for this plan are based on the hydrogeological conceptual model and results of hydrogeological testing. The plan should be reviewed as additional information becomes available, and mitigation efforts adapted as appropriate to achieve pore pressure reduction needs.



Assumptions:
Pore pressure system advanced or components replaced as needed at least through End of Year 6. At that time, the zone below talc will become accessible. Permanent horizontal drains can be installed.

- 8 vertical sacrificial in-pit pumping wells per pit stage
- Completed at depth below talc
- Spacing 50m, depth 250 to 150m, decreasing as mining advances
- Rotary drilling diameter 6", well diameter 5"
- Design flow rate per well 100 m³/d

- 8 horizontal drains per pit stage, at bottom benches
- Drilled to below talc
- Spacing 50m, length 50m
- 125mm diameter PVC drain installations

- Drain and well spacing based on connectivity observations during 2019 injection tests to distances of 50 to 100m

- 3 vertical in-pit monitoring wells per pit stage, from upper bench
- Completed to similar depths as in-pit pumping wells.
- Spaced along drainage system for performance monitoring
- VWPs
- HQ diameter

Overall Pit Monitoring:
- 2 multi-point monitoring systems north of pit perimeter, completed to depth of pit
- 2 multi-point monitoring systems south of pit perimeter, completed to depth of pit
- 2 multi-point monitoring systems west of pit, between pit and Subarctic Creek, completed to depth of pit. HQ drilling, VWPs

Figure 16-8 Pore Pressure Management Assumptions for East and Northeast Pit Walls (SRK 2020)

16.8 Geotechnical Review

The geotechnical analysis of open pit slopes was performed by SRK Consulting and it is included in Section 9.7.1.

Wood concurs with the recommendations provided by SRK, which were applied to the open pit mine design at the FS level. These designs were vetted by SRK Consulting.

17 Recovery Methods

17.1 Mineral Processing

A 10,000 t/d process plant was designed to process the massive and semi-massive sulphide mineralization. The process plant will operate two shifts per day, 365 d/a with an overall plant availability of 92%. The process plant will produce three concentrates: 1) copper concentrate, 2) zinc concentrate, and 3) lead concentrate. Gold and silver are expected to be payable at a smelter; silver is expected to be payable in the copper and lead concentrates, with gold expected to be payable in the lead concentrate only. The process plant feed will be supplied from the proposed Arctic open pit mine.

Run-of-mine (ROM) material will be hauled from the open pit to a primary crushing facility where it will be crushed by a jaw crusher. The crusher discharge will have a particle size of 80% passing 80 mm and will be stockpiled and fed to the grinding circuit. The crushed material will be ground in two stages of grinding including a SAG mill and a ball mill. The ball mill will be operated in closed circuit with classifying cyclones. The ball mill cyclone overflow will have a grind size of approximately 80% passing 70 µm. The mineralization will contain significant levels of talc and will first undergo talc pre-flotation to remove the talc prior to traditional base metal flotation for production of copper, zinc, and lead concentrates. The process plant final tailings will be pumped to the TMF. Copper, zinc, and lead concentrates will be thickened and pressure-filtered before being transported off site and shipped to market. A process flowsheet is shown in Figure 17-1.

The LOM average annual dry concentrate production is estimated as follows:

Copper concentrate:	241,024 t/a
Lead concentrate:	28,234 t/a
Zinc concentrate:	173,093 t/a

17.1.1 Flowsheet Selection

The process plant will consist of the following unit operations:

- Crushing:
    - Primary (jaw) crushing.
    - Stockpile and reclaim system.
    - Associated conveying and dust collection systems.
- Grinding:
    - Primary grinding using a SAG mill with pebble recycle.
    - Secondary grinding using a closed-circuit ball mill.
- Talc pre-flotation:
    - Rougher flotation using tank cells.
    - Single-stage cleaner flotation using a Jameson cell.
- Copper & lead bulk flotation:

  - Rougher flotation using tank cells.
  - Regrinding of rougher and cleaner-scavenger concentrates with a closed-circuit vertical mill.
  - Single-stage cleaning using a Jameson cell with tank-cell scavenging of values from the Jameson cell tails.

- Copper & lead separation:
  - Rougher flotation of lead from bulk cleaner concentrate using tank cells.
  - Three-stage cleaner flotation of lead using tank cells.
  - High-rate thickening of lead flotation tails as copper concentrate.
  - High-rate thickening of lead flotation concentrate.

- Zinc flotation:
  - Rougher flotation using tank cells.
  - Regrinding of rougher concentrate with a closed-circuit vertical mill.
  - Jameson-cell scalping of fast-floating material from the regrind cyclone overflow directly to zinc final concentrate.
  - Tank-cell first cleaning of scalper tails and second cleaner tails.
  - Jameson-cell second cleaning of 1st cleaner concentrate, with second cleaner concentrate joining scalper concentrate as zinc final concentrate.
  - High-rate thickening of zinc flotation concentrate.

- Concentrate filtration and concentrate load-out:
  - Filtration of each concentrate using a dedicated vertically stacked horizontal plate pressure filter with the discharge dropping directly to stockpiles.
  - Transfer of stockpiled concentrate into bulk containers for off-site shipping.

- Tailings disposal:
  - Pumping of tailings at run-of-mill density to the TMF.

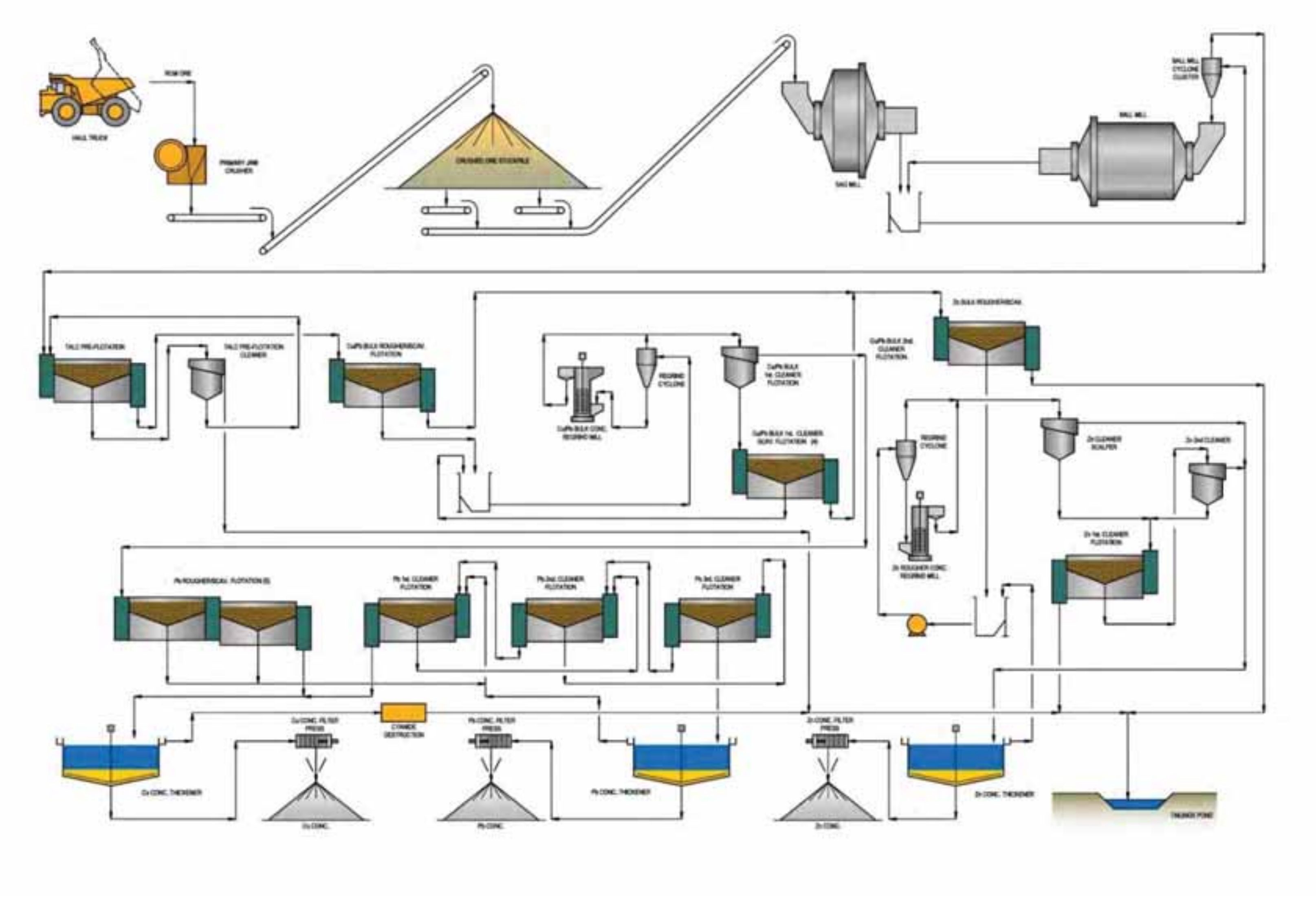


Figure 17-1 Simplified Process Flowsheet (Ausenco 2020)

17.2 Major Design Criteria

The process plant is designed to process 10,000 t/d, equivalent to 3,650,000 t/a. The design criteria developed for the processing facilities are outlined in Table 17-1.

Table 17-1 Processing Facility Design Criteria

Design Criteria	Unit	Value
Daily Processing Rate	t/d	10,000
Operating Days per Year	d/a	365
Operating Schedule		two shifts/day; 12 hours/shift
Crushing Availability	%	65
Grinding/Flotation Availability	%	92
Abrasion Index	g	0.032
Bond Ball Mill Work Index (design)	kWh/t	11.3
SAG Mill Comminution: A x b parameter (design)		109
Crushing		
Nominal Processing Rate	t/h	641
Crusher Feed Particle Size	mm	less than 770
Primary Crushing Product Particle Size, 80% Passing	mm	80
Grinding		
Nominal Processing Rate	t/h	453
Secondary Grind Size, 80% Passing	µm	70

17.3 Process Plant Description

The process plant is designed in general for efficient use of space and for limited installation costs. The overall process is arranged as a single processing line.

17.3.1 Crushing Plant

ROM material will be trucked to the crushing station and dumped into a 200 t receiving bin protected with a 1000 mm aperture stationary grizzly screen. Ore will be reclaimed from the bin with an apron feeder and scalped of fines with a vibrating grizzly. Grizzly oversize will be passed to a 200 kW jaw crusher. The designed nominal crushing rate is 641 t/h at 65% availability.

The combined grizzly undersize and jaw crusher discharge product is expected to be 80% passing 80 mm. The crusher product will be conveyed to a 5,000 t live capacity stockpile, providing up to 12 hours of live storage for the grinding/flotation plant.

A dust collection system will be provided to control fugitive dust generated during dumping, crushing, and transport of the materials. A belt magnet will be provided over the crusher discharge conveyor to remove any tramp iron.

The main equipment in the crushing area will include:

- One 1000 mm stationary grizzly.
- One primary apron feeder, 1,500 mm wide by 7,000 mm long.
- One vibrating grizzly (1,600 mm wide x 6,100 mm long, 100 mm aperture).

- One jaw crusher, 1,067mm x 1,270mm; driven by a 187kW motor.
- One belt scale.
- One belt magnet.
- One jaw crusher discharge conveyor.
- One stockpile feed conveyor.
- One baghouse/dust collector.

17.3.2 Coarse Ore Storage

The coarse ore stockpile will have a live capacity of 5,000 t equivalent to approximately 12hr of mill feed at the nominal mill feed rate. The stockpile dead capacity will be approximately 20,000 t. The coarse ore stockpile will be a covered facility equipped with a dust collector to effectively control dust losses and to mitigate freezing of the stockpiled material. The coarse ore stockpile building access will allow for the operation of mobile equipment to work the pile as required. Reclaim of ore from the stockpile will be accomplished using two 1000 mm wide by 4,800 mm long apron feeders at a nominal rate of 226 t/h per feeder. Reclaimed material from the apron feeders will be discharged onto a 900 mm wide by 125 m long SAG mill feed conveyor.

17.3.3 Grinding and Classification

17.3.3.1 Primary Grinding and Classification

Crushed ore reclaimed from the coarse ore stockpile will feed the SAG mill at a rate of 453 t/h. The initial lime and zinc sulphate addition to establish downstream flotation chemistry will be added here. The SAG mill will be a 6.1 m diameter by 4.9 m long unit equipped with a classifying trommel screen. The installed power on the SAG mill will be 3000 kW provided by a single motor and variable speed drive.

The SAG mill trommel undersize will flow by gravity to a pump box which will feed the classifying cyclones. Oversized pebbles from the SAG mill trommel will be returned to the SAG mill for additional grinding. The circulating load of oversize from the SAG mill trommel is estimated at 20% of SAG mill feed. As required, steel balls will be added to the SAG mill to maintain mill power.

17.3.3.2 Secondary Grinding and Classification

The secondary grinding circuit will include a single ball mill operated in closed circuit with a classifying cyclone cluster. The ball mill will be a 6.1 m diameter by 9.1 m effective grinding length (EGL) ball mill, powered by a 6,000 kW motor. The SAG mill trommel undersize will be combined with ball mill discharge to feed the classifying cyclone cluster. The cyclone underflow will gravity-flow to the ball mill, while the cyclone overflow, with a solids content of 36.5%, will gravitate to the flotation plant. The designed circulation load for the ball mill is approximately 300%. The flotation feed slurry is estimated to have a particle size of 80% passing 70 µm.

As required, steel balls will be added into the ball mill to maintain the required mill power.

17.3.4 Flotation

The flotation plant will produce a talc concentrate for disposal, as well as three payable base metal concentrates for shipment to market and sale. The talc concentrate will be produced prior to metal flotation to minimize dilution of the base metal concentrates. The base metal flotation process is industry-standard and includes the flotation of a bulk copper and lead concentrate followed by the flotation of a zinc concentrate. The bulk copper and lead concentrate will be separated by flotation of lead from the bulk concentrate to produce individual copper and lead concentrates.

The flotation tailings, including talc concentrate and zinc flotation tailings, will be pumped to the TMF for final disposal.

17.3.4.1 Talc Flotation

The cyclone overflow at 35-39% solids will feed four 130 m^3 tank flotation cells for removal of talc minerals. The talc rougher flotation concentrate will undergo single-stage cleaning using a single Jameson B4500/12 cell to reject any entrained payable sulphide minerals. Talc cleaner tails will return to the talc rougher feed, while talc cleaner concentrate will be pumped to the final tailings pump box for disposal. The pre-flotation tailings will become feed to the copper / lead bulk flotation circuit.

17.3.4.2 Copper–Lead Bulk Flotation and Regrinding

The talc pre-flotation tailings will be pumped to the copper–lead bulk flotation conditioning tanks where copper and lead mineral collectors will be added. The conditioned slurry will undergo rougher flotation in five 100 m^3 tank flotation cells for recovery of copper and lead minerals. The rougher concentrate will be pumped to classifying cyclones, with cyclone underflow reporting to a 337kW vertical regrind mill. Cyclone overflow and regrind discharge will gravitate to the Jameson feed pump-box, and will have a combined particle size of 80% passing 40 µm.

The bulk copper–lead cleaner flotation will be conducted in a Jameson B4500/12 cell. Bulk copper–lead concentrate will be pumped to the lead flotation circuit for separation of lead from copper, while tailings from the cleaner cell will be pumped to five 20 m^3 tank flotation cells for recovery of residual copper and lead minerals. Concentrate from the cleaner-scavenger flotation cells will flow to the regrind cyclone feed pump box for further regrinding, while the cleaner-scavenger tailings will join the rougher flotation tailings for pumped transfer to the zinc flotation conditioners.

Bulk copper–lead rougher flotation and cleaner flotation will be carried out at a pH of 8.5 to 9.0. Reagents to be used in the circuit include:

- $ZnSO_4$ as a zinc depressant
- Sodium isopropyl xanthate (SIPX) and 3418A as collectors
- Methyl Isobutyl Carbinol (MIBC) as frother.

The major process equipment used in the copper–lead bulk flotation circuit will include:

- Two conditioning tanks.
- Five 100 m^3 rougher and scavenger flotation cells.
- One vertical regrind mill with an installed power of 337 kW.
- Classifying hydrocyclones.
- One Jameson B4500/12 cell for cleaner flotation.
- Five 20 m^3 tank flotation cells for cleaner-scavenger flotation.

17.3.4.3 Copper–Lead Separation Flotation Circuit and Cyanide Destruction

Bulk copper–lead concentrate will be pumped to the copper–lead separation flotation conditioning tanks, where sodium cyanide will be added to depress copper minerals. The conditioned slurry will flow to a row of five 5m^3 lead rougher flotation tank cells.

Concentrate produced in the lead rougher cells will be pumped to a second row of five 5 m^3 tank cells for first cleaner flotation. The lead first cleaner concentrate will be upgraded in two more stages of counter-current cleaning, each consisting of a pair of 5 m^3 tank flotation cells. The final lead concentrate from the third stage of cleaning will be pumped to the lead concentrate thickener, while first cleaner tailings will join the rougher flotation tailings as copper concentrate and will be pumped to the copper concentrate thickener.

Lead flotation dilution water and launder spray water will be supplied by a dedicated process-water system, using water recovered from the copper concentrate thickener overflow. Water within the Cu/Pb separation circuit will carry elevated levels of cyanide and copper thickener overflow will provide feed to an SO_2/air cyanide destruction process. Cyanide destruction effluent will be pumped to the final tailings pump-box for disposal in the TMF.

Lead flotation will be operated at a pH range of 9.5 to 11.5. Reagents that will be used in the circuit include:

- Lime for pH control
- Sodium cyanide as a copper mineral depressant
- 3418A as a lead collector
- MIBC as a frother
- Sodium metabisulphite (SMBS) for cyanide destruction.

The copper–lead flotation circuit and cyanide destruction system will consist of:

- Two conditioning tanks
- Five 5 m^3 lead rougher flotation cells
- Five 5 m^3 lead first cleaner flotation cells
- Two 5 m^3 lead second cleaner flotation cells
- Two 5 m^3 lead third cleaner flotation cells
- Two cyanide destruction tanks.

17.3.4.4 Zinc Flotation and Regrinding Circuit

The bulk copper–lead flotation tailings will constitute the feed to the zinc flotation circuit. The zinc circuit will consist of feed slurry conditioning, rougher/scavenger flotation, zinc rougher concentrate regrinding, and cleaner flotation.

Bulk copper–lead flotation tails will be conditioned with lime to increase the pH to approximately 10.5, and copper sulphate will be added to the slurry to activate zinc minerals. Conditioning of the zinc flotation feed slurry will be completed in two tanks operated in series.

Rougher flotation will be conducted in five 100 m^3 tank flotation cells, with the concentrate reporting to the regrind cyclone feed pump-box and the rougher tails reporting to the zinc tails pump-box. The regrind cyclone overflow will gravitate to the Jameson E2532/6 zinc cleaner scalper cell, while the regrind cyclone underflow will feed an 337kW vertical regrind mill. Zinc cleaner circuit pH adjustment will be accomplished with lime addition to the regrind mill, and will result in a minimum cleaner circuit pH of 11 to reject pyrite. Regrind mill discharge will be pumped to the cleaner scalper cell, and in combination with the regrind cyclone overflow will have a particle sizing of 80% passing 40 µm. Zinc cleaner scalper concentrate will report to the cleaner concentrate pump-box for relay to the zinc concentrate thickener, while the cleaner scalper tails will be pumped to the zinc first cleaner cells.

Zinc first cleaning will take place in five 20 m^3 tank cells. First cleaner concentrate will be pumped to the Jameson E2514/3 second cleaner cell, while the first cleaner tails will join the zinc rougher tails prior to transfer to the final tails pump-box. The second cleaner concentrate will join the zinc cleaner scalper concentrate as zinc final concentrate. The second cleaner tails will join the cleaner scalper tails for pumped transfer to the first cleaner feed.

Zinc cleaner flotation dilution water, column froth-wash water, and launder sprays will be supplied by a dedicated process-water system. The supply for this system will be a combination of zinc concentrate thickener overflow and main plant process water.

Reagents used in the zinc flotation circuit will include copper sulphate, lime, SIPX, and MIBC.

The main equipment used for the zinc flotation circuit will consist of:

- Two conditioning tanks
- Five 100 m^3 zinc rougher and rougher scavenger flotation cells
- One 337 kW vertical mill
- Classifying cyclones
- One Jameson E2532/6 zinc cleaner scalper cell
- Five 20 m^3 tank cells for zinc first cleaner flotation
- One Jameson E2514/3 zinc second cleaner cell.

17.3.5 Product Dewatering

Each of the flotation concentrates, including copper, lead, and zinc concentrates, will be thickened in individual thickeners. Concentrates will be further dewatered by pressure filtration to a design moisture content of approximately 6%.

17.3.5.1 Copper Concentrate Dewatering

Copper concentrate will be pumped to a 15.0 m diameter high-rate thickener. The copper concentrate will be dosed with diluted flocculant solution injected ahead of an inline mixer in the thickener feed pipe. Prior to pressure filtration, thickener underflow slurry at approximately 65% solids will be pumped to an agitated concentrate stock tank with twelve hours storage capacity. Thickener overflow solution will discharge into a standpipe for pumped distribution as lead flotation area process water.

The target filter cake design moisture is 6%. The copper concentrate discharged directly onto a stockpile, from which a FEL will load concentrate into containers for shipment. Filtrate from the filtration will return to the copper concentrate thickener for incorporation into the overflow solution. The in-plant storage will be capable of storing up to four days of copper concentrate production, to accommodate potential truck haulage interruptions.

The equipment required for concentrate thickening and filtration will include:

- One 15.0 m diameter high-rate thickener
- One 12 hr concentrate stock tank
- One Outotec Larox PF84/96 M60 1 60 concentrate filter.

17.3.5.2 Lead Concentrate Dewatering

Lead concentrate will be pumped to an 8.0 m diameter high capacity thickener. The lead concentrate will be dosed with diluted flocculant solution injected ahead of an inline mixer in the thickener feed pipe. Prior to pressure filtration, thickener underflow slurry at approximately 65% solids will be pumped to an agitated concentrate stock tank with 12 hours storage capacity. Thickener overflow solution will join the copper thickener overflow for pumped distribution as lead flotation area process water.

The target filter cake design moisture is 6%. The lead concentrate will be discharged directly onto a stockpile, from which a FEL will load concentrate into containers for shipment. Filtrate from the filtration will return to the lead concentrate thickener for incorporation into the overflow solution. The in-plant storage will be capable of storing up to nine days of lead concentrate production, to accommodate potential truck haulage interruptions.

The equipment required for lead concentrate thickening and filtration will include:

- One 8.0 m diameter high-rate thickener
- One agitated concentrate stock tank
- One Outotec Larox PF7.9/11 M1.6 1 60 concentrate filter.

17.3.5.3 Zinc Concentrate Dewatering

Zinc concentrate will be pumped to a 12.0 m diameter high-rate thickener. The zinc concentrate will be dosed with diluted flocculant solution injected ahead of an inline mixer in the thickener feed pipe. Prior to pressure filtration, thickener underflow slurry at approximately 65% solids will be pumped to an agitated concentrate stock tank with twelve hours storage capacity. Thickener overflow solution and main plant process water will discharge into a standpipe for pumped distribution as zinc flotation area process water.

The target filter cake design moisture is 6%. The zinc concentrate will be discharged directly onto a stockpile, from which a FEL will load concentrate into containers for shipment. Filtrate from the filtration will return to the zinc concentrate thickener for incorporation into the overflow solution. The in-plant storage will be capable of storing up to four days of zinc concentrate production, to accommodate potential truck haulage interruptions.

The equipment required for lead concentrate thickening and filtration will include:

- One 12.0 m diameter high-rate thickener
- One agitated concentrate stock tank
- One Outotec Larox PF60/72 M60 1 60 concentrate filter.

17.3.6 Tailings Disposal

The final flotation tailings will be pumped in five stages, discharging at a final elevation approximately 285 m higher than the processing plant. The pump system will be duplicated such that there are a pair of five-stage pump trains arranged in a duty/standby configuration. The tailings stream is a combination of the following:

- The talc flotation concentrate
- The zinc rougher scavenger tailings
- The zinc first cleaner flotation tailings
- Cyanide detox solution from copper- lead separation.

The TMF will be equipped with a reclaim water pump barge which will return water from the pond to the process water tank. A pressure reduction station will be present in this line to eliminate the pressure in this line due to the large difference (up to 285 m) in elevation between the TMF and the process plant. Tailings management is discussed in Section 18.

17.3.7 Reagent Handling and Storage

Various chemical reagents will be added to the grinding and flotation circuits to adjust the mineral particle surface chemistry to facilitate the recovery of valuable minerals to the concentrate products. Reagents will be prepared and stored in a dedicated area within an annex to the main process plant and will be delivered by individual metering pumps or centrifugal pumps to the required addition points. MIBC and SIPX will be isolated within a room and common sump in the reagent area for ventilation purposes. Sodium cyanide will be stored in a second bunded area along with the lime system, while copper sulphate, zinc sulphate, and SMBS will share a third containment. All mixed reagents will be prepared using contact water from the contact water tank.

17.3.7.1 Collectors

The collector SIPX in a solid form will be shipped to the mine site in boxed 750 kg super-sacks. The SIPX will be diluted to 20% solution strength in a mixing tank and stored in a holding tank, before being added to the copper-lead bulk flotation circuit and the zinc flotation circuit via metering pumps.

The collector 3418A will be received as a liquid in 1,000 L totes. This collector will be delivered to the lead flotation and the copper–lead rougher flotation circuit via metering pumps without dilution.

17.3.7.2 Frother

MIBC frother will be received as a liquid in 1,000 L totes. The reagent will be used at the supplied solution strength. Metering pumps will deliver the frother to all flotation circuits.

17.3.7.3 Lime

Lime will be trucked to the site as unslaked lime in 2,000 kg super-sacks. The sacks will be dumped into the lime slaker feed hopper. From the feed hopper, the quicklime will be conveyed by screw into a detention slaker, with un-slaked grit being screened from the slaker product. The slaked lime slurry will be pumped to an agitated storage tank. Distribution of the lime from the storage tank to the addition points will be accomplished using a lime slurry loop. The bulk of the lime slurry will be used in the zinc flotation circuit. Slaker operation will be triggered automatically based on the lime slurry levels in the holding tank.

17.3.7.4 Flocculant

Stock flocculant solutions will be made up from powdered flocculant in a packaged preparation system, including a screw feeder, a flocculant eductor, and agitators. Mixed flocculant will be stored in a day-tank at 0.5% strength for metering to three static mixers for dilution with process water. Diluted flocculant at a 0.015% solution strength will then be introduced to the three final concentrate thickeners by way of injection into the feed pipes which will be fitted with inline mixers.

17.3.7.5 Other Reagents

Sodium cyanide will be supplied in briquette solid form in 1,000 kg boxed super-sacks. It will be mixed at a strength of approximately 20% and held in a day-tank for metering to the copper–lead separation circuit.

Cyanide monitoring/alarm systems will be installed in the cyanide preparation areas and areas of cyanide bearing solutions (i.e. lead flotation cells, copper and lead filtration areas, etc).

The remaining dry-mixed reagents (copper sulphate, zinc sulphate, and SMBS) will be handled, mixed, and distributed the same way as the sodium cyanide. Copper sulphate and zinc sulphate will each be mixed to a 15% solution strength, while SMBS will be mixed at 20%. Zinc sulphate and SMBS will arrive on site in 1,000 kg super-sacks, while copper sulphate will arrive in 1,300 kg super-sacks.

Scale inhibitor will be required to minimize scale build-up in the cyanide destruction tanks. The chemical will be delivered in liquid form (200 L drums) and metered into the first cyanide destruction tank.

Storage tanks will be equipped with level indicators and instrumentation to ensure that spills do not occur during normal operation. Appropriate ventilation, fire and safety protection equipment and devices will be provided at reagent preparation areas.

17.3.8 Water Supply Systems

There will be three separate water supply systems: a fresh water supply system, a contact water system, and a process water supply system. The contact water will originate principally from the WRF and mine dewatering operations.

17.3.8.1 Fresh Water Supply System

Fresh water will be supplied from wells and will be used for fire suppression and for potable water. A 350 m^3 fresh water/fire water storage tank will hold operating fresh water prior to treatment and distribution as potable water. Fresh water will be mainly used for fire water, and as a feed to the potable water system.

17.3.8.2 Potable Water System

The potable water system will only supply typical potable loads as the supply of fresh water is expected to be limited. The system will use a filtration and chlorinization system feeding a 50 m^3 surge tank, which in turn will feed the distribution system with pumps.

17.3.8.3 Contact Water System

Contact water will be pumped from the contact water pond to the process plant as a source of additional process water, and as a source for gland-seal water and reagent mixing water. Contact water addition to the process water tank will be sourced directly from the contact water tank feed pipe, while the gland-seal and reagent mixing water will be pumped from a 350 m^3 contact water storage tank.

17.3.8.4 Process Water

Process water will be composed of water reclaimed from the TMF, complemented by contact water. Reclaimed water from the TMF and contact water from the waste rock collection pond (WRCP) will be directed to a 1668 m^3 water tank, from where the water will be distributed to the process plant and other service locations. Principal destinations for process water within the plant will include:

- Grinding, talc flotation, and copper–lead bulk flotation areas
- Zinc process water make-up.

17.3.9 Air Supply

Air service systems will supply air to the grinding and flotation plant, as follows:

- Low-pressure systems:
  - Five blowers will supply air for the mechanically agitated flotation cells as well as for the cyanide destruction tanks.
- Compressors:
  - Four plant air compressors will supply the general plant utilities (wet air) and plant instrument air (through dryers)
  - Two compressors will supply the copper and zinc concentrate filters for cake pressing (wet air)
  - Three compressors will supply the three final concentrate filters for cake drying (wet air).

A separate high-pressure air service system will supply air to the crushing plant using a dedicated air compressor. The air will be provided for use in the dust collector baghouse and for general utilities.

17.3.10 On-Stream Analyzer

A single X-ray fluorescence on-stream analyzer (OSA) will be installed for indication of slurry stream metals contents and for production of shift composite samples for analysis by the assay laboratory. The unit will be fitted with three multiplexers for measurement of a total of 16 streams with an estimated maximum cycle time of 15 minutes. For each flotation circuit (including rougher and cleaner flotation), there will be a circuit feed sample, a cleaner concentrate sample, and a circuit tail sample pumped to the OSA. These samples will allow determination of overall metal recovery within that circuit. To allow determination of individual rougher circuit and cleaner circuit recoveries, each base-metals flotation circuit will also be equipped to provide a rougher concentrate sample and a cleaner tailings sample to the OSA. The analyses from the OSA will be fed to the central control room for process monitoring. The data obtained will be used for process control, product quality control and ongoing process optimization.

17.3.11 Site Laboratory Facilities and Quality Control

The laboratory will be used to analyze samples collected from the mine, process plant and concentrate. The laboratory facilities will consist of a sample preparation area, a metallurgical laboratory, and an assay laboratory.

Sample throughput is expected to be approximately:

- 120 samples per day for mine grade control and exploration
- 30 samples per day for process and metallurgical accounting (16 samples per shift).

The sample preparation area will be used to prepare both mine and process plant samples for analysis by the assay laboratory, and for the determination of process plant sample size distributions. Equipment included in the sample-preparation area will include:

- Jaw crusher
- Splitters
- Ovens
- Pulverizers
- Sieve shakers
- Scales.

For the purpose of ongoing plant optimization and diagnosis of metallurgical problems, the metallurgical laboratory will be equipped for routine testing such as batch flotation testing and concentrate settling tests. Equipment included in the metallurgical laboratory will include:

- Rolls and a batch rod-mill / ball mill
- One flotation cell
- One combination pH/temperature/oxygen reduction potential (ORP) meter
- Two pressure filters.

The assay laboratory will be equipped for metals analysis, including precious metal assaying and acid-base accounting. Equipment will include:

- Instruments such as pH and redox potential meters and experimental balances
- Various fume hoods, hot-plates, and stirrers for sample digestion

- Two AAS units (four metals each)
- One LECO furnace.

17.4 Plant Process Control

The plant control system will consist of a distributed control system (DCS) with personal computer-based operator interface stations (OIS) located in the control rooms of the following areas:

- Primary crushing: A control room will be provided in the primary crushing area with a single OIS. Control and monitoring of all primary crushing and conveying operations will be conducted from this location.
- Mill building: A central control room will be provided in the mill building with the required number of OIS.

In conjunction with the OIS, the DCS will perform all equipment and process interlocking, control, alarming, trending, event logging, and report generation.

The plant control rooms will be staffed by trained personnel at all times.

Programmable logic controllers (PLCs) (or other third-party control systems supplied as part of mechanical packages) will interface with the plant control system via Ethernet network communication systems when possible.

Operator workstations will be capable of monitoring the entire plant site process operations and will be capable of viewing alarms and controlling equipment within the plant. Field instruments will be microprocessor-based “smart” type devices. Instruments will be grouped by process area and wired to each respective area’s local field instrument junction boxes. Signal trunk cables will connect the field instrument junction boxes to DCS input/output (I/O) cabinets. Intelligent-type motor control centres (MCCs) will be in electrical rooms throughout the plant. Utilizing an industrial communication protocol interfaced to the DCS, a serial bus network will facilitate remote operation and monitoring of the MCC.

18 Project Infrastructure

18.1 Introduction

The proposed Arctic mine is a greenfield site, remote from existing infrastructure. Infrastructure that will be required for the mining and processing operations will include:

- Open pit mine
- Stockpiles and WRF
- Truck workshop, truck wash, mine offices, mine dry facility and warehouse
- Administration building
- Mill dry facility
- Plant workshop and warehouse
- Primary crushing building
- Fine ore stockpile building
- Process plant and laboratory
- Concentrate loadout building
- Reagent storage and handling building
- Raw water supply building
- TMF
- Diversion and collection channels, culverts, and containment structures
- WRCP
- Water treatment plants (WTPs).

Figure 18-1 shows the proposed site layout and Figure 18-2 shows the proposed locations of the processing plant, truck workshop and mine offices (collectively referred to as the mine infrastructure area) and administration buildings.

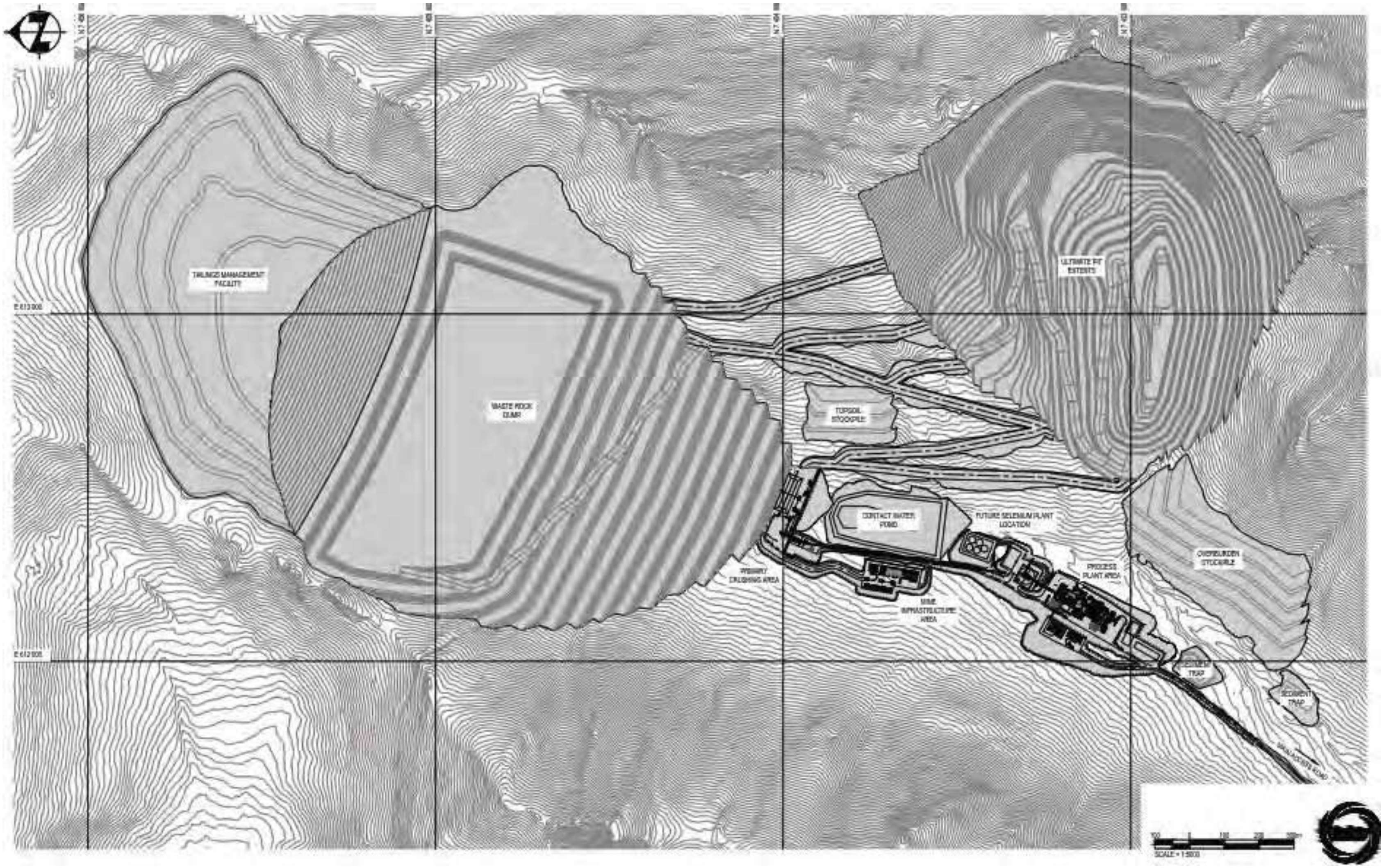


Figure 18-1 Proposed Site Layout (Ausenco, 2020)

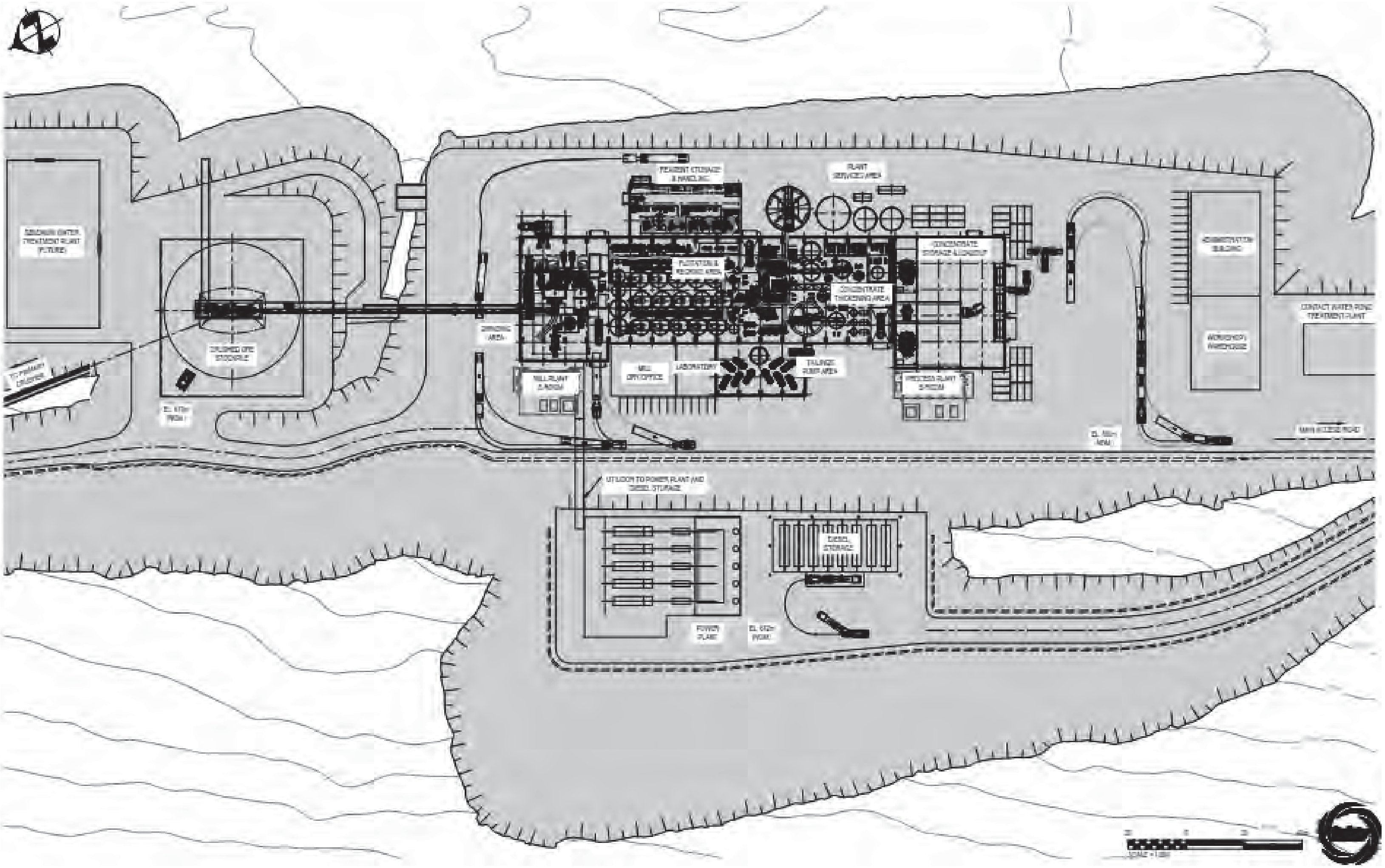


Figure 18-2 Proposed Location of the Processing Plant and Other Buildings (Ausenco, 2020)

18.2 Access Roads

The Project site will be accessed through a combination of State of Alaska owned highways, a proposed AIDEA owned private road, and proposed Trilogy Metals-owned access roads.

18.2.1 Ambler Mining District Industrial Access Project Road

The Project assumes that the AMDIAP road will be constructed prior to commencing construction of the Arctic Project.

There is currently no developed surface access to the Arctic Project area and beyond. Access to the Arctic Project is proposed to be via AMDIAP, a road approximately 340 km (211 miles) long, extending west from the Dalton Highway where it would connect with the proposed Arctic Project area. The final terminal for the road has not yet been determined.

The AMDIAP road is permitted as a private road with restricted access for industrial use and has just received a Federal Record of Decision on July 23, 2020 by the Bureau of Land Management and the National Park Service. Figure 18-3 shows the proposed route of the AMDIAP road.

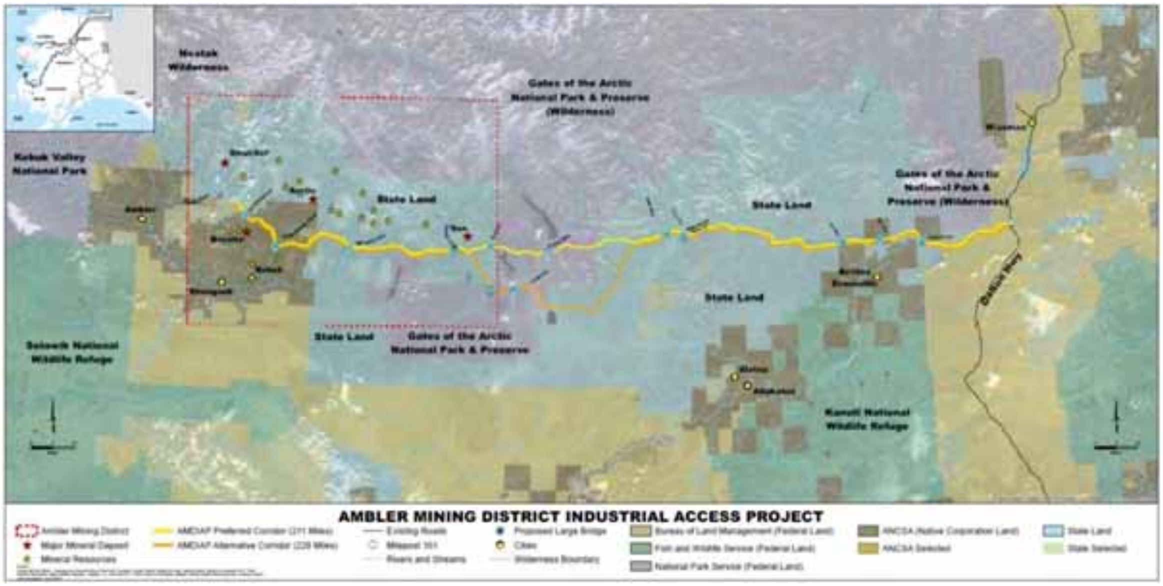


Figure 18-3 Proposed Route of AMDIAP Road (Ambler Access Website 2018)

18.2.2 Arctic Access Road

The Arctic access road is required to connect the Dahl Creek Airport to the Arctic Project using a portion of the AMDIAP road.

Trilogy Metals plans to develop two access roads to support the proposed Arctic mine: a southern route that will connects the Dahl Creek airport to the AMDIAP road, and a northern route that connects the AMDIAP road to the Arctic Mine. Development will include upgrading existing roads and trails and construction of new road segments where they currently do not exist. The roads will be designed to accommodate the types of vehicles expected to serve the intended mine and process plant operations.

The south route will be 21.4 km long and will be used to transport employees and air freight from the Dahl Creek airport to the Arctic mine. The first 17 km will generally follow the alignment of the existing road between the airport and the existing exploration camp. The remaining 4.5 km to the junction with the AMDIAP road will require new construction.

The north route will be 22 km long and will support operations at the Arctic mine by transporting employees, mining equipment, supplies, and ore concentrate to and from the mine site. Approximately the first 8.8 km of the north route will be new construction across the Ambler lowlands. The remaining 13 km will upgrade an existing undeveloped summer/winter trail, including 7.7 km that extend up a narrow and steep valley to the Arctic mine site. The north route will be the sole method for transporting ore concentrate from the mine to off-site processing locations via the AMDIAP road and the Dalton Highway.

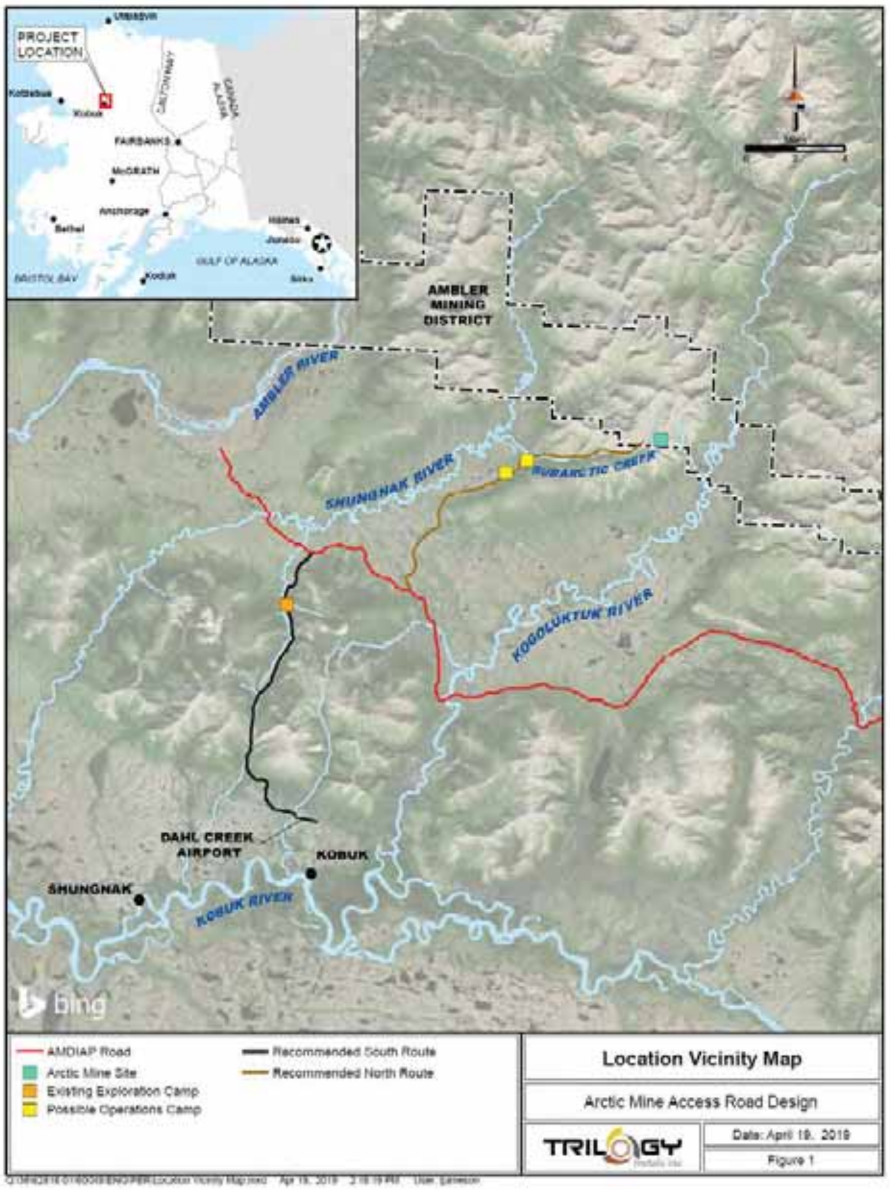


Figure 18-4 **Arctic Access Road (Trilogy Metals, 2019)**

18.3 Airstrip

The Dahl Creek airport is situated approximately 32 km south of the Arctic deposit. The airport would need to be upgraded with a lighting system and an automated weather observation system to be functional for Project purposes. These upgrades would support the use of Dash 8 aircraft for transporting crew to and from the Fairbanks International airport. The Dahl Creek airport is owned by the State of Alaska, and it is assumed that the upgrades would be accepted if funded by the Project.

New infrastructure that would be associated with the airstrip would include:

- Pre-fabricated 90 m^2 passenger building to accommodate personnel waiting to depart the site.
- Fabric structure approximately 175 m^2 in area to accommodate snow-removal and aircraft service equipment.
- Precision approach pathway indicators on each end of the runway to aid pilots in acquiring and maintaining the correct approach.
- Local utilities such as generator power and water services.

18.4 Camps

The Project will require the use of three different accommodation camps. Each camp will generally be self-contained and have its own power generation and heating capabilities, potable water treatment plant, garbage incineration and sewage treatment plant.

18.4.1 Bornite Exploration Camp

There is an existing camp at Bornite, which is currently used as an exploration camp. This camp can hold approximately 90 people with some minor upgrades. This camp will be used to support the construction of the Arctic access road.

18.4.2 Temporary Construction Camp

Due to the remote location of the Project site, a construction camp will be required. This camp will be constructed along the Arctic access road approximately 8 km from the intersection of the AMDIAP road and Arctic access road. The camp will be constructed to provide room and board for 185 people. After Project construction is complete, this camp will be removed.

18.4.3 Construction/Operations Permanent Camp

The permanent camp will be constructed along the Arctic access road, adjacent to the temporary construction camp. The permanent camp will be constructed ahead of operations to support the peak accommodation requirements during construction. The camp will be constructed to provide room and board for 400 people. An indicative breakdown of personnel onsite during operations is shown in Table 18-1.

Table 18-1 Personnel Onsite during Operations

Personnel Description	Number of Personnel Onsite
Owner Personnel	
General and Administration	30
Mill Operations	47
Mill Maintenance	101
Mine Operations and Maintenance	135
Contractor Personnel	
Concentrate Trucking Contractor	21
Camp Contractor	29
Other Contractor	8
Other Guests and Non-Employees	7
Total Personnel	**378**

18.5 Fuel Supply, Storage and Distribution

Diesel will be stored onsite in double-walled steel tanks for use in the power plant at the processing facility and for use in the mine fleet vehicles. A total of 12 horizontal tanks will be used, four tanks within the mine infrastructure area for mine fleet fuel requirements, and eight tanks adjacent to the power plant for generator fuel.

Each tank at the mine infrastructure area will hold 30,000 US gallons and each tank adjacent to the power plant will hold 27,243 US gallons. The volume stored at the mine infrastructure area will represent nine days of storage and the volume stored at the power plant will represent seven days of storage.

18.6 Power Generation

The plant power supply will be generated on site, with no utility interconnection. A total of five diesel generator sets will be installed to operate in parallel with 4 operating and 1 on standby.

Each generator will be rated 13.8 kV, 5.4 MW, and the total power output capacity will be 21.6 MW excluding the redundant unit. All five generators will be housed within a shared power plant building; the adjacent area has been left free to allow for addition of a sixth generator in the future if required.

18.7 Electrical System

The primary power distribution will be at 13.8 kV and will run via above ground cable trays to the area electrical rooms. There will be a total of four major electrical rooms, one of which will be part of the power plant building. The remaining three will be prefabricated modularized type buildings that will be shipped with all equipment pre-installed; these will be placed in the grinding, process and crushing areas. The smaller electrical room for the reclaim water barge will be supplied integral with the barge.

The total connected load for the plant will be 27.1 MW with a normal operating load of 16.0MW.

18.8 Surface Water Management

The proposed mine development is in the upper reach of Subarctic Creek valley, a tributary of the Shungnak River The combination of the climate, terrain, soils and sparse vegetation result in high runoff potential, especially in early season when soils are still frozen.

The catchment area of Subarctic Creek is approximately 25.8 km^2. All mine infrastructure and mine affected water is within the Subarctic Creek valley. A surface water management system will be constructed to segregate contact and non-contact water. Non-contact water will be diverted around mine infrastructure to Sub-Arctic Creek. Contact water will be collected and treated prior to discharge to the Shungnak River.

The objectives of the water management system are to:

- Ensure sufficient water quantity is available to support processing.
- Manage contact and non-contact water separately to minimize volume of contact water collected on site.
- Collect and treat contact and high-sediment water that could otherwise impair the water quality of the receiving streams.
- Protect mine infrastructure from damage of unmanaged run-off.
- Reduce suspended solid loading in surface runoff prior to discharge.

Water on site will be managed as one of the following:

- Non-contact water: Non-contact water will be diverted away from mine infrastructure to the extent possible to reduce infiltration into the WRF, TMF inflows, and pit inflows. Non-contact water will be discharged to Subarctic Creek during operations and closure.
- Contact water: Contact water will be generated when precipitation or run-on comes in contact with mine waste rock, tailings or is collected in the pit. Contact water is treated prior to discharge to the Shungnak River.
- High-sediment water: High-sediment water (i.e. surface flows from pads and topsoil stockpiles) is collected and conveyed to downstream sedimentation ponds to treat for total suspended solids (TSS) prior to discharge in Subarctic Creek, during operations and closure.

Figure 18-5 Surface Water Management Plan during Operations (SRK, 2020)

Figure 18-5 and Figure 18-6 illustrate the water management plan for the initial construction phase and the LOM footprint of the project.

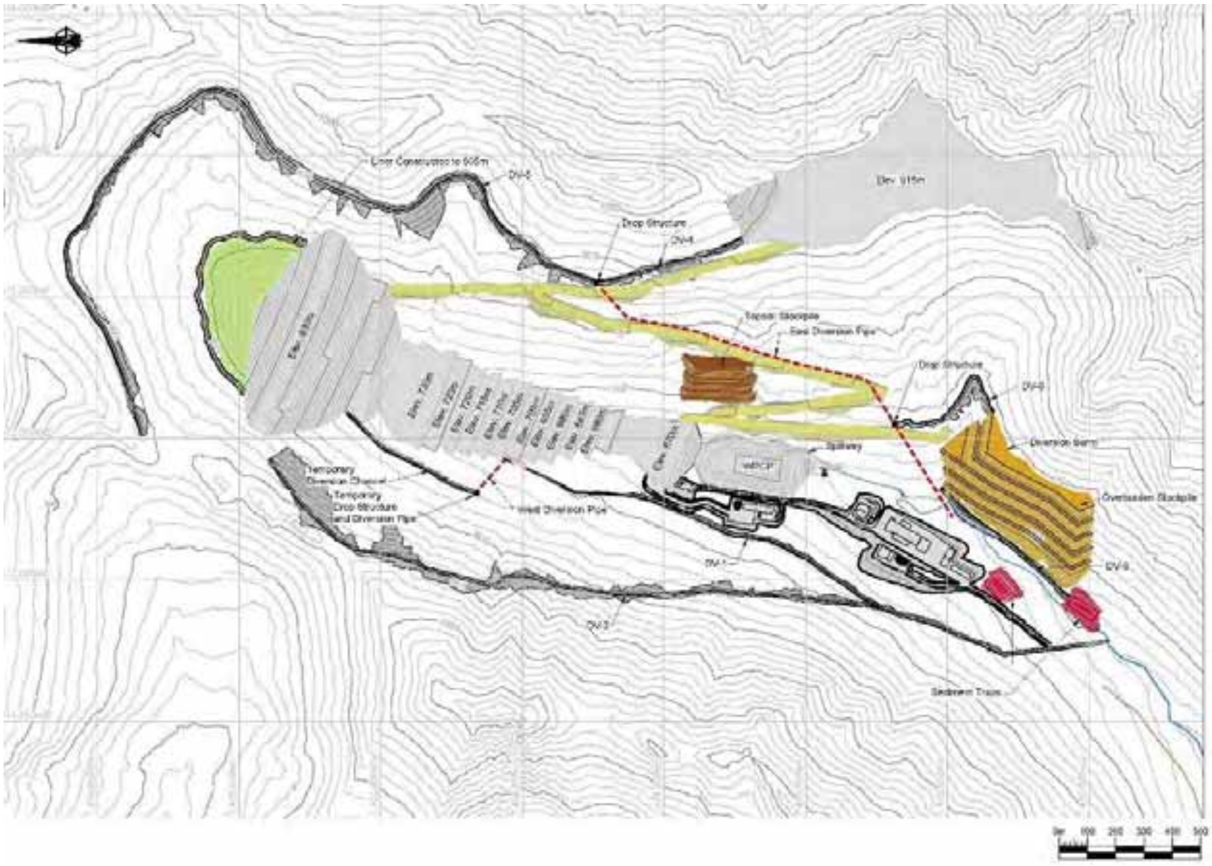


Figure 18-5 Surface Water Management Plan during Operations (SRK, 2020)

Figure 18-6 Surface Water Management Plan Life of Mine (SRK, 2020)

18.8.1 Process Water Supply

Process water, gland water, and reagent make-up water will be supplied primarily from reclaim in the TMF and secondarily from the WRCP. Table 18-2 summarizes mill water supply throughout the year. The TMF dam will be constructed prior to the processing of ore. Water will be allowed to initially collect in the TMF to a volume of 1.3 Mm^3 to supply the mill during start-up.

Table 18-2 Process water supply summary

Months	Supply Source	Comments
October to May	TMF reclaim water and WRCP	All water from the WRCP is pumped to the mill from October to May. This water is accumulated from groundwater flows during the winter months.
June to September	TMF reclaim water	No WRCP water is pumped to the mill. From June to September the Shungnak River has enough dilution capacity to receive all excess water from the WRCP, after treatment.

18.8.2 Water Management Infrastructure

Stormwater will be managed within the project boundaries by capturing and conveying contact and high sediment water for treatment and diverting non-contact water away from developed areas. Water conveyance and storage facilities proposed include the following structure types:

- Diversion and collection channels.
- Drop structures, diversion pipes and culverts.
- Collection ponds.

Soils found within the project limits consist of alluvial sands and gravels, with limited fines. Runoff from the overburden stockpile and mill site areas should be mitigated by temporarily seeding or using material to create durable less erodible surfaces to prevent or reduce erosion prior to entering the sediment ponds. Flocculation, filtration curtains and/or or baffles are contingency measures that can be used to meet enhance settling. In addition, water could be recirculated into the TMF or mill flow stream in extreme circumstances. Sediment that accumulates in the pond will be removed periodically to maintain the design capacity.

18.8.2.1 Diversions and Collection Channels

The steep mountainous terrain and compact development footprint will require additional geotechnical and geochemical studies to confirm soil and bedrock depths along the proposed conveyance alignments and acid rock drainage/metal leaching potential. Bedrock is expected to be relatively shallow creating challenges for construction, however shallow bedrock may increase the collection efficiency of surface and shallow sub-surface water interception. In addition, construction of channels within bedrock will eliminate the need for riprap protection while reducing potential seepage through soils in the channel bottom.

Diversion channels will be constructed around the perimeter of the TMF and WRF, above and below the overburden stockpile, and above the mill site infrastructure area. The channels will convey runoff either to Subarctic Creek, or to settling ponds to reduce suspended sediment. Runoff from haul roads is anticipated to be managed within the road footprint via roadside ditches with runoff reporting to the WRCP. The main purpose of the diversion channels is to reduce the amount runoff contacting mined materials. The diversion of non-contact water will reduce water treatment costs, and storage volume requirements. Channel construction will be phased during the construction period, and prior to commencement of mining to maximize non-contact water diversion.

Non-contact and contact water diversions are designed to convey the peak flow from a 100-year 24-hour rain-on-snow event respectively. All channels will have a minimum depth and width of 1.0 m and with lining either consisting of bedrock or riprap to provide erosion protection. Riprap will be sized to provide a stable non-erodible conveyance route, with riprap of reasonable size sourced locally on-site (max $D50 \leq 300$-450 mm). The riprap thickness is specified at two times the D50 and will be placed on geotextile fabric to limit erosion below the armor and reduce sediment loading downstream. Channel depths will be designed to have a minimum freeboard of 0.3 m above the design peak flow depth to accommodate potential ice or sediment accumulation, unforeseen climatic event or other uncertainties.

A 4 m wide access road will be located adjacent to each of the channels to provide access during construction and then for maintenance and cleaning of ice and sediment accumulation during operations and closure.

Localized seeps are anticipated to be encountered along the alignments during construction. A thorough survey prior to development of engineered design is required to identify areas of potential seep locations and accommodate mitigation measures as needed. Seepage collection and management may require widening of channels in the immediate area to allow for ice buildup during the late fall as conditions change from flowing to frozen water, or to intercept and manage subsurface flowing water within talus slopes. Maintenance of these seeps during the winter could prove challenging during freeze-up and prior to freshet. Prior to freshet flows, channel maintenance will be critical to ensure that adequate freeboard is available, and run-off is contained within the channels.

18.8.2.2 Culverts

Culverts will be required to manage contact water intercepted on the haul roads, and to pass diverted non-contact water through access and haul road corridors. The haul road corridors will traverse the hillside above the WRCP, between the pit and the WRF. The switch-backing layout of the haul roads will present a challenge to manage contact water for each of the small catchment areas, which will change throughout the project life. However, the location of the WRCP immediately down slope of the haul road corridor will allow for contact water to be collected in roadside channels and discharge downslope towards the WRCP for collection. The location and sizing of the culverts along the haul road should be incorporated into the haul road design. A small allowance has been included in the capital expenditures for culvert construction.

A major pipe structure (the eastern diversion pipe) will be located above the haul road corridors on the eastern edge of the project. This pipe will collect and convey non-contact water collected upslope of diversion channels DV-4, DV-5 and DV-6 and discharge into Subarctic creek downstream of the overburden stockpile. Concrete inlet or drop structures will be constructed at the terminus of the channels connecting to the diversion pipe.

A temporary diversion channel and pipe (upper reaches of DV 1) will be constructed during the pre-operations period on the western boundary of the WRF. The temporary diversion channel will terminate in an excavated sump, pre-cast manhole or constructed concrete manhole. A pipe will be installed in the sump/manhole conveying water immediately downslope into a receiving channel. The temporary diversion channel pipe, and sump will be buried at the end of the pre-operations period. The temporary channel will be breached periodically at the boundary of the WRF to prevent contact water entering the non-contact water system downstream.

All pipe structures are designed to accommodate the 100 year 24-hour rain-on-snow event. The culverts will be trenched in and backfilled with fine-grained engineering fill. Diversion pipes located on hillsides will be stabilized by burial or mounding of soils sourced in the immediate area, trenching and backfill or placed on a prepared bed and secured with concrete thrust block anchors if bedrock depths prevent conventional trenching or burial anchors. All pipes will discharge onto a stabilized rip-rap apron to reduce erosion potential.

18.8.2.3 Collection Ponds

Contact and high sediment water will be routed to either the WRCP or into one of two sedimentation ponds located along Subarctic Creek. After treatment, water in the sedimentation ponds will discharge directly to Subarctic Creek, while water collected in the WRCP will pumped into the process plant or water treatment plant.

The sedimentation ponds will allow suspended solids to be removed from the water column using gravity; in addition, they attenuate peak flows prior to discharge to Subarctic Creek. The ponds will maintain a permanent pool depth of 1 m to dissipate the water velocity entering the sediment ponds, and allow for particles to settle out prior to outflow through the outfall structure. The outfall structure may consist of a vertical perforated pipe and barrel through the embankment or an engineered rock fill spillway. The ponds will have a dimension ratio of approximately 3:1 length to width. This ratio optimizes residence time allowing for sedimentation to occur within the pond. The sedimentation ponds are designed to contain the volume from the 10-year 24-hour rain-on-snow event, which is roughly equivalent to two days of snow melt. The spillway is designed to convey the peak flow from a 200-year storm.

18.8.3 Waste Rock Collection Pond

The WRCP will be located directly below the toe of the WRF. The pond will collect seepage from the WRF, runoff from the WRF and haul road corridor area, and water pumped from the pit. The pond is sized to store the 100-year 24-hour rain-on-snow storm volume plus two days of average snow melt runoff and operational volume. The pond capacity will be approximately 370,000 m^3 to the spillway invert of 638 masl with a crest height of 640 masl.

Water from the WRCP will be pumped to the mill for reuse as process water or to the treatment plant to be treated and discharged to the Shungnak River during the open water season (May to October).

The dam will be constructed using the overburden and bedrock material stripped from within the WRCP excavation footprint or from a borrow source of suitable materials. All overburden within the WRCP footprint will be stripped to exposed bedrock, excess material will be placed in the overburden stockpile for use as cover material during closure activities.

Overburden material below the footprint of the dam will be removed and backfilled with well drained soils (as needed) to provide foundation stability. The excavation limit and dam foundation design requires additional geotechnical investigation. The design presented assumes all material upstream of the centerline of the embankment will be excavated to bedrock and material downstream excavated to suitable soils. The embankment will be constructed in 300 mm lifts, or as determined by the engineer. The down-stream face of the dam will be constructed to 3H:1V while the upstream face will be 2.5H:1V. The upstream face of the pond will be lined with a LLDPE geomembrane liner connected to a concrete plinth (curb) and grouted curtain wall to maximize interception of surface water and shallow subsurface groundwater.

A concrete lined spillway will be constructed to manage flows up to the potential maximum precipitation (PMP) event. The spillway will include an intake weir and collection throat prior to discharging in the spillway. A stilling basin will be located at the outfall of the spillway, to reduce flows to non-erosive velocities. The spillway length could be reduced by using one of various methods of energy dissipation within the channel; however, energy reduction in the channel generally requires additional depth of flow, resulting in larger concrete requirements. The construction cost would likely be similar. A riprap lined spillway was investigated; however, terrain, lack of geotechnical information and channel configuration would likely result in a large costly excavation that could encroach on the haul road located up-slope of the WRCP.

Figure 18-7, Figure 18-8 and Figure 18-9 illustrates the proposed construction of the WRCP.

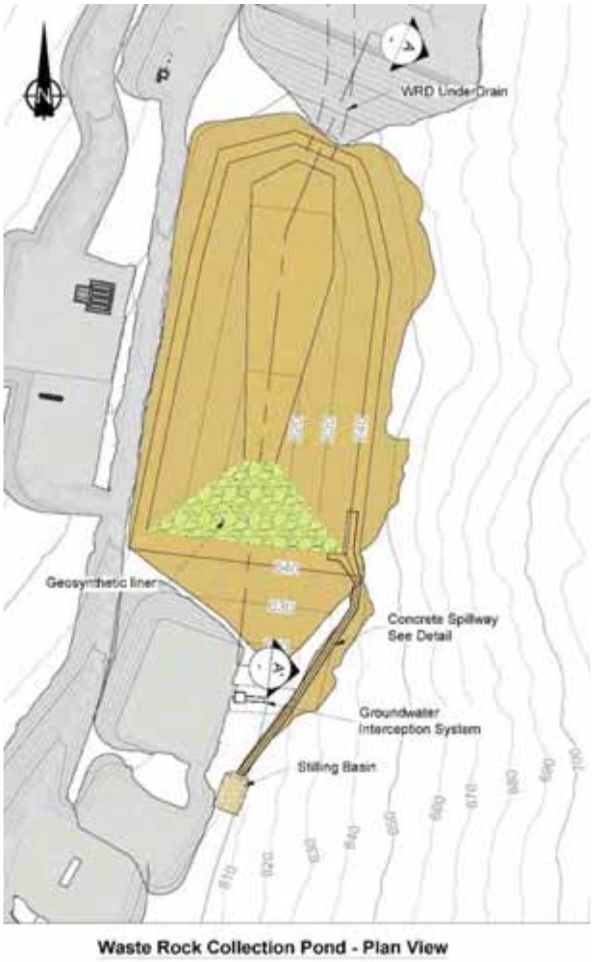


Figure 18-7 WRCP Proposed Construction (SRK, 2020)

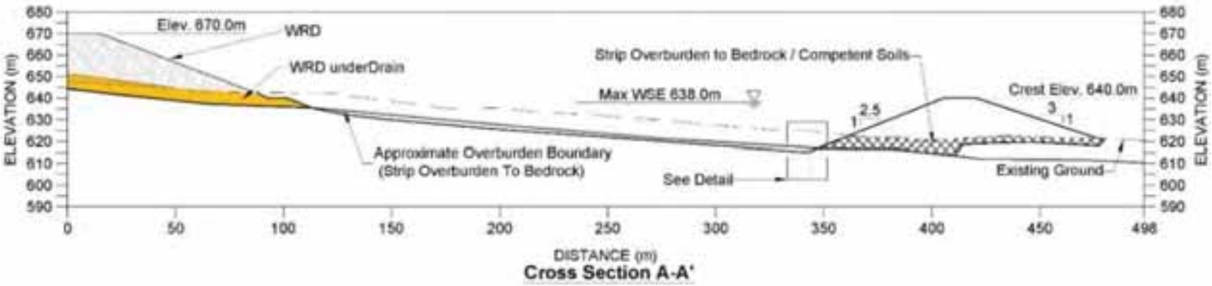


Figure 18-8 WRCP Typical Section (SRK, 2020)

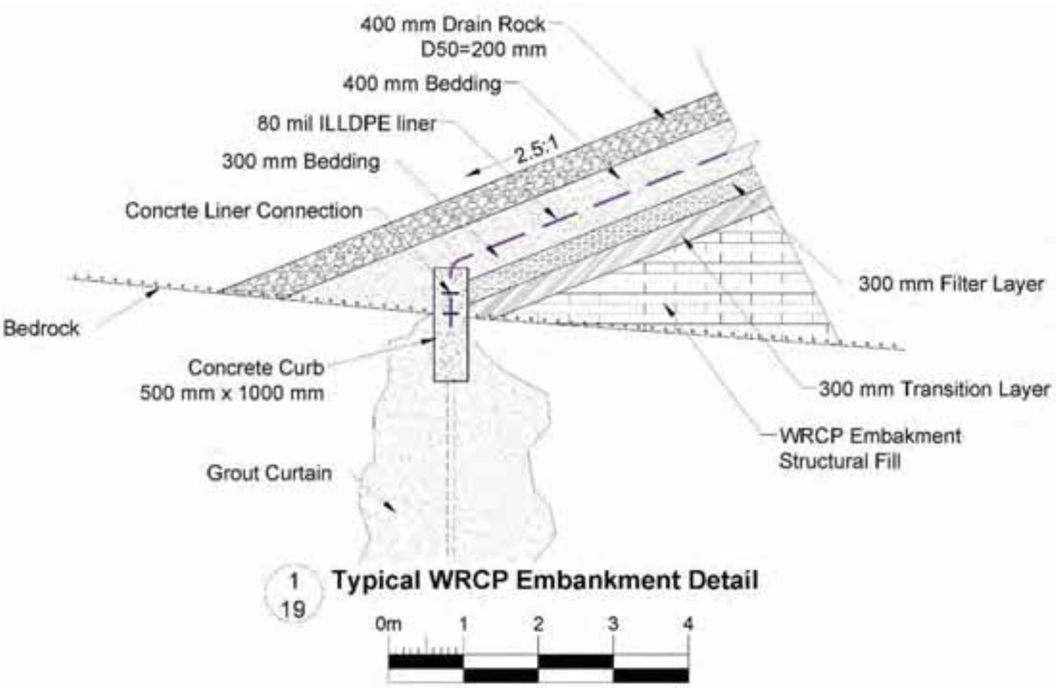


Figure 18-9 WRCP Typical Embankment Detail (SRK, 2020)

18.8.4 Groundwater Management System

Results from the preliminary water and load balance suggest that small amounts of groundwater bypassing the WRCP and cut-off wall may need to be collected to prevent degradation of water quality in Subarctic Creek. A groundwater interception system was defined to be located down gradient of the WRCP. This system would include:

- Shallow collector trench across the Sub-Arctic valley bottom for overburden water.
- Small diameter collector pumping wells completed in bedrock for deep water bypass.
- Down gradient performance monitoring wells with completions in overburden, weathered bedrock and competent bedrock.

A second system located down gradient of all site water management infrastructure was included as a contingency for the closure period, when the open pit contains water and leakage from mine components could bypass the primary system. This system includes small diameter collector pumping wells completed in bedrock, and down gradient performance monitoring wells.

Groundwater management system operation would be guided under an adaptive management plan or trigger action response plan.

18.8.5 Site Water and Load Balance

A water and load balance model was built based on the water management plan.

The water balance model predicts water use, surpluses and deficits for the site and mine water management infrastructure (TMF reclaim pond and WRCP) over the 12-year mine life through to closure and post-closure. Mine facility footprints vary according to the mine plan over the LOM. The model evaluated the following hydrological conditions:

- Average hydrological conditions with mean annual precipitation of 1,294 mm/a over the LOM.
- Consecutive 1-in-25 year wet years with annual precipitation of 1,769 mm/a in years 10 and 11 at the maximum extent of build-out of site infrastructure.
- Consecutive 1-in-25 year dry years with annual precipitation of 988 mm/a in years 10 and 11.

The load balance integrated source terms with the water balance. Source terms defined the water chemistry of each water type. For potentially acid generating materials in the WRF and pit, two source terms were developed:

- Operations source terms prior to onset of acid generation.
- Closure source terms post-onset of acid generation.

PAG waste rock was assumed to generate acid at closure. This change in source terms increased the mass leaching from the WRF and pit during closure.

Constituent mass loads and flows were mixed to estimate concentrations at various locations on the site and in the receiving environment. To define treatment requirements, the estimated concentrations in the Shungnak River (the receiving environment for site effluents) were compared to the Alaskan Water Quality Standards (WQS; 18 AAC 70), as described in Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances (ADEC 2008).

The results from the water and load balance indicated that during operations excess water from the WRCP will need to be treated prior to discharge to the receiving environment In the last year of operations and during closure, water from the dewatering of the TMF will also need to be treated for selenium and copper prior to discharge to the receiving environment (see description in Section 20.4).

18.9 High Density Sludge Water Treatment Plant

The results from the water and load balance were used to develop a water treatment strategy.

A high density sludge (HDS) lime-based neutralization and precipitation process is proposed to treat effluent from the WRCP through a HDS WTP. This process will consist of neutralization and precipitation with lime, followed by coagulation/co-precipitation with ferric iron, flocculation, clarification, and pH adjustment (if required). The neutralization and precipitation process will include aeration to oxidize metals and lime dosing to neutralize acidity, increase pH, and provide hydroxide ions for the precipitation of metal hydroxides. The coagulation/co-precipitation process will include ferric iron to promote the adsorption/co-precipitation of anionic metals (e.g., arsenic, antimony, molybdenum, uranium, and some forms of selenium) with iron oxyhydroxide precipitates. The HDS WTP will be housed in a dedicated building and will comprise the following: lime storage silo, lime slurry preparation, and lime slurry distribution systems; ferric chloride storage and dosing systems; flocculant storage, preparation, and dosing systems; hydrochloric acid storage and dosing systems; agitated lime-sludge mix tank; agitated reactor tanks; aeration blowers; clarifier; clarifier underflow recycle and waste pump systems; agitated overflow tank, flush water and dilution water pump systems; sump and sump pump systems.

During operations, sludge from the HDS WTP will be disposed of at the TMF via the tailings pump box at the mill. During closure, sludge from the HDS water treatment plant WTP will be disposed of in the pit for approximately 20 years. After the pit fills to a specified elevation, the sludge will be filter pressed and hauled to sludge disposal cells in the dewatered TMF. This water treatment plant will operate in perpetuity.

The HDS WTP will operate during the open water season from May through October. Treated effluent will be discharged via a 12 km pipeline to the Shungnak River.

Elevated selenium concentrations in the WRCP are predicted. The HDS WTP is unlikely to remove appreciable amounts of selenium and discharging to the Shungnak River is the proposed selenium management option during most of operations. The water quality in the Shungnak River below the discharge point is predicted to meet water quality criteria after a mixing zone. The discharge location in the Shungnak River and the mixing zone will both require regulatory approval. Obtaining a permit to discharge into the Shungnak River and defining a mixing zone in the Shungnak River are regulatory risks for the Project.

18.10 Tailings Management Facility

18.10.1 General Description

The TMF will be located at the headwaters of the Subarctic Creek, in the upper-most portion of the creek valley (refer to Figure 18-6). The maximum storage capacity of the facility will be about 39 Mm³ (tailings and process water) at an elevation of 887.5 m plus an additional 2.5 m of freeboard. The 58.6 ha footprint of the TMF will be fully lined with an impermeable liner (LLDPE).

Tailings containment will be provided by an engineered dam that will be buttressed by the WRF, constructed immediately downstream of the TMF, and the natural topography on the valley sides. A starter dam will be constructed to elevation 805 m two years prior to mine start up and then increased to 830 m by the end of the construction period. Three subsequent raises will bring the final dam crest elevation to 890 m, which is 40 m lower than the final elevation of the WRF. The expected maximum tailings production rate is 8,700 t/d and the TMF is designed to store approximately 34.5 Mm^3 (37.8 Mt) of tailings plus 4.5 Mm3 of water over the 12 years mine life as well as the probable maximum flood (PMF).

Tailings will be deposited as conventional slurry from the dam crest by multiple spigots. For this work, a dry density of 1.1 t/m3 was used to estimate the storage capacity of the facility. Considering that the base of the impoundment will be impermeable, the final consolidated tailings dry density is assumed to be 1.25 t/m3 based on simple 2 D consolidation calculations. The operation scheme of the facility will result in a subaqueous tailings deposition with a rate of rise varying from 25 m/y at start-up to 4 m/y at the end of the operation. It is assumed that tailings deposition will be sub-aqueous and that an underwater beach slope of 1% will be created during deposition. The reclaim pond will form overtop of the tailings and against the natural terrain upstream of the dam and will reach a maximum design elevation of 887.5 m by the end of operations.

18.10.2 Design Criteria

The basis of the TMF design is provided in Table 18-3. Values were determined from project-specific information, judgment, and experience with other projects.

The 2020 FS design was performed in accordance with the following guidelines and regulations and comply with the general industry guidelines and standards of practice:

- Guidelines for Cooperation with the Alaska Dam Safety Program, July 2017.
- Alaska Administrative Code Title 11, Chapter 93, Article 3 Dam Safety.
- State of Alaska Mining Laws and Regulations, Alaska Department of Natural Resources Division of Land and Water, 2014.
- Canadian Dam Association, 2013. Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams. (CDA, 2013).

Table 18-3 TMF Design Parameters and Design Criteria

Design Item	Criterion	Reference
Operational life of TMF	12 years	Trilogy
Total tailings	37.8 Mt	Ausenco
Annual Tailings Production (Solids)	2.86 Mm^3/yr	Ausenco
Tailings percent solids (in the slurry pipeline)	18% (Ms/(Ms+Mw))	Ausenco
Tailings solids specific gravity	3.1	Ausenco
Tailings settled dry density	1.1 t/m^3	SRK
Expected tailings deposition angles	1.0 % (subaqueous)	SRK
Tailings Deposition	Spigots from dam crest	SRK
Target storage requirement	34.5 Mm^3	SRK
Reclaimed water storage requirement	4.5 Mm^3	Trilogy
Dam Hazard Classification	Class I	ADSP
Minimum Freeboard above tailings	2.5 m	SRK
Tailings dam crest width	30 m	SRK
Tailings dam max elevation (height)	890 masl (190 m)	SRK
Design Earthquake	1:2475 year, PGA = 0.2645	ADSP
Stability Factor of Safety (FOS)	1.0 (seismic) to 1.5 (static)	ADSP
Dam construction materials	Waste rock compacted in 1 m lifts	SRK
Dam downstream and upstream slopes	2.5H:1V	SRK
Starter dam storage capacity (elevation)	1.5 Mm^3, Year -1, (805 masl)	SRK
End of Construction capacity (elevation)	6.5 Mm^3, Year 0, (830 masl)	SRK
Dam Raise 1 storage capacity (elevation)	13.9 Mm^3, Year 1, (850 masl)	SRK
Dam Raise 2 storage capacity (elevation)	24.8 Mm^3, Year 4, (870 masl)	SRK
Dam Raise 3 storage capacity (elevation)	39.0 Mm^3, Year 7, (890 masl)	SRK
Storm inflow design flood without overtopping	1.5 x Probable Maximum Flood (PMF)	SRK
Maximum allowed vertical crest deformation due to dynamic loading	0.5 m	SRK

Notes: Dam classification follows Guidelines for Cooperation with the Alaska Dam Safety Program (ADSP, 2005, 2017)

The design criteria were based on site conditions as of August 2019, on assumptions interpreted from a review of available information, and on feasibility-level field investigations and associated reporting. Where data were not available, could be obtained or generated, feasibility-level assumptions were made.

18.10.3 Overburden Geotechnical Investigation

An overburden geotechnical investigation was carried out in 2017 (SRK, 2017) and 2018 (SRK, 2018) to provide overburden characterization in support of the waste facility siting evaluation and geotechnical design of the WRF and TMF.

Surficial deposits mapped in the Project area include glacial, aeolian, and fluvial deposits, with colluvium covered slopes. Most morainal deposits at the site are from the late Pleistocene Walker Lake glaciation, and consist of drift deposits characterized by boulders, cobbles, and gravels in a fine-grained matrix, as well as outwash deposits of silty sand. The Subarctic Creek valley mainly consists of well-graded silty sand and gravel colluvium and alluvium, with some zones of large cobbles and boulders. Overburden thickness within the Subarctic Creek valley generally increases down-valley towards the Shungnak River valley.

In the proposed TMF and starter dam footprints, groundwater was encountered during drilling and test pitting at depths between 0.2 and 4.9 m. Groundwater was encountered at depths between 6 and 21 m below ground in the bedrock around the perimeter of the TMF. Based on groundwater elevation records in these areas, the planned facilities will be located in groundwater recharge zones.

In the planned WRF footprint, groundwater was encountered during drilling and test pitting at depths between 0.76 m and 13.5 m. Groundwater levels are generally near the surface on the western and central parts of the footprint and deeper on the eastern side of the footprint. Drill holes on both sides of the valley appear to be located in groundwater recharge zones. The center of the valley may correspond to both recharge and discharge zones.

The groundwater depth within the footprint of each planned infrastructure within the Subarctic Creek valley is relatively shallow. The average groundwater depth is 1.53 m and seems to correspond to the weathered bedrock–overburden contact. The water depth seems to be relatively constant despite varying surface slope angles.

18.10.4 Site Selection

The TMF site was selected in August 2017 during a workshop (Ausenco 2017) to evaluate locations for the TMF and WRF.

A weighting system was applied to four broad categories including environmental concerns, permitting, capital costs, and operating costs.

18.10.5 Starter Dam

Overburden in the TMF starter dam area is characterized as thin well-graded silty sand with gravel or silty gravel with sand (SM or GM). The contact with the underlying fractured weathered bedrock occurs at depths varying between 0.20 and 3.05 m in the TMF and between 1.07 and 9.14 m in the starter dam area. The thicker overburden occurs in the center of the valley, south of the toe of the starter dam. The overburden is interpreted to be colluvial in origin. Bedrock crops out at the north end of the TMF.

The overburden will be excavated underneath the footprint of the starter dam and removed to reduce potential settlement and deformation of the TMF dam; overburden removal will therefore reduce the potential underperformance of the liner that will be installed on the dam’s upstream face.

The topsoil and overburden material will be stockpiled near the pit for use in future reclamation of the waste facilities.

The starter dam will be constructed in two phases to an ultimate lined elevation of 830 m, which will allow for storage of the pre-production water and approximately one year of storage (~1.3 Mm^3) to supply the mill during start-up. The upstream and downstream faces of the starter dam will be constructed at 2.5H:1V and constructed entirely of waste rock from the open pit. Waste rock will be placed in 1 m lifts and compacted by the mine fleet haul trucks. Figure 18-10 shows a cross section through complete TMF and WRF, illustrating the starter dam in relation to the Final dam and the abutting WRF.

The TMF footprint and the upstream face of the dam will be lined with a textured 80 mil LLDPE geomembrane, placed over 32 oz geotextile on grade. To prepare for liner installation, the TMF area will be cleared, grubbed and stripped of topsoil prior to grading and placement of the geotextile. The face of the dam will be covered with bedding material to protect the liner against puncture from potential sharp edges in the waste rock.

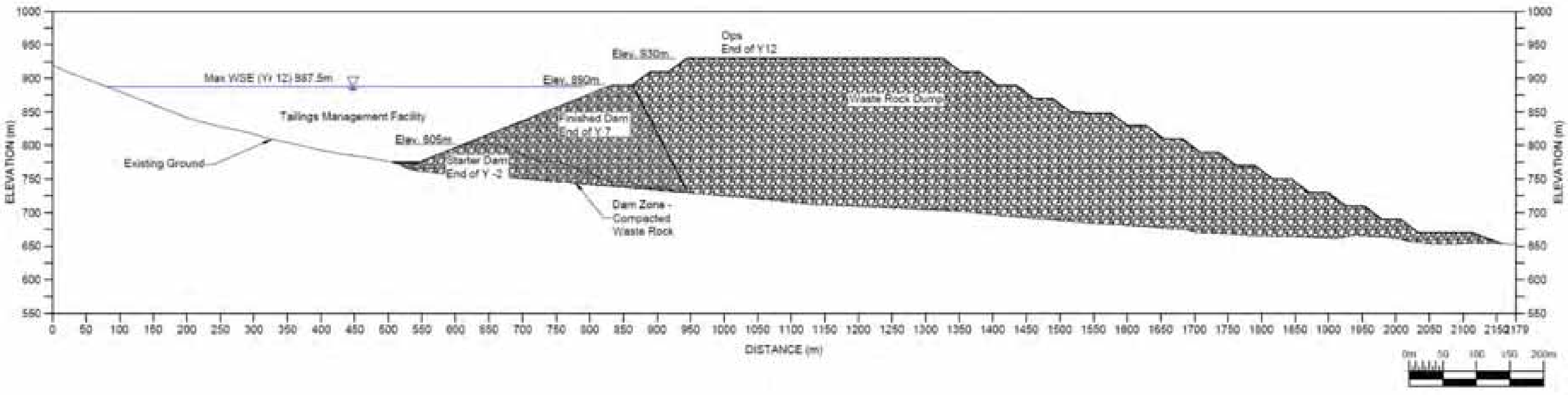


Figure 18-10 Cross Section through the TMF & WRF showing Starter Dam to Elevation 805 m (SRK, 2020)

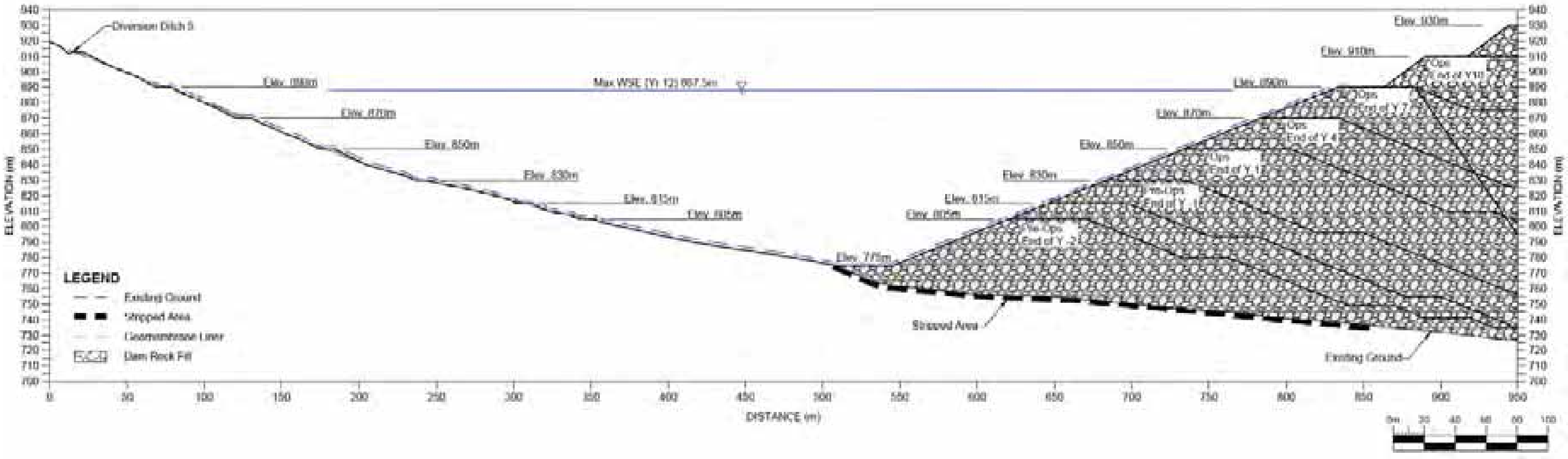


Figure 18-11 Cross Section of the TMF and raises to Final Design Elevation (SRK, 2020)

18.10.6 Dam Raises and Final Dam

Three dam raises will be completed to reach the final dam height of 890 m. The construction for these raises will be completed in years 1, 4, and 7 to elevations 850 m, 870 m and 890 m respectively. Construction will be completed using the downstream method and will connect the structural fill in the tailings dam with the uncompacted WRF. Tailings deposition will be required from the perimeter of the TMF during the construction sequence of the dam crest. The dam crest will be constructed to a width of 30 m at the end of each construction campaign.

An upstream slope of 2.5H:1V will be maintained throughout the construction of the dam to facilitate the placement of the bedding layer and the installation of the liner. The downstream portion of the dam will abut the WRF at each stage of dam raising. Construction material for the dam will be waste rock compacted in 1 m lifts.

Additional liner will be placed within the expanded TMF footprint using the same procedures as for the initial starter dam. The TMF area will be cleared, grubbed and bedding material and geotextile placed prior to the single side textured 80 mil LLDPE geomembrane being laid down and seamed to the existing liner.

Figure 18-11 shows a cross section of the complete TMF and the raises constructed to reach the final design elevation.

18.10.7 TMF Water Pool and Water Return

Under normal situations, the pool will be maintained deeper towards the south portion of the TMF away from the deposition spigots. Recycle water will be obtained using a floating barge and pipeline system situated on the pool.

Tailings deposition in winter will be managed to limit ice formation in the tailings by maintaining sub aqueous deposition of the tailings.

18.10.8 Tailings Delivery and Return System

The tailings delivery system will transport slurried tailings from the processing plant to the TMF. This will consist of one three-kilometre pipeline, with two kilometres of this being 500 mm (20 inch) diameter carbon steel rubber lined pipeline and the remaining one kilometre being 600 mm (24 inch) HDPE. This pipeline will transport up to 1,843 m^3/h of tailings to the TMF.

The return water delivery system for recycle water from the TMF has been sized on the basis of 1,308 m^3/h of water being pumped from the TMF to the process water pond. This system will consist of a barge pump and a 3 km-long pipeline, run adjacent to the tailings pipeline. The pipeline will consist of 2 kms of 450 mm (18 inch) diameter carbon steel pipeline, with the remaining 1 km being 500 mm (20 inch) HDPE.

Both pipelines will be heat-traced to prevent freezing.

18.11 Waste Rock Facility and Overburden Stockpiles

A large WRF will be developed north of the planned Arctic pit in the upper part of the Arctic valley. The waste rock placed in the most northern portion of the WRF will be compacted to provide the structural fill for the TMF.

There will also be two small overburden stockpiles to store the stripped topsoil and overburden from the TMF footprint.

18.11.1 Waste Rock Facility

The overburden in the WRF area is characterized as well-graded silty sand with gravel or silty gravel with sand (SM or GM) and angular cobbles interpreted to be colluvial in origin. Overburden is slightly thicker on the west side of the valley (± 10 m) than on the east side of the valley (± 6 m), and ranges between 3 and 5.60 m in the centre of the valley. Based on exposed bedrock, overburden is inferred to thin on the valley sides.

The total volume of waste rock is expected to be 145.6 Mm^3 (298 Mt); however, there is potential for expanded volume in the waste if placement density is < 2.0 t/m³. Most of the waste rock is anticipated to be PAG and there will be no separation of waste based on acid generation potential. Rather, seepage from the WRF will be collected and treated. An underdrain at the based of the WRF will be built to collect and manage the seepage.

The WRF is planned to be constructed in in 5 m lifts with benches set back at 27.5 m after every fourth lift, to achieve an overall slope of 2.7H:1V. The final design is expected to have variations in the slope aspect, to best manage overland flow, resulting in a transitioning convex to concave shape of the WRF face.

The maximum stacking height (above existing grade) of the WRF is planned at 280 m to an elevation of 930 masl. The effective normal stress for potential critical failure surfaces at the base could reach values up to 5,000 kPa, which is higher than the weathered bedrock's unconfined resistance (on the order of 3,000 kPa) and significantly lower that the competent bedrock resistance (± 32,000 kPa). These values were obtained from UCS tests performed on samples. Considering the potentially mobilized zone under the stress (and potential strains) imposed by the stacked material, crushing of the WRF should be expected. A sensitivity assessment was performed to assess what the impact would be if the waste rock in the WRF behaved as a finer granular material.

A rockfill underdrain will be constructed under the WRF in the current Sub-Arctic Creek channel bed. The underdrain will be excavated into the overburden prior to WRF construction and will be capable of handling base flow through the Subarctic Creek valley. Water will be collected in a pond at the base of the WRF and held for treatment. The underdrain system will be used to maintain the phreatic water level as low as practicable within the WRF to increase the stability of the facility.

18.11.2 Overburden and Topsoil Stockpiles

Two stockpiles will be developed on the western side of the planned pit to store topsoil and overburden materials for use in final site reclamation. The topsoil stockpile will be placed in between the haul roads and will store up to 325,000 m³ of material. The overburden stockpile will be located below the lower haul road between the pit and the mill site and will have a storage capacity up to 2,200,000 m³.

Existing soils located near the toe of the overburden stockpile shall be stripped to competent bedrock prior to placement of material. Stripping material is required to provide a stable foundation.

A collection channel is located below the overburden stockpile to convey water into sedimentation pond before discharging the water into Subarctic Creek.

18.12 Compressed Air Supply

High-pressure compressed air will be provided by three duty and one standby screw compressors and a duty plant air receiver. The instrument air will be dried and then stored in a dedicated air receiver. The plant air will be fed directly from the plant air receiver.

High-pressure air for the concentrate filters will come from a dedicated system of two duty and one standby screw compressors and a concentrate filtration area air receiver.

Low-pressure air for flotation-cell air requirements will be provided by four duty and one standby centrifugal blowers.

18.13 Site Communications

External communications, including voice and data, will use a satellite connection with a line-of-sight to an orbiting geostationary satellite. Earth stations are expected to be located at the process plant area, camp area, contractor laydown yard proposed to be located at the road junction between the planned mine access road and the proposed AMDIAP road, and the Dahl Creek airport. There will be separate systems for business operations and personal use.

Radio communications around the operation will be a very high frequency (VHF) Hi-Band system with radios in all mobile equipment and operations offices. There will be multiple frequencies with a frequency assigned to a specific operational group. The Dahl Creek airport will have a UHF radio to communicate with in-bound aircraft.

It is expected that there will be cell phone access for personal use in a limited area. This system will be installed and maintained by a communications service provider.

Communications for truck operators on the AMDIAP road will be with VHF radios utilizing a system that will be installed as part of the AMDIAP road.

18.14 Fire Protection

The firewater distribution network will be maintained under a constant pressure with a jockey pump and will be looped and sectionalized to minimize loss of fire protection during maintenance. Where run outside buildings, fire water piping will be above ground and be heat traced and insulated.

Yard hydrants will be limited to the fuel storage tank area. Wall hydrants will be used in lieu of yard hydrants, and these will be located on the outside walls of the buildings in heated cabinets.

Fire protection within buildings will include standpipe systems, sprinkler systems and portable fire extinguishers. Standpipe systems will be provided in structures that exceed 14m in height and additionally where required by regulations, local authorities or the insurance underwriter.

Camp modules will be purchased with fire detection; fire rated walls and will use separation as a means of fire protection. Handheld extinguishers will be located throughout the buildings.

Fire protection of the generators will be provided by a water mist system. Gas detection will be provided to detect dangerous levels of diesel gas within the generator building.

18.15 Plant Buildings

18.15.1 Truck Shop and Mine Offices

The mine infrastructure area will be 2,400 m^2 in area and will be positioned on an upper pad adjacent to the fuel storage area. This building will consist of the truck workshop, truck wash, mine offices, and mine dry. The truck workshop will have lifting and handling activities fulfilled by an overhead gantry crane. This building will be a pre-engineered steel frame and metal-clad building. The building will be heated using a system that will use waste heat produced from the diesel generators.

18.15.2 Laboratory

The laboratory will be 300 m^2 in area and will be situated adjacent to the process building. The building will house all laboratory equipment for the daily operational process control including the metallurgical and environmental requirements. Any mechanical items associated with the dust collection equipment will be located external to the building. The building will be constructed as a single-storey modular wood-frame building. This building will be heated using an air handler system that using waste heat produced from the diesel generators.

18.15.3 Administration Building

The administration building will consist of HR, accounting and senior site management. The building will have an approximate area of 850 m^2. The building will be constructed as a single-storey modular wood-frame building. This building will be heated using an air handler system that will use waste heat produced from the diesel generators.

18.15.4 Mill Dry Facility

The mill dry facility will consist of plant change rooms for the process plant area. The building will be approximately 400 m^2 in area. These facilities will have clean and dirty areas and will be complete with showers, basins, toilets, lockers and overhead laundry baskets. The building will be constructed as a single-storey modular wood-frame building. This building will be heated using an air handler system that will use waste heat produced from the diesel generators.

18.15.5 Plant Workshop and Warehouse

The plant workshop will be used to perform maintenance on process equipment and equipment spares. The plant workshop will be approximately 780 m^2 in area. This building will be a pre-engineered steel frame and metal-clad building. This building will be heated using an air handler system that utilizes waste heat produced from the diesel generators.

18.15.6 Primary Crushing

The primary crushing area will feature a fabric structure approximately 70 m^2 in area that will be located above and adjacent to the crusher dump pocket to assist with dust collection measures.

18.15.7 Crushed Ore Stockpile

A geodesic dome will be used over the crushed ore stockpile to keep the ore dry during the winter. The building will be approximately 2,700 m^2 in area.

18.15.8 Process Plant

The process plant building will have an approximate area of 4,800 m^2, and will house all of the milling, flotation and concentrate thickening equipment. The building will be divided into two sections. The first section will contain the mill and will have dimensions of 30 x 24 m; the second section will contain the flotation, regrind and thickening equipment and will be 36 x 98 m in size. Both sections will be serviced by overhead cranes.

This building will be a pre-engineered steel frame and metal-clad building with internal insulation to reduce heat loss. This building will be heated using an air handler system that utilizes waste heat produced from the diesel generators.

18.15.9 Concentrate Loadout

The concentrate loadout building will house process equipment and provide a covered area for loading the concentrate on to the trucks. This building will be separated from the process plant building to minimize the building volume that requires process ventilation equipment. The building will be approximately 1,700 m^2 in area, will be a fabric structure and will not be heated to assist in drying out the concentrate prior to transport.

18.15.10 Reagent Storage and Handling

The reagent storage and handling building will be located outside the process plant building. The building will have an approximate area of 680 m^2. This building will be pre-engineered steel frame and metal-clad building. This building will be heated using an air handler system that will use waste heat produced from the diesel generators.

18.15.11 Raw Water Supply

The raw water supply building will be located at the fresh water source and house the pumping equipment. The building will be 36 m^2 in area and will be a pre-engineered modular building. It will be heated using electric unit heaters.

18.16 Concentrate Transportation

Concentrate will be shipped from the Arctic mine site to the Port of Alaska in Anchorage in specialized 6 m intermodal bulk shipping containers for direct loading into bulk carrier vessels for ocean transport to the smelter or refinery. Containers will be trucked to Fairbanks, and then transferred to rail for delivery to the Anchorage port terminal.

A concentrate trucking contractor will be responsible for loading the containers in the concentrate storage building using a wheeled loader. Containers will be loaded with net 28.1 wmt of concentrate, resulting in 31.2 t gross weight per container. Based on a daily production of 1,289 wmt of concentrates (470,586 wmt per year), approximately 46 containers will be loaded per day and shipped from the Arctic site.

The base for the trucking operation will be at the junction where the road to the Arctic Mine would intersect the proposed AMDIAP road, hereafter referred to as the Arctic Mine Junction (AMJ). This would be the primary laydown yard for concentrate containers. The trucking contractor would have a maintenance facility at AMJ, and mobile maintenance trucks along the AMDIAP; however, most major equipment maintenance work is expected to be performed at the concentrate trucking contractor's Fairbanks operating base.

The trucking of the containers to Fairbanks is planned to be undertaken in three stages:

- Load trucking containers at the Arctic mine concentrate storage building and then transport the container to the AMJ.
- The containers would be trucked from AMJ using the AMDIAP road to the Dalton Transfer Yard (DTY) facility. The DTY would be located near the intersection of the AMDIAP road with the Dalton Highway and would be operated by the concentrate trucking contractor. A Super B-train configuration will be used, with each truck hauling two containers. At DTY, each truck will offload the two containers and return to the mine with two empty containers. This will require approximately 23 trips per day. Drivers would be based at the Arctic site and will complete one return trip per day from AMJ to DTY.
- The concentrate trucking contractor would use a Fairbanks-based fleet to move the containers using a single trailer configuration from the DTY to a depot in Fairbanks. When the trucks undertake the trip from Fairbanks to DTY, each truck would transport one empty container.

In Fairbanks, the containers would be loaded on railcars for transport to the Port of Alaska. At the port, the containers would be staged for direct loading into marine vessels using fixed shore cranes and a container rotator attachment. Concentrate would be shipped from Alaska in 10,000 dmt parcels for copper and zinc, and 5,000 dmt parcels for lead.

Table 18-4 provides details of the planned concentrate movement.

Table 18-4 Mode of Transport and Distances for Concentrate Shipping

Segment		Mode	Distance (km)	Trips/Day	Trips/Week
1	Arctic Site to AMJ	Truck – Single Trailer	16	46	322
2	AMJ to DTY	Truck – Double Trailer	324	23	161
3	DTY to Fairbanks	Truck – Single Trailer	391	46	322
4	Fairbanks to Port of Alaska	Rail	573		3
5	Port of Alaska to Asian Port	Marine Bulk Carrier	9,000		

Concentrate shipping containers would be sourced from one of several suppliers and leased. It is expected that a fleet of approximately 1,770 containers would be required.

19 Market Studies and Contracts

A marketing review for the three Arctic concentrates, dated July 14, 2020, was conducted by StoneHouse Consulting, based on the expected concentrate assays as provided by Trilogy Metals.

The three Arctic concentrates- copper, zinc and lead- will be marketed differently but will all be sold within the Asia Pacific area.

The copper concentrate is relatively high grade with low penalty impurities. The quality can be sold directly into China and therefore will have the advantage of the most competitive terms. There is payable silver content, and potential penalties for Zn + Pb and antimony will be low dollar value. The copper concentrate contains arsenic and selenium levels that are close to the penalty threshold. Overall, this is a good quality with few elements for which a penalty can be applied.

The zinc concentrate has a cadmium content that is above the current import limit set by the Chinese government so cannot be sold into China. The obvious markets for this quality would be to smelters in Korea, Australia and Canada. The concentrate is high grade zinc with relatively low iron. As the market is currently long in high silica and high manganese concentrates, this quality will be a welcome feed to blend down those impurities. Not all smelters will value fully a high zinc grade material as it is expensive per unit of zinc, so this material will need to be spread around to several smelters. The silica levels are low, separating this material from the product of other new mines currently entering the market.

The lead concentrate contains most of the payable precious metals from the Arctic mine. In particular, the 37 gpt gold will need to find a smelter home that can recover this gold efficiently and be willing to give a good gold payment. The concentrate can be sold into China as it does not exceed any of the Chinese import restrictions. The concentrate has high levels of fluorine, selenium and magnesium, which may restrict the amount that any one lead plant would be willing to accept. Arctic lead concentrate will compete with the fluorine in Cannington lead concentrate and with selenium in Penasquito lead concentrate. With an annual production averaging 30,000 dmt per year, the Arctic lead concentrate is expected to be sold into Chinese and Korean smelters.

As of July 2020, copper and zinc concentrates with origin in the United States are subject to a 25% duty going into China, with 10% duties on US origin lead concentrates. The US and China have just entered into a phase 1 agreement on trade, but it is understood that duties on concentrates have not be lifted. As the trade issue is very fluid, this issue will have to be addressed closer to the time of sanctioning of the project.

19.1 Metal Prices

Trilogy Metals established the commodity pricing using a combination of two year trailing actual metal prices, and market research and bank analyst forward price projections, prepared in June 2020 by Jim Vice of StoneHouse Consulting Inc.

The long-term consensus metal price assumptions used in the 2020 FS economic analysis were:

Copper:	$3.00/lb
Zinc:	$1.10/lb
Lead:	$1.00/lb
Gold:	$1,300/oz
Silver:	$18.00/oz

19.2 Markets and Contracts

19.2.1 General

No contracts were entered into at the Report effective date for mining, concentrating, smelting, refining, transportation, handling, sales and hedging, and forward sales contracts or arrangements. It is assumed that any contracts of these types will be within industry norms. It is expected that any future concentrate sales will include a mixture of long-term and spot contracts.

Most concentrate is traded on the basis of term contracts. These frequently run for terms of one to 10 years, although many long-term contracts are treated as evergreen arrangements that continue indefinitely with periodic renegotiation of key terms and conditions. Generally, a term contract is a frame agreement under which a specified tonnage of material is shipped from mine to smelter, with treatment and other charges negotiated at regular intervals (typically annually).

Spot contracts are normally a one-off sale of a specific quantity of concentrate with a merchant or smelter. The material is paid for in much the same way as a concentrate shipped under a term contract. Merchant business is a mixture of one-off contracts with smelters and long-term contracts with both miners and smelters.

Often terms of sale for a term contract between miners and smelters are at “benchmark terms”, which is the consensus annual terms for the sale of concentrate and negotiated annually. Spot sales are made at spot terms, negotiated on a contract by contract basis.

19.2.2 Copper Concentrate

Trilogy Metals will have the option of selling some portion of the copper concentrate under long term contracts directly to smelters in China, Japan, or Korea, with the balance sold under shorter term or spot contracts to the trade, with the same delivery points. The planned concentrate production is too large to rely on the spot market for all the sales volume, although a portion sold under generally more favourable spot terms is recommended.

19.2.3 Zinc Concentrate

Because of the elevated level of cadmium, China will not be a market for the zinc concentrate. It is unlikely China would increase the cadmium limit for imported concentrates, which would allow access to the Chinese market for the zinc concentrate, as the current trend is for a tightening of limits.

Without the Chinese market Arctic zinc concentrate could still be sold to several smelters. Some smelters would prefer a higher silver content than will be the case in the Arctic concentrate, but many would value the high zinc and good iron level. The low silica level would be very attractive to many Asian smelters. Given that most Japanese and Korean smelters are relatively well supplied in the current market, and Chinese delivery is not an option, spot market opportunities for the zinc concentrate will be limited. It is recommended that most of the zinc concentrate be sold under long term contracts to Asian smelters, and perhaps to the Teck-owned Trail smelter.

It may not be necessary for Arctic to consider shipments to Europe, although larger volume shipments to the Korea Zinc smelter in Australia might be cost effective.

19.2.4 Lead Concentrate

The lead concentrate will carry most of the silver and gold content. The negative aspects of the lead concentrate will be the elevated levels of selenium, fluorine and magnesium, which may restrict the marketing for the product. The concentrate can be characterized as a medium grade lead concentrate with good precious metals values. The gold content is significant, so sales to smelters that will pay competitively for the gold is important.

The Arctic lead concentrate, which is anticipated to have a gold content of 37 g/t, could be imported into China as a gold concentrate and as such would not be subject to the import restrictions of lead concentrates. To be labelled a gold concentrate a material must contain a minimum of 1 oz per ton (31.1 g/t) gold content. The specification for Arctic lead concentrate does not exceed any of the Chinese import restrictions for lead concentrate, so the label of a gold concentrate would not be critical for accessing the Chinese market. If the gold content is expected to be variable to the extent that the gold grade might fall under 31.1 gpt, then it would be safer to always export to China as a lead concentrate.

The copper content in the lead concentrate will be high and will add to the complexity of the concentrate. As this concentrate will already have to be blended due to the fluorine and selenium contents, the copper content, when blended, will be a value-added benefit to the smelter.

In a typical stand-alone lead smelter, selenium volatilizes in the furnace and follows the gas stream. As the gas cools the selenium drops out into the acid mud, which can be purchased by processors who then recover the selenium. Because the selenium is expected to be recovered, treatment of the Arctic lead concentrate will not be a problem in a stand-alone lead smelter, of which there are many in China.

However, in an integrated lead–zinc smelter, treatment is more difficult. In an integrated plant many waste streams are treated for further processing to recover as many by-product metals as possible, e.g.- zinc residues are treated in the lead furnace, lead slags are treated in slag fuming furnaces, copper skimmings are treated to recover copper, antimony, etc. The selenium does not necessarily accumulate in any one area but contaminates several processes. That means that integrated smelters such as Trail and Korea Zinc's Onsan smelter may be more sensitive to selenium. Trail has indicated that it is already receiving the maximum selenium it can handle from Penasquito concentrates, but Korea Zinc has not said it has a problem. Korea Zinc may be somewhat sensitive to selenium, and with the level of selenium in Arctic lead being 400% more than the Penasquito lead concentrates Korea Zinc may not be able to take a significant amount of the lead concentrate production.

Many smelters also have limits in the amount of fluorine that they can receive in concentrates. The current indication is that the Arctic lead concentrate will contain 3260 ppm fluorine, although there are indications that the level can be brought down to 1500 ppm by controlling the talc overflow into the lead concentrate. A competing lead concentrate to Arctic will be Cannington in Australia, which has a fluorine content of 700- 1200 ppm. The Trail lead smelter has historically rejected lead concentrate parcels containing 1300 ppm F, so the potential impact of the high level in Arctic lead concentrate should not underestimated.

China remains the best market for this lead concentrate. China produces approximately 75% of the world's primary lead, and since the production volume of lead concentrate at Arctic is not high, the Chinese market should be a good fit. The lead tonnage could be placed into other markets, but then the selenium content becomes an issue, particularly for integrated lead- zinc smelters.

The challenge would be to find an appropriate smelter that can value the silver and gold content but can handle the fluorine and selenium levels.

The current indication is that the Arctic lead concentrate will contain between 4–6% magnesium, presumably as MgO. As this is such a significant impurity the impact on a lead smelter should be evaluated. The current thinking is that the MgO will harmlessly slag off in the furnace, but each smelter may have different sensitivities, so the impact of the high Mg needs to be further evaluated.

19.3 Smelter Term Assumptions

Smelter terms were applied for the delivery of copper, zinc and lead concentrate. It was assumed that delivery of all concentrates would be to an East Asian smelter at currently available freight rates.

19.3.1 Copper

The contracts for the copper concentrate will generally include the following payment terms:

- Copper: pay 96.5% of the content, subject to a minimum deduction of 1 percentage point, at the price for Grade A copper less a refining charge in US cents per payable pound. The minimum deduction applies for Cu grades less than 28.5%.
- Treatment charge: $85 per dmt of concentrates.
- Gold credit: no payment if gold content is less than 1 gr/dmt. If greater than 1 gr/dmt then payment is 90% of content less a refining charge of $5 per payable oz.
- Silver credit - if Ag content is greater than 30gms/dmt, payment is for 90% of content, with a refining charge of $0.50/payable oz.
- Treatment charge: $85 per dmt of concentrates.

Penalty charges:

- Zinc plus lead: $3 per each 1% (Pb + Zn) above 3%
- Arsenic: $2 per each 0.1% above 0.2%
- Antimony: $2 per each 0.1% over 0.1%
- Selenium: $2 for each 100 ppm above 300 ppm.

These penalty formulae, given the expected content of the copper concentrate, are not expected to generally be applicable. However, penalties may be triggered during early months of production from the process plant, when concentrate penalty levels may be more variable than expected for the LOM.

19.3.2 Zinc

The typical payables that would apply to the zinc concentrate include:

- Zinc: pay 85% of content, subject to minimum deduction of eight units at the London Metals Exchange (LME) price (Minimum deduction applies below 53.3%, therefore not applicable to Arctic zinc concentrate).
- Treatment charge: $230/dmt of concentrate delivered.

- Gold credit: minimum deduction 1 g/t; therefore, no gold payment.
- Silver credit: deduct 3 oz/dmt (93 g/t) from the content and pay for 70% of the balance. Therefore, no silver payment.

The only penalty charge expected for the zinc concentrate is for cadmium, at a penalty payment of $2 (per dmt) per 0.1% over 0.3%.

19.3.3 Lead

The contracts for the lead concentrate are assumed to include the following payment terms:

- Lead: pay 95% of the content subject to a minimum deduction of three percentage points. Minimum deduction to apply at lead grades less than 60%
- Treatment charge: $180/dmt of concentrate delivered.
- Gold credit: pay 95% of content, subject to a minimum deduction of 1 g/t (applies to concentrates with less than 20 g/t), with a refining charge of $10/payable oz.
- Silver credit: pay 95% of content, subject to a minimum deduction of 50 g/t (applies to silver content less than 1000 g/t), with a refining charge of $0.80/payable oz.

Penalty charges that may be incurred for the lead concentrate include:

- Selenium: $2 for each 100 ppm above 800 ppm
- Fluorine: $1.50 for each 100 ppm over 500 ppm
- Bismuth: $1.50 for each 1000 ppm over 1000 ppm.

A penalty for magnesium was not included as it was expected that this element would slag off during lead smelting; this point should be checked at the next phase of the project.

An analysis for chlorine content in the lead concentrate should also be undertaken.

19.4 Transportation and Logistics

Transportation cost assumptions for the concentrate are summarized in Table 19-1.

Table 19-1 Concentrate Transport Costs

Description	US$/dmt
Containers leasing	$5.30
Arctic Mine to Fairbanks	$175.63
Fairbanks to Port of Alaska	$27.52
Port Terminal & Handling	$19.97
Ocean Freight to Asian Port	$42.55
Total Transport Costs	**$270.98**

19.5 Insurance

An assumed insurance rate of 0.15% was applied to the recovered value of the concentrates less refining, smelting, penalties, treatment charges and concentrate transport charges.

19.6 Representation and Marketing

An allowance of $2.50/wmt of concentrate was applied as an allowance for marketing and representation.

19.7 Comment on Section 19

The QP has reviewed the information on marketing, payable and penalty assumptions and metal price assumptions, and considers that they are acceptable for use to support the economic analysis in Section 22 and to support Mineral Reserve estimates.

20 Environmental Studies, Permitting and Social or Community Impact

20.1 Environmental Studies

The Arctic Project area includes the Ambler lowlands and Subarctic Creek within the Shungnak River drainage. To date, a moderate amount of baseline environmental data collection has occurred in the area including surface and ground water quality sampling, surface hydrology monitoring, wetlands mapping, aquatic life surveys, avian and mammal habitat surveys, cultural resource surveys, hydrogeology studies, meteorological monitoring, and metal leaching and acid rock drainage (ML/ARD) studies.

20.1.1 Hydrology

The Arctic Project area hydrology has been characterized. In 2007, 2008 and 2009, Shaw Environmental collected water quality samples and measured stream flow at 13 stations on the Shungnak River, Subarctic Creek, Arctic Creek, and the Kogoluktuk River (Shaw, 2007, 2008, 2009).

In July 2010, Tetra Tech performed baseline studies to characterize flow and water quality in streams that could be potentially impacted by construction and operation of a proposed access road between the Bornite and Arctic airstrips, and the existing road between the Arctic airstrip and the Arctic deposit. Tetra Tech collected water quality and flow data at 14 sites (Tetra Tech, 2010a).

Two hydrologic gauging stations were installed on the Shungnak River (SRGS) and Subarctic Creek (SCGS) respectively by DOWL HKM in July 2012. Each station is powered by dual solar panels and a battery, and continually measures and records water temperature, pH, conductivity, and water depth. A third hydrologic gauging station was established at the Lower Ruby Creek Gauging Site (RCDN) by WHPacific in June 2013. The RCDN station was moved upstream in 2017 due to a beaver dam.

Trilogy Metals staff also measured instantaneous stream flow and other standard field parameters (YSI 556 multi-parameter unit) during seasonal sampling events from 2013 to 2019 in Sub-Arctic Creek, Ruby Creek, the Shungnak River, and select tributaries to these drainages. The baseline water quality and hydrology program was expanded considerably in 2016 when Trilogy Metals increased the program from seven to over 20 sites, adding sample sites in Cabin Creek, Riley Creek, Wesley Creek, and the Kogoluktuk River (Craig, 2016).

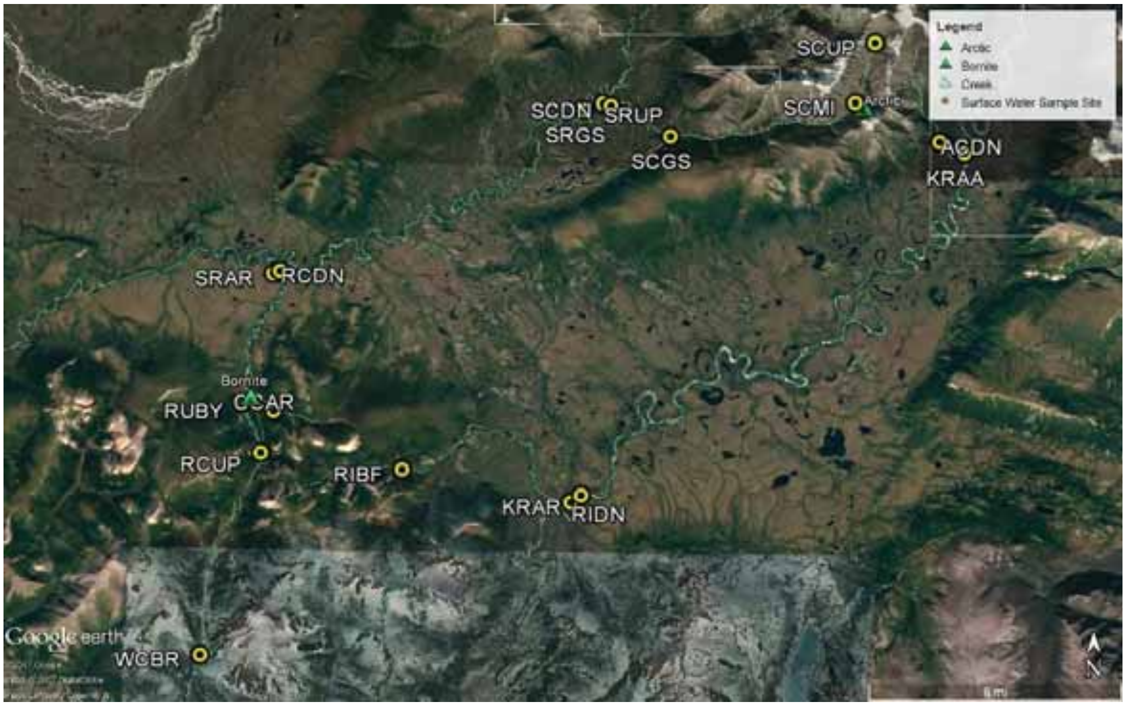


Figure 20-1 Current Water Quality and Hydrology Stations Location Map (Craig, 2017)

In March 2018, a snow survey was conducted around the site area in the upper reaches of the Subarctic Creek watershed.

SRK (2020) reviewed existing baseline hydrological data for the Project site and prepared a regional analysis of hydrology.

Site and publicly available data were used to estimate mean annual precipitation (MAP) and mean annual runoff (MAR) at the Project and to extend the available period of record. This analysis predicted a MAP of 1,294 mm and a MAR of 1,089 mm for the Subarctic Valley. The increase in estimated MAP from the SRK 2018 investigation is mainly due to the incorporation of a precipitation undercatch correction which was developed based on the snow survey data collected in 2018.

Evaporation estimates were also updated for the site using climatic records and an empirical relationship. Evaporation estimates are very stable and have not changed since SRK's previous review (SRK 2018).

Unit measured flows at the nearby USGS Dahl Creek station were compared to unit measured flows at the SRGS and SCGS hydrologic gauging stations for a concurrent monitoring period Flows measured in Dahl Creek closely resemble unit flows at the Project.

20.1.1.1 Recommendations

Upgrading the rain and temperature stations in the Subarctic valley to wind protected total precipitation gauges would reduce the uncertainty in and refine future MAP estimates. Low flow measurements should be collected at the SRGS, SCGS, and RCDN hydrologic gauging stations to improve low flow and baseflow estimates. Snow course surveys should continue to be conducted on an annual basis to progress the understanding of freshet and peak flow timing.

In addition, it is recommended to install a monitoring gauging station closer to the headwaters of Subarctic Creek (i.e. directly below proposed project site location) to calibrate and validate the water and load balance predicted for Subarctic Creek flows.

20.1.2 Water Quality

Environmental baseline monitoring was conducted in the area over the past eight years. The baseline monitoring data was supplemented with publicly available regional data to evaluate long-term trends.

In July 2010, Tetra Tech performed baseline studies to characterize flow and water quality in several streams that could be potentially impacted by construction and operation of a proposed access road between the Bornite airstrip and the Arctic airstrip, and the existing road between the Arctic airstrip and the Arctic deposit. Tetra Tech collected water quality and flow data at 14 sites. The results of the Tetra Tech sampling program indicate that, in general, the water quality for all sites meets applicable Alaska State water quality standards (WQS) for the parameters analyzed. Water quality sampling was conducted by Trilogy Metals from 2012 to the present. Small sampling programs were performed from 2012-2015 during the summer field season. The water quality sampling program was expanded in 2016 to include more sample locations in the Shungnak River, Subarctic Creek, Ruby Creek, Riley Creek, Wesley Creek, and the Kogoluktuk River and to include sampling throughout the year. Several seeps in the Subarctic Creek drainage near the Arctic Project were sampled.

Samples were analyzed for both total and dissolved metals, mercury, cyanide, chloride, fluoride, nitrates, sulfate, acidity, alkalinity, total suspended solids, conductivity, pH, total dissolved solids, total organic carbon, and total phosphorus. The information will be used in the permitting and facilities design.

20.1.3 Wetlands Data

Tetra Tech performed a program of jurisdictional wetlands identification in a portion of the Arctic Project area in 2010, as part of a study to identify potential road alignment alternatives between the Bornite and Arctic airstrips. The work included data review, vegetation mapping, aerial photographic interpretation (segmentation), and field soil surveys. The work is summarized as follows.

The area between the Bornite and Arctic airstrips consists of a wide valley containing the Ambler lowlands and the Shungnak River. Wetlands are prevalent throughout much of the Ambler lowlands. Most of the wetlands within the area occur within tundra vegetation communities composed primarily of ericaceous shrubs, such as bog blueberry shrubs (Vaccinium uliginosum and V. vitis-ideae) and graminoids, such as cottongrass (Eriophorum vaginatum) and sedges (Carex bigelowii and C. aquatilis). Spruce forests (Picea glauca and P. mariana) and shrub birch communities (Betula nana and B. glandulosa) make up most of the upland communities.

In 2015, Trilogy Metals engaged DOWL to perform additional wetlands mapping and generate two preliminary wetlands determinations for a 5,910-acre study area (DOWL, 2016). The study area included the entire Subarctic Creek drainage and the majority of the areas that could be directly impacted by the proposed Arctic open pit and mine facilities. The broad study area comprises 715 acres of potentially jurisdictional wetlands, 40 acres of Waters of the United States and 5,155 acres of non-jurisdictional uplands. According to DOWL (2016), the field work was performed in accordance with Part IV of the Corps of Engineers 1987 Wetlands Delineation Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Version 2.0, 2007). Wetlands were classified and grouped according to the Class Level and system guidelines outlined in Classification of Wetlands and Deepwater Habitats of the

United States (1979). The functional rating of potentially jurisdictional areas was determined using the criteria outlined in the 2009 Alaska Regulatory Guidance Letter, ID No. 09-10, the Cowardin Class, and observed hydrology. Ten ecological attributes were examined to subsequently rank wetland habitats as having low, moderate, or high functional ecological services. Riverine habitats (rivers and streams) perform vastly different functions compared to wetlands. Accordingly, riverine systems were evaluated based on the presence or absence of 17 functions according to the criteria outlined in the U.S. Department of the Interior Bureau of Land Management, Technical Report 1737-15, Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas.

Additional wetlands delineation work was done by DOWL in 2016, 2018 and 2019 to provide wetlands delineation of the entire proposed project footprint including access roads, camps, stockpiles, mining, and waste storage facilities.

20.1.4 Aquatic Life Data

Tetra Tech performed aquatic life studies in 2010 in the area between the Bornite and Arctic airstrips, and along the Arctic deposit road in Subarctic Creek. The purpose of this study was to characterize the aquatic life within the Shungnak River and select tributaries. Opportunistic observations were also collected in the Kogoluktuk River. Fish and macroinvertebrate data were collected from July 8 to 14, 2010.

In 2016 Trilogy Metals engaged Alaska Department of Fish and Game (ADFG) to complete aquatic studies as an extension of the work done by consultants in prior years. ADFG has performed aquatic surveys onsite from 2016-2019. ADFG performed water quality sampling, periphyton sampling, fish tissue sampling, and aquatic invertebrate and fish surveys (minnow traps) at five sites in the Shungnak River drainage and one site on upper Riley Creek, a tributary of the Kogoluktuk River. In addition, they completed fish surveys using fyke nets at lower Ruby Creek and lower Subarctic Creek.

Some of ADFG's results show that Subarctic Creek, which drains the Arctic deposit area contained some of the lowest background concentrations of zinc and copper, as well as the lowest total dissolved solids (TDS), but the broadest range of TDS values, compared to other drainages (Bradley, 2017). Upper Subarctic Creek had the highest number of aquatic invertebrates but also had the lowest species richness with a total of 11 taxa identified. Lower Subarctic Creek had a significantly lower average number of aquatic invertebrates but more diversity than upper Subarctic Creek.

ADFG retained a number of fish for element analysis. They noted that the same species were not captured at every location, making direct comparisons between sample sites difficult. Additionally, sample sizes were low at some locations. However, results provide a good start for a baseline data set regarding metals concentrations in fish. Bradley (2017) concluded that despite being isolated from the Kobuk River by a large waterfall preventing migrations by anadromous fish, the Shungnak River drainage supports self-sustaining populations of Arctic grayling, Dolly Varden, round whitefish and slimy sculpin. Upper Subarctic Creek was unique as the fish catches were dominated by Dolly Varden, and the catchment contained the highest density of aquatic insects. According to Bradley (2017) it is likely the Dolly Varden move into the upper reaches of Subarctic Creek to feed on the abundant aquatic insects.

20.1.5 Hydrogeology Data

In total, from all programs over the last 10+ years, hydrogeological data is available from:

- 39 boreholes; 15 in the area of the proposed open pit and 24 in the valley bottom area;

- Hydrogeologic testing data from 50 packer-based hydraulic tests; 11 slug tests; two pumping tests in valley bottom, each with an observation well; three injection tests in planned open pit area, one of six hours duration and two greater than 24 hours, each with monitoring at nearby vibrating wire piezometers (VWPs); 122 particle size distributions from test pits in valley floor;
- Water level data from 24 VWPs in pit area; 12 water level dataloggers in valley bottom;
- Dedicated ground temperature cables at six locations in valley floor; temperature from all VWP sensors, including those in the planned open pit area;
- 22 monitoring wells and two pumping wells in valley bottom; three standpipe piezometers in proposed pit area;
- Groundwater quality data from eleven monitoring wells, collected quarterly to once per year, depending on access and location. Most wells are within the Subarctic Creek valley bottom, upgradient, within and down gradient of the mine footprint.

Data were compiled into conceptual models for the planned valley bottom WRF and water management areas, as well as for the open pit area. Hydraulic head data indicate that groundwater flow is topographically driven, with recharge in the uplands and discharge in the valley bottom. At the large scale, hydrostratigraphic units include overburden, weathered bedrock and competent bedrock.

In the valley bottom, overburden, where coarse grained, and weathered bedrock are the primary aquifer units. Flow within competent bedrock is restricted to open fractures and generally has a lower hydraulic conductivity. Flow is in a down-valley direction, with groundwater divides generally aligned with the surrounding ridges.

In the planned pit area, the hydrostratigraphy is dominated by competent bedrock, with sub-units including upper and lower fractured rock, talc and geological structures. Talc may represent an aquitard located between the upper and lower fractured rock units. Water levels from the fractured rock units show a downwards gradient across the talc; the talc acts as a confining unit with the potentiometric surface for the lower fractured rock typically above the talc. Geological structures are present and can act as conduits or barriers to flow. There were no structures showing consistent barrier or conduit characteristics over the scale of the proposed pit. Compartmentalization is a possibility.

In the valley bottom, WRF and water management structures are designed to reduce release of contact water towards the down gradient receiving environment. Groundwater bypass of these systems could occur, though would be expected to be of low quantity as it would likely occur through the competent bedrock hydrostratigraphic unit. Groundwater moving down the valley can be assumed to largely discharge to Subarctic Creek before the creek enters the Shungnak River valley.

20.1.6 Cultural Resources Data

In 2016, Trilogy Metals engaged consultant WHPacific to perform a cultural resource assessment of the Arctic Project area. WHPacific (2016) noted that all 2,327 acres of the survey area were flown by helicopter at low elevation for observation by the archaeologists. The result of this flyover was the determination that the majority of the Project area had a low probability of containing cultural resources and had very low surface visibility. Of the total Project acreage, 530 acres were traversed on foot. These areas included the lower valley slopes, ridges, flat areas overlooking valleys, and terraces along the waterways. No cultural resources were found in the survey area. As part of their work WHPacific also completed a literature review, archival research and held stakeholder meetings in the communities of Shungnak and Kobuk. The results of that work include reviewing confidential Alaska Heritage Resource Survey Site information. No archaeologic sites have been recorded in the Project area (WHPacific, 2016). Late 20th century mining exploration is in evidence in the Project area as seen by roads, abandoned equipment, and the airfield (outside of the direct survey area). These are of an age that is on the cusp of being considered historical period resources (50 years or older) according to the National Historic Preservation Act. These resources are not unique within northern Alaska or for 20th century mining materials.

Local community members communicated that the region was not one that was used by local residents in the past due to its lack of resources and passages to areas north, west, and east, where other resources and trading opportunities existed.

WHPacific (2016) recommended no further cultural resources work and that Project work associated with the proposed Arctic pit, facilities, tailings, and access road corridor project should proceed as planned. However, small additional areas were added to the survey, such as road corridors and material sites to provide complete archaeological coverage for all areas of planned development.

Additional cultural resource work was performed by Kuna Engineering in 2018 and 2019. This work included a literature review and field investigations of the remaining areas potentially impacted by the project footprint including camps, access roads and material sites. No cultural resources were found.

20.1.7 Subsistence Data

Access to the Arctic Project area includes travel over private lands owned by NANA Regional Corporation. Trilogy Metals acknowledges the importance of subsistence to local residents, and as a result, a Subsistence Committee comprised of locally-appointed residents from five potentially-affected communities in the region has been formed to review and discuss subsistence issues related to the Project and to develop future compliance plans. Representatives from NANA and Trilogy Metals facilitate the meetings and report a summary of the discussions and recommendations provided by the Subsistence Committee to the Oversight Committee, as defined by the NANA Agreement. The Subsistence Committee meets twice annually and discusses development plans and potential subsistence issues.

A formal subsistence survey has not been performed in the immediate vicinity; however, Trilogy Metals has established a “Wildlife Log” to document potential subsistence resources, species diversity and human/wildlife encounters. In 2012, Stephen R. Braund & Associates completed a subsistence data-gap memo under contract to the Alaska Department of Transportation and Public Facilities as part of the baseline studies associated with the proposed road to the Ambler Mining District. The purpose of this analysis was to identify what subsistence research had been conducted for the potentially affected communities, determine if subsistence uses and use areas overlap with or may be affected by the access road project, and identify what, if any, additional information (i.e., data gaps) needed to be collected to accurately assess potential effects to subsistence (Braund 2012). Among other topics, the report outlined historic subsistence uses including maps and a literature review, and provided a synopsis, by village, including those villages closest to the Arctic Project, and suggested further study.

An ADFG report titled, “Wild Food Harvests in 3 Upper Kobuk River Communities: Ambler, Shungnak, and Kobuk 2012-2013” (ADFG 2015) provides a comprehensive analysis of subsistence food sources and their usage by the three Upper Kobuk villages. The report detailed the ethnographic history, contemporary usage, common species harvest methods, and abundance.

Previous sampling efforts established the presence of various salmon species, northern pike and sheefish in the lower Kogoluktuk River. Sampling efforts in the Shungnak River have established the presence of northern pike. The presences of fish are good indicators of the possibility of subsistence use of these rivers, but boat access is limited due to waterfalls and rapids. In comparison, the Kobuk River, a wide and easily navigable river on which the communities of the region exist, supports the bulk of subsistence fishing.

Determining the presence and distribution of caribou is complex because of seasonal and annual variability in migration patterns. The ADFG and National Parks Service employ a radio collar monitoring program as well as aerial photography to estimate herd size and migration patterns. The ADFG also estimates mortality rates for cows, calves, and bulls, as well as other biomonitors for health such as body fat and predator populations.

The Northwest Arctic Borough (NWAB), through its Title 9 Conditional Use permit, regulates the Project with respect to caribou interactions to assure the migration is minimally affected by mining and exploration activities. To this end, Trilogy Metals has communicated with the ADFG wildlife biologists, who monitor caribou herd movements in the spring and fall in proximity to the Arctic Project by using radio-collared caribou. Summary maps of those movements constructed from years of radio collar information indicate three main migration corridors to the west of the Arctic Project area for the Western Arctic caribou herd. The nearest herd is approximately 48 km west of the Arctic Project area.

DOWL (2016) performed a large mammal habitat survey in the Project area. Historic maps of caribou migration included in their report show that the Project area is outside of main caribou corridor routes and calving areas, but that data from 1988-2007 suggested that the area may be used for wintering habitat.

20.1.8 Endangered Species, Migratory Birds, and Bald and Golden Eagle protection

In 2016, Trilogy Metals engaged WHPacific, through subcontractor ABR, Inc., to perform aerial surveys of nesting raptors in the Project area, including the Bornite area located some 24 km southwest of the Arctic Project area. ABR (2017) identified a total of 26 nests, of which 18 were in the Bornite area and eight were in the Arctic Project area. Fifteen of the totals were occupied in the initial occupancy survey; nine were occupied by rough-legged hawks, with three peregrine falcon nests and three raven nests. In the later productivity survey ABR observed that only one rough-legged hawk nest had a (single) nestling, one peregrine falcon nest had two young and an unhatched egg, and two raven nests had young (not counted).

In 2017, Trilogy Metals engaged WHPacific to review requirements that would be necessary to comply with the Endangered Species Act, the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. WHPacific (2017) concluded that there are no endangered species or critical habitat in the Project area. Further they reported that nine avian species of conservation concern are expected to occur or could potentially be affected by activities in the Project area. They provided the timing guidelines for vegetation clearing that are meant to protect these species during nesting activities and advised that if impacts to migratory species are unavoidable for the project that the US Fish and Wildlife Service (USFW) must be consulted. They also recommended that Trilogy Metals request a project review from USFW when the Project is closer to initiation.

20.1.9 Metal Leaching / Acid Base Accounting Data (ML/ABA)

Sampling efforts were used to characterize the acid generation potential of the mine waste for the Arctic Project. In 1998, Robertson collected 60 representative core samples from the deposit for their acid base accounting (ABA) characteristics; these samples provided a broad assessment of ARD potential at the Arctic deposit with a focus on characterization for surface development. In

2010, SRK collected 148 samples and prepared a preliminary analysis of the ML/ARD potential of waste rock at the Arctic deposit (SRK 2011). The SRK report focused on characterization for underground development rather than an open pit scenario; however, it did provide a more refined analysis of ARD potential based on advances that have been made in understanding the importance of sulfide mineralogy in assessing ARD. The criteria used for classifying ARD potential also differed slightly from the Robertson era work.

Trilogy Metals retained SRK to provide on-going ML/ARD characterization services for the Arctic Project. Activities in 2016 through 2018 focused on three objectives: 1) on-going monitoring of on-site barrel tests (kinetics), 2) on-going monitoring of parallel laboratory humidity cell tests (kinetics), and 3) expansion of the ABA database (statics). Barrel test leachate samples were routinely collected during 2016 through 2018 and analyzed by ARS Aleut Analytical. Humidity cell tests, initiated in 2015, were monitored on a weekly basis by Maxxam Analytics of Burnaby, British Columbia. Trilogy Metals and SRK selected 1,119 samples to be analyzed for a conventional static ABA package with a trace element scan using the same methods as the exploration database. Samples were analyzed by Global ARD Testing Services of Burnaby, British Columbia.

Activities in 2019 focused on expanding the kinetic testing program to characterize the metal leaching potential of the range of geochemical compositions present in each of the main waste rock units. New kinetic tests were initiated and monitoring of the kinetic tests initiated in 2015 also continued, with all tests operating at Maxxam Analytics of Burnaby, British Columbia. Barrel test leachates were sampled routinely in 2019 and also analyzed by Maxxam Analytics, to maintain consistency in detection limits between laboratory and field kinetic tests. All kinetic testwork is on-going (field and laboratory tests).

20.2 Permitting

20.2.1 Exploration Permits

Trilogy Metals performs mineral exploration at the Arctic deposit under State of Alaska and NWAB permits.

Trilogy Metals is presently operating under a State of Alaska Miscellaneous Land Use Permit (APMA permit) that expires at 2022 year-end. Cumulative surface disturbance for exploration activities on the Arctic Project remains less than 5 acres (excluding historic disturbance that includes roads and camp disturbances) and therefore there are currently no State requirements for reclamation bonding for the Arctic Project.

Trilogy Metals reports that the NWAB Title 9 Conditional Use Permit authorizing exploration and bulk fuel storage, use of airstrips, operation of a landfill and gravel extraction expires on December 31, 2022. No bonding is required for the borough permits.

Trilogy Metals obtained several other permits for camp-support operations. These permits include a drinking water permit, a domestic wastewater discharge permit, camp establishment permits, and construction and operation of a Class III Camp Municipal Landfill, all of which are issued by the Alaska Department of Environmental Conservation (ADEC). Temporary water-use authorizations were issued by the ADNR, a Title 16 Fish Habitat permit, and a wildlife hazing permit were issued by the ADFG.

20.2.2 Major Mine Permits

The following discussion identifies the major permits and approvals that will likely be required for development of the Arctic deposit.

Permits would be required from Federal, State, and Regional agencies, including: the US Army Corps of Engineers (USACE), ADEC, ADFG, ADNR, and the NWAB. The State of Alaska permit for exploration on the project, the Annual Hardrock Exploration Activity (AHEA) Permit, is obtained and renewed every five years through the ADNR – Division of Mining, Land and Water.

The types of major mine permits required by this project are largely driven by the underlying land ownership; regulatory authorities vary depending on land ownership. The Arctic Project area includes patented mining claims (private land under separate ownership by Trilogy Metals and NANA), State of Alaska land, and NANA land (private land). The mine pit would situated mostly on patented land while the mill, TMF and WRF would be largely on State land. Other facilities, such as the camp, would be on NANA land. Federal land would likely underlie portions of an access road between the Dalton Highway and the Arctic Project area. However, permits associated with such an access road are being investigated in a separate action by the State of Alaska and are not addressed in this report. A list of likely major mine permits is included in Table 20-1.

Because the Arctic Project is situated to a large extent on State land, it will likely be necessary to obtain a Plan of Operation Approval (which includes the Reclamation Plan) from the ADNR. The Project will also require certificates to construct and then operate a dam(s) (tailings and water storage) from the ADNR (Dam Safety Unit) as well as water use authorizations, an upland mining lease and a mill site lease, as well as several minor permits including those that authorize access to construction material sites from ADNR.

The ADEC would authorize waste management under an integrated waste management permit, air emissions during construction and then operations under an air permit, and require an Alaska Pollution Discharge Elimination System (APDES) permit for any wastewater discharges to surface waters, and a Multi-Sector General Permit for stormwater discharges. The ADEC would also be required to review the USACE Section 404 permit to certify that it complies with Section 401 of the Clean Water Act (CWA).

The ADFG would have to authorize any culverts or bridges that are required to cross fish-bearing streams or other impacts to fish-bearing streams that result in the loss of fish habitat.

The USACE would require a CWA Section 404 permit for dredging and filling activities in Waters of the United States, including jurisdictional wetlands.

The USACE Section 404 permitting action would require the USACE to comply with National Environmental Policy Act (NEPA) and, for a project of this magnitude, the development of an Environmental Impact Statement (EIS) is anticipated. The USACE would likely be the lead federal agency for the NEPA process. The NEPA process will require an assessment of direct, indirect and cumulative impacts of the Arctic Project and the identification of project alternatives, and include consultation and coordination with additional federal agencies, such as the US Fish and Wildlife Service (if endangered or threatened species are present) and National Marine Fisheries Service (if essential fish habitat is present), and with the State Historic Preservation Office and Tribal Governments under Section 106 of the *Historical and Cultural Resources Protection Act*.

As part of the Section 404 permitting process, the Arctic Project will have to meet USACE wetlands guidelines to avoid, minimize and mitigate impacts to wetlands. The USACE will likely require Trilogy Metals to develop a compensatory wetlands mitigation plan for mitigating unavoidable wetlands impacts.

The Arctic Project will also have to obtain approval for a Master Plan from the NWAB. In addition, actions will have to be taken to change the borough zoning for the Arctic Project area from Subsistence Conservation and General Conservation to Resource Development.

The overall timeline required for permitting would be largely driven by the time required for the NEPA process, which is triggered by the submission of the 404 permit application to the USACE. The timeline includes the development and publication of a draft and final EIS and ends with a Record of Decision (ROD), and 404-permit issuance. In Alaska, the EIS and other State and Federal permitting processes are generally coordinated so that permitting and environmental review occurs in parallel. The NEPA process could require between two to three years to complete, and could potentially take longer.

Table 20-1 Major Mine Permits Required for the Arctic Project

Agency	Authorization
State of Alaska	
ADNR	Plan of Operations Approval (including Reclamation Plan)
	Upland Mining Lease
	Mill Site Lease
	Reclamation Bond
	Certificate of Approval to Construct a Dam
	Certificate of Approval to Operate a Dam
	Water Rights Permit to Appropriate Water
ADFG	Title 16 Permits for Fish Passage (authorize stream crossings)
ADEC	APDES Water Discharge Permit
	Alaska Multi-Sector General Permit (MSGP) for Stormwater
	Stormwater Discharge Pollution Prevention Plan (part of MSGP)
	Section 401 Water Quality Certification of the CWA Section 404 Permit
	Integrated Waste Management Permit
	Air Quality Control – Construction Permit
	Air Quality Control – Title V Operating Permit
	Reclamation Bond
Federal Government	
EPA	Spill Prevention, Control, and Countermeasure (SPCC) Plan (fuel transport and storage)
USACE	CWA Section 404 Dredge and Fill Permit
NWAB	
NWAB	Master Plan Approval and rezoning lands from Subsistence Conservation to Resource Extraction

Note: “Major” permits generally define critical permitting path. Additional “minor” permits are also required.

20.3 Social or Community Considerations

The Arctic Project is located approximately 40 km northeast of the native villages of Shungnak and Kobuk, and 64 km east-northeast of the native village of Ambler. The population in these villages range from 151 in Kobuk (2010 Census) to 262 in Shungnak (2010 Census). Residents live a largely subsistence lifestyle with incomes supplemented by trapping, guiding, local development projects, government aid and other work in, and outside of, the villages.

The Arctic Project has the potential to significantly improve work opportunities for village residents. Trilogy Metals is working directly with the villages to employ residents in the ongoing exploration program as mechanics, geotechnicians, core cutters, administrative staff, heavy equipment operators, drill operators, drill helpers, and environmental technicians. Trilogy Metals and NANA have established a Workforce Development Committee, described below, to assist with developing a local workforce. In addition, Trilogy Metals has existing contracts with native-affiliated companies (such as NANA Management Services and KUNA Engineering Inc.) that are providing camp catering and environmental services for the project, respectively.

In October 2011, NovaCopper (now Trilogy Metals) signed a cooperative agreement with NANA. In addition to consolidating landholdings in the Ambler Mining District, the agreement has language establishing shareholder hiring preferences and preferential use of NANA-affiliated consultants and contractors. Furthermore, the agreement formalized the Subsistence Committee to protect subsistence and the Iñupiaq way of life and an Oversight Committee, with equal representation from Trilogy Metals and NANA, to regularly review project plans and activities. The Workforce Development Committee also addresses current and future employment needs on the project through the development of training and educational programs that build skill sets for local residents interested in exploration and mining careers. The agreement also includes a scholarship funded annually by Trilogy Metals that promotes education for youth in the region. Trilogy Metals generally meets at least once during the summer months, with the residents of Kobuk, Shungnak and Ambler, the three villages closest to the Project area. Trilogy Metals also generally meets annually with several other NANA region villages including, Kotzebue, Kiana, Selawik and Noorvik, for updating residents on project plans and fielding their questions and concerns. This agreement with NANA has been assigned to Ambler Metals.

In general terms, rural Alaska residents are often concerned about potential mining impacts to wildlife and fish for those projects within their traditional use areas. Trilogy Metals acknowledged these concerns and is taking substantive steps to address them during the current exploration stage of the Project.

Local community concerns will also be formally recognized during the development of the project EIS. Early in the EIS process, the lead federal permitting agency will hold scoping meetings in rural villages to hear and record the concerns of the local communities so that the more significant of these concerns can be addressed during the development of the EIS. In addition, the lead federal agency would have government-to-government consultations with the Tribal Councils in each of the villages, as part of the EIS process, to discuss the project and hear Council concerns.

Characterizing the level of support or opposition to the Arctic Project would be speculative at this time. A poll conducted by Dittman Research for the 2011 NANA Shareholder opinion survey asked if Shareholders supported or opposed road projects on NANA land to assist in economic and potential mineral development. Eighty three percent supported the concept while 15% opposed. Surveys of this sort show a broad support for infrastructure and of mineral development indirectly in the region if regional interests are met. Regional engagement by Trilogy Metals has also encountered a strong desire for the economic benefits that come with mining projects.

20.4 Mine Reclamation and Closure

Mine reclamation and closure considerations are largely driven by State regulations (11 AAC 86.150, 11 AAC 97.100-910, and 18 AAC 70) and statutes (AS 27.19) that specify that a mine must be reclaimed concurrent with mining operations to the greatest extent possible and then closed in a way that leaves the site stable in terms of erosion and avoids degradation of water quality from acid rock drainage or metal leaching on the site. A detailed reclamation plan will be submitted to the State agencies for review and approval in the future, during the formal mine permitting process. The approval process for the plan varies somewhat depending on the land status for any particular mine. Owing to the fact that the Arctic Project is likely to have facilities on a combination of private (patented mining claims and native land) and State land, it is likely that the reclamation plan will be submitted and approved as part of the plan of operations, which is approved by the ADNR. However, since the reclamation plan must meet regulations of both ADNR and the ADEC, both agencies will review and approve the Reclamation Plan. In addition, private land owners must formally concur with the portion of the reclamation plan for their lands so that it is compatible with their intended post-mining land use.

20.4.1 Reclamation and Closure Plan

A final reclamation plan for the Arctic Project will be developed as part of the formal mine permitting process in the future. A preliminary plan was developed by SRK for the 2020 FS.

20.4.1.1 Closure Objectives and Closure Criteria

The overall closure objective is to establish stable chemical and physical conditions that protect the environment and human health. To the extent practicable, rehabilitation efforts will endeavor to return the site to a condition which generally conforms with the surrounding terrain. The site will be monitored and maintained post-closure in order to demonstrably meet these conditions.

The following general closure objectives were considered:

- Demolish and remove all construction, camp and industrial facilities and reclamation of affected footprints.
- Achieve long-term slope stability of the pit, WRF, and TMF.
- Meet water quality criteria for all mine water and seeps prior to discharge to the environment.
- Prevent intrusion and migration of tailings porewater and water from the pit into the regional groundwater.
- Prevent and limit to the greatest extent practical, contact of humans and wildlife with the mine waste (waste rock and tailings).
- Establish adequate vegetation density to ensure erosion protection of the soil slopes.
- Re-establish vegetation on areas returned to normal land use.

20.4.1.2 Closure Activities

Closure activities will be undertaken at the end of mine life to bring the mine facilities in a state consistent with the stated closure objectives and compliant with the regulations for closure and abandonment. Major activities planned for the various mine components and facilities are detailed as follows. The closure plan will be conducted in two phases. Phase One will include reclamation of the majority of the site, while Phase Two will include closure of the TMF. Figure 20-2 and Figure 20-3 illustrate the closure phase.

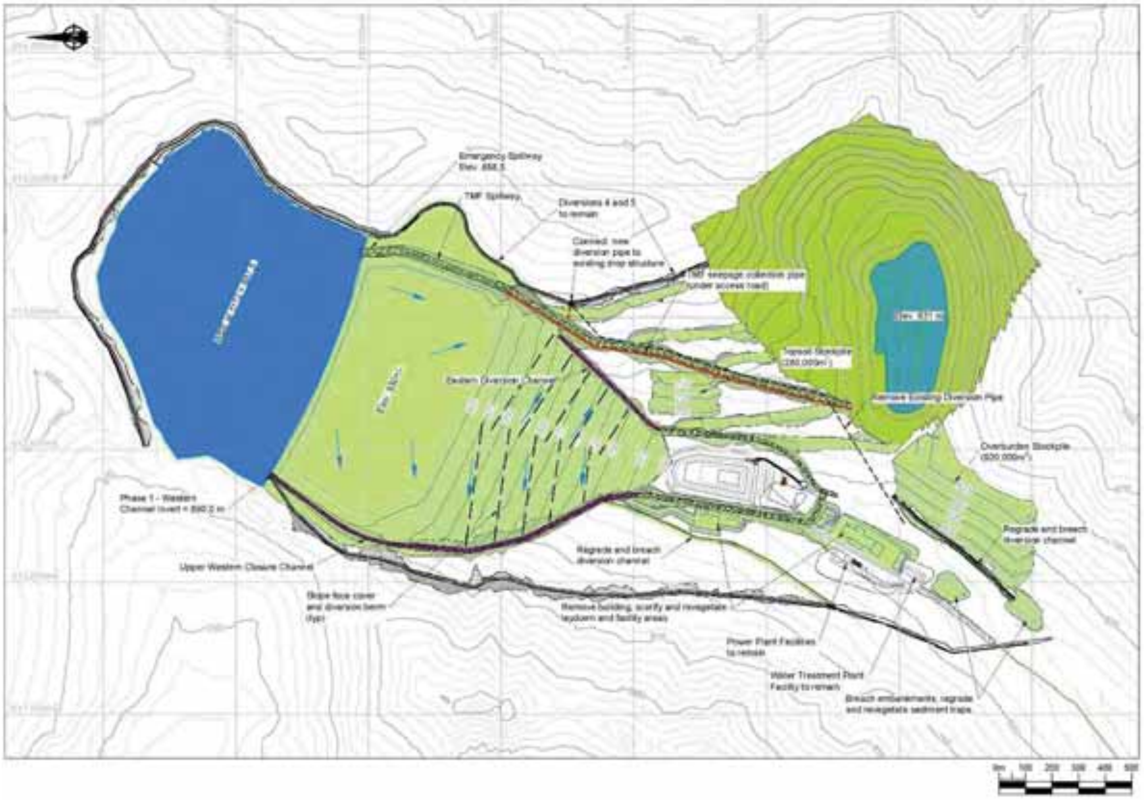


Figure 20-2 Phase One Closure (SRK, 2020)

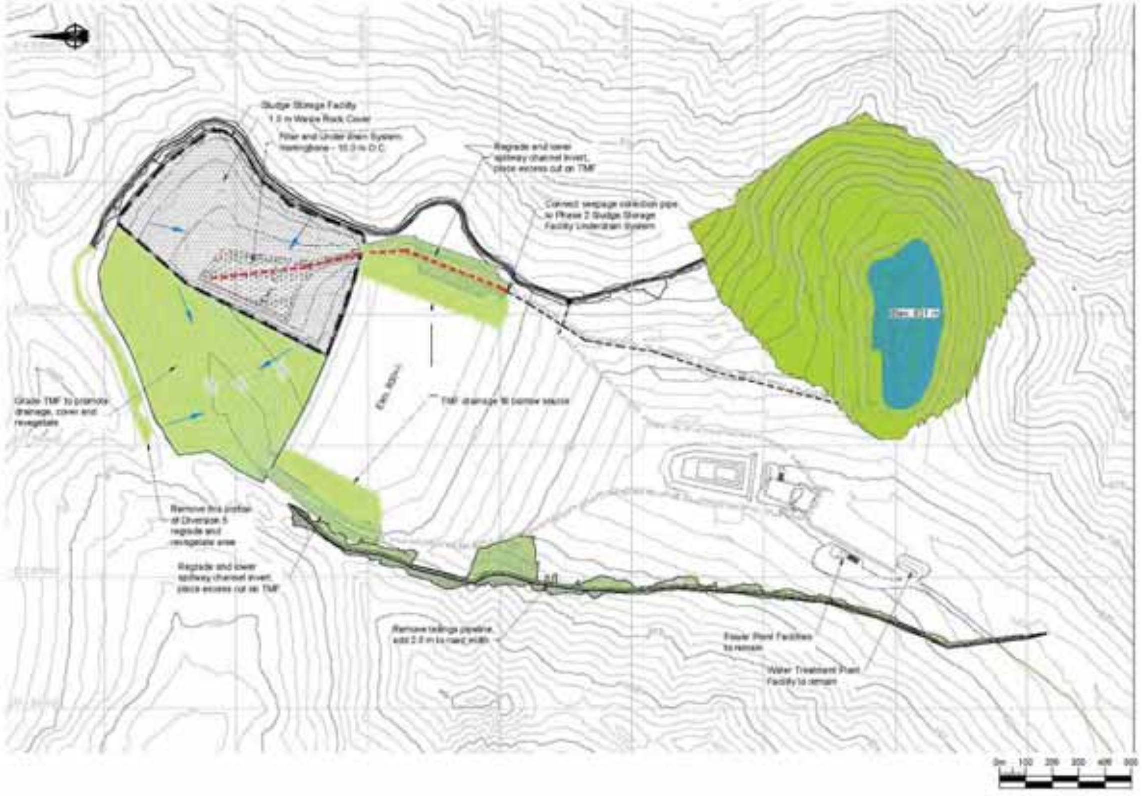


Figure 20-3 Phase Two Closure (SRK, 2020)

20.4.1.2.1 Open Pit Workings

It is expected that the pit wall will be geotechnically stable in the long-term, and therefore no in-pit work is required at closure. The pit perimeter straddles a steep mountainous ridgeline, installation of typical preventative safety measures such as fencing, or warning berms are not practical to install. Clear signage will be installed to warn of existing dangers, such as highwall presence and falling rock in areas which could potentially be accessed by the public.

Once operations are completed, the water in the pit will be allowed to rise and a pit lake will form. Seepage water from consolidation of the tailings, infiltration of the tailings cover, and seepage from the WRF will report to the open pit for seasonal treatment. Sludge generated from water treatment will be returned to the pit for long term storage until capacity has been met, then sludge will be transferred to a repository constructed on the eastern half of the consolidated TMF. The pit capacity will be finite, with approximately 25 years' worth of sludge storage capacity available before impacting the treatment reservoir (the pit) capacity. The TMF sludge repository has capacity in excess of 75-years' worth of storage.

The pit lake will not be allowed to overflow and the elevation will be carefully monitored to provide storage of the freshet volume and probable maximum precipitation event. Further hydrological and geotechnical studies are required to determine the maximum elevation which water could be stored in the pit to prevent seepage through bedrock and into the environment. A conservative approach assumes that the maximum pit lake elevation will be maintained 40 m below the top of competent bedrock surface. An emergency spillway will be constructed as a matter of best practice.

20.4.1.2.2 Waste Rock Facility and Tailings Management Facility

It is anticipated that the WRF will be PAG after closure and into the foreseeable future. The face of the WRF will be regraded at closure for long-term stability at an overall slope of approximately 3H:1V. Efforts will be made to create a convex shape on the WRF face, which is the predominant shape of natural slopes in mature landscapes in the area. This shape together with installation of intermittent diversion berms on the face of the WRF slope will reduce riling and erosion from uncontrolled runoff. The diversion berms on the WRF face will divert water to the perimeter. There, geosynthetic lined and armored perimeter channels will be installed at the interface of the existing ground and the WRF. The lined channels will limit infiltration of collected runoff both from the WRF surface and upstream run-on. Thus, limiting the volume of seepage reporting to the WRCP which requires treatment. Upon completion of grading, all surface areas of the WRF will be covered with approximately 830 mm of overburden and 170 mm of growth media, for a full cover thickness of approximately one meter. A cover infiltration study should be conducted prior to final closure to determine the optimum cover thickness to reduce infiltration rates while maintaining long-term survival of vegetation.

At completion of mining, approximately 3.25 Mm^3 of water will be stored in the TMF. Over the course of 15 years, post closure, water will be removed from the TMF, treated, and discharged to the environment. Tailings consolidation is expected to continue for up to 100+ years but, the majority of the consolidation is expected to occur in the first 15–20 years post closure. Once substantial consolidation has occurred, Phase Two of reclamation will commence, and waste and drain rock will be placed on the exposed tailings.

Waste rock will be relocated to the western half of the tailings surface to provide positive drainage towards the western diversion channel. Upon completion of grading and placement of waste rock, the western half of the TMF will be covered with 830 mm of overburden and 170 mm of growth media, for a full cover thickness of approximately one meter.

The eastern half of the TMF will serve as a future sludge repository once capacity in the pit has been exhausted. An engineered drainage layer will be placed on top of the tailings in the eastern half the TMF. The drainage layer will collect seepage from the western TMF, consolidation tailings water, and precipitation falling on to the eastern half of the TMF. An underdrain and control structure will remove collected water and convey it through a pipe adjacent to the spillway, ultimately to the pit for treatment. The pipe will collect seepage water and attenuate larger storm events, eliminating the need to line the spillway to the pit to limit infiltration of impacted water. An engineered spillway will be installed at the completion of mining. The spillway is designed to safely convey the probable maximum flood event from the TMF to the pit, both during Phase one and Phase Two closure.

Material for covering the WRF and TMF will be relocated from the overburden and topsoil stockpiles. Once all material has been relocated, the footprints will be reclaimed, and sedimentation pond will be graded and revegetated.

All disturbed areas will be seeded with native species of grasses and shrubs to re-establish vegetation. Efforts to work with the Alaska Plants Material Center should be taken to maximize the potential for sustainable regrowth. The elevation, climate and latitude will likely limit the early growth success and trials should be conducted throughout the LOM to determine the best management practices for revegetation and stabilization.

20.4.1.2.3 Buildings and Equipment

The WTP and a modified power generation plant will be left in place, together with all appurtenant facilities and utilities. All other steel frame buildings including the mill, the truck shop, and the conveyors will be demolished selectively by removing the roof and siding and then dismantling the steel frames and trusses. Resulting debris will be disposed of in approved landfill that will be located on the WRF. Concrete walls, pillars, and beams will be demolished to the ground and concrete foundations will be covered in place. Controlled blasting may be used to help with the demolition. All sumps and cavities will be backfilled to ground level. The rock fill pads underlying all buildings and equipment will be re-graded to prevent permanent ponding.

Non-hazardous and hazardous waste will be segregated. Hazardous waste will be placed in suitable containers and hauled to a licensed disposal facility, while non-hazardous waste will be placed in the landfill.

Any unwanted mobile or stationary equipment will be stripped of electronics and batteries, drained of all fluids (fuels, lubricants, coolants), decontaminated by power washing, and placed in the landfill for final disposal.

20.4.1.2.4 Mine Infrastructure

Mine support infrastructure will consist of internal access roads, haul roads, and rock fill pads underlying the site buildings and facilities.

All bridges and culverts associated with the haul roads and internal access roads will be removed and natural drainage will be restored. Swales will be created where needed, to allow continued use of the roads into post-closure water treatment, monitoring, and maintenance. Roads that are not needed in post-closure will be ripped and re-vegetated.

The surface of the rockfill pads underlying some of the buildings and facilities on site will be re-graded and/or crowned as necessary to prevent ponding of water. The pads will be scarified and re-vegetated. Additional overburden up to 300 mm may be applied, as needed, to promote revegetation.

The site access road will be maintained as long as water treatment is occurring on site.

20.4.1.2.5 Landfill

An unlined non-hazardous landfill will be located in the WRF. Demolition waste and other non-hazardous waste will be placed in the landfill and consolidated to minimize the occupied volume. The waste will then be covered with at least 1 m of waste rock. The final surface will then be graded to prevent permanent ponding and will be covered similarly to the rest of the WRF cover.

20.4.1.2.6 Water Management System

The water management system consisting of the pit lake, the WRCP, the tailings reclaim water pond, diversion channels, and various pipelines will be largely decommissioned. The dams and the sediment ponds will be breached, regraded and re-vegetated. New diversion channels along the perimeter of the WRF will be created to manage surface runoff on and around the TMF and the WRF, as well as intake and discharge pipelines between the pit and the WRCP. Runoff from the WRF is expected to meet water quality standards and will be discharged to the environment. Seepage from the WRF will report to the WRCP and be pumped to the pit for treatment. As the pit fills naturally, water levels will be managed by treating and discharging treated water for the long-term.

The WRCP will collect seepage from the WRF in perpetuity. The expected seepage volume reporting to the WRCP is approximately 1400 m³ per day. The pond has a capacity of approximately eight months of storage. Prior to closure for the winter, the WRCP will be pumped dry, to provide storage capacity for spring freshet, and minimal seepage flows reporting to the pond in the winter. Water treatment is expected to occur between May 15 and October 31 during the open water season. Should the water flow to the WRCP exceed capacity, excess seepage will be pumped to the pit for future treatment.

20.4.1.2.7 Water Treatment Plants

20.4.1.2.7.1 Overview and HDS WTP

During closure, contact water will be treated in two treatment systems: the HDS WTP constructed during operations (see Section 18.9) will treat excess water from the pit and the SeWTP will treat dewatering water from the TMF as well as a portion of the treated effluent from the HDS WTP, as the HDS WTP is unlikely to remove appreciable amounts of selenium. The SeWTP is currently projected to commence treatment in the final year of operation of the process plant.

Long-term water treatment at the HDS WTP will be required, possibly in perpetuity. Water treatment at the SeWTP will cease once the TMF is dewatered (by approximately year 15 of closure).

Both plants will operate during the open water season from May through October. The effluent from both treatment plants will be combined and discharged via a 12 km pipeline to the Shungnak River.

Some modifications to the HDS WTP will be required at closure due to the change in estimated influent quality between operations and closure (see Section 18.8.4). Lime demand and solids generation will increase at closure, necessitating changes to the lime system, flocculant system, blowers, underflow pumps, flush water, and dilution water pumps. It is assumed that no changes are required to the reactors or clarifier and affiliated equipment (e.g., agitators, rake). The ferric chloride dosing system can be decommissioned at closure, as influent will have sufficient iron for coagulation/co-precipitation of anionic metals. At closure, the HDS WTP sludge will be disposed of at the pit via a new pipeline, rather than sent to the tailings pump box at the mill, which is assumed to be decommissioned at closure. The pit will have capacity for approximately 20 years of sludge storage, after which a filter press system will be added to the HDS WTP and sludge will be disposed of as filter cake within the TMF.

The HDS WTP will operate and dispose of sludge in perpetuity.

SRK recommends that the water and load balance should be updated as the project design is advanced, during operations, and as the site approaches closure in order to refine the understanding of the volumes and quality of effluents from the pit and TMF to be treated at closure, and to refine the water treatment design and closure cost estimates.

20.4.1.2.7.2 Selenium Water Treatment Plant

The SeWTP design will include the following unit operations and processes:

- Stream concentration:

  - Pretreatment (strainer & ultra-filtration (UF)): filtrate from the UF system will be directed to reverse osmosis, while reject bypasses downstream copper precipitation.
  - Reverse Osmosis (RO) membrane filtration – filtrate from the RO will bypass all downstream processes and is sent to the plant discharge tank while concentrate (brine) will be conveyed to copper precipitation.
- Copper precipitation:
  - Caustic and ferric sulphate will be added to precipitate copper at pH 7.0 to 7.5.
- Solids separation:
  - High-rate, chemically-enhanced, ballasted flocculation-type clarification (Veolia Actiflo) – underflow will be directed to solids thickening and dewatering, supernatant will be directed to downstream pH adjustment.
- pH adjustment:
  - pH will be adjusted as needed using sulfuric acid to achieve the operating conditions required for biological treatment.
- Heating will be conducted as required to enhance downstream biological treatment; expected to be used primarily in initial start-up.
- Biological treatment will be undertaken using moving bed biofilm reactors (MBBR's):
  - First step – mbbr nitrogen reduction (targeting nitrate/nitrite/ammonia).
  - Second step – two-stage mbbr selenium reduction.
- Solids separation:
  - High-rate, chemically-enhanced, ballasted flocculation-type clarification (Veolia Actiflo): underflow will be directed to solids thickening and dewatering, supernatant will be directed to downstream reoxidation.
- MBBR re-oxidation and carbon uptake:
  - Excess carbon will be consumed, and compressed air will be injected to increase dissolved oxygen concentration.
- Treated effluent will be sent to discharge.
- Solids management:
  - Recovered solids will be thickened, dewatered, and removed for storage.
  - Metal precipitates from the copper precipitation stage will be deposited in:
    - The TMF during operations
    - The pit during closure
  - Biological treatment solids (which contain selenium) will be deposited in lined cells with a leak detection and collection system.

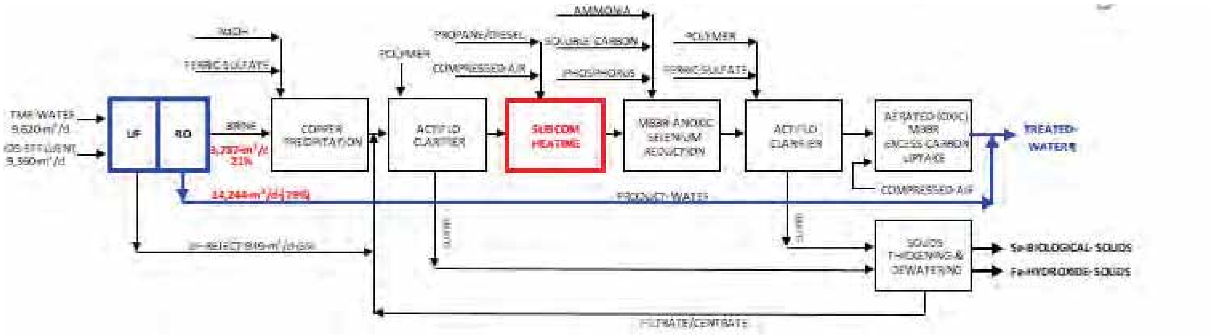


Figure 20-4 Selenium Water Treatment Plant Process (Integrated Sustainability, 2020)

20.4.1.2.8 Post-Closure

Continued presence at site will be required in the post-closure period for as long as water treatment is necessary. This will require maintaining road access, a seasonal camp, and the water discharge pipeline to Shungnak River. Generators and mobile equipment will also be required for the WTP operations as well as sampling and monitoring activities.

In the short-term (up to 10 years following closure) monitoring to confirm that the closure objectives are met will be based on the following requirements:

- The site should be visually inspected by a qualified Professional Engineer annually for three consecutive years and less frequently thereafter for up to 10 years to ensure that erosion-prone areas have stabilized.
- The soil covers over the WRF and the TMF should be regularly inspected by a qualified inspector to ensure the physical integrity of the cover is maintained. Inspection intervals should be by-annually for the first 10 years after construction.
- The site should be inspected by a vegetation specialist to confirm suitability of the revegetation efforts. Inspections should be completed at the following intervals, unless otherwise recommended by the vegetation expert: Year 1, Year 3, Year 7 and Year 10 post-closure.

In the long-term, continuous water quality monitoring will be implemented at sampling frequencies prescribed by future discharge permits.

Maintenance will be performed on areas that monitoring identifies as needing repairs. Water treatment in perpetuity will likely require a well-defined set of discharge quality criteria to be determined at the later stages of permitting and design.

20.4.1.3 Closure Cost Estimate

20.4.1.3.1 General

The estimated closure cost of is based on unit rates used by SRK on other closure projects in cold environments. The indirect costs were included as percentages of the estimated direct costs based on guidelines for Alaska (DOWL 2015).

Long-term water treatment and maintenance of certain water management facilities were calculated separately, and an NPV value is provided for the first 100 years, at a discount rate of 4.3%.

Reclamation and closure costs were estimated to be $158.2 million, in undiscounted 2020 US dollars. Annual (undiscounted) costs associated with long-term operations of the HDS WTP are estimated to be $5.1 million. A summary of estimated costs is provided in Table 20-2. Costs for the Selenium eater treatment plant are captured separately in Section 20.4.1.3.2.

Table 20-2 Summary of Closure and Reclamation Costs

Cost Items	Subtotals Closure Costs (USD, M)
DIRECT CLOSURE COSTS	
WRF	$ 8.9
Selenium Sludge Management Facility	$ 0.6
Yards and Laydown Areas	$ 0.1
Buildings and Equipment	$ 3.3
TMF Spillway (Phase 1)	$ 3.9
Surface Water Management (Phase 1)	$ 6.1
Sediment Traps and Stockpiles	$ 0.1
Roads and Diversion Channel Regrade	$ 0.2
Hazardous Waste and Solid Waste Disposal	$ 0.6
Camp and Turn-around Costs	$ 1.9
Subtotal Direct Closure Cost	**$ 25.8**
INDIRECT CLOSURE COSTS	
Contingency (20%)	$ 5.1
Engineering Redesign (3%)	$ 0.8
Contract Administration (7%)	$ 1.8
Performance Bond (3%)	$ 0.8
Liability Insurance (0.5%)	$ 0.1
Subtotal Indirect Closure Cost	**$ 8.6**
Total Closure Cost	**$ 34.4**
POST-CLOSURE COSTS (100 years)	
Water Quality Sampling	$ 6.9
Annual Reporting	$ 2.5
Post-closure Monitoring and Inspections	$ 10.2
Vegetation and Cover Maintenance	$ 3.6
Water Treatment Plant Capital Cost Estimate	$ 28.6
Discharge Pipeline Replacement and Maint.	$ 26.6
Water Treatment Operating Costs	$ 314.1
Camp and Road Maint.	$ 17.5
Mobile Equipment and Operating	$ 11.6
TMF Reclamation (yr 16)	$ 24.4
Sludge Repository Construction (yr 17)	$ 9.6
Sludge Management Crew and Camp Support	$ 4.2
Filter Press and Sludge Handling	$ 53.0

Cost Items	Subtotals Closure Costs (USD, M)
Subtotal Post-Closure Costs (undiscounted)	$ **512.7**
Post-closure Costs NPV(4.3% discount rate)	**$ 123.8**
Discounted General Closure Cost	**$ 158.2**

20.4.1.3.2 Selenium Water Treatment Plant

Closure costs associated with the SeWTP were estimated by taking those annual operating costs occurring post closure and discounting these back to the end of the processing plant's life, in a similar manner to what was undertaken for other closure costs. These costs were estimated as $4.5 million in the first year of operation and $4.3 million per year for the following 15 years, giving a discounted amount of $47.2 million to be incurred at the end of the process plant's working life. The same 4.3% discount rate has been used as for the general costs.

Note that as there is a possibility that the SeWTP will be required to operate during the final year of production, the capital costs associated with the plant, and the operating cost of the first year of operation are captured as sustaining capital and operating costs respectively (and not as closure costs).

The SeWTP will operate for at least 16 years or until the selenium load from the TMF can be discharged to the Shungnak River without treatment.

20.4.1.4 Reclamation and Closure Financial Assurance

In the absence of activities on Federal Land in the mine area and excluding the access road to the district from the Dalton Highway, there would not be any financial assurance requirements from the Federal government for the mine.

There are three State of Alaska agencies that require financial assurance in conjunction with approval and issuance of large mine permits.

The ADNR, under authority of Alaska Statute 27.19, requires a reclamation plan be submitted prior to mine development and requires financial assurance, typically prior to construction, to assure reclamation of the site. The ADNR Dam Safety Unit also requires a financial assurance sufficient to cover the cost of decommissioning dams or the cost for long term maintenance and monitoring of dams that will remain in-place. The ADEC requires financial assurance both during and after operations, and to cover short and long-term water treatment if necessary, as well as reclamation costs, monitoring, and maintenance needs. The State requires that the financial assurance amount also include the property holding costs for a one-year period.

The final financial assurance amount will be calculated through the process of reviewing and approving the Arctic Project reclamation plan during the formal permitting process. In general, the approach is to combine the reclamation costs, post-closure monitoring costs and the long-term annual water treatment costs into a financial amount that includes deriving the NPV of the long-term costs and combining that with the reclamation cost. The costs assume that a third-party contractor will perform and manage the project. The estimate required for bonding is likely to be similar to the estimate provided above. Until actual Owner operating costs are known, the internal closure liability noted in Table 20-2 cannot readily be reduced.

Ambler Metals may satisfy the State financial assurance requirement by providing any of the following: (1) a surety bond, (2) a letter of credit, (3) a certificate of deposit, (4) a corporate guarantee that meets the financial tests set in regulation by the ADNR commissioner, (5) payments and deposits into the trust fund established in AS 37.14.800, or (6) for the dam- or

ADEC-related obligation - any other form of financial assurance that meets the financial test or other conditions set in regulation by the ADNR or ADEC commissioners.

The adequacy of the reclamation plan, and the amount of the financial assurance, are reviewed by the State agencies at a minimum of every five years and must be updated whenever there is a significant change to the mine plan of operations, or other costs that could affect the reclamation plan costs.

21 Capital and Operating Costs

21.1 Capital Costs

21.1.1 Introduction

The objective of the 2020 FS was to develop a capital cost estimate with an accuracy of ±15% in accordance with the Association for the Advancement of Cost Engineering (AACE) Class 3 estimate guidelines. This includes the cost to complete the design, procurement, construction and commissioning, of all the facilities.

This estimate collectively presents the entire costs for the project.

The physical facilities and utilities for the Arctic Project include but are not limited to the following areas:

- Ausenco:
    - Process plant
    - Surface infrastructure and ancillaries
    - Off plant roads (by DOWL)
    - Existing airstrip upgrade (DOWL).
- Trilogy Metals:
    - Owners' costs
- SRK:
    - TMF
    - Waste rock facility
    - HDS WTP
    - Site water management.
- Integrated Sustainability:
    - SeWTP
- Wood:
    - Mine pre-stripping
    - Construction of mine roads
    - Emulsion plant and explosives magazine
    - Mining equipment fleet.

21.1.2 Project Execution

The estimate was based on the traditional engineering, procurement and construction management (EPCM) approach where the EPCM contractor will oversee the delivery of the completed project from detailed engineering and procurement to handover of working facility. The EPCM contractor would engage and coordinate several subcontractors to complete all work within the given scopes. Typical vertical and/or horizontal contract packages were identified and aligned with different pricing models such as, but not limited to:

- Schedule of rates (unit price)
  - This contract pricing model is based on estimated quantities of items included in the scope and their unit prices. The final contract price is dependent on the quantities needed to complete the work under the contract.
- Time and materials
  - Time and materials (T&M) fixes rates for labour and material expenditures, with the contractor paid on the basis of actual labour hours (time), usually at specified hourly rates, actual cost of materials and equipment usage, and an agreed upon fixed add-on to cover the contractor's overheads and profit.
- Design and construct
  - With this option one entity will provide design and construction services for an awarded scope of work. A higher degree of price certainty can be achieved when a lump sum arrangement is used; this method also provides a single point of accountability and an improved integration of the design with construction.

21.1.3 Work Breakdown Structure

The estimate was arranged by major area, area, major facility, and facility. Each sub-area was further broken down into disciplines such as earthworks, concrete etc. Each discipline line item was defined into resources such as labour, materials, equipment, etc., so that each line consisted all the elements required to complete each task.

The work breakdown structure (WBS) was developed in sufficient detail to provide the required level of confidence and accuracy and also to provide the basis for further development as the project moves into execution phase.

21.1.4 Estimate Summary

The estimate was derived from a number of fundamental assumptions as shown on the process flow diagrams (PFDs), drawings, scope definition and WBS. It included all associated infrastructure as defined within the scope of works.

The capital cost estimate was summarized at the levels indicated in Table 22-1 and Table 22-2, is stated in United States dollars (US$) with a base date of 4th quarter 2019 and with no provision for forward escalation.

Table 21-1 Estimate Summary Level 1 Major Facility

Cost Type	Description	US$M
Direct	Mine	280.1
	Crushing	28.3

Cost Type	Description	US$M
	Process	116.6
	Tailings	69.0
	On-Site Infrastructure	109.3
	Off-Site Infrastructure	53.7
	Direct Subtotal	**656.9**
Indirect	Indirects	130.7
	Contingency	94.5
	Owners Costs	23.4
	Indirect Total	**248.7**
Project Total		**905.6**

Table 21-2 Initial Estimate by Major Discipline

Description	US$M
Earthworks	20.3
Concrete	35.2
Structural Steel	10.7
Architectural	57.7
Platework	5.1
Mechanical Equipment	76.3
Mobile Equipment	6.4
Piping	42.1
Electrical Equipment	43.2
Electrical Bulks	12.4
Instrumentation	2.9
Third Party Estimates (Wood, SRK, Dowl)	344.6
Subtotal Direct Costs	**648.1**
Field Indirects	55.4
Spares & First Fills	9.1
EPCM	66.2
Contingency	94.5
Owners Costs	23.4
Indirect Costs	**248.7**
Project Total	**905.6**

21.1.5 Definition

21.1.5.1 Definition of Costs

The estimate was distributed into a direct and indirect initial capital cost estimate.

Initial capital included all costs anticipated to be incurred during the pre-production period.

Sustaining capital was the capital cost associated with the periodic addition of new plant, equipment or services that will be required to maintain production and operations at their operating levels.

Direct costs were those costs that pertained to the permanent equipment, materials and labour associated with the physical construction of the process facility, infrastructure, utilities, buildings, etc. Contractor's indirect costs were contained within each discipline's all-in rates.

Indirect costs include all costs associated with implementation of the plant and incurred by the Owner, engineer or consultants in project design, procurement, construction, and commissioning.

21.1.5.2 General Methodology

The estimate was developed based on a mix of detailed material take-offs and factored quantities and costs, detailed unit costs supported by contractor bids and budgetary quotations for major equipment supply.

The structure of the estimate was a build-up of the direct and indirect cost of the current quantities; this included the installation/construction hours, unit labour rates and contractor distributable costs, bulk and miscellaneous material and equipment costs, any subcontractor costs, freight and growth costs.

The methodology applied and source data used to develop the estimate included:

- Define the scope of work.
- Quantify the work in accordance with standard commodities.
- Organize the estimate structure in accordance with an agreed WBS.
- Calculate "all in" labour rates for construction work.
- Determine the purchase cost of equipment and bulk materials.
- Determine the installation cost for equipment and bulks.
- Establish requirements for freight.
- Determine the costs to carry out detailed engineering design and project management.
- Determine foreign exchange content and exchange rates.
- Determine growth allowances for each estimate line item.
- Determine the estimate contingency value by probabilistic method.
- Undertake internal peer review, finalize the estimate, estimate basis and obtain sign off by the Project Manager and Qualified Professional.

21.1.5.3 Exchange Rates

The exchange rates in Table 21-3 were used to develop the capital cost estimate for the 2020 FS.

Table 21-3 Estimate Exchange Rates

Exchange Rate	US$
AUD 1.46	1
EUR 0.90	1
CAD 1.32	1
GBP 0.78	1

Notes: AUD = Australian Dollar, EUR = Euro, CAD = Canadian Dollar, GBP = Great British Pound

21.1.5.4 Market Availability

The pricing and delivery information for quoted equipment, material and services was provided by suppliers based on the market conditions and expectations applicable at the time of developing the estimate.

The market conditions are susceptible to the impact of demand and availability at the time of purchase and could result in variations in the supply conditions. The estimate in this Report was based on information provided by suppliers and assumes there are no problems associated with the supply and availability of equipment and services during the execution phase.

21.1.6 Road Construction

The total estimate for the main site access road is $15.0M. The access road includes approximately 8 km of road between the Bornite camp and the Arctic intersection. The estimate included the access road design and construction package, stream crossings and drainage structures, road surfacing, project delivery costs, and contingency.

21.1.7 Basis of Mining Capital Cost Estimate

21.1.7.1 General Mining Costs

The scope of the mining capital costs included estimated mine operating costs, capital costs, and sustaining capital costs within an Excel based cost model using first principles build-up.

The scope of the mining capital cost estimate included:

- The purchase of mining fleet, maintenance, and mine support equipment.
- Miscellaneous equipment.
- Emulsion plant construction.
- Haul roads construction.
- Mine operating cost during pre-production periods.

Estimates for mining equipment were based on mining fleet equipment schedules and equipment pricing provided by vendors for supply, delivery, assembly, and testing. Estimates for miscellaneous equipment were based on Wood's internal database.

The emulsion plant capital cost was provided by the explosive supplier.

Haul road construction was estimated by Wood in accordance with the Class 3 Estimate criteria. Materials takeoffs (MTOs) for roads were estimated using a 3D software modelling program.

Mine operating costs were based on mining quantities, local rates for major consumable costs, equipment operation costs based on supplier quotes, and labor costs based on a detailed staffing plan and local rates. Fuel consumption, like other consumables, were estimated from vendor-supplied data for each type of equipment and equipment utilization factors. Mining quantities were derived from mine-phased planning to achieve the planned production rates.

21.1.7.2 Pit Slope Stability Costs

A pore pressure monitoring system and mitigation plan was developed to manage elevated pore pressures in areas of the pit that do not drain naturally as mining advances, and active depressurization may be required. The system includes vertical wells, horizontal drains and associated monitoring systems as described in Section 16.7.2.

21.1.8 Mining

21.1.8.1 General

Total mine initial capital costs are estimated at US$265.4 M (Table 21-4). The initial capital costs total to US$265.4 M, including US$141.1 M in preproduction operating costs for a two year preproduction period, US$96.5 M in initial capital expenditures for mobile equipment, US$6.2 M in initial equipment spares, US$5.6M for the emulsion plant, and US$16.5M for haul roads construction. Equipment purchase payments were scheduled in the period before the equipment is required.

Table 21-4 Mine Capital Costs

Cost Area	US$ millions
Pre-Production Mining	141.1
Engineering and Management	6.2
Drilling	7.3
Blasting	5.7
Loading	17.2
Hauling	49.2
Support	16.5
Maintenance	5.5
Haul Roads Construction	16.5
Total Initial Capital	**265.4**

Notes:

1. Figures may not sum due to rounding.
2. Sustaining capital associated with general mining costs ($12.7 m) are captured in Table 21-5.
3. Contingency associated with general mining costs ($35.5 m) are included in the total shown in Table 21-1.
4. Total includes $6.2 million of general mining indirect costs.

21.1.8.2 Pit Slope Stability

Pore pressure management system initial capital costs are estimated at $1.6 M to achieve pore pressure reduction needs required for adequate pit wall stability.

21.1.8.3 Mine Infrastructure

Mine infrastructure costs of $19.2 M have been carried for the mine infrastructure area, comprising the mine fuel storage and dispensing systems, service road to the area, and other miscellaneous mining related infrastructure.

21.1.9 Process Plant

The capital cost estimate for the process plant included provision for all mechanical and electrical equipment, as well as quantities for bulks such as earthworks, concrete, steel, piping, electrical and instrumentation.

21.1.10 Tailings Management Facility

The capital cost estimate for the TMF included provision for constructing the initial starter dam of the TMF to an elevation of 830 m, which is sufficient to store the first year of tailings production. The TMF would be constructed using waste rock material for the adjacent WRF and compacted in 1 m lifts. As the rock is already being delivered to the WRF, no allowance was provided for spreading and compacting the material as it is assumed that the dozers already on the WRF will handle that activity and the 1m lifts would be track packed by haul truck traffic.

An allowance as made for excavating the overburden encountered beneath the starter dam footprint and portions of the WRF. This material will be stockpiled and used in reclamation activities at the end of mine life. Costs were estimated for the general foundation preparation within the footprint of the tailings impoundment in advance of the liner placement. Supply and installation of the geotextile and LLDPE geomembrane was only considered in the capital cost estimate for placement up to the starter dam elevation of 830m.

The storage capacity of the TMF will be increased through three additional raises of the dam in years 1, 4 and 7 to an ultimate elevation of 890 m. Sustaining capital has been estimated for each of these raises to accommodate construction of access roads around the TMF, placement of underliner material and installation of geosynthetics.

21.1.11 HDS Water Treatment Plant

Costs for major equipment items were based on vendor budgetary quotations solicited specifically for the project feasibility study. Costs for other equipment were scaled from recent (Q4 2019) vendor budgetary quotations.

A factor-based methodology was used to estimate the total capital investment for the HDS WTP. The factors used to convert the delivered equipment costs to total fixed capital investment are based on estimating norms established using experience from past projects. The cost estimate includes a 1,600 m^2 heated building. A 20% contingency was applied to the capital cost estimate.

21.1.12 Sustaining Capital and Closure Costs

Sustaining capital costs include expenditure related to additions to the truck mining fleet, to replace equipment beyond its manufacturer's recommended service life, processing plant equipment, onsite infrastructure (largely comprising the cost of the SeWTP towards the end of the mine life) and miscellaneous indirect costs. In addition, sustaining costs are carried for the three TMF dam raises. However, costs associated with placement and compaction of the material for dam raises, being achieved through building up of the WRF, are captured as mining operating costs.

Table 21-5 summarizes the sustaining capital and closure costs. Further details related to the closure cost total are provided in Section 20.4.1.3.

Table 21-5 Sustaining Capital and Closure Costs

	Sustaining Capital (US$M)
Mining	15.3
Process	1.3
Tailings	25.1
Onsite Infrastructure	50.4
Indirects	13.8
Contingency	8.0
Total Sustaining Capital	**113.8**
	Closure Cost (US$M)
Closure Costs	**205.4**

21.2 Operating Cost Estimate

21.2.1 Operating Cost Summary

An average operating cost was estimated for the Arctic Project based on the proposed mining schedule. These costs included, mining, processing, G&A, surface services, and road toll costs. The average LOM operating cost for the Arctic Project is estimated to be $50.65/t milled.

The processing plant throughput is designed to operate at approximately 10,000 t/d, or 3,650,000 t/a. The proposed mining schedule ramps up in Year 1 and ramps down in Year 12 resulting in a LOM average of approximately 3,620,000 t processed per year. Total throughput is estimated to be 43,443,000 t over the 12-year LOM. The breakdown of costs in Table 21-6 is based on the average LOM annual mill feed rate.

Table 21-6 Overall Operating Cost Estimate

Description	LOM Average Unit Operating Cost ($/ t milled)	Percentage of Total Annual Operating Costs
Mining*	18.48	36%
Processing	18.31	36%
G&A	5.15	10%
Surface Operations	0.68	1%
Road Toll and Maintenance	8.04	16%
Total Operating Cost	**50.65**	**100%**

*Excludes pre-production costs.

21.2.2 Mining Operating Cost Estimate

Mining operating costs average $2.76/primary tonne mined including stockpile rehandling. Excluding the preproduction period, the average mining cost is $2.89/t. Total tonnes moved includes 0.31 Mt of stockpile rehandle and 341.8 Mt of primary production. During PP -2 and PP-1, the mining costs below average due to the short hauls and high mining rates. In Year 1, mining costs increase as the haul cycles increase with the deepening of the Phase 1 and Phase 2 laybacks and the mining of the upper zones of Phase 3. Mining costs then decrease in Year 2 as a new exit from the pit is used, decreasing the haulage distances. There is a steady increase in the following four years as Phase 1, 2 and 3 start deepening. A decrease in mining costs occurs in Year 6 caused by the completion of Phase 1 mining and the use of a new exit closer to the crusher. After Year 7, only Phase 3 is mined and the cost increases with the deepening of the final pit phase and a reduction in total tonnes mined. Table 21-7 shows the projected mining operating costs per period.

Table 21-7 Life of Mine Mining Cost

Period	Mining Cost	Primary Production		Total Mined[1]	
	$US (000's)	(kt)	US$/t	(kt)	US$/t
PP -2	61.2	28,200	2.17	28,200	2.17
PP -1	79.9	36,148	2.21	36,148	2.21
Year 1	95.6	36,425	2.63	36,740	2.60
Year 2	81.2	34,211	2.37	34,211	2.37
Year 3	84.4	31,633	2.67	31,633	2.67
Year 4	74.1	27,223	2.72	27,223	2.72
Year 5	73.3	26,465	2.77	26,465	2.77
Year 6	66.7	25,615	2.60	25,615	2.60
Year 7	70.0	23,750	2.95	23,750	2.95
Year 8	67.6	20,581	3.28	20,581	3.28
Year 9	59.2	17,236	3.43	17,236	3.43
Year 10	52.9	15,572	3.39	15,572	3.39
Year 11	45.2	11,714	3.86	11,714	3.86
Year 12	32.6	6,981	4.67	6,981	4.67
Total	**944.0**	**341,754**	**2.76**	**342,068**	**2.76**

Note: Figures may not sum due to rounding.

1. Total Material Mined includes low-grade stockpile rehandle.
2. Pre-production operating costs are capitalized and included in the initial capital costs.

21.2.3 Processing Operating Cost Estimate

The LOM average process operating cost is $18.31/t milled. This estimated unit cost was based on the designed 10,000 t/d throughput rate. Table 21-8 summarizes the processing operating cost estimates.

Table 21-8 Summary of Processing Operating Cost Estimates

Description	Annual Operating Costs ($M)	Annual Operating Costs ($/t milled)
Plant Operations Labour	9.63	2.64
Plant Maintenance Labour	11.44	3.13
Power Supply (Mill and Tailings)	29.86	8.18
Processing Consumables	12.47	3.42

Description	Annual Operating Costs ($M)	Annual Operating Costs ($/t milled)
Maintenance Supplies	3.13	0.86
Light Vehicles & Mobile Equipment	0.29	0.08
Total (Processing)	66.82	18.31

Plant operations labour costs were estimated to be $2.64/t milled and plant maintenance labour costs is estimated to be $3.13/t milled. The estimated labour force for plant operations and plant maintenance was estimated at 71 and 82 people respectively. Annual salaries and wages were supplied by Trilogy Metals. The estimate was based on providing a labour force to support continuous operations at 24 hr/d, 365 d/a.

The power supply cost of $8.18/t milled was based on an average use of 126,008 MWh per year and an energy price of $0.237/kWh for electric power generated on site.

Processing consumables costs included primary crushing liners and screens, grinding media, reagents, and other plant consumables. Consumable rates were estimated based on obtained quotes from suppliers. All costs included freight charges to site.

Annual maintenance supplies costs were estimated as a percentage of major capital equipment costs plus an allowance for freight charges.

21.2.4 General and Administrative and Surface Services Cost Estimates

The LOM average G&A costs were estimated to be $5.15/t milled. These estimated costs were developed with Trilogy Metals and Ausenco and include:

- Labour cost for the 60 administrative staff (30 hourly, and 30 salaried), with approximately 42 of these administrative staff onsite at any given time. These numbers included the 16 personnel (15 hourly and 1 salaried) surface operations crew.
- Service cost for safety, training, medical and first aid expenditure, computer supplies and software, human resources services, and entertainment/membership.
- Asset operations costs including operating vehicles, and warehouse costs.
- Contract services expenditures, including insurance, consulting, relocation expenses, recruitment, auditing and legal services.
- Camp costs and personnel transport.
- Operation and maintenance of the airport.
- Other costs, including liaisons to local communities, sustainability costs, and an allowance for regional taxes and licenses.

Table 21-9 shows a summary of the G&A cost estimates.

Table 21-9 G&A Cost Estimates

Cost Description	Annual Costs ($ M)	Average Unit LOM Cost ($/t)
Labour Costs – Salaried Staff	4.4	1.19
Labour Costs – Hourly Staff	4.0	1.14

Cost Description	Annual Costs ($ M)	Average Unit LOM Cost ($/t)
Airport Operation	0.1	0.04
General Office Expense	0.1	0.03
Medical and First Aid	0.1	0.03
Environment	0.2	0.04
Travel	0.1	0.03
Training and Safety	0.2	0.04
Computer Supplies Including Software	0.1	0.03
Entertainment/Membership	0.05	0.01
Vehicles	0.3	0.07
Warehouse	0.2	0.05
Communications	0.4	0.11
Insurance	2.0	0.55
Consulting/External Assays	0.05	0.01
Relocation Expense	0.02	0.01
Recruitment	0.02	0.01
Audit	0.1	0.03
Legal Services	0.05	0.01
Rotational Travel and Camp	6.1	1.67
Liaison Committee/Sustainability	0.1	0.03
Other	0.1	0.03
Total (G&A)	**18.8**	**5.15**

The surface operations costs are estimated to be $0.68/t milled. These costs include:

- Asset operations including heating, site services for general maintenance, general road maintenance, and ground transportation.
- Operation (labour, reagents, power) and maintenance costs for the HDS WTP (annual maintenance costs were estimated as 5% of the capital cost) during plant operation, and those for the SeWTP in the final year of production. Operating costs for these two water treatment plant post-closure are captured under closure costs.
- Other expenses including road dust suppression.

Table 21-10 shows the surface services cost estimates.

Table 21-10 Surface Services Cost Estimates

Cost Description	Annual Costs ($ M)	Average Unit LOM Cost ($/t)
Surface Equipment	0.4	0.10
Water Treatment	2.0	0.55
Other	0.1	0.03
Total (Surface Services)	**$2.5**	**0.68**

21.2.5 Road Toll Cost Estimate

Trilogy Metals will pay road toll costs to use the AMDIAP that is proposed to be built by AIDEA. AIDEA anticipates that there will be multiple users of the access road for multiple purposes with significantly different levels of use. These variables make it difficult to accurately project, at this time, what the estimated road toll will be for the Arctic Project. Trilogy Metals provided Ausenco with the company's view of the likely costs.

There is currently no developed surface access to the Arctic Project area and beyond. Access to the Arctic Project is proposed to be via AMDIAP, a road approximately 340 km (211 miles) long, extending west from the Dalton Highway where it would connect with the proposed Arctic Project area. The final terminal for the road has not yet been determined. Although the construction costs of the road are not yet final, an estimate of approximately $449 million less funding by Ambler Metals of $35 million has been used in the 2020 FS. Trilogy has been in discussions with AIDEA , and AIDEA have been investigating alternatives to reduce the cost to construct the AMDIAP, the final cost of the road could be lower or higher. The working assumption of the 2020 FS was that AIDEA would arrange financing in the form of a public-private partnership to construct and arrange for the construction and maintenance of the access road. AIDEA would charge a toll to multiple mining and industrial users (including the Arctic Project) in order to pay back the costs of financing the AMDIAP. This model is very similar to what AIDEA undertook when the DeLong Mountain Transportation System (also known as the Red Dog Mine Road and Port facilities) were constructed in the 1980s. The amount paid in tolls by any user would be affected by the cost of the road, its financing structure, and the number of mines and other users of the road which could also include commercial transportation of materials and consumer items that would use the AMDIAP to ship concentrates to the Port of Anchorage in Alaska and possibly provide goods and commercial materials to villages in the region.

For the purposes of the 2020 FS, Trilogy Metals reviewed AMDIAP development costs presented to the AIDEA board in December 2019. Although the final toll payments will be negotiated with AIDEA and the public-private partnership owners of the access road sometime in the future, Trilogy has assumed that a toll would be paid based on the Arctic Project being one of four potential projects identified by AIDEA to use the road. Based on all these factors, the FS assumes Arctic is paying $20 million each year for its 12-year mine life. In addition, a road maintenance fee of $2.52/t milled processed has been assumed. The toll payments are assumed in the 2020 FS to commence in Year 1 of production.

The toll payments equate to a LOM unit cost of $5.52/t milled, resulting in a total road toll and maintenance LOM unit cost of $8.04/t milled.

22 Economic Analysis

22.1 Forward-Looking Information Cautionary Statements

The results of the economic analyses discussed in this section represent forward-looking information as defined under Canadian securities law. The results depend on inputs that are subject to several known and unknown risks, uncertainties, and other factors that may cause actual results to differ materially from those presented herein. Information that is forward-looking includes the following:

- Proven and Probable Mineral Reserves that have been modified from Measured and Indicated Mineral Resource estimates.
- Assumed commodity prices and exchange rates.
- Proposed mine and process production plan.
- Projected mining and process recovery rates.
- Ability to market the three types of concentrate on favourable terms.
- Ability to control the levels of deleterious elements expected in some of the concentrate batches.
- Sustaining costs and proposed operating costs.
- Assumptions as to closure costs and closure requirements, including WTP requirements.
- Assumptions as to development of the AMDIAP, timeframe of such development, and assumed toll charges.
- Assumptions as to ability to permit the project.
- Assumptions about environmental, permitting, and social risks.

Additional risks to the forward-looking information include:

- Changes to costs of production from what is assumed.
- Unrecognised environmental risks.
- Unanticipated reclamation expenses.
- Unexpected variations in quantity of mineralization, grade or recovery rates.
- Geotechnical or hydrogeological considerations during operations being different from what was assumed.
- Failure of mining methods to operate as anticipated.
- Failure of plant, equipment or processes to operate as anticipated.
- Changes to assumptions as to the generation of electrical power, and the power rates used in the operating cost estimates and financial analysis.
- Ability to maintain the social licence to operate.
- Accidents, labour disputes and other risks of the mining industry.

- Changes to interest rates.
- Changes to tax rates.
- Changes to applicable laws.
- Receipt of all required permits.

22.2 Methodology

- An economic model was developed to estimate annual pre-tax and post-tax cash flows and sensitivities of the project based on a 8% discount rate.
- Calendar years used in the economic analysis are provided for conceptual purposes only. Permits still must be obtained in support of operations; and approval to proceed is still required from Trilogy Metal's Board of Directors.

22.3 Inputs to the Cash Flow Model

The Project will consist of a three-year pre-production construction period, followed by 12 years of production. The NPV and IRR were calculated at the beginning of the construction period in Year -3. All currency is in US dollars (US$) unless otherwise stated.

The cost and revenue estimates were assembled using real dollars, treating Year-3 as the base year. No escalation was applied to any of the estimates beyond this date.

The long-term consensus metal price assumptions were included in Section 19.1.

The LOM material tonnages and payable metal production used in the cash flow model are included in Table 22-1.

Table 22-1 Mine and Payable Metal Production for the Arctic Mine

Description	Units	Value
Total Tonnes Mined	ktonnes	342,068
Mill Feed	ktonnes	43,443
Concentrate		
Cu Concentrate	ktonnes	2,892
Zn Concentrate	ktonnes	2,077
Pb Concentrate	ktonnes	339
Payable Metal		
Payable Cu	'000'lb	1,864,427
Payable Zn	'000'lb	2,304,277
Payable Pb	'000'lb	388,406
Payable Au	'000'oz	386
Payable Ag	'000'oz	40,586

22.4 Basis of Pre-Tax Financial Evaluation

The pre-tax financial model incorporated the production schedule and smelter term assumptions to produce annual recovered payable metal, or gross revenue, in each concentrate stream by year. Off-site costs, including the applicable refining and treatment costs, penalties, concentrate transportation charges, and marketing and representation fees, and royalties were then deducted from gross revenue to determine the NSR. Further details of the smelter terms used to calculate the recovered metal value and off-site operating costs can be found in Section 19. Royalties are discussed in Section 4.

The operating cash flow was produced by deducting annual mining, processing, G&A, surface services, and road toll charges from the NSR.

Initial and sustaining capital was deducted from the operating cash flow in the years they occur, to determine the net cash flow before taxes.

Initial capital cost included all estimated expenditures in the construction period, from Year -3 to Year -1 inclusive. First production would occur at the beginning of Year 1. Sustaining capital expenditure includes all capital expenditures purchased after first production, including mine closure and rehabilitation.

Under the NANA Agreement, NANA has the right, following a construction decision, to elect to purchase a 16% to 25% direct interest in the Arctic Project or, alternatively, to receive a 15% Net Proceeds Royalty (refer to Section 4). This financial analysis was carried out on a 100% ownership basis and does not include any future potential impact on the Project interest if NANA elects to purchase an interest of between 16% and 25% in the Arctic Project under the NANA Agreement or, alternatively, the impact on the Project interest if the 15% net proceeds royalty becomes applicable. The financial analysis does include the 1.0% NSR to be granted to NANA under the NANA Agreement in exchange for a surface use agreement.

The financial analysis was carried out on a 100% ownership basis, of which Trilogy's share is 50%.

22.5 Pre-Tax Financial Results

A summary of the pre-tax financial results is provided in Table 22-2. The presentation is on a 100% Project basis. Trilogy Metals holds a 50% interest in Ambler Metals.

Table 22-2 Summary of Pre-Tax Financial Results

Description	Unit	LOM Value
Recovered Metal Value		
Copper	US$ million	5,593.3
Lead	US$ million	388.4
Zinc	US$ million	2,534.7
Gold	US$ million	501.8
Silver	US$ million	730.6
Total Recovered Metal Value	US$ million	9,748.7
Off-Site Operating Costs		
Royalties, Refining and Treatment Charges, Penalties, Insurance, Marketing and Representation & Concentrate Transportation	US$ million	2,555.5
On-Site Operating Costs		
Mining	US$/t milled	18.48
Processing	US$/t milled	18.31

Description	Unit	LOM Value
G&A	US$/t milled	5.15
Surface Service	US$/t milled	0.68
Road Toll	US$/t milled	8.04
Total Operating Cost	US$/t milled	50.65
Total Operating Cost	US$ million	2,200.5
Capital Expenditure		
Initial Capital	US$ million	905.6
Sustaining Capital	US$ million	113.8
Mine Closure & Reclamation	US$ million	205.4
Total Capital Expenditure	US$ million	1,224.7
Financial Summary		
Pre-tax Undiscounted Cash Flow	US$ million	3,768.0
Pre-Tax NPV at 8%	US$ million	1,550.9
Cash Costs, Net of By-product Credits	$US/lb Cu payable	0.32
All-in Cost, Net of By-product Credits	$US/lb Cu payable	0.98
Pre-Tax IRR	%	30.8
Pre-Tax Payback Period	years	2.4

22.6 Post-Tax Financial Analysis

The following tax regimes were incorporated in the post-tax analysis as provided by EY: US Federal Income Tax, Alaska State Income Tax (AST), and Alaska Mining License Tax (AMLT). Taxes were calculated based on currently enacted United States and State of Alaska tax laws and regulations, including the US Federal enactment of the Tax Cuts & Jobs Act (TCJA) on December 22, 2017 and the Coronavirus Aid, Relief and Economic Security Act (CARES Act) on March 27, 2020.

The Alaska Production Royalty tax of 3% is not applicable to the Project as the Project's claims are all federal mining patented claims.

22.6.1 US Federal Tax

For tax years beginning on or after January 01, 2018, the US Federal income tax corporate rate is 21% of taxable income, as opposed to a 35% rate which was applicable to prior tax years. Taxable income is calculated as revenues less allowable costs. In addition to other allowable costs, Alaska State Income Tax, AMLT, tax depreciation and the greater of the cost depletion or percentage depletion can be deducted. Cost depletion is the ratable recovery of cost basis as units are produced and sold. IRC §613(a) governs percentage depletion and provides that the deduction for depletion shall be a statutorily prescribed percentage of the taxpayer's gross income from the mineral property during the taxable year. Such allowance shall not exceed 50% of the taxpayer's taxable income from the property that is mining related. Relevant statutorily prescribed percentages are 15% for gold, silver and copper, and 22% for lead and zinc. As a result of the TCJA, losses incurred for tax years beginning on or after January 01, 2018 are not eligible to be carried back to prior tax years but may be carried forward indefinitely. However, losses generated under the TCJA are only eligible to offset 80% of taxable income in future years.

For the purposes of this Report, as a stand-alone project, it was assumed that the initial adjusted cost base of the depletable and depreciable property was zero and that the initial loss carry-forwards were zero.

22.6.2 Alaska State Tax

Alaska State Taxes (AST) are determined on a basis similar to US federal tax. AST is calculated using a graduated rate table times taxable income with 9.4% being the highest applicable rate, where taxable income is calculated on the same basis as US federal tax (except that State tax is not deductible). The Alaskan AMT statutes are tied to the federal AMT statutes; therefore, the repeal of federal corporate AMT has effectively repealed Alaskan State AMT for tax years beginning on or after January 1, 2018.

22.6.3 Alaska Mining License Tax

The Alaska Mining Licence Tax (AMLT) is an income-based tax imposed on the mining income calculated for AST purposes, before any deduction of AMLT, except the percentage depletion is the lower of 15% of net metal revenues and 50% of net income before depletion. No loss carry-forwards or carry-backs are applied when calculating income subject to AMLT. No AMLT tax is charged for the first 3.5 years following commencement of production. In each year, AMLT can be reduced by up to 50% through the application of “Exploration Incentive Credits” (EICs); however, the credits may not exceed $20m in the aggregate for a mining operation and the credits must be utilized within 15 years. Note the EICs can be utlized against AST as well.

For the purposes of this Report, as a stand-alone project evaluated at the project level, it was assumed that the initial EIC balance is zero even though the Trilogy Metals has a history of exploration at the Project. It was also assumed that no EICs would be earned over the life of the Arctic Project.

22.6.4 Post-Tax Financial Results

At the base case metal prices used for the Report, the total estimated taxes payable on the Arctic Project profits are $924.7 million over the 12-year mine life.

The post-tax financial results are summarized in Table 22-3. The presentation is on a 100% Project basis. Trilogy Metals holds a 50% interest in Ambler Metals.

Table 22-3 Summary of Post-Tax Financial Results

Description	Unit	LOM Value
Financial Summary		
Income Tax	US$ million	924.7
Post-Tax Undiscounted Cash Flow	US$ million	2,843.4
Post-tax NPV at 8%	US$ million	1,134.7
Post-Tax IRR	%	27.1
Post-Tax Payback Period	years	2.6

22.7 Cash Flow

The annual production schedule and estimated cash flow forecast for the Arctic Project can be found in Table 22-4. The presentation is on a 100% Project basis. Trilogy Metals holds a 50% interest in Amber Metals.

Table 22-4 Pre and Post-Tax Arctic Project Production and Cash Flow Forecast

Arctic Project	Units	LOM	Yr -3	Yr -2	Yr -1	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12
Mine Production																	
Total Tonnes Mined	ktonnes	342,068	-	28,200	36,148	36,740	34,211	31,633	27,223	26,465	25,615	23,750	20,581	17,236	15,572	11,714	6,981
Mill Feed	ktonnes	43,443	-	-	-	3,478	3,650	3,650	3,650	3,649	3,650	3,650	3,650	3,650	3,650	3,650	3,464
Cu	%	2.24	-	-	-	2.49	2.15	1.99	2.08	2.10	2.17	2.26	2.28	2.61	2.43	2.30	2.07
Zn	%	3.12	-	-	-	3.02	2.89	2.82	3.00	3.03	2.82	2.65	3.47	3.90	3.26	3.42	3.21
Pb	%	0.54	-	-	-	0.50	0.54	0.48	0.50	0.55	0.51	0.44	0.58	0.64	0.54	0.57	0.67
Au	g/t	0.47	-	-	-	0.40	0.46	0.36	0.39	0.45	0.46	0.45	0.51	0.56	0.55	0.52	0.52
Ag	g/t	34.69	-	-	-	35.02	32.99	27.86	28.04	29.46	31.82	32.56	37.84	44.49	39.41	37.94	39.10
Concentrate																	
Cu Concentrate	ktonnes	2,892	-	-	-	256.9	232.9	215.5	225.3	227.4	235.0	244.8	246.9	282.7	263.1	249.1	212.8
Cu Recovery	%	89.9	-	-	-	89.9	89.9	89.9	89.9	89.9	89.9	89.9	89.9	89.9	89.9	89.9	89.9
Cu Concentrate Grade	%	30.30	-	-	-	30.30	30.30	30.30	30.30	30.30	30.30	30.30	30.30	30.30	30.30	30.30	30.30
Cu Payable	%	96.5	-	-	-	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
Ag Concentrate Grade	g/t	138	-	-	-	138	138	138	138	138	138	138	138	138	138	138	138
Ag Payable	%	90.0	-	-	-	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Zn Concentrate	ktonnes	2,077	-	-	-	160.7	161.4	157.5	167.6	169.2	157.5	148.0	193.8	217.9	182.1	191.0	170.2
Zn Recovery	%	90.60	-	-	-	90.60	90.60	90.60	90.60	90.60	90.60	90.60	90.60	90.60	90.60	90.60	90.60
Zn Concentrate Grade	%	59.2	-	-	-	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2
Zn Payable in Concentrate	%	85.0	-	-	-	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0
Pb Concentrate	ktonnes	339	-	-	-	25.0	28.3	25.2	26.2	28.8	26.7	23.1	30.4	33.6	28.3	29.9	33.3
Pb Recovery	%	79.0	-	-	-	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0
Pb Concentrate Grade	%	55.0	-	-	-	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
Pb Payable	%	55.0	-	-	-	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
Ag Concentrate Grade	g/t	2,806	-	-	-	2,806	2,806	2,806	2,806	2,806	2,806	2,806	2,806	2,806	2,806	2,806	2,806
Ag Payable	%	95.0	-	-	-	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
Au Concentrate Grade	g/t	37.3	-	-	-	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3
Au Payable	%	95.0	-	-	-	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.	95.0

Arctic Project	Units	LOM	Yr -3	Yr -2	Yr -1	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12
Payable Metal																	
Payable Cu	'000'lb	1,864,427	-	-	-	165,634	150,106	138,917	145,211	146,573	151,503	157,773	159,177	182,217	169,620	160,543	137,152
Payable Zn	'000'lb	2,304,277	-	-	-	178,327	179,109	174,748	185,916	187,732	174,772	164,222	215,047	241,698	201,999	211,909	188,798
Payable Pb	'000'lb	388,406	-	-	-	28,635	32,459	28,849	30,053	33,051	30,656	26,446	34,862	38,469	32,452	34,255	38,220
Payable Au	'000'oz	386	-	-	-	28	32	29	30	33	30	26	35	38	32	34	38
Payable Ag	'000'oz	40,586	-	-	-	3,167	3,356	3,017	3,146	3,379	3,230	2,954	3,592	4,005	3,477	3,555	3,707
Contained Metal Value																	
Contained Metal Value	US$ M	9,748.7	-	-	-	815.7	782.1	729.4	765.7	782.8	775.2	767.8	858.7	972.8	868.0	857.2	773.4
Off-Site Charges																	
Off-Site Charges*	US$ M	2,555.5	-	-	-	211.3	203.5	191.8	201.9	205.5	201.3	198.1	227.7	257.7	227.2	226.8	202.7
Capital Costs																	
Mining	US$ M	295.2	93.6	91.4	95.1	6.3	0.1	3.6	0.1	0.3	0.1	1.2	1.1	1.1	0.9	-	-
Crushing	US$ M	28.3	-	9.4	18.8	-	-	-	-	-	-	-	-	-	-	-	-
Processing	US$ M	117.9	-	58.6	58.0	-	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-	-	-
Tailings	US$ M	95.1	-	30.2	38.8	6.6	-	-	9.0	-	-	9.4	-	-	-	-	-
On-Site Infrastructure	US$ M	159.7	18.6	53.3	37.4	-	-	-	-	-	-	-	-	-	25.2	25.2	-
Off-Site Infrastructure	US$ M	53.7	16.7	20.9	16.0	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Costs	US$ M	144.5	43.7	45.2	41.8	-	-	-	-	-	-	-	-	-	6.8	6.8	-
Owner's Cost	US$ M	23.4	11.0	6.2	6.2	-	-	-	-	-	-	-	-	-	-	-	-
Mine Closure	US$ M	205.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	205.4
Contingency	US$ M	102.5	16.0	47.1	31.4	-	-	-	-	-	-	-	-	-	4.0	4.0	-
Total Capital Costs	US$ M	1,224.7	199.6	362.3	343.6	13.1	0.1	3.8	9.4	0.5	0.3	10.8	1.3	1.6	36.9	36.0	205.4
Operating Costs																	
Mining	US$ M	802.9	-	-	-	95.6	81.2	84.4	74.1	73.3	66.7	70.0	67.6	59.2	52.9	45.2	32.6
Processing	US$ M	795.3	-	-	-	63.7	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	63.4
Surface Operations	US$ M	29.4	-	-	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	6.9
G&A	US$ M	223.5	-	-	-	17.9	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	17.8
Road Toll & Maintenance	US$ M	349.4	-	-	-	29.5	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.1	28.7
Total Operating Costs	US$ M	2,200.5	-	-	-	208.7	198.0	201.2	190.9	190.1	183.5	186.8	184.4	176.0	169.6	162.0	149.4
Undiscounted Pre-Tax Cashflow	US$ M	3,768.0	(199.6)	(362.4)	(343.6)	382.6	380.6	332.7	363.5	386.8	390.0	372.0	445.3	537.5	434.2	432.4	215.9
Income Tax	US$ M	924.7	-	-	-	14.6	14.4	36.2	75.3	87.6	90.6	88.7	107.1	135.0	115.3	113.7	46.4
Undiscounted Post-Tax Cashflow	US$ M	2,843.4	(199.6)	(362.4)	(343.6)	368.0	366.3	296.5	288.1	299.2	299.4	283.4	338.3	402.5	319.0	318.8	169.6

* Costs include Royalties, Insurance, Marketing and Representation Fees, Refining, Treatment, Penalties, and Concentrate Transport

22.8 Sensitivity Analysis

Ausenco investigated the sensitivity of the Project's pre-tax NPV, and IRR to several project variables. The following variables were elected for this analysis:

- Copper price
- Zinc price
- Lead price
- Gold price
- Silver price
- Capital costs
- On-site operating costs
- Off-site operating costs (royalties, refining and treatment charges, penalties, insurance, marketing and representation fees, and concentrate transportation).

Each variable was changed in increments of 10% between -30% to +30% while holding all other variables constant. Figure 22-1 and Figure 22-2 show the results of the pre-tax sensitivity analysis.

The metal grade is not presented in these sensitivity graphs because the impacts of changes in the metal grade mirror the impact of changes in metal price.

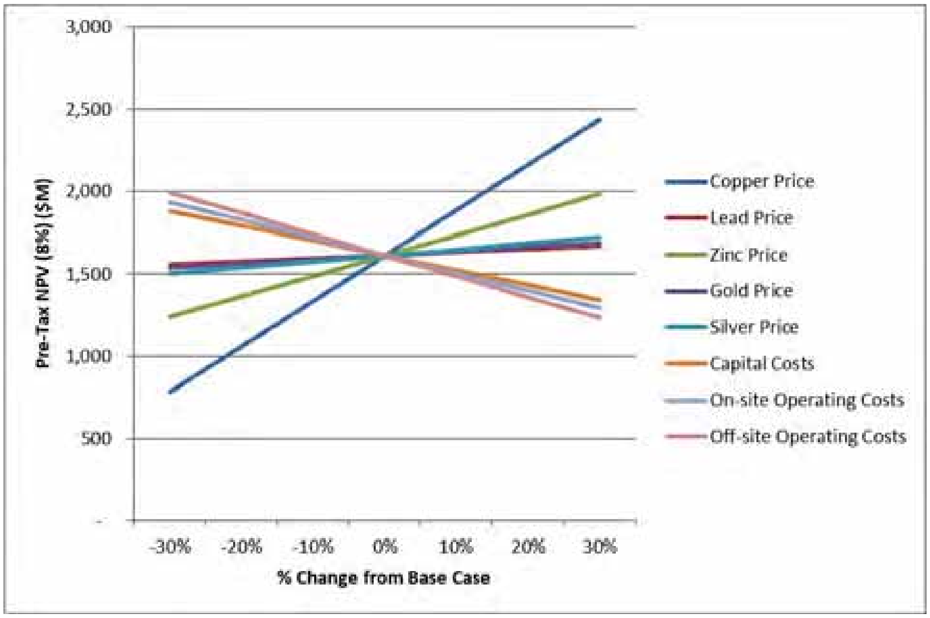


Figure 22-1 Pre-tax NPV Sensitivity Analysis (Ausenco, 2020)

As shown in Figure 22-1, the Project's NPV at an 8% discount rate is most sensitive to changes in copper price, followed by zinc price, off-site operating costs, on-site operating costs, capital costs, silver price, gold price, and lead price.

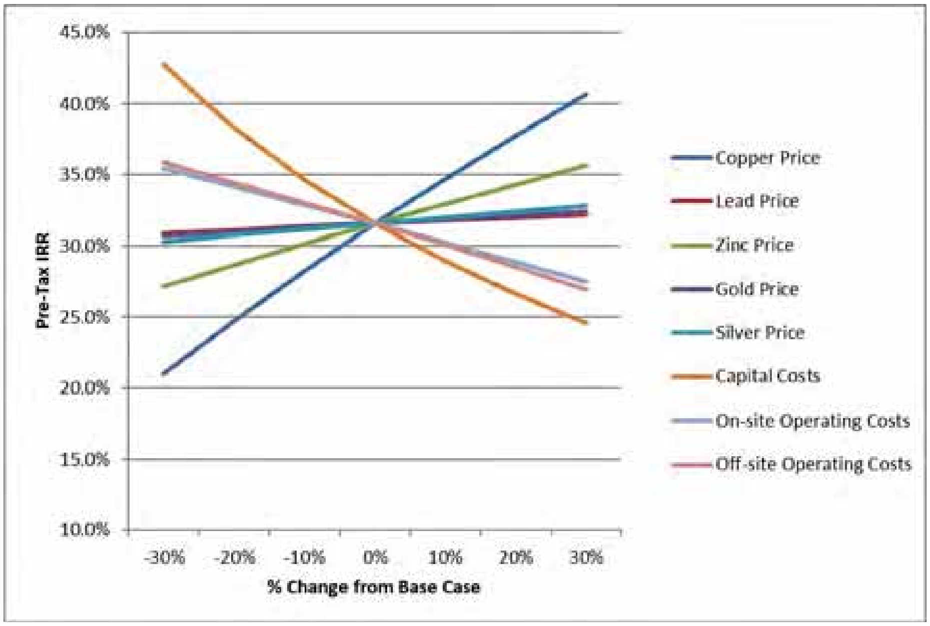


Figure 22-2 **Pre-tax IRR Sensitivity Analysis (Ausenco, 2020)**

As shown in Figure 22-2, the Project's IRR is most sensitive to changes in copper price and capital cost, followed by zinc price and off site operating costs, and in then decreasing order, on-site operating costs, silver price, gold price, and lead price.

22.9 Copper and Zinc Metal Price Scenarios

Metal price scenarios were completed to determine the effects of copper and zinc price on the Project's IRR, payback period and NPV at an 8% discount rate. In the first scenario the copper price was varied from $2.00/lb to $4.00/lb, while holding all other variables constant, the results of this scenario can be found in Table 22-5. The base case scenario is bolded in the table.

Table 22-5 **Pre-tax Copper Price Scenarios**

Variable	Unit	Copper Price ($/lb)				
		2.00	2.50	3.00	3.50	4.00
NPV at 8%	US$ million	629.9	1,090.4	**1,550.9**	2,011.4	2,471.9
IRR	%	18.8	25.1	**30.8**	36.1	41.1
Payback Period	Years	4.2	3.1	**2.4**	2.0	1.7

In the second scenario the zinc price was varied from $0.90/lb to $1.30/lb, while holding all other variables constant, the results of this scenario can be found in Table 22-6. The base case scenario is bolded in the table.

Table 22-6 **Pre-tax Zinc Price Scenarios**

Variable	Unit	Zinc Price ($/lb)				
		0.90	1.00	1.10	1.20	1.30
NPV at 8%	US$ million	1,325.9	1,438.4	**1,550.9**	1,663.4	1,775.9
IRR	%	28.2	29.5	**30.8**	32.1	33.4
Payback Period	years	2.7	2.6	**2.4**	2.3	2.2

23 Adjacent Properties

This section is not relevant to this Report.

24 Other Relevant Data and Information

24.1 Project Execution Plan

Key considerations for the execution of project are as noted below.

24.1.1 Constraints and Interfaces

The project will be an integrated development with several consultants contributing to the overall design process. Specialist contractors will most likely be engaged for specific packages, such as the Arctic access road, and the construction camps, generally on a “design and construct” basis.

It is essential that these parties work together to ensure data being used is both current and meaningful. Data transfer between parties shall be strictly controlled and in accordance with Document Control protocols.

The early design interfaces for the Project will include at least:

- Mine development
- Waste Rock placement and Tails Dam
- Project water management and treatment
- Arctic Access Road design and construction, in particular the pioneer road necessary to allow earliest possible access to the Mine pre-assembly construction site
- Pioneer, Construction and Permanent Camps.

The Interface Management procedures will be developed to ensure services at the battery limits are clearly defined and understood by all parties affected.

24.1.2 Key Project Milestones

Key project milestones will be developed once the project is committed to construction and the required permits are in hand.

The Mine requires nominally two years of pre-strip operations, tailings pond starter dam development and water accumulation before actual production mining operations can commence.

For that pre-strip work to start, the Arctic access road from the AMDIAP intersection to the mine site will have to be constructed to at least a pioneer road condition that will to allow the mine fleet and the support facilities to be delivered, built and made operational.

Tailings pond construction must be to a height to allow natural collection of water in quantities that will allow plant operations to commence.

24.1.3 Proven Technology

The Project will utilize proven technology and equipment that can be built, operated and maintained under adverse weather conditions

The Design Criteria, Technical Specifications and Data sheets shall reflect the location, the environmental and initial logistics constraints that may affect the procurement and construction effort.

24.1.4 Engineering, Procurement and Construction Management Approach

Two EPCM strategies have been identified that are structured to account for the abnormally long pre-strip mining operation. The first option is the basis for the capital and operating cost estimate.

24.1.4.1 Early Engineering Only with 2-Stage Procurement

There is a need to establish the mine facilities and assemble the Mine Fleet in time to allow the pre-strip operation to start some two years before the Process Plant receives its first ore. This means that there will be a significant amount of detailed engineering requiring completion well in advance of the time required for conventional engineering, procurement and construction of just the process plant and supporting infrastructure. This has been assessed as requiring detailed engineering to start some four years before the process plant starts production.

In particular, the pioneer access road design and contracts and civil design for the Mine Support facilities will be required early in the schedule. By default, the rest of the civil design would need to attach to that early works for simple plant layout and construction coordination purposes. For that to occur the plant layout will be required to be frozen a lot earlier than normal. That in turn is dependent on sizing and selection of the major process equipment items and the receipt of certified vendor data.

Effectively, the detailed design phase will need to follow the conventional approach and run its course but started at a time that meets the early works schedule requirements. Everything other than the mine support facilities will be designed some two years in advance of when it is needed

With the early equipment order placement, the supply phase could become inordinately long, extending over three years in most cases, when in fact the equipment is not likely to be needed until the last eighteen months prior to plant start-up.

An unorthodox but proven option to this extended design, supply and construction schedule is to have the EPCM Contractor buy the major equipment in two steps:

- Step 1: Buy only the vendor certified engineering data to allow detailed engineering to continue to completion but hold the manufacturing functions until later in the overall schedule, effectively a delay of around twelve to fifteen months.
- Step 2: Based on agreed vendor manufacturing durations, apply a “late” release of the equipment for manufacture with deliveries effectively becoming a “Just-in Time” logistics operation.

This strategy provides the following advantages:

- Engineering can start and continue to completion using critical certified vendor data without the need for an extended “standby” involvement.
- Procurement functions can work in parallel with the engineering group with no disconnect between the two disciplines.
- The Procurement team can generally disband early in the schedule with just key personnel retained to provide continuity of support.
- The expediting team can mobilise later in the schedule to drive manufacture and delivery in a concerted campaign.
- Equipment deliveries can be orchestrated to suit the conditions at the time with everything consolidated into a transit compound for coordinated shipping to site.

- Reduced cashflow demands.

The disadvantages with this approach are:

- The vendors need to be clearly briefed as to what the system means to their manufacturing schedule.
- A payments formula needs to be in place to account for a delayed delivery strategy.
- Some vendors have difficulty in determining just what their actual engineering costs are.

24.1.4.2 Early EPCM Leading to Plant Care and Maintenance

Under this approach, the EPCM would work to conventional design and construction schedule, starting to suit the Mine access requirements but following on to completion without interruption. That would bring the total process plant and supporting infrastructure to a mechanical completion condition nominally twelve to fifteen months before it is able to start work.

The plant could not be commissioned through lack of ore and would have to be placed into care and maintenance mode until ore became available. This has an inherent advantage in that if the pre-strip operation was completed earlier than scheduled, and sufficient water is accumulated, the plant operations would be able to take advantage of the fact the plant was already mechanically complete. The care and maintenance requirements in that environment for that duration will require close assessment.

25 Interpretation and Conclusions

25.1 Introduction

The QPs note the following interpretations and conclusions in their respective areas of expertise, based on the review of data available for this Report.

25.2 Mineral Tenure, Surface Rights, Royalties and Agreements

Information from legal experts supports that the mining tenure held is valid and is sufficient to support declaration of Mineral Resources and Mineral Reserves.

Kennecott holds a 1% NSR royalty that is purchasable at any time for a one-time payment of $10 million. This royalty covers the patented federal mining claims and many, but not all, of the State mining claims.

The NANA Agreement granted to NovaCopper US certain rights, for consideration, which include an exclusive right to explore for minerals and a nonexclusive right to enter upon and use certain NANA lands for various purposes including access to NovaCopper's Ambler mining properties. The NANA Agreement further provides that if NovaCopper completes a Feasibility Study and a Draft Environmental Impact Statement for a project to develop the Ambler properties, NANA will become entitled elect to purchase an interest in the project by exercising a back-in right to acquire an undivided interest of between 16% and 25% (at NANA's option) of the mining project. If this back-in right were to be exercised by NANA the two parties would form a Joint Venture to proceed with the project. The Joint Venture would lease the mining properties from NovaCopper US Inc. in exchange for a 1% NSR royalty and NANA would enter into a surface use agreement with the Joint Venture in exchange for a 1% NSR royalty. In the alternative, should NANA elect not to exercise this back-in right, the Joint Venture would not be formed and NANA would instead become entitled to a 15% net proceeds royalty. As noted above, this agreement has been assigned to Ambler Metals.

The owner of a State mining claim or lease will be obligated to pay a production royalty to the State of Alaska in the amount of 3% of net income received from minerals produced from the State mining claims.

25.3 Geology and Mineralization

The Arctic deposit is considered to be an example of a VMS system.

Knowledge of the deposit settings, lithologies, mineralization style and setting, and structural and alteration controls on mineralization is sufficient to support Mineral Resource and Mineral Reserve estimation.

25.4 Exploration, Drilling and Analytical Data Collection in Support of Mineral Resource Estimation

The quantity and quality of the lithological, geotechnical, collar and downhole survey data collected in the exploration and infill drill programs conducted is sufficient to support Mineral Resource and Mineral Reserve estimation.

Analytical and density data are suitable to support Mineral Resource and Mineral Reserve estimation.

NovaGold, NovaCopper and Trilogy Metals sample security procedures met industry standards at the time the samples were collected. Current sample storage procedures and storage areas are consistent with industry standards.

Data collected have been sufficiently verified that they can support Mineral Resource and Mineral Reserve estimation and be used for mine planning purposes.

25.5 Metallurgical Testwork

Metallurgical studies have spanned over 30 years.

Testwork conducted prior to 2012 is considered relevant to the project, but predictive metallurgical results are considered to be best estimated from testwork conducted on sample materials obtained from exploration work under the direction of Trilogy Metals conducted in 2012 and 2017.

To the extent known, the metallurgical samples are representative of the styles and types of mineralization and the mineral deposit as a whole.

The LOM average mill feed is expected to contain 2.24% Cu, 3.12% Zn, 0.54% Pb, 0.47 g/t Au, and 34.69 g/t Ag.

Concentrate quality test results indicated that key penalty elements, as well as precious metals are typically concentrated into a lead concentrate, leaving the copper concentrate of higher than expected quality given the levels of impurities seen in the test samples. The lead concentrate may have penalties for the high arsenic and antimony concentrations seen in the results of this testwork. Precious metal deportment into a lead concentrate is very high and should benefit the payable levels of precious metals at a smelter. Silicon dioxide and fluoride assays should be conducted on the concentrates to determine whether or not they are higher than the penalty thresholds.

Talc will be managed through a pre-float step.

In general, the flowsheet developed in the 2012 test program and further tested in the 2017 testwork program at ALS Metallurgy is feasible for the Arctic deposit mineralization. Further metallurgical testwork is recommended on representative samples to confirm and optimize the flowsheet and better understand the impact of talc levels in the process feed samples. Lead concentrate quality can be impacted by the level of talc in the process feed and a better understanding of the level of talc in an expected process feed is critical in maximizing the value of a lead concentrate. There are no outstanding metallurgical issues related to the production of a copper or zinc concentrate from all of the materials tested.

25.6 Mineral Resource Estimates

Mineral Resources have been prepared using industry-standard methods and software.

Mineral Resources have had reasonable prospects of eventual economic extraction considerations applied and assume an open pit mining method.

Mineral Resources are prepared in accordance with the 2014 CIM Definition Standards.

Factors that may affect the Mineral Resource estimate include: Metal price and exchange rate assumptions; changes to the assumptions used to generate the CuEq cut-off grade that constrains the estimate; changes in local interpretations of mineralization geometry and continuity of mineralized zones; changes to geological and mineralization shapes, and geological and grade continuity assumptions; density and domain assignments; changes to geotechnical, mining and metallurgical recovery assumptions; changes to the input and design parameter assumptions that pertain to the conceptual pit constraining the estimates; assumptions as to concentrate marketability, payability and penalty terms; assumptions as to the continued ability to access the site, retain mineral and obtain surface rights titles, obtain environment and other regulatory permits, and maintain the social license to operate; and assumptions as to future site access.

25.7 Mineral Reserve Estimates

The 2020 FS mine plan is based on Probable Mineral Reserves resulting from modifying factors being applied to a subset of the Indicated Mineral Resource estimates.

Mineral Reserves are prepared in accordance with the 2014 CIM Definition Standards.

Risks that may affect the Mineral Reserve estimates include: commodity price and exchange rate assumptions; changes to the assumptions used to generate the NSR cut-off grades that constrains the estimate; changes in local interpretations of mineralization geometry and continuity of mineralized zones; changes to geological and mineralization shapes, and geological and grade continuity assumptions; density and domain assignments; changes to geotechnical and hydrological assumptions, changes to mining and metallurgical recovery assumptions; changes to the input and design parameter assumptions that pertain to the conceptual pit constraining the estimates; assumptions as to concentrate marketability, payability and penalty terms; assumptions as to the continued ability to access the site, retain mineral and obtain surface rights titles, obtain environment and other regulatory permits, and maintain the social license to operate.

There is a risk to the estimate if the AMDIAP road is not constructed as envisaged, or in the time frame envisaged, or that the toll charges assumed in this Report are not the final charges levied. Other risks include: proper management of groundwater will be important to maintaining pit slope stability; the east wall is highly sensitive to several geotechnical parameters, and talc horizons that may not have been included in the geological model might also affect its stability; the presence of talc layers in the rock could affect recoveries in the process plant and therefore could be a risk to the Mineral Reserves.

25.8 Mining Recovery

Wood selected conventional open-pit mining because of the deposit's geometry and proximity to surface. The deposit will be mined in three nested phases, including the ultimate pit limit.

An Owner-operated and maintained conventional truck–shovel operation was specified, with outside service providers supporting mine operations.

The planned open pit will operate for 12 years. A three-year pre-production period is envisaged.

25.9 Recovery Plan

The recovery plan is conventional. A 10,00 t/d throughput rate is envisaged, with an overall plant availability of 92%.

The process plant will produce three concentrates: 1) copper concentrate, 2) zinc concentrate, and 3) lead concentrate. Gold and silver are expected to be payable at a smelter; silver is expected to be payable in the copper and lead concentrates, with gold expected to be payable in the lead concentrate only.

There are several deleterious elements reporting to the concentrates at levels which would incur penalties; however, there are no special processing provisions required to make a readily saleable concentrate.

25.10 Project Infrastructure

The planned mine will be a greenfields site and require construction of camp, mine and process-related infrastructure. Access roads in and around the Project site will be required.

Site access assumes that the AMDIAP road will be constructed.

Power generation will be provided by five diesel generators.

Process water will be supplied primarily from reclaim in the TMF. The TMF has sufficient water quantity to support processing during operations. TMF dewatering must start in the last year of operations (year 12), to prevent the TMF from exceeding the maximum storage capacity. Stormwater will be managed within the project boundaries by capturing and conveying contact and impacted water for treatment and diverting non-contact water away from developed areas. Well water will be used for potable purposes.

A high-density sludge lime-based neutralization and precipitation process is proposed to treat effluent from the WRCP. A SeWTP will be constructed towards the end of the LOM that will treat dewatering water from the TMF as well as a portion of the treated effluent from the HDS WTP.

The TMF will be a conventional wet-stack facility. The maximum storage capacity of the facility will be approximately 39 Mm^3 (tailings and process water) plus an additional 2.5 m of freeboard. The 58.6 ha footprint of the TMF will be fully lined with an impermeable LLDPE liner. Three dam raises will be completed.

25.11 Environmental, Permitting and Social

To date, a moderate amount of baseline environmental data collection has occurred in the area including surface water quality sampling, surface hydrology monitoring, wetlands mapping, stream flow monitoring, aquatic life surveys, avian and mammal habitat surveys, cultural resource surveys, hydrogeology studies, meteorological monitoring, and metal leaching and acid rock drainage (ML/ARD) studies.

The Arctic Project will be subject to a mine permitting process typical for a mine of its size in Alaska. In order to support this process, Trilogy Metals will have to broaden their existing baseline environmental program and complete a number of studies that will support the permit applications.

The project is dependent on obtaining a APDES permit that allows a mixing zone to dilute selenium in the Shungnak River to meet water quality standards.

Trilogy Metals has formally started engaging the Arctic Project stakeholders and recognizes the need to earn their trust and support by making the Arctic Project directly beneficial to them throughout the Project life and closure/post-closure periods.

Trilogy Metals will be required to develop a mine plan that is protective of the environment during mining operations as well as reclamation and closure plan that ensures the environment is protected after mine closure.

Closure activities will be undertaken at the end of mine life to bring the mine facilities in a state consistent with the stated closure and post-closure objectives and compliant with the regulations for closure and abandonment.

25.12 Markets and Contracts

For the respective concentrates, copper will be payable at 96.5%, zinc at 85% and lead at 55%, with lead payability being subject to a 3% minimum deduction. Silver will be payable at 90% in the copper concentrate and both silver and gold will be payable at 95% in the lead concentrate.

No contracts are currently in place for any production from the Project. It is expected that the sale of concentrate will include a mixture of long-term and spot contracts.

The copper concentrate production is too large to rely on the spot market for all the sales volume, although a portion sold under generally more favourable spot terms is recommended. Penalty charges may be imposed for zinc, arsenic, antimony and selenium content of some concentrate batches. These penalties are most likely to be triggered, if triggered, during the early months of production from the process plant, because this start-up period may have more variation than expected for the LOM.

The Chinese market will not be a destination for the zinc concentrate due to cadmium levels expected in the concentrate. Spot market opportunities for the zinc concentrate will be limited. It is recommended that most Arctic zinc concentrate be sold under long term contracts to Asian smelters. The only penalty charge expected for the zinc concentrate is for cadmium.

The lead concentrate from Arctic carries most of the silver and gold content. The negative aspects of the lead concentrate are the elevated levels of selenium, fluorine and magnesium, which may restrict the marketing initiative for the product. The copper content in the lead concentrate is high and adds to the complexity of the concentrate; however, as this concentrate will already have to be blended due to the fluorine and selenium content, the copper content, when blended, will be a value-added benefit to the smelter. The most likely end-destination for the lead concentrate is China. There are possible penalties that may be levied on the bismuth, fluorine and selenium content. Magnesium may also represent a penalty; however, this is likely to be managed via slag off during lead smelting. Chlorite levels remain to be checked in LOM concentrate makeup forecasts.

Smelter terms were applied for the delivery of copper, zinc and lead concentrate. It was assumed that delivery of all concentrates would be to an East Asian smelter at currently available freight rates.

Commodity pricing for purposes of the economic analysis were based on a combination of two year trailing actual metal prices, and market research and bank analyst forward price projections, prepared in July 2020 by Jim Vice of StoneHouse Consulting Inc.

25.13 Capital Costs

Overall capital costs are estimated at $1,224.7 million. The estimate accuracy is +-15%.

25.14 Operating Costs

The average LOM operating cost for the Arctic Project is estimated to be $50.65/ t milled.

There is a risk to the capital and operating cost estimates if the toll road is not built in the time frame required for the Arctic Project, the design basis for the road cost estimate changes (for example from a single lane roadway as assumed in this Report to a dual lane), or if the annual toll charges that will be levied are significantly different from what was assumed.

25.15 Economic Analysis

The financial analysis was conducted on a 100% ownership basis. Trilogy Metals holds a 50% ownership interest in Ambler Metals.

The base case pre-tax NPV was $1,550.9 million, calculated at the beginning of the construction period in Year -3, using an 8% discount rate. The base case pre-tax IRR, and payback period on initial capital were 30.8%, and 2.4 years respectively.

The post-tax NPV was $1,134.7 million, calculated at the beginning of the construction period in Year -3 using an 8% discount rate. The post-tax IRR and payback period on initial capital were 27.1%, and 2.6 years, respectively.

The Project's pre-tax NPV at an 8% discount rate is most sensitive to changes in copper price, followed by zinc price, off-site operating costs, on-site operating costs, capital costs, silver price, gold price, and lead price.

The Project's pre-tax IRR is most sensitive to changes in copper price and capital cost, followed by zinc price and off site operating costs, and in then decreasing order, on-site operating costs, silver price, gold price, and lead price.

The economic analysis does not include an allocation for the 1% NSR payable to Kennecott or the alternative option to purchase payment of $10 million. It is likely that Trilogy Metals would avail itself of the option to purchase the NSR.

25.16 Conclusions

Under the assumptions presented in this Report, the Project demonstrates positive economics.

The financial analysis does not include any future potential impact on Trilogy Metals' Project interest if NANA elects to purchase an interest of between 16% and 25% in the Arctic Project under the NANA Agreement or, alternatively, the impact on Trilogy Metals' Project interest if the 15% net proceeds royalty becomes applicable should NANA elect not to exercise this back-in right.

The economic analysis does not include an allocation for the 1% NSR payable to Kennecott or the alternative option to purchase payment of $10 million. It is likely that Trilogy Metals would avail itself of the option to purchase the NSR.

The financial analysis excludes consideration of the NANA Agreement, whereby NANA has the right, following a construction decision, to elect to purchase a 16% to 25% direct interest in the Arctic Project or, alternatively, to receive a 15% Net Proceeds Royalty.

25.17 Risks and Opportunities

25.17.1 AMDIAP Road

The cost assumptions for the AMDIAP road are estimates provided by Trilogy Metals. There is a risk to the capital and operating cost estimates, the financial analysis, and the Mineral

Reserves if the toll road is not built in the time frame required for the Arctic Project, or if the toll charges are significantly different from what was assumed.

25.17.2 Permitting

Mine development permitting will be largely driven by the underlying land ownership; regulatory authorities vary depending on land ownership. Because the Arctic Project is situated to a large extent on State land, it will be necessary to obtain a Plan of Operation Approval (which includes the Reclamation Plan) from the ADNR. The overall timeline required for permitting would be largely driven by the time required for the NEPA process.

There is a risk to the capital and operating cost estimates, the financial analysis, and the Mineral Reserves if the NEPA process, Plan of Operation Approval and ancillary permits to support operations cannot be obtained in the timeframe envisioned for Project start-up.

25.17.3 Water and Load Balance

- Insufficient geochemistry data to run a statistical analysis on samples to provide low and high source term values, which would have been assessed in a sensitivity analysis.
- Surface run-off from cuts for roads is assumed to be non-contact water, however geochemical characterization of road cuts should be conducted to confirm this.
- Water quality predictions for the construction phase (mine year -3 to -1) were not evaluated as construction source terms were not developed. Source terms for waste rock and pit wall run-off should be developed for the construction phase.
- Based on kinetic data available to date, there is a high degree of uncertainty with prediction of when waste rock and pit wall will transition from neutral pH to acidic conditions.
- Inherent risk associated with assuming the groundwater interception system needs to be 100% efficient in order to prevent any seepage from impacting Subarctic Creek (and the Shungnak River).
- Uncertainty remains in predicted groundwater and seepage flows as these are a function of hydraulic conductivity and bedrock thickness which is only known at specific coordinates.
- Uncertainty in estimated tailings porewater release rate during closure phase of project. Further consolidation testwork should be carried out.
- Climate change impacts should be incorporated into model and results should be assessed.
- The water quality in the Shungnak River below the discharge point is predicted to meet water quality criteria after a mixing zone. The discharge location in the Shungnak River and the mixing zone will both require regulatory approval. Obtaining a permit to discharge into the Shungnak River and defining a mixing zone in the Shungnak River are regulatory risks for the Project.

25.17.4 Processing

Further testwork to improve understanding of the talc present in the ore body and consideration during detailed design to minimize the risk of talc carry-over to downstream circuits should be implemented.

26 Recommendations

26.1 Introduction

A single-phase work program is proposed for the Project at a total cost of $7.0 million, comprising the following fields of work.

26.1.1 Mining

- Carry out additional drilling to upgrade a portion of the Indicated Resource to Measured Resource. This drilling should target the Resource to be mined during the first three years of production. This is recommended to classify Proven Reserves and provide high confidence in the production plan at project start. Estimated cost $4,000,000.
- Perform a SMU study to define an optimal block size that can support the envisioned production rate while minimizing dilution. Estimated cost of $50,000.
- Carry out a drill and blast study to verify blast patterns and estimate the material fragmentation size distribution. Estimated cost of $35,000.
- Assess the use of alternate fuel sources for the mine mobile equipment including LNG. Estimated cost of $18,000.
- Request budgetary quotations for the construction of initial haul roads to qualified contractors in the area to confirm the assumptions used in the mining costs. Estimated cost of $10,000.

26.1.2 Geotechnical

The Talc Zone domain represents the weakest geotechnical domain observed at the Arctic deposit. The extent and persistence of the unit is of concern to the pit slope stability and the potential need for additional waste mining on the upper north east pit walls. Further investigation (drill program) of the extent and geotechnical characteristics of this unit is required and the slope stability re-evaluated, prior to starting mining. Estimated cost of $290,000.

The current pit design contains areas on the east walls of interim phases and the lower east walls of the final pit where conventional benches are designed rather than mining to foliation. Further design adjustments will be required prior to construction, and ongoing geotechnical model verification and design refinement will be necessary to manage the risks related to the foliation. The interim phases will be adjusted to consider in the next stage of the project, once new information has been added to the resource model.

A second access road to the pit bottom is recommended, potentially at 660 masl switchback, to reduce the consequences of a loss of access from slope instability. In the low slope angle areas, there is an opportunity to dump slope accesses rather than mine wide benches.

Once mining begins, regular pit wall mapping is recommended as the new rock faces are exposed to enable a reconciliation against the geotechnical information used in the FS slope design. Foliation mapping will be critical for the short-term planning in the NE, E and SE slope sectors. The foliation model should be constantly updated as pit wall mapping is being undertaken and be utilized for making ongoing adjustments to the short-term slope design and mining plan.

The seismic impact on the slope design should be re-evaluated once the site-specific assessment of the seismicity is completed. This will be best undertaken when the talc zone extent and characteristics have been further validated in the upper northeast wall.

26.1.3 Structural and Geohazards

The results of the geohazards assessment indicated that snow avalanches are a potentially significant concern. Further studies are required to assess magnitude, frequency, intensity and runout to better quantify risks to the mine infrastructures. Estimated cost of $100,000.

Ongoing structural mapping should be undertaken so that these can be reconciled against the model used in the slope design to identify any potential risks or opportunities.

26.1.4 Hydrogeology

The hydrogeological conceptual model for the pit and valley areas should be updated over time as more data becomes available. For the pit, the potential effects of seasonal or rapid and high amplitude recharge events (i.e. freshet) on sump sizing needs to be considered and opportunities for pit sump locations that could promote drainage from below talc layers should be identified. Where feasible, runoff into the pit should be reduced by drainage ditches around and set back from the pit perimeter, and internal ditching that directs water to pit sumps or out of the pit. Estimated cost of $15,000.

For the valley bottom groundwater seepage interception system (SIS), data should be collected to characterize overburden and fractured rock properties in the specific area of the system and the conceptual model updated. Estimates of potential groundwater bypass of the WRCP should be updated and the groundwater SIS design updated as appropriate. Baseline monitoring of groundwater quality in this area should be initiated as soon as possible to provide a dataset for environmental permitting and to support performance monitoring of the groundwater SIS once in operation. Estimated cost of $150,000.

The pit Groundwater Management Plan should be updated as mine design advances and implemented at the start of mining. Continue water level monitoring, update interpretations of seasonal variation and develop baseline for comparison with slope monitoring to assess drainage performance. Include provisions in the Feasibility Study for groundwater monitoring and drainage works on the east/northeast slope. Install general pit perimeter groundwater monitoring on the north, south and west sides of the pit. Estimated cost of $10,000 to update as mine design advances.

26.1.5 Tailings Management Facility

The waste rock used for construction of the TMF and WRF requires more detailed strength characterization as it is not well defined in any current testing and could affect the overall stability of the waste facilities. In addition, further geotechnical and hydrogeological investigations should be completed in the foundations of the TMF, WRF, and WRCP including borehole drilling and test pit excavations to develop better accuracy on excavation volumes under the waste facilities, on ground water regimes and on overburden depths below the WRCP and seepage collection system. Estimated cost of $1,500,000.

Further engineering studies required for the WRF and TMF design include:

- Site specific seismic hazard assessment and subsequent inundation studies for the WRCP and TMF to delineate potential risks. Estimated cost $80,000.
- Dam Breach Assessment, based on site specific hazard assessment, for the TMF and the WRCP. Estimated cost of $65,000.
- Further consolidation testwork should be carried out to confirm tailings dry density and porewater release rates. Estimated cost of $20,000.
- Finite element consolidation modelling of the tailings to better understand the long-term settlement of the tailings and the impacts on capacity and closure. Estimated cost $50,000.

- Tailings deposition planning and review of deposition method to ensure winter deposition will not develop ice entrainment issues that affect capacity. Estimated cost $35,000.
- Updating WRF and TMF stability design based on additional field investigation results, lab testing and seismic study. Estimated cost $125,000.

26.1.6 Hydrology

Additional baseline studies and environmental permitting activities, including:

- Upgrading the rain and temperature stations in the Subarctic valley to wind-protected total precipitation gauges would reduce the uncertainty and refine future MAP estimates. Estimated cost $30,000.
- Low flow measurements should be collected at the SRGS, SCGS, and RCDN hydrologic gauging stations to improve low flow and baseflow estimates. Estimated cost $15,000.
- Snow course surveys should continue to be conducted on an annual basis to progress the understanding of freshet and peak flow timing. Estimated cost $90,000.
- A monitoring gauging station should be installed closer to headwaters of Subarctic Creek (i.e. directly below proposed project site location) to calibrate and validate the water and load balance predicted Subarctic Creek flows. Estimated cost $30,000.

26.1.7 Water and Load Balance

SRK recommends that the water and load balance be updated as the project design is advanced in order to refine the understanding of the effluents to be treated during operations and at closure, and to refine the water treatment design and closure cost estimates.

Other items that require evaluation are:

- The size of the mixing zone needed in the Shungnak River to meet in stream selenium water quality limits. Estimated cost $35,000.
- Most likely and reasonable worst-case source term values should be developed and assessed in sensitivity analysis. Estimated cost $25,000.
- Geochemical characterization studies should be conducted along road alignments and source terms developed. Estimated cost $20,000.
- Source terms should be developed for the construction phase (mine year -3 to -1) for waste rock and pit wall runoff. Estimated cost $5,000.
- Further consolidation testwork should be carried out to confirm tailings dry density and porewater release rates.
- The effect of climate change on the project should be incorporated into model and design of long-term infrastructure modified to incorporate these results. Estimated cost $5,000, assuming no major modification to infrastructure.

26.1.8 Water Treatment

26.1.8.1 HDS WTP

The water treatment strategy for the project will require an update following any revised engineering studies, including water management, WRF and TMF design (detailed in previous sections). If only minor changes to flow and/or influent water quality are needed based on the updated engineering studies, the estimated cost to update and revise water treatment plant design and cost estimate would be approximately $50,000. However, if any changes in water and load balance (see section 26.2.7) require new and/or additional water treatment technologies, costs will be significantly higher.

Opportunities that should be evaluated are:

- Reduce project lime storage, preparation and distribution costs, such as combining the lime silo, slaker, slurry tank, and distribution systems required for the mill and WTP during operations, or repurposing the mill lime systems for use at the WTP at closure, when lime demand increases.
- Reduce HDS WTP building costs should be explored, such as combining reagent storage areas required for the mill and HDS WTP during operations.

26.1.8.2 SeWTP

The following works are recommended for further works related to the SeWTP:

- Input for integration of HDS and SeWTP systems, including process integration study, plot plant and model integration. Estimated cost approximately $20,000
- Process trade-off including technology evaluation and costs for fluidized bed reactor, ion exchange, produce block flows, plot plans. Estimated cost approximately $25,000.
- Waste disposal trade-off including stabilization options, disposal well evaluation, with system diagrams and plot plans. Estimated cost approximately $20,000.
- Lab program including treatability program, lab-scale reactor design and execution, pilot system detailed plan, scope and costs. Estimated cost approximately $35,000.

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Appendix A - List of Claims

State Claims

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
540543	Arctic 40A	State Claim	2	acres	Kateel River	21N	11E	35	SW
540544	Arctic 496A	State Claim	2	acres	Kateel River	21N	11E	34	SE
540545	Arctic 1001	State Claim	8	acres	Kateel River	21N	11E	34	SE
540546	Arctic 1002	State Claim	8	acres	Kateel River	21N	11E	34	SE & SW
540549	Arctic 1005	State Claim	6	acres	Kateel River	21N	11E	35	SW
546144	SC 24	State Claim	40	acres	Kateel River	21N	10E	16	SW & SE
546145	SC 25	State Claim	40	acres	Kateel River	21N	10E	16	SW, SE, NW & NE
546146	SC 26	State Claim	40	acres	Kateel River	21N	10E	16	NW & NE
546147	SC 34	State Claim	40	acres	Kateel River	21N	10E	16	SE
546148	SC 35	State Claim	40	acres	Kateel River	21N	10E	16	SE & NE
546149	SC 36	State Claim	40	acres	Kateel River	21N	10E	16	NE
546150	SC 44	State Claim	40	acres	Kateel River	21N	10E	15; 16	SW; SE
546151	SC 45	State Claim	40	acres	Kateel River	21N	10E	15; 16	SW & NW; SE & NE
546152	SC 46	State Claim	40	acres	Kateel River	21N	10E	15; 16	NW; NE
546153	SC 54	State Claim	40	acres	Kateel River	21N	10E	15	SW
546154	SC 55	State Claim	40	acres	Kateel River	21N	10E	15	SW & NW
546155	SC 56	State Claim	40	acres	Kateel River	21N	10E	15	NW
546156	SC 64	State Claim	40	acres	Kateel River	21N	10E	15	SW & SE
546157	SC 65	State Claim	40	acres	Kateel River	21N	10E	15	SW, SE, NW & NE
546158	SC 66	State Claim	40	acres	Kateel River	21N	10E	15	NW & NE
590853	AM 63-165	State Claim	40	acres	Kateel River	21N	9E	14	NW
590854	AM 63-166	State Claim	40	acres	Kateel River	21N	9E	14	NW
590855	AM 63-167	State Claim	40	acres	Kateel River	21N	9E	14	NE
590856	AM 63-168	State Claim	40	acres	Kateel River	21N	9E	14	NE
590857	AM 63-169	State Claim	40	acres	Kateel River	21N	9E	13	NW
590858	AM 63-170	State Claim	40	acres	Kateel River	21N	9E	13	NW
590859	AM 63-171	State Claim	40	acres	Kateel River	21N	9E	13	NE
590860	AM 63-172	State Claim	40	acres	Kateel River	21N	9E	13	NE
590874	AM 64-165	State Claim	40	acres	Kateel River	21N	9E	14	NW
590875	AM 64-166	State Claim	40	acres	Kateel River	21N	9E	14	NW
590876	AM 64-167	State Claim	40	acres	Kateel River	21N	9E	14	NE
590877	AM 64-168	State Claim	40	acres	Kateel River	21N	9E	14	NE
590878	AM 64-169	State Claim	40	acres	Kateel River	21N	9E	13	NW
590879	AM 64-170	State Claim	40	acres	Kateel River	21N	9E	13	NW
590880	AM 64-171	State Claim	40	acres	Kateel River	21N	9E	13	NE
590881	AM 64-172	State Claim	40	acres	Kateel River	21N	9E	13	NE
590895	AM 65-165	State Claim	40	acres	Kateel River	21N	9E	11	SW
590896	AM 65-166	State Claim	40	acres	Kateel River	21N	9E	11	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
590897	AM 65-167	State Claim	40	acres	Kateel River	21N	9E	11	SE
590898	AM 65-168	State Claim	40	acres	Kateel River	21N	9E	11	SE
590899	AM 65-169	State Claim	40	acres	Kateel River	21N	9E	12	SW
590900	AM 65-170	State Claim	40	acres	Kateel River	21N	9E	12	SW
590901	AM 65-171	State Claim	40	acres	Kateel River	21N	9E	12	SE
590902	AM 65-172	State Claim	40	acres	Kateel River	21N	9E	12	SE
590916	AM 66-165	State Claim	40	acres	Kateel River	21N	9E	11	SW
590917	AM 66-166	State Claim	40	acres	Kateel River	21N	9E	11	SW
590918	AM 66-167	State Claim	40	acres	Kateel River	21N	9E	11	SE
590919	AM 66-168	State Claim	40	acres	Kateel River	21N	9E	11	SE
590920	AM 66-169	State Claim	40	acres	Kateel River	21N	9E	12	SW
590921	AM 66-170	State Claim	40	acres	Kateel River	21N	9E	12	SW
590922	AM 66-171	State Claim	40	acres	Kateel River	21N	9E	12	SE
590923	AM 66-172	State Claim	40	acres	Kateel River	21N	9E	12	SE
590940	AM 67-165	State Claim	40	acres	Kateel River	21N	9E	11	NW
590941	AM 67-166	State Claim	40	acres	Kateel River	21N	9E	11	NW
590942	AM 67-167	State Claim	40	acres	Kateel River	21N	9E	11	NE
590943	AM 67-168	State Claim	40	acres	Kateel River	21N	9E	11	NE
590944	AM 67-169	State Claim	40	acres	Kateel River	21N	9E	12	NW
590945	AM 67-170	State Claim	40	acres	Kateel River	21N	9E	12	NW
590946	AM 67-171	State Claim	40	acres	Kateel River	21N	9E	12	NE
590947	AM 67-172	State Claim	40	acres	Kateel River	21N	9E	12	NE
590998	AM 56-186	State Claim	40	acres	Kateel River	21N	10E	27	NW
590999	AM 56-187	State Claim	40	acres	Kateel River	21N	10E	27	NE
591000	AM 56-188	State Claim	40	acres	Kateel River	21N	10E	27	NE
591001	AM 56-189	State Claim	40	acres	Kateel River	21N	10E	26	NW
591002	AM 56-190	State Claim	40	acres	Kateel River	21N	10E	26	NW
591003	AM 56-191	State Claim	40	acres	Kateel River	21N	10E	26	NE
591004	AM 56-192	State Claim	40	acres	Kateel River	21N	10E	26	NE
591005	AM 56-193	State Claim	40	acres	Kateel River	21N	10E	25	NW
591006	AM 56-194	State Claim	40	acres	Kateel River	21N	10E	25	NW
591007	AM 56-195	State Claim	40	acres	Kateel River	21N	10E	25	NE
591008	AM 57-176	State Claim	40	acres	Kateel River	21N	10E	19	SE
591009	AM 57-177	State Claim	40	acres	Kateel River	21N	10E	20	SW
591010	AM 57-178	State Claim	40	acres	Kateel River	21N	10E	20	SW
591011	AM 57-179	State Claim	40	acres	Kateel River	21N	10E	20	SE
591012	AM 57-180	State Claim	40	acres	Kateel River	21N	10E	20	SE
591013	AM 57-181	State Claim	40	acres	Kateel River	21N	10E	21	SW
591014	AM 57-182	State Claim	40	acres	Kateel River	21N	10E	21	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591015	AM 57-183	State Claim	40	acres	Kateel River	21N	10E	21	SE
591016	AM 57-184	State Claim	40	acres	Kateel River	21N	10E	21	SE
591017	AM 57-185	State Claim	40	acres	Kateel River	21N	10E	22	SW
591018	AM 57-186	State Claim	40	acres	Kateel River	21N	10E	22	SW
591019	AM 57-187	State Claim	40	acres	Kateel River	21N	10E	22	SE
591020	AM 57-188	State Claim	40	acres	Kateel River	21N	10E	22	SE
591021	AM 57-189	State Claim	40	acres	Kateel River	21N	10E	23	SW
591022	AM 57-190	State Claim	40	acres	Kateel River	21N	10E	23	SW
591023	AM 57-191	State Claim	40	acres	Kateel River	21N	10E	23	SE
591024	AM 57-192	State Claim	40	acres	Kateel River	21N	10E	23	SE
591025	AM 57-193	State Claim	40	acres	Kateel River	21N	10E	24	SW
591026	AM 57-194	State Claim	40	acres	Kateel River	21N	10E	24	SW
591027	AM 57-195	State Claim	40	acres	Kateel River	21N	10E	24	SE
591028	AM 58-176	State Claim	40	acres	Kateel River	21N	10E	19	SE
591029	AM 58-177	State Claim	40	acres	Kateel River	21N	10E	20	SW
591030	AM 58-178	State Claim	40	acres	Kateel River	21N	10E	20	SW
591031	AM 58-179	State Claim	40	acres	Kateel River	21N	10E	20	SE
591032	AM 58-180	State Claim	40	acres	Kateel River	21N	10E	20	SE
591033	AM 58-181	State Claim	40	acres	Kateel River	21N	10E	21	SW
591034	AM 58-182	State Claim	40	acres	Kateel River	21N	10E	21	SW
591035	AM 58-183	State Claim	40	acres	Kateel River	21N	10E	21	SE
591036	AM 58-184	State Claim	40	acres	Kateel River	21N	10E	21	SE
591037	AM 58-185	State Claim	40	acres	Kateel River	21N	10E	22	SW
591038	AM 58-186	State Claim	40	acres	Kateel River	21N	10E	22	SW
591039	AM 58-187	State Claim	40	acres	Kateel River	21N	10E	22	SE
591040	AM 58-188	State Claim	40	acres	Kateel River	21N	10E	22	SE
591041	AM 58-189	State Claim	40	acres	Kateel River	21N	10E	23	SW
591042	AM 58-190	State Claim	40	acres	Kateel River	21N	10E	23	SW
591043	AM 58-191	State Claim	40	acres	Kateel River	21N	10E	23	SE
591044	AM 58-192	State Claim	40	acres	Kateel River	21N	10E	23	SE
591045	AM 58-193	State Claim	40	acres	Kateel River	21N	10E	24	SW
591046	AM 58-194	State Claim	40	acres	Kateel River	21N	10E	24	SW
591047	AM 59-176	State Claim	40	acres	Kateel River	21N	10E	19	NE
591048	AM 59-177	State Claim	40	acres	Kateel River	21N	10E	20	NW
591049	AM 59-178	State Claim	40	acres	Kateel River	21N	10E	20	NW
591050	AM 59-179	State Claim	40	acres	Kateel River	21N	10E	20	NE
591051	AM 59-180	State Claim	40	acres	Kateel River	21N	10E	20	NE
591052	AM 59-181	State Claim	40	acres	Kateel River	21N	10E	21	NW
591053	AM 59-182	State Claim	40	acres	Kateel River	21N	10E	21	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591054	AM 59-183	State Claim	40	acres	Kateel River	21N	10E	21	NE
591055	AM 59-184	State Claim	40	acres	Kateel River	21N	10E	21	NE
591056	AM 59-185	State Claim	40	acres	Kateel River	21N	10E	22	NW
591057	AM 59-186	State Claim	40	acres	Kateel River	21N	10E	22	NW
591058	AM 59-187	State Claim	40	acres	Kateel River	21N	10E	22	NE
591059	AM 59-188	State Claim	40	acres	Kateel River	21N	10E	22	NE
591060	AM 59-189	State Claim	40	acres	Kateel River	21N	10E	23	NW
591061	AM 59-190	State Claim	40	acres	Kateel River	21N	10E	23	NW
591062	AM 59-191	State Claim	40	acres	Kateel River	21N	10E	23	NE
591063	AM 59-192	State Claim	40	acres	Kateel River	21N	10E	23	NE
591064	AM 59-193	State Claim	40	acres	Kateel River	21N	10E	24	NW
591065	AM 60-176	State Claim	40	acres	Kateel River	21N	10E	19	NE
591066	AM 60-177	State Claim	40	acres	Kateel River	21N	10E	20	NW
591067	AM 60-178	State Claim	40	acres	Kateel River	21N	10E	20	NW
591068	AM 60-179	State Claim	40	acres	Kateel River	21N	10E	20	NE
591069	AM 60-180	State Claim	40	acres	Kateel River	21N	10E	20	NE
591070	AM 60-181	State Claim	40	acres	Kateel River	21N	10E	21	NW
591071	AM 60-182	State Claim	40	acres	Kateel River	21N	10E	21	NW
591072	AM 60-183	State Claim	40	acres	Kateel River	21N	10E	21	NE
591073	AM 60-184	State Claim	40	acres	Kateel River	21N	10E	21	NE
591074	AM 60-185	State Claim	40	acres	Kateel River	21N	10E	22	NW
591075	AM 60-186	State Claim	40	acres	Kateel River	21N	10E	22	NW
591076	AM 60-187	State Claim	40	acres	Kateel River	21N	10E	22	NE
591077	AM 60-188	State Claim	40	acres	Kateel River	21N	10E	22	NE
591078	AM 60-189	State Claim	40	acres	Kateel River	21N	10E	23	NW
591079	AM 60-190	State Claim	40	acres	Kateel River	21N	10E	23	NW
591080	AM 60-191	State Claim	40	acres	Kateel River	21N	10E	23	NE
591081	AM 60-192	State Claim	40	acres	Kateel River	21N	10E	23	NE
591082	AM 60-193	State Claim	40	acres	Kateel River	21N	10E	24	NW
591083	AM 61-176	State Claim	40	acres	Kateel River	21N	10E	18	SE
591084	AM 61-177	State Claim	40	acres	Kateel River	21N	10E	17	SW
591085	AM 61-178	State Claim	40	acres	Kateel River	21N	10E	17	SW
591086	AM 61-179	State Claim	40	acres	Kateel River	21N	10E	17	SE
591087	AM 61-180	State Claim	40	acres	Kateel River	21N	10E	17	SE
591088	AM 61-181	State Claim	40	acres	Kateel River	21N	10E	16	SW
591089	AM 61-182	State Claim	40	acres	Kateel River	21N	10E	16	SW
591090	AM 61-183	State Claim	40	acres	Kateel River	21N	10E	16	SE
591091	AM 61-184	State Claim	40	acres	Kateel River	21N	10E	16	SE
591092	AM 61-185	State Claim	40	acres	Kateel River	21N	10E	15	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591093	AM 61-186	State Claim	40	acres	Kateel River	21N	10E	15	SW
591094	AM 61-187	State Claim	40	acres	Kateel River	21N	10E	15	SE
591095	AM 61-188	State Claim	40	acres	Kateel River	21N	10E	15	SE
591096	AM 61-189	State Claim	40	acres	Kateel River	21N	10E	14	SW
591097	AM 61-190	State Claim	40	acres	Kateel River	21N	10E	14	SW
591098	AM 61-191	State Claim	40	acres	Kateel River	21N	10E	14	SE
591099	AM 61-192	State Claim	40	acres	Kateel River	21N	10E	14	SE
591100	AM 61-193	State Claim	40	acres	Kateel River	21N	10E	13	SW
591101	AM 62-176	State Claim	40	acres	Kateel River	21N	10E	18	SE
591102	AM 62-177	State Claim	40	acres	Kateel River	21N	10E	17	SW
591103	AM 62-178	State Claim	40	acres	Kateel River	21N	10E	17	SW
591104	AM 62-179	State Claim	40	acres	Kateel River	21N	10E	17	SE
591105	AM 62-180	State Claim	40	acres	Kateel River	21N	10E	17	SE
591106	AM 62-181	State Claim	40	acres	Kateel River	21N	10E	16	SW
591107	AM 62-182	State Claim	40	acres	Kateel River	21N	10E	16	SW
591108	AM 62-187	State Claim	40	acres	Kateel River	21N	10E	15	SE
591109	AM 62-188	State Claim	40	acres	Kateel River	21N	10E	15	SE
591110	AM 62-189	State Claim	40	acres	Kateel River	21N	10E	14	SW
591111	AM 62-190	State Claim	40	acres	Kateel River	21N	10E	14	SW
591112	AM 62-191	State Claim	40	acres	Kateel River	21N	10E	14	SE
591113	AM 62-192	State Claim	40	acres	Kateel River	21N	10E	14	SE
591114	AM 62-193	State Claim	40	acres	Kateel River	21N	10E	13	SW
591115	AM 63-173	State Claim	40	acres	Kateel River	21N	10E	18	NW
591116	AM 63-174	State Claim	40	acres	Kateel River	21N	10E	18	NW
591117	AM 63-175	State Claim	40	acres	Kateel River	21N	10E	18	NE
591118	AM 63-176	State Claim	40	acres	Kateel River	21N	10E	18	NE
591119	AM 63-177	State Claim	40	acres	Kateel River	21N	10E	17	NW
591120	AM 63-178	State Claim	40	acres	Kateel River	21N	10E	17	NW
591121	AM 63-179	State Claim	40	acres	Kateel River	21N	10E	17	NE
591122	AM 63-180	State Claim	40	acres	Kateel River	21N	10E	17	NE
591123	AM 63-181	State Claim	40	acres	Kateel River	21N	10E	16	NW
591124	AM 63-182	State Claim	40	acres	Kateel River	21N	10E	16	NW
591125	AM 63-187	State Claim	40	acres	Kateel River	21N	10E	15	NE
591126	AM 63-188	State Claim	40	acres	Kateel River	21N	10E	15	NE
591127	AM 63-189	State Claim	40	acres	Kateel River	21N	10E	14	NW
591128	AM 63-190	State Claim	40	acres	Kateel River	21N	10E	14	NW
591129	AM 63-191	State Claim	40	acres	Kateel River	21N	10E	14	NE
591130	AM 63-192	State Claim	40	acres	Kateel River	21N	10E	14	NE
591131	AM 63-193	State Claim	40	acres	Kateel River	21N	10E	13	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591132	AM 64-173	State Claim	40	acres	Kateel River	21N	10E	18	NW
591133	AM 64-174	State Claim	40	acres	Kateel River	21N	10E	18	NW
591134	AM 64-175	State Claim	40	acres	Kateel River	21N	10E	18	NE
591135	AM 64-176	State Claim	40	acres	Kateel River	21N	10E	18	NE
591136	AM 64-177	State Claim	40	acres	Kateel River	21N	10E	17	NW
591137	AM 64-178	State Claim	40	acres	Kateel River	21N	10E	17	NW
591138	AM 64-179	State Claim	40	acres	Kateel River	21N	10E	17	NE
591139	AM 64-180	State Claim	40	acres	Kateel River	21N	10E	17	NE
591140	AM 64-181	State Claim	40	acres	Kateel River	21N	10E	16	NW
591141	AM 64-182	State Claim	40	acres	Kateel River	21N	10E	16	NW
591142	AM 64-183	State Claim	40	acres	Kateel River	21N	10E	16	NE
591143	AM 64-184	State Claim	40	acres	Kateel River	21N	10E	16	NE
591144	AM 64-185	State Claim	40	acres	Kateel River	21N	10E	15	NW
591145	AM 64-186	State Claim	40	acres	Kateel River	21N	10E	15	NW
591146	AM 64-187	State Claim	40	acres	Kateel River	21N	10E	15	NE
591147	AM 64-188	State Claim	40	acres	Kateel River	21N	10E	15	NE
591148	AM 64-189	State Claim	40	acres	Kateel River	21N	10E	14	NW
591149	AM 64-190	State Claim	40	acres	Kateel River	21N	10E	14	NW
591150	AM 64-191	State Claim	40	acres	Kateel River	21N	10E	14	NE
591151	AM 64-192	State Claim	40	acres	Kateel River	21N	10E	14	NE
591152	AM 64-193	State Claim	40	acres	Kateel River	21N	10E	13	NW
591153	AM 65-173	State Claim	40	acres	Kateel River	21N	10E	7	SW
591154	AM 65-174	State Claim	40	acres	Kateel River	21N	10E	7	SW
591155	AM 65-175	State Claim	40	acres	Kateel River	21N	10E	7	SE
591156	AM 65-176	State Claim	40	acres	Kateel River	21N	10E	7	SE
591157	AM 65-177	State Claim	40	acres	Kateel River	21N	10E	8	SW
591158	AM 65-178	State Claim	40	acres	Kateel River	21N	10E	8	SW
591159	AM 65-179	State Claim	40	acres	Kateel River	21N	10E	8	SE
591160	AM 65-180	State Claim	40	acres	Kateel River	21N	10E	8	SE
591161	AM 65-181	State Claim	40	acres	Kateel River	21N	10E	9	SW
591162	AM 65-182	State Claim	40	acres	Kateel River	21N	10E	9	SW
591163	AM 65-183	State Claim	40	acres	Kateel River	21N	10E	9	SE
591164	AM 65-184	State Claim	40	acres	Kateel River	21N	10E	9	SE
591165	AM 65-185	State Claim	40	acres	Kateel River	21N	10E	10	SW
591166	AM 65-186	State Claim	40	acres	Kateel River	21N	10E	10	SW
591167	AM 65-187	State Claim	40	acres	Kateel River	21N	10E	10	SE
591168	AM 65-188	State Claim	40	acres	Kateel River	21N	10E	10	SE
591169	AM 65-189	State Claim	40	acres	Kateel River	21N	10E	11	SW
591170	AM 65-190	State Claim	40	acres	Kateel River	21N	10E	11	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591171	AM 65-191	State Claim	40	acres	Kateel River	21N	10E	11	SE
591172	AM 65-192	State Claim	40	acres	Kateel River	21N	10E	11	SE
591173	AM 65-193	State Claim	40	acres	Kateel River	21N	10E	12	SW
591174	AM 66-173	State Claim	40	acres	Kateel River	21N	10E	7	SW
591175	AM 66-174	State Claim	40	acres	Kateel River	21N	10E	7	SW
591176	AM 66-175	State Claim	40	acres	Kateel River	21N	10E	7	SE
591177	AM 66-176	State Claim	40	acres	Kateel River	21N	10E	7	SE
591178	AM 66-177	State Claim	40	acres	Kateel River	21N	10E	8	SW
591179	AM 66-178	State Claim	40	acres	Kateel River	21N	10E	8	SW
591180	AM 66-179	State Claim	40	acres	Kateel River	21N	10E	8	SE
591181	AM 66-180	State Claim	40	acres	Kateel River	21N	10E	8	SE
591182	AM 66-181	State Claim	40	acres	Kateel River	21N	10E	9	SW
591183	AM 66-182	State Claim	40	acres	Kateel River	21N	10E	9	SW
591184	AM 66-183	State Claim	40	acres	Kateel River	21N	10E	9	SE
591185	AM 66-184	State Claim	40	acres	Kateel River	21N	10E	9	SE
591186	AM 66-185	State Claim	40	acres	Kateel River	21N	10E	10	SW
591187	AM 66-186	State Claim	40	acres	Kateel River	21N	10E	10	SW
591188	AM 66-187	State Claim	40	acres	Kateel River	21N	10E	10	SE
591189	AM 66-188	State Claim	40	acres	Kateel River	21N	10E	10	SE
591190	AM 66-189	State Claim	40	acres	Kateel River	21N	10E	11	SW
591191	AM 66-190	State Claim	40	acres	Kateel River	21N	10E	11	SW
591192	AM 66-191	State Claim	40	acres	Kateel River	21N	10E	11	SE
591193	AM 66-192	State Claim	40	acres	Kateel River	21N	10E	11	SE
591194	AM 66-193	State Claim	40	acres	Kateel River	21N	10E	12	SW
591195	AM 67-173	State Claim	40	acres	Kateel River	21N	10E	7	NW
591196	AM 67-174	State Claim	40	acres	Kateel River	21N	10E	7	NW
591197	AM 67-175	State Claim	40	acres	Kateel River	21N	10E	7	NE
591198	AM 67-176	State Claim	40	acres	Kateel River	21N	10E	7	NE
591199	AM 67-177	State Claim	40	acres	Kateel River	21N	10E	8	NW
591200	AM 67-178	State Claim	40	acres	Kateel River	21N	10E	8	NW
591201	AM 67-179	State Claim	40	acres	Kateel River	21N	10E	8	NE
591202	AM 67-180	State Claim	40	acres	Kateel River	21N	10E	8	NE
591203	AM 67-181	State Claim	40	acres	Kateel River	21N	10E	9	NW
591204	AM 67-182	State Claim	40	acres	Kateel River	21N	10E	9	NW
591205	AM 67-183	State Claim	40	acres	Kateel River	21N	10E	9	NE
591206	AM 67-184	State Claim	40	acres	Kateel River	21N	10E	9	NE
591207	AM 67-185	State Claim	40	acres	Kateel River	21N	10E	10	NW
591208	AM 67-186	State Claim	40	acres	Kateel River	21N	10E	10	NW
591209	AM 67-187	State Claim	40	acres	Kateel River	21N	10E	10	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591210	AM 67-188	State Claim	40	acres	Kateel River	21N	10E	10	NE
591211	AM 67-189	State Claim	40	acres	Kateel River	21N	10E	11	NW
591212	AM 67-190	State Claim	40	acres	Kateel River	21N	10E	11	NW
591213	AM 67-191	State Claim	40	acres	Kateel River	21N	10E	11	NE
591214	AM 67-192	State Claim	40	acres	Kateel River	21N	10E	11	NE
591215	AM 67-193	State Claim	40	acres	Kateel River	21N	10E	12	NW
591216	AM 67-194	State Claim	40	acres	Kateel River	21N	10E	12	NW
591217	AM 67-195	State Claim	40	acres	Kateel River	21N	10E	12	NE
591218	AM 67-196	State Claim	40	acres	Kateel River	21N	10E	12	NE
591219	AM 49-206	State Claim	40	acres	Kateel River	21N	11E	33	SW
591220	AM 49-207	State Claim	40	acres	Kateel River	21N	11E	33	SE
591221	AM 49-208	State Claim	40	acres	Kateel River	21N	11E	33	SE
591222	AM 49-209	State Claim	40	acres	Kateel River	21N	11E	34	SW
591223	AM 49-210	State Claim	40	acres	Kateel River	21N	11E	34	SW
591224	AM 49-214	State Claim	40	acres	Kateel River	21N	11E	35	SW
591225	AM 49-215	State Claim	40	acres	Kateel River	21N	11E	35	SE
591226	AM 49-216	State Claim	40	acres	Kateel River	21N	11E	35	SE
591227	AM 49-217	State Claim	40	acres	Kateel River	21N	11E	36	SW
591228	AM 49-218	State Claim	40	acres	Kateel River	21N	11E	36	SW
591229	AM 49-219	State Claim	40	acres	Kateel River	21N	11E	36	SE
591230	AM 49-220	State Claim	40	acres	Kateel River	21N	11E	36	SE
591231	AM 50-206	State Claim	40	acres	Kateel River	21N	11E	33	SW
591232	AM 50-207	State Claim	40	acres	Kateel River	21N	11E	33	SE
591233	AM 50-208	State Claim	40	acres	Kateel River	21N	11E	33	SE
591234	AM 50-209	State Claim	40	acres	Kateel River	21N	11E	34	SW
591235	AM 50-210	State Claim	40	acres	Kateel River	21N	11E	34	SW
591236	AM 50-211	State Claim	40	acres	Kateel River	21N	11E	34	SE
591237	AM 50-213	State Claim	40	acres	Kateel River	21N	11E	35	SW
591238	AM 50-214	State Claim	40	acres	Kateel River	21N	11E	35	SW
591239	AM 50-215	State Claim	40	acres	Kateel River	21N	11E	35	SE
591240	AM 50-216	State Claim	40	acres	Kateel River	21N	11E	35	SE
591241	AM 50-217	State Claim	40	acres	Kateel River	21N	11E	36	SW
591242	AM 50-218	State Claim	40	acres	Kateel River	21N	11E	36	SW
591243	AM 50-219	State Claim	40	acres	Kateel River	21N	11E	36	SE
591244	AM 50-220	State Claim	40	acres	Kateel River	21N	11E	36	SE
591245	AM 51-206	State Claim	40	acres	Kateel River	21N	11E	33	NW
591246	AM 51-207	State Claim	40	acres	Kateel River	21N	11E	33	NE
591247	AM 51-208	State Claim	40	acres	Kateel River	21N	11E	33	NE
591248	AM 51-209	State Claim	40	acres	Kateel River	21N	11E	34	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591249	AM 51-210	State Claim	40	acres	Kateel River	21N	11E	34	NW
591250	AM 51-211	State Claim	40	acres	Kateel River	21N	11E	34	NE
591251	AM 51-212	State Claim	40	acres	Kateel River	21N	11E	34	NE
591252	AM 51-213	State Claim	40	acres	Kateel River	21N	11E	35	NW
591253	AM 51-214	State Claim	40	acres	Kateel River	21N	11E	35	NW
591254	AM 51-215	State Claim	40	acres	Kateel River	21N	11E	35	NE
591255	AM 51-216	State Claim	40	acres	Kateel River	21N	11E	35	NE
591256	AM 51-217	State Claim	40	acres	Kateel River	21N	11E	36	NW
591257	AM 51-218	State Claim	40	acres	Kateel River	21N	11E	36	NW
591258	AM 51-219	State Claim	40	acres	Kateel River	21N	11E	36	NE
591259	AM 51-220	State Claim	40	acres	Kateel River	21N	11E	36	NE
591260	AM 52-206	State Claim	40	acres	Kateel River	21N	11E	33	NW
591261	AM 52-207	State Claim	40	acres	Kateel River	21N	11E	33	NE
591262	AM 52-208	State Claim	40	acres	Kateel River	21N	11E	33	NE
591263	AM 52-209	State Claim	40	acres	Kateel River	21N	11E	34	NW
591264	AM 52-210	State Claim	40	acres	Kateel River	21N	11E	34	NW
591265	AM 52-211	State Claim	40	acres	Kateel River	21N	11E	34	NE
591266	AM 52-212	State Claim	40	acres	Kateel River	21N	11E	34	NE
591267	AM 52-213	State Claim	40	acres	Kateel River	21N	11E	35	NW
591268	AM 52-214	State Claim	40	acres	Kateel River	21N	11E	35	NW
591269	AM 52-215	State Claim	40	acres	Kateel River	21N	11E	35	NE
591270	AM 52-216	State Claim	40	acres	Kateel River	21N	11E	35	NE
591271	AM 52-217	State Claim	40	acres	Kateel River	21N	11E	36	NW
591272	AM 52-218	State Claim	40	acres	Kateel River	21N	11E	36	NW
591273	AM 52-219	State Claim	40	acres	Kateel River	21N	11E	36	NE
591274	AM 52-220	State Claim	40	acres	Kateel River	21N	11E	36	NE
591275	AM 53-206	State Claim	40	acres	Kateel River	21N	11E	28	SW
591276	AM 53-207	State Claim	40	acres	Kateel River	21N	11E	28	SE
591277	AM 53-208	State Claim	40	acres	Kateel River	21N	11E	28	SE
591278	AM 53-209	State Claim	40	acres	Kateel River	21N	11E	27	SW
591279	AM 53-210	State Claim	40	acres	Kateel River	21N	11E	27	SW
591280	AM 53-211	State Claim	40	acres	Kateel River	21N	11E	27	SE
591281	AM 53-212	State Claim	40	acres	Kateel River	21N	11E	27	SE
591282	AM 53-213	State Claim	40	acres	Kateel River	21N	11E	26	SW
591283	AM 53-214	State Claim	40	acres	Kateel River	21N	11E	26	SW
591284	AM 53-215	State Claim	40	acres	Kateel River	21N	11E	26	SE
591285	AM 53-216	State Claim	40	acres	Kateel River	21N	11E	26	SE
591286	AM 53-217	State Claim	40	acres	Kateel River	21N	11E	25	SW
591287	AM 53-218	State Claim	40	acres	Kateel River	21N	11E	25	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591288	AM 53-219	State Claim	40	acres	Kateel River	21N	11E	25	SE
591289	AM 53-220	State Claim	40	acres	Kateel River	21N	11E	25	SE
591290	AM 54-206	State Claim	40	acres	Kateel River	21N	11E	28	SW
591291	AM 54-207	State Claim	40	acres	Kateel River	21N	11E	28	SE
591292	AM 54-208	State Claim	40	acres	Kateel River	21N	11E	28	SE
591293	AM 54-209	State Claim	40	acres	Kateel River	21N	11E	27	SW
591294	AM 54-210	State Claim	40	acres	Kateel River	21N	11E	27	SW
591295	AM 54-211	State Claim	40	acres	Kateel River	21N	11E	27	SE
591296	AM 54-212	State Claim	40	acres	Kateel River	21N	11E	27	SE
591297	AM 54-213	State Claim	40	acres	Kateel River	21N	11E	26	SW
591298	AM 54-214	State Claim	40	acres	Kateel River	21N	11E	26	SW
591299	AM 54-215	State Claim	40	acres	Kateel River	21N	11E	26	SE
591300	AM 54-216	State Claim	40	acres	Kateel River	21N	11E	26	SE
591301	AM 54-217	State Claim	40	acres	Kateel River	21N	11E	25	SW
591302	AM 54-218	State Claim	40	acres	Kateel River	21N	11E	25	SW
591303	AM 54-219	State Claim	40	acres	Kateel River	21N	11E	25	SE
591304	AM 54-220	State Claim	40	acres	Kateel River	21N	11E	25	SE
591305	AM 55-206	State Claim	40	acres	Kateel River	21N	11E	28	NW
591306	AM 55-207	State Claim	40	acres	Kateel River	21N	11E	28	NE
591307	AM 55-208	State Claim	40	acres	Kateel River	21N	11E	28	NE
591308	AM 55-209	State Claim	40	acres	Kateel River	21N	11E	27	NW
591309	AM 55-210	State Claim	40	acres	Kateel River	21N	11E	27	NW
591310	AM 55-211	State Claim	40	acres	Kateel River	21N	11E	27	NE
591311	AM 55-212	State Claim	40	acres	Kateel River	21N	11E	27	NE
591312	AM 55-213	State Claim	40	acres	Kateel River	21N	11E	26	NW
591313	AM 55-214	State Claim	40	acres	Kateel River	21N	11E	26	NW
591314	AM 55-215	State Claim	40	acres	Kateel River	21N	11E	26	NE
591315	AM 55-216	State Claim	40	acres	Kateel River	21N	11E	26	NE
591316	AM 55-217	State Claim	40	acres	Kateel River	21N	11E	25	NW
591317	AM 55-218	State Claim	40	acres	Kateel River	21N	11E	25	NW
591318	AM 55-219	State Claim	40	acres	Kateel River	21N	11E	25	NE
591319	AM 55-220	State Claim	40	acres	Kateel River	21N	11E	25	NE
591320	AM 56-206	State Claim	40	acres	Kateel River	21N	11E	28	NW
591321	AM 56-207	State Claim	40	acres	Kateel River	21N	11E	28	NE
591322	AM 56-208	State Claim	40	acres	Kateel River	21N	11E	28	NE
591323	AM 56-209	State Claim	40	acres	Kateel River	21N	11E	27	NW
591324	AM 56-210	State Claim	40	acres	Kateel River	21N	11E	27	NW
591325	AM 56-211	State Claim	40	acres	Kateel River	21N	11E	27	NE
591326	AM 56-212	State Claim	40	acres	Kateel River	21N	11E	27	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591327	AM 56-213	State Claim	40	acres	Kateel River	21N	11E	26	NW
591328	AM 56-214	State Claim	40	acres	Kateel River	21N	11E	26	NW
591329	AM 56-215	State Claim	40	acres	Kateel River	21N	11E	26	NE
591330	AM 56-216	State Claim	40	acres	Kateel River	21N	11E	26	NE
591331	AM 56-217	State Claim	40	acres	Kateel River	21N	11E	25	NW
591332	AM 56-218	State Claim	40	acres	Kateel River	21N	11E	25	NW
591333	AM 56-219	State Claim	40	acres	Kateel River	21N	11E	25	NE
591334	AM 56-220	State Claim	40	acres	Kateel River	21N	11E	25	NE
591335	AM 57-206	State Claim	40	acres	Kateel River	21N	11E	21	SW
591336	AM 57-207	State Claim	40	acres	Kateel River	21N	11E	21	SE
591337	AM 57-208	State Claim	40	acres	Kateel River	21N	11E	21	SE
591338	AM 57-209	State Claim	40	acres	Kateel River	21N	11E	22	SW
591339	AM 57-210	State Claim	40	acres	Kateel River	21N	11E	22	SW
591340	AM 57-211	State Claim	40	acres	Kateel River	21N	11E	22	SE
591341	AM 57-212	State Claim	40	acres	Kateel River	21N	11E	22	SE
591342	AM 57-213	State Claim	40	acres	Kateel River	21N	11E	23	SW
591343	AM 57-214	State Claim	40	acres	Kateel River	21N	11E	23	SW
591344	AM 57-215	State Claim	40	acres	Kateel River	21N	11E	23	SE
591345	AM 57-216	State Claim	40	acres	Kateel River	21N	11E	23	SE
591346	AM 57-217	State Claim	40	acres	Kateel River	21N	11E	24	SW
591347	AM 57-218	State Claim	40	acres	Kateel River	21N	11E	24	SW
591348	AM 57-219	State Claim	40	acres	Kateel River	21N	11E	24	SE
591349	AM 57-220	State Claim	40	acres	Kateel River	21N	11E	24	SE
591350	AM 58-206	State Claim	40	acres	Kateel River	21N	11E	21	SW
591351	AM 58-207	State Claim	40	acres	Kateel River	21N	11E	21	SE
591352	AM 58-208	State Claim	40	acres	Kateel River	21N	11E	21	SE
591353	AM 58-209	State Claim	40	acres	Kateel River	21N	11E	22	SW
591354	AM 58-210	State Claim	40	acres	Kateel River	21N	11E	22	SW
591355	AM 58-211	State Claim	40	acres	Kateel River	21N	11E	22	SE
591356	AM 58-212	State Claim	40	acres	Kateel River	21N	11E	22	SE
591357	AM 58-213	State Claim	40	acres	Kateel River	21N	11E	23	SW
591358	AM 58-214	State Claim	40	acres	Kateel River	21N	11E	23	SW
591359	AM 58-215	State Claim	40	acres	Kateel River	21N	11E	23	SE
591360	AM 58-216	State Claim	40	acres	Kateel River	21N	11E	23	SE
591361	AM 58-217	State Claim	40	acres	Kateel River	21N	11E	24	SW
591362	AM 58-218	State Claim	40	acres	Kateel River	21N	11E	24	SW
591363	AM 58-219	State Claim	40	acres	Kateel River	21N	11E	24	SE
591364	AM 58-220	State Claim	40	acres	Kateel River	21N	11E	24	SE
591365	AM 59-202	State Claim	40	acres	Kateel River	21N	11E	20	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591366	AM 59-203	State Claim	40	acres	Kateel River	21N	11E	20	NE
591367	AM 59-204	State Claim	40	acres	Kateel River	21N	11E	20	NE
591368	AM 59-205	State Claim	40	acres	Kateel River	21N	11E	21	NW
591369	AM 59-206	State Claim	40	acres	Kateel River	21N	11E	21	NW
591370	AM 59-207	State Claim	40	acres	Kateel River	21N	11E	21	NE
591371	AM 59-208	State Claim	40	acres	Kateel River	21N	11E	21	NE
591372	AM 59-209	State Claim	40	acres	Kateel River	21N	11E	22	NW
591373	AM 59-210	State Claim	40	acres	Kateel River	21N	11E	22	NW
591374	AM 59-211	State Claim	40	acres	Kateel River	21N	11E	22	NE
591375	AM 59-212	State Claim	40	acres	Kateel River	21N	11E	22	NE
591376	AM 59-213	State Claim	40	acres	Kateel River	21N	11E	23	NW
591377	AM 59-214	State Claim	40	acres	Kateel River	21N	11E	23	NW
591378	AM 59-215	State Claim	40	acres	Kateel River	21N	11E	23	NE
591379	AM 59-216	State Claim	40	acres	Kateel River	21N	11E	23	NE
591380	AM 59-217	State Claim	40	acres	Kateel River	21N	11E	24	NW
591381	AM 59-218	State Claim	40	acres	Kateel River	21N	11E	24	NW
591382	AM 60-202	State Claim	40	acres	Kateel River	21N	11E	20	NW
591383	AM 60-203	State Claim	40	acres	Kateel River	21N	11E	20	NE
591384	AM 60-204	State Claim	40	acres	Kateel River	21N	11E	20	NE
591385	AM 60-205	State Claim	40	acres	Kateel River	21N	11E	21	NW
591386	AM 60-206	State Claim	40	acres	Kateel River	21N	11E	21	NW
591387	AM 60-207	State Claim	40	acres	Kateel River	21N	11E	21	NE
591388	AM 60-208	State Claim	40	acres	Kateel River	21N	11E	21	NE
591389	AM 60-209	State Claim	40	acres	Kateel River	21N	11E	22	NW
591390	AM 60-210	State Claim	40	acres	Kateel River	21N	11E	22	NW
591391	AM 60-211	State Claim	40	acres	Kateel River	21N	11E	22	NE
591392	AM 60-212	State Claim	40	acres	Kateel River	21N	11E	22	NE
591393	AM 60-213	State Claim	40	acres	Kateel River	21N	11E	23	NW
591394	AM 60-214	State Claim	40	acres	Kateel River	21N	11E	23	NW
591395	AM 60-215	State Claim	40	acres	Kateel River	21N	11E	23	NE
591396	AM 60-216	State Claim	40	acres	Kateel River	21N	11E	23	NE
591397	AM 60-217	State Claim	40	acres	Kateel River	21N	11E	24	NW
591398	AM 60-218	State Claim	40	acres	Kateel River	21N	11E	24	NW
591399	AM 61-202	State Claim	40	acres	Kateel River	21N	11E	17	SW
591400	AM 61-203	State Claim	40	acres	Kateel River	21N	11E	17	SE
591401	AM 61-204	State Claim	40	acres	Kateel River	21N	11E	17	SE
591402	AM 61-205	State Claim	40	acres	Kateel River	21N	11E	16	SW
591403	AM 61-206	State Claim	40	acres	Kateel River	21N	11E	16	SW
591404	AM 61-207	State Claim	40	acres	Kateel River	21N	11E	16	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591405	AM 61-208	State Claim	40	acres	Kateel River	21N	11E	16	SE
591406	AM 61-209	State Claim	40	acres	Kateel River	21N	11E	15	SW
591407	AM 61-210	State Claim	40	acres	Kateel River	21N	11E	15	SW
591408	AM 61-211	State Claim	40	acres	Kateel River	21N	11E	15	SE
591409	AM 61-212	State Claim	40	acres	Kateel River	21N	11E	15	SE
591410	AM 61-213	State Claim	40	acres	Kateel River	21N	11E	14	SW
591411	AM 61-214	State Claim	40	acres	Kateel River	21N	11E	14	SW
591412	AM 61-215	State Claim	40	acres	Kateel River	21N	11E	14	SE
591413	AM 61-216	State Claim	40	acres	Kateel River	21N	11E	14	SE
591414	AM 61-217	State Claim	40	acres	Kateel River	21N	11E	13	SW
591415	AM 61-218	State Claim	40	acres	Kateel River	21N	11E	13	SW
591416	AM 62-202	State Claim	40	acres	Kateel River	21N	11E	17	SW
591417	AM 62-203	State Claim	40	acres	Kateel River	21N	11E	17	SE
591418	AM 62-204	State Claim	40	acres	Kateel River	21N	11E	17	SE
591419	AM 62-205	State Claim	40	acres	Kateel River	21N	11E	16	SW
591420	AM 62-206	State Claim	40	acres	Kateel River	21N	11E	16	SW
591421	AM 62-207	State Claim	40	acres	Kateel River	21N	11E	16	SE
591422	AM 62-208	State Claim	40	acres	Kateel River	21N	11E	16	SE
591423	AM 62-209	State Claim	40	acres	Kateel River	21N	11E	15	SW
591424	AM 62-210	State Claim	40	acres	Kateel River	21N	11E	15	SW
591425	AM 62-211	State Claim	40	acres	Kateel River	21N	11E	15	SE
591426	AM 62-212	State Claim	40	acres	Kateel River	21N	11E	15	SE
591427	AM 62-213	State Claim	40	acres	Kateel River	21N	11E	14	SW
591428	AM 62-214	State Claim	40	acres	Kateel River	21N	11E	14	SW
591429	AM 62-215	State Claim	40	acres	Kateel River	21N	11E	14	SE
591430	AM 62-216	State Claim	40	acres	Kateel River	21N	11E	14	SE
591431	AM 62-217	State Claim	40	acres	Kateel River	21N	11E	13	SW
591432	AM 62-218	State Claim	40	acres	Kateel River	21N	11E	13	SW
591433	AM 63-202	State Claim	40	acres	Kateel River	21N	11E	17	NW
591434	AM 63-203	State Claim	40	acres	Kateel River	21N	11E	17	NE
591435	AM 63-204	State Claim	40	acres	Kateel River	21N	11E	17	NE
591436	AM 63-205	State Claim	40	acres	Kateel River	21N	11E	16	NW
591437	AM 63-206	State Claim	40	acres	Kateel River	21N	11E	16	NW
591438	AM 63-207	State Claim	40	acres	Kateel River	21N	11E	16	NE
591439	AM 63-208	State Claim	40	acres	Kateel River	21N	11E	16	NE
591440	AM 63-209	State Claim	40	acres	Kateel River	21N	11E	15	NW
591441	AM 63-210	State Claim	40	acres	Kateel River	21N	11E	15	NW
591442	AM 63-211	State Claim	40	acres	Kateel River	21N	11E	15	NE
591443	AM 63-212	State Claim	40	acres	Kateel River	21N	11E	15	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591444	AM 64-202	State Claim	40	acres	Kateel River	21N	11E	17	NW
591445	AM 64-203	State Claim	40	acres	Kateel River	21N	11E	17	NE
591446	AM 64-204	State Claim	40	acres	Kateel River	21N	11E	17	NE
591447	AM 64-205	State Claim	40	acres	Kateel River	21N	11E	16	NW
591448	AM 64-206	State Claim	40	acres	Kateel River	21N	11E	16	NW
591449	AM 64-207	State Claim	40	acres	Kateel River	21N	11E	16	NE
591450	AM 64-208	State Claim	40	acres	Kateel River	21N	11E	16	NE
591451	AM 64-209	State Claim	40	acres	Kateel River	21N	11E	15	NW
591452	AM 64-210	State Claim	40	acres	Kateel River	21N	11E	15	NW
591453	AM 64-211	State Claim	40	acres	Kateel River	21N	11E	15	NE
591454	AM 64-212	State Claim	40	acres	Kateel River	21N	11E	15	NE
591455	AM 65-202	State Claim	40	acres	Kateel River	21N	11E	8	SW
591456	AM 65-203	State Claim	40	acres	Kateel River	21N	11E	8	SE
591457	AM 65-204	State Claim	40	acres	Kateel River	21N	11E	8	SE
591458	AM 65-205	State Claim	40	acres	Kateel River	21N	11E	9	SW
591459	AM 65-206	State Claim	40	acres	Kateel River	21N	11E	9	SW
591460	AM 65-207	State Claim	40	acres	Kateel River	21N	11E	9	SE
591461	AM 65-208	State Claim	40	acres	Kateel River	21N	11E	9	SE
591462	AM 65-209	State Claim	40	acres	Kateel River	21N	11E	10	SW
591463	AM 65-210	State Claim	40	acres	Kateel River	21N	11E	10	SW
591464	AM 65-211	State Claim	40	acres	Kateel River	21N	11E	10	SE
591465	AM 65-212	State Claim	40	acres	Kateel River	21N	11E	10	SE
591466	AM 66-202	State Claim	40	acres	Kateel River	21N	11E	8	SW
591467	AM 66-203	State Claim	40	acres	Kateel River	21N	11E	8	SE
591468	AM 66-204	State Claim	40	acres	Kateel River	21N	11E	8	SE
591469	AM 66-205	State Claim	40	acres	Kateel River	21N	11E	9	SW
591470	AM 66-206	State Claim	40	acres	Kateel River	21N	11E	9	SW
591471	AM 66-207	State Claim	40	acres	Kateel River	21N	11E	9	SE
591472	AM 66-208	State Claim	40	acres	Kateel River	21N	11E	9	SE
591473	AM 66-209	State Claim	40	acres	Kateel River	21N	11E	10	SW
591474	AM 66-210	State Claim	40	acres	Kateel River	21N	11E	10	SW
591475	AM 66-211	State Claim	40	acres	Kateel River	21N	11E	10	SE
591476	AM 66-212	State Claim	40	acres	Kateel River	21N	11E	10	SE
591477	AM 67-197	State Claim	40	acres	Kateel River	21N	11E	7	NW
591478	AM 67-198	State Claim	40	acres	Kateel River	21N	11E	7	NW
591479	AM 67-199	State Claim	40	acres	Kateel River	21N	11E	7	NE
591480	AM 67-200	State Claim	40	acres	Kateel River	21N	11E	7	NE
591481	AM 67-201	State Claim	40	acres	Kateel River	21N	11E	8	NW
591482	AM 67-202	State Claim	40	acres	Kateel River	21N	11E	8	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591483	AM 67-203	State Claim	40	acres	Kateel River	21N	11E	8	NE
591484	AM 67-204	State Claim	40	acres	Kateel River	21N	11E	8	NE
591485	AM 67-205	State Claim	40	acres	Kateel River	21N	11E	9	NW
591486	AM 67-206	State Claim	40	acres	Kateel River	21N	11E	9	NW
591487	AM 67-207	State Claim	40	acres	Kateel River	21N	11E	9	NE
591488	AM 67-208	State Claim	40	acres	Kateel River	21N	11E	9	NE
591489	AM 67-209	State Claim	40	acres	Kateel River	21N	11E	10	NW
591490	AM 67-210	State Claim	40	acres	Kateel River	21N	11E	10	NW
591491	AM 67-211	State Claim	40	acres	Kateel River	21N	11E	10	NE
591492	AM 67-212	State Claim	40	acres	Kateel River	21N	11E	10	NE
591493	AM 68-208	State Claim	40	acres	Kateel River	21N	11E	9	NE
591494	AM 68-209	State Claim	40	acres	Kateel River	21N	11E	10	NW
591495	AM 68-210	State Claim	40	acres	Kateel River	21N	11E	10	NW
591496	AM 68-211	State Claim	40	acres	Kateel River	21N	11E	10	NE
591497	AM 68-212	State Claim	40	acres	Kateel River	21N	11E	10	NE
591498	AM 69-208	State Claim	40	acres	Kateel River	21N	11E	4	SE
591499	AM 69-209	State Claim	40	acres	Kateel River	21N	11E	3	SW
591500	AM 69-210	State Claim	40	acres	Kateel River	21N	11E	3	SW
591501	AM 69-211	State Claim	40	acres	Kateel River	21N	11E	3	SE
591502	AM 69-212	State Claim	40	acres	Kateel River	21N	11E	3	SE
591503	AM 49-221	State Claim	40	acres	Kateel River	21N	12E	31	SW
591504	AM 49-222	State Claim	40	acres	Kateel River	21N	12E	31	SW
591505	AM 49-223	State Claim	40	acres	Kateel River	21N	12E	31	SE
591506	AM 49-224	State Claim	40	acres	Kateel River	21N	12E	31	SE
591507	AM 49-225	State Claim	40	acres	Kateel River	21N	12E	32	SW
591508	AM 49-226	State Claim	40	acres	Kateel River	21N	12E	32	SW
591509	AM 49-227	State Claim	40	acres	Kateel River	21N	12E	32	SE
591510	AM 49-228	State Claim	40	acres	Kateel River	21N	12E	32	SE
591511	AM 49-229	State Claim	40	acres	Kateel River	21N	12E	33	SW
591512	AM 49-230	State Claim	40	acres	Kateel River	21N	12E	33	SW
591513	AM 50-221	State Claim	40	acres	Kateel River	21N	12E	31	SW
591514	AM 50-222	State Claim	40	acres	Kateel River	21N	12E	31	SW
591515	AM 50-223	State Claim	40	acres	Kateel River	21N	12E	31	SE
591516	AM 50-224	State Claim	40	acres	Kateel River	21N	12E	31	SE
591517	AM 50-225	State Claim	40	acres	Kateel River	21N	12E	32	SW
591518	AM 50-226	State Claim	40	acres	Kateel River	21N	12E	32	SW
591519	AM 50-227	State Claim	40	acres	Kateel River	21N	12E	32	SE
591520	AM 50-228	State Claim	40	acres	Kateel River	21N	12E	32	SE
591521	AM 50-229	State Claim	40	acres	Kateel River	21N	12E	33	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591522	AM 50-230	State Claim	40	acres	Kateel River	21N	12E	33	SW
591523	AM 51-221	State Claim	40	acres	Kateel River	21N	12E	31	NW
591524	AM 51-222	State Claim	40	acres	Kateel River	21N	12E	31	NW
591525	AM 51-223	State Claim	40	acres	Kateel River	21N	12E	31	NE
591526	AM 51-224	State Claim	40	acres	Kateel River	21N	12E	31	NE
591527	AM 51-225	State Claim	40	acres	Kateel River	21N	12E	32	NW
591528	AM 51-226	State Claim	40	acres	Kateel River	21N	12E	32	NW
591529	AM 51-227	State Claim	40	acres	Kateel River	21N	12E	32	NE
591530	AM 51-228	State Claim	40	acres	Kateel River	21N	12E	32	NE
591531	AM 51-229	State Claim	40	acres	Kateel River	21N	12E	33	NW
591532	AM 51-230	State Claim	40	acres	Kateel River	21N	12E	33	NW
591533	AM 52-221	State Claim	40	acres	Kateel River	21N	12E	31	NW
591534	AM 52-222	State Claim	40	acres	Kateel River	21N	12E	31	NW
591535	AM 52-223	State Claim	40	acres	Kateel River	21N	12E	31	NE
591536	AM 52-224	State Claim	40	acres	Kateel River	21N	12E	31	NE
591537	AM 52-225	State Claim	40	acres	Kateel River	21N	12E	32	NW
591538	AM 52-226	State Claim	40	acres	Kateel River	21N	12E	32	NW
591539	AM 52-227	State Claim	40	acres	Kateel River	21N	12E	32	NE
591540	AM 52-228	State Claim	40	acres	Kateel River	21N	12E	32	NE
591541	AM 52-229	State Claim	40	acres	Kateel River	21N	12E	33	NW
591542	AM 52-230	State Claim	40	acres	Kateel River	21N	12E	33	NW
591543	AM 53-221	State Claim	40	acres	Kateel River	21N	12E	30	SW
591544	AM 53-222	State Claim	40	acres	Kateel River	21N	12E	30	SW
591545	AM 53-223	State Claim	40	acres	Kateel River	21N	12E	30	SE
591546	AM 53-224	State Claim	40	acres	Kateel River	21N	12E	30	SE
591547	AM 54-221	State Claim	40	acres	Kateel River	21N	12E	30	SW
591548	AM 54-222	State Claim	40	acres	Kateel River	21N	12E	30	SW
591549	AM 54-223	State Claim	40	acres	Kateel River	21N	12E	30	SE
591550	AM 54-224	State Claim	40	acres	Kateel River	21N	12E	30	SE
591551	AM 55-221	State Claim	40	acres	Kateel River	21N	12E	30	NW
591552	AM 55-222	State Claim	40	acres	Kateel River	21N	12E	30	NW
591553	AM 55-223	State Claim	40	acres	Kateel River	21N	12E	30	NE
591554	AM 55-224	State Claim	40	acres	Kateel River	21N	12E	30	NE
591555	AM 56-221	State Claim	40	acres	Kateel River	21N	12E	30	NW
591556	AM 56-222	State Claim	40	acres	Kateel River	21N	12E	30	NW
591557	AM 56-223	State Claim	40	acres	Kateel River	21N	12E	30	NE
591558	AM 56-224	State Claim	40	acres	Kateel River	21N	12E	30	NE
591575	AM 37-226	State Claim	40	acres	Kateel River	20N	12E	16	SW
591576	AM 37-227	State Claim	40	acres	Kateel River	20N	12E	16	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591577	AM 37-228	State Claim	40	acres	Kateel River	20N	12E	16	SE
591578	AM 37-229	State Claim	40	acres	Kateel River	20N	12E	15	SW
591579	AM 37-230	State Claim	40	acres	Kateel River	20N	12E	15	SW
591590	AM 38-226	State Claim	40	acres	Kateel River	20N	12E	16	SW
591591	AM 38-227	State Claim	40	acres	Kateel River	20N	12E	16	SE
591592	AM 38-228	State Claim	40	acres	Kateel River	20N	12E	16	SE
591593	AM 38-229	State Claim	40	acres	Kateel River	20N	12E	15	SW
591594	AM 38-230	State Claim	40	acres	Kateel River	20N	12E	15	SW
591605	AM 39-226	State Claim	40	acres	Kateel River	20N	12E	16	NW
591606	AM 39-227	State Claim	40	acres	Kateel River	20N	12E	16	NE
591607	AM 39-228	State Claim	40	acres	Kateel River	20N	12E	16	NE
591608	AM 39-229	State Claim	40	acres	Kateel River	20N	12E	15	NW
591609	AM 39-230	State Claim	40	acres	Kateel River	20N	12E	15	NW
591620	AM 40-226	State Claim	40	acres	Kateel River	20N	12E	16	NW
591621	AM 40-227	State Claim	40	acres	Kateel River	20N	12E	16	NE
591622	AM 40-228	State Claim	40	acres	Kateel River	20N	12E	16	NE
591623	AM 40-229	State Claim	40	acres	Kateel River	20N	12E	15	NW
591624	AM 40-230	State Claim	40	acres	Kateel River	20N	12E	15	NW
591635	AM 41-225	State Claim	40	acres	Kateel River	20N	12E	9	SW
591636	AM 41-226	State Claim	40	acres	Kateel River	20N	12E	9	SW
591637	AM 41-227	State Claim	40	acres	Kateel River	20N	12E	9	SE
591638	AM 41-228	State Claim	40	acres	Kateel River	20N	12E	9	SE
591639	AM 41-229	State Claim	40	acres	Kateel River	20N	12E	10	SW
591640	AM 41-230	State Claim	40	acres	Kateel River	20N	12E	10	SW
591648	AM 42-223	State Claim	40	acres	Kateel River	20N	12E	8	SE
591649	AM 42-224	State Claim	40	acres	Kateel River	20N	12E	8	SE
591650	AM 42-225	State Claim	40	acres	Kateel River	20N	12E	9	SW
591651	AM 42-226	State Claim	40	acres	Kateel River	20N	12E	9	SW
591652	AM 42-227	State Claim	40	acres	Kateel River	20N	12E	9	SE
591653	AM 42-228	State Claim	40	acres	Kateel River	20N	12E	9	SE
591654	AM 42-229	State Claim	40	acres	Kateel River	20N	12E	10	SW
591655	AM 42-230	State Claim	40	acres	Kateel River	20N	12E	10	SW
591661	AM 43-221	State Claim	40	acres	Kateel River	20N	12E	8	NW
591662	AM 43-222	State Claim	40	acres	Kateel River	20N	12E	8	NW
591663	AM 43-223	State Claim	40	acres	Kateel River	20N	12E	8	NE
591664	AM 43-224	State Claim	40	acres	Kateel River	20N	12E	8	NE
591665	AM 43-225	State Claim	40	acres	Kateel River	20N	12E	9	NW
591666	AM 43-226	State Claim	40	acres	Kateel River	20N	12E	9	NW
591667	AM 43-227	State Claim	40	acres	Kateel River	20N	12E	9	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591668	AM 43-228	State Claim	40	acres	Kateel River	20N	12E	9	NE
591669	AM 43-229	State Claim	40	acres	Kateel River	20N	12E	10	NW
591670	AM 43-230	State Claim	40	acres	Kateel River	20N	12E	10	NW
591676	AM 44-219	State Claim	40	acres	Kateel River	20N	12E	7	NE
591677	AM 44-220	State Claim	40	acres	Kateel River	20N	12E	7	NE
591678	AM 44-221	State Claim	40	acres	Kateel River	20N	12E	8	NW
591679	AM 44-222	State Claim	40	acres	Kateel River	20N	12E	8	NW
591680	AM 44-223	State Claim	40	acres	Kateel River	20N	12E	8	NE
591681	AM 44-224	State Claim	40	acres	Kateel River	20N	12E	8	NE
591682	AM 44-225	State Claim	40	acres	Kateel River	20N	12E	9	NW
591683	AM 44-226	State Claim	40	acres	Kateel River	20N	12E	9	NW
591684	AM 44-227	State Claim	40	acres	Kateel River	20N	12E	9	NE
591685	AM 44-228	State Claim	40	acres	Kateel River	20N	12E	9	NE
591686	AM 44-229	State Claim	40	acres	Kateel River	20N	12E	10	NW
591687	AM 44-230	State Claim	40	acres	Kateel River	20N	12E	10	NW
591693	AM 45-217	State Claim	40	acres	Kateel River	20N	12E	6	SW
591694	AM 45-218	State Claim	40	acres	Kateel River	20N	12E	6	SW
591695	AM 45-219	State Claim	40	acres	Kateel River	20N	12E	6	SE
591696	AM 45-220	State Claim	40	acres	Kateel River	20N	12E	6	SE
591697	AM 45-221	State Claim	40	acres	Kateel River	20N	12E	5	SW
591698	AM 45-222	State Claim	40	acres	Kateel River	20N	12E	5	SW
591699	AM 45-223	State Claim	40	acres	Kateel River	20N	12E	5	SE
591700	AM 45-224	State Claim	40	acres	Kateel River	20N	12E	5	SE
591701	AM 45-225	State Claim	40	acres	Kateel River	20N	12E	4	SW
591702	AM 45-226	State Claim	40	acres	Kateel River	20N	12E	4	SW
591703	AM 45-227	State Claim	40	acres	Kateel River	20N	12E	4	SE
591704	AM 45-228	State Claim	40	acres	Kateel River	20N	12E	4	SE
591705	AM 45-229	State Claim	40	acres	Kateel River	20N	12E	3	SW
591706	AM 45-230	State Claim	40	acres	Kateel River	20N	12E	3	SW
591712	AM 46-217	State Claim	40	acres	Kateel River	20N	12E	6	SW
591713	AM 46-218	State Claim	40	acres	Kateel River	20N	12E	6	SW
591714	AM 46-219	State Claim	40	acres	Kateel River	20N	12E	6	SE
591715	AM 46-220	State Claim	40	acres	Kateel River	20N	12E	6	SE
591716	AM 46-221	State Claim	40	acres	Kateel River	20N	12E	5	SW
591717	AM 46-222	State Claim	40	acres	Kateel River	20N	12E	5	SW
591718	AM 46-223	State Claim	40	acres	Kateel River	20N	12E	5	SE
591719	AM 46-224	State Claim	40	acres	Kateel River	20N	12E	5	SE
591720	AM 46-225	State Claim	40	acres	Kateel River	20N	12E	4	SW
591721	AM 46-226	State Claim	40	acres	Kateel River	20N	12E	4	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
591722	AM 46-227	State Claim	40	acres	Kateel River	20N	12E	4	SE
591723	AM 46-228	State Claim	40	acres	Kateel River	20N	12E	4	SE
591724	AM 46-229	State Claim	40	acres	Kateel River	20N	12E	3	SW
591725	AM 46-230	State Claim	40	acres	Kateel River	20N	12E	3	SW
591731	AM 47-217	State Claim	40	acres	Kateel River	20N	12E	6	NW
591732	AM 47-218	State Claim	40	acres	Kateel River	20N	12E	6	NW
591733	AM 47-219	State Claim	40	acres	Kateel River	20N	12E	6	NE
591734	AM 47-220	State Claim	40	acres	Kateel River	20N	12E	6	NE
591735	AM 47-221	State Claim	40	acres	Kateel River	20N	12E	5	NW
591736	AM 47-222	State Claim	40	acres	Kateel River	20N	12E	5	NW
591737	AM 47-223	State Claim	40	acres	Kateel River	20N	12E	5	NE
591738	AM 47-224	State Claim	40	acres	Kateel River	20N	12E	5	NE
591739	AM 47-225	State Claim	40	acres	Kateel River	20N	12E	4	NW
591740	AM 47-226	State Claim	40	acres	Kateel River	20N	12E	4	NW
591741	AM 47-227	State Claim	40	acres	Kateel River	20N	12E	4	NE
591742	AM 47-228	State Claim	40	acres	Kateel River	20N	12E	4	NE
591743	AM 47-229	State Claim	40	acres	Kateel River	20N	12E	3	NW
591744	AM 47-230	State Claim	40	acres	Kateel River	20N	12E	3	NW
591745	AM 48-217	State Claim	40	acres	Kateel River	20N	12E	6	NW
591746	AM 48-218	State Claim	40	acres	Kateel River	20N	12E	6	NW
591747	AM 48-219	State Claim	40	acres	Kateel River	20N	12E	6	NE
591748	AM 48-220	State Claim	40	acres	Kateel River	20N	12E	6	NE
591749	AM 48-221	State Claim	40	acres	Kateel River	20N	12E	5	NW
591750	AM 48-222	State Claim	40	acres	Kateel River	20N	12E	5	NW
591751	AM 48-223	State Claim	40	acres	Kateel River	20N	12E	5	NE
591752	AM 48-224	State Claim	40	acres	Kateel River	20N	12E	5	NE
591753	AM 48-225	State Claim	40	acres	Kateel River	20N	12E	4	NW
591754	AM 48-226	State Claim	40	acres	Kateel River	20N	12E	4	NW
591755	AM 48-227	State Claim	40	acres	Kateel River	20N	12E	4	NE
591756	AM 48-228	State Claim	40	acres	Kateel River	20N	12E	4	NE
591757	AM 48-229	State Claim	40	acres	Kateel River	20N	12E	3	NW
591758	AM 48-230	State Claim	40	acres	Kateel River	20N	12E	3	NW
634110	EDC 1	State Claim	40	acres	Kateel River	21N	10E	12	SW
634111	EDC 2	State Claim	40	acres	Kateel River	21N	10E	12	SE
634112	EDC 3	State Claim	40	acres	Kateel River	21N	10E	12	SE
634113	EDC 4	State Claim	40	acres	Kateel River	21N	11E	7	SW
634114	EDC 5	State Claim	40	acres	Kateel River	21N	11E	7	SW
634115	EDC 6	State Claim	40	acres	Kateel River	21N	11E	7	SE
634116	EDC 7	State Claim	40	acres	Kateel River	21N	11E	7	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
634117	EDC 8	State Claim	40	acres	Kateel River	21N	11E	8	SW
634118	EDC 9	State Claim	40	acres	Kateel River	21N	10E	12	SW
634119	EDC 10	State Claim	40	acres	Kateel River	21N	10E	12	SE
634120	EDC 11	State Claim	40	acres	Kateel River	21N	10E	12	SE
634121	EDC 12	State Claim	40	acres	Kateel River	21N	11E	7	SW
634122	EDC 13	State Claim	40	acres	Kateel River	21N	11E	7	SW
634123	EDC 14	State Claim	40	acres	Kateel River	21N	11E	7	SE
634124	EDC 15	State Claim	40	acres	Kateel River	21N	11E	7	SE
634125	EDC 16	State Claim	40	acres	Kateel River	21N	11E	8	SW
634126	EDC 17	State Claim	40	acres	Kateel River	21N	10E	13	NW
634127	EDC 18	State Claim	40	acres	Kateel River	21N	10E	13	NE
634128	EDC 19	State Claim	40	acres	Kateel River	21N	10E	13	NE
634129	EDC 20	State Claim	40	acres	Kateel River	21N	11E	18	NW
634130	EDC 21	State Claim	40	acres	Kateel River	21N	11E	18	NW
634131	EDC 22	State Claim	40	acres	Kateel River	21N	11E	18	NE
634132	EDC 23	State Claim	40	acres	Kateel River	21N	11E	18	NE
634133	EDC 24	State Claim	40	acres	Kateel River	21N	11E	17	NW
634134	EDC 25	State Claim	40	acres	Kateel River	21N	10E	13	NW
634135	EDC 26	State Claim	40	acres	Kateel River	21N	10E	13	NE
634136	EDC 27	State Claim	40	acres	Kateel River	21N	10E	13	NE
634137	EDC 28	State Claim	40	acres	Kateel River	21N	11E	18	NW
634138	EDC 29	State Claim	40	acres	Kateel River	21N	11E	18	NW
634139	EDC 30	State Claim	40	acres	Kateel River	21N	11E	18	NE
634140	EDC 31	State Claim	40	acres	Kateel River	21N	11E	18	NE
634141	EDC 32	State Claim	40	acres	Kateel River	21N	11E	17	NW
634142	EDC 33	State Claim	40	acres	Kateel River	21N	10E	13	SW
634143	EDC 34	State Claim	40	acres	Kateel River	21N	10E	13	SE
634144	EDC 35	State Claim	40	acres	Kateel River	21N	10E	13	SE
634145	EDC 36	State Claim	40	acres	Kateel River	21N	11E	18	SW
634146	EDC 37	State Claim	40	acres	Kateel River	21N	11E	18	SW
634147	EDC 38	State Claim	40	acres	Kateel River	21N	11E	18	SE
634148	EDC 39	State Claim	40	acres	Kateel River	21N	11E	18	SE
634149	EDC 40	State Claim	40	acres	Kateel River	21N	11E	17	SW
634150	EDC 41	State Claim	40	acres	Kateel River	21N	10E	13	SW
634151	EDC 42	State Claim	40	acres	Kateel River	21N	10E	13	SE
634152	EDC 43	State Claim	40	acres	Kateel River	21N	10E	13	SE
634153	EDC 44	State Claim	40	acres	Kateel River	21N	11E	18	SW
634154	EDC 45	State Claim	40	acres	Kateel River	21N	11E	18	SW
634155	EDC 46	State Claim	40	acres	Kateel River	21N	11E	18	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
634156	EDC 47	State Claim	40	acres	Kateel River	21N	11E	18	SE
634157	EDC 48	State Claim	40	acres	Kateel River	21N	11E	17	SW
634158	EDC 49	State Claim	40	acres	Kateel River	21N	10E	24	NW
634159	EDC 50	State Claim	40	acres	Kateel River	21N	10E	24	NE
634160	EDC 51	State Claim	40	acres	Kateel River	21N	10E	24	NE
634161	EDC 52	State Claim	40	acres	Kateel River	21N	11E	19	NW
634162	EDC 53	State Claim	40	acres	Kateel River	21N	11E	19	NW
634163	EDC 54	State Claim	40	acres	Kateel River	21N	11E	19	NE
634164	EDC 55	State Claim	40	acres	Kateel River	21N	11E	19	NE
634165	EDC 56	State Claim	40	acres	Kateel River	21N	11E	20	NW
634166	EDC 57	State Claim	40	acres	Kateel River	21N	10E	24	NW
634167	EDC 58	State Claim	40	acres	Kateel River	21N	10E	24	NE
634168	EDC 59	State Claim	40	acres	Kateel River	21N	10E	24	NE
634169	EDC 60	State Claim	40	acres	Kateel River	21N	11E	19	NW
634170	EDC 61	State Claim	40	acres	Kateel River	21N	11E	19	NW
634171	EDC 62	State Claim	40	acres	Kateel River	21N	11E	19	NE
634172	EDC 63	State Claim	40	acres	Kateel River	21N	11E	19	NE
634173	EDC 64	State Claim	40	acres	Kateel River	21N	11E	20	NW
634174	EDC 65	State Claim	40	acres	Kateel River	21N	10E	24	SE
634175	EDC 66	State Claim	40	acres	Kateel River	21N	10E	24	SE
634176	EDC 67	State Claim	40	acres	Kateel River	21N	11E	19	SW
634177	EDC 68	State Claim	40	acres	Kateel River	21N	11E	19	SW
634178	EDC 69	State Claim	40	acres	Kateel River	21N	11E	19	SE
634179	EDC 70	State Claim	40	acres	Kateel River	21N	11E	19	SE
634180	EDC 71	State Claim	40	acres	Kateel River	21N	11E	20	SW
634181	EDC 72	State Claim	40	acres	Kateel River	21N	11E	20	SW
634182	EDC 73	State Claim	40	acres	Kateel River	21N	11E	20	SE
634183	EDC 74	State Claim	40	acres	Kateel River	21N	11E	20	SE
634184	EDC 75	State Claim	40	acres	Kateel River	21N	11E	21	SW
634185	EDC 76	State Claim	40	acres	Kateel River	21N	10E	24	SE
634186	EDC 77	State Claim	40	acres	Kateel River	21N	11E	19	SW
634187	EDC 78	State Claim	40	acres	Kateel River	21N	11E	19	SW
634188	EDC 79	State Claim	40	acres	Kateel River	21N	11E	19	SE
634189	EDC 80	State Claim	40	acres	Kateel River	21N	11E	19	SE
634190	EDC 81	State Claim	40	acres	Kateel River	21N	11E	20	SW
634191	EDC 82	State Claim	40	acres	Kateel River	21N	11E	20	SW
634192	EDC 83	State Claim	40	acres	Kateel River	21N	11E	20	SE
634193	EDC 84	State Claim	40	acres	Kateel River	21N	11E	20	SE
634194	EDC 85	State Claim	40	acres	Kateel River	21N	11E	21	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
634195	EDC 86	State Claim	40	acres	Kateel River	21N	10E	25	NE
634196	EDC 87	State Claim	40	acres	Kateel River	21N	11E	30	NW
634197	EDC 88	State Claim	40	acres	Kateel River	21N	11E	30	NW
634198	EDC 89	State Claim	40	acres	Kateel River	21N	11E	30	NE
634199	EDC 90	State Claim	40	acres	Kateel River	21N	11E	30	NE
634200	EDC 91	State Claim	40	acres	Kateel River	21N	11E	29	NW
634201	EDC 92	State Claim	40	acres	Kateel River	21N	11E	29	NW
634202	EDC 93	State Claim	40	acres	Kateel River	21N	11E	29	NE
634203	EDC 94	State Claim	40	acres	Kateel River	21N	11E	29	NE
634204	EDC 95	State Claim	40	acres	Kateel River	21N	11E	28	NW
650291	HOSS 01	State Claim	160	acres	Kateel River	22N	10E	18	NW
650292	HOSS 02	State Claim	160	acres	Kateel River	22N	10E	18	NE
650293	HOSS 03	State Claim	160	acres	Kateel River	22N	10E	17	NW
650294	HOSS 04	State Claim	160	acres	Kateel River	22N	10E	17	NE
650295	HOSS 05	State Claim	160	acres	Kateel River	22N	10E	16	NW
650296	HOSS 06	State Claim	160	acres	Kateel River	22N	10E	16	NE
650297	HOSS 07	State Claim	160	acres	Kateel River	22N	10E	15	NW
650298	HOSS 08	State Claim	160	acres	Kateel River	22N	10E	18	SW
650299	HOSS 09	State Claim	160	acres	Kateel River	22N	10E	18	SE
650300	HOSS 10	State Claim	160	acres	Kateel River	22N	10E	17	SW
650301	HOSS 11	State Claim	160	acres	Kateel River	22N	10E	17	SE
650302	HOSS 12	State Claim	160	acres	Kateel River	22N	10E	16	SW
650303	HOSS 13	State Claim	160	acres	Kateel River	22N	10E	16	SE
650304	HOSS 14	State Claim	160	acres	Kateel River	22N	10E	15	SW
650305	HOSS 15	State Claim	160	acres	Kateel River	22N	10E	19	NW
650306	HOSS 16	State Claim	160	acres	Kateel River	22N	10E	19	NE
650307	HOSS 17	State Claim	160	acres	Kateel River	22N	10E	20	NW
650308	HOSS 18	State Claim	160	acres	Kateel River	22N	10E	20	NE
650309	HOSS 19	State Claim	160	acres	Kateel River	22N	10E	21	NW
650310	HOSS 20	State Claim	160	acres	Kateel River	22N	10E	21	NE
650311	HOSS 21	State Claim	160	acres	Kateel River	22N	10E	22	NW
650312	HOSS 22	State Claim	160	acres	Kateel River	22N	10E	19	SW
650313	HOSS 23	State Claim	160	acres	Kateel River	22N	10E	19	SE
650314	HOSS 24	State Claim	160	acres	Kateel River	22N	10E	20	SW
650315	HOSS 25	State Claim	160	acres	Kateel River	22N	10E	20	SE
650316	HOSS 26	State Claim	160	acres	Kateel River	22N	10E	21	SW
650317	HOSS 27	State Claim	160	acres	Kateel River	22N	10E	21	SE
650318	HOSS 28	State Claim	160	acres	Kateel River	22N	10E	22	SW
650319	HOSS 29	State Claim	160	acres	Kateel River	22N	10E	30	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
650320	HOSS 30	State Claim	160	acres	Kateel River	22N	10E	30	NE
650321	HOSS 31	State Claim	160	acres	Kateel River	22N	10E	29	NW
650322	HOSS 32	State Claim	160	acres	Kateel River	22N	10E	29	NE
650323	HOSS 33	State Claim	160	acres	Kateel River	22N	10E	28	NW
650324	HOSS 34	State Claim	160	acres	Kateel River	22N	10E	28	NE
650325	HOSS 35	State Claim	160	acres	Kateel River	22N	10E	27	NW
651152	ZED 1	State Claim	160	acres	Kateel River	20N	12E	10	NE
651153	ZED 2	State Claim	160	acres	Kateel River	20N	12E	11	NW
651154	ZED 3	State Claim	160	acres	Kateel River	20N	12E	11	NE
651155	ZED 4	State Claim	160	acres	Kateel River	20N	12E	10	SE
651156	ZED 5	State Claim	160	acres	Kateel River	20N	12E	11	SW
651157	ZED 6	State Claim	160	acres	Kateel River	20N	12E	11	SE
651158	ZED 7	State Claim	160	acres	Kateel River	20N	12E	12	SW
651159	ZED 8	State Claim	160	acres	Kateel River	20N	12E	12	SE
651160	ZED 9	State Claim	160	acres	Kateel River	20N	12E	15	NE
651161	ZED 10	State Claim	160	acres	Kateel River	20N	12E	14	NW
651162	ZED 11	State Claim	160	acres	Kateel River	20N	12E	14	NE
651163	ZED 12	State Claim	160	acres	Kateel River	20N	12E	13	NW
651164	ZED 13	State Claim	160	acres	Kateel River	20N	12E	13	NE
651165	ZED 14	State Claim	160	acres	Kateel River	20N	13E	18	NW
651166	ZED 15	State Claim	160	acres	Kateel River	20N	13E	18	NE
651167	ZED 16	State Claim	160	acres	Kateel River	20N	13E	17	NW
651168	ZED 17	State Claim	160	acres	Kateel River	20N	13E	17	NE
651169	ZED 18	State Claim	160	acres	Kateel River	20N	13E	16	NW
651170	ZED 19	State Claim	160	acres	Kateel River	20N	13E	16	NE
651171	ZED 20	State Claim	160	acres	Kateel River	20N	13E	15	NW
651172	ZED 21	State Claim	160	acres	Kateel River	20N	13E	15	NE
651173	ZED 22	State Claim	160	acres	Kateel River	20N	12E	15	SE
651174	ZED 23	State Claim	160	acres	Kateel River	20N	12E	14	SW
651175	ZED 24	State Claim	160	acres	Kateel River	20N	12E	14	SE
651176	ZED 25	State Claim	160	acres	Kateel River	20N	12E	13	SW
651177	ZED 26	State Claim	160	acres	Kateel River	20N	12E	13	SE
651178	ZED 27	State Claim	160	acres	Kateel River	20N	13E	18	SW
651179	ZED 28	State Claim	160	acres	Kateel River	20N	13E	18	SE
651180	ZED 29	State Claim	160	acres	Kateel River	20N	13E	17	SW
651181	ZED 30	State Claim	160	acres	Kateel River	20N	13E	17	SE
651182	ZED 31	State Claim	160	acres	Kateel River	20N	13E	16	SW
651183	ZED 32	State Claim	160	acres	Kateel River	20N	13E	16	SE
651184	ZED 33	State Claim	160	acres	Kateel River	20N	13E	15	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
651185	ZED 34	State Claim	160	acres	Kateel River	20N	13E	15	SE
651186	ZED 35	State Claim	160	acres	Kateel River	20N	12E	24	NE
651187	ZED 36	State Claim	160	acres	Kateel River	20N	13E	19	NW
651188	ZED 37	State Claim	160	acres	Kateel River	20N	13E	19	NE
651189	ZED 38	State Claim	160	acres	Kateel River	20N	13E	20	NW
651190	ZED 39	State Claim	160	acres	Kateel River	20N	13E	20	NE
651191	ZED 40	State Claim	160	acres	Kateel River	20N	13E	21	NW
651192	ZED 41	State Claim	160	acres	Kateel River	20N	13E	21	NE
651193	ZED 42	State Claim	160	acres	Kateel River	20N	13E	22	NW
651194	ZED 43	State Claim	160	acres	Kateel River	20N	13E	22	NE
651195	ZED 44	State Claim	160	acres	Kateel River	20N	13E	19	SE
651196	ZED 45	State Claim	160	acres	Kateel River	20N	13E	20	SW
651197	ZED 46	State Claim	160	acres	Kateel River	20N	13E	20	SE
651198	ZED 47	State Claim	160	acres	Kateel River	20N	13E	21	SW
651199	ZED 48	State Claim	160	acres	Kateel River	20N	13E	21	SE
651200	ZED 49	State Claim	160	acres	Kateel River	20N	13E	22	SW
651201	ZED 50	State Claim	160	acres	Kateel River	20N	13E	22	SE
651202	ZED 51	State Claim	160	acres	Kateel River	20N	13E	23	NW
651203	ZED 52	State Claim	160	acres	Kateel River	20N	13E	23	NE
651204	ZED 53	State Claim	160	acres	Kateel River	20N	13E	24	NW
651205	ZED 54	State Claim	160	acres	Kateel River	20N	13E	24	NE
651206	ZED 55	State Claim	160	acres	Kateel River	20N	14E	19	NW
651207	ZED 56	State Claim	160	acres	Kateel River	20N	14E	19	NE
651208	ZED 57	State Claim	160	acres	Kateel River	20N	14E	20	NW
651209	ZED 58	State Claim	160	acres	Kateel River	20N	14E	20	NE
651210	ZED 59	State Claim	160	acres	Kateel River	20N	14E	21	NW
651211	ZED 60	State Claim	160	acres	Kateel River	20N	14E	21	NE
651212	ZED 61	State Claim	160	acres	Kateel River	20N	14E	22	NW
651213	ZED 62	State Claim	160	acres	Kateel River	20N	14E	22	NE
651214	ZED 63	State Claim	160	acres	Kateel River	20N	14E	23	NW
651215	ZED 64	State Claim	160	acres	Kateel River	20N	14E	23	NE
651216	ZED 65	State Claim	160	acres	Kateel River	20N	14E	24	NW
651217	ZED 66	State Claim	160	acres	Kateel River	20N	14E	24	NE
651218	ZED 67	State Claim	160	acres	Kateel River	20N	15E	19	NW
651219	ZED 68	State Claim	160	acres	Kateel River	20N	13E	23	SW
651220	ZED 69	State Claim	160	acres	Kateel River	20N	13E	23	SE
651221	ZED 70	State Claim	160	acres	Kateel River	20N	13E	24	SW
651222	ZED 71	State Claim	160	acres	Kateel River	20N	13E	24	SE
651223	ZED 72	State Claim	160	acres	Kateel River	20N	14E	19	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
651224	ZED 73	State Claim	160	acres	Kateel River	20N	14E	19	SE
651225	ZED 74	State Claim	160	acres	Kateel River	20N	14E	20	SW
651226	ZED 75	State Claim	160	acres	Kateel River	20N	14E	20	SE
651227	ZED 76	State Claim	160	acres	Kateel River	20N	14E	21	SW
651228	ZED 77	State Claim	160	acres	Kateel River	20N	14E	21	SE
651229	ZED 78	State Claim	160	acres	Kateel River	20N	14E	22	SW
651230	ZED 79	State Claim	160	acres	Kateel River	20N	14E	22	SE
651231	ZED 80	State Claim	160	acres	Kateel River	20N	14E	23	SW
651232	ZED 81	State Claim	160	acres	Kateel River	20N	14E	23	SE
651233	ZED 82	State Claim	160	acres	Kateel River	20N	14E	24	SW
651234	ZED 83	State Claim	160	acres	Kateel River	20N	14E	24	SE
651235	ZED 84	State Claim	160	acres	Kateel River	20N	15E	19	SW
651236	ZED 85	State Claim	160	acres	Kateel River	20N	13E	26	NW
651237	ZED 86	State Claim	160	acres	Kateel River	20N	13E	26	NE
651238	ZED 87	State Claim	160	acres	Kateel River	20N	13E	25	NW
651239	ZED 88	State Claim	160	acres	Kateel River	20N	13E	25	NE
651240	ZED 89	State Claim	160	acres	Kateel River	20N	14E	30	NW
651241	ZED 90	State Claim	160	acres	Kateel River	20N	14E	30	NE
651242	ZED 91	State Claim	160	acres	Kateel River	20N	14E	29	NW
651243	ZED 92	State Claim	160	acres	Kateel River	20N	14E	29	NE
651244	ZED 93	State Claim	160	acres	Kateel River	20N	14E	28	NW
651245	ZED 94	State Claim	160	acres	Kateel River	20N	14E	28	NE
651246	ZED 95	State Claim	160	acres	Kateel River	20N	14E	27	NW
651247	ZED 96	State Claim	160	acres	Kateel River	20N	14E	27	NE
651248	ZED 97	State Claim	160	acres	Kateel River	20N	14E	26	NW
651249	ZED 98	State Claim	160	acres	Kateel River	20N	14E	26	NE
651250	ZED 99	State Claim	160	acres	Kateel River	20N	14E	25	NW
651251	ZED 100	State Claim	160	acres	Kateel River	20N	14E	25	NE
651252	ZED 101	State Claim	160	acres	Kateel River	20N	15E	30	NW
651253	ZED 102	State Claim	160	acres	Kateel River	20N	13E	26	SW
651254	ZED 103	State Claim	160	acres	Kateel River	20N	13E	26	SE
651255	ZED 104	State Claim	160	acres	Kateel River	20N	13E	25	SW
651256	ZED 105	State Claim	160	acres	Kateel River	20N	13E	25	SE
651257	ZED 106	State Claim	160	acres	Kateel River	20N	14E	30	SW
651258	ZED 107	State Claim	160	acres	Kateel River	20N	14E	30	SE
651259	ZED 108	State Claim	160	acres	Kateel River	20N	14E	29	SW
651260	ZED 109	State Claim	160	acres	Kateel River	20N	14E	29	SE
651261	ZED 110	State Claim	160	acres	Kateel River	20N	14E	28	SW
651262	ZED 111	State Claim	160	acres	Kateel River	20N	14E	28	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
651263	ZED 112	State Claim	160	acres	Kateel River	20N	14E	27	SW
651264	ZED 113	State Claim	160	acres	Kateel River	20N	14E	27	SE
651265	ZED 114	State Claim	160	acres	Kateel River	20N	14E	26	SW
651266	ZED 115	State Claim	160	acres	Kateel River	20N	14E	26	SE
651267	ZED 116	State Claim	160	acres	Kateel River	20N	14E	25	SW
651268	ZED 117	State Claim	160	acres	Kateel River	20N	14E	25	SE
651269	ZED 118	State Claim	160	acres	Kateel River	20N	15E	30	SW
651270	PAL 1	State Claim	40	acres	Kateel River	21N	10E	25	NE
651271	PAL 2	State Claim	40	acres	Kateel River	21N	10E	25	NE
651272	PAL 3	State Claim	40	acres	Kateel River	21N	11E	30	NW
651273	PAL 4	State Claim	40	acres	Kateel River	21N	11E	30	NW
651274	PAL 5	State Claim	40	acres	Kateel River	21N	11E	30	NE
651275	PAL 6	State Claim	40	acres	Kateel River	21N	11E	30	NE
651276	PAL 7	State Claim	40	acres	Kateel River	21N	11E	29	NW
651277	PAL 8	State Claim	40	acres	Kateel River	21N	11E	29	NW
651278	PAL 9	State Claim	40	acres	Kateel River	21N	11E	29	NE
651279	PAL 10	State Claim	40	acres	Kateel River	21N	11E	29	NE
651280	PAL 11	State Claim	40	acres	Kateel River	21N	11E	28	NW
651289	PAL 20	State Claim	160	acres	Kateel River	21N	10E	25	SE
651290	PAL 21	State Claim	160	acres	Kateel River	21N	11E	30	SW
651291	PAL 22	State Claim	160	acres	Kateel River	21N	11E	30	SE
651292	PAL 23	State Claim	160	acres	Kateel River	21N	11E	29	SW
651293	PAL 24	State Claim	160	acres	Kateel River	21N	11E	29	SE
651294	PAL 25	State Claim	160	acres	Kateel River	21N	11E	28	SW
651296	PAL 27	State Claim	160	acres	Kateel River	21N	11E	32	NE
651297	PAL 28	State Claim	160	acres	Kateel River	21N	11E	33	NW
651299	GAP 1	State Claim	160	acres	Kateel River	22N	8E	28	NW
651300	GAP 2	State Claim	160	acres	Kateel River	22N	8E	28	NE
651301	GAP 3	State Claim	160	acres	Kateel River	22N	8E	27	NW
651302	GAP 4	State Claim	160	acres	Kateel River	22N	8E	27	NE
651303	GAP 5	State Claim	160	acres	Kateel River	22N	8E	26	NW
651304	GAP 6	State Claim	160	acres	Kateel River	22N	8E	26	NE
651305	GAP 7	State Claim	160	acres	Kateel River	22N	8E	25	NW
651306	GAP 8	State Claim	160	acres	Kateel River	22N	8E	25	NE
651307	GAP 9	State Claim	160	acres	Kateel River	22N	9E	30	NW
651308	GAP 10	State Claim	160	acres	Kateel River	22N	9E	30	NE
651309	GAP 11	State Claim	160	acres	Kateel River	22N	9E	29	NW
651310	GAP 12	State Claim	160	acres	Kateel River	22N	8E	28	SW
651311	GAP 13	State Claim	160	acres	Kateel River	22N	8E	28	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
651312	GAP 14	State Claim	160	acres	Kateel River	22N	8E	27	SW
651313	GAP 15	State Claim	160	acres	Kateel River	22N	8E	27	SE
651314	GAP 16	State Claim	160	acres	Kateel River	22N	8E	26	SW
651315	GAP 17	State Claim	160	acres	Kateel River	22N	8E	26	SE
651316	GAP 18	State Claim	160	acres	Kateel River	22N	8E	25	SW
651317	GAP 19	State Claim	160	acres	Kateel River	22N	8E	25	SE
651318	GAP 20	State Claim	160	acres	Kateel River	22N	9E	30	SW
651319	GAP 21	State Claim	160	acres	Kateel River	22N	9E	30	SE
651320	GAP 22	State Claim	160	acres	Kateel River	22N	9E	29	SW
651321	GAP 23	State Claim	160	acres	Kateel River	22N	9E	29	SE
651322	GAP 24	State Claim	160	acres	Kateel River	22N	9E	28	SW
651323	GAP 25	State Claim	160	acres	Kateel River	22N	9E	28	SE
651324	GAP 26	State Claim	160	acres	Kateel River	22N	9E	27	SW
651325	GAP 27	State Claim	160	acres	Kateel River	22N	8E	34	NE
651326	GAP 28	State Claim	160	acres	Kateel River	22N	8E	35	NW
651327	GAP 29	State Claim	160	acres	Kateel River	22N	8E	35	NE
651328	GAP 30	State Claim	160	acres	Kateel River	22N	8E	36	NW
651329	GAP 31	State Claim	160	acres	Kateel River	22N	8E	36	NE
651330	GAP 32	State Claim	160	acres	Kateel River	22N	9E	31	NW
651331	GAP 33	State Claim	160	acres	Kateel River	22N	9E	31	NE
651332	GAP 34	State Claim	160	acres	Kateel River	22N	9E	32	NW
651333	GAP 35	State Claim	160	acres	Kateel River	22N	9E	32	NE
651334	GAP 36	State Claim	160	acres	Kateel River	22N	9E	33	NW
651335	GAP 37	State Claim	160	acres	Kateel River	22N	9E	33	NE
651336	GAP 38	State Claim	160	acres	Kateel River	22N	9E	34	NW
651337	GAP 39	State Claim	160	acres	Kateel River	22N	9E	34	NE
651338	GAP 40	State Claim	160	acres	Kateel River	22N	9E	35	NW
651339	GAP 41	State Claim	160	acres	Kateel River	22N	9E	35	NE
651340	GAP 42	State Claim	160	acres	Kateel River	22N	9E	36	NW
651341	GAP 43	State Claim	160	acres	Kateel River	22N	9E	36	NE
651342	GAP 44	State Claim	160	acres	Kateel River	22N	10E	31	NW
651343	GAP 45	State Claim	160	acres	Kateel River	22N	10E	31	NE
651344	GAP 46	State Claim	160	acres	Kateel River	22N	10E	32	NW
651345	GAP 47	State Claim	160	acres	Kateel River	22N	10E	32	NE
651346	GAP 48	State Claim	160	acres	Kateel River	22N	10E	33	NW
651347	GAP 49	State Claim	160	acres	Kateel River	22N	10E	33	NE
651348	GAP 50	State Claim	160	acres	Kateel River	22N	10E	34	NW
651349	GAP 51	State Claim	160	acres	Kateel River	22N	10E	30	SW
651350	GAP 52	State Claim	160	acres	Kateel River	22N	10E	30	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
651351	GAP 53	State Claim	160	acres	Kateel River	22N	10E	29	SW
651352	GAP 54	State Claim	160	acres	Kateel River	22N	10E	29	SE
651353	GAP 55	State Claim	160	acres	Kateel River	22N	10E	28	SW
651354	GAP 56	State Claim	160	acres	Kateel River	22N	10E	28	SE
651355	GAP 57	State Claim	160	acres	Kateel River	22N	10E	27	SW
651356	GAP 58	State Claim	160	acres	Kateel River	22N	8E	34	SE
651357	GAP 59	State Claim	160	acres	Kateel River	22N	8E	35	SW
651358	GAP 60	State Claim	160	acres	Kateel River	22N	8E	35	SE
651359	GAP 61	State Claim	160	acres	Kateel River	22N	8E	36	SW
651360	GAP 62	State Claim	160	acres	Kateel River	22N	8E	36	SE
651361	GAP 63	State Claim	160	acres	Kateel River	22N	9E	31	SW
651362	GAP 64	State Claim	160	acres	Kateel River	22N	9E	31	SE
651363	GAP 65	State Claim	160	acres	Kateel River	22N	9E	32	SW
651364	GAP 66	State Claim	160	acres	Kateel River	22N	9E	32	SE
651365	GAP 67	State Claim	160	acres	Kateel River	22N	9E	33	SW
651366	GAP 68	State Claim	160	acres	Kateel River	22N	9E	33	SE
651367	GAP 69	State Claim	160	acres	Kateel River	22N	9E	34	SW
651368	GAP 70	State Claim	160	acres	Kateel River	22N	9E	34	SE
651369	GAP 71	State Claim	160	acres	Kateel River	22N	9E	35	SW
651370	GAP 72	State Claim	160	acres	Kateel River	22N	9E	35	SE
651371	GAP 73	State Claim	160	acres	Kateel River	22N	9E	36	SW
651372	GAP 74	State Claim	160	acres	Kateel River	22N	9E	36	SE
651373	GAP 75	State Claim	160	acres	Kateel River	22N	10E	31	SW
651374	GAP 76	State Claim	160	acres	Kateel River	22N	10E	31	SE
651375	GAP 77	State Claim	160	acres	Kateel River	22N	10E	32	SW
651376	GAP 78	State Claim	160	acres	Kateel River	22N	10E	32	SE
651377	GAP 79	State Claim	160	acres	Kateel River	22N	10E	33	SW
651378	GAP 80	State Claim	160	acres	Kateel River	22N	10E	33	SE
651379	GAP 81	State Claim	160	acres	Kateel River	22N	10E	34	SW
651380	GAP 82	State Claim	160	acres	Kateel River	21N	8E	3	NE
651381	GAP 83	State Claim	160	acres	Kateel River	21N	8E	2	NW
651382	GAP 84	State Claim	160	acres	Kateel River	21N	8E	2	NE
651383	GAP 85	State Claim	160	acres	Kateel River	21N	8E	1	NW
651384	GAP 86	State Claim	160	acres	Kateel River	21N	8E	1	NE
651385	GAP 87	State Claim	160	acres	Kateel River	21N	9E	6	NW
651386	GAP 88	State Claim	160	acres	Kateel River	21N	9E	6	NE
651387	GAP 89	State Claim	160	acres	Kateel River	21N	9E	2	NW
651388	GAP 90	State Claim	160	acres	Kateel River	21N	9E	2	NE
651389	GAP 91	State Claim	160	acres	Kateel River	21N	9E	1	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
651390	GAP 92	State Claim	160	acres	Kateel River	21N	9E	1	NE
651391	GAP 93	State Claim	160	acres	Kateel River	21N	10E	6	NW
651392	GAP 94	State Claim	160	acres	Kateel River	21N	10E	6	NE
651393	GAP 95	State Claim	160	acres	Kateel River	21N	10E	5	NW
651394	GAP 96	State Claim	160	acres	Kateel River	21N	10E	5	NE
651395	GAP 97	State Claim	160	acres	Kateel River	21N	10E	4	NW
651396	GAP 98	State Claim	160	acres	Kateel River	21N	10E	4	NE
651397	GAP 99	State Claim	160	acres	Kateel River	21N	10E	3	NW
651398	GAP 100	State Claim	160	acres	Kateel River	21N	9E	2	SW
651399	GAP 101	State Claim	160	acres	Kateel River	21N	9E	2	SE
651400	GAP 102	State Claim	160	acres	Kateel River	21N	9E	1	SW
651401	GAP 103	State Claim	160	acres	Kateel River	21N	9E	1	SE
651402	GAP 104	State Claim	160	acres	Kateel River	21N	10E	6	SW
651403	GAP 105	State Claim	160	acres	Kateel River	21N	10E	6	SE
651404	GAP 106	State Claim	160	acres	Kateel River	21N	10E	5	SW
651405	GAP 107	State Claim	160	acres	Kateel River	21N	10E	5	SE
651406	GAP 108	State Claim	160	acres	Kateel River	21N	10E	4	SW
651407	GAP 109	State Claim	160	acres	Kateel River	21N	10E	4	SE
651408	GAP 110	State Claim	160	acres	Kateel River	21N	10E	3	SW
651409	GAP 111	State Claim	160	acres	Kateel River	21N	10E	3	SE
651410	GAP 112	State Claim	160	acres	Kateel River	21N	10E	2	SW
651411	GAP 113	State Claim	160	acres	Kateel River	21N	10E	2	SE
651412	GAP 114	State Claim	40	acres	Kateel River	21N	9E	11	NW
651413	GAP 115	State Claim	40	acres	Kateel River	21N	9E	11	NW
651414	GAP 116	State Claim	40	acres	Kateel River	21N	9E	11	NE
651415	GAP 117	State Claim	40	acres	Kateel River	21N	9E	11	NE
651416	GAP 118	State Claim	40	acres	Kateel River	21N	9E	12	NW
651417	GAP 119	State Claim	40	acres	Kateel River	21N	9E	12	NW
651418	GAP 120	State Claim	40	acres	Kateel River	21N	9E	12	NE
651419	GAP 121	State Claim	40	acres	Kateel River	21N	9E	12	NE
651420	GAP 122	State Claim	40	acres	Kateel River	21N	10E	7	NW
651421	GAP 123	State Claim	40	acres	Kateel River	21N	10E	7	NW
651422	GAP 124	State Claim	40	acres	Kateel River	21N	10E	7	NE
651423	GAP 125	State Claim	40	acres	Kateel River	21N	10E	7	NE
651424	GAP 126	State Claim	40	acres	Kateel River	21N	10E	8	NW
651425	GAP 127	State Claim	40	acres	Kateel River	21N	10E	8	NW
651426	GAP 128	State Claim	40	acres	Kateel River	21N	10E	8	NE
651427	GAP 129	State Claim	40	acres	Kateel River	21N	10E	8	NE
651428	GAP 130	State Claim	40	acres	Kateel River	21N	10E	9	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
651429	GAP 131	State Claim	40	acres	Kateel River	21N	10E	9	NW
651430	GAP 132	State Claim	40	acres	Kateel River	21N	10E	9	NE
651431	GAP 133	State Claim	40	acres	Kateel River	21N	10E	9	NE
651432	GAP 134	State Claim	40	acres	Kateel River	21N	10E	10	NW
651433	GAP 135	State Claim	40	acres	Kateel River	21N	10E	10	NW
651434	GAP 136	State Claim	40	acres	Kateel River	21N	10E	10	NE
651435	GAP 137	State Claim	40	acres	Kateel River	21N	10E	10	NE
651436	GAP 138	State Claim	40	acres	Kateel River	21N	10E	11	NW
651437	GAP 139	State Claim	40	acres	Kateel River	21N	10E	11	NW
651438	GAP 140	State Claim	40	acres	Kateel River	21N	10E	11	NE
651439	GAP 141	State Claim	40	acres	Kateel River	21N	10E	11	NE
651440	GAP 142	State Claim	160	acres	Kateel River	21N	9E	5	NW
651441	GAP 143	State Claim	160	acres	Kateel River	21N	9E	5	NE
651442	GAP 144	State Claim	160	acres	Kateel River	21N	9E	4	NW
651443	GAP 145	State Claim	160	acres	Kateel River	21N	9E	4	NE
651444	GAP 146	State Claim	160	acres	Kateel River	21N	9E	3	NW
651445	GAP 147	State Claim	160	acres	Kateel River	21N	9E	3	NE
651446	GAP 148	State Claim	160	acres	Kateel River	21N	8E	3	SE
651447	GAP 149	State Claim	160	acres	Kateel River	21N	8E	2	SW
651448	GAP 150	State Claim	160	acres	Kateel River	21N	8E	2	SE
651449	GAP 151	State Claim	160	acres	Kateel River	21N	8E	1	SW
651450	GAP 152	State Claim	160	acres	Kateel River	21N	8E	1	SE
651451	GAP 153	State Claim	160	acres	Kateel River	21N	9E	6	SW
651452	GAP 154	State Claim	160	acres	Kateel River	21N	9E	6	SE
651453	GAP 155	State Claim	160	acres	Kateel River	21N	9E	5	SW
651454	GAP 156	State Claim	160	acres	Kateel River	21N	9E	5	SE
651455	GAP 157	State Claim	160	acres	Kateel River	21N	9E	4	SW
651456	GAP 158	State Claim	160	acres	Kateel River	21N	9E	4	SE
651457	GAP 159	State Claim	160	acres	Kateel River	21N	9E	3	SW
651458	GAP 160	State Claim	160	acres	Kateel River	21N	9E	3	SE
651459	GAP 161	State Claim	160	acres	Kateel River	21N	8E	10	NE
651460	GAP 162	State Claim	160	acres	Kateel River	21N	8E	11	NW
651461	GAP 163	State Claim	160	acres	Kateel River	21N	8E	11	NE
651462	GAP 164	State Claim	160	acres	Kateel River	21N	8E	12	NW
651463	GAP 165	State Claim	160	acres	Kateel River	21N	8E	12	NE
651464	GAP 166	State Claim	160	acres	Kateel River	21N	9E	7	NW
651465	GAP 167	State Claim	160	acres	Kateel River	21N	9E	7	NE
651466	GAP 168	State Claim	160	acres	Kateel River	21N	9E	8	NW
651467	GAP 169	State Claim	160	acres	Kateel River	21N	9E	8	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
651468	GAP 170	State Claim	160	acres	Kateel River	21N	9E	9	NW
651469	GAP 171	State Claim	160	acres	Kateel River	21N	9E	9	NE
651470	GAP 172	State Claim	160	acres	Kateel River	21N	9E	10	NW
651471	GAP 173	State Claim	160	acres	Kateel River	21N	9E	10	NE
651472	GAP 174	State Claim	160	acres	Kateel River	21N	8E	10	SE
651473	GAP 175	State Claim	160	acres	Kateel River	21N	8E	11	SW
651474	GAP 176	State Claim	160	acres	Kateel River	21N	8E	11	SE
651475	GAP 177	State Claim	160	acres	Kateel River	21N	8E	12	SW
651476	GAP 178	State Claim	160	acres	Kateel River	21N	8E	12	SE
651477	GAP 179	State Claim	160	acres	Kateel River	21N	9E	7	SW
651478	GAP 180	State Claim	160	acres	Kateel River	21N	9E	7	SE
651479	GAP 181	State Claim	160	acres	Kateel River	21N	9E	8	SW
651480	GAP 182	State Claim	160	acres	Kateel River	21N	9E	8	SE
651481	GAP 183	State Claim	160	acres	Kateel River	21N	9E	9	SW
651482	GAP 184	State Claim	160	acres	Kateel River	21N	9E	9	SE
651483	GAP 185	State Claim	160	acres	Kateel River	21N	9E	10	SW
651484	GAP 186	State Claim	160	acres	Kateel River	21N	9E	10	SE
651485	GAP 187	State Claim	160	acres	Kateel River	21N	8E	15	NE
651486	GAP 188	State Claim	160	acres	Kateel River	21N	8E	14	NW
651487	GAP 189	State Claim	160	acres	Kateel River	21N	8E	14	NE
651488	GAP 190	State Claim	160	acres	Kateel River	21N	8E	13	NW
651489	GAP 191	State Claim	160	acres	Kateel River	21N	8E	13	NE
651490	GAP 192	State Claim	160	acres	Kateel River	21N	9E	18	NW
651491	GAP 193	State Claim	160	acres	Kateel River	21N	9E	18	NE
651492	GAP 194	State Claim	160	acres	Kateel River	21N	9E	17	NW
651493	GAP 195	State Claim	160	acres	Kateel River	21N	9E	17	NE
651494	GAP 196	State Claim	160	acres	Kateel River	21N	9E	16	NW
651495	GAP 197	State Claim	160	acres	Kateel River	21N	9E	16	NE
651496	GAP 198	State Claim	160	acres	Kateel River	21N	9E	15	NW
651497	GAP 199	State Claim	160	acres	Kateel River	21N	9E	15	NE
655537	ZED 119	State Claim	160	acres	Kateel River	20N	12E	12	NW
655538	ZED 120	State Claim	160	acres	Kateel River	20N	12E	12	NE
655539	ZED 121	State Claim	160	acres	Kateel River	20N	13E	7	NW
655540	ZED 122	State Claim	160	acres	Kateel River	20N	13E	7	SW
655541	ZED 123	State Claim	160	acres	Kateel River	20N	13E	7	SE
655542	ZED 124	State Claim	160	acres	Kateel River	20N	13E	8	SW
655543	ZED 125	State Claim	160	acres	Kateel River	20N	13E	8	SE
655648	KG 1	State Claim	160	acres	Kateel River	21N	11E	11	SW
655649	KG 2	State Claim	160	acres	Kateel River	21N	11E	11	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
655650	KG 3	State Claim	160	acres	Kateel River	21N	11E	14	NW
655651	KG 4	State Claim	160	acres	Kateel River	21N	11E	14	NE
655652	KG 5	State Claim	160	acres	Kateel River	21N	11E	13	NW
655653	KG 6	State Claim	160	acres	Kateel River	21N	11E	13	NE
655654	KG 7	State Claim	160	acres	Kateel River	21N	11E	13	SE
655655	KG 8	State Claim	160	acres	Kateel River	21N	11E	24	NE
714584	East DH 1	State Claim	160	acres	Kateel River	22N	10E	15	SE
714585	East DH 2	State Claim	160	acres	Kateel River	22N	10E	22	NE
714586	East DH 3	State Claim	160	acres	Kateel River	22N	10E	23	NW
714587	East DH 4	State Claim	160	acres	Kateel River	22N	10E	22	SE
714588	East DH 5	State Claim	160	acres	Kateel River	22N	10E	23	SW
714589	COBRE 1	State Claim	160	acres	Kateel River	22N	7E	2	NW
714590	COBRE 2	State Claim	160	acres	Kateel River	22N	7E	2	NE
714591	COBRE 3	State Claim	160	acres	Kateel River	22N	7E	1	NW
714592	COBRE 4	State Claim	160	acres	Kateel River	22N	7E	1	NE
714593	COBRE 5	State Claim	160	acres	Kateel River	22N	8E	6	NW
714594	COBRE 6	State Claim	160	acres	Kateel River	22N	8E	6	NE
714595	COBRE 7	State Claim	160	acres	Kateel River	22N	8E	5	NW
714596	COBRE 8	State Claim	160	acres	Kateel River	22N	8E	5	NE
714597	COBRE 9	State Claim	160	acres	Kateel River	22N	7E	2	SW
714598	COBRE 10	State Claim	160	acres	Kateel River	22N	7E	2	SE
714599	COBRE 11	State Claim	160	acres	Kateel River	22N	7E	1	SW
714600	COBRE 12	State Claim	160	acres	Kateel River	22N	7E	1	SE
714601	COBRE 13	State Claim	160	acres	Kateel River	22N	8E	6	SW
714602	COBRE 14	State Claim	160	acres	Kateel River	22N	8E	6	SE
714603	COBRE 15	State Claim	160	acres	Kateel River	22N	8E	5	SW
714604	COBRE 16	State Claim	160	acres	Kateel River	22N	8E	5	SE
714605	COBRE 17	State Claim	160	acres	Kateel River	22N	7E	11	NW
714606	COBRE 18	State Claim	160	acres	Kateel River	22N	7E	11	NE
714607	COBRE 19	State Claim	160	acres	Kateel River	22N	7E	12	NW
714608	COBRE 20	State Claim	160	acres	Kateel River	22N	7E	12	NE
714609	COBRE 21	State Claim	160	acres	Kateel River	22N	8E	7	NW
714610	COBRE 22	State Claim	160	acres	Kateel River	22N	8E	7	NE
714611	COBRE 23	State Claim	160	acres	Kateel River	22N	8E	8	NW
714612	COBRE 24	State Claim	160	acres	Kateel River	22N	8E	8	NE
714613	COBRE 25	State Claim	160	acres	Kateel River	22N	8E	9	NW
714614	COBRE 26	State Claim	160	acres	Kateel River	22N	8E	9	NE
714615	COBRE 27	State Claim	160	acres	Kateel River	22N	8E	7	SE
714616	COBRE 28	State Claim	160	acres	Kateel River	22N	8E	8	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
714617	COBRE 29	State Claim	160	acres	Kateel River	22N	8E	8	SE
714618	COBRE 30	State Claim	160	acres	Kateel River	22N	8E	9	SW
714619	COBRE 31	State Claim	160	acres	Kateel River	22N	8E	9	SE
714620	COBRE 32	State Claim	160	acres	Kateel River	22N	8E	17	NW
714621	COBRE 33	State Claim	160	acres	Kateel River	22N	8E	17	NE
714622	COBRE 34	State Claim	160	acres	Kateel River	22N	8E	16	NW
714623	COBRE 35	State Claim	160	acres	Kateel River	22N	8E	16	NE
714624	COBRE 36	State Claim	160	acres	Kateel River	22N	8E	15	NW
714625	COBRE 37	State Claim	160	acres	Kateel River	22N	8E	15	NE
714626	COBRE 38	State Claim	160	acres	Kateel River	22N	8E	17	SE
714627	COBRE 39	State Claim	160	acres	Kateel River	22N	8E	16	SW
714628	COBRE 40	State Claim	160	acres	Kateel River	22N	8E	16	SE
714629	COBRE 41	State Claim	160	acres	Kateel River	22N	8E	15	SW
714630	COBRE 42	State Claim	160	acres	Kateel River	22N	8E	15	SE
714631	COBRE 43	State Claim	160	acres	Kateel River	22N	8E	21	NW
714632	COBRE 44	State Claim	160	acres	Kateel River	22N	8E	21	NE
714633	COBRE 45	State Claim	160	acres	Kateel River	22N	8E	22	NW
714634	COBRE 46	State Claim	160	acres	Kateel River	22N	8E	22	NE
714635	COBRE 47	State Claim	160	acres	Kateel River	22N	8E	23	NW
714636	COBRE 48	State Claim	160	acres	Kateel River	22N	8E	23	NE
714637	COBRE 49	State Claim	160	acres	Kateel River	22N	8E	21	SW
714638	COBRE 50	State Claim	160	acres	Kateel River	22N	8E	21	SE
714639	COBRE 51	State Claim	160	acres	Kateel River	22N	8E	22	SW
714640	COBRE 52	State Claim	160	acres	Kateel River	22N	8E	22	SE
714641	COBRE 53	State Claim	160	acres	Kateel River	22N	8E	23	SW
714642	COBRE 54	State Claim	160	acres	Kateel River	22N	8E	23	SE
714643	West Horse 1	State Claim	160	acres	Kateel River	22N	9E	12	SW
714644	West Horse 2	State Claim	160	acres	Kateel River	22N	9E	12	SE
714645	West Horse 3	State Claim	160	acres	Kateel River	22N	10E	7	SW
714646	West Horse 4	State Claim	160	acres	Kateel River	22N	10E	7	SE
714647	West Horse 5	State Claim	160	acres	Kateel River	22N	10E	8	SW
714648	West Horse 6	State Claim	160	acres	Kateel River	22N	9E	13	NW
714649	West Horse 7	State Claim	160	acres	Kateel River	22N	9E	13	NE
714650	West Horse 8	State Claim	160	acres	Kateel River	22N	9E	13	SW
714651	West Horse 9	State Claim	160	acres	Kateel River	22N	9E	13	SE
714652	West Horse 10	State Claim	160	acres	Kateel River	22N	9E	24	NW
714653	West Horse 11	State Claim	160	acres	Kateel River	22N	9E	24	NE
714654	West Horse 12	State Claim	160	acres	Kateel River	22N	9E	24	SW
714655	West Horse 13	State Claim	160	acres	Kateel River	22N	9E	24	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
714656	West Horse 14	State Claim	160	acres	Kateel River	22N	9E	27	NE
714657	West Horse 15	State Claim	160	acres	Kateel River	22N	9E	26	NW
714658	West Horse 16	State Claim	160	acres	Kateel River	22N	9E	26	NE
714659	West Horse 17	State Claim	160	acres	Kateel River	22N	9E	25	NW
714660	West Horse 18	State Claim	160	acres	Kateel River	22N	9E	25	NE
714661	West Horse 19	State Claim	160	acres	Kateel River	22N	9E	27	SE
714662	West Horse 20	State Claim	160	acres	Kateel River	22N	9E	26	SW
714663	West Horse 21	State Claim	160	acres	Kateel River	22N	9E	26	SE
714664	West Horse 22	State Claim	160	acres	Kateel River	22N	9E	25	SW
714665	West Horse 23	State Claim	160	acres	Kateel River	22N	9E	25	SE
714748	AM 37-225	State Claim	40	acres	Kateel River	20N	12E	16	SW
714749	AM 38-225	State Claim	40	acres	Kateel River	20N	12E	16	SW
714750	AM 39-225	State Claim	40	acres	Kateel River	20N	12E	16	NW
714751	AM 40-225	State Claim	40	acres	Kateel River	20N	12E	16	NW
714752	AM 41-223	State Claim	40	acres	Kateel River	20N	12E	8	SE
714753	AM 41-224	State Claim	40	acres	Kateel River	20N	12E	8	SE
714754	AM 43-219	State Claim	40	acres	Kateel River	20N	12E	7	NE
714755	AM 43-220	State Claim	40	acres	Kateel River	20N	12E	7	NE
714756	AM 38-217	State Claim	160	acres	Kateel River	20N	12E	18	SW
714757	AM 38-219	State Claim	160	acres	Kateel River	20N	12E	18	SE
714758	AM 38-221	State Claim	160	acres	Kateel River	20N	12E	17	SW
714759	AM 38-223	State Claim	160	acres	Kateel River	20N	12E	17	SE
714760	AM 42-219	State Claim	160	acres	Kateel River	20N	12E	7	SE
714761	AM 42-221	State Claim	160	acres	Kateel River	20N	12E	8	SW
714762	AM 44-217	State Claim	160	acres	Kateel River	20N	12E	7	NW
714763	AM 40-217	State Claim	160	acres	Kateel River	20N	12E	18	NW
714764	AM 40-219	State Claim	160	acres	Kateel River	20N	12E	18	NE
714765	AM 40-221	State Claim	160	acres	Kateel River	20N	12E	17	NW
714766	AM 40-223	State Claim	160	acres	Kateel River	20N	12E	17	NE
714767	AM 42-217	State Claim	160	acres	Kateel River	20N	12E	7	SW
714768	KG 9	State Claim	160	acres	Kateel River	21N	12E	19	NW
714769	KG 10	State Claim	160	acres	Kateel River	21N	12E	19	NE
714770	KG 11	State Claim	160	acres	Kateel River	21N	12E	19	SW
714771	KG 12	State Claim	160	acres	Kateel River	21N	12E	19	SE
715147	Cobre 55	State Claim	160	acres	Kateel River	23N	7E	14	SW
715148	Cobre 56	State Claim	160	acres	Kateel River	23N	7E	14	SE
715149	Cobre 57	State Claim	160	acres	Kateel River	23N	7E	13	SW
715150	Cobre 58	State Claim	160	acres	Kateel River	23N	7E	23	NW
715151	Cobre 59	State Claim	160	acres	Kateel River	23N	7E	23	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
715152	Cobre 60	State Claim	160	acres	Kateel River	23N	7E	24	NW
715153	Cobre 61	State Claim	160	acres	Kateel River	23N	7E	24	NE
715154	Cobre 62	State Claim	160	acres	Kateel River	23N	8E	19	NW
715155	Cobre 63	State Claim	160	acres	Kateel River	23N	7E	23	SE
715156	Cobre 64	State Claim	160	acres	Kateel River	23N	7E	24	SW
715157	Cobre 65	State Claim	160	acres	Kateel River	23N	7E	24	SE
715158	Cobre 66	State Claim	160	acres	Kateel River	23N	8E	19	SW
715159	Cobre 67	State Claim	160	acres	Kateel River	23N	8E	19	SE
715160	Cobre 68	State Claim	160	acres	Kateel River	23N	7E	26	NE
715161	Cobre 69	State Claim	160	acres	Kateel River	23N	7E	25	NW
715162	Cobre 70	State Claim	160	acres	Kateel River	23N	7E	25	NE
715163	Cobre 71	State Claim	160	acres	Kateel River	23N	8E	30	NW
715164	Cobre 72	State Claim	160	acres	Kateel River	23N	8E	30	NE
715165	Cobre 73	State Claim	160	acres	Kateel River	23N	8E	29	NW
715166	Cobre 74	State Claim	160	acres	Kateel River	23N	8E	29	NE
715167	Cobre 75	State Claim	160	acres	Kateel River	23N	7E	26	SE
715168	Cobre 76	State Claim	160	acres	Kateel River	23N	7E	25	SW
715169	Cobre 77	State Claim	160	acres	Kateel River	23N	7E	25	SE
715170	Cobre 78	State Claim	160	acres	Kateel River	23N	8E	30	SW
715171	Cobre 79	State Claim	160	acres	Kateel River	23N	8E	30	SE
715172	Cobre 80	State Claim	160	acres	Kateel River	23N	8E	29	SW
715173	Cobre 81	State Claim	160	acres	Kateel River	23N	8E	29	SE
715174	Cobre 82	State Claim	160	acres	Kateel River	23N	7E	36	NW
715175	Cobre 83	State Claim	160	acres	Kateel River	23N	7E	36	NE
715176	Cobre 84	State Claim	160	acres	Kateel River	23N	8E	31	NW
715177	Cobre 85	State Claim	160	acres	Kateel River	23N	8E	31	NE
715178	Cobre 86	State Claim	160	acres	Kateel River	23N	8E	32	NW
715179	Cobre 87	State Claim	160	acres	Kateel River	23N	8E	32	NE
715180	Cobre 88	State Claim	160	acres	Kateel River	23N	8E	31	SE
715181	Cobre 89	State Claim	160	acres	Kateel River	23N	8E	32	SW
715182	Cobre 90	State Claim	160	acres	Kateel River	23N	8E	32	SE
622359	Eggplant 1	State Claim	40	acres	Kateel River	21N	10E	26	NW
622360	Eggplant 2	State Claim	40	acres	Kateel River	21N	10E	26	NW
622361	Eggplant 3	State Claim	40	acres	Kateel River	21N	10E	26	NE
622362	Eggplant 4	State Claim	40	acres	Kateel River	21N	10E	26	NE
622363	Eggplant 5	State Claim	40	acres	Kateel River	21N	10E	25	NW
622364	Eggplant 6	State Claim	40	acres	Kateel River	21N	10E	25	NW
622365	Eggplant 7	State Claim	160	acres	Kateel River	21N	10E	26	SW
622366	Eggplant 8	State Claim	160	acres	Kateel River	21N	10E	26	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
622367	Eggplant 9	State Claim	160	acres	Kateel River	21N	10E	25	SW
622368	Eggplant 10	State Claim	160	acres	Kateel River	21N	10E	34	NW
622369	Eggplant 11	State Claim	160	acres	Kateel River	21N	10E	34	NE
622370	Eggplant 12	State Claim	160	acres	Kateel River	21N	10E	35	NW
622371	Eggplant 13	State Claim	160	acres	Kateel River	21N	10E	35	NE
622372	Eggplant 14	State Claim	160	acres	Kateel River	21N	10E	36	NW
622373	Eggplant 15	State Claim	160	acres	Kateel River	21N	10E	36	NE
622374	Eggplant 16	State Claim	160	acres	Kateel River	21N	11E	31	NW
622375	Eggplant 17	State Claim	160	acres	Kateel River	21N	11E	31	NE
622376	Eggplant 18	State Claim	160	acres	Kateel River	21N	11E	32	NW
622377	Eggplant 19	State Claim	160	acres	Kateel River	21N	10E	34	SW
622378	Eggplant 20	State Claim	160	acres	Kateel River	21N	10E	34	SE
622379	Eggplant 21	State Claim	160	acres	Kateel River	21N	10E	35	SW
622380	Eggplant 22	State Claim	160	acres	Kateel River	21N	10E	35	SE
622381	Eggplant 23	State Claim	160	acres	Kateel River	21N	10E	36	SW
622382	Eggplant 24	State Claim	160	acres	Kateel River	21N	10E	36	SE
622383	Eggplant 25	State Claim	160	acres	Kateel River	21N	11E	31	SW
622384	Eggplant 26	State Claim	160	acres	Kateel River	21N	11E	31	SE
622385	Eggplant 27	State Claim	160	acres	Kateel River	21N	11E	32	SW
622386	Eggplant 28	State Claim	160	acres	Kateel River	21N	11E	32	SE
622387	Eggplant 29	State Claim	40	acres	Kateel River	21N	11E	33	SW
622388	Eggplant 30	State Claim	40	acres	Kateel River	21N	11E	33	SW
626222	LUK 1	State Claim	160	acres	Kateel River	22N	10E	8	NW
626223	LUK 2	State Claim	160	acres	Kateel River	22N	10E	8	NE
626224	LUK 3	State Claim	160	acres	Kateel River	22N	10E	9	NW
626225	LUK 4	State Claim	160	acres	Kateel River	22N	10E	9	NE
626226	LUK 5	State Claim	160	acres	Kateel River	22N	10E	10	NW
626227	LUK 6	State Claim	160	acres	Kateel River	22N	10E	10	NE
626228	LUK 7	State Claim	160	acres	Kateel River	22N	10E	11	NW
626229	LUK 8	State Claim	160	acres	Kateel River	22N	10E	11	NE
626230	LUK 9	State Claim	160	acres	Kateel River	22N	10E	8	SE
626231	LUK 10	State Claim	160	acres	Kateel River	22N	10E	9	SW
626232	LUK 11	State Claim	160	acres	Kateel River	22N	10E	9	SE
626233	LUK 12	State Claim	160	acres	Kateel River	22N	10E	10	SW
626234	LUK 13	State Claim	160	acres	Kateel River	22N	10E	10	SE
626235	LUK 14	State Claim	160	acres	Kateel River	22N	10E	11	SW
626236	LUK 15	State Claim	160	acres	Kateel River	22N	10E	11	SE
626237	LUK 16	State Claim	160	acres	Kateel River	22N	10E	15	NE
626238	LUK 17	State Claim	160	acres	Kateel River	22N	10E	14	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626239	LUK 18	State Claim	160	acres	Kateel River	22N	10E	14	NE
626240	LUK 19	State Claim	160	acres	Kateel River	22N	10E	13	NW
626241	LUK 20	State Claim	160	acres	Kateel River	22N	10E	13	NE
626242	LUK 21	State Claim	160	acres	Kateel River	22N	10E	14	SW
626243	LUK 22	State Claim	160	acres	Kateel River	22N	10E	14	SE
626244	LUK 23	State Claim	160	acres	Kateel River	22N	10E	13	SW
626245	LUK 24	State Claim	160	acres	Kateel River	22N	10E	13	SE
626246	LUK 25	State Claim	160	acres	Kateel River	22N	10E	23	NE
626247	LUK 26	State Claim	160	acres	Kateel River	22N	10E	24	NW
626248	LUK 27	State Claim	160	acres	Kateel River	22N	10E	24	NE
626249	LUK 28	State Claim	160	acres	Kateel River	22N	11E	19	NW
626250	LUK 29	State Claim	160	acres	Kateel River	22N	11E	19	NE
626251	LUK 30	State Claim	160	acres	Kateel River	22N	10E	23	SE
626252	LUK 31	State Claim	160	acres	Kateel River	22N	10E	24	SW
626253	LUK 32	State Claim	160	acres	Kateel River	22N	10E	24	SE
626254	LUK 33	State Claim	160	acres	Kateel River	22N	11E	19	SW
626255	LUK 34	State Claim	160	acres	Kateel River	22N	11E	19	SE
626256	LUK 35	State Claim	160	acres	Kateel River	22N	10E	27	NE
626257	LUK 36	State Claim	160	acres	Kateel River	22N	10E	26	NW
626258	LUK 37	State Claim	160	acres	Kateel River	22N	10E	26	NE
626259	LUK 38	State Claim	160	acres	Kateel River	22N	10E	25	NW
626260	LUK 39	State Claim	160	acres	Kateel River	22N	10E	25	NE
626261	LUK 40	State Claim	160	acres	Kateel River	22N	11E	30	NW
626262	LUK 41	State Claim	160	acres	Kateel River	22N	11E	30	NE
626263	LUK 42	State Claim	160	acres	Kateel River	22N	11E	29	NW
626264	LUK 43	State Claim	160	acres	Kateel River	22N	11E	29	NE
626265	LUK 44	State Claim	160	acres	Kateel River	22N	11E	28	NW
626266	LUK 45	State Claim	160	acres	Kateel River	22N	11E	28	NE
626267	LUK 46	State Claim	160	acres	Kateel River	22N	10E	27	SE
626268	LUK 47	State Claim	160	acres	Kateel River	22N	10E	26	SW
626269	LUK 48	State Claim	160	acres	Kateel River	22N	10E	26	SE
626270	LUK 49	State Claim	160	acres	Kateel River	22N	10E	25	SW
626271	LUK 50	State Claim	160	acres	Kateel River	22N	10E	25	SE
626272	LUK 51	State Claim	160	acres	Kateel River	22N	11E	30	SW
626273	LUK 52	State Claim	160	acres	Kateel River	22N	11E	30	SE
626274	LUK 53	State Claim	160	acres	Kateel River	22N	11E	29	SW
626275	LUK 54	State Claim	160	acres	Kateel River	22N	11E	29	SE
626276	LUK 55	State Claim	160	acres	Kateel River	22N	11E	28	SW
626277	LUK 56	State Claim	160	acres	Kateel River	22N	11E	28	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626278	LUK 57	State Claim	160	acres	Kateel River	22N	10E	34	NE
626279	LUK 58	State Claim	160	acres	Kateel River	22N	10E	35	NW
626280	LUK 59	State Claim	160	acres	Kateel River	22N	10E	35	NE
626281	LUK 60	State Claim	160	acres	Kateel River	22N	10E	36	NW
626282	LUK 61	State Claim	160	acres	Kateel River	22N	10E	36	NE
626283	LUK 62	State Claim	160	acres	Kateel River	22N	11E	31	NW
626284	LUK 63	State Claim	160	acres	Kateel River	22N	11E	31	NE
626285	LUK 64	State Claim	160	acres	Kateel River	22N	11E	32	NW
626286	LUK 65	State Claim	160	acres	Kateel River	22N	11E	32	NE
626287	LUK 66	State Claim	160	acres	Kateel River	22N	11E	33	NW
626288	LUK 67	State Claim	160	acres	Kateel River	22N	11E	33	NE
626289	LUK 68	State Claim	160	acres	Kateel River	22N	11E	34	NW
626290	LUK 69	State Claim	160	acres	Kateel River	22N	11E	34	NE
626291	LUK 70	State Claim	160	acres	Kateel River	22N	11E	35	NW
626292	LUK 71	State Claim	160	acres	Kateel River	22N	11E	35	NE
626293	LUK 72	State Claim	160	acres	Kateel River	22N	11E	36	NW
626294	LUK 73	State Claim	160	acres	Kateel River	22N	11E	36	NE
626295	LUK 74	State Claim	160	acres	Kateel River	22N	10E	34	SE
626296	LUK 75	State Claim	160	acres	Kateel River	22N	10E	35	SW
626297	LUK 76	State Claim	160	acres	Kateel River	22N	10E	35	SE
626298	LUK 77	State Claim	160	acres	Kateel River	22N	10E	36	SW
626299	LUK 78	State Claim	160	acres	Kateel River	22N	10E	36	SE
626300	LUK 79	State Claim	160	acres	Kateel River	22N	11E	31	SW
626301	LUK 80	State Claim	160	acres	Kateel River	22N	11E	31	SE
626302	LUK 81	State Claim	160	acres	Kateel River	22N	11E	32	SW
626303	LUK 82	State Claim	160	acres	Kateel River	22N	11E	32	SE
626304	LUK 83	State Claim	160	acres	Kateel River	22N	11E	33	SW
626305	LUK 84	State Claim	160	acres	Kateel River	22N	11E	33	SE
626306	LUK 85	State Claim	160	acres	Kateel River	22N	11E	34	SW
626307	LUK 86	State Claim	160	acres	Kateel River	22N	11E	34	SE
626308	LUK 87	State Claim	160	acres	Kateel River	22N	11E	35	SW
626309	LUK 88	State Claim	160	acres	Kateel River	22N	11E	35	SE
626310	LUK 89	State Claim	160	acres	Kateel River	22N	11E	36	SW
626311	LUK 90	State Claim	160	acres	Kateel River	22N	11E	36	SE
626312	LUK 91	State Claim	160	acres	Kateel River	21N	10E	3	NE
626313	LUK 92	State Claim	160	acres	Kateel River	21N	10E	2	NW
626314	LUK 93	State Claim	160	acres	Kateel River	21N	10E	2	NE
626315	LUK 94	State Claim	160	acres	Kateel River	21N	10E	1	NW
626316	LUK 95	State Claim	160	acres	Kateel River	21N	10E	1	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626317	LUK 96	State Claim	160	acres	Kateel River	21N	11E	6	NW
626318	LUK 97	State Claim	160	acres	Kateel River	21N	11E	6	NE
626319	LUK 98	State Claim	160	acres	Kateel River	21N	11E	5	NW
626320	LUK 99	State Claim	160	acres	Kateel River	21N	11E	5	NE
626321	LUK 100	State Claim	160	acres	Kateel River	21N	11E	4	NW
626322	LUK 101	State Claim	160	acres	Kateel River	21N	11E	4	NE
626323	LUK 102	State Claim	160	acres	Kateel River	21N	11E	3	NW
626324	LUK 103	State Claim	160	acres	Kateel River	21N	11E	3	NE
626325	LUK 104	State Claim	160	acres	Kateel River	21N	11E	2	NW
626326	LUK 105	State Claim	160	acres	Kateel River	21N	11E	2	NE
626327	LUK 106	State Claim	160	acres	Kateel River	21N	11E	1	NW
626328	LUK 107	State Claim	160	acres	Kateel River	21N	11E	1	NE
626329	LUK 108	State Claim	160	acres	Kateel River	21N	12E	6	NW
626330	LUK 109	State Claim	160	acres	Kateel River	21N	12E	6	NE
626331	LUK 110	State Claim	160	acres	Kateel River	21N	10E	1	SW
626332	LUK 111	State Claim	160	acres	Kateel River	21N	10E	1	SE
626333	LUK 112	State Claim	160	acres	Kateel River	21N	11E	6	SW
626334	LUK 113	State Claim	160	acres	Kateel River	21N	11E	6	SE
626335	LUK 114	State Claim	160	acres	Kateel River	21N	11E	5	SW
626336	LUK 115	State Claim	160	acres	Kateel River	21N	11E	5	SE
626337	LUK 116	State Claim	160	acres	Kateel River	21N	11E	4	SW
626338	LUK 117	State Claim	40	acres	Kateel River	21N	11E	4	NW of SE
626339	LUK 118	State Claim	40	acres	Kateel River	21N	11E	4	SW of SE
626340	LUK 119	State Claim	40	acres	Kateel River	21N	11E	4	NE of SE
626341	LUK 120	State Claim	40	acres	Kateel River	21N	11E	3	NW of SW
626342	LUK 121	State Claim	40	acres	Kateel River	21N	11E	3	NE of SW
626343	LUK 122	State Claim	40	acres	Kateel River	21N	11E	3	NW of SE
626344	LUK 123	State Claim	40	acres	Kateel River	21N	11E	3	NE of SE
626345	LUK 124	State Claim	160	acres	Kateel River	21N	11E	2	SW
626346	LUK 125	State Claim	160	acres	Kateel River	21N	11E	2	SE
626347	LUK 126	State Claim	160	acres	Kateel River	21N	11E	1	SW
626348	LUK 127	State Claim	160	acres	Kateel River	21N	11E	1	SE
626349	LUK 128	State Claim	160	acres	Kateel River	21N	12E	6	SW
626350	LUK 129	State Claim	160	acres	Kateel River	21N	12E	6	SE
626351	LUK 130	State Claim	40	acres	Kateel River	21N	10E	12	NW of NW
626352	LUK 131	State Claim	40	acres	Kateel River	21N	10E	12	NE of NW
626353	LUK 132	State Claim	40	acres	Kateel River	21N	10E	12	NW of NE
626354	LUK 133	State Claim	40	acres	Kateel River	21N	10E	12	NE of NE
626355	LUK 134	State Claim	40	acres	Kateel River	21N	11E	7	NW of NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626356	LUK 135	State Claim	40	acres	Kateel River	21N	11E	7	NE of NW
626357	LUK 136	State Claim	40	acres	Kateel River	21N	11E	7	NW of NE
626358	LUK 137	State Claim	40	acres	Kateel River	21N	11E	7	NE of NE
626359	LUK 138	State Claim	40	acres	Kateel River	21N	11E	8	NW of NW
626360	LUK 139	State Claim	40	acres	Kateel River	21N	11E	8	NE of NW
626361	LUK 140	State Claim	40	acres	Kateel River	21N	11E	8	NW of NE
626362	LUK 141	State Claim	40	acres	Kateel River	21N	11E	8	NE of NE
626363	LUK 142	State Claim	40	acres	Kateel River	21N	11E	9	NW of NW
626364	LUK 143	State Claim	40	acres	Kateel River	21N	11E	9	NE of NW
626365	LUK 144	State Claim	40	acres	Kateel River	21N	11E	9	NW of NE
626366	LUK 145	State Claim	160	acres	Kateel River	21N	11E	11	NW
626367	LUK 146	State Claim	160	acres	Kateel River	21N	11E	11	NE
626368	LUK 147	State Claim	160	acres	Kateel River	21N	11E	12	NW
626369	LUK 148	State Claim	160	acres	Kateel River	21N	11E	12	NE
626370	LUK 149	State Claim	160	acres	Kateel River	21N	12E	7	NW
626371	LUK 150	State Claim	160	acres	Kateel River	21N	12E	7	NE
626372	LUK 151	State Claim	160	acres	Kateel River	21N	11E	12	SW
626373	LUK 152	State Claim	160	acres	Kateel River	21N	11E	12	SE
626374	LUK 153	State Claim	160	acres	Kateel River	21N	12E	7	SW
626375	LUK 154	State Claim	160	acres	Kateel River	21N	12E	7	SE
626376	LUK 155	State Claim	160	acres	Kateel River	21N	12E	18	NW
626377	LUK 156	State Claim	160	acres	Kateel River	21N	12E	18	NE
626378	LUK 157	State Claim	160	acres	Kateel River	21N	12E	17	NW
626379	LUK 158	State Claim	160	acres	Kateel River	21N	12E	17	NE
626380	LUK 159	State Claim	160	acres	Kateel River	21N	12E	16	NW
626381	LUK 160	State Claim	160	acres	Kateel River	21N	12E	16	NE
626382	LUK 161	State Claim	160	acres	Kateel River	21N	12E	15	NW
626383	LUK 162	State Claim	160	acres	Kateel River	21N	12E	15	NE
626384	LUK 163	State Claim	160	acres	Kateel River	21N	12E	14	NW
626385	LUK 164	State Claim	160	acres	Kateel River	21N	12E	14	NE
626386	LUK 165	State Claim	160	acres	Kateel River	21N	12E	18	SW
626387	LUK 166	State Claim	160	acres	Kateel River	21N	12E	18	SE
626388	LUK 167	State Claim	160	acres	Kateel River	21N	12E	17	SW
626389	LUK 168	State Claim	160	acres	Kateel River	21N	12E	17	SE
626390	LUK 169	State Claim	160	acres	Kateel River	21N	12E	16	SW
626391	LUK 170	State Claim	160	acres	Kateel River	21N	12E	16	SE
626392	LUK 171	State Claim	160	acres	Kateel River	21N	12E	15	SW
626393	LUK 172	State Claim	160	acres	Kateel River	21N	12E	15	SE
626394	LUK 173	State Claim	160	acres	Kateel River	21N	12E	14	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626395	LUK 174	State Claim	160	acres	Kateel River	21N	12E	14	SE
626396	LUK 175	State Claim	160	acres	Kateel River	21N	12E	20	NW
626397	LUK 176	State Claim	160	acres	Kateel River	21N	12E	20	NE
626398	LUK 177	State Claim	160	acres	Kateel River	21N	12E	21	NW
626399	LUK 178	State Claim	160	acres	Kateel River	21N	12E	21	NE
626400	LUK 179	State Claim	160	acres	Kateel River	21N	12E	22	NW
626401	LUK 180	State Claim	160	acres	Kateel River	21N	12E	22	NE
626402	LUK 181	State Claim	160	acres	Kateel River	21N	12E	23	NW
626403	LUK 182	State Claim	160	acres	Kateel River	21N	12E	23	NE
626404	LUK 183	State Claim	160	acres	Kateel River	21N	12E	24	NW
626405	LUK 184	State Claim	160	acres	Kateel River	21N	12E	24	NE
626406	LUK 185	State Claim	160	acres	Kateel River	21N	13E	19	NW
626407	LUK 186	State Claim	160	acres	Kateel River	21N	13E	19	NE
626408	LUK 187	State Claim	160	acres	Kateel River	21N	12E	20	SW
626409	LUK 188	State Claim	160	acres	Kateel River	21N	12E	20	SE
626410	LUK 189	State Claim	160	acres	Kateel River	21N	12E	21	SW
626411	LUK 190	State Claim	160	acres	Kateel River	21N	12E	21	SE
626412	LUK 191	State Claim	160	acres	Kateel River	21N	12E	22	SW
626413	LUK 192	State Claim	160	acres	Kateel River	21N	12E	22	SE
626414	LUK 193	State Claim	160	acres	Kateel River	21N	12E	23	SW
626415	LUK 194	State Claim	160	acres	Kateel River	21N	12E	23	SE
626416	LUK 195	State Claim	160	acres	Kateel River	21N	12E	24	SW
626417	LUK 196	State Claim	160	acres	Kateel River	21N	12E	24	SE
626418	LUK 197	State Claim	160	acres	Kateel River	21N	13E	19	SW
626419	LUK 198	State Claim	160	acres	Kateel River	21N	13E	19	SE
626420	LUK 199	State Claim	160	acres	Kateel River	21N	12E	29	NW
626421	LUK 200	State Claim	160	acres	Kateel River	21N	12E	29	NE
626422	LUK 201	State Claim	160	acres	Kateel River	21N	12E	28	NW
626423	LUK 202	State Claim	160	acres	Kateel River	21N	12E	28	NE
626424	LUK 203	State Claim	160	acres	Kateel River	21N	12E	27	NW
626425	LUK 204	State Claim	160	acres	Kateel River	21N	12E	27	NE
626426	LUK 205	State Claim	160	acres	Kateel River	21N	12E	26	NW
626427	LUK 206	State Claim	160	acres	Kateel River	21N	12E	26	NE
626428	LUK 207	State Claim	160	acres	Kateel River	21N	12E	25	NW
626429	LUK 208	State Claim	160	acres	Kateel River	21N	12E	25	NE
626430	LUK 209	State Claim	160	acres	Kateel River	21N	13E	30	NW
626431	LUK 210	State Claim	160	acres	Kateel River	21N	13E	30	NE
626432	LUK 211	State Claim	160	acres	Kateel River	21N	13E	29	NW
626433	LUK 212	State Claim	160	acres	Kateel River	21N	13E	29	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626434	LUK 213	State Claim	160	acres	Kateel River	21N	13E	28	NW
626435	LUK 214	State Claim	160	acres	Kateel River	21N	13E	28	NE
626436	LUK 215	State Claim	160	acres	Kateel River	21N	12E	29	SW
626437	LUK 216	State Claim	160	acres	Kateel River	21N	12E	29	SE
626438	LUK 217	State Claim	160	acres	Kateel River	21N	12E	28	SW
626439	LUK 218	State Claim	160	acres	Kateel River	21N	12E	28	SE
626440	LUK 219	State Claim	160	acres	Kateel River	21N	12E	27	SW
626441	LUK 220	State Claim	160	acres	Kateel River	21N	12E	27	SE
626442	LUK 221	State Claim	160	acres	Kateel River	21N	12E	26	SW
626443	LUK 222	State Claim	160	acres	Kateel River	21N	12E	26	SE
626444	LUK 223	State Claim	160	acres	Kateel River	21N	12E	25	SW
626445	LUK 224	State Claim	160	acres	Kateel River	21N	12E	25	SE
626446	LUK 225	State Claim	160	acres	Kateel River	21N	13E	30	SW
626447	LUK 226	State Claim	160	acres	Kateel River	21N	13E	30	SE
626448	LUK 227	State Claim	160	acres	Kateel River	21N	13E	29	SW
626449	LUK 228	State Claim	160	acres	Kateel River	21N	13E	29	SE
626450	LUK 229	State Claim	160	acres	Kateel River	21N	13E	28	SW
626451	LUK 230	State Claim	160	acres	Kateel River	21N	13E	28	SE
626452	LUK 231	State Claim	160	acres	Kateel River	21N	12E	33	NE
626453	LUK 232	State Claim	160	acres	Kateel River	21N	12E	34	NW
626454	LUK 233	State Claim	160	acres	Kateel River	21N	12E	34	NE
626455	LUK 234	State Claim	160	acres	Kateel River	21N	12E	35	NW
626456	LUK 235	State Claim	160	acres	Kateel River	21N	12E	35	NE
626457	LUK 236	State Claim	160	acres	Kateel River	21N	12E	36	NW
626458	LUK 237	State Claim	160	acres	Kateel River	21N	12E	36	NE
626459	LUK 238	State Claim	160	acres	Kateel River	21N	13E	31	NW
626460	LUK 239	State Claim	160	acres	Kateel River	21N	13E	31	NE
626461	LUK 240	State Claim	160	acres	Kateel River	21N	13E	32	NW
626462	LUK 241	State Claim	160	acres	Kateel River	21N	13E	32	NE
626463	LUK 242	State Claim	160	acres	Kateel River	21N	13E	33	NW
626464	LUK 243	State Claim	160	acres	Kateel River	21N	13E	33	NE
626465	LUK 244	State Claim	160	acres	Kateel River	21N	13E	34	NW
626466	LUK 245	State Claim	160	acres	Kateel River	21N	13E	34	NE
626467	LUK 246	State Claim	160	acres	Kateel River	21N	13E	35	NW
626468	LUK 247	State Claim	160	acres	Kateel River	21N	13E	35	NE
626469	LUK 248	State Claim	160	acres	Kateel River	21N	12E	33	SE
626470	LUK 249	State Claim	160	acres	Kateel River	21N	12E	34	SW
626471	LUK 250	State Claim	160	acres	Kateel River	21N	12E	34	SE
626472	LUK 251	State Claim	160	acres	Kateel River	21N	12E	35	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626473	LUK 252	State Claim	160	acres	Kateel River	21N	12E	35	SE
626474	LUK 253	State Claim	160	acres	Kateel River	21N	12E	36	SW
626475	LUK 254	State Claim	160	acres	Kateel River	21N	12E	36	SE
626476	LUK 255	State Claim	160	acres	Kateel River	21N	13E	31	SW
626477	LUK 256	State Claim	160	acres	Kateel River	21N	13E	31	SE
626478	LUK 257	State Claim	160	acres	Kateel River	21N	13E	32	SW
626479	LUK 258	State Claim	160	acres	Kateel River	21N	13E	32	SE
626480	LUK 259	State Claim	160	acres	Kateel River	21N	13E	33	SW
626481	LUK 260	State Claim	160	acres	Kateel River	21N	13E	33	SE
626482	LUK 261	State Claim	160	acres	Kateel River	21N	13E	34	SW
626483	LUK 262	State Claim	160	acres	Kateel River	21N	13E	34	SE
626484	LUK 263	State Claim	160	acres	Kateel River	21N	13E	35	SW
626485	LUK 264	State Claim	160	acres	Kateel River	21N	13E	35	SE
626486	LUK 265	State Claim	160	acres	Kateel River	20N	12E	3	NE
626487	LUK 266	State Claim	160	acres	Kateel River	20N	12E	2	NW
626488	LUK 267	State Claim	160	acres	Kateel River	20N	12E	2	NE
626489	LUK 268	State Claim	160	acres	Kateel River	20N	12E	1	NW
626490	LUK 269	State Claim	160	acres	Kateel River	20N	12E	1	NE
626491	LUK 270	State Claim	160	acres	Kateel River	20N	13E	6	NW
626492	LUK 271	State Claim	160	acres	Kateel River	20N	13E	6	NE
626493	LUK 272	State Claim	160	acres	Kateel River	20N	13E	5	NW
626494	LUK 273	State Claim	160	acres	Kateel River	20N	13E	5	NE
626495	LUK 274	State Claim	160	acres	Kateel River	20N	13E	4	NW
626496	LUK 275	State Claim	160	acres	Kateel River	20N	13E	4	NE
626497	LUK 276	State Claim	160	acres	Kateel River	20N	13E	3	NW
626498	LUK 277	State Claim	160	acres	Kateel River	20N	13E	3	NE
626499	LUK 278	State Claim	160	acres	Kateel River	20N	13E	2	NW
626500	LUK 279	State Claim	160	acres	Kateel River	20N	13E	2	NE
626501	LUK 280	State Claim	160	acres	Kateel River	20N	13E	1	NW
626502	LUK 281	State Claim	160	acres	Kateel River	20N	13E	1	NE
626503	LUK 282	State Claim	160	acres	Kateel River	20N	14E	6	NW
626504	LUK 283	State Claim	160	acres	Kateel River	20N	14E	6	NE
626505	LUK 284	State Claim	160	acres	Kateel River	20N	14E	5	NW
626506	LUK 285	State Claim	160	acres	Kateel River	20N	14E	5	NE
626507	LUK 286	State Claim	160	acres	Kateel River	20N	12E	3	SE
626508	LUK 287	State Claim	160	acres	Kateel River	20N	12E	2	SW
626509	LUK 288	State Claim	160	acres	Kateel River	20N	12E	2	SE
626510	LUK 289	State Claim	160	acres	Kateel River	20N	12E	1	SW
626511	LUK 290	State Claim	160	acres	Kateel River	20N	12E	1	SE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626512	LUK 291	State Claim	160	acres	Kateel River	20N	13E	6	SW
626513	LUK 292	State Claim	160	acres	Kateel River	20N	13E	6	SE
626514	LUK 293	State Claim	160	acres	Kateel River	20N	13E	5	SW
626515	LUK 294	State Claim	160	acres	Kateel River	20N	13E	5	SE
626516	LUK 295	State Claim	160	acres	Kateel River	20N	13E	4	SW
626517	LUK 296	State Claim	160	acres	Kateel River	20N	13E	4	SE
626518	LUK 297	State Claim	160	acres	Kateel River	20N	13E	3	SW
626519	LUK 298	State Claim	160	acres	Kateel River	20N	13E	3	SE
626520	LUK 299	State Claim	160	acres	Kateel River	20N	13E	2	SW
626521	LUK 300	State Claim	160	acres	Kateel River	20N	13E	2	SE
626522	LUK 301	State Claim	160	acres	Kateel River	20N	13E	1	SW
626523	LUK 302	State Claim	160	acres	Kateel River	20N	13E	1	SE
626524	LUK 303	State Claim	160	acres	Kateel River	20N	14E	6	SW
626525	LUK 304	State Claim	160	acres	Kateel River	20N	14E	6	SE
626526	LUK 305	State Claim	160	acres	Kateel River	20N	14E	5	SW
626527	LUK 306	State Claim	160	acres	Kateel River	20N	14E	5	SE
626528	LUK 307	State Claim	160	acres	Kateel River	20N	13E	7	NE
626529	LUK 308	State Claim	160	acres	Kateel River	20N	13E	8	NW
626530	LUK 309	State Claim	160	acres	Kateel River	20N	13E	8	NE
626531	LUK 310	State Claim	160	acres	Kateel River	20N	13E	9	NW
626532	LUK 311	State Claim	160	acres	Kateel River	20N	13E	9	NE
626533	LUK 312	State Claim	160	acres	Kateel River	20N	13E	10	NW
626534	LUK 313	State Claim	160	acres	Kateel River	20N	13E	10	NE
626535	LUK 314	State Claim	160	acres	Kateel River	20N	13E	11	NW
626536	LUK 315	State Claim	160	acres	Kateel River	20N	13E	11	NE
626537	LUK 316	State Claim	160	acres	Kateel River	20N	13E	12	NW
626538	LUK 317	State Claim	160	acres	Kateel River	20N	13E	12	NE
626539	LUK 318	State Claim	160	acres	Kateel River	20N	14E	7	NW
626540	LUK 319	State Claim	160	acres	Kateel River	20N	14E	7	NE
626541	LUK 320	State Claim	160	acres	Kateel River	20N	14E	8	NW
626542	LUK 321	State Claim	160	acres	Kateel River	20N	14E	8	NE
626543	LUK 322	State Claim	160	acres	Kateel River	20N	14E	9	NW
626544	LUK 323	State Claim	160	acres	Kateel River	20N	14E	9	NE
626545	LUK 324	State Claim	160	acres	Kateel River	20N	14E	10	NW
626546	LUK 325	State Claim	160	acres	Kateel River	20N	14E	10	NE
626547	LUK 326	State Claim	160	acres	Kateel River	20N	14E	11	NW
626548	LUK 327	State Claim	160	acres	Kateel River	20N	14E	11	NE
626549	LUK 328	State Claim	160	acres	Kateel River	20N	14E	12	NW
626550	LUK 329	State Claim	160	acres	Kateel River	20N	14E	12	NE

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626551	LUK 330	State Claim	160	acres	Kateel River	20N	15E	7	NW
626552	LUK 331	State Claim	160	acres	Kateel River	20N	13E	9	SW
626553	LUK 332	State Claim	160	acres	Kateel River	20N	13E	9	SE
626554	LUK 333	State Claim	160	acres	Kateel River	20N	13E	10	SW
626555	LUK 334	State Claim	160	acres	Kateel River	20N	13E	10	SE
626556	LUK 335	State Claim	160	acres	Kateel River	20N	13E	11	SW
626557	LUK 336	State Claim	160	acres	Kateel River	20N	13E	11	SE
626558	LUK 337	State Claim	160	acres	Kateel River	20N	13E	12	SW
626559	LUK 338	State Claim	160	acres	Kateel River	20N	13E	12	SE
626560	LUK 339	State Claim	160	acres	Kateel River	20N	14E	7	SW
626561	LUK 340	State Claim	160	acres	Kateel River	20N	14E	7	SE
626562	LUK 341	State Claim	160	acres	Kateel River	20N	14E	8	SW
626563	LUK 342	State Claim	160	acres	Kateel River	20N	14E	8	SE
626564	LUK 343	State Claim	160	acres	Kateel River	20N	14E	9	SW
626565	LUK 344	State Claim	160	acres	Kateel River	20N	14E	9	SE
626566	LUK 345	State Claim	160	acres	Kateel River	20N	14E	10	SW
626567	LUK 346	State Claim	160	acres	Kateel River	20N	14E	10	SE
626568	LUK 347	State Claim	160	acres	Kateel River	20N	14E	11	SW
626569	LUK 348	State Claim	160	acres	Kateel River	20N	14E	11	SE
626570	LUK 349	State Claim	160	acres	Kateel River	20N	14E	12	SW
626571	LUK 350	State Claim	160	acres	Kateel River	20N	14E	12	SE
626572	LUK 351	State Claim	160	acres	Kateel River	20N	15E	7	SW
626573	LUK 352	State Claim	160	acres	Kateel River	20N	13E	14	NW
626574	LUK 353	State Claim	160	acres	Kateel River	20N	13E	14	NE
626575	LUK 354	State Claim	160	acres	Kateel River	20N	13E	13	NW
626576	LUK 355	State Claim	160	acres	Kateel River	20N	13E	13	NE
626577	LUK 356	State Claim	160	acres	Kateel River	20N	14E	18	NW
626578	LUK 357	State Claim	160	acres	Kateel River	20N	14E	18	NE
626579	LUK 358	State Claim	160	acres	Kateel River	20N	14E	17	NW
626580	LUK 359	State Claim	160	acres	Kateel River	20N	14E	17	NE
626581	LUK 360	State Claim	160	acres	Kateel River	20N	14E	16	NW
626582	LUK 361	State Claim	160	acres	Kateel River	20N	14E	16	NE
626583	LUK 362	State Claim	160	acres	Kateel River	20N	14E	15	NW
626584	LUK 363	State Claim	160	acres	Kateel River	20N	14E	15	NE
626585	LUK 364	State Claim	160	acres	Kateel River	20N	14E	14	NW
626586	LUK 365	State Claim	160	acres	Kateel River	20N	14E	14	NE
626587	LUK 366	State Claim	160	acres	Kateel River	20N	14E	13	NW
626588	LUK 367	State Claim	160	acres	Kateel River	20N	14E	13	NE
626589	LUK 368	State Claim	160	acres	Kateel River	20N	15E	18	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626590	LUK 369	State Claim	160	acres	Kateel River	20N	13E	14	SW
626591	LUK 370	State Claim	160	acres	Kateel River	20N	13E	14	SE
626592	LUK 371	State Claim	160	acres	Kateel River	20N	13E	13	SW
626593	LUK 372	State Claim	160	acres	Kateel River	20N	13E	13	SE
626594	LUK 373	State Claim	160	acres	Kateel River	20N	14E	18	SW
626595	LUK 374	State Claim	160	acres	Kateel River	20N	14E	18	SE
626596	LUK 375	State Claim	160	acres	Kateel River	20N	14E	17	SW
626597	LUK 376	State Claim	160	acres	Kateel River	20N	14E	17	SE
626598	LUK 377	State Claim	160	acres	Kateel River	20N	14E	16	SW
626599	LUK 378	State Claim	160	acres	Kateel River	20N	14E	16	SE
626600	LUK 379	State Claim	160	acres	Kateel River	20N	14E	15	SW
626601	LUK 380	State Claim	160	acres	Kateel River	20N	14E	15	SE
626602	LUK 381	State Claim	160	acres	Kateel River	20N	14E	14	SW
626603	LUK 382	State Claim	160	acres	Kateel River	20N	14E	14	SE
626604	LUK 383	State Claim	160	acres	Kateel River	20N	14E	13	SW
626605	LUK 384	State Claim	160	acres	Kateel River	20N	14E	13	SE
626606	LUK 385	State Claim	160	acres	Kateel River	20N	15E	18	SW
626607	NORA 1	State Claim	160	acres	Kateel River	20N	12E	19	NW
626608	NORA 2	State Claim	160	acres	Kateel River	20N	12E	19	NE
626609	NORA 3	State Claim	160	acres	Kateel River	20N	12E	20	NW
626610	NORA 4	State Claim	160	acres	Kateel River	20N	12E	20	NE
626611	NORA 5	State Claim	160	acres	Kateel River	20N	12E	21	NW
626612	NORA 6	State Claim	160	acres	Kateel River	20N	12E	21	NE
626613	NORA 7	State Claim	160	acres	Kateel River	20N	12E	22	NW
626614	NORA 8	State Claim	160	acres	Kateel River	20N	12E	22	NE
626615	NORA 9	State Claim	160	acres	Kateel River	20N	12E	23	NW
626616	NORA 10	State Claim	160	acres	Kateel River	20N	12E	23	NE
626617	NORA 11	State Claim	160	acres	Kateel River	20N	12E	24	NW
626618	NORA 12	State Claim	160	acres	Kateel River	20N	12E	19	SW
626619	NORA 13	State Claim	160	acres	Kateel River	20N	12E	19	SE
626620	NORA 14	State Claim	160	acres	Kateel River	20N	12E	20	SW
626621	NORA 15	State Claim	160	acres	Kateel River	20N	12E	20	SE
626622	NORA 16	State Claim	160	acres	Kateel River	20N	12E	21	SW
626623	NORA 17	State Claim	160	acres	Kateel River	20N	12E	21	SE
626624	NORA 18	State Claim	160	acres	Kateel River	20N	12E	22	SW
626625	NORA 19	State Claim	160	acres	Kateel River	20N	12E	22	SE
626626	NORA 20	State Claim	160	acres	Kateel River	20N	12E	23	SW
626627	NORA 21	State Claim	160	acres	Kateel River	20N	12E	23	SE
626628	NORA 22	State Claim	160	acres	Kateel River	20N	12E	24	SW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626629	NORA 23	State Claim	160	acres	Kateel River	20N	12E	24	SE
626630	NORA 24	State Claim	160	acres	Kateel River	20N	13E	19	SW
626631	NORA 25	State Claim	160	acres	Kateel River	20N	12E	28	NW
626632	NORA 26	State Claim	160	acres	Kateel River	20N	12E	28	NE
626633	NORA 27	State Claim	160	acres	Kateel River	20N	12E	27	NW
626634	NORA 28	State Claim	160	acres	Kateel River	20N	12E	27	NE
626635	NORA 29	State Claim	160	acres	Kateel River	20N	12E	26	NW
626636	NORA 30	State Claim	160	acres	Kateel River	20N	12E	26	NE
626637	NORA 31	State Claim	160	acres	Kateel River	20N	12E	25	NW
626638	NORA 32	State Claim	160	acres	Kateel River	20N	12E	25	NE
626639	NORA 33	State Claim	160	acres	Kateel River	20N	13E	30	NW
626640	NORA 34	State Claim	160	acres	Kateel River	20N	13E	30	NE
626641	NORA 35	State Claim	160	acres	Kateel River	20N	13E	29	NW
626642	NORA 36	State Claim	160	acres	Kateel River	20N	13E	29	NE
626643	NORA 37	State Claim	160	acres	Kateel River	20N	13E	28	NW
626644	NORA 38	State Claim	160	acres	Kateel River	20N	13E	28	NE
626645	NORA 39	State Claim	160	acres	Kateel River	20N	13E	27	NW
626646	NORA 40	State Claim	160	acres	Kateel River	20N	13E	27	NE
626647	NORA 41	State Claim	160	acres	Kateel River	20N	12E	28	SW
626648	NORA 42	State Claim	160	acres	Kateel River	20N	12E	28	SE
626649	NORA 43	State Claim	160	acres	Kateel River	20N	12E	27	SW
626650	NORA 44	State Claim	160	acres	Kateel River	20N	12E	27	SE
626651	NORA 45	State Claim	160	acres	Kateel River	20N	12E	26	SW
626652	NORA 46	State Claim	160	acres	Kateel River	20N	12E	26	SE
626653	NORA 47	State Claim	160	acres	Kateel River	20N	12E	25	SW
626654	NORA 48	State Claim	160	acres	Kateel River	20N	12E	25	SE
626655	NORA 49	State Claim	160	acres	Kateel River	20N	13E	30	SW
626656	NORA 50	State Claim	160	acres	Kateel River	20N	13E	30	SE
626657	NORA 51	State Claim	160	acres	Kateel River	20N	13E	29	SW
626658	NORA 52	State Claim	160	acres	Kateel River	20N	13E	29	SE
626659	NORA 53	State Claim	160	acres	Kateel River	20N	13E	28	SW
626660	NORA 54	State Claim	160	acres	Kateel River	20N	13E	28	SE
626661	NORA 55	State Claim	160	acres	Kateel River	20N	13E	27	SW
626662	NORA 56	State Claim	160	acres	Kateel River	20N	13E	27	SE
626663	NORA 57	State Claim	160	acres	Kateel River	20N	12E	35	NW
626664	NORA 58	State Claim	160	acres	Kateel River	20N	12E	35	NE
626665	NORA 59	State Claim	160	acres	Kateel River	20N	12E	36	NW
626666	NORA 60	State Claim	160	acres	Kateel River	20N	12E	36	NE
626667	NORA 61	State Claim	160	acres	Kateel River	20N	13E	31	NW

Lease	Name	Type	Current Area	Area Type	Meridian	Township	Range	Section	1/4 Section
626668	NORA 62	State Claim	160	acres	Kateel River	20N	13E	31	NE
626669	NORA 63	State Claim	160	acres	Kateel River	20N	13E	32	NW
626670	NORA 64	State Claim	160	acres	Kateel River	20N	13E	32	NE
626671	NORA 65	State Claim	160	acres	Kateel River	20N	13E	33	NW
626672	NORA 66	State Claim	160	acres	Kateel River	20N	13E	33	NE
626673	NORA 67	State Claim	160	acres	Kateel River	20N	13E	34	NW
626674	NORA 68	State Claim	160	acres	Kateel River	20N	13E	34	NE
626675	NORA 69	State Claim	160	acres	Kateel River	20N	12E	35	SW
626676	NORA 70	State Claim	160	acres	Kateel River	20N	12E	35	SE
626677	NORA 71	State Claim	160	acres	Kateel River	20N	12E	36	SW
626678	NORA 72	State Claim	160	acres	Kateel River	20N	12E	36	SE
626679	NORA 73	State Claim	160	acres	Kateel River	20N	13E	31	SW
626680	NORA 74	State Claim	160	acres	Kateel River	20N	13E	31	SE
626681	NORA 75	State Claim	160	acres	Kateel River	20N	13E	32	SW
626682	NORA 76	State Claim	160	acres	Kateel River	20N	13E	32	SE
626683	NORA 77	State Claim	160	acres	Kateel River	20N	13E	33	SW
626684	NORA 78	State Claim	160	acres	Kateel River	20N	13E	33	SE
626685	NORA 79	State Claim	160	acres	Kateel River	20N	13E	34	SW
626686	NORA 80	State Claim	160	acres	Kateel River	20N	13E	34	SE

Federal Claims:

Mineral Survey	Patent Number	Claim Name
MS 2245	50-81-0127	ARCTIC 1
MS 2245	50-81-0127	ARCTIC 2
MS 2245	50-81-0127	ARCTIC 4
MS 2245	50-81-0127	ARCTIC 9
MS 2245	50-81-0127	ARCTIC 11
MS 2245	50-81-0127	ARCTIC 13
MS 2245	50-81-0127	ARCTIC 15
MS 2245	50-81-0127	ARCTIC 17
MS 2245	50-81-0127	ARCTIC 19
MS 2245	50-81-0127	ARCTIC 23
MS 2245	50-81-0127	ARCTIC 24
MS 2245	50-81-0127	ARCTIC 25
MS 2245	50-81-0127	ARCTIC 26
MS 2245	50-81-0127	ARCTIC 27
MS 2245	50-81-0127	ARCTIC 28
MS 2245	50-81-0127	ARCTIC 29
MS 2245	50-83-0174	ARCTIC 10
MS 2245	50-83-0174	ARCTIC 495

Trilogy Metals Inc.
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