RUBICON MINERALS

National Instrument 43-101 Technical Report for the Phoenix Gold Project Cochenour, Ontario

PREPARED FOR:
Rubicon Minerals Corporation

PREPARED BY:
T. Maunula & Associates Consulting Inc.

QUALIFIED PERSONS:
Tim Maunula, P.Geo.
John William Frostiak, P.Eng.
Michael Willett, P.Eng.

EFFECTIVE DATE: March 18, 2019 REPORT DATE: April 23, 2019

IMPORTANT NOTICE

This report was prepared as a National Instrument 43-101 Technical Report in accordance with Form 43-101F1, for Rubicon Minerals Corporation (Client), by Qualified Persons: Tim Maunula, P.Geo., T. Maunula & Associates Consulting Inc. (TMAC); John Frostiak, P.Eng., Independent Consultant and Michael Willett, P.Eng., Rubicon Minerals Corporation. The quality of information, conclusions, and estimates contained in this report are based on: i) information available at the time of preparation of data; ii) data from outside sources; and iii) the assumptions, conditions, and qualifications as put forth by the writer of the report. This report is intended to be used by the Client, subject to terms and conditions with TMAC. The relationship permits the Client to file this report as a Technical Report with applicable securities regulatory authorities pursuant to provincial securities legislation.

CAUTIONARY STATEMENT REGARDING FORWARD-LOOKING STATEMENTS AND OTHER CAUTIONARY NOTES

This technical report contains statements that constitute "forward-looking statements" and "forward looking information" (collectively, "forward-looking statements") within the meaning of applicable Canadian and United States securities legislation. Generally, these forward-looking statements can be identified by the use of forward-looking terminology such as "believes", "intends", "may", "will", "should", "plans", "anticipates", "potential", "expects", "estimates", "forecasts", "budget", "likely", "goal" and similar expressions or statements that certain actions, events or results may or may not be achieved or occur in the future. In some cases, forward-looking information may be stated in the present tense, such as in respect of current matters that may be continuing, or that may have a future impact or effect. Forward-looking statements reflect our current expectations and assumptions, and are subject to a number of known and unknown risks, uncertainties and other factors which may cause our actual results, performance or achievements to be materially different from any anticipated future results, performance or achievements expressed or implied by the forward-looking statements. Forward-looking statements include, but are not limited to statements regarding the anticipated future infill drilling to be completed, the potential amount of mineralized material and its grade to be realized from the Explore Target areas, the impact of the data from the 20,000 m of drilling planned in 2019 on the 2019 Mineral Resource Estimate, the potential advancement of the Phoenix Gold Project to a viable commercial operation, the anticipated outcome of further oriented infill and expansion drilling of the deposit, the nature of the 2019 Mineral Resource Estimate when compared with the 2018 Mineral Resource Estimate, the potential to improve the quantities and classification of the 2019 Mineral Resource Estimate, the further steps necessary to potentially improve upon the 2019 Mineral Resource Estimates, including targeted infill and step-out drilling to potentially convert Inferred Resources to Indicated Resources, using the results from the bulk sampling program for reconciliation and validation purposes, the evaluation of the McFinley Deposit and other close proximity targets for potential inclusion in a future Mineral Resources Estimate, and follow-up drilling of the F2 Gold Deposit at depth and along strike.

Forward-looking statements are based on the opinions and estimates of management as of the date such statements are made and represent management's best judgment based on facts and assumptions that management considers reasonable. If such opinions and estimates prove to be incorrect, actual and future results may be materially different than expressed in the forward-looking statements.

Forward-looking statements involve known and unknown risks, uncertainties and other factors which may cause the actual results, performance or achievements of Rubicon to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. Such factors include, among others: possible variations in mineralization, grade or recovery or throughput rates; uncertainty of mineral resources, inability to realize exploration potential, mineral grades and mineral recovery estimates; actual results of current exploration activities; actual results of reclamation activities; uncertainty of future operations, delays in completion of exploration plans for any reason including insufficient capital, delays in permitting, and labour issues; conclusions of future economic or geological evaluations; changes in project parameters as plans continue to be refined; failure of equipment or processes to operate as anticipated; accidents and other risks of the mining industry; delays and other risks related to operations; timing and receipt of regulatory approvals; the ability of Rubicon and other relevant parties to satisfy regulatory requirements; the ability of Rubicon to comply with its obligations under material agreements including financing agreements; the availability of financing for proposed programs and working capital requirements on reasonable terms; the ability of third-party service providers to deliver services on reasonable terms and in a timely manner; risks associated with the ability to retain key executives and key operating personnel; cost of environmental expenditures and potential environmental liabilities; dissatisfaction or disputes with local communities or First Nations or Aboriginal Communities; failure of plant, equipment *or processes to operate as anticipated; market conditions and general business, economic, competitive, political and social conditions; our ability to generate sufficient cash flow from operations or obtain adequate financing to fund our capital expenditures and working capital needs and meet our other obligations; the volatility of our stock price, and the ability of our common stock to remain listed and traded on the TSX.*

Forward-looking statements contained herein are made as of the date of this technical report and Rubicon disclaims any obligation to update any forward-looking statements, whether as a result of new information, future events or results or otherwise, except as required by applicable securities laws. Readers are advised to carefully review and consider the risk factors identified in the Company's annual information form dated March 22, 2019 under the heading "Risk Factors" and in other continuous disclosure documents of the Company filed at www.sedar.com for a discussion of the factors that could cause Rubicon's actual results, performance and achievements to be materially different from any anticipated future results, performance or achievements expressed or implied by the forward-looking statements. Readers are further cautioned that the foregoing list of assumptions and risk factors is not exhaustive and it is recommended that prospective investors consult the more complete discussion of Rubicon's business, financial condition and prospects that is included in this technical report. The forward-looking statements contained herein are expressly qualified by this cautionary statement.

Cautionary Note to U.S. Readers Regarding Estimates of Measured, Indicated, and Inferred Resources

This technical report uses the terms "Measured," "Indicated," and "Inferred" Mineral Resources. The Company advises U.S. investors that while these terms are recognized and required by Canadian securities administrators, they are not recognized by the SEC. The estimation of "Measured" and "Indicated" Mineral Resources involves greater uncertainty as to their existence and economic feasibility than the estimation of Proven and Probable Reserves. The estimation of "Inferred" resources involves far greater uncertainty as to their existence and economic viability than the estimation of other categories of resources. It cannot be assumed that all or any part of a "Measured," "Inferred" or "Indicated" mineral resource will ever be upgraded to a higher category.

Under Canadian rules, estimates of "inferred mineral resources" may not form the basis of feasibility studies, pre-feasibility studies or other economic studies, except in prescribed cases, such as in a preliminary economic assessment under certain circumstances. The SEC normally only permits issuers to report mineralization that does not constitute "reserves" as in-place tonnage and grade without reference to unit measures. Under U.S. standards, mineralization may not be classified as a "reserve" unless the determination has been made that the mineralization could be economically and legally produced or extracted at the time the reserve determination is made. U.S. investors are cautioned not to assume that any part or all of a "measured", "indicated" or "inferred" mineral resource exists or is economically or legally mineable. Information concerning descriptions of mineralization and resources contained herein may not be comparable to information made public by U.S. companies subject to the reporting and disclosure requirements of the SEC.

Date and Signature Page

The undersigned prepared this Technical Report, titled "National Instrument 43-101 Technical Report for the Phoenix Gold Project, Cochenour, Ontario," and dated April 23, 2019, in support of the public disclosure for public listing. The format and content of this report conforms to the National Instrument 43-101 (NI 43-101) guidelines of the Canadian Securities Administrators.

Dated at Chatham, Ontario on April 23, 2019.

Original Signed and Sealed

Tim Maunula, P.Geo.
Principal Geologist
T. Maunula & Associates Consulting Inc.

Original Signed and Sealed

John William Frostiak, P.Eng.
Independent Consultant

Original Signed and Sealed

Michael Willett, P.Eng.
Director of Projects, Mining Engineer
Rubicon Minerals Corporation

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Units of Measure

Centimetre cubic	cm^3
Centimetre	cm
Degree	°
Degrees Celsius	°C
Dry Tonnes	dmt
Gallons per day	gpd
Gallons per minute	gpm
Gram	g
Grams per cubic centimetre	g/cm^3
Grams per tonne	g/t
Greater than	>
Hectare (10,000 m^2)	ha
Kilogram	kg
Kilograms per cubic metre	kg/m^3
Kilograms per square metre	kg/m^2
Kilometre square	km^2
Kilometre	km
Kilovolt	kV
Less than	<
Litre	L
Litres per minute	L/min
Mega-annum (1 million years)	Ma
Megavolt	MV
Metre cubic	m^3
Metre square	m^2
Metre	m

Metres above sea level	masl
Metres cubic per hour	m^3/h
Micron	µm
Millimetre	mm
Million tonnes per annum	Mt/a
Million tonnes	Mt
Million years	Ma
Million	M
Ounce (troy ounce – 31.1035 grams)	oz
Ounce per tonne	oz/t
Percent mass fraction for percent mass	%w/w
Percent	%
Pound	lb
Pounds per square inch gage	psig
Tonnes per cubic metre	t/m^3
Tonnes per day	t/d
Tonnes per hour	t/h
Volt	V

Abbreviations and Acronyms

Accurassay Laboratories	Accurassay
ALS Minerals	ALS
Ammonium Nitrate/Fuel Oil	ANFO
Atomic Absorption Spectroscopy	AAS
West Limb Basalt	WLB
F2 Basalt	F2
Canadian Dam Association	CDA
Canadian Institute of Mining, Metallurgy and Petroleum	CIM
Capital Expenditure	CAPEX
Carbon-in-Leach	CIL
CDN Resource Laboratories Ltd.	CDN
Certified Reference Material	CRM
Coefficient of Variation	CV
Comma-Separate Values File (electronic file format)	csv
Distribution Station	DS
Dominion Goldfields Corporation	Dominion Goldfields
EAG Inc.	EAG
East Bay Deformation Zone	EBDZ

East-West	E-W
Exploratory Data Analysis	EDA
G&T Metallurgical Services Ltd.	G&T
Global Positioning System	GPS
Gold	Au
Golder Associates Ltd.	Golder
Hangingwall	HW
High Grade	HG
High Titanium Basalt	High-Ti
Historical McFinley Shaft	now the Phoenix Shaft
Inductively-Coupled Plasma Atomic Emission Spectroscopy	ICP-AE
Internal Rate-of-Return	IRR
International Electrotechnical Commission	IEC
International Organization for Standardization	ISO
Inverse Distance Cubic	ID^3
Inverse Distance Square	ID^2
Inverse Distance	ID
Inverse Distance Weighting	IDW
ioGlobal Pty Ltd.	ioGlobal
Light Detection and Ranging	LiDAR
Load-Haul-Dump	LHD
Low Grade	LG
Metre Level	m Level
Ministry of Natural Resources	MNR
Ministry of Natural Resources and Forestry	MNRF
Ministry of Energy, Northern Development and Mines	MENDM
Ministry of Northern Development and Mines	MNDM
Multiple Indicator Kriging	MIK
National Instrument	NI
Nearest Neighbour	NN
Net Smelter Return	NSR
Northeast	NE
North-South	N-S
Operating Expense	OPEX
Ordinary Kriging	OK
Parts per Billion	ppb
Parts per Million	ppm
Phoenix Gold Property	previously McFinley Property

Qualified Persons	QPs
Quality Assurance	QA
Quality Control	QC
Quantile–Quantile	Q-Q
Relative percentage difference	RPD
Rubicon Minerals Corporation	Rubicon
Semi-Autogenous Grinding	SAG
SGS Canada Inc.	SGS
Smallest Mining Unit	SMU
SMC (Canada) Ltd.	SMC
Southwest	SW
Specific gravity	SG
SRK Consulting Canada Inc.	SRK
Stratigraphic	strat
T. Maunula & Associates Consulting Inc.	TMAC
Tailings Management Facility	TMF
Technical Standards & Safety Authority	TSSA
Tonnes/day	t/d
Total Precision Survey	TPS
United States	US
Universal Transverse Mercator	UTM
Unmineralized	unmin
West-East	W-E
X-ray fluorescence spectrometry	XRF

1 SUMMARY

1.1 Introduction

The Phoenix Gold Project is an underground exploration development Project located in the District of Red Lake, Ontario, Canada. Rubicon Minerals Corporation (Rubicon) wholly owns 100 percent of the Phoenix Gold Project.

This Technical Report was prepared for Rubicon and documents material changes to the Mineral Resource Estimate for the Phoenix Gold Project. This Mineral Resource Estimate and Technical Report were prepared by T. Maunula & Associates Consulting Inc. (TMAC) following the guidelines of the Canadian Securities Administrators' National Instrument 43-101 and Form 43-101F1, and supersedes all prior Technical Reports prepared for the Phoenix Gold Project.

1.2 Property Description, Location, and Ownership

The Phoenix Gold Project is located in the southwestern part of Bateman Township within the Red Lake mining district of northwestern Ontario, Canada. The Town of Red Lake is approximately 150 km northwest of Dryden, Ontario and 265 km northeast of Winnipeg, Manitoba.

The Phoenix Gold Project is centered on the Phoenix Shaft, located at UTM coordinates 448,167E, 5,663,962N (NAD 83 / Zone 15N) at an elevation of 369 m (above sea level). The total area of the land tenure is 510.4 hectares (ha).

Rubicon has a 100 percent interest in the Phoenix Gold Project subject to a 2% net smelter return (NSR) royalty on most of the water portions of the property to Franco-Nevada Corporation and 1% on all tenure to RGLD Gold AG.

1.3 Geology and Mineralization

The stratigraphy in the East Bay area, where the Phoenix Gold Project is located, comprises submarine tholeiitic basalt, komatiite and komatiitic basalt with minor felsic intrusive volcanic rock, iron formation, and fine-grained clastic metasedimentary rocks, all of which constitute the Balmer Assemblage.

The local geology comprises a series of mine grid north-south (N-S) trending, steeply dipping to sub-vertical alternating panels of talc-altered komatiitic ultramafic flows (Ultramafic) and biotite and silica altered basaltic mafic volcanic flows (High-Ti Basalt) that have been boudinaged to form elongated lenses. The Ultramafic and High-Ti Basalt units were intruded by dykes and sills of the Felsic Intrusive unit pre- to syn-mineralization.

An early phase of lower grade mineralization, with gold grades generally less than 4 g/t Au, occurs as quartz-actinolite-sulphide veins and stringers and as disseminated mineralization associated with quartz-biotite-sulphide alteration in the High-Ti Basalt and Felsic Intrusive units.

The higher-grade second mineralization event has been linked to an array of shear-related veins and minor localized shear zones. The gold mineralization occurs in association with disseminated sulphide mineralization in the High-Ti Basalt and also in gold-bearing quartz-actinolite veins in the High-Ti Basalt and Felsic Intrusive units.

The best gold grades occur in the thickest portions of the High-Ti Basalt, where the unit presented both favourable structural traps for developing gold-bearing veins and chemical traps where disseminated sulphides and associated gold mineralization are developed.

1.4 Mineral Resource Estimates

Under the direction of Principal Geologist Mr. Tim Maunula, P.Geo., TMAC completed the 2019 Mineral Resource Estimate for the Phoenix Gold Project, reported herein. The Mineral Resources reported are classified as Measured, Indicated, and Inferred Resources. The effective date of this Mineral Resource estimate is March 18, 2019.

The Mineral Resource estimate for the Phoenix Gold Project is based on diamond drill hole data consisting of gold assays, geological descriptions and density measurements. Underground development and bulk sample stopes were also taken into consideration.

The drill hole database received from Rubicon consisted of 1,631 drill holes totalling 551,811 m of core drilling. The database includes all drilling on the Phoenix Gold Project in proximity to the interpreted mineralization zones. This current resource included an additional 106 holes that were drilled since the 2018 resource (Golder, 2018b). The database included 104,308 gold assays that were used for modelling and resource estimation.

The Phoenix Gold Project block models were estimated using Inverse Distance Cubed (uncapped-AUCID, capped-AUCID3). Ordinary kriging (OK) (capped-AUCOK) and nearest neighbour (NN) (capped-AUCNN) were also run for validation purposes. The block models were estimated in four passes. The NN grade model used 2 m composites and, Inverse Distance Weighting Cubed (IDW3) and OK used 1 m composites for grade interpolation.

Outlier controls were applied during the interpolation passes. For Pass 1, the capped outliers were used in the normal grade interpolation. For Pass 2 through Pass 4, the outliers were excluded and not used for grade interpolation.

1.4.1 Mineral Resource Statement

Mineral resources were classified as Measured, Indicated, and Inferred Resources in accordance with definitions provided by CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014).

The Mineral Resource Estimate, as prepared by TMAC, for the Phoenix Gold Project is reported in Table 1-1 (Effective March 18, 2019).

Table 1-1: Phoenix Gold Project 2019 Mineral Resource Estimate Reported at 3.0 g/t Au Cut-off Grade

Resource Category	Quantity (t '000s)	Grade (g/t Au)	Contained Gold Ounces
Measured (M)	442	6.99	99,000
Indicated (I)	2,485	6.13	490,000
M+I	2,927	6.26	589,000
Inferred	2,570	6.53	540,000

Notes: Effective date for this Mineral Resource is March 18, 2019
Mineral Resource Estimate uses a break-even economic cut-off grade of 3.0 g/t Au based on assumptions of a gold price of US$1,400/oz, an exchange rate of US$/C$ 0.77, mining cash costs of C$97/t, processing costs of C$24/t, G&A of C$6/t, sustaining capital C$20/t, refining, transport and royalty costs of C$57/oz, and average gold recoverability of 95%
Mineral Resource Estimate reported from within envelopes accounting for mineral continuity
Mineral Resources are not Mineral Reserves and do not demonstrate economic viability
There is no certainty that all or any part of this Mineral Resource will be converted into Mineral Reserve
All figures are rounded to reflect the relative accuracy of the estimates and totals may not add correctly

The Mineral Resource Estimate excludes mineralization within the crown pillar located between the lake bottom and a depth of 40 m below the lake bottom. In addition, all mineralization within underground development was excluded from the Mineral Resource Estimate.

Mineral Resources are not Mineral Reserves and do not necessarily demonstrate economic viability. There is no certainty that all or any part of this Mineral Resource will be converted into mineral reserve.

1.5 Operations Status

The mill is currently under care and maintenance. During 2015 and 2018, the mill processed approximately 100,000 tonnes. The mill was shut down in an orderly fashion and steps have been taken to preserve the integrity of the installed equipment. Based on data and observations from the 2018 operation, a number of recommendations were made by the metallurgical consultant who ran the 2018 test mining program, to optimise and incrementally improve future mill operation. The mill could be restarted after a short period of operational readiness where equipment could be inspected, any modifications deemed necessary could be made, consumables could be purchased, supervision and the operating and maintenance teams could be recruited and trained.

The paste backfill circuit is incomplete. Major equipment such as the positive displacement pump and hydraulic drive, and two disc filters have been installed but never commissioned. As this equipment has never been operated and four years have passed, a thorough mechanical and electrical inspection is required. The installation needs to be checked to ensure that all components shown on the Piping & Instrument Diagrams (P&IDs) have been installed and properly terminated. Programming of the control system must be completed and then tested. A commissioning period must be scheduled when the mill is operating, and tailings are available.

1.6 Conclusions and Recommendations

1.6.1 Conclusions

The Resource QP (T. Maunula) is of the opinion that the Phoenix Gold Project has been interpolated using industry accepted modelling techniques in Geovia GEMS 6.7.3 Desktop Software. This included geologic input, appropriate block model cell sizes, grade capping, assay compositing, and reasonable interpolation parameters.

The results have been verified by visual review and statistical comparisons between the estimated block grades and the composites used to interpolate. The IDW3 model (AUCID3) has been selected as the best representation of the grade distribution based on the current geological understanding and gold mineralization. The IDW3 model has been validated with alternate estimation methods: NN and OK. No biases have been identified in the model.

Risk factors potentially impacting the reported Mineral Resource Estimate are:

- Revision of geological interpretation impacting rock type and volume
- Possible variation in continuity and grade of gold mineralization, especially with reference to outlier grades
- Assumptions for criteria used to determine reasonable prospect for eventual economic extraction
- Possible reduction in recovery within the Ultramafic unit due to poor ground control.

The Mineral Resource conforms to the requirements of the CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014). TMAC is unaware of any known environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant factors that could materially impact the 2019 Mineral Resource Estimate provided in this technical report. The Mineral Resources are adequate to support mining studies.

1.6.2 Recommendations

In TMAC's opinion, Rubicon can potentially improve or increase the 2019 Mineral Resource Estimate with the following recommendations:

- Target infill and step-out drilling in areas containing Inferred Resources (about 40 m centres drill spacing) to upgrade resource classification and Exploration Targets (>80 m centres) to convert to Mineral Resources. Drilling is proposed from the 244 m Level, 610 m Level and 685 m Level. The Exploration Targets could potentially contain between 0.9 million tonnes (Mt) to 1.2 Mt with potential grades between 5.0 to 7.0 g/t Au[1].
- Evaluate McFinley Deposit and Close Proximity Targets (specifically PEN Zone) which could potentially be included in a future Mineral Resource Estimate.

Table 1-2 summarizes a proposed exploration budget of $2.46 million for the F2 Gold Zone.

Table 1-2: 2019 Exploration Budget – F2 Gold Zone

Items	Levels	Metres	Units	Cost/Unit (C$)	Total Cost (C$ '000s)	Grand Total (C$ '000s)
Drilling	244 m Level	825	-	90	74	
	610 m Level	12,475	-	90	1,123	
	685 m Level	7,830	-	90	705	1,902
Assaying	244 m Level	-	413	40	17	
	610 m Level	-	6,238	40	250	
	685 m Level	-	3,915	40	157	423
Consumables	244 m Level	-	-	-	5	
	610 m Level	-	-	-	80	
	685 m Level	-	-	-	50	136
						2,460

Note: All figures are rounded to reflect the relative accuracy of the cost estimate and totals may not add correctly

The budget of C$451,000 for the McFinley Deposit and the PEN Zone is included in Table 1-3.

[1] According to NI 43-101 Section (2)(a), the potential quantity and grade of the Exploration Target is conceptual in nature and there has been insufficient exploration to define a mineral resource. It is uncertain if further exploration will result in the Exploration Target material being delineated as a mineral resource. The Exploration Target has been defined based on blocks estimated using >80 m drill centres, lower confidence based on decreased data density and increased cut-off grade with depth.

Table 1-3: 2019 Exploration Budget – McFinley Deposit and PEN Zone

Items	Levels	Metres	Units	Cost/Unit (C$)	Total Cost (C$ '000s)	Grand Total (C$ '000s)
Drilling	685 m Level (McFinley)	1,170	-	90	105	
	244 m Level (PEN Zone)	2,700	-	90	243	348
Assaying	685 m Level (McFinley) 685 m Level	-	585	40	23	
	244 m Level (PEN Zone)	-	1,350	40	54	77
Consumables	685 m Level (McFinley)	-	-	-	8	
	244 m Level (PEN Zone)	-	-	-	17	25
						451

Note: All figures are rounded to reflect the relative accuracy of the cost estimate and totals may not add correctly

1.7 Operations

The extension of the exploration drift 200 m southward on the 610 m Level (parallel to the F2 Gold Zone) is proposed to provide additional drilling platforms for step-out drilling. Table 1-4 reports the potential cost of C$1.1 million for this underground development.

Table 1-4: 2019 Operations Budget

Items	Levels	Metres	Units	Cost/Unit (C$)	Total Cost (C$ '000s)	Grand Total (C$ '000s)
Development	610 m Level	200	-	5,500	1,100	**1,100**

Note: All figures are rounded to reflect the relative accuracy of the cost estimate and totals may not add correctly

2 INTRODUCTION

The Phoenix Gold Project is an underground exploration development Project located in the District of Red Lake, Ontario, Canada. It is located approximately 265 km northeast of Winnipeg, Manitoba. Rubicon Minerals Corporation (Rubicon) wholly owns 100 percent of the Phoenix Gold Project.

This Technical Report was prepared for Rubicon and documents material changes to the Mineral Resource Estimate for the Phoenix Gold Project. This Mineral Resource Estimate and Technical Report were prepared by T. Maunula & Associates Consulting Inc. (TMAC) following the guidelines of the Canadian Securities Administrators' National Instrument 43-101 and Form 43-101F1 and supersedes all prior Technical Reports prepared for the Phoenix Gold Project.

Tim Maunula, (P.Geo.), completed the Mineral Resource Estimate (Resource QP) with contributions and reviews completed by Paul Daigle, (P.Geo.) of Daigle Consulting Services. Mr. Maunula and Mr. Daigle are QPs as defined under NI 43-101.

Tim Maunula completed QP site visits from April 17 to April 21, 2017, June 5 to 9, 2017, September 7, 2018, and February 18, 2019. During his QP site visits, Mr. Maunula reviewed and observed the geological data collection and sampling of drill core, underground development, and surface geology. Mr. Maunula confirmed gold mineralization through the inspection of drill core and observed the independent verification samples collected by Golder (Golder, 2018b).

John Frostiak, P.Eng., completed the Mineral Processing and Metallurgical Testing and Recovery Methods sections; and is the mineral processing QP as defined under NI 43-101. Mr. Frostiak completed an informal mill tour on March 13, 2018, and three site visits and tours as QP on April 17, 2018, May 1, 2018 and September 7, 2018. Meetings were held with Michael Willett and Chris Hunter of Rubicon to confirm that the mineralized material now included in the 2018 Mineral Resource is from the zone that was mined and milled in 2015. A meeting was held with Adrian McNutt (metallurgical consultant) on the state of the process plant and his plans for preparing the plant for operation. Mr. Frostiak also toured the plant with Adrian McNutt when it was in operation on September 7th, 2018.

Michael Willett, Director of Projects, P.Eng. (Mining Engineer), is a full-time employee of Rubicon and is stationed at Rubicon's Phoenix Gold Project site in Red Lake.

The Mineral Resource estimate and supporting data summarized in this Technical Report are considered by the QPs to meet the requirements of NI 43-101.

2.1 Source of Information

The sources of information utilized in the preparation of the Mineral Resource Estimate and Technical Report were provided by Rubicon, Michael Nerup, P.Geo., and Denise Saunders, P.Geo., under the direction of Mr. Michael Willett, P.Eng. This Technical Report Mineral Resource Estimate is based on the following data and pre-existing reports:

- Rubicon drill hole database containing:
  - Gold assays
  - Lithology, mineralogy, and structural descriptions
  - Bulk density measurements
  - Collar coordinates and down-hole survey data
- Rubicon underground mapping
- Underground structural mapping completed by Terrane Geoscience in 2017
- Rubicon internal reports
- Assay certificates from SGS Laboratories
- Rubicon metal price and break-even mining cost assumptions
- Public reports.

Further sources of information utilized by the authors, and references are included in Section 27.

2.2 Qualified Persons

This Technical Report was prepared by the QPs listed in Table 2-1, and their responsibilities for each section of this Technical Report are indicated. The following summarizes the dates of the QPs Project site visits:

- Tim Maunula, P.Geo., completed four site visits between 2017 and 2019 with the most recent on February 18, 2019
- John Frostiak, P.Eng., completed site visits on March 13, April 17, May 1, and September 7, 2018
- Michael Willett, P.Eng., is located at the Phoenix Gold Project site in Red Lake.

Table 2-1: Qualified Persons – Section Responsibility

Qualified Person	Title, Company	Responsible for Sections
Tim Maunula, P.Geo.	Principal Geologist, TMAC	1.1 to 1.4, 1.6, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 23, 25, 26.1, 27
John Frostiak, P.Eng.	Mining Engineer (mineral processing), Independent Consultant	1.5, 13, 17, 24.8, 24.9
Michael Willett, P.Eng.	Director of Projects, Mining Engineer, Rubicon	1.7,15, 16, 18, 19, 20, 21, 22, 24.1, 24.2, 24.3, 24.4, 24.5, 24.6, 24.7, 24-10, 24.11, 26.2

2.2.1 Acknowledgments

TMAC and Rubicon would like to thank and acknowledge the following people who have contributed to the preparation of this report and the underlying studies under the supervision of the QPs, including: George Ogilvie, P.Eng., President and CEO of Rubicon, Nick Nikolakakis, CFO of Rubicon, Eric Setchell, Site General Manager of Rubicon, Isaac Oduro, Manager of Technical Services for Rubicon, Denise Saunders, P.Geo., Geologist of Rubicon, Michael Nerup, P.Geo., Senior Geologist of Rubicon, Cathy Willett, Mine Planner of Rubicon, Lynne Rasmussen, Environmental Coordinator of Rubicon, and Dana Dobrescu, Land Manager of Rubicon.

2.3 Units of Measure and Abbreviations

Unless otherwise noted, the following measurement units, formats, and systems are used throughout this Report:

- Measurement Units: all references to measurement units use the System International (SI or metric) for measurement. The primary linear distance unit, unless otherwise noted, are metres (m).
- General Orientation: all references to orientation and coordinates in this Report are presented as decimal degrees in the Rubicon Mine Grid; the mine grid is oriented with grid north parallel to the orientation of the East Bay Deformation Zone, which results in a +45.0° rotation relative to True North (0.0/360.0° azimuth in Mine Grid equates to 045.0° azimuth True North).
- Currencies outlined in the report are stated in Canadian dollars (C$) unless otherwise noted.

3 RELIANCE ON OTHER EXPERTS

For certain Sections in this Technical Report the QPs authoring those Sections relied on a report, opinion, or statement of another expert who is not a QP or on information provided by the issuer concerning legal, political, environmental, or tax matters relevant to the Technical Report. In each case, the QP hereby disclaims responsibility for such information to the extent of his/her reliance on such reports, opinions, or statements. This reliance applies to information provided by Rubicon for Sections 4.1 (Property Land Tenure), 4.2 (Underlying Agreements), 4.3 (Permits and Authorization), and 4.4 (Environmental Considerations) of this Report. The QPs have relied upon fully and believe there is a reasonable basis for this reliance on, information provided by Rubicon regarding mineral tenure, surface rights, ownership details, royalties, environmental obligations, and applicable legislation relevant to the Phoenix Gold Project. The QPs have not independently reviewed the information in these sections and have fully relied upon, and disclaim responsibility for, information provided by Rubicon in these sections.

4 PROPERTY DESCRIPTION AND LOCATION

The Phoenix Gold Project is located in the southwestern part of Bateman Township within the Red Lake mining district of northwestern Ontario, Canada (Figure 4-1). The Town of Red Lake is approximately 150 km northwest of Dryden, Ontario and 265 km northeast of Winnipeg, Manitoba.

The Phoenix Gold Project is centered on the Phoenix Shaft, located at UTM coordinates 448,167E, 5,663,962N (NAD 83 / Zone 15N) at an elevation of 369 m (above sea level). The total area of the land tenure is 510.4 hectares (ha).

Rubicon has a 100 percent interest in the Phoenix Gold Project subject to a 2% net smelter return (NSR) royalty on most of the water portions of the property to Franco-Nevada Corporation and 1% on all tenure to RGLD Gold AG.

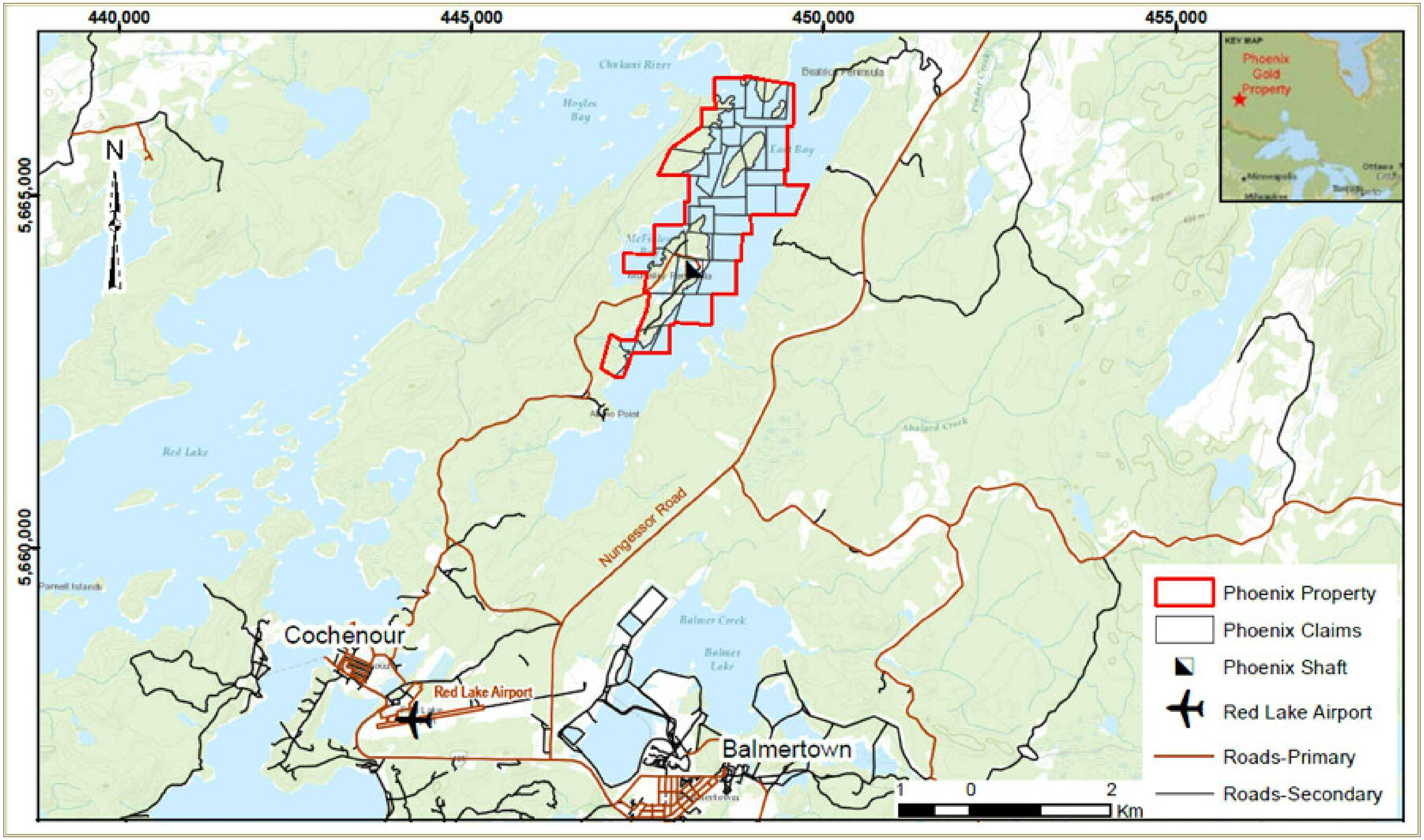


Figure 4-1: Location of the Phoenix Gold Project (Source: Rubicon, 2019)

4.1 Property Land Tenure

The Phoenix Property consists of 31 contiguous Mining Leases, Patented Claims, Mining Licences of Occupation, and a single Staked Claim (Table 4-1 and Figure 4-2) comprising:

- One Mining Lease covering four Kenora Red Lake (KRL) blocks
- Sixteen Patented Claims covering land portions of the property
- Twenty-five Mining Licences of Occupation covering water portions of the property
- One Staked Claim.

A single KRL or K numbered block can consist of a land portion (Patented Claim) and associated water portion (Mining Licences of Occupation containing a separate number) when it covers land and water within its boundaries. A single KRL or K numbered block can also consist solely of land portions or solely of water portions of the property.

Certified Ontario land surveyor Jim Bowman surveyed the perimeter of the Phoenix Property on February 7, 1985. This legal survey defined the Phoenix Property at the time of the original mining lease application on October 20, 1986. Rubicon verified this land survey via professional land surveying services of Geomatics Inc. on August 3, 2012.

The mining rights of the Mining Lease and the mining rights of the Patented Claims are registered under Rubicon Minerals Corporation with Ontario's Electronic Land Registration System. The surface rights of the Patented Claims are registered under 0691403 B.C. Ltd, a wholly owned subsidiary of Rubicon, with Ontario's Electronic Land Registration System. The mining rights of the Mining Licences of Occupation and the holder name of the Staked Claim are registered under Rubicon Minerals Corporation with the Mining and Minerals Division of the Ministry of Energy, Northern Development and Mines (MENDM).

The Mining Licences of Occupation are subject to payment of rents shown on the face of each licence. No application for renewal is required.

The Mining Lease is for a standard fixed term. The current term has been extended to October 31, 2028. Prior to expiry of the extended term, an application must be made under the Ontario *Mining Act* for the Minister's consent to extend the leasehold for a further fixed term.

On June 22, 2009, Rubicon Minerals Corporation was registered as the 100% recorded holder for one Staked Claim with the Minerals Division of the Ministry of Energy, Northern Development and Mines (MENDM). To maintain the claim in good standing Rubicon is required to carry out eligible assessment work of C$400 prior to June 22, 2022.

Table 4-1: Mineral Tenure Information

Short Legal Description	Mining Rights Number	Parcel Number	Start Date	Expiry Date	Hectares
Mining Lease					
KRL503297, KRL503298, KRL503299, KRL526262	LEA-108126	936LKP	Nov-86	31-Oct-28	56
Patented Mining Claims (Land Portion)					
K1498	PAT-7228	992DP	1-Oct-45	Not Applicable	3
K1499	PAT-7229	993DPF	1-Oct-45	Not Applicable	11.5
K1493	PAT-7224	994DPF	1-Mar-46	Not Applicable	5.1
K1494	PAT-7225	995DPF	1-Mar-46	Not Applicable	8.4
K1495	PAT-7226	996DPF	1-Mar-46	Not Applicable	10.4
KRL246	PAT-7222	997DP	1-Mar-46	Not Applicable	15
KRL247	PAT-7223	998DPF	1-Mar-46	Not Applicable	17.9
K1497	PAT-7227	999DPF	1-Mar-46	Not Applicable	13.5
KRL11481	PAT-7232	1446DPF	1-Nov-41	Not Applicable	4.2
KRL11482	PAT-7233	1447DPF	1-Nov-48	Not Applicable	6.9
KRL11483	PAT-7230	1448DPF	1-Nov-41	Not Applicable	12.2
KRL11487	PAT-7231	1452DPF	1-Nov-41	Not Applicable	15.3
K954 (recorded as KRL 18152)	PAT-7234	1977DPF	1-Jan-47	Not Applicable	6.9
K955 (recorded as KRL 18515)	PAT-7236	1978DPF	1-Jan-47	Not Applicable	4.1
KRL18457	PAT-7235	2449DPF	1-Jan-50	Not Applicable	7.9
KRL18735	PAT-7237	2450DPF	1-Jan-50	Not Applicable	20.9
Licenses of Occupation (Water Portion)					
KRL2155	MLO-3186		1-Aug-45	Not Applicable	9.9
KRL2156	MLO-3187		1-Aug-45	Not Applicable	13.7
K1498	MLO-3289		1-Oct-45	Not Applicable	11
K1499	MLO-3290		1-Oct-45	Not Applicable	2.4
K1493	MLO-3370		1-Mar-46	Not Applicable	5
K1494	MLO-3371		1-Mar-46	Not Applicable	18.7
K1495	MLO-3372		1-Mar-46	Not Applicable	10.1
K1497	MLO-3380		1-Mar-46	Not Applicable	6.1
KRL246	MLO-3381		1-Mar-46	Not Applicable	4.3
KRL247	MLO-3382		1-Mar-46	Not Applicable	4.5
KRL11483	MLO-10495		1-Nov-41	Not Applicable	6.7
KRL11482	MLO-10496		1-Nov-48	Not Applicable	5.6
KRL11481	MLO-10497		1-Nov-41	Not Applicable	14.1

Short Legal Description	Mining Rights Number	Parcel Number	Start Date	Expiry Date	Hectares
KRL11487	MLO-10499		1-Nov-41	Not Applicable	5.7
KRL11038-39 (recorded as KRL18377)	MLO-10830		1-Jan-47	Not Applicable	28.7
KRL11031 (recorded as KRL18519	MLO-10834		1-Jan-47	Not Applicable	17.9
K954 (recorded as KRL18152)	MLO-10835		1-Jan-47	Not Applicable	9.3
K955 (recorded as KRL18515)	MLO-10836		1-Jan-47	Not Applicable	10
KRL18514	MLO-10952		1-Oct-47	Not Applicable	17.5
KRL18735	MLO-11111		1-Jan-50	Not Applicable	12.2
KRL18457	MLO-11112		1-Jan-50	Not Applicable	11
KRL18373	MLO-11114		1-Jan-50	Not Applicable	7.7
KRL18374	MLO-11115		1-Jan-50	Not Applicable	19.7
KRL18375	MLO-11116		1-Jan-50	Not Applicable	22.9
KRL18376	MLO-11117		1-Jan-50	Not Applicable	15
Staked Claim					
143643 & 312889 (single cell claims) converted from KRL4229741		N/A	22-Jun-09	21-Jun-24	16
Total Area					**525**

Note: The total hectares may not add up due rounding.

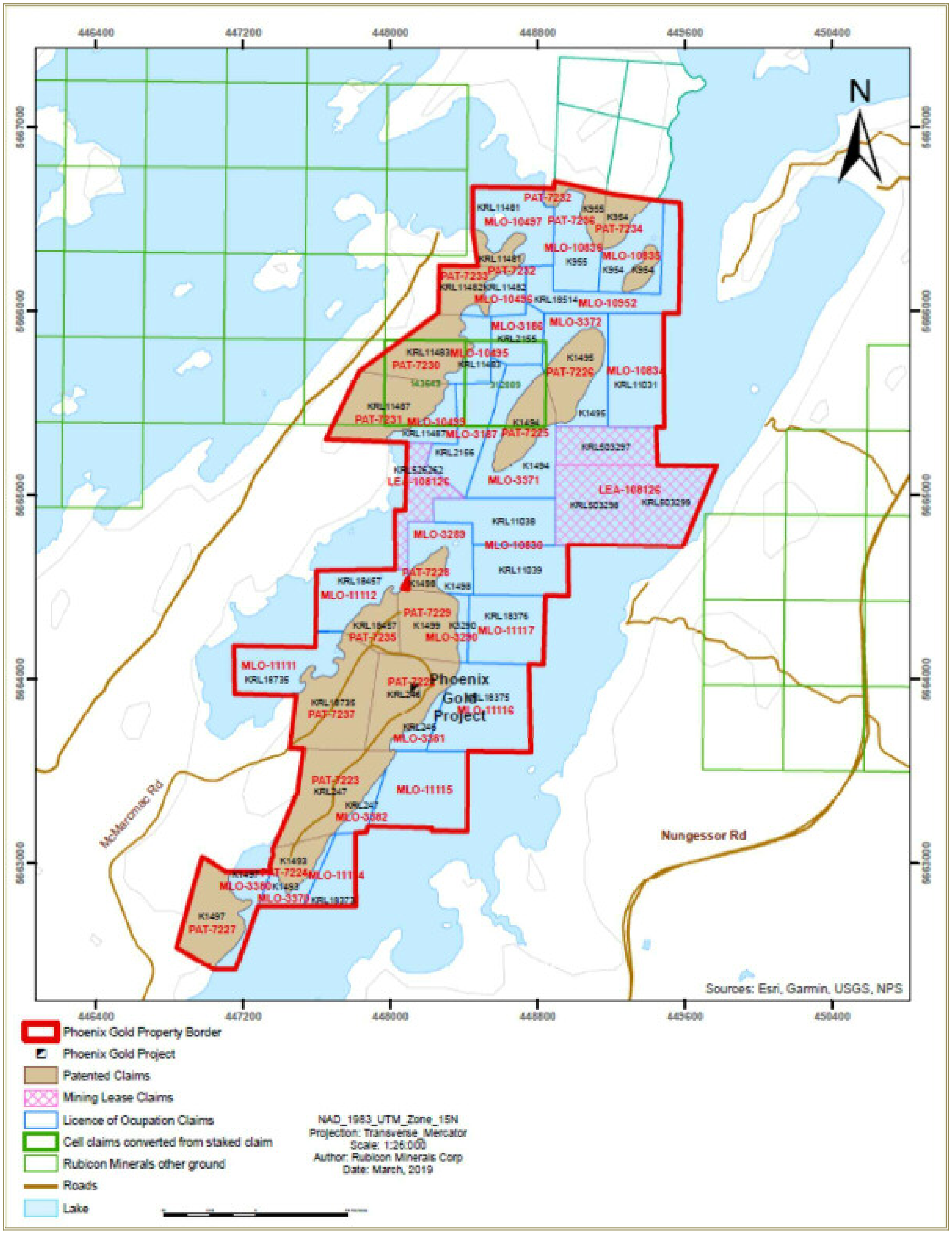


Figure 4-2: Phoenix Property Land Tenure (Source: Rubicon, 2019)

4.2 Underlying Agreements

Rubicon's 100% interest in the property was acquired in two separate agreements entered into with Dominion Goldfields Corporation (Dominion Goldfields) in 2002. The 25 Mining Licences of Occupation and the one Mining Lease were optioned from Dominion Goldfields in January 2002 by agreeing to pay C$800,000 in cash, issue 260,000 shares to Dominion Goldfields, and complete US$1,300,000 of exploration work prior to March 31, 2006. During 2004, Rubicon acquired the Mining Licences of Occupation and Mining Lease from Dominion Goldfields after completing all required payments and expenditures. The Mining Licences of Occupation and the Mining Lease were subsequently transferred to Rubicon.

The water portions of the property, except the Staked Claim, are subject to an NSR royalty of 2% to Franco-Nevada Corporation. Franco-Nevada Corporation purchased the NSR royalty from Dominion Goldfields in August 2011. Advance royalties of US$50,000 are due annually to a maximum of US$1,000,000 prior to commercial production of which a cumulative US$750,000 was paid by Rubicon to January 1, 2018. Rubicon has the option to acquire a 0.5% NSR royalty for US$675,000 at any time; however, this option is subject to a right of first refusal, whereby a third party has the initial right to exercise this option, in which case the NSR royalty to Franco-Nevada Corporation would be reduced to 1.5%. Upon a positive production decision, Rubicon would be required to make an additional advance royalty payment of US$675,000. Rubicon has confirmed that the annual payments are up to date.

The mining rights of the Patented Claims were optioned from Dominion Goldfields in June 2002 and the rights pertaining to surface portions of the same patented claims were optioned from Dominion Goldfields subsidiary 1519369 Ontario Ltd.

The surface rights of the Patented Claims are owned by 0691403 B.C. Ltd, a wholly owned subsidiary of Rubicon. On October 25, 2011, Rubicon announced that by execution of its right of first refusal under its agreement with Dominion Goldfields, it had acquired and thereby extinguished all royalties on the blocks covering the land portions of the property. On closing the agreement, Rubicon issued a total of 1,216,071 of its common shares to Dominion Goldfields, at a deemed price per share of C$3.50, for total consideration of C$4,256,249.

On February 10, 2014, Rubicon entered into a US$75 million gold streaming agreement (Streaming Agreement) with Royal Gold Inc. and its affiliate, RGLD Gold AG. On May 12, 2015, Rubicon entered into a US$50 million secured loan agreement (Loan Agreement) with CPPIB Credit Investments Inc., a wholly-owned subsidiary of Canada Pension Plan Investment Board.

On December 20, 2016, following the completion of the restructuring of Rubicon, the amount outstanding under the Loan Agreement was reduced to C$12 million and the Streaming Agreement was exchanged in part for a 1.0% NSR royalty on all tenure (Patented, Lease, Mining Licences of Occupation and the staked claim) of the Phoenix Property granted to RGLD Gold AG through a royalty agreement (Royalty Agreement). On December 20, 2018, the Loan Agreement was transferred to Sprott Private Resource Lending (Collector), L.P. (Sprott).

Pursuant to the Loan Agreement (Sprott) and the Royalty Agreement (RGLD GOLD AG), the Mining Lease, owned Patented Claims, Licences of Occupation, and the Staked Claim of the Phoenix property are subject to charges/mortgages in favour of Sprott and RGLD Gold AG, respectively.

4.3 Permits and Authorization

Rubicon currently holds all material permits required for it to carry out its drilling, underground exploration, and development initiatives, and is substantially permitted for potential future production on the Phoenix Gold Project at an annual average rate of 1,200 tonnes per day (t/d). The industrial sewage Environmental Compliance Approval (ECA) contains several clauses that would need to be fulfilled prior to any potential commencement of commercial production. Further amendments to some permits would be required for any potential future increases to the currently authorized production rate. Please note that the Rubicon Gold Project is in the development stage, and there are no current Mineral Reserves defined for the Project. Future production is not supported by a current preliminary economic assessment, pre-feasibility, or feasibility study.

A full list of permits and applications, including their current statuses, is provided in Section 24.

4.4 Environmental Considerations

The current and potential production phase environmental liabilities associated with the Project site are described in the Phoenix Gold Project Closure Plan (June 2016), filed with the Ontario Ministry of Energy, Northern Development and Mines pursuant to Part VII of the *Mining Act*. There are no significant physical stability liabilities associated with the Project site, and chemical stability issues are limited to two areas that may require excavation and the removal of contaminated soil. Financial assurance has been provided to the Government of Ontario by Rubicon to rehabilitate all identified features of the Project site in accordance with the *Mining Act*.

4.5 Mining Rights in Ontario

The Phoenix Gold Project is located in the province of Ontario, a jurisdiction that has a well-established permitting process. This process is coordinated between the municipal, provincial, and federal regulatory agencies. As is the case for similar mine developments in Canada, the Project is subject to federal and provincial environmental assessment processes. Due to the complexity and size of such projects, various federal and provincial agencies have jurisdiction to provide authorizations or permits that enable Project construction to proceed.

Federal agencies that have significant regulatory involvement include the Canadian Environmental Assessment Agency, Environment and Climate Change Canada, Natural Resources Canada, and Fisheries and Oceans Canada.

Provincially, the Ministry of Energy, Northern Development and Mines, Ministry of Environment, Conservation and Parks, Ministry of Transportation, and the Ministry of Natural Resources and Forestry each have key Project development permit responsibilities.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

5.1 Accessibility

The Phoenix Gold Project is centered within the Red Lake area of northwestern Ontario, approximately 565 km by road (430 km direct) northwest of Thunder Bay and approximately 475 km by road (265 km direct) east-northeast of Winnipeg, Manitoba. Red Lake can be reached via Highway 105, which branches off the Trans-Canada Highway 17 some 170 km south of Red Lake. Red Lake is also serviced with daily flights from Thunder Bay and Winnipeg. Bus service is available from Winnipeg, Manitoba three days per week.

The Project site is accessible via 8 km of all-weather road from Nungesser Road in the community of Balmertown, part the Municipality of Red Lake (Figure 4-1).

5.2 Local Resources and Infrastructure

The Red Lake Municipality comprises six communities: Red Lake, Balmertown, Cochenour, Madsen, McKenzie Island, and Starratt-Olsen. The Canada Census performed in 2016 indicates a population of 4,107 for the area. Mining is the primary industry and employer; other industries include small-scale logging and tourism focused on hunting and fishing. All services expected in a municipality of this size are present, including a hospital and medical clinic.

The Phoenix Gold Project site is currently supplied by a 10.4 km power transmission line connected to Hydro One's 44,000 V (44 kV) M6 feeder in the Red Lake Transformer Station. There are two (parallel connected) 18 MVA transformers in the main substation (one main, one back up) as well as 2 MW of diesel emergency power generation capacity. On-site distribution reduces voltage to 4,160 V for surface and underground. Further voltage step-downs are utilized locally as required for specific equipment installations.

Mine water supply is from the nearby East Bay of Red Lake. The water is piped underground via a 100 mm water line for purposes such as drilling use, muck pile watering and other uses. A potable water plant is fully commissioned and operating on-site. A second treatment plant is located at the camp area, although this area is not currently operational. Rubicon has all the surface rights required to conduct its potential operations at the Phoenix Gold Project, and has access to local and fly-in, fly-out workers. Workers requiring accommodations in the area are currently housed offsite.

5.3 Climate

The climate in this portion of northwestern Ontario is considered subarctic with temperature extremes generally ranging from winter lows of approximately -45 degrees Celsius (°C) to summer highs of roughly 30°C. Average winter temperatures are in the range of -15°C to -20°C and average summer temperatures are in the range of 15°C to 20°C. Between 1971 and 2000, annual average precipitation was measured at 686 mm, with the greatest majority being received as rainfall in the summer and fall months (May to October). Mean annual rainfall measured 515 mm with 171 mm equivalent annual average snowfall. Average winter snow depths in the region range from 40 cm to 50 cm. Weather conditions have minimal impact on underground production, allowing operations to proceed all year long.

5.4 Physiography

The topography within much of the Project is mildly rugged. The elevation is commonly less than 15 m above the level of Red Lake. Glacially scoured southwest trending ridges, swamps, marshes, small streams, and small- to moderate-sized lakes dominate the topography. Rock exposure varies locally, but rarely exceeds 15% of the surface area and is mostly restricted to shoreline exposures. Glacial overburden depth is generally shallow, rarely exceeding 10 m, and primarily consists of ablation till, minor basal till, minor outwash sand and gravel, and silty clay glaciolacustrine sediments.

Vegetation consists of thick boreal forest composed of black spruce, jack pine, trembling aspen, and white birch. Figure 5-1 illustrates the typical landscape around the Phoenix Gold Project and the associated vegetation.

The East Bay of Red Lake with McFinley Island covers a portion of the Project directly to the north of McFinley Peninsula, representing the largest island on the property. Seismic surveys completed in the past indicated average accumulations of 10 m to 20 m of lake sediments and overburden on the lake bottom, with the water depth less than 8.5 m within the property boundary. The location of the tailings storage area and other site infrastructure are discussed in Section 24.10.

Figure 5-1: Typical Landscape in the Phoenix Gold Project Area (Source: Rubicon, 2019)

6 HISTORY

Information in this section is summarized from a previous technical report prepared by AMC Mining Consultants (Canada) Ltd. (2011) and references therein.

R.J. Gilbert of the Northwestern Ontario Development Company (Parrot, 1995) originally reported gold in the Red Lake area in 1897. The exploration and mining history of the Red Lake mining district dates to 1925, when significant gold was first discovered by prospector L.B. Howey. The gold bearing veins he discovered were developed into Red Lake's first producing mine – the Howey mine.

The Phoenix Gold property (previously known as the McFinley property) was initially staked and owned by McCallum Red Lake Mines Ltd. in 1922. Between 1944 and 1974, the property was owned by McFinley Red Lake Gold Mines Ltd. (McFinley Red Lake Gold Mines). In 1974, Sabina Industries Ltd. (Sabina) earned a 60% interest in the property. McFinley Red Lake Gold Mines changed its name to McFinley Red Lake Mines Ltd. (McFinley Red Lake Mines) in 1975 and in 1983 by a plan of arrangement; Sabina transferred its 60% in the Project to McFinley Red Lake Mines.

In 1984, McFinley Red Lake Mines joint ventured the Project with Phoenix Gold Mines Ltd. (42.9%) and Coniagas Mines Ltd. (7.1%). McFinley Red Lake Mines subsequently repurchased this 50% joint venture interest in 1986 with financial backing from Alexandra Mining Company (Bermuda) Ltd.

Financial difficulties experienced by McFinley Red Lake Mines in 1989 subsequently led to a period of inactivity between 1990 and 2002 with the eventual acquisition of the property by creditors in lieu of unpaid debts. Dominion Goldfields was awarded title to the Mining Licences of Occupation and Mining Lease of the Project in 1999 and 2002 through vesting orders from the Superior Court of Ontario. Dominion Goldfields and its wholly-owned subsidiary, 1519369 Ontario Ltd., were subsequently granted ownership of the mining rights and surface rights respectively by a vesting order of the Superior Court of Ontario in 2002.

Rubicon optioned the property from Dominion Goldfields in two agreements in 2002. The surface rights of the Patented Claims are now owned by 0691403 B.C. Ltd, a wholly-owned subsidiary of Rubicon.

6.1 Historical Exploration

The extensive history of exploration activities on the Project have been described in detail in two previous reports prepared by G.M. Hogg (2002a, 2002b). One report covered the Patented Claims, with the second document discussing historical work completed on the Mining Licences of Occupation and Mining Lease, which comprise the Project.

All historical information regarding property ownership, previous exploration work, and Mineral Resources prepared prior to 2002 is summarized in Table 6-1. Exploration activities from 2002 through 2018 are summarized in Table 9-1.

Table 6-1: Exploration History of the Phoenix Gold Project

Year	Description of Work
1922	Original staking in 1922 undertaken to cover a high-grade silver occurrence on the McFinley Peninsula, the first mineral prospect on record in the area. Trenching, sampling, and shallow drilling was undertaken by McCallum Red Lake Mines Ltd. Widespread but erratic gold mineralization was noted in cherty metasedimentary rock on both McFinley Peninsula and McFinley Island.
1941 – 1942	Mineral occurrences were drilled as part of the Wartime Minerals Evaluation program.
1944 – 1946	McFinley Red Lake Gold Mines Ltd. carried out ground magnetic surveys, a 48-drill hole drilling program consisting of 167 m (548 feet [ft]) of drilling over the McFinley Peninsula, and a 1,487 m (4,877 ft) drilling program from the ice of Red Lake.
1946 – 1955	Fourteen drill holes (M Series) were completed for approximately 1,585 m (5,200 ft) of diamond drilling.
1955 – 1956	Little Long Lac Gold Mines sank a 130 m (428 ft) vertical shaft on claim KRL 246 and completed 414 m (1,358 ft) of exploratory underground development on two levels.
1974 – 1975	Sabina completed 25 diamond drill holes for approximately 3,048 m (10,000 ft) of drilling on the project; ground magnetic and electromagnetic surveys; and 10 drill holes for approximately 735 m (2,410 ft) of diamond drilling over a portion of the lake properties.
1981 – 1983	Sabina and McFinley Red Lake Mines completed a magnetic/electromagnetic geophysical survey over the McFinley Peninsula area, surface bulk sampling, and 3,672 m (12,046 ft) of surface diamond drilling in 33 drill holes.
1983 – 1984	McFinley Red Lake Mines and Sabina completed seven drill holes for approximately 646 m (2,120 ft) of diamond drilling.
1984 – 1985	An agreement with Phoenix Gold Mines Ltd. allowed the opening of the McFinley Shaft (now called the Phoenix Shaft) and completion of a total of 479 m (1,570 ft) of drifting and crosscutting on the 150 ft (46 m) and 400 ft (122 m) levels. Metallurgical work and mineral processing were carried out. Eighty underground drill holes totaling 1,829 m (6,000 ft) and 69 surface drill holes totaling 10,628 m (34,870 ft) of diamond drilling were completed. Funding difficulties resulted in the Project being placed on temporary standby in February 1985.
1985 – 1987	A total of 1,151 m (3,775 ft) of drifting and crosscutting was carried out on the 150 ft (46 m) and 400 ft (122 m) levels. A total of 7,111 m (23,333 ft) of underground drilling, 9.14 m (30 ft) of raising, and an extensive chip-sampling program were completed. A program of 12,763 m (41,874 ft) of diamond drilling was also completed in 61 surface drill holes.
1987 – 1989	In recognition of a nugget effect in sampling results, a decision was made to proceed with a minimum 15,000-ton bulk sample. A 150-t/d mill and tailings management facility was constructed. Underground development (2,890 m/9,482 ft) continued on the 150 ft (46 m) and 400 ft (122 m) levels, a new 275 level (at 84 m) and on a ventilation raise from the 400 ft (122 m) level to surface. Additional sampling, diamond drilling (8,730 m/28,642 ft), and metallurgical testing were completed. Bulk sampling operations commenced in July 1988 with sampling indicating head grades in the range of 0.25 ounces per ton gold (8.57 g/t Au) from prepared stope areas (Hogg, 2002b). Mill design problems, lack of income from bulk sampling, and lack of exploration funding forced the

Year	Description of Work
	closure of the operation after an estimated 2,250 tonnes of material were milled. Total historical development in drifting, crosscutting, and raising is estimated to be more than 5,791 m (19,000 ft). Total historical diamond drilling focused on the McFinley Peninsula area is estimated to be 45,110 m (148,000 ft) from surface and 35,814 m (117,500 ft) from underground. An estimated 54,864 m (180,000 ft) of core is stored on the property (Hogg, 2003).
1999 – 2002	Dominion Goldfields foreclosed on the Mining Licences of Occupation and Mining Lease and was awarded title to the lake portion of the Phoenix Gold Project in 1999 and 2002, respectively. Dominion Goldfields and its subsidiary were subsequently awarded title to the Patented Claims of the Project in 2002.

6.2 Previous Mineral Resource Estimates

The 2019 Mineral Resource Estimate discussed herein has superseded historical and past Mineral Resource Estimates presented in this section. The following information is relevant to provide context but is not current and should not to be relied upon. The QPs responsible for the preparation of this Technical Report have not done sufficient work to classify the historical estimate as current Mineral Resources or Mineral Reserves and Rubicon is not treating any historical estimates as current Mineral Resources or Mineral Reserves.

6.2.1 McFinley Red Lake Mines – 1986

McFinley Red Lake Mines staff prepared a historical Mineral Resource Estimate in 1986 (Hogg, 2002a; Hogg, 2002b; and Hogg, 2003). The McFinley Red Lake Mines historical Mineral Resource is located approximately 450 m northwest of the F2 Gold Zone. The estimate refers to the shaft area located on the McFinley Peninsula where historical underground exploration and development, and extensive sampling, were carried out. The shaft area is in stratigraphic units separate to the current F2 Gold Zone. The 1986 historical Mineral Resource Estimate was developed using underground sampling results augmented with closely spaced drill hole data. The historical resource (to a depth of 400 ft) published in 2002 was 303,006 tonnes (334,007 tons) at a grade of 6.86 g/t Au [0.20 oz of Au/ton].

6.2.2 GeoEx Limited – 2010 and 2011

GeoEx Limited (GeoEx) reported a historical Mineral Resource Estimate for the F2 Gold Zone in April 2011 (GeoEx, 2011b). The historical Mineral Resource Estimate was calculated for data from surface to 1,200 m Level using the polygonal resource estimation method, with a 5 g/t Au cut-off. An Inferred Resource of 5,500,000 tonnes at a grade of 20.34 g/t Au was reported.

6.2.3 AMC Mining Consultants (Canada) Ltd. – 2011

AMC prepared a Mineral Resource Statement (AMC, 2011) for the F2 Gold Zone using a block modelling approach based on drilling information available to February 28, 2011 (Table 6-2). The model was not constrained by a crown pillar and was extended to incorporate all drilling data. The Mineral Resource Statement was reported at a cut-off grade of 5.0 g/t Au.

Table 6-2: Mineral Resource Statement, Phoenix Project, AMC Mining Consultant (Canada) Ltd., June 15, 2011

Classification	Tonnage (Mt)	Grade (g/t Au)	Gold (Moz)
Indicated	1.028	14.5	0.477
Inferred	4.230	17.0	2.317

Notes: CIM definitions used for Mineral Resources. Cut-off grade of 5.0 g/t Au applied. Capping value of 270 g/t Au applied to composites. Based on drilling results to February 28, 2011. The 2011 Estimates are not current and should not be relied upon.

A total of 511 drill holes were used in the 2011 AMC Mineral Resource Estimate. Rubicon's interpretations of lithologies, mineralization controls, and geology domains were reviewed and accepted by AMC. Twelve mineralized domains were interpreted by AMC using a low gold threshold (0.1 g/t Au) and were further expanded to incorporate all significant mineralized zones.

A composite length of 1.0 m was chosen, and gold composites were capped at 270 g/t Au. The parent block size was 2 m by 8 m by 12 m, and sub blocking was utilized. The model blocks were assigned a gold grade using an inverse distance (power of three) estimator and a three-pass search strategy with search ellipsoids adjusted to the geometry of the modelled gold mineralization. Search parameters for the first pass were 8 m by 24 m by 36 m for the second and third pass the search volumes were inflated by two and three times, respectively. An average bulk density value of 2.90 t/m^3 was used for all rock types.

Blocks were classified considering data support as a main criterion with a manual review creating volumes based on drill hole density and number of samples to inform a block.

6.2.4 SRK Consulting (Canada) Inc. – 2013

SRK (2013b) prepared a Mineral Resource Statement for the F2 Gold Zone using a block modelling approach based on drilling information available to October 31, 2012. The database included information from 820 core drill holes (355,611 m), all drilled by Rubicon since 2008. The model was not constrained vertically by a crown pillar. The Mineral Resource Statement was reported at a cut-off grade of 4.0 g/t Au (Table 6-3).

Table 6-3: Mineral Resource Statement, Phoenix Gold Project, Ontario SRK Consulting (Canada) Inc., June 24, 2013*

Domain	Resource Category	Quantity (t '000)	Grade Au (g/t)	Contained Gold (oz '000)
Main*	Measured	-	-	-
	Indicated	4,120	8.52	1,129
	Measured + Indicated	4,120	8.52	1,129
	Inferred	6,027	9.49	1,839
HW	Measured	-	-	-
	Indicated	-	-	-
	Measured + Indicated	-	-	-
	Inferred	151	5.21	25
External	Measured	-	-	-
	Indicated	-	-	-
	Measured + Indicated	-	-	-
	Inferred	1,274	8.66	355
Combined	Measured	-	-	-
	Indicated	4,120	8.52	1,129
	Measured + Indicated	4,120	8.52	1,129
	Inferred	7,452	9.26	2,219

Notes: *Mineral Resources are not Mineral Reserves and do not have a demonstrated economic viability. All figures have been rounded to reflect the relative accuracy of the estimates. Reported at a cut-off grade of 4.0 g/t Au and assuming an underground extraction scenario, a gold price of US$1,500/oz, and metallurgical recovery of 92.5%. The Main domain includes the Main 45 domain. The 2013 Estimates are not current and should not be relied upon.

The gold mineralization wireframes were defined using an explicit wireframe interpretation constructed from a sectional interpretation of the drilling data that took into consideration structural geology investigation and modelling undertaken by SRK in collaboration with Rubicon. Resource domains were defined using a 0.5 g/t Au threshold. Within the gold mineralization domains, narrower, higher-grade subdomains were defined using a 3.0 g/t Au threshold. SRK defined 56 gold mineralization domains (31 higher-grade and 25 lower grade domains) that were used to constrain Mineral Resource modelling. These 56 domains were combined into three groups based on their spatial orientation: Main, Main 45, and Hanging Wall (HW). Also, the gold mineralization located outside the modelled domains was evaluated unconstrained.

Four rotated sub-celled block models were generated with block sizes and orientation specific to the mineralization domain grouping. SRK chose a primary 2.5 m by 5 m by 10 m dimension for the Main and Main 45 domains, a 10 m by 20 m by 20 m dimension for the HW domain and a 5 m by 10 m by 20 m dimension for the External domain.

Sample assay data were composited to a 1.0 m length and extracted for geostatistical analysis and variography. The impact of gold outliers was examined on composites using log probability plots and cumulative statistics. SRK evaluated the spatial distributions of the gold mineralization using variograms and correlograms of original capped composited data as well as the normal score transform of the capped composited data. The block model was populated with a gold grade using ordinary kriging (OK). Three estimation runs were used, each considering increasing search neighborhoods and less restrictive search criteria. The first estimation pass considered search neighborhoods adjusted to 80% of the modelled variogram ranges. A uniform specific gravity of 2.87 t/m^3 was applied to the lower grade domains and a value of 2.96 t/m^3 was assigned to the higher-grade domains to convert volumes into tonnages.

6.2.5 SRK Consulting (Canada) Inc. – 2016

The 2016 Mineral Resource Estimate (SRK, 2016) was based on a revised geological model that considered information from 94,575 m of new infill core drilling information acquired since October 31, 2012, the cut-off date for the previous SRK Mineral Resource evaluation. The Mineral Resource reported included drilling information available to November 1, 2015. In addition, the Mineral Resource Estimate considered information on geological continuity gained from excavated underground workings exposing the gold mineralization on several levels and in test stopes.

The Mineral Resources were evaluated using a geostatistical block modelling approach constrained by 71 explicit gold mineralization wireframes interpreted using a 3 g/t Au cut-off grade (HG) and enclosed in 19 explicit gold mineralization wireframes derived using a 0.5 g/t Au cut-off grade (LG). The HG domains were constructed as explicit wireframes using interval selections of assay data while the broad LG domains were constructed with polylines on vertical sections. The domains were not modelled as grade interpolants.

Assay statistics were assessed for each domain separately and capping was applied to samples prior to compositing. Capping values were chosen based on a combination of probability plots, decile analysis, capping sensitivity plots, and 3D visualization to determine the capping values. Capping in the HG domains range from 10 to 120 g/t Au, and in the LG domains range from 5 to 45 g/t Au. Gold and capped assay data were composited to a 1.0 m length and extracted for geostatistical analysis and variography.

SRK evaluated the spatial distributions of the gold mineralization using traditional semi-variograms and traditional correlograms of composited data as well as the normal score transform of the composited data.

A block model was generated with a block size of 2.5 m by 5 m by 5 m with sub-cells at 0.5 m resolution used to honor the geometry of the modelled mineralization. The block model was populated with a gold grade using OK. Three estimation runs were used, each considering increasing search neighborhoods and less restrictive search criteria. A spatial restriction was applied to high-grade composites to further restrict their influence during estimation.

In the F2 Gold Zone, higher-grade gold mineralization was associated with crosscutting, east-west trending D2 structures, while the plunge of the gold mineralization within a given domain is controlled by the line of intersection between the domain and the crosscutting structure. Using the dynamic anisotropy function in Datamine Studio 3, polylines were used to assign an estimated dip and dip direction for each cell of that HG domain in the block model based on those intersections.

Based on specific gravity measurement of core samples, a mean specific gravity value for the domain type and lithology was assigned to blocks to convert volumes into tonnages. The specific gravity of lithology and mineralization domains varied from 2.76 to 2.90 t/m^3.

SRK considered that blocks within the HG domains estimated during the first estimation pass, informed from composites from at least three drill holes from five octants and located within the full range of the variogram for that domain, could be classified in the Indicated category within the meaning of the CIM Definition Standards for Mineral Resources and Mineral Reserves (November 2010). SRK considered that for those blocks the level of confidence was sufficient to allow the appropriate application of technical and economic parameters to support mine planning and to allow the evaluation of the economic viability of the deposit. Conversely, all other modelled blocks were classified in the Inferred category as the confidence in the estimates was insufficient to allow for the meaningful application of technical and economic parameters, or to enable an evaluation of economic viability.

SRK considered that the gold mineralization at the Phoenix Gold Project was amenable to underground extraction. SRK reported the Phoenix Gold Project Mineral Resources at a cut-off grade of 4.0 g/t Au. The 2016 Mineral Resource Statement for the Phoenix Gold Project is presented in Table 6-4. Mineralization excavated by underground development, stoping blocks and in a 40 m crown pillar below the lake bottom has been excluded from the Mineral Resource Statement.

Table 6-4: Mineral Resource Statement*, Phoenix Gold Project, Ontario SRK Consulting (Canada) Inc., January 11, 2016

Resource Category	Quantity (t ‘000)	Grade Au (g/t)	Contained Gold (oz ‘000)
Measured	-	-	-
Indicated	492	6.73	106
Measured + Indicated	492	6.73	106
Inferred	1,519	6.28	307

Notes: *All figures are rounded to reflect the relative accuracy of the estimate. Samples have been capped where appropriate. Underground Mineral Resources reported at a cut-off grade of 4.0 g/t Au assuming a metal price of US$1,125/oz of gold and a gold recovery of 92.5%. The 2016 Estimates are not current and should not be relied upon.

6.2.6 Golder Associates Ltd. – 2018

The 2018 Mineral Resource Estimate (Golder, 2018b), prepared by Golder Associates Ltd. (Golder), was based on data provided by Rubicon from surface and underground diamond drill programs, as well as chip samples and mapping from underground development completed mainly between 2002 and 2017. All data received was in the Phoenix Mine coordinate system, which is rotated 45 degrees to the east of magnetic North. No other data translations were completed for the purpose of this Mineral Resource Estimate.

The Phoenix Gold Project mineralization was modelled in four zones defined as Zones 1 to 4. A three-dimensional (3D) block model was constructed for estimating stratigraphy (i.e., rock type groupings) and Au grades, where stratigraphy was used as a zonal control on gold grade estimates. High-grade, outlier samples were controlled by top-cutting with a maximum distance restriction of 10 m. Resources were reported at a 3.0 g/t Au cut-off grade and classified according to CIM Definition Standards for Mineral Resources and Mineral Reserves (May 2014). Density values were assigned to the model based on the default mean value of each stratigraphic unit.

The block model validation process included visual comparisons between block estimates and composite grades in plan and section, along with global comparisons of mean grades, swath plots and smoothing ration calculations.

Table 6-5 presents the Mineral Resource statement for the Phoenix Gold Project. This Mineral Resource Estimate excludes isolated blocks with little potential for mining, mineralization within the crown pillar, and all mineralized development that has been mined.

Table 6-5: Mineral Resource Statement, Phoenix Gold Project, Golder 30 April 2018

Resource Category	Quantity (t '000)	Grade Au (g/t)	Contained Gold (oz '000)
Measured	188	6.80	41,000
Indicated	1,186	6.30	240,000
Measured + Indicated	1,374	6.37	281,000
Inferred	3,884	6.00	749,000

Notes: Effective date for this Mineral Resource was April 30, 2018.
Mineral Resource Estimate used a break-even economic cut-off grade of 3.0 g/t Au based on assumptions of a gold price of US$1,300/oz, an exchange rate of US$/C$ 0.77, mining cash costs of C$97/t, processing costs of C$20/t, G&A of C$5/t, sustaining capital C$10/t, refining, transport and royalty costs of C$53/ounce, and average gold recoverability of 92%.
Mineral Resource Estimate reported from within an envelope accounting for mineral continuity.
Mineral Resources are not Mineral Reserves and do not demonstrate economic viability.
There is no certainty that all or any part of this Mineral Resource will be converted into Mineral Reserve.
All figures are rounded to reflect the relative accuracy of the estimates and totals may not add correctly.

6.2.7 Mineral Reserve Estimates

There are no historical Mineral Reserves at the Phoenix Gold Project.

6.3 Past Production

There has been limited past production in the form of lateral development and trial longhole stope mining on the property. Mining exploration activities on the property were terminated in 1989 after test-milling of an estimated 2,250 tonnes of material unrelated to the F2 Gold Zone (Hogg, 2003).

Development of the Phoenix Gold Project by Rubicon commenced in 2012 with shaft deepening and mill building foundation work, followed by the establishment of levels and associated infrastructure at the 122 m, 183 m, 244 m, 305 m, 488 m, and 610 m Levels.

In 2015, Rubicon began trial stoping on the 305 m Level. Subsequent trial stoping followed on the 183 m and 244 m Levels. Typical development followed mineralized material, via Alimak raising, lateral sill and sublevel advance. Test production of three longhole stopes was completed on the 305 m and 244 m Levels. The 244-Z2-159, 244-Z1-977, and 305-Z2-030 stopes were mined, skipped to surface, and processed at the Rubicon mill facility on site.

Rubicon processed 57,793 tonnes of mineralized material, grading at 3.02 g/t Au. Rubicon achieved an average mill recovery of 91.9% and produced 5,610 oz of gold. Underground activities were suspended on November 3, 2015 and milling ceased on November 21, 2015.

In 2018, Rubicon completed a test mining and processing program that started in July and was completed in October. During that time, 43,250 tonnes of material were processed through the mill, grading at 4.08 g/t Au, for a total of 5,669 oz of gold being produced.

Within this total material run through the mill, three test stopes (244-Z1-015, 244-Z1-977, and 183-Z1-161) were developed and mined for a total of 35,629 tonnes at a grade of 4.51 g/t Au, for a total of 5,165 oz of gold being produced. A reconciliation exercise was completed on the three test stopes with comparing actual tonnes, grade and ounces of gold to that outlined using the 2018 Mineral Resource block model tonnes, grade and ounces of gold, with a positive reconciliation of 7.4% for tonnes, 5.9% for grade, and 13.8% for ounces of gold occurring (Golder, 2019).

Rubicon achieved an average mill recovery of 95.1% gold recovery, with 43.2% gold recovered from gravity. Based on operating information during the processing of the bulk sample, the processing plant was able to sustain a steady state throughput rate of 70 tonnes per hour (t/h), which is equivalent to 1,540 t/d, on a 22-hour availability during the bulk sample processing exercise.

7 GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional Geology

The following description of the geology of the Red Lake Greenstone Belt was modified from Sanborn-Barrie et al. (2004) and the references therein.

The Phoenix Gold Project is located in the Uchi Subprovince of the Superior Province of the Canadian Precambrian Shield. Within the Uchi Subprovince, the Red Lake Greenstone Belt is host to one of Canada's preeminent gold districts having produced more than 29 Moz of gold since the 1930s.

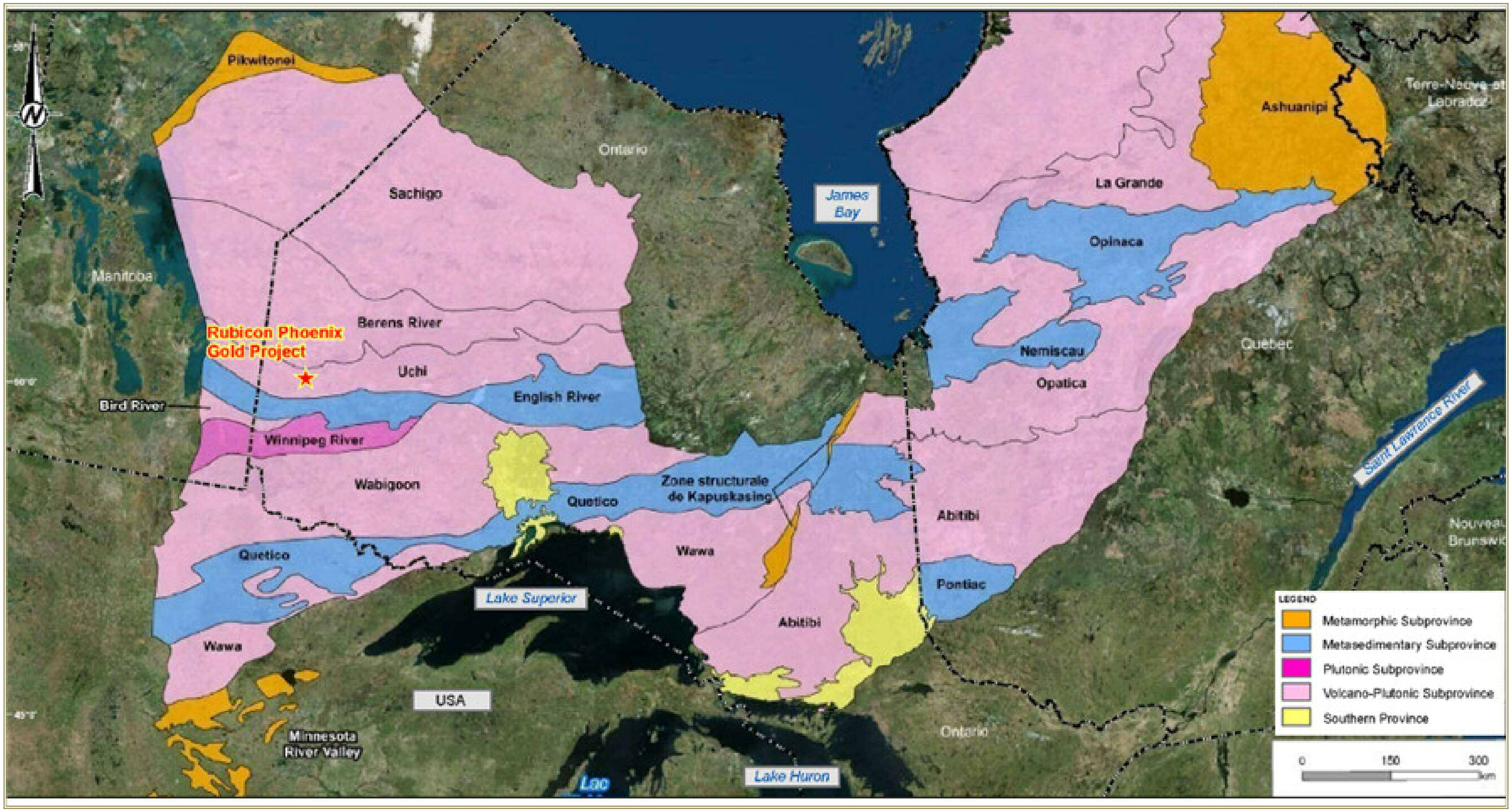
The Red Lake Greenstone Belt is interpreted to have been formed on the southern margin of the North Caribou Terrane, an ancient Mesoarchean continental block of approximately 3,000 Ma that makes up part of the southern Uchi Subprovince (Figure 7-1 and Figure 7-2). The Red Lake Greenstone Belt was formed and evolved as the result of extensive magmatic and sedimentary activity as well as multiple events of intense deformation, metamorphism, hydrothermal alteration, and gold mineralization that occurred between 3,000 to 2,700 Ma before present. Regional metamorphic assemblages indicate that peak metamorphism corresponded to greenschist and amphibolite grades.

The regional geology of the Red Lake Belt is shown in Figure 7-3 and it is described in the following paragraphs, proceeding from the oldest to the youngest stratigraphic assemblages.

Rocks of the Mesoarchean Balmer Assemblage, the oldest stratigraphic assemblage in the Red Lake Greenstone Belt host all the major gold producers in the Red Lake District. The Balmer Assemblage is dated between circa (ca.) 3,000 and 2,988 Ma and it includes volcanic units composed of komatiite, komatiitic basalt and tholeiitic basalt as well as lesser amounts of peridotitic and gabbroic intrusive rocks, felsic volcanic rocks, iron formation and clastic sedimentary rocks.

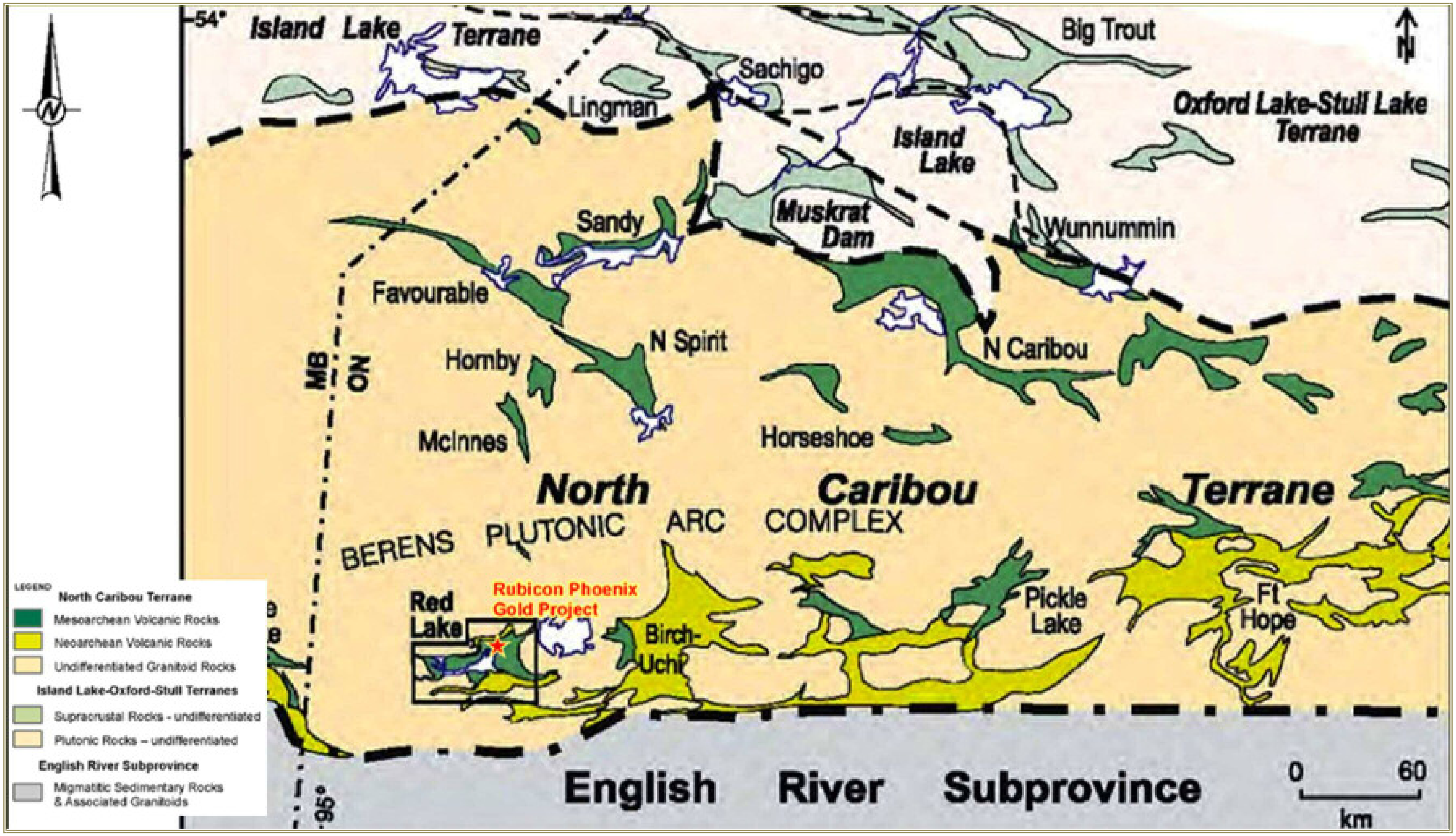
Underlying the northwestern portion of the Red Lake Greenstone Belt is the Ball Assemblage (ca. 2,940 Ma to ca. 2,925 Ma), consisting predominantly of a thick sequence of metamorphosed intermediate to felsic calc-alkaline volcanic flows and pyroclastic rocks, and lesser amounts of mafic to ultramafic volcanic rocks and peridotitic to gabbroic intrusive rocks.

The Slate Bay Assemblage (ca. 2,903 Ma to ca. 2,850 Ma) extends the length of the belt and consists of clastic sedimentary rocks including several lithological facies: conglomerates, quartzose arenites, wackes, and mudstones. The contact of the Slate Bay Assemblage with the underlying Ball and Balmer assemblages represents an unconformity (Figure 7-3).



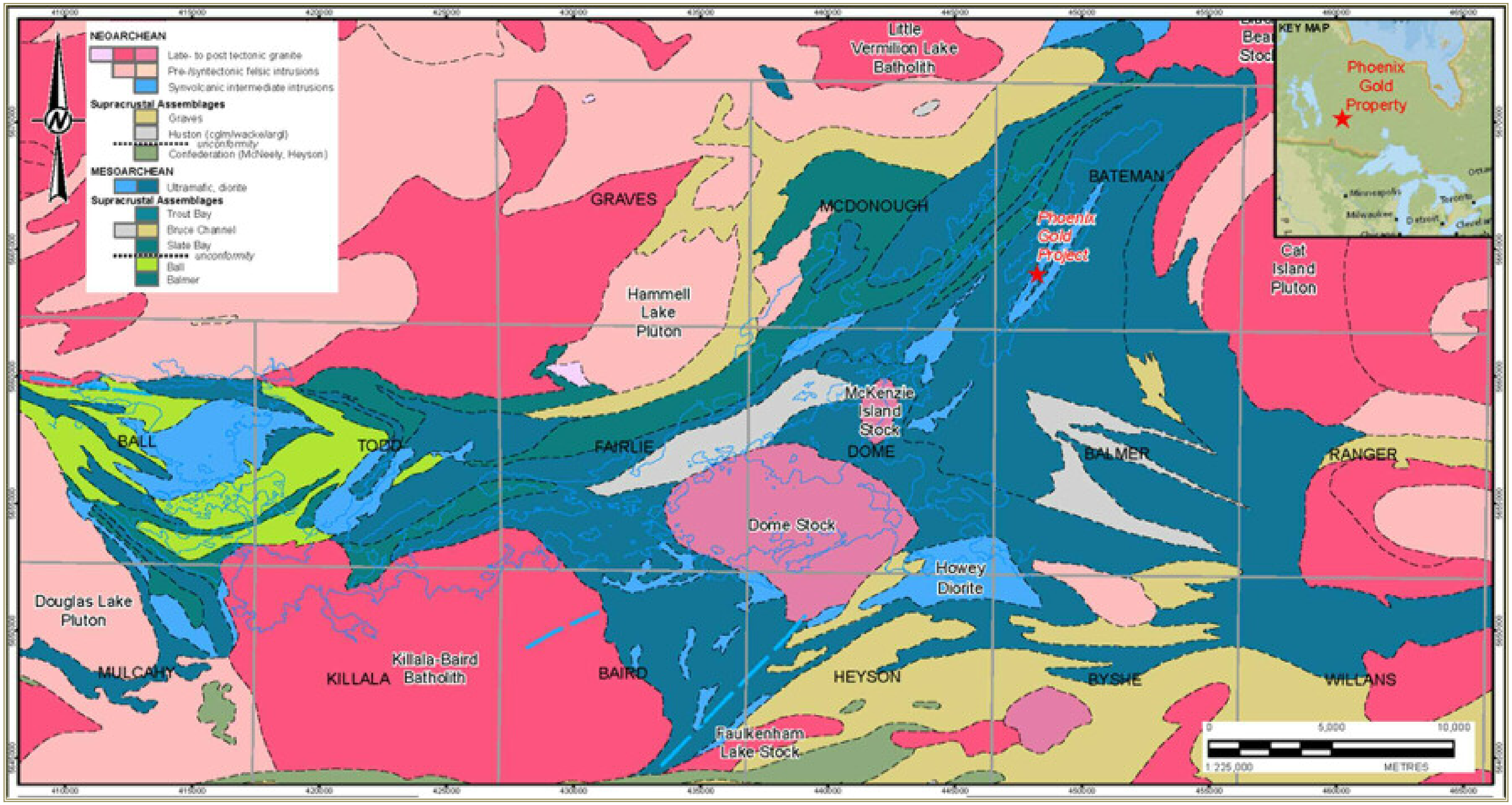
Note: Modified after Géologie Québec (GQ.MINES.GOUV.QC.CA), which is adapted from Card and Poulson, 1998.

Figure 7-1: Superior Province Subdivisions (Source: Rubicon, 2019)



Note: Modified from Sanborn-Barrie et al., 2004

Figure 7-2: Geology of the North Caribou Terrane of the Superior Province (Source: Rubicon 2019)



Note: Adapted from Ontario Geological Survey, 2011

Figure 7-3: Regional Geology (Source: Rubicon 2019)

The Bruce Channel Assemblage (ca. 2,894 Ma) is composed of a thin sequence of calc-alkaline dacitic to rhyodacitic pyroclastic rocks overlain by an upward-fining sequence of clastic sedimentary rocks and chert-magnetite iron formation. Trace element profiles of the calc-alkaline volcanic rocks relative to the Balmer Assemblage are interpreted to indicate crustal growth at a juvenile continental margin.

The Trout Bay Assemblage (ca. 2,853 Ma) is exposed in the southwest portion of the Red Lake Greenstone Belt. It is a volcano-sedimentary sequence consisting of a lower tholeiitic basalt unit overlain by clastic sedimentary rocks that are interbedded with an intermediate tuff unit and a chert-magnetite-iron formation.

Deposition of the Confederation Assemblage followed a pause in volcanic activity of approximately 100 million years. The Confederation Assemblage represents a time of widespread Neoarchean calc-alkaline volcanism (ca. 2,748 to 2,739 Ma). The McNeely sequence is the oldest unit of the Confederation Assemblage; it formed during shallow marine to subaerial arc volcanism and was deposited upon the existing Mesoarchean continental margin. The McNeely sequence is overlain by and interstratified with the tholeiitic Heyson volcanic sequence that is thought to have formed during a period of intra-arc extension. In the Madsen area, an angular unconformity at the base of the Confederation Assemblage is indicated by opposing facing directions of units belonging to the Confederation and Balmer assemblages, suggesting the Balmer Assemblage was overturned prior to the deposition of the Confederation Assemblage.

The Huston Assemblage (dated between ca. 2,742 and 2,733 Ma) is represented by fine to coarse-grained clastic sedimentary units including conglomerate, wacke, siltstone, and argillite that unconformably to conformably overlie the McNeely sequence of the Confederation Assemblage. The Huston Assemblage has been compared to the Timiskaming conglomerates commonly associated with gold mineralization in the Timmins camp of the Abitibi Greenstone Belt (Dubé et al., 2003).

The Graves Assemblage (ca. 2,733 Ma) represents a period of calc-alkaline volcanism dominated by andesitic to dacitic pyroclastic tuff. The rocks of this assemblage overlie and are locally transitional with the underlying Huston Assemblage.

Plutonic rocks in the Red Lake Greenstone Belt are temporally and, in some cases, petrologically correlated with the periods of magmatism recorded by the volcanic units belonging to the above-described assemblages. The plutonic units include mafic to ultramafic intrusions associated with the Balmer and Ball Assemblages, gabbroic sills with chemical affinities to the basalts of the Trout Bay Assemblage, small volumes of felsic dykes and diorite intrusions associated with the Confederation Assemblage, and intermediate to felsic plutons, batholiths, and stocks coeval with the Graves Assemblage. Post-volcanism plutonic activity is represented by granitoid rocks such as the McKenzie Island stock, Dome stock, and Abino granodiorite (ca. 2,720 to 2,718 Ma) that host past producing gold mines. The last magmatic event recorded in the belt occurred ca. 2,700 Ma and is represented by a series of potassium-feldspar megacrystic granodiorite batholiths, including the Killala-Baird

Batholith, as well as some other granitoid plutons and dykes. Structurally, the Red Lake Greenstone Belt underwent continental collision (the Kenoran Orogeny), ca. 2,720 to 2,710 Ma, which led to multiple episodes of intense hydrothermal alteration, deformation, metamorphism, and gold mineralization (Dubé et al., 2003). The belt records several episodes of deformation interpreted to be closely linked with intensive hydrothermal activity and gold mineralization. Current regional interpretations of the Red Lake area identify three main deformation events:

- D1: Regional NW-SE shortening, resulting in NE-SW striking folds, thrust faults, thrust related strike-slip faults, quartz veins, and penetrative regional foliation (S1) fabric.
- D2: Regional NE-SW shortening resulting in development of pre- to syn-mineralization oblique strike slip fault systems and a fold overprint of the earlier D1 deformation. During D2 deformation in the East Bay area, oblique dextral strike slip faults re-activated D1 thrust faults, and associated D1 strike slip faults along a zone of crustal weakness inherited from earlier D1 faulting.
- D3: Regional-scale folding resulting in open folding of D1 and D2 structural features.

7.2 Phoenix Property Geology

The stratigraphy in the East Bay area (Figure 7-4), where the Phoenix Gold Project is located, comprises submarine tholeiitic basalt, komatiite and komatiitic basalt with minor felsic intrusive volcanic rock, iron formation, and fine-grained clastic metasedimentary rocks, all of which constitute the Balmer Assemblage. Extensive mapping, trenching, core drilling, and geophysical surveys have defined a consistent geological sequence that can be correlated along the length of the property for over 4 km. A summary of the stratigraphic units found within the Project area is shown in Table 7-1 and Figure 7-4.

Table 7-1: Summary of Phoenix Gold Project Area Stratigraphy

Sequence	Stratigraphy
West Peninsula Sequence	Pillowed to massive basalts with banded iron formation (BIF), graphitic BIF and chert, banded silty to arenaceous sedimentary rocks and significant pyrite/pyrrhotite
Central Basalt Sequence	Pillowed and massive tholeiitic basalts with flow top breccias occasional BIF and (graphitic) argillite.
Intrusive Komatiite Sequence	Massive, spinifex, and columnar jointed basaltic komatiite bounded by Hanging Wall BIF to the east and by Main BIF to the west. BIF possible in central part of sequence
McFinley Sequence	Bounded to the west by Hanging Wall BIF and to the east by the Footwall BIF. At least five horizons of silica/oxide (carbonate) facies BIF within pillowed and amygdaloidal basalt
Hanging Wall Basalt Sequence	Pillowed to massive, amygdaloidal basalts. Variably carbonate altered, variable foliation
East Bay Serpentinite[1]	Extrusive and intrusive ultramafic rocks. Variable talcose alteration
High-Titanium Basalt[2] (High-Ti Basalt)	Variable biotite alteration, sulphides (pyrite, pyrrhotite). Silica flooding, quartz breccia, and quartz veining throughout. The High-Ti Basalt is the principal host to gold mineralization in the F2 Gold Zone.

Note: [1]Labelled as Ultra Mafic in Figure 7-4. [2]Unit is observed underground does not outcrop at surface.

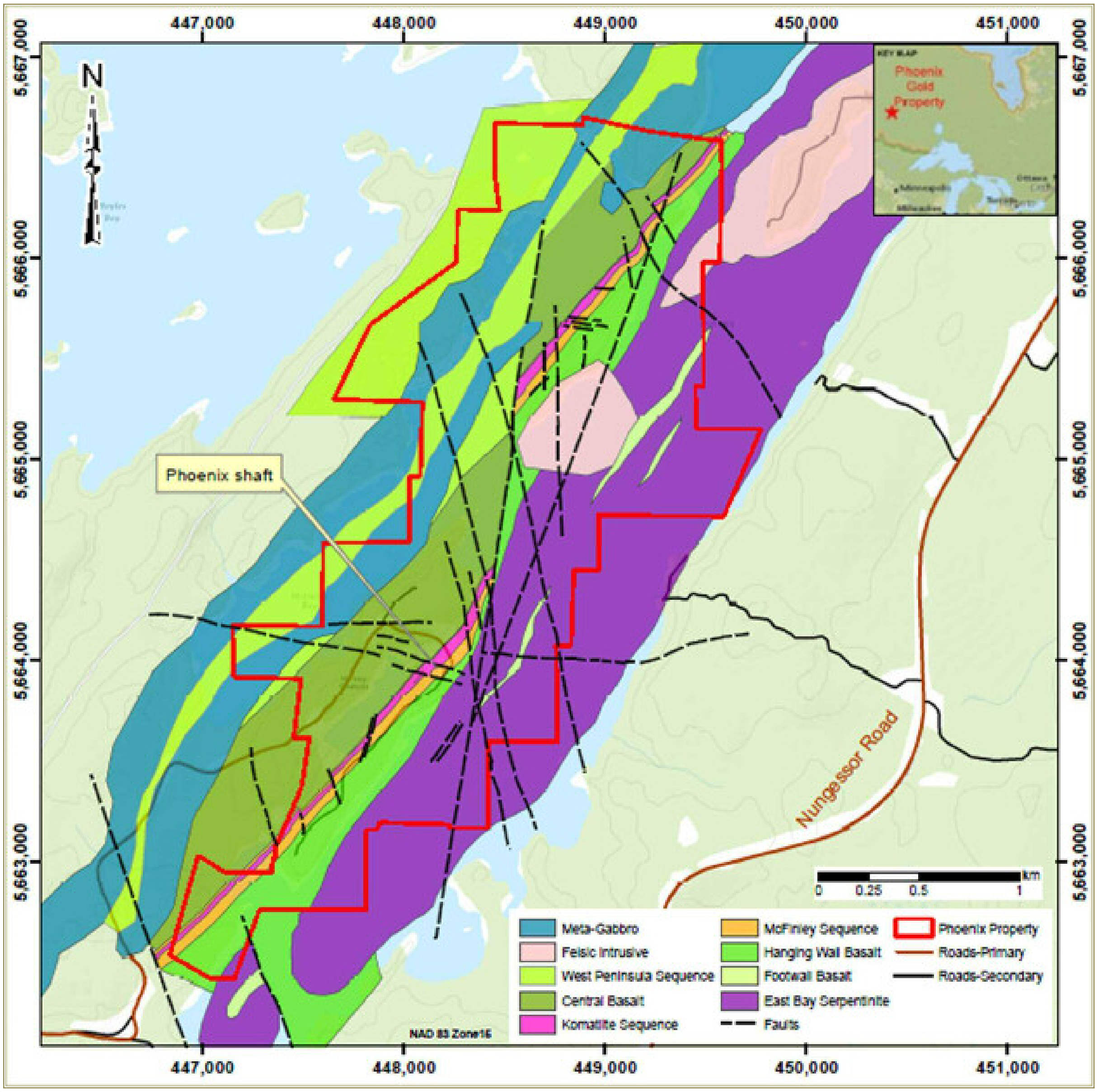


Figure 7-4: Phoenix Gold Project Surficial Geology (Source: Rubicon, 2019)

The Balmer Assemblage basalt flows are tholeiitic and distinguished from other basaltic sequences in the Red Lake Belt by their relatively high TiO_2 contents (commonly >2 wt.%), and as a result the unit is termed High-Titanium (High-Ti) Basalt by Rubicon.

The following summary of geology in the Phoenix Gold Project area is referenced to Rubicon's local mine grid, for which grid north is oriented 045° to true north.

The local geology comprises a series of mine grid north-south (N-S) trending, steeply dipping to sub-vertical alternating panels of talc-altered komatiitic ultramafic flows (Ultramafic Flows) and biotite and silica altered basaltic mafic volcanic flows (High-Ti Basalt). Three main panels of High-Ti Basalt are observed, namely the F2 Basalt Zone, West Limb Basalt Zone, and the Hanging Wall Basalt Zone; in addition to these three main basalt panels there are other less continuous or less well-defined panels of basalt located in the deposit area. The volcanic units are intruded by a series of quartz-feldspar porphyry felsic dykes and sills (Felsic Intrusive), as well as less abundant intermediate and mafic dykes and sills. The Felsic Intrusive dykes and sills post-date D1 deformation features and are cross-cut by mineralized D2 deformation features.

The East Bay Deformation Zone (EBDZ) is located within the western portion of the deposit, where it forms a mine grid N-S orientation, steeply dipping to sub-vertical high strain zone localized within the Ultramafic Flow unit. Within the Phoenix Gold Project area, the EBDZ forms a distinct boundary between the alternating panels of Ultramafic Flows and High-Ti Basalt units to the east of the structure, and Ultramafic Flows without interlayered High-Ti Basalt to the west of the structure.

The EBDZ may have developed as a D1 thrust fault that was subsequently steepened. Alternatively, the EBDZ may have been initiated as a steeply dipping D1 strike-slip fault. A full re-interpretation of the regional D1 tectonic history is beyond the scope of this Study. The D1 EBDZ fault was later reactivated as a regional dextral shear zone during D2.

The dominant structural fabric present in the Phoenix Gold Project area is a mine grid N-S orientation that is steeply dipping to sub-vertical penetrative tectonic foliation (S1) developed during D1 deformation. The S1 foliation is well developed in the talc-rich ultramafic rocks but is generally absent or not observable in the basalt and felsic intrusive units.

D2 features present in the Phoenix Gold Project area are predominantly mineralized quartz-actinolite veins and discontinuous shear zones and brittle faults produced by dextral transpression along the reactivated EBDZ.

D3 regional folding resulted in gentle folding of the Phoenix Gold Project area stratigraphy along a mine grid sub-horizontal N-S oriented fold axis.

7.3 Phoenix Gold Project Mineralization

Gold mineralization occurs primarily within High-Ti Basalt in the form of mineralized quartz-actinolite veins and in association with disseminated sulphides in the High-Ti Basalt, with lesser mineralization in felsic dykes and sills. Previous studies (SRK, 2013a) have identified an earlier low-grade gold mineralization event, with a later overprinting higher-grade gold mineralization event.

The early low-grade gold mineralization event appears to have formed pre- to syn-D1 as the mineralization is overprinted by the S1 foliation. The early phase of mineralization is generally low-grade, with gold grades generally less than 4 g/t Au and occurs as quartz-actinolite-sulphide veins and stringers and as disseminated mineralization associated with quartz-biotite-sulphide alteration in the High-Ti Basalt and Felsic Intrusive units.

The higher-grade second mineralization event has been linked to an array of shear-related veins and minor localized shear zones interpreted to have formed as a result of D2 dextral transpression along the EBDZ. The gold mineralization occurs in association with disseminated sulphide mineralization in the High-Ti Basalt and also in gold-bearing quartz-actinolite veins in the High-Ti Basalt and Felsic Intrusive units. The mineralized veins occur in several orientations, with the east striking, steeply-dipping vein arrays being associated with higher grade gold mineralization. Mine grid East-West (E-W) striking structures are limited to the High-Ti Basalt and Felsic Intrusive; those structures are interpreted as R’ shear veins associated with the regional dextral transpression. No regional or through-going deposit-scale E-W structures were identified.

7.4 Deposit Scale Structural Analysis

Golder (2018a) combined statistical and graphical orientation analysis with 3D geological and structural modelling to evaluate the data and observations from the 2017 structural study for updating the structural interpretation and model for the Project. The 2017 structural study focused on the evaluation of structural impacts on the geometry and distribution of the host units to the mineralization, namely the High-Ti Basalt and the Felsic Intrusive, as well as evaluated controls on the distribution of gold mineralization with an aim to identifying potential high-grade domains.

The underground mapping, 2017 drilling program, and structural modelling demonstrate that although mine grid E-W oriented faults and shear zones do occur within the deposit, they are generally more localized and discontinuous in both their lateral and vertical extents than previously interpreted. They do not appear to represent deposit-scale features. The mine grid E-W oriented faults and shear zones are not necessary to explain the geometry and continuity of the N-S oriented High-Ti Basalt and Ultramafic Flow panels and the Felsic Intrusive dykes and sills.

The three main panels of basalt in the deposit, namely the F2 Basalt Zone, the West Limb Basalt Zone and the Hanging Wall Basalt Zone are all N-S striking, steeply dipping panels. Although they can be followed along strike and down-dip, they are not single continuous panels of basalt but rather they can be broken out into numerous segments in both the N-S and down-dip direction.

The High-Ti Basalt units have the appearance of a more or less well-developed chocolate-tablet boudinage structure. A N-S oriented stretching, associated with deformation along the EBDZ during the D1 deformation event, and with regional dextral movement during reactivation of the EBDZ during the D2 deformation event, is interpreted to have resulted in boudinage of the High-Ti Basalt units, with the primary horizontal stretching direction parallel to the N-S orientation of the EBDZ. A component of dextral-transpression, possibly relating to emplacement of large plutonic stocks to the northeast (NE) and southwest (SW) of the area, is interpreted to impart a lesser vertical component of stretching, such that the High-Ti Basalt and Felsic Intrusive units are also boudinaged in the vertical plane.

7.5 Quartz Vein Analysis and Interpretation

Quartz veins are scarce within the Ultramafic Flow units in comparison to the veins observed in the High-Ti Basalt and Felsic Intrusive units. Quartz veins occurring in the Ultramafic Flow units generally occur in isolated areas, are thin (several centimetres wide) and pinch out with lengths less than several metres. The quartz veins in the Ultramafic Flow units generally lack associated gold mineralization.

Quartz veins are common in the High-Ti Basalt, where they often occur as vein arrays comprising multiple parallel and closely spaced veins. The veins are generally present throughout most of the High-Ti Basalt, with concentrated mineralized areas where vein abundance increases significantly.

Quartz veins are present in the Felsic Intrusive units but are not as common as in the High-Ti Basalt and do not generally have the same associated elevated gold grades as observed in the High-Ti Basalt. It is likely that the Felsic Intrusive unit and the High-Ti Basalt both underwent brittle deformation resulting in the development of structural traps controlling the emplacement of quartz-actinolite veins. The quartz-feldspar porphyry did not provide the same chemical trap as the more iron rich (relative to the Felsic Intrusive units) High-Ti Basalt. This did not allow for significant gold mineralization to develop in the Felsic Intrusive units compared to the High-Ti Basalts.

The quartz veins in the High-Ti Basalt and the Felsic Intrusive dykes and sills are interpreted as shear and extensional veins developed during brittle deformation of the units during D2 dextral transpression. The various orientations of vein arrays are interpreted as the following dextral shear-related vein sets:

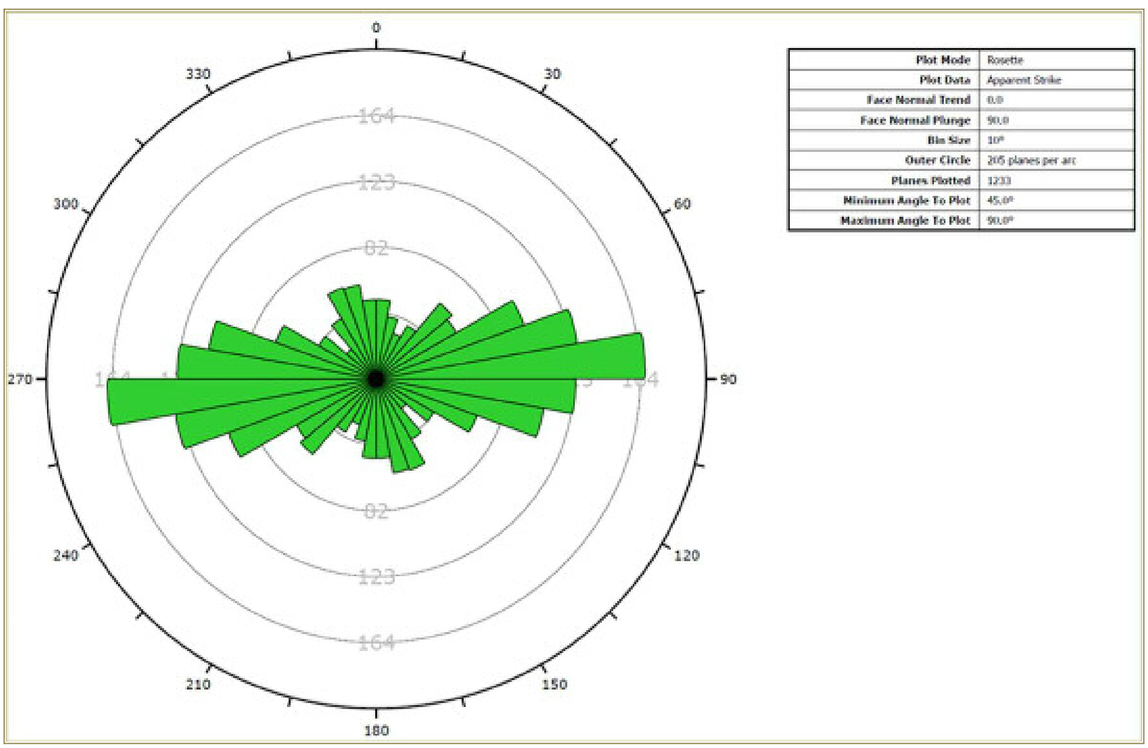
- Riedel Prime Shear Veins (R’): the most common vein orientation, striking E-W, dipping sub-vertical, orientated at a high angle to the orientation of the EBDZ and showing sinistral shear sense indicators, antithetic to the dextral movement of the EBDZ.
- Riedel Shear Veins (R): striking N-S steeply dipping to sub-vertical, oriented at low angle clockwise to the orientation of the EBDZ, with dextral shear sense indicators synthetic to the dextral movement of the EBDZ.
- P Shear Veins: striking NW-SE steeply dipping to sub-vertical, oriented at low angle counter-clockwise to the orientation of the EBDZ, with dextral shear sense indicators synthetic to the dextral movement of the EBDZ.
- Low-angle Veins: shallow-dipping to sub-horizontal extensional veins oriented approximately orthogonal to the shear veins, with vertical extensional fabrics.

The vein-set relative abundances and orientations are shown in Figure 7-5, with the E-W striking R’ shear veins occurring in significantly greater numbers than the other vein types.

The R’, R and P shear veins all host gold mineralization, with the highest gold grade generally occurring within the E-W oriented R’ veins.

The higher-grade gold mineralization in the F2 Basalt Zone is observed to be spatially associated with Quartz-Breccia Zones that share the same geometry as the R’ Shear Veins. The Quartz-Breccia Zones are interpreted to have developed as multiple opening and sealing events of the E-W striking sub-vertical R’ shear veins. A possible explanation for the development of the R’ Shear Vein related Breccia Zones is that their sinistral sense of shear is opposed to the dextral bulk sense of shear. As a result, the R’ shear veins will not accommodate significant displacement, but they may develop into zones of intense deformation, where repeated fracturing and comminution of the vein and entrained and surrounding wall rock material results in the creation of high porosity and permeability zones for mineralizing fluids.

In areas where the Quartz-Breccia is thick and is associated with a surrounding envelope of increased abundance of mineralized quartz-actinolite vein arrays, they impart a clear E-W component to the high-grade mineralization.



Note: Data used for rose plots was limited to data with orientation confidence >5, which translates to core orientation lock angles of less than 10 degrees. (Golder, 2018a)

Figure 7-5: Rose Plot of Quartz-Actinolite Veins

The Quartz-Breccia zones have minor sinistral movement indicated by limited shear sense indicators that include shear fabrics, minor offsets, and alignment/imbrication of wall rock fragments entrained in the Quartz-Breccia zones. A Quartz-Breccia zone exposed in development on the 305 m Level of the mine exhibits what appears to be well-developed sinistral releasing bend geometry.

The Quartz-Breccia Zones do not appear to be thoroughgoing (cutting across all units) E-W shear zones or shear veins, but rather they are discontinuous, occurring primarily within the thickest parts of the F2 Basalt Zone. The 305 m Level Quartz-Breccia zone clearly cuts across the multiple panels of basalt and a thin sliver of ultramafic sandwiched between them. This is attributed to ductile strain partitioning favoured in the more plastic Ultramafic Flow units.

Quartz-Breccia Zones have been identified in the West Limb Basalt and the Hanging Wall Basalt zones but the best developed zones identified to date have been found in the F2 Basalt Zone. Evaluation for Quartz-Breccia Zones in the other panels should be a high priority in future exploration and infill drilling.

The final deformation event observed in the deposit resulted in the entire sequence of Ultramafic Flow, High-Ti Basalt, and Felsic Intrusive units having been gently folded into a broad, open fold with an N-S oriented, sub-horizontal fold axis during the D3 deformation event. The broad open folding of the stratigraphy is apparent when viewing the deposit on a W-E (north facing) section. A subtle change in geometry is also observed in the orientation of the quartz-actinolite veins as they undergo a slight change in orientation and their dips shallow slightly with depth below the 610 m Level.

7.6 Updated Structural Interpretation for the Phoenix Gold Project

Based on an analysis of the data and observations obtained during the 2017 structural oriented core drilling and mapping programs, Golder's conceptual model (Golder, 2018a) of the revised structural interpretation is presented in Figure 7-6. The updated structural interpretation and model include the following key elements:

- The EBDZ has been remodelled to show it as a broader zone of high strain in the Ultramafic Flow unit rather than as a discrete feature that is then offset by E-W brittle faulting per the previous model.
- Strain partitioning during D1 and D2 deformation events resulted in ductile deformation of the talc-rich Ultramafic Flow units and brittle-ductile deformation of the more resistant High-Ti Basalt and Felsic Intrusive units.
- Ductile behaviour of the Ultramafic Flow unit resulted in the generation of the pervasive N-S oriented, steeply dipping to sub vertical S1 penetrative foliation during D1 deformation.

- Brittle-ductile behavior of the High-Ti Basalt units resulted in the boudinage of these units with the primary stretching direction paralleling the N-S orientation, with a lesser vertical component of stretching such that the boudin necks that bound the High-Ti Basalt panels are arranged in both N-S shallowly dipping and subvertical orientations.
- The High-Ti Basalt is modelled as a series of mine grid N-S oriented panels that have been boudinaged during D1 and D2 deformation events so that they form mine grid N-S elongated lenses that pinch out at the north and south ends. In some instances, there are gaps of tens of metres between boudinaged basalt panels. This geometry is shown in both the N-S planar view and the vertical view (Figure 7-6).
- Ultramafic Flows and High-Ti Basalt units were intruded by dykes and sills of the Felsic Intrusive unit pre- to syn-mineralization.
- Arrays of quartz-actinolite veins with associated gold mineralization were developed in the more competent High-Ti Basalt and to a lesser degree in the Felsic Intrusive. The R', R, and P shear veins all host gold mineralization, with the highest gold grades generally occurring within the E-W oriented R' veins.
- The best gold grades occur in the thickest portions of the High-Ti Basalt, where the unit presented both favourable structural traps for developing gold-bearing veins and chemical traps where disseminated sulphides and associated gold mineralization are developed. Golder recommended these areas should be the focus/targets of future exploration efforts.
- The entire sequence of Ultramafic Flow, High-Ti Basalt and Felsic Intrusive units were then folded into a broad gentle fold with a mine grid N-S oriented, sub-horizontal fold axis during D3 deformation event.
- Some deposit scale and macro scale evidence for pre-D3 folding was observed in the Ultramafic Flow units; however, at present Golder (2018a) interpreted these features to be a result of foliation orientation variability due to dragging associated with the regional D2 dextral deformation and to warping of the foliation in boudin neck regions rather than a result of deposit-scale steeply plunging isoclinal folding.

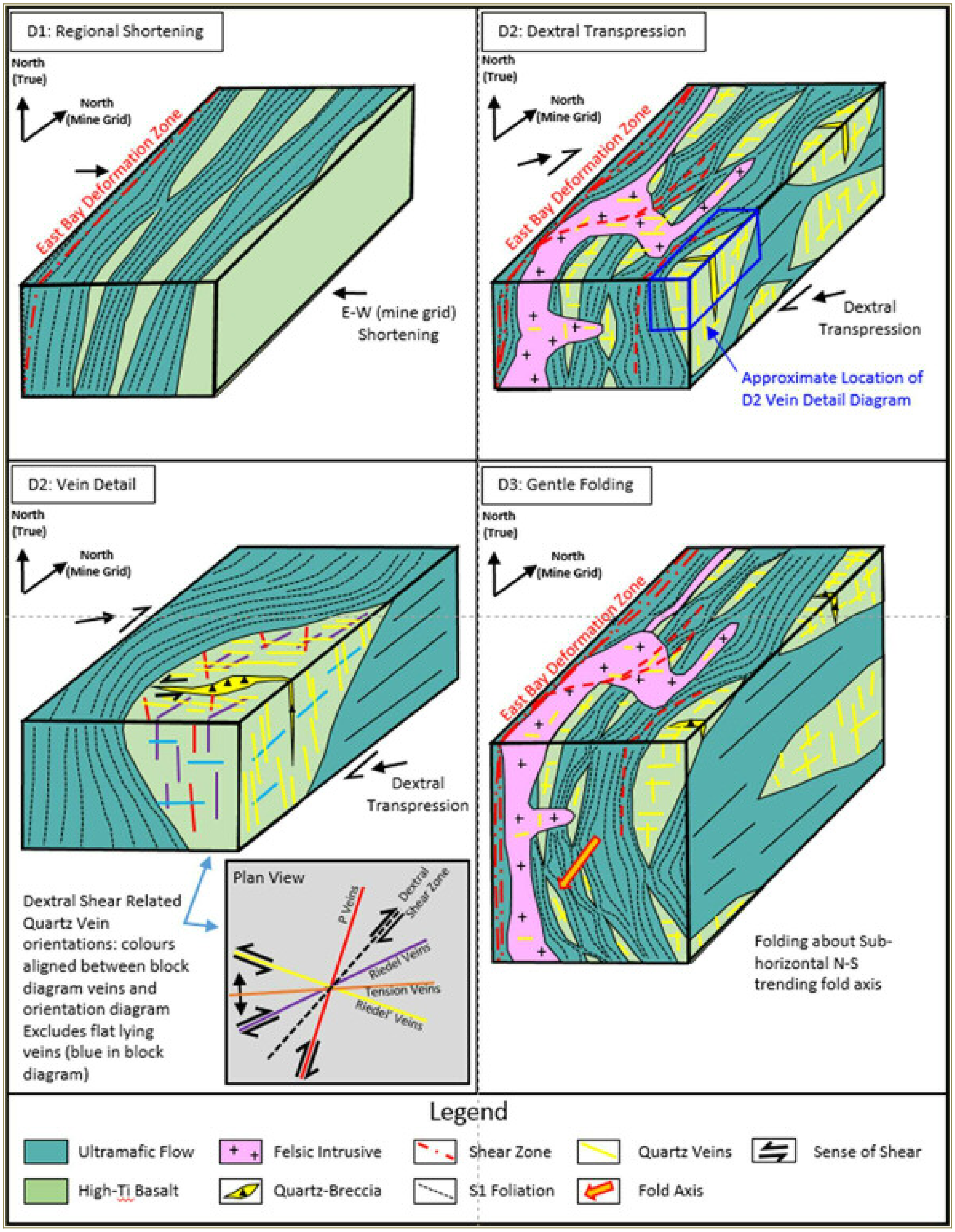


Figure 7-6: Updated Conceptual Structural Model for the Phoenix Gold Project Area (Golder, 2018a)

8 DEPOSIT TYPES

The style of veining, the lithological setting, and the structural relationship with shear zones at the F2 Gold Zone are compatible with orogenic-style gold mineralization (also referred to as mesothermal, or Archean greenstone-hosted quartz-carbonate vein gold mineralization or Archean lode gold). This style of gold deposit is typically associated with regional folding and arrays of major shear zones and is formed by circulation of gold-bearing hydrothermal fluids in structurally-enhanced permeable zones. The deposits are characterized by strong lithological and structural controls and are hosted in deformed and metamorphosed volcanic, sedimentary and granitoid rocks occurring across a range of crustal depths (Groves et al., 1998).

Orogenic gold deposits are widely distributed in the Neoarchean greenstone belts of the Superior, Churchill, and Slave provinces, and also occur in younger terranes such as the Canadian Cordillera and the Appalachian terranes. In Canada, the most important concentration of orogenic gold deposits occurs in the greenstone belts of the south-central Superior Province.

In the Red Lake district, most of the gold production is derived from orogenic-style high-grade quartz-carbonate veins that are associated with deformation of the Balmer Assemblage mafic and ultramafic volcanic rocks (Sanborn-Barrie et al., 2004). At the Campbell-Red Lake Mines, located to the south of the Phoenix Property, the main source of gold is within quartz-carbonate veins associated with the Campbell and Dickenson fault zones that are locally controlled by F2 folding (Dubé et al., 2001). A spatial relationship exists between the ultramafic rocks and gold mineralization, with the majority of gold mineralization at the Cochenour-Willans and Campbell-Red Lake gold mines occurring within a few hundred metres of ultramafic bodies. Dubé et al. (2001) suggested that a competency contrast between the mafic (basalt) and ultramafic (komatiitic basalt) units was important in the formation of extensional carbonate veins in fold hinge zones during deformation. The carbonate veins were then partially replaced as the result of interactions with gold-rich siliceous fluids.

The F2 Gold Zone shares attributes of other orogenic gold deposits of the Red Lake district. These include the association of auriferous quartz-carbonate veins with regional scale D2 deformation zones (D2 shear zones and related brittle-ductile structural features) and the favourable lithological setting of Balmer Assemblage mafic and ultramafic volcanic rocks.

9 EXPLORATION

9.1 Rubicon, 2002 – 2018

Since acquiring the Phoenix Gold Project in 2002, Rubicon has conducted an extensive exploration program that has included geological mapping, re-logging of selected historical drill holes, digital compilation of available historical data, ground and airborne magnetic surveys, mechanical trenching, channel sampling, a bathymetric survey, an induced polarization Titan 24 survey, petrographic studies, a topographic survey, data modelling and processing, and numerous drilling programs.

A summary of the exploration activities undertaken at the Phoenix Gold Project between 2002 and 2018 by Rubicon is shown in Table 9-1. Figure 9-1 shows the gold zones and targets areas for the Phoenix Gold Project and surroundings.

Table 9-1: Summary of Exploration Activities by Rubicon from 2002 to 2018

Year	Description of Work
2002	• Geological mapping • Cataloguing, numbering, and re-boxing of historical core cross-piled on property (over 60,000 m) • Digital compilation of historical data • High-resolution airborne magnetic survey • 22,000 m^2 of mechanical trenching and power washing (in 2002 and 2004) Channel sampling (876 samples between 2002 and 2004) • Overwater bathymetric survey of Red Lake within property boundary • 1,900 m of drilling on the Phoenix Peninsula
2003	• Re-logging of selected historical drill holes (approximately 23,000 m from 161 drill holes) • Digital compilation of historical data • Phase 1 drilling program with 9,600 m of winter drilling including ice drilling • Phase 2 drilling program consisting of 3,000 m drilled on the Phoenix Peninsula
2004	• Continued mechanical trenching, power washing, and channel sampling • Winter drilling program with 13,300 m drilled
2005	• 11,800 m of surface drilling
2006	• 1,614 m of surface drilling
2007	• 13,444 m of surface drilling
2008	• First phase of Titan 24 DCIP and MT survey • 43,800 m of surface drilling

Year	Description of Work
2009	• Second and final phase of airborne Titan 24 survey completed • Preliminary petrographic study • Surface (44,675 m) and underground (25,512 m) core drilling
2010	• Topographic survey utilizing airborne LiDAR technology (light detection and ranging) • Surface (37,823 m) and underground (82,068 m) core drilling
2011	• Surface (5,462 m) and underground (74,337 m) core drilling
2012	• Surface (40,900 m) and underground (17,627 m) core drilling (to cut-off date of Nov. 1, 2012)
2013	• Underground core drilling (876 m) to support shaft development
2014	• Underground core drilling (40,574 m), infill and step out drilling in central portion of deposit • Surface core drilling (6,064 m) used to investigate the crown pillar
2015	• Underground core drilling (47,061 m), infill used as production support for trial stoping • Exploration surface core drilling (9,553 m) targeting the Carbonate (CARZ) Zone
2017	• Underground core drilling (28,995 m) from 244 m, 305 m, 610 m, and 685 m Levels, including: 3,500 m to evaluate E-W structures and mineralization features for the F2 deposit structural model, 24,139 m of infill and step out drilling to update mineral resource and structural models for the F2 deposit, and 1,356 m to test down-dip continuity of mineralization on the McFinley deposit.
2018	• Underground core drilling (20,159 m to October 15, 2018 drilling cut-off date), 17,443 m of infill drilling to upgrade inferred mineral resources, 2,716 m definition drilling and drilling on trial stopes as part of the 2018 Test Mining program.

9.1.1 Core Re-logging Program, 2002

A core re-logging program initiated in 2002 formed a solid basis for understanding the nature of mineralization hosted within the hanging wall volcanic units of the East Bay Deformation Zone.

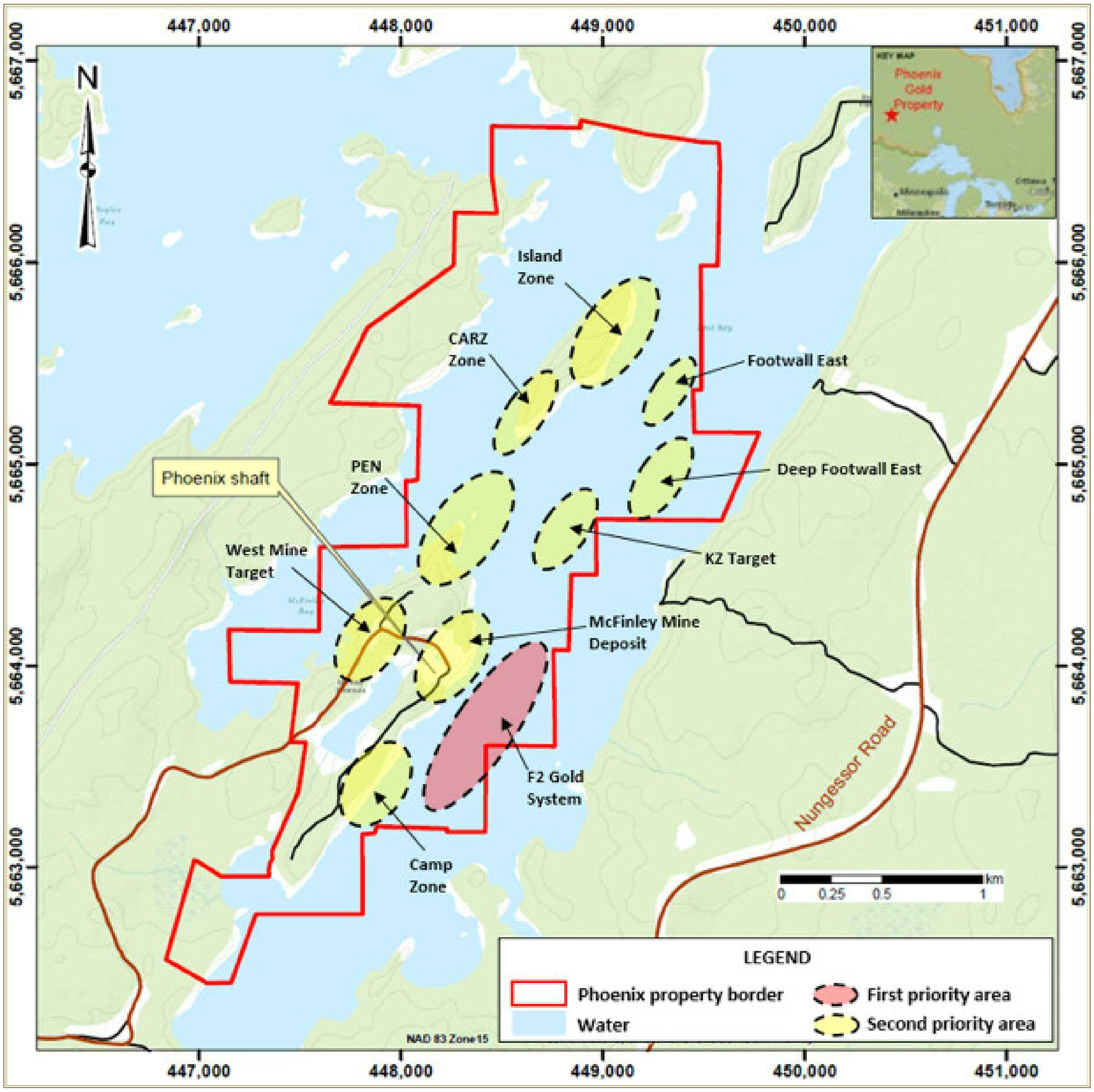


Figure 9-1: Key Target Areas (Source: Rubicon, 2019)

9.1.2 Geophysical Surveys, 2002, 2008

The airborne magnetometer survey flown by Fugro Airborne Surveys in 2002 provided the data necessary to allow re-interpretation of the local geology within the Phoenix property boundary, including the extrapolation of known geological contacts, the identification of local structural offsets, and the identification of large target areas such as magnetic lows, which potentially represent the destruction of magnetite through hydrothermal alteration processes.

The 2008 Titan 24 DCIP survey by Quantec Geoscience was completed after the 2008 discovery of the F2 Gold Zone (Figure 9-1). The Titan 24 survey successfully detected several known near-surface gold zones; the survey is also interpreted to have detected alteration that is spatially associated with the F2 gold zone. The defined chargeability anomaly is over 1,500 m long and appears to correlate with a zone of strongly altered host rocks and sulphide minerals that are associated with gold mineralization that extends from the southern limit of the F2 gold zone to the Pen Zone. The F2 Titan chargeability anomaly is one of a number of similar anomalies defined by the same survey along 3 km of prospective stratigraphy extending to the northeast on the property. The chargeability anomalies range from vertical depths of 200 m to over 800 m and constitute high priority regional targets.

9.1.3 Petrographic Study, 2009

Preliminary petrographic analysis performed by Vancouver Petrographics in 2009 on select representative core samples from the F2 Gold Zone indicated that 90% to 95% of the native gold occurs in quartz as equant grains, mainly from 20 µm to 100 µm in size. Petrography identified that such fragments should be liberated relatively easily. Finer grains of native gold (mainly 5 µm to 20 µm), both in fragments of meta-andesite and less commonly in quartz, will be more difficult to liberate. Most likely, the recovery of gold would not increase greatly with grinding below 15 µm.

9.1.4 Exploration, 2010-2016

The exploration programs between 2010 and 2015 were focused on expanding the F2 resource. A LiDAR survey over the property in 2010 was used to create a high-resolution topographic map. A total of 362,345 m of drilling occurred from 2010 to 2015. Of this, 262,543 m was drilled underground to enlarge and upgrade the F2 resource. The remaining 99,802 m was drilled from surface. This drilling targeted the F2 Gold Zone and other close exploration targets. A small minority of the surface drilling, 6,064 m, was for geotechnical purposes investigating the crown pillar.

There was a hiatus of drilling and exploration during 2016.

9.1.5 Diamond Drilling, Structural Geology and Core Re-logging Program, 2017

A total of 28,995 m was drilled during 2017. Most of the 2017 drilling (27,475 m) was intended to upgrade the F2 resource and to provide more information for the F2 Gold Zone structural model. Most of the 2017 drilling was focused on this (24,139 m). The remaining drilling (1,356 m) was to test C and B Zones of the McFinley deposit.

Exploration during 2018 was focused on drilling underground targets. The majority of targets were designed to upgrade the resource for the F2 Gold Zone from inferred to indicated or better classification. Rubicon drilled a total of 20,159 m. An additional 2,716 m of drilling was completed for the 2018 test mining and processing program.

The 2018 Mineral Resource estimation update by Golder included an update to the deposit scale structural model for the Phoenix Gold Project (Golder, 2018a). As part of this study, Rubicon geologists relogged 46 historical drill holes in the F2 Gold Zone, totalling 10,899 m, during 2017. The primary focus of the relogging exercise was to identify and evaluate drill holes for structural geological features that may have been overlooked or misinterpreted in earlier core logging programs. Targeted drill holes were selected by Rubicon geologists with support from Golder. Formal structural point data measurements could not be obtained because the historical drill holes were not oriented core; however, observations and measurements relative to the core axis were captured to provide a more complete picture of the structural association with mineralization. Existing assay results were cross referenced against lithological, alteration and structural features when revisiting the core, and proved to be informative to planning subsequent drilling programs.

10 DRILLING

10.1 Historical Drilling

The history of exploration from 1922 to 2002 is discussed in Section 6. Drilling conducted by previous owners is summarized in Table 6-1. The historical core drill holes are mainly located outside the main resource area. However, some core drill holes targeted the Hanging Wall Basalt Zone (Part of F2 Gold Zone) between 1984 and 1987 and have been used for geology and resource modelling.

10.2 Drilling by Rubicon

Since 2002 and up to December 31, 2018, Rubicon has completed 602,901 m of core drilling (265,224 m of surface drilling and 337,677 m of underground drilling) on the Phoenix Gold Project. Included in the total is 25,257 m of directional drilling, wedged from pilot holes to conserve drilling on deep targets, as well as 6,530 m of geotechnical drilling to inform mine development plans or provide mine services. This drilling is tabulated in Table 10-1, by location and year completed. Of the total drilling, 533,859 m were drilled to target the F2 Gold Zone.

Since the 2013 Mineral Resource Statement (SRK, 2013b), infill and step-out drilling focused on the resource areas, testing the northern and southern extensions of the gold mineralization to assist with preparing trial stoping development in the core of the F2 Basalt Zone, and to investigate the crown pillar. Between November 1, 2012 and November 1, 2015, Rubicon drilled 429 drill holes (94,575 m) (SRK, 2016).

There was no diamond drilling in 2016. With the 2017 restart of the Phoenix Gold Project, Rubicon undertook an ambitious underground exploration drilling campaign with 28,995 m of NQ oriented core drilled primarily on 244 m Level, 305 m Level, 610 m Level, and 685 m Level. Of the total metres drilled in 2017, approximately 3,500 m was structural core drilling, and this was to provide information to update the structural interpretation of the mineralized zones. The remainder of the metres was used for to provide additional information to update the Mineral Resource which was completed in early 2018 (Golder, 2018b).

In 2018, Rubicon continued its underground drilling program, comprising a total of 20,159 m of NQ oriented core from the 244 m Level, 305 m Level, 610 m Level, and 685 m Level (Figure 10-1), to October 15, 2018 (drilling cut-off date for this report). This infill drilling is being used to update the current Mineral Resource, reported herein.

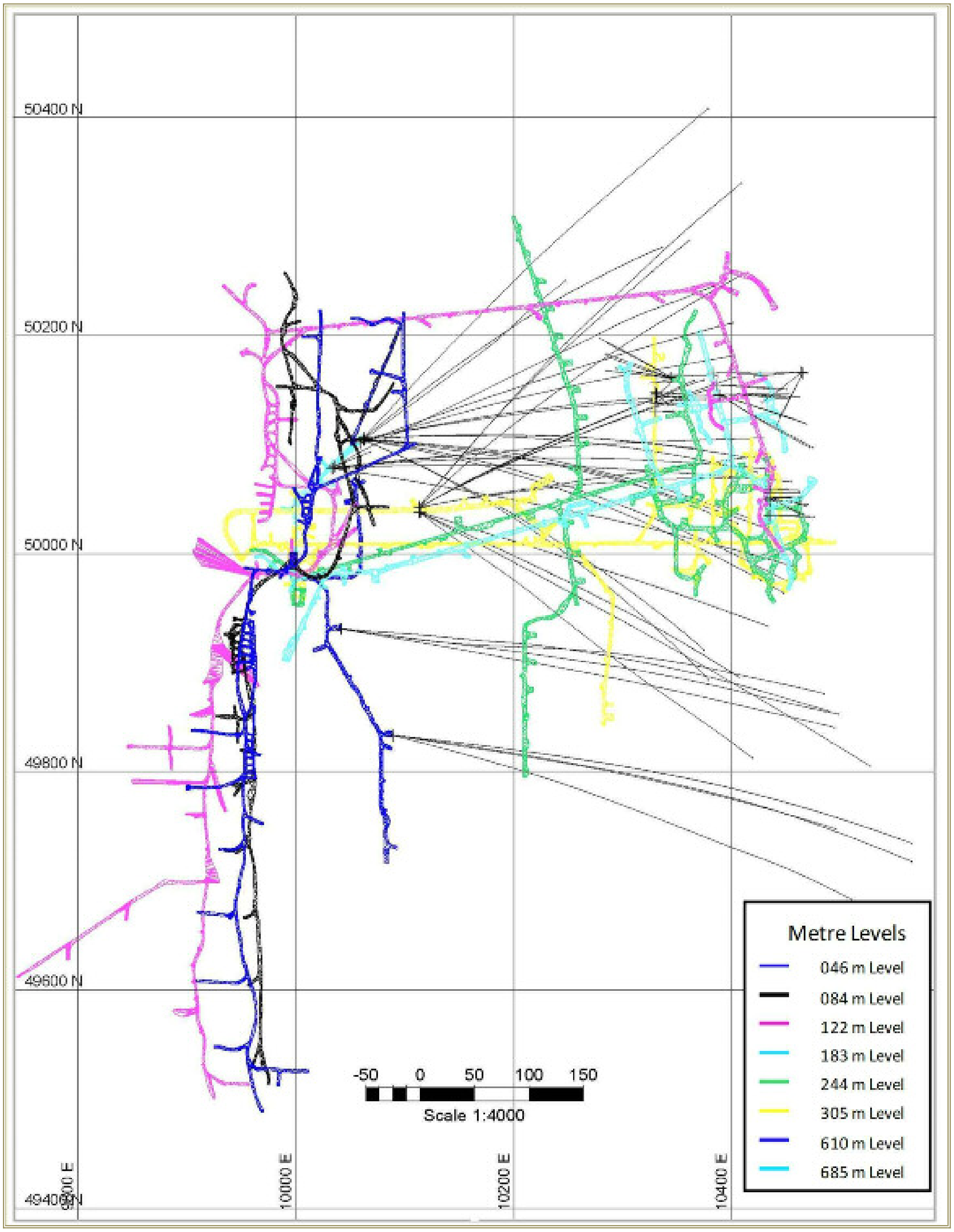


Figure 10-1: 2018 Diamond Drilling—Plan View Top Grid North (Source: Rubicon, 2019)

Table 10-1 summarizes the surface and underground drilling on the Phoenix Gold Project.

Table 10-1: Summary of All Drilling on the Phoenix Gold Project to December 31, 2018

Year	Surface Holes		Underground Holes		Geotechnical Holes[1]		Total Holes	
	Count	Metres	Count	Metres	Count	Metres	Count	Metres
2002 – 2005	188	42,189	-	-	-	-	188	42,189
2006	11	1,614	-	-	-	-	11	1,614
2007	23	13,004	-	-	-	-	23	13,004
2008	65	46,199	-	-	1	593	65	46,199
2009	68	43,500	42	25,511	-	-	110	69,011
2010	73	56,334	209	83,748	-	-	282	140,082
2011	7	6,746	333	73,752	-	-	340	80,498
2012	94	39,688	42	18,314	7	1,129	136	58,002
2013	-	-	6	916	6	916	6	916
2014	39	5,966	214	42,329	28	2,410	253	48,295
2015	23	9,984	285	40,809	2	431	308	50,793
2016	-	-	-	-	-	-	-	-
2017	-	-	83	28,995	1	83	83	28,995
2018	-	-	108	23,303	-	-	108	23,303
Total	**591**	**265,224**	**1,322**	**337,677**			**1,913**	**602,901**

Note: [1]Count and metres for geotechnical drill holes are in included in the statistics under the applicable surface or underground category. Meterage reported for wedged drill holes does not include the overlapping portion from the parent hole.

The majority of core drilling by Rubicon has targeted areas outside of the historical McFinley Red Lake Mines area that were historically perceived to have exploration potential. Key target areas on the Phoenix Gold Project are presented in Figure 9-1.

The distribution of the surface drilling targeting the F2 Gold Zone is shown in Figure 10-2. Surface drilling was completed generally along east-west sections. However, drill hole azimuth and plunge varied widely because much of the drilling was completed on the lake using a barge or on winter drill platforms. Surface drilling completed to November 1, 2012 improved the definition of the gold mineralization at a drill hole spacing of approximately 50 m or better, locally. Underground drilling targeted the gold mineralization from the 122 m Level, 183 m Level, 244 m Level, and 305 m Level along east-west sections (normal to interpreted trace of the gold mineralization). Given the limited underground drilling stations available, fan drilling was necessary to target north, south, and depth extensions of the interpreted gold mineralization. The additional underground drilling reduced the spacing between drill holes in the core of the F2 Gold Zone to approximately 10 m or less (Figure 10-3).

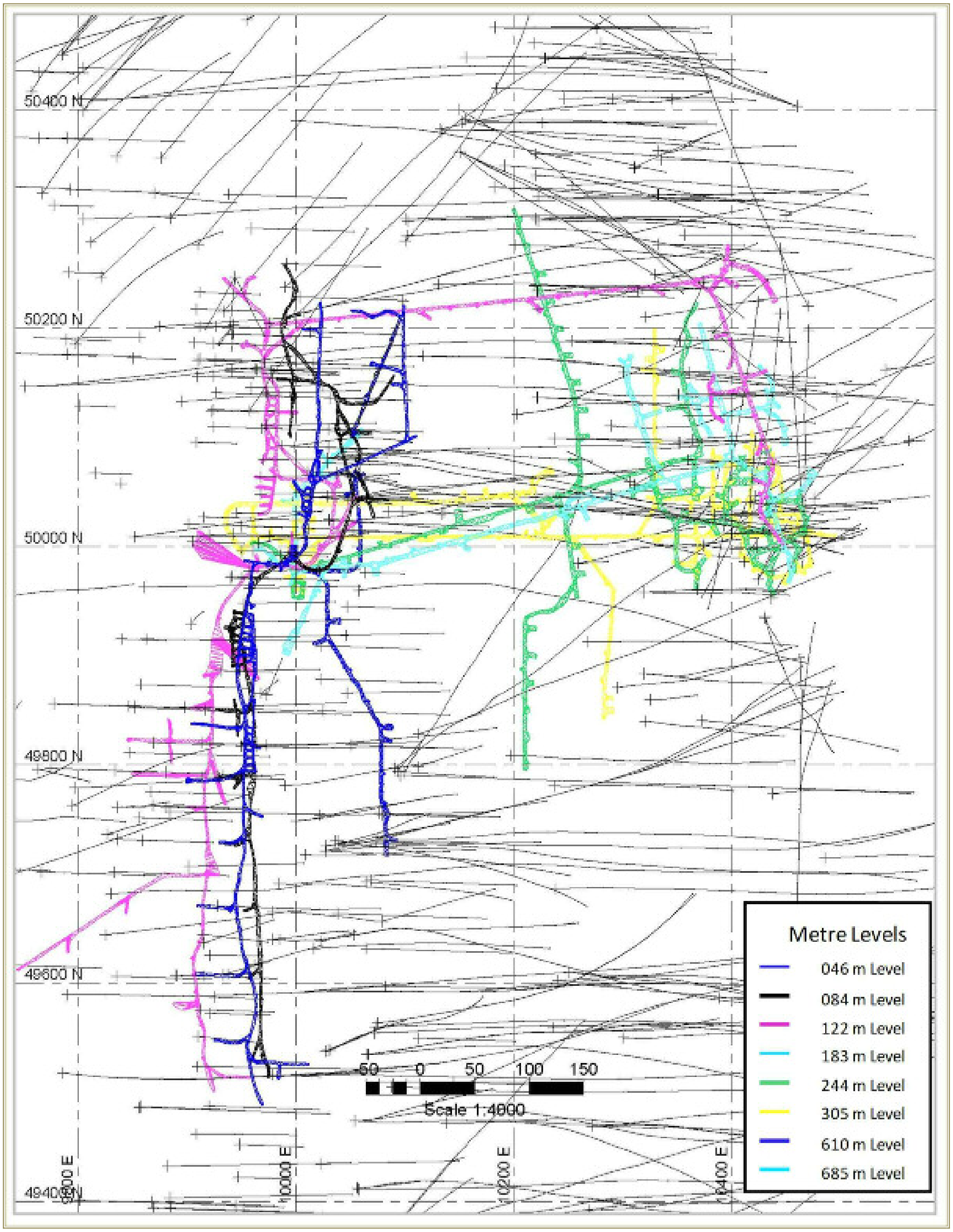


Figure 10-2: Diamond Drilling – Holes Drilled from Surface Locations, Plan View (Source: Rubicon, 2019)

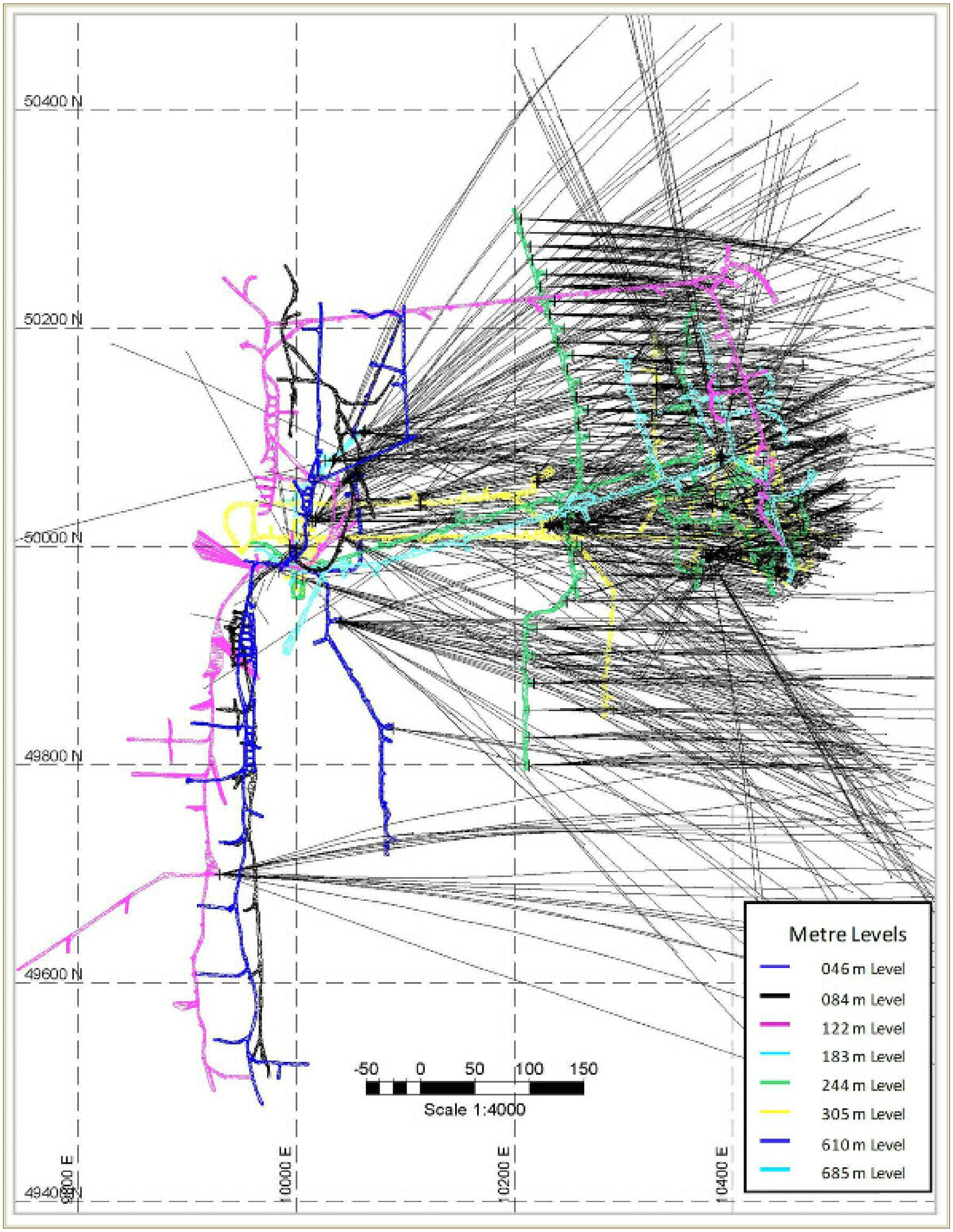


Figure 10-3: Diamond Drilling – Holes Drilled from Underground, Plan View (Source: Rubicon, 2019)

In 2011, 340 core drill holes were drilled (80,498 m), including 6,746 m from surface and 73,752 m from underground. Underground core drilling was conducted on the 305 m Level, from seven separate drill stations, 305-02 through 305-08. Most of the drilling was focused on the F2 Gold Zone with a number of drill holes testing the extension of the zone along strike (Figure 10-3).

The 2011 drilling campaign continued to define the northeast-trending F2 Gold Zone mineralization associated with silicification, quartz veining, and strong alteration within, and adjacent to, favourable host rock types. Gold mineralization also occurs in northwest-trending structures that are generally confined within, or immediately adjacent to, northeast-trending bounding geological units and parallel to the regional F2 fold trend direction. Typically, this mineralization occurs as local quartz veining and brecciation.

In 2012, 126 drill holes (58,527 m) were drilled up to November 1. Underground core drilling was conducted from the 305 m Level, 244 m Level, and 122 m Level, from four separate drill stations (305-02, 305-03, 244-09, and 122-03). Surface drilling was carried out on the ice during the winter months, as well as from land. The drilling was focused on the up-plunge extension of the F2 core zone as well as a series of deep targets. Although the main focus of the 2012 drilling campaign was infill, it also expanded the known strike length of the system by 71 m and the depth by 105 m.

In 2013, six underground geotechnical core drill holes were completed (916 m) to test the lower area of the shaft.

The 2014 to 2015 drilling program on the F2 Gold Zone focused on testing the gold mineralization along strike, north and south of the core area of drilling, and to assist with planning the test mining areas (Figure 13-4). An exploration drift was developed on the 244 m Level parallel to the main zone of gold mineralization. The program was completed with 25 m spaced pierce points both vertically and horizontally throughout. The program was designed to test between 5,248 m elevation to 4,943 m elevation (122 m Level to 427 m Level), targeting the High-Ti Basalt units. Phase two of the program was designed to infill, where needed, to 12.5-m spacing. Drilling along the northern portion of the deposit identified several higher-grade targets. Drilling in the far southern portion of the F2 Gold Zone confirmed the extension of the High-Ti Basalt with gold mineralization showing that the gold system is open to the south.

In 2015, Rubicon also drilled 21 surface core drill holes (9,553 m) targeting historical high-grade drilling results on the Carbonate Zone (CARZ – refer to Figure 9-1 for location). In 2016, no diamond drilling was conducted.

There was no Diamond drilling program in 2016. For the 2017 drilling program, 27,475 m of underground NQ-sized core was drilled on 244 m Level, 305 m Level, 610 m Level, and 685 m Level as shown in Figure 10-1. The exploration focused on the down-dip / down-plunge extensions of the known F2 Basalt Zone, West Limb Basalt Zone, and Hanging Wall Basalt Zone units. Of the drilling completed in 2017, approximately 3,500 m drilling program targeted E-W oriented structures on 244 m Level and 305 m Level by drilling generally grid N-S oriented holes, and another 1,356 m were drilled on the McFinley zone, to capture structural geology information.

All of the core in 2017 was drilled as "oriented core" using the Boart-Longyear TruCore™ tool, in order to obtain true Alpha and Beta angles on structures and veining. In addition, approximately 10,000 m of previously logged core was re-logged to verify previous lithological, mineralization, and structural interpretations.

The 2018 drilling program continued many of the efforts begun in 2017. A total of 20,159 metres was drilled underground in 101 drill holes with NQ-sized core. Drilling was from the 183 m Level, 244 m Level, 305 m Level, 610 m Level, and 685 m Level. The targets for the 2018 underground drilling were the F2 Basalt Zone, West Limb Basalt Zone, and Hanging Wall Basalt Zone units for the purpose of upgrading the resource classification.

All of the core in 2018 was drilled as "oriented core" using the Boart-Longyear TruCore™ tool, in order to obtain true Alpha and Beta angles on structures and veining.

10.2.1 Drilling Procedures

All proposed land and ice drill hole collars were surveyed with a handheld global positioning system (GPS) instrument with an accuracy of ±3 m. Two foresight pickets were also surveyed, and drills were set up under the direct supervision of a Rubicon geologist or geological technician. Collars for barge drill holes were also surveyed with a handheld GPS instrument and then marked with a buoy; the same foresight procedure was carried out. Changes in actual drill hole location from planned locations, due to local ice conditions or other technical reasons, were noted with the true easting and northing coordinates. Final collar locations were surveyed with a differential GPS unit (sub-metre accuracy) and recorded in the database. All surveys currently use the mine grid, which lies at an orientation of +45 degrees to the UTM grid.

The majority of the core drilling performed prior to 2013 was carried out by Hy-Tech Drilling of Smithers, British Columbia using Tech-4000 diamond core drills both from surface (on land, ice or barge) having a depth capacity of 2,500 m, and from underground having a depth capacity of 1,500 m. Layne Christensen Canada Limited of Sudbury, Ontario was also contracted to complete deep drill holes using their skid-mounted CS 4002, which has a depth capacity of 2,500 m. Orbit Garant Drilling of Val-d'Or, Quebec was contracted to complete underground drilling using either a B-20 or Orbit 1500, which have a depth capacity of 1,500 m. Each drilling program was supervised by a Rubicon geologist. In general, NQ (50.8 mm diameter) or NQ (47.6 mm diameter) core was drilled.

From 2013 to 2015, Boart Longyear was the drilling contractor. Boart utilized LM 75 electric drill rigs that have the ability to drill a 1,000-m hole at various core sizes. Boart Longyear also had several air powered drills, used for close proximity definition drill holes. All drilling was supervised by a Rubicon geologist. Drilling was completed with NQ (47.6 mm core diameter), BQTK (40.7 mm core diameter), or AQTK (35.5 mm core diameter) size core.

For the 2017 and 2018 drill program and continuing into 2019, Rubicon contracted with Boart Longyear for underground exploration drilling, utilizing two LM90 electric drills to core NQ (50.6 mm core diameter) core. The majority of the core was oriented using Boart-Longyear's True-Core tool to provide true alpha and beta readings. All drilling was supervised and logged on-site by Rubicon geologists and sent for assay at SGS Labs Red Lake.

Casing for drill holes collared on land were left in place, plugged, cemented, and covered with aluminum caps with the drill hole number etched or stamped into the cap. Prior to 2012, drill holes that were drilled from the ice or barge were plugged with a Van Ruth plug at 30 m down the drill hole from the base of the casing, and then cemented to the top of the drill hole. All casing was removed from these drill holes. Since January 2012, all drill holes drilled from the ice or barges were cemented from the bottom of the hole to the base of the casing. All drill holes drilled from underground were purposely left un-grouted if the drill hole produced water at a rate of less than 5 L/min. If the drill hole produced water at a rate greater than 5 L/min, the hole was pressure grouted from the bottom to top and sealed with a Van Ruth grout plug.

10.2.2 Collar and Down-Hole Survey

For the 2017 to 2019 drilling programs, Rubicon utilized the Boart Longyear Devi-Shot downhole survey instrument measuring azimuth, inclination, magnetic field strength, and temperature at 30 m intervals. All collars were surveyed by Rubicon surveyors, and a select set of holes were Gyro surveyed by Reflex Instruments contractors until February 2018 to verify the downhole survey results. In October of 2018, SurveyTECH of Timmins, Ontario was contracted to train Boart Longyear personnel in proper procedures to conduct gyro surveys for all remaining holes drilled in 2018. Subsequently, Boart Longyear has been conducting a gyro survey immediately upon completion of each diamond drill hole.

Rubicon discovered an error with underground core drill hole collar locations. In April 2013 and in January 2015, Total Precision Survey (TPS), using a gyro and plumb-bob, corrected the vertical reference line (survey control points at the shaft) resulting in both a translation and rotational shift to the underground excavations from the old survey to the new survey. The collars for many underground holes required correction due to an adjustment of the underground survey control points. The TPS work in 2013 and in 2015 resulted in a shift/rotation of the 84 m Level, 122 m Level, 244 m Level, and 305 m Level. The result was that all drill holes surveyed after April 2013 had the "corrected" mine grid coordinates, while holes surveyed prior to April 2013 (mostly on 305 m Level) had "uncorrected" mine grid coordinates. The shift in the corrected collar coordinates ranges from approximately 0.25 m to 3.0 m.

Rubicon performed a check "closed loop" survey on the 122 m Level, 244 m Level, and 305 m Level, to confirm accuracy and correct the location of the underground excavations. The closed loop survey data was verified by TPS and an Ontario Land Surveyor to be within first and second order accuracy in November 2015.

11 SAMPLING PREPARATION, ANALYSIS, AND SECURITY

11.1 Sample Preparation and Security

Since 2002, upon arrival at the core storage facility, the core was washed, core orientation and measurements were performed (when applicable on oriented core), it was visually logged, and it was marked up and tagged for sampling. Downhole depths, geological and structural features, and sample locations were marked on the core using china markers. Since March of 2017, detailed structural data from oriented drill core was collected to enhance geological modelling. The logging of oriented drill core involved collection of alpha and beta angles for each structural feature, relative to an orientation line scribed along the bottom of the drill core. The location of the orientation line was placed based on Boart Longyear's TruCore™ drill core orientation system and was only scribed on sections of core where there was high confidence in both the initial orientation mark and the interlocking quality of the core segments within and between sequential coring runs, per procedures described in Phoenix Gold Project Supplemental Core Logging Protocol (Golder, 2017).

Since 2007, digital photos have been taken of the core to preserve a digital record of all drill core on the Phoenix Gold Project. Until 2017, the digital photos were taken of the core before logging was completed, using a hand-held camera from an elevated position over the core logging table. At the edge of each photo, a small whiteboard was included recording the drill hole identification, down hole depth range, and date of the photo. The photos typically captured 3-4 boxes of core laid out on the logging table and lightly misted with water to enhance colour contrasts in different lithological units. Since January 2017, Rubicon has utilized a customized camera stand to take the photos from a fixed 1 m height above the core table and ensured the camera angle was consistently parallel to the plane of the tabletop. The photo procedure was altered at this time such that the photos were now taken after core logging was completed, thereby preserving all notations written on the core. Detailed photos were also taken of interesting geological or structural features, when warranted.

All sampling was performed by Rubicon geologists or consultants/contractors, under the supervision of both internal QPs and reviewed/monitored by external QPs. Samples were moved directly from the core shack to the cutting shack, where sampled intervals were cut in half and placed in plastic bags for submission to an assaying facility.

From 2002 to 2014, approximately 10 individually bagged samples were placed in a large rice bag that was sealed with a security zip tie containing a uniquely numbered tamper-proof security seal. From 2002 to 2007, samples were shipped by courier to either ALS Minerals or Accurassay in Thunder Bay. Since 2008, samples were delivered directly from the mine site to the SGS Canada Inc. (SGS) laboratory in Red Lake by Rubicon staff. Each sample number and security seal was recorded and then verified by SGS with a written acknowledgment upon receipt.

In 2014, the core shipping procedure was streamlined. Core samples were cut and individually packaged for shipping, as before. Rubicon sampling personnel then sorted and placed the core samples in a larger shipping crate, allowing more samples to be shipped with fewer chain-of-custody forms. Generally, all samples from an individual drill hole would be placed in a crate, sealed with a tamper proof security seal and delivered to the lab by Rubicon personnel. Each sample number and security seal was recorded and then verified by SGS with a written acknowledgment upon receipt.

In 2017, the core shipping procedure was modified such that individual shipments no longer comprised all samples from an individual drill hole. Instead, shipments were dispatched strictly in sequential sample tag order, in lots of 75 samples, each of which correlated to three complete QC batches and one complete lab furnace batch. Generally, three lots of 75 samples were included in each shipment. The implementation of smaller lab batches resulted in faster turnaround times on assay results and improved tracking and correlation between QC samples and affected core samples.

Analytical protocols were developed in 2003 and revised in 2009 and 2011 in consultation with Barry Smee, PhD, P.Geo., an independent geochemist (Smee, 2009b and 2011).

Individual samples received by the laboratory typically ranged from 0.5 to 2 kg in mass. When necessary, samples were dried prior to any sample preparation in the laboratory. The entire sample was crushed to 2 mm in an oscillating steel jaw crusher and either an approximate 250 g split, or, in the case of metallic screen fire assay, the whole sample was pulverized in a chrome steel ring mill. The coarse reject and residual pulp materials were bagged and returned to the Phoenix site for secure storage. Prior to 2009, the samples were crushed to 90% -8 mesh, split into 250 g to 450 g subsamples using a Jones Riffle Splitter and subsequently pulverized to 90% -150 mesh in a shatter box using a steel puck. Silica cleaning between each sample was also performed to prevent any cross-contamination. All samples were sent for fire assay and the pulps remained on-site.

Beginning in October 2009, new sample preparation protocols were implemented in accordance with recommendations from Smee (2009a). These included crushing the samples to 85% -2 mm before taking a 500 g split for pulverization. The subsample was then pulverized to 95% -150 mesh, from which a 50 g split was taken for fire assay analysis. Silica cleaning between each sample was also performed to prevent any cross-contamination. All samples were sent to an external lab for fire assay and the pulps remained on-site.

Since 2017, sample pulps selected for umpire check assay analyses were sorted at the Rubicon core site and shipped via courier in security-tag sealed containers to Activation Laboratories Ltd. (Actlabs) facility in Thunder Bay, Ontario for analysis. Sample manifests, listing the sample numbers were emailed to the lab, prior to shipping, and a receipt of the samples was received for each shipment, with confirmation that the security seals were intact upon delivery. Blank, duplicate and Certified Reference Material (CRM) samples from the original testing were included in the suite of umpire check assay samples, as well as additional sealed packets of CRMs to ensure laboratory bias checks were unaffected by any potential preparation contamination at the original lab.

The logged and sampled core is securely stored at the Project site and as well as in a secured storage yard in Cochenour surrounded by a six-foot high chain link fence with a padlocked gate. There is only one road into the mine site, which has a gate with 24-hour security and restricted access. The pulps and rejects were returned from SGS and are securely stored on the Project site for long-term storage.

11.2 Sample Analyses

Since 2002, Rubicon has used three primary independent analytical laboratories for gold analysis on the Phoenix Gold Project. From 2002 to 2007, samples were sent to either the ALS Minerals (ALS) preparation laboratory in Thunder Bay, Ontario, or its analytical laboratory in Vancouver, British Columbia, or to Accurassay Laboratories (Accurassay), Thunder Bay, Ontario. From 2008 to 2018, samples were submitted to SGS Minerals in Red Lake, Ontario for preparation and analysis. From January 2010 to October 2012, and in 2014 and 2015 (no samples were taken in 2013), umpire check assays were conducted by ALS and Accurassay, respectively. Rubicon Lab and Actlabs, the latter of which is independent, were utilized for a small portion of assaying on the project; the former for analysis of production geology and mill related process samples in 2015, and the latter for umpire check assays since 2017.

The four commercial laboratories are accredited to ISO/IEC Guideline 17025 by the Standards Council of Canada for conducting certain testing procedures, including all the procedures used by Rubicon to prepare and assay for gold. Although the Rubicon Lab was not accredited, the quantity of drill hole data from this lab was not considered by the QP to be material and was accepted for resource estimation.

Dr. Barry Smee, P.Geo., Consulting Geochemist, audited the sample preparation facilities of SGS in Red Lake, Ontario on behalf of Rubicon in 2009 and 2011. Recommendations from his audit were provided to SGS and corrective measures were implemented (Smee, 2009b and 2011).

11.2.1 ALS Minerals (From 2002 – 2007)

Beginning in 2002, sample preparation was completed at ALS in Thunder Bay, and the pulps were shipped to ALS in North Vancouver, BC for analysis. Gold concentrations were determined by fire assay fusion of a 50 g subsample with an atomic absorption spectroscopy (AAS) finish, as the standard analytical procedure.

The gold-metallics assay, also known as screen fire assaying, required 100% pulverization of the sample and screening of the sample through a 150 mesh (100 µm) screen. Material remaining on the screen was retained and analyzed in its entirety by fire assay fusion followed by cupellation and a gravimetric finish. The -150 mesh (pass) fraction was homogenized and two 50 g subsamples were analyzed by standard fire assay procedures. In this way, the magnitude of the coarse gold effect can be evaluated via the levels of the +150 mesh material.

Representative samples for each geological rock unit and, generally, at least one sample every 20 m, were selected for four-acid digestion followed by multi-element assaying using inductively-coupled plasma atomic emission spectroscopy (ICP-AES). Copper, lead, and zinc values exceeding ICP-AES limits were re-assayed using wet chemistry. Only a few samples were assayed for whole rock major elements using X-ray fluorescence spectrometry (XRF).

Results were reported electronically to the Project site in Red Lake and to the head office in Vancouver to multiple recipients with assay certificates filed and catalogued at Rubicon's head office in Vancouver.

Umpire check assays completed at ALS in 2010 to 2012 utilized standard fire assay procedure on a 50 g subsample. If the sample contained >10 g/t Au, it was re-assayed with a gravimetric finish.

11.2.2 Accurassay Laboratories (From 2002 – 2007, 2014 – 2015)

Gold was determined by fire assay using a 30 g fire assay charge. This procedure used lead collection with a silver inquart. The beads were then digested and an AAS or ICP-AES finish was used. All gold assays >10 g/t were automatically re-assayed by fire assay with a gravimetric finish. A Sartorius micro-balance was used with a sensitivity of 1 microgram (six decimal places) corresponding to 5 parts per billion (ppb) detection limit.

Screen metallics analyses included the crushing of the entire sample to 90% -10 mesh and using a Jones Riffle Splitter to split the sample to a 1-kg subsample. The entire subsample was then pulverized and subsequently sieved through a series of meshes (80, 150, 200, 230, 400 mesh). Each fraction was then assayed for gold (maximum 50-g). Results were reported as a calculated weighted average of gold in the entire sample. Core samples were also assayed for a suite of 32 trace elements using a multi-acid digestion followed by ICP-AES. As with ALS, results were reported electronically to the Project site in Red Lake with assay certificates filed and catalogued at Rubicon's head office in Vancouver.

For the umpire check assays from 2014 to 2015, gold was determined by fire assay using a 50 g fire assay charge. If the sample contained >10 g/t Au, it was re-assayed with a gravimetric finish.

11.2.3 SGS Mineral Services (From 2008 – 2018)

At SGS, prior to 2009, gold was analyzed using the fire assay process on a 30 g subsample. If the sample contained >10 g/t Au, it was re-assayed using a gravimetric finish. Starting in October 2009, the subsample size was increased to 50 g on the recommendations of Smee (2009a). All gold assays >10 g/t were automatically re-assayed with gravimetric finish.

Beginning September 2018, samples from well-mineralized intersections of High-Ti Basalt were selected for metallic screen analysis at SGS, to allow for assaying results relative to coarse gold. This analysis allows for the determination of both coarse and fine material after the screening process and can benefit in understanding the grade distribution locally. Samples to be analysed by this method were selected by the logging geologist based on mineralization observed during core logging. Samples generally ranged from 0.5 to 1.0 m in length, and 1 to 2 kg in weight. Upon receipt at the lab, samples were dried then crushed to achieve a nominal sample size (~9 mesh). Samples were then split using a 14 slot, ¾ inch splitter that divides the sample into two portions. One portion was reserved as a “reject” portion in the event that a re-assay was required due to a QC failure. The other portion was pulverized then screened using a Ro-tap assembly to 106 µm. The entire plus fraction was submitted to the lab for analysis to extinction. Two 50 g-aliquots were riffled from the minus fraction and submitted for analysis. Final assays were weight ratioed back to the representative sample weight. All fractions were analysed by fire assay with a gravimetric finish. All analyses and weight fractions were reported.

A select suite of sample pulps was also assayed for a suite of 50 trace elements by the SGS Laboratory in Toronto, Ontario, using a multi-acid digestion and ICP-AES.

Until 2014, results were reported electronically to the Project site in Red Lake and to the head office in Vancouver to multiple recipients with assay certificates filed and catalogued at Rubicon’s head office in Vancouver and added to the master Microsoft Access database stored on the Vancouver and Red Lake servers. Subsequent to closure of the Vancouver office, all data is currently stored on servers located in Toronto and Red Lake.

In 2014, the database management was moved from Vancouver to the Project site. Approved assay certificates from SGS were received at Rubicon Red Lake site in digital format since that time.

11.2.4 Rubicon Assay Laboratory (2015)

In 2015, Rubicon purchased and operated an assay laboratory located in Balmertown, Ontario, approximately 8 km from the Phoenix Gold Project. This laboratory processed all production geology and mill related processing samples. A total of 1,894 samples from 63 production-related Bazooka drill holes and 1,566 chip samples taken from 411 sampling locations were processed at this lab. Gold concentrations were determined by fire assay fusion of a 30 g subsample with an AAS finish as the standard analytical procedure. Currently, this assay lab is closed, and all assaying is outsourced.

11.2.5 Actlabs (2017 – 2018)

For the umpire check assay samples analyzed at Actlabs, gold was analyzed by fire assay with AAS finish on a 50 g charge from pulps that had previously been prepared and analyzed by SGS Lab in

Red Lake. Following the same analytical protocols as the original lab, all samples that returned a result >10 g/t Au were automatically repeated by fire assay with gravimetric finish.

11.2.6 Handling of Multiple Assay Values for One Sample

In cases where multiple assays were completed on an individual sample, gold values produced by the metallic fire assay were deemed to supersede fire assay gold values owing to the larger size of the sample analyzed and/or the better reproducibility in samples with coarse gold. When samples were analyzed multiple times by the same method (i.e., duplicate or umpire check assay analyses), the original assay was incorporated in the model. Replicate analyses were used only as QC checks to validate the original result.

11.2.7 Data Management

Data are verified and double checked by senior geologists at site for data entry verification, error analysis, and adherence to strict analytical quality control protocols. Drill hole data collected from 2009 to 2014 was managed by ioGlobal Pty. Ltd. (ioGlobal) and reviewed for quality assurance and quality control. In 2014, database management was returned to the Phoenix site, under the supervision of Rubicon.

11.3 Sample Analyses of Metallurgical Test Work

11.3.1 G&T Metallurgical Services

Metallurgical testwork was completed at the G&T Metallurgical Services Ltd. (G&T) facility in Kamloops, British Columbia. Gold was measured by fire assay method using a 30 g assay charge. When requested, metallic sieve preparation method was also used. Although not accredited, the laboratory has a complete written procedure and participates in a Proficiency Testing Program accredited by the Standards Council of Canada. This facility also performed assays for iron and arsenic content using a multi-acid digestion and ICP-AES method, and assays for sulphur and carbon by combustion furnace.

G&T also performed different metallurgical testing for the characterization of the mineralized material. All tests performed were done using industry recognized methods for the testwork. In 2013, the facility was visited by Soutex personnel (SRK, 2013b). Soutex noted that the facility has well-documented controlled procedures for all types of testing. The quality management includes ISO-9001 accreditation.

11.3.2 ALS Minerals

All the assays related to the treatment of the bulk samples were processed at SMC (Canada) Ltd.'s (SMC) McAlpine mill in Cobalt, Ontario during the summer and fall of 2011 were sent to ALS accredited laboratories. Gold assays were done with fire assay on a 30 g assay charge. All head grade samples and tailings samples were prepared with screen metallic sieve preparation done on the whole received sample. All gold concentrate samples were assayed without screen metallic sieve preparation. The samples were expedited and received at the Val d'Or ALS facility and the assays were performed in ALS laboratory in North Vancouver. A series of blank, duplicate and CRM samples were also sent to the laboratory for quality control. No further metallurgical testing has been completed since the mill start-up in 2015.

11.4 Specific Gravity Data

The specific gravity database includes 6,666 records generated by Rubicon from measurements on core from 470 drill holes (Table 11-1). Specific gravity measurements were taken from representative core sample intervals (approximately 0.1 to 0.2 m in length). Specific gravity was measured using a water dispersion method. The samples were weighed in air, and then the uncoated sample was placed in a basket suspended in water and weighed again. Table 11-1 summarizes the measurements by rock type.

Table 11-1: Specific Gravity Data by Lithology Type

			Specific Gravity			
Rock Code	**Description**	**Count**	**Average**	**Std. Dev.**	**Minimum**	**Maximum**
E1H	High-Ti Basalt	1,396	2.96	0.10	2.20	3.72
E0T	Talc rich unit	1,600	2.90	0.05	2.61	3.15
I3	Felsic intrusive rocks	847	2.67	0.07	2.36	3.08
E0	Ultramafic flow	1,264	2.92	0.08	2.50	3.76
E0B	Komatiitic basalt	370	2.98	0.07	2.61	3.24
E1A	Basalt	198	2.89	0.09	2.67	3.54
AGZ	Altered Green Zone	97	2.93	0.09	2.69	3.20
Other	Other	894	2.88	0.12	1.85	3.45
Total		**6,666**				

Note: Std. Dev. = standard deviation

In 2017, a suite of samples was selected for specific gravity testing at Actlabs, to confirm the measurements taken by Rubicon. Sample pulps were shipped to Actlabs and analyzed using method RX17 for specific gravity on pulp, which is measured using the relative volumes of solids to water and air in a given volume. The 2017 specific gravity results and the difference from 2016 values are summarized in Table 11-2. The results for High-Ti Basalt were further subdivided into unmineralized (unmin: <2.99 g/t Au), low-grade (low: 3.00 to 9.99 g/t Au) and high-grade (high: >10 g/t Au) sources (Golder, 2018b). The difference noted in the specific gravity values of Komatiitic Basalt from 2016 and 2017 measurements is attributed to the inclusion of samples in the 2017 dataset which were logged as Komatiitic Basalt but were actually mixed Komatiitic Basalt/High-Ti Basalt units.

Table 11-2: 2017 Specific Gravity from Pulps by Lithology Type (Golder, 2018b)

Rock Code	Description	Count	Specific Gravity				Difference
			Average	Std. Dev.	Minimum	Maximum	
E1H	High-Ti Basalt (overall)*	24	2.95	0.09	2.80	3.18	0.01
	**High-Ti Basalt (unmin. & low)*	*19*	*2.93*	*0.08*	*2.80*	*3.11*	
	**High-Ti Basalt (high)*	*5*	*3.02*	*0.12*	*2.85*	*3.18*	
E0T	Talc rich unit	6	2.94	0.07	2.84	3.05	-0.04
I3	Felsic intrusive rocks	1	2.62	-	2.62	2.62	0.05
E0	Ultramafic flow	0	-	-	-	-	
E0B	Komatiitic basalt	8	2.91	0.11	2.70	3.02	0.07
E1A	Basalt	0	-	-	-	-	
AGZ	Altered green zone	0	-	-	-	-	
Other	Other (V2_BX veins)	5	2.87	0.10	2.79	3.04	0.01
Total		**44**					

Notes: Std. Dev. = standard deviation. Difference = 2016 SG – 2017 SG

11.5 Quality Assurance and Quality Control Programs

Quality control (QC) measures are typically set in place to ensure the reliability and trustworthiness of exploration data. These measures include written field procedures and independent verifications of aspects such as drilling, surveying, sampling and assaying, data management, and database integrity. Appropriate documentation of quality control measures and regular analysis of quality control data are important as a safeguard for Project data and form the basis for the quality assurance (QA) program implemented during exploration.

Analytical QC measures typically involve internal and external laboratory procedures implemented to monitor the precision and accuracy of the sample preparation and assay data. They are also important to identify potential sample sequencing errors and to monitor for contamination of samples.

Sampling and analytical QA/QC protocols typically involve taking duplicate samples and inserting quality control samples (CRMs and blanks) to monitor the reliability of the assay results throughout the drill program. Umpire check assays are normally performed to evaluate the primary lab for bias and involves re-assaying a set proportion of sample rejects and pulps at a secondary umpire laboratory.

11.5.1 Rubicon Sampling 2008–2015

Rubicon monitored the internal analytical QC measures implemented by the primary laboratories it used for analysis. In addition, Rubicon implemented external analytical QC measures starting in 2008 on all sampling conducted at the Phoenix Gold Project. The analytical QA/QC program was designed and monitored by both internal and external QPs. For drill core, analytical control measures used by Rubicon consisted of inserting control samples (blank, grade-matched CRMs, and field duplicates) in all sample batches submitted for assaying. For 2015 production-related sampling, including Bazooka drill core, chip sampling, and muck sampling, the external QC measures consisted of commercially sourced CRMs only.

No drilling took place in 2013 or 2016 with associated geochemical sampling.

From 2008 to 2010, the blank samples consisted of store-bought white garden stone (quartz or quartzite). In 2010, Rubicon used material sourced from a granite boulder located near Red Lake. From February 2011 to July 2015, Rubicon used granite slab purchased from Nelson Granite in Vermillion Bay, Ontario. Beginning August 2015, locally sourced granite from Red Lake was used after submitting a number of samples to verify that it was barren in gold.

Field duplicates consisting of half core were taken from June 2009 to November 2015. Since 2017, Rubicon is submitting coarse reject duplicates only.

Twenty-nine different commercial CRMs, with various gold grades, were sourced from CDN Resource Laboratories Ltd. (CDN) to monitor sampling accuracy between 2008 and 2015. Control samples used range from 0.121 to 29.21 g/t Au (Table 11-3).

Table 11-3: Specifications of CDN CRMs Used by Rubicon on the Phoenix Gold Project between 2008 and 2015

Gold CRM	Recommended Value (g/t Au)	Standard Deviation (g/t)	Number of Samples
CDN-GS-P1	0.121	0.011	58
CDN-GS-P5B	0.44	0.02	90
CDN-GS-P7A	0.77	0.03	93
CDN-GS-P8	0.78	0.03	178
CDN-GS-10	0.82	0.05	3
CDN-GS-1J	0.946	0.051	170
CDN-GS-1H	0.972	0.054	297
ZCDN-GS-1G	1.14	0.05	91
CDN-GS-1E	1.16	0.03	1,649
CDN-GS-1L	1.16	0.05	186
CDN-GS-1P5A	1.37	0.06	16
CDN-GS-1P5B	1.46	0.06	83

Gold CRM	Recommended Value (g/t Au)	Standard Deviation (g/t)	Number of Samples
CDN-GS-1P5L	1.53	0.07	5
CDN-GS-9	1.75	0.07	123
CDN-GS-2B	2.03	0.06	77
CDN-GS-2A	2.04	0.095	5
CDN-GS-2C	2.06	0.075	243
CDN-GS-3E	2.97	0.135	107
CDN-GS-3D	3.41	0.125	180
CDN-GS-5C	4.74	0.14	1
CDN-GS-5E	4.83	0.185	1,244
CDN-GS-5J	4.96	0.21	162
CDN-GS-5A	5.1	0.135	10
CDN-GS-5F	5.3	0.18	431
CDN-GS-6A	5.69	0.24	478
CDN-GS-7A	7.2	0.3	121
CDN-GS-6	9.99	0.25	8
CDN-GS-11A	11.21	0.435	17
CDN-GS-30B	29.21	0.615	170

Control samples (including blanks, gold CRM samples, and field duplicates) were inserted every 25 samples. In addition, umpire check assays were performed on approximately 3% to 5% of samples.

In addition to in-house monitoring, analytical QC data produced by Rubicon between 2002 and 2007 was reviewed in a report by AMC (2011). Analytical QC data collected between 2008 and October 2012 was summarized and analyzed in a 2013 technical report by SRK (2013b). Analytical QC data for the drilling completed between 2014 and 2015 was reviewed and summarized in a technical report by SRK (2016). TMAC has reviewed the work completed and relied on SRK's review. Historical drill holes drilled prior to 2002 do not have known analytical QC data.

11.5.2 Rubicon Sampling 2017–2018

Rubicon monitored the internal analytical QC measures implemented by the primary laboratories it used for analysis. In addition, Rubicon implemented external analytical QC measures on all sampling conducted at the Phoenix Gold Project since the previous technical report. The analytical QA/QC program was designed and monitored by both internal and external QPs. For drill core sampling, analytical QC measures by Rubicon consisted of inserting control samples in all sample batches submitted for assaying. For most 2017-2018 production-related sampling, including chip sampling and test hole sampling, the external QC measures consisted of commercially sourced CRMs only, testing both high- and low-grade ranges. Rubicon also monitored internal laboratory blank and duplicate analyses for production-related sampling. For 2017-2018 muck sampling, Rubicon relied entirely on the laboratory's internal QC measures, with the exception of high-grade analyses, which were covered under Rubicon's blanket policy requiring the laboratory to insert a blind external CRM with all gravimetric analyses.

Blank samples were inserted to monitor sample cross contamination during the sample preparation process as well as to identify potential sample sequencing issues. The blank used in 2017-2018 consisted of locally sourced granite from Red Lake that had previously been tested to verify that it was barren in gold. Blanks were inserted a minimum of 1 per 25 samples, preferentially placed after samples expected to return higher assay values, especially when visible gold had been observed in the core. Multiple blanks were inserted in batches when numerous high-grade samples were noted by the geologist. A total of 514 blank samples were used in the new data covered in this report.

CRMs were used to monitor the accuracy of the gold assays and to check for laboratory bias when samples were sent for umpire check assays. The selection of the CRM sample in each batch was made by the geologist to match the expected grade of the samples analyzed by fire assay – AAS. Additionally, the lab was required to insert a blind high-grade standard whenever a gravimetric analysis was completed on samples that assayed >10 g/t Au by the AAS method. Seven commercial gold CRMs sourced from CDN were used in sampling on the 2017–2018 program ranging from 1.16 to 29.21 g/t Au (Table 11-4).

Table 11-4: Specifications of CDN CRMs Used by Rubicon on the Phoenix Gold Project in 2017-2018

Gold CRM	Recommended Value (g/t Au)	Standard Deviation (g/t)	Number of Samples	Number of Failures	Percent Failures
CDN-GS-1P5L	1.53	0.07	326	4	1.2%
CDN-GS-4E	4.19	0.11	79	7	8.9%
CDN-GS-6A	5.69	0.24	16	2	12.5%
CDN-GS-7F	6.90	0.21	61	3	4.9%
CDN-GS-11A	11.21	0.47	55	2	3.6%
CDN-GS-30B	29.21	0.62	55	13	24%

Replicate samples included coarse reject and pulp duplicates as a check on laboratory precision in assaying. Two replicate samples were completed in every batch of 25, one from the pulps and one from the coarse rejects. Approximately 970 replicate analyses were completed on the new data covered in this report.

Additionally, in July 2018, seven drill holes were selected for resampling of approximately 50 m continuous intercepts from each drill hole, including both mineralized and unmineralized lithological units (effectively field duplicate analyses). The remaining half of the hole was sampled, over the same intervals as the original sampling, assigned new sample identities and submitted to SGS for routine fire assay analysis. The program comprised 470 core samples, including the usual complement of CRMs, blanks, and replicate samples. Results of this sampling are discussed below.

Rubicon conducted umpire check assay programs throughout the course of the program. In 2012, 5% of the sample pulps were re-assayed by ALS. In 2015, 3% of the sample pulps were re-assayed by Accurassay (2014–2015). Since 2017, 5 to 6% of the sample pulps were re-assayed at Actlabs.

Analytical results were validated by monitoring analytical results of QC samples inserted with the routine core samples submitted for assaying. The QC data was monitored concurrently with data collection, allowing immediate resolution of any issues identified. Both internal and blind quality control samples were plotted on Shewhart control charts on a regular basis to identify outliers and trends in the control samples, which would indicate potential issues with the assay data. Paired data (replicates and umpire check assays) were analyzed using bias charts, quantile-quantile, relative difference plots, and Thompson-Howarth precision plots. Examples of the QC monitoring charts are shown in Figure 11-1 through Figure 11-5.

For the 2017–2018 drill programs, the blind CRMs (or standards) were within the range of accepted values with no significant trend or bias noted. Several examples of Shewhart control charts used for monitoring the blind standards are illustrated in Figure 11-1 and Figure 11-2. These charts record all QC samples, including blind CRM failures. Outliers were noted and explanations provided on the respective charts. All QC failures for batches having significant gold assay values were re-assayed. For batches having no significant gold values, when the CRM result failed on the low side, the core was reviewed and if no significant results were expected for the samples in that batch, a geological override was applied, and the assay values were accepted. Thirty-one of the total 592 CRM samples failed their initial assay and of these, 27 were re-assayed successfully and 4 were resolved with a geological override. In general, outliers for the blind CRMs tended to be biased toward low values. No significant cross contamination of samples was noted in the analytical process (Figure 11-3). When the blind preparation blank assayed >0.1 g/t Au cut-off, the entire batch was re-assayed from the coarse reject to obtain acceptable results. If acceptable results could not be obtained from the coarse reject, the remaining half of the core was submitted for re-assay, with a request for a silica wash after every sample through the entire preparation process. Two example internal laboratory CRM charts (Figure 11-4 and Figure 11-5) are also presented. These charts plot all CRM results, including failed CRMs that were ultimately re-assayed by the lab.

The following control charts are reported in Au ppm, note that 1 ppm Au = 1 g/t Au.

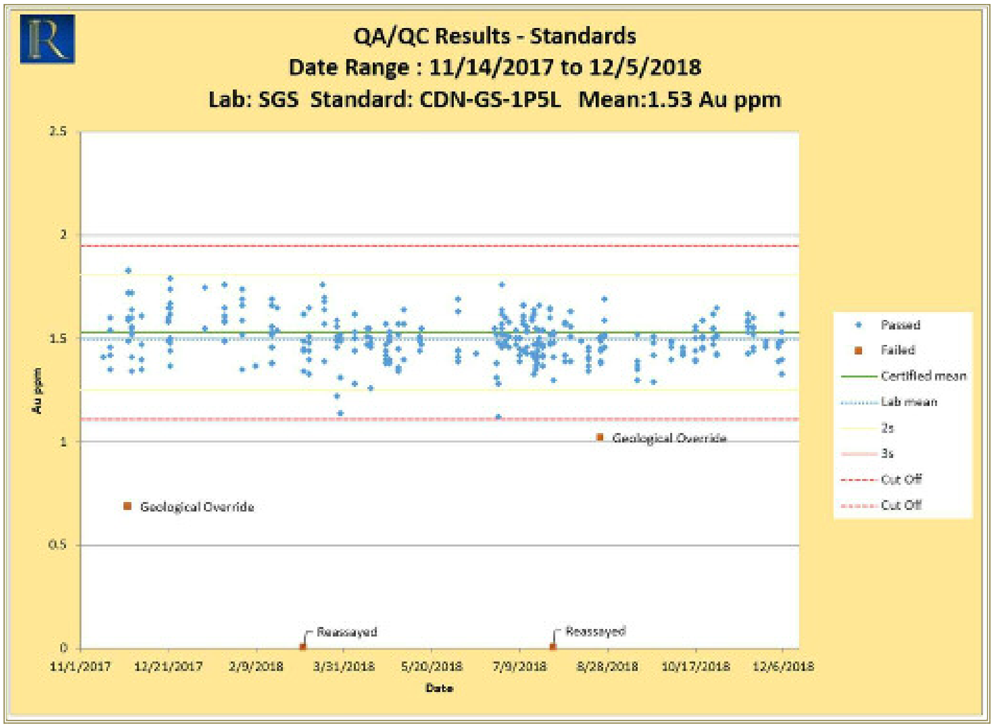


Figure 11-1: Shewhart Control Chart for CDN-GS-1P5L

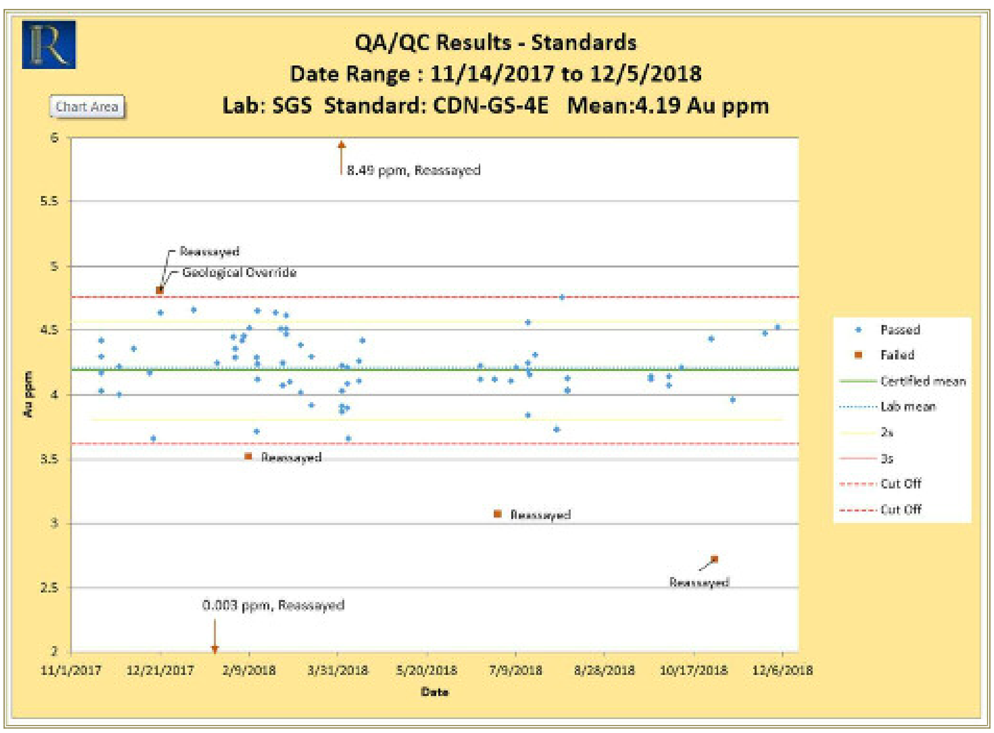


Figure 11-2: Shewhart Control Chart for CRM CDN-GS-4E

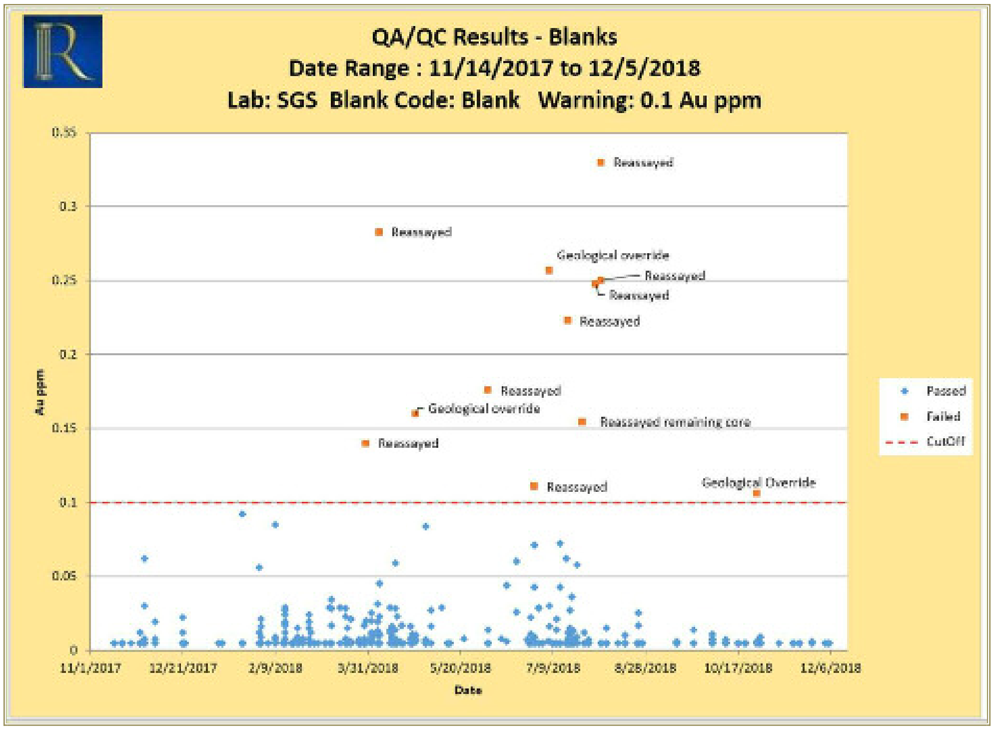


Figure 11-3: Shewhart Control Charts for Monitoring Results for Blank Samples

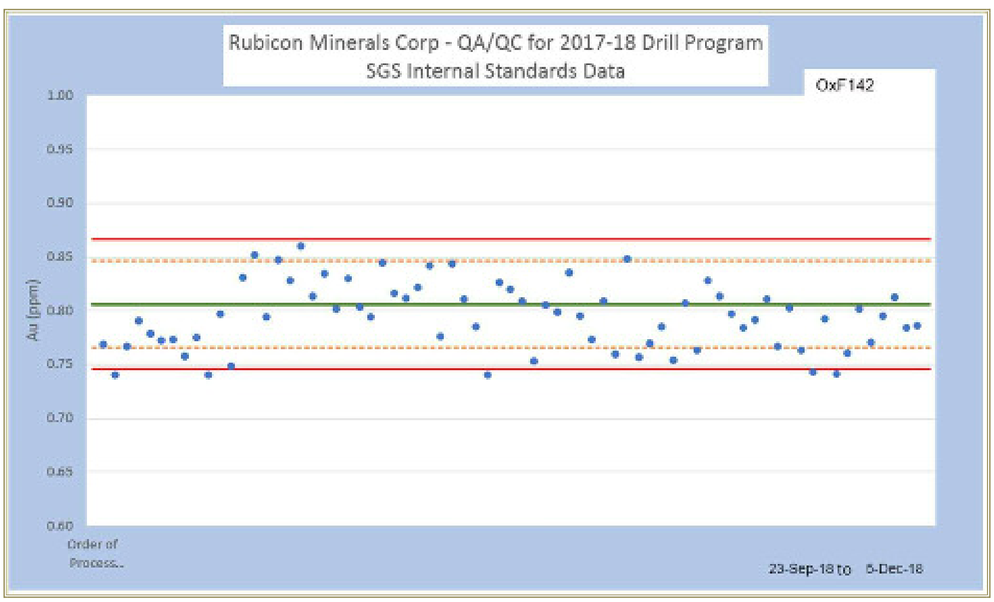


Figure 11-4: SGS Internal CRM OxF142 Processed with RMX 2018 Drill Program Samples

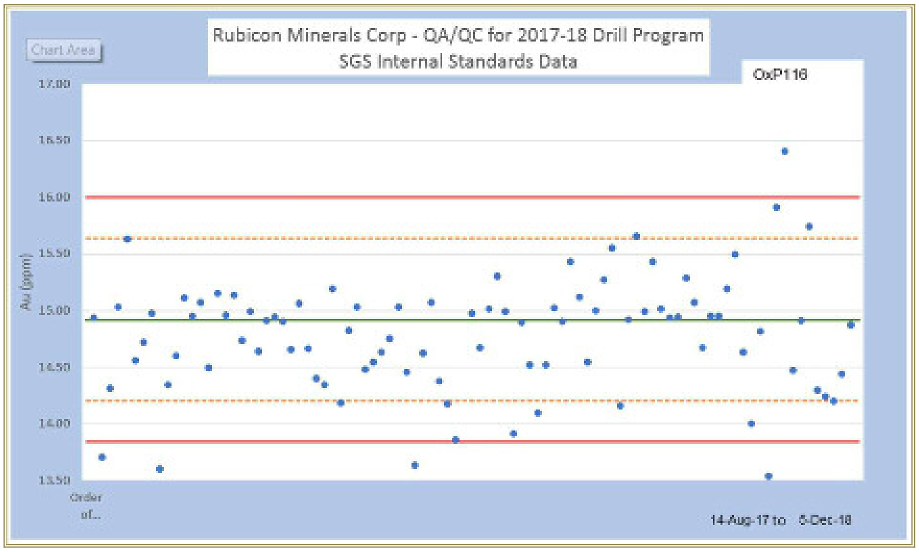


Figure 11-5: SGS Internal CRM OxP116 Processed with RMX 2017-2018 Drill Program Samples

Analytical QC failures were identified as:

- Any blank sample that reported >0.1 g/t Au
- Any CRM result that reported with a difference >3 standard deviations from the certified mean or recommended value for the standard
- More than 2 sequential CRM results that reported with differences >2 standard deviations from the certified mean or recommended value, having the same positive or negative bias.

Results were tracked in an action log as part of the standard QA/QC procedures. Failures were investigated and samples were re-assayed as required.

SGS' performance on the CRMs used in the new data covered by this report is summarized in Table 11-6.

Table 11-5 and Table 11-6.

Table 11-5: Internal Lab CRMs

Constituent	Certified Value	Absolute Standard Deviations					RSD (%)	# Used	Lab Mean	Bias (ppm[2])	Percent Bias
		1SD	2SD Low	2SD High	3SD Low	3SD High					
Fire Assay											
OxF125	0.806	0.020	0.766	0.846	0.746	0.866	2.48	433	0.793	-0.013	-1.6%
OxF142	0.805	0.019	0.767	0.843	0.748	0.862	2.36	71	0.794	-0.011	-1.4%
OxN117	7.679	0.207	7.265	8.093	7.058	8.300	2.70	12	7.471	-0.208	-2.7%

[2] The QAQC database stores gold grades in ppm rather than g/t. 1 ppm Au = 1 g/t Au

Constituent	Certified	Absolute Standard Deviations					RSD	# Used	Lab	Bias	Percent
OxN134	7.667	0.155	7.357	7.977	7.202	8.132	2.02	1	-	-	-
OxP116	14.92	0.360	14.200	15.640	13.840	16.000	2.41	88	14.72	-0.15	-1.0%

Table 11-6: Blind CRMs

Constituent	Certified Value	Absolute Standard Deviations					RSD (%)	# Used	Lab Mean	Bias (ppm)	Percent Bias
		1SD	2SD Low	2SD High	3SD Low	3SD High					
Fire Assay											
GS-1P5L	1.53	0.07	1.25	1.81	1.11	1.95	4.58	326	1.50	-0.03	-2.1%
GS-4E	4.19	0.11	3.81	4.57	3.62	4.76	2.69	79	4.22	0.03	0.6%
GS-6A	5.69	0.24	5.21	6.17	4.97	6.41	4.22	16	5.95	0.26	4.6%
GS-7F	6.90	0.20	6.08	7.72	5.67	8.13	2.97	61	6.97	0.07	1.0%
GS-11A	11.21	0.44	10.34	12.08	9.91	12.52	3.88	55	11.01	-0.20	-1.8%
GS-30B	29.21	0.62	27.98	30.44	27.37	31.06	2.11	55	28.94	-0.27	-0.9%

Scatter plots and Q-Q plots for pulp and coarse reject duplicate pairs indicate good correlation between original and duplicate assays. The Thompson-Howarth precision for the pulp and coarse reject duplicates are 12% and 19%, respectively, which is within typical ranges for Archean lode gold deposits.

The results of the resampling (field duplicate) program indicated that the correlation of results was generally good, in that the samples that returned anomalous results in the original sampling were also anomalous when re-assayed. However, the precision on the results was quite poor, evidenced by the broad scatter of data, particularly below 1.2 ppm (1.2 g/t Au), and most concerning, in the 2 to 5 ppm (2 to 5 g/t Au) range, which affects values near cut-off grade (i.e. waste to ore category boundary). Re-assay samples assaying greater than 5 ppm (5 g/t Au) tended to be biased toward the re-assay result, but this was likely due to the inherent sampling bias related to selection of samples that originally ran lower than anticipated. Because of the aforementioned bias in this dataset, precision analysis was not undertaken, as it would not be considered reliable.

Check assay results from pulps analysed at Actlabs indicated an excellent correlation with the original assay values. The linear correlation and rank correlation values of 0.99 and 0.97, respectively, confirm that the datasets are very similar. Mean values for the datasets were comparable, having a difference of only 0.07 ppm. The Thompson & Howarth precision was 10% for the entire dataset, which is within expected tolerances for pulp duplicate analyses.

11.6 Qualified Person Opinion on the Adequacy of Sample Preparation, Security, and Analytical Procedures

It is TMAC's opinion that the sample preparation, security, and analytical procedures used by Rubicon are consistent with standard industry practices and that the data is suitable for the 2018 Mineral Resource Estimate. TMAC has no material concerns with the geological or analytical procedures used or the quality of the resulting data.

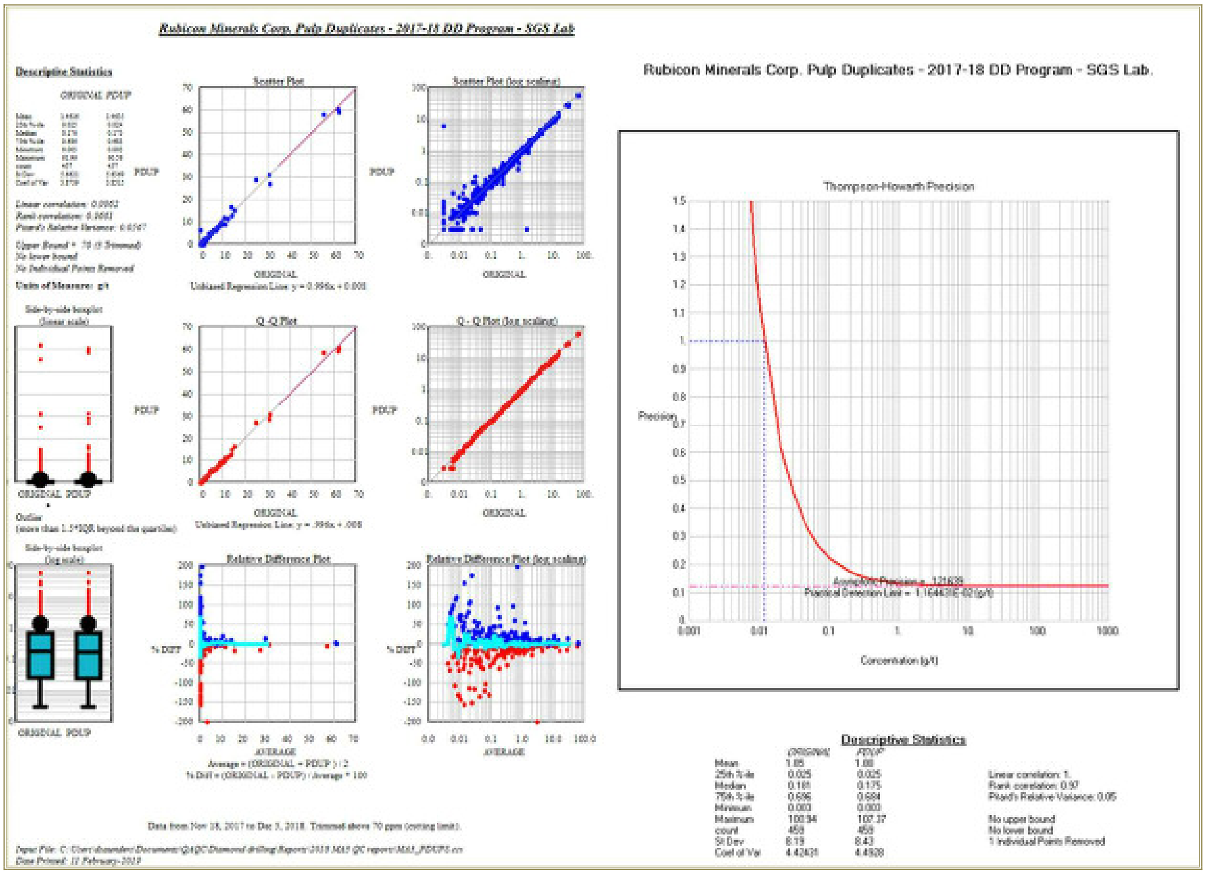


Figure 11-6: Scatter Plots, Quantile-Quantile Plots, Relative Difference Plots, and Thompson-Howarth Plots Used to Monitor Precision on Duplicate Assay Pairs for Pulp Duplicates

12 DATA VERIFICATION

TMAC conducted data verification during the update of the Mineral Resource Estimate. This included the built-in checks associated with importing data in Geovia GEMS Desktop software, random checks of database assays compared with assay certificates, and review of the QA/QC performance during the 2017–2018 drill programs (Section 11). This data verification was supported by four site visits during the past two years. Exploratory data analysis, as discussed in Section 14, was an additional component of the data verification process.

12.1 Site Visit

Tim Maunula, P.Geo., conducted four site visits to the Phoenix Gold Project:

- April 17 to 21, 2017
- June 5 to 9, 2017
- September 7, 2018
- February 18, 2019.

The site visit activities included:

- Review of surface geology, mineralization, and structures
- Underground inspection of geology, structural controls, mineralization, underground development, and active diamond drilling stations
- Review of drill hole logging, sampling, and associated QA/QC procedures
- Review of re-logging and resampling procedures for historical drilling
- Review of chain of custody from drilling to assay lab
- Confirmation of drill logs and sampling
- Inspection of the SGS Laboratory located in Red Lake.

For the most recent site visit in 2019, TMAC reviewed logging and sampling of drill hole 610L-18-06 (Figure 12-1).

No significant issues were identified during the site visits. The data collection, sampling procedures, and chain of custody were found to be consistent with industry standards and in accordance with Rubicon internal procedure documentation.

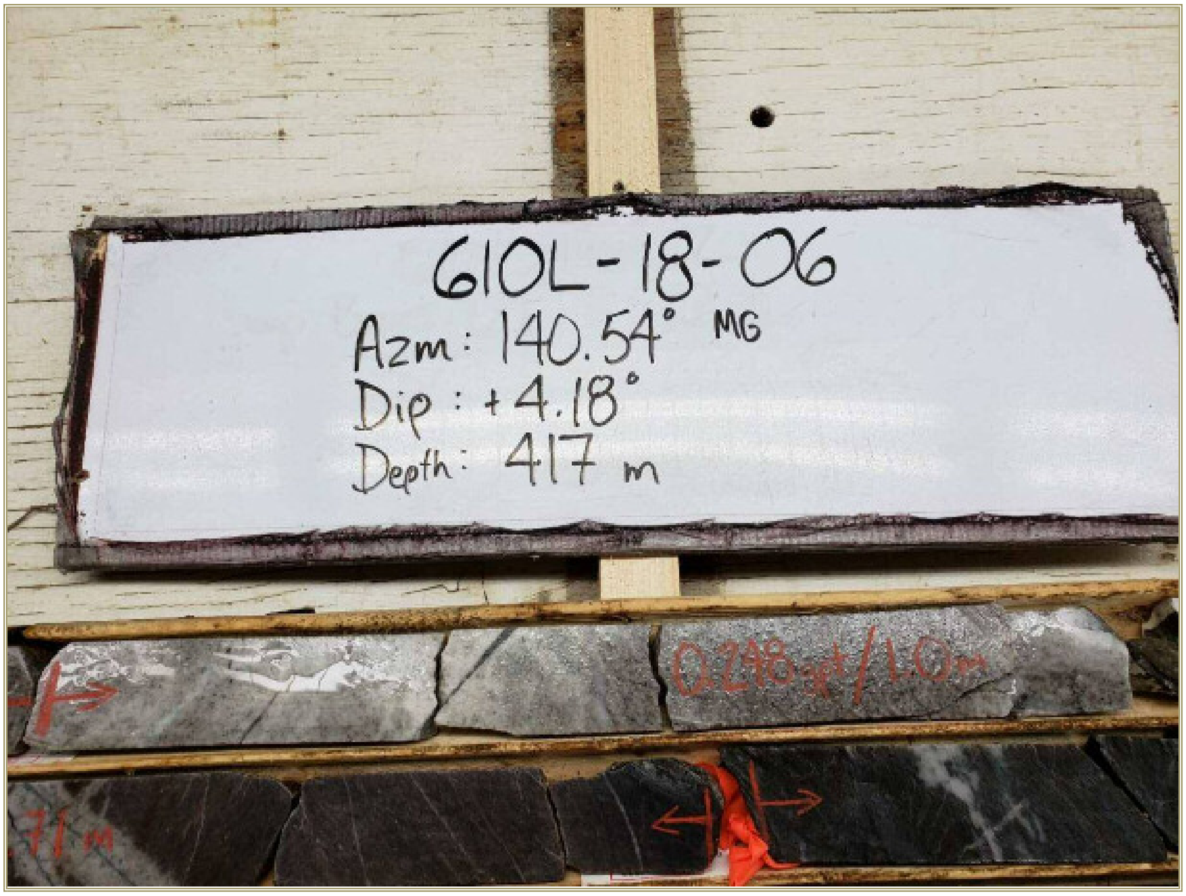


Figure 12-1: Selected Core Interval, Drill Hole 610L-18-06

12.1.1 SGS Laboratory Inspection

The TMAC QP conducted unannounced inspections of the SGS laboratory in Red Lake during each of the 2017 site visits. The manager of the laboratory led the tour through the sample receiving area, sample preparation area, fire assay area, and the wet lab. A detailed audit of the laboratory was not conducted, but no issues were identified.

12.1.2 Independent Sampling by Golder (2017)

Golder (Golder, 2018b) selected intervals from five holes from the 2017 drill program for validation logging and sampling. The TMAC QP participated in the validation and sampling process.

A total of 27 core samples and 3 control samples (2 CRM standards and 1 blank) were taken from quarter sawn core. Golder elected to combine some of the shorter sample intervals, ranging from 0.3 m to 0.5 m, into longer composite samples due to the low sample volume of the quartered core.

The core was compared to the logged descriptions and found to be reasonably accurate with some minor inconsistency issues identified.

Samples were quarter sawn and placed into plastic sample bags and then combined into larger rice bags and secured with a security seal. All samples were then shipped to the Actlabs facility in Ancaster, Ontario for fire assay using the same analytical procedures as used by Rubicon.

Golder compared the assay results to the Rubicon database and summarized in the following scatter plot (Figure 12-2). Despite some obvious sample variance, most assays compared within reasonable tolerances for the deposit type and no material bias was evident. One Rubicon outlier assay (1,182 g/t Au) from a short sample interval (0.35 m) was not repeatable, and the composite grade of the entire 1.35 m interval plotted off the scale of the graph at 85.62 g/t Au. The Golder composite grade for the same interval was 4.38 g/t Au.

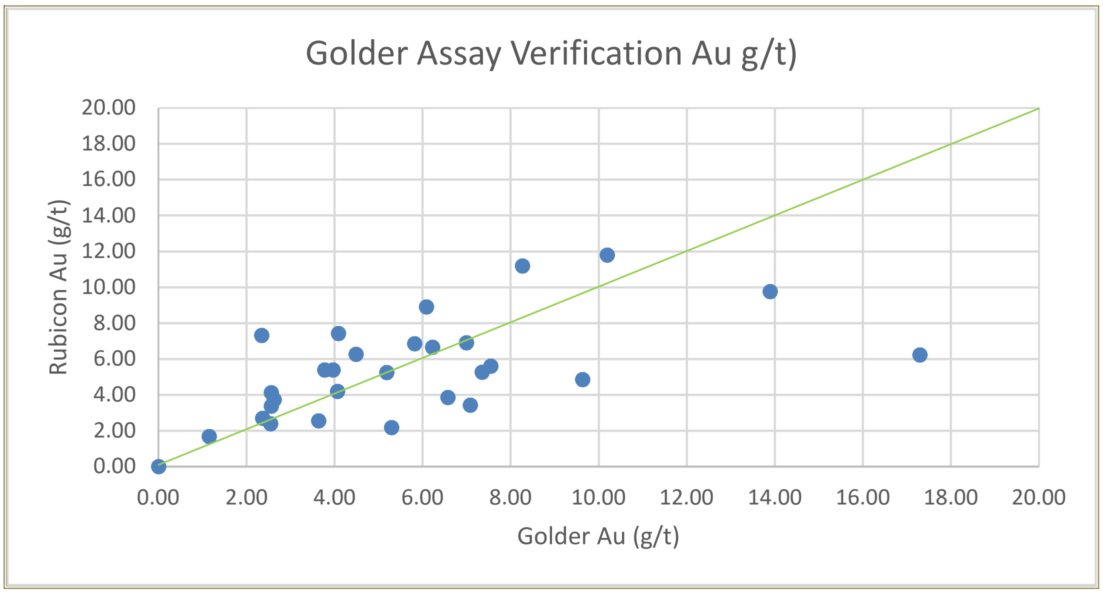


Figure 12-2: Scatterplot Comparison of Verification Samples (Golder, 2018b)

TMAC did not collect an independent sample for verification.

12.1.3 Database Verification

In 2018, Golder completed spot check verification of 281 Au assays from representative areas within the modelled mineral zones, focusing on samples having a grade >2.0 g/t Au. Sample intervals were selected from holes spanning date ranges from 2008 to 2017. Golder did not identify any material issues, and the data was found to match the original lab certificates. A summary of the data validation is listed in Table 12-1.

Table 12-1: Drill Hole Sample Data Validation

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
# of Samples	12	37	112	15	51	0	1	1	0	52
# of Errors	0	0	0	0	0	0	0	0	0	0

TMAC supplemented the Golder verification with verification of the post-2017 drill hole data. TMAC selected 34 assay certificates filtering by submission period (2017Q4 to 2018Q3) and by level (305 m Level, 610 m Level, and 685 m Level). A total of 831 assays from 21 drill holes were verified. TMAC did not identify any material issues.

12.2 Conclusions

On completion of the data verification process, it is the TMAC QP's opinion that the geological data collection, sampling, and QA/QC procedures used by Rubicon are consistent with accepted industry practices, and that the database is of suitable quality to support the 2019 Mineral Resource Estimate, as reported in Section 14.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

This section summarizes the metallurgical testwork completed on samples from the F2 Gold Zone between 2008 and 2012 to support the conceptual design of a processing plant for the 2013 Technical Report (SRK, 2013b). This section also summarizes the processing of material mined from selected stopes in the F2 Gold Zone in 2015 and 2018. The metallurgical testwork information for this section was extracted from the SRK 2013 Technical Report. No additional specific metallurgical or process development testing was conducted after 2012. The mill operated in 2015 and 2018 providing data to assess the mill metallurgical design parameters. The 2015 mineral processing summary was described in the 2016 Technical Report (SRK, 2016), and the 2018 Technical Report (Golder, 2018b). Mill operation in 2015 and 2018 confirmed that the basic process design criteria with respect to gold recovery and throughput at 1,250 t/d could be achieved.

In 2018, Rubicon successfully batch-processed in the Phoenix mill additional material mined from three stopes in the F2 Gold Zone in order to validate its mineral resource model. Mining of the first test stope commenced in Q4 2017 while processing occurred in 2018. Prior to processing the test stopes material, approximately 1,700 tonnes of waste rock was used to bed in the mill prior to initial processing 7,620 tonnes of low grade material from non-stope sources. In total, 43,250 tonnes of mineralized material were processed, producing 5,669 oz Au and 1,043 oz Ag. The 2018 bulk sample processing campaign yielded an improvement in overall gold recovery, with the largest gain occurring in gravity gold recovery as compared to the 2015 operation. The 2018 campaign reinforces the conclusion that the mill at the Phoenix project is robust and capable of processing the mineralized material extracted from the F2 Gold Zone at the 1,250 t/d design level and can achieve the 1,800 t/d level with relatively minor downstream process changes. The process facility has now treated a total of 100,543 tonnes and produced 11,279 fine oz of gold (after settlement).

13.1 Summary of Historical Testwork

In September 2008, Vancouver Petrographics Ltd. performed a petrographic analysis on 10 thin sections derived from representative mineralized core samples from the F2 Gold Zone (Vancouver Petrographics, 2008).

In October 2010, Rubicon completed a metallurgical testwork program (the 2010 study) performed by Soutex. The study was done on small samples from different underground zones. The testwork program was conducted at G&T under the supervision of Soutex (G&T, 2010). This study included running a metallurgical testwork program, developing a preliminary milling process, and designing a preliminary concentrator. The design addressed the gold recovery process, from mineralized material delivered from the mine to the process plant for gold extraction, to producing gold doré and discharging cyanide-free tailings to the Tailings Management Facility (TMF). Paste backfill plant considerations and the TMF were not included in the study.

In September 2011, Rubicon commissioned Soutex to perform additional metallurgical testwork. The study was done on representative subsamples (composites) extracted from two approximately 1,000-tonne bulk samples representing two underground areas on the 305 m Level. The metallurgical testwork program was conducted at G&T under the supervision of Soutex (G&T, 2011).

Characterization of mineralized material competency for semi-autogenous grinding (SAG) milling was performed by G&T under the supervision of JKTech Pty Ltd. (JKTech, 2011). The grinding circuit design was validated by simulation with SGS Minerals Services (SGS, 2011). In July 2012, the processing of the two approximately 1,000-tonne bulk samples was completed at Sabin Minerals Corporation, McAlpine mill under the supervision of Soutex in order to reconcile the bulk sample grades against the Mineral Resource Estimate (Soutex, 2013).

The process plant construction at the Phoenix site was initiated in 2013 and completed during early 2015. The process flowsheet consisted of a SAG and a ball mill in closed circuit with hydrocyclones, gravity concentration, and carbon-in-leach (CIL) followed by electrowinning, cyanide destruction, paste preparation, tailing disposal and refining. Doré is produced by smelting the gravity concentrate and electrowinning sludge. The cyanide destruction circuit using the SO2/O2 process was installed to reduce the cyanide levels in the tailings slurry prior to deposition in the TMF. The detoxified tailing will also feed the paste backfill preparation plant when U/G operations require backfill

The material handling systems, grinding, gold recovery, and refinery areas of the process plant were commissioned and operated between May and November 2015, processing a total of 57,793 tonnes of low-grade development material and mineralized material extracted from test stopes in the F2 Gold Zone. The average head grade to the mill in 2015 was 3.02 g/t. The mill ceased operating on November 21, 2015 and was placed into care and maintenance. A total of 5,610 oz Au were produced. The cleanup effort, while significant, was not to the extent of a permanent mine closure. Grade and recovery values reported in the 2016 SRK Technical Report have been adjusted to include these clean-up ounces in the Mineral Processing and Metallurgical Testing section of the 2018 Technical Report (Golder, 2018b). Gold recovery achieved was 91.9%. This result is consistent with the results obtained in the metallurgical testwork used by Soutex for process flowsheet development in the Preliminary Economic Assessment (PEA) (Figure 13-1). The cyanide destruction circuit achieved the target cyanide (CN) levels required at the TMF during operation in 2015.

In 2018, Rubicon prepared the mill for operation to batch process approximately 40,000 tonnes of mineralized material to be mined from three stopes within the F2 Gold Zone. The principal objective of the test was to verify the gold grades from the selected stopes relative to the updated 2018 resource model (Golder, 2018b) This bulk test provided another opportunity to confirm the process capability of the mill. A metallurgical consultant who was experienced in commissioning new mills and re-starting mills previously shut down was retained to supervise the preparation and operation of the facility for the bulk test programme. A number of deficiencies were found and corrected. Some deficiencies were legacy issues, either missed or left uncorrected in 2015. While the company attempted to shut down and place the plant in care and maintenance in an effective manner, there were some oversights and omissions. Focus was placed mainly on the grinding mills, which were rotated on a scheduled basis. As a result of the hurried 2015 shutdown, water pumps that were not drained and sat idle for three years experienced corrosion and required rebuilding. During the 2015–2016 winter, the mill building was not heated; some freezing damage occurred to some of the instrumentation but was corrected prior to start-up. The knowledge gained will benefit future start up and shut downs.

Rubicon successfully batch-processed material mined from three stopes in the F2 Gold Zone along with 7,620 tonnes of low-grade material from various other sources. In total, 43,250 tonnes was processed, producing 5,669 oz Au. The 2018 bulk sample processing campaign yielded an improvement in overall gold recovery, with the largest gain occurring in gravity gold recovery as compared to the 2015 operation. The 2018 campaign reinforces the conclusion that the mill at the Phoenix project is robust and capable of processing the mineralized material extracted from the F2 Gold Zone at the 1,250 t/d design level and can achieve the 1,800 t/d level with relatively minor downstream process changes. The batch test results also provide valuable data and information to support a conclusion that the basic design criteria produced by Soutex for an expansion to 2,500 t/d is realistic and achievable with the installation of the additional equipment listed.

13.2 Gold Recovery Estimates

13.2.1 Projected Gold Recovery

The gold recovery results obtained from only two core samples (RL-01-01 and RL-01-02) were used to evaluate the average gold recovery, using gravity and cyanide leaching, for the PEA (SRK, 2013b): these results are presented in Figure 13-1. It should be noted that the gold grade used at the time for metallurgical testing was >5 g/t Au, while the mineralized material subsequently processed in the Phoenix mill in 2015 and 2018 was <5.5 g/t Au.

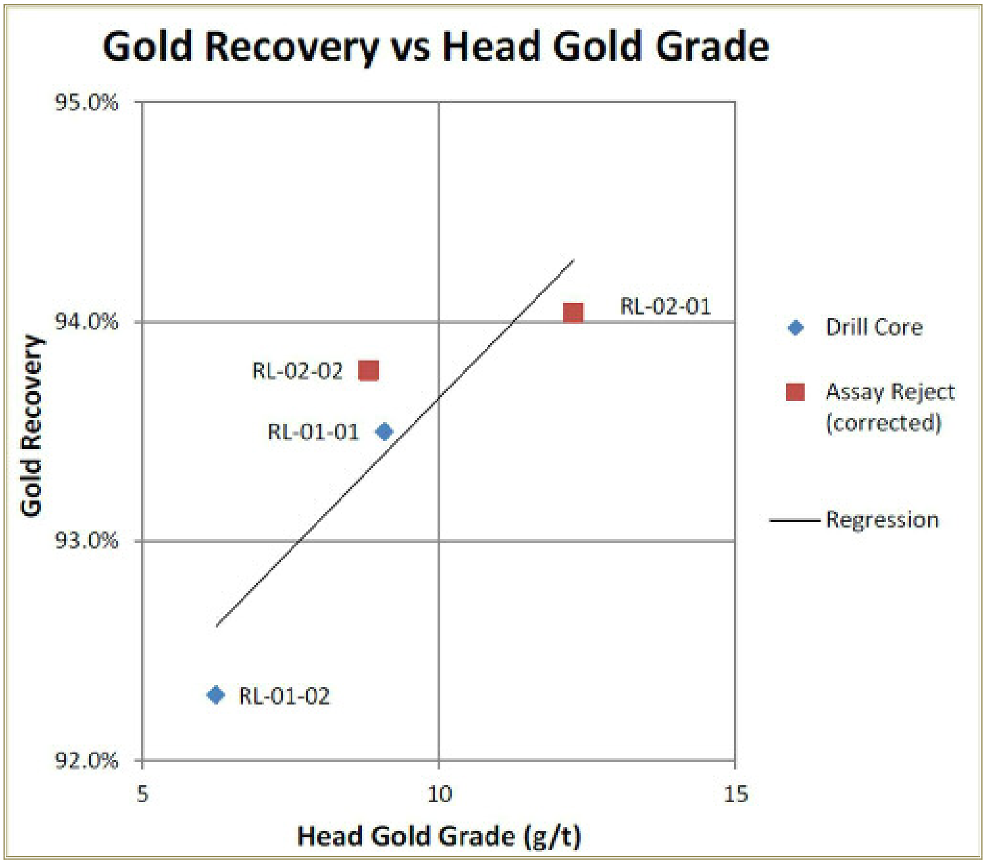


Figure 13-1: Effect of Head Gold Grade on Gold Recovery

13.2.2 Actual Gold Recovery Achieved During Operation in 2015

The mill commenced operation in May 2015 using gravity and CIL to recover gold. Operation of the mill was intermittent, as the mine could not sustain the designed daily feed rate of 1,250 t/d. Mill operation ceased on November 21, 2015, and the majority of the gold-locked inventory contained in the gravity and leach circuit was recovered during cleanup.

During commissioning and start-up of the process plant, the mill treated low-grade mineralized material mined during underground mine development. During initial operation, the ammonia levels in the TMF were greater than the allowable discharge limit. Pond levels were high. Two CIL tanks were repurposed to recover ammonia and enable effluent to be discharged from the TMF. Despite the loss of two stages of CIL, the actual gold recovery achieved from processing (between May and December 2015) 57,793 tonnes of mineralized material from trial stopes grading an average of 3.02 g/t Au was 91.9%. This is consistent with the results obtained in the metallurgical testwork and used for the estimates in the PEA (Figure 13-1). In the PEA, the grade recovery relationship was developed from a small number of samples, with head grades in a higher range than were delivered from the stopes mined. By extrapolating this curve into the lower head grade range of the mineralized material milled in 2015, the expected recoveries fall into the 88% to 90% range. The recoveries achieved by the mill are relatively high, at 91.9% for the lower-grade material, when compared to the extrapolated grade recovery curve.

The final reconciled metallurgical data by month for the processing of test stopes is shown in Table 13-1. The total amount of gold recovered was 5,610 oz Au, including 741 oz Au recovered from the ball mill cleanup after operations ceased. Figure 13-2 displays the relationship between head grade and recovery, derived from actual plant data combined with metallurgical testwork data.

Table 13-1: Monthly Metallurgical Reconciliation for 2015 During Test Mining (including cleanup ounces)

Parameter	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Mill Feed (dmt)	13,226	11,747	5,940	8,460	6,318	275	11,826	-	57,793
Gold Poured (oz)	0	742	448	570	738	0	1,915	-	4,412
Inventory Change (oz)	795	-227	116	319	-172	34	-370	-	740*
Change in Cathodes (oz)	0	178	94	49	100	0	-421	-	0
Gold in Tails (oz)	73	76	36	102	75	2	93	-	457
Gold in Mill Feed (oz)	868	769	693	1,041	740	35	1,217	-	5,610
Grade (g/t)	2.04	2.04	3.63	3.83	3.64	4.00	3.20	-	3.02
Recovery (%)	91.5	90.1	94.8	90.2	89.9	94.7	92.4	-	91.9

Note: *740 ounces recovered in 2016 from partial mill cleanup included in gold accounting
Source: RMX internal document

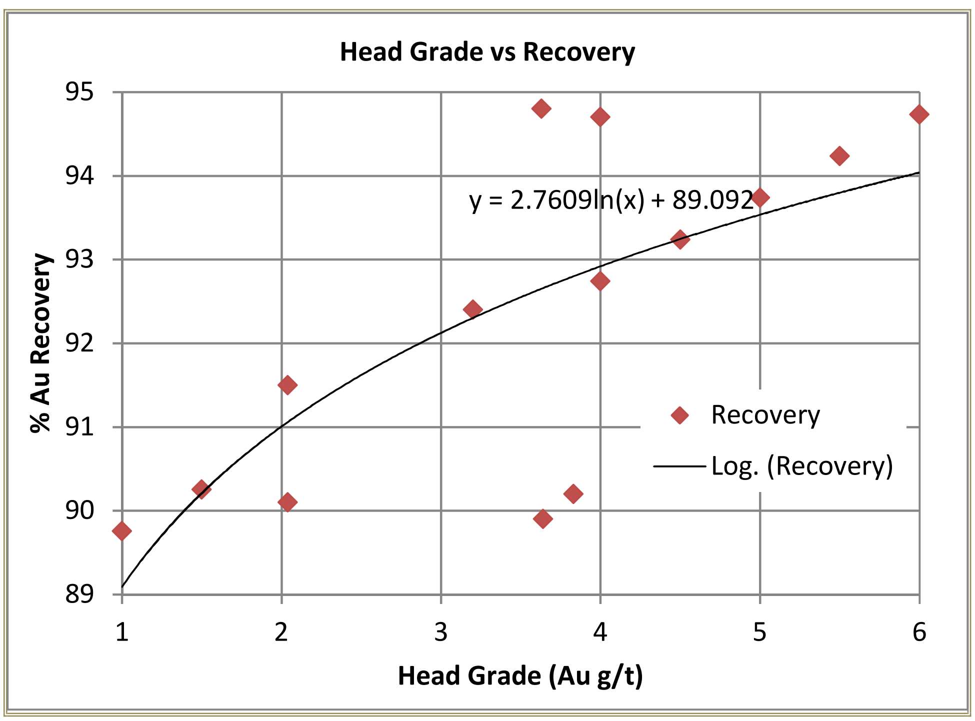


Figure 13-2: Head Grade and Recovery Derived from 2015 Actual Plant Data and Metallurgical Test Work Data

13.3 Mill Feed Sources – 2015

During commissioning and start-up of the process plant, the mill treated low-grade mineralized material mined during underground mine development. This is standard practice in commissioning a new facility. The main source of feed was from the HW and West Limb Basalts of the F2 Gold Zone. Several stoping areas (305-Z2-030, 305-Z2-489, 305-Z1-065, 305-Z1-980, 244-Z2-159FW, 244-Z1-994, 183-Z1-161, and 183-Z1-164) were developed in preparation for mining, accounting for 61% of the mineralized material milled. The balance of mill feed was mined from four trial stopes (305-Z2-030, 305-Z1-065, 244-Z1-977, and 244-Z1-994). Development muck in the F2 Gold Zone accounted for 17% of the mineralized material milled. The remaining 22% of tonnes milled was waste rock that entered the system while mining low-grade mineralized material. The primary mineralized material sources are shown in Figure 13-3.

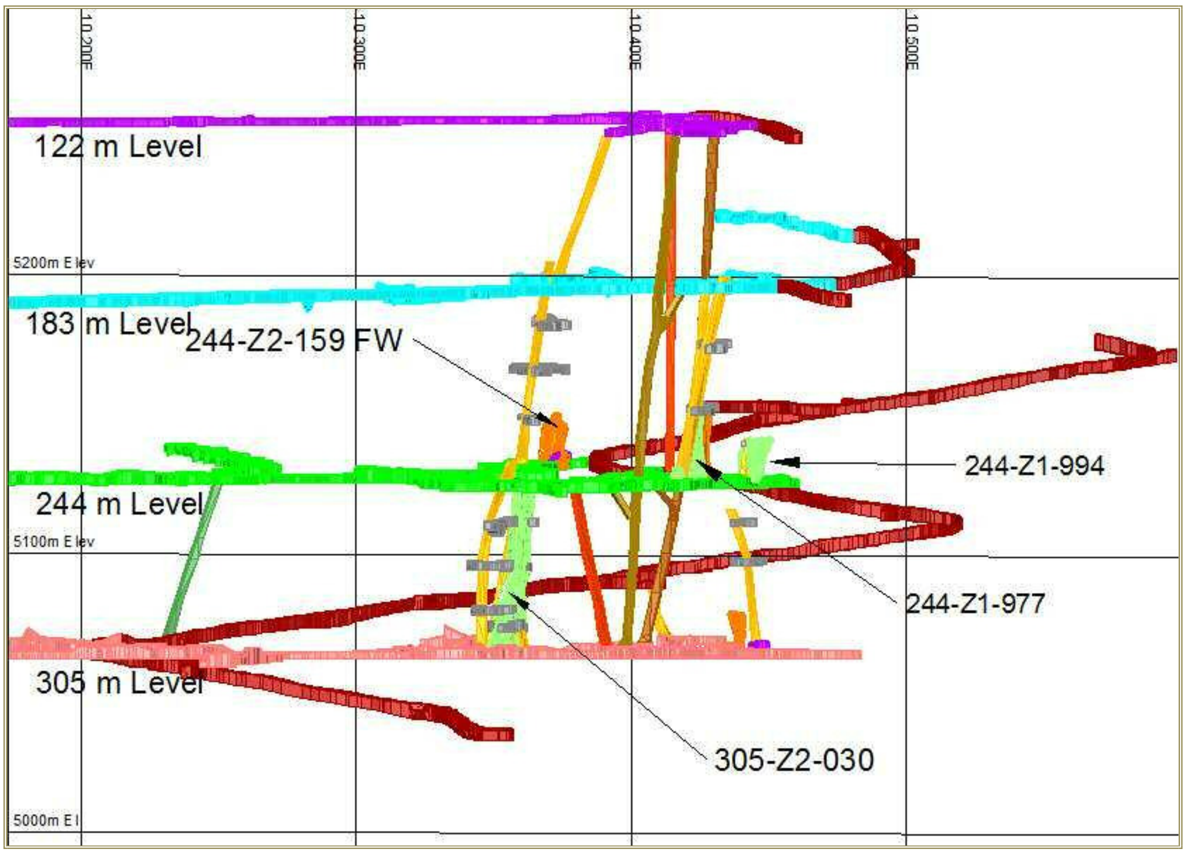


Figure 13-3: Mineralized Material Sources 2015, Looking North (Source: Rubicon 2019)

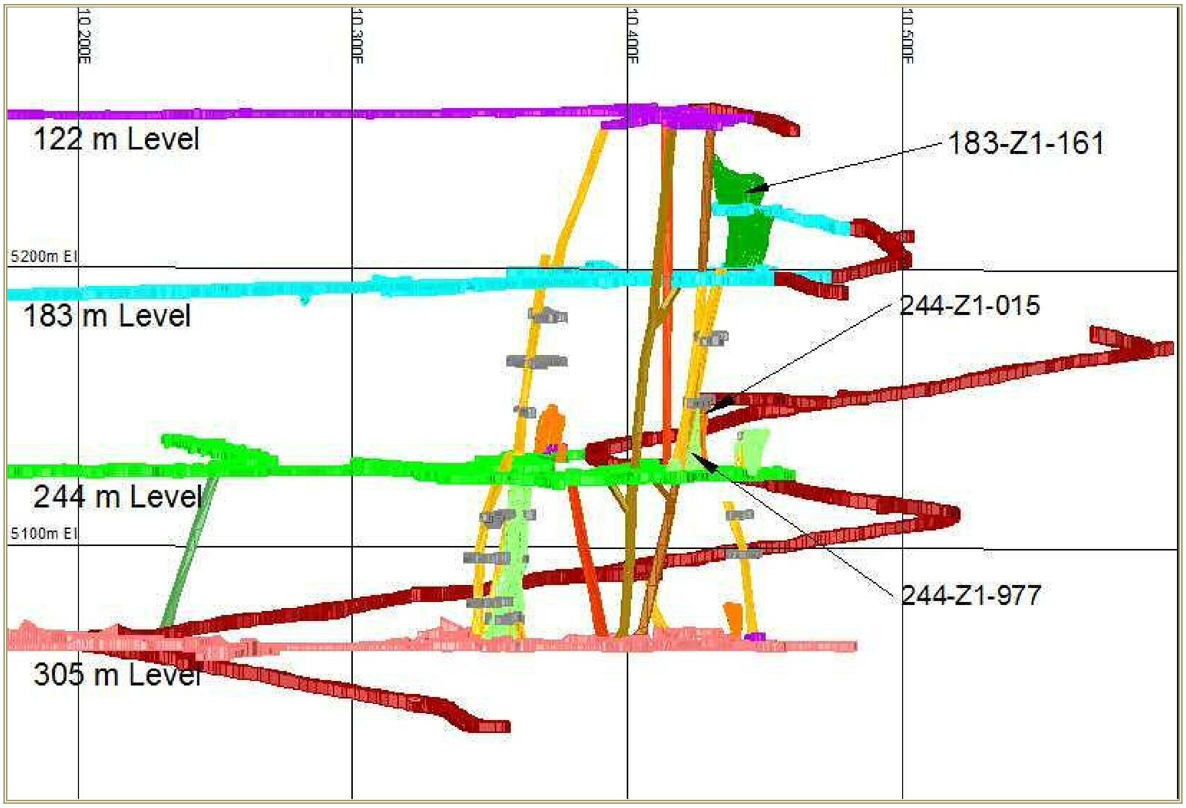


Figure 13-4: Mineralized Material Sources for 2018 Bulk Test, Looking North (Source: Rubicon 2019)

13.3.1 Actual Gold Recovery Achieved In 2018 Bulk Test

Rubicon continued its exploration program through 2017 and into 2018. The ultimate goal was to verify the 2018 geological model by batch processing approximately 40,000 tonnes of mineralized material from selected test stopes in the F2 Gold Zone. A rigorous plan was prepared to layout the stopes to be mined within the F2 Gold Zone, extensively sample and survey the material mined from the stopes and ensure that this material was kept segregated through to milling. Rubicon retained the services of a metallurgical consultant who was very experienced in starting up and operating mills that were newly constructed or shut down for extended periods. When operations ceased in 2015, Rubicon implemented a closure plan for placing the milling facility under care and maintenance. This included turning the heat off in the mill building. The mill building was used as a store for mine equipment during the shutdown period and some equipment and instrumentation was damaged by freezing. This was revealed by inspections in early 2018, which also showed some legacy deficiencies remained from the original commissioning and operation. Other issues identified were the result of lines and tanks not being completely drained. Most notably, the freshwater pumps were not drained, and required a rebuild. Some elements in sensors and instrumentation have limited service lives and had to be replaced. The belt scales were recalibrated, and the material handling system was modified as needed to control spillage.

The grinding circuit was bedded in with a small amount of waste and low-grade material prior to commencing the batch processing of mineralized material from the test stopes. The mill was operated and maintained by a combination of contract operators and maintenance personnel along with some direct hires. Basic assay services to support the operation, with a 24-hour turnaround, were provided by the SGS laboratory in Red Lake, while the more complex analyses such as loaded carbon samples were performed by SGS Lakefield. Turnaround times were not ideal for the operation, but the data received was adequate for metallurgical balancing and reconciliation. A basic cleanout of sumps and easily accessible gold traps and a circuit inventory was performed after each stope was processed. A more comprehensive cleanup was completed after the final bulk sample was processed. The cleanup gold ounces recovered were allocated to the test stopes on a pro rata basis. The metallurgical results of the bulk test program are summarized in Table 13-2. The test stopes were identified as 244-Z1-015, 244-Z1-977, and 183-Z1-161. The processing the results for each source of mill feed are shown separately, but for block model reconciliation the data for Stope 244-Z1-161 is combined. It is important to note that the gold recovery from each of the test stopes was consistently higher than the recovery from the other mineralized material.

Table 13-2: Metallurgical Results of the 2018 Test Mining Program

	Total	Low Grade (977 & 015)	244-Z1-015	244-Z1-977	183-Z1-161 Down Hole	244-159 FW LH	183-Z1-161 Sump	LG Dev (Sump)	244-Z1-161 Upper
Grade (Au g/t)	4.08	1.47	3.66	3.55	4.98	2.34	2.22	2.99	5.76
Recovery (%)	94.8	98	95.5	94.7	93.4	87.1	86.1	92.9	96.7
Tonnes	43,250	3,396	6,230	10,394	9,093	1,542	1,206	1,477	9,412
Gold (oz)	5,669.3	160.7	792.3	1,184.6	1,455.6	115.9	86.1	142.1	1,732

During the 2018 bulk test the Phoenix mill demonstrated that it could efficiently process mineralized material mined from the F2 Gold Zone. Average gold recovery in 2018 was notably higher, at 95.1%, than the 91.9% achieved in 2015. Gravity gold recoveries ranged from 40% to 50%, and gold recoveries from the test stopes ranged from 93.4% to 96.7%. In 2015, monthly gold recoveries ranged from 89.9% to 94.8%. The recovery improvement between 2015 and 2018 is significant. This overall recovery improvement is primarily attributed to the gravity gold circuit performance. Deficiencies were found in the Knelson concentrator installation that would have prevented it from working optimally in 2015. Changes were also made in primary hydrocyclone control that stabilized the slurry feed to the Knelson concentrators. The impact of reducing the gold load reporting to the leach circuit, combined with having all six CIL tanks available for leaching as originally designed increased the leach retention time. Reagent requirements were also reduced, and the reagent addition controls improved. Lead nitrate was added to the leach circuit in 2018 but was not used in 2015. Lead nitrate is generally added to leach circuits to mitigate the effect of sulphide ions on the leaching of gold. Lead nitrate was included in the reagent regime in the plant design criteria. A grade recovery trend was generated from the operating data and is shown in Figure 13-5.

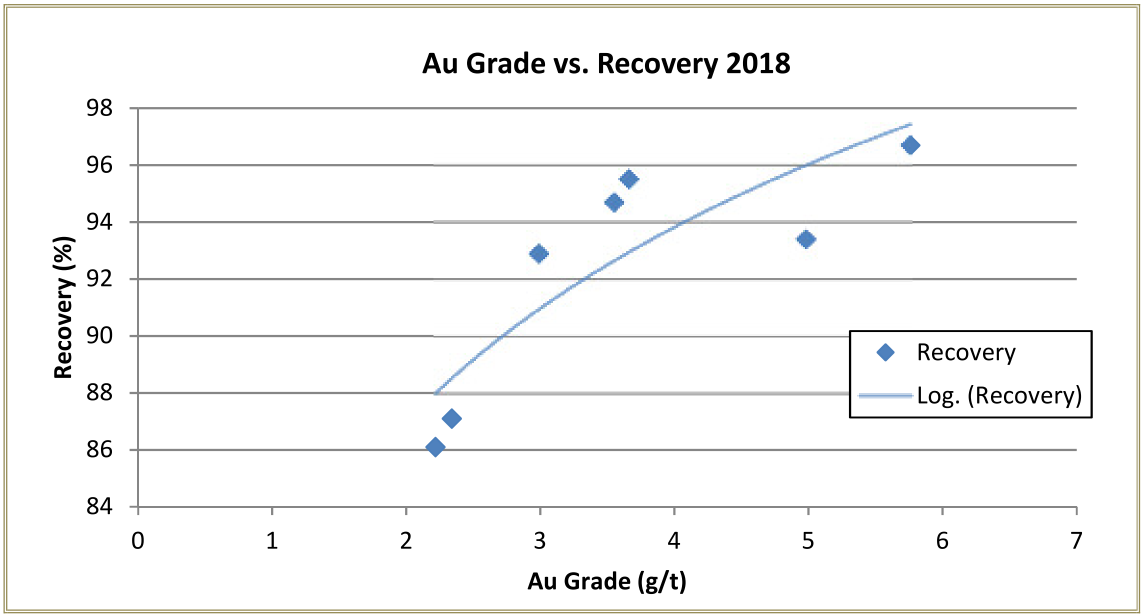


Figure 13-5: Gold Grade vs. Recovery for 2018 Test Mining

13.4 Plant Operating Data

Table 13-3 summarizes key plant operating data from 2015 and 2018. Significant improvements in metallurgical performance were achieved in 2018. These were the result of having a more stable feed to the SAG mill, finding and correcting legacy issues in the Knelson concentrator installation during the prestart up period, having improved control of the cyclone pack which fed the gravity concentrators and optimizing the collection and discharge periods during operation. Other metallurgical improvements were the result of having all six CIL tanks available for leaching and the addition of lead nitrate to the leach circuit. In 2015, the Knelson concentrators were operated, but did not perform as expected. Having a functioning gravity circuit in 2018 reduced the gold load reporting to CIL. That combined with having all six CIL tanks available improved CIL recovery. In 2015, two CIL tanks were dedicated to ammonia reduction and were not available for leaching.

Table 13-3: Test Mining Results

Description	Unit	2015	2018
Tonnes Milled Dry	dmt	57,793	43,250
Total Production	oz Au	5,610	5,669
Gravity Production	oz Au	0	2,421
Recovery	%	91.9	94.8
Head Grade	g/t Au	3.02	4.08
Tailings Grade	g/t Au	0.25	0.21

The author considers evaluation of actual plant operating data to be the best indicator for future recovery estimates.

13.5 Additional Improvements in Gold Recovery

The metallurgical results achieved in 2018 were significantly better than those achieved in 2015. As a result, 95% recovery from mineralized material grading between 3.5 g/t Au and 5.0 g/t Au is achievable with the current milling circuit. Additional improvement in gravity recovery can be achieved by increasing the capacity of the gravity circuit by either adding a third Knelson concentrator, upgrading the gravity table and/ or intensive leaching gravity concentrates. Recovery in CIL could be improved by installing pre-aeration tanks ahead of the CIL. Provision for these tanks was made in the original plant layout. It is anticipated that with better knowledge and understanding of the gold deportment in the various zones of gold mineralization incremental increases are possible. With a stable steady state ore supply grading a nominal 5 g/t, combined with continuous operational improvements, gold recoveries >95.0% may be realized in future years of operation.

13.6 Statement of Representativeness of Samples, 2015 Operation

The mineralized material processed in 2015 was test mined from the F2 Gold Zone. Metallurgical testing and process flowsheet development were based on a small number of samples and two 1,000 tonne bulk samples that were custom processed. Metallurgical testing was conducted on samples with gold grades higher than those delivered to the mill during the 2015 milling campaign. The grade to the mill averaged 3.02 g/t Au, which was much lower than the development testwork, which ranged from 5 g/t Au to 15 g/t Au. Grade recovery data generated during mill operation in 2015 was incorporated in to the grade recovery curve developed for the Project. The head grade and recovery results obtained from 2015 mill operation have been adjusted to include actual ounces recovered from the partial mill cleanup. The mineralized material milled was lower-grade than the head grades used in the development testwork, but the relationship held and could be considered robust considering that 57,793 tonnes were milled.

In 2015, mill operations were intermittent and leach capacity was sacrificed, as two leach tanks were temporarily repurposed to reduce ammonia concentrations to acceptable discharge levels. At start up, the TMF ponds contained water with extremely high ammonia concentrations that could not be discharged to the environment.

In 2015 the Phoenix mill never truly achieved steady-state operation under optimal, controlled conditions. The expectation is that under optimum operating conditions, at steady state, gold recoveries should be higher than those achieved in 2015.

The metallurgical QP interviewed the senior mine geologist and relied on information supplied by Rubicon personnel that the source of the material milled in 2015 was from the F2 Gold Zone.

13.7 Statement of Representativeness of Samples 2018 Bulk Test

The mineralized material processed in 2018 was test mined from three stopes (244-Z1-015, 244-Z1-977, and 183-Z1-161 in the F2 Gold Zone) and low–grade material from previously developed areas. The material was extensively sampled as it was mined and transported to the surface stockpiles. Additional details are found in the mining section. No laboratory metallurgical testing has been conducted on samples from this deposit since 2011. The two milling campaigns, however, have provided sufficient data to conclude that the basic design criteria of the Phoenix mill can be achieved. The initial response of the material milled in 2015 demonstrated that the mill as configured was capable of extracting gold from the F2 Gold Zone. The 2015 experience also indicated there were opportunities for improvement in gold extraction and optimizing reagent usage.

The head grades processed in 2018 ranged from 1.47 g/t Au to 5.36 g/t Au, with 82 % of the mill feed between 3.55 g/t Au and 5.36 g/t Au. The head grade and recovery results obtained from 2018 mill operation include actual gold ounces recovered from the partial mill cleanup. The gold recovery achieved from processing the material mined from the bulk test stopes was higher than the recovery attained during metallurgical testing. This was also the case in 2015 when the mill first operated. The average head grade in the 2018 bulk test was higher at 4.08 g/t Au compared to 3.02 g/t Au in 2015 but still fell into the low end of the range of test sample grades (5 g/t Au to 15 g/t Au). The 2018 bulk test confirms that the grade recovery relationship developed during metallurgical testing is conservative as the mill has been able to meet or exceed the predicted recovery at lower head grades.

The metallurgical QP met with Rubicon management, and relied on information regarding sources and grade of mineralized material provided during those meetings. The QP also visited the mill during the operational readiness period and discussed the pre-start work being managed by Adrian McNutt, the metallurgical consultant for the bulk test. The QP also toured the mill during the bulk test.

13.8 Factors with Possible Effects on Potential Economic Extraction

13.8.1 Main Process Equipment

For operation of the grinding circuit at 1,250 t/d, it was expected that the SAG mill would be operated at a lower speed with a reduced ball charge. This was experienced in the early stages of the 2015 trial operation. During the bulk sample testing in 2018, the SAG mill ball charge was managed in line with the design criteria. The mills were test run to determine the grinding capacity of the installed mills and identify downstream limitations. Although the mill is currently designed and constructed to process up to 1,250 t/d, the grinding mills are capable of processing approximately 1,800 t/d with equipment changes and additions required in the downstream processes. The mill layout allows for the addition of a second ball mill, a second hydrocyclone cluster, a pre-crushing unit, and a second stripping column, if required in the future to achieve 2,500 t/d.

Additional incremental improvements in the plant can be expected in the future. The mill could benefit from having dedicated assay services available at its metallurgical lab in Balmertown or on site to provide timely feedback to the operators. The nominal 24-hour turnaround time is acceptable for the short term but does not allow for efficient troubleshooting.

A mineralogical study of the tailings generated could provide information that could identify potential improvements in recovery or reduce costs. It is important for the metallurgist to understand the deportment of the gold lost in tailings. For example, is liberated gold reporting to the tailings? Is the grind optimal? Can more gold be extracted by gravity?

The design paste backfill requirement is 55% by weight of the mill feed. For 1,250 t/d operation the requirement is 687.5 t at 80% solids. One disc filter should meet the operating requirements at 1,250 t/d, with the second unit on standby. The second disc filter would be used to increase paste production to 990 t/d to meet the underground requirements at 1,800 t/d if needed. There is provision to install a third disc filter; the decision to install this filter could be deferred until a definite need for additional filtering capacity is demonstrated by operation of the installed equipment. This additional capacity could either be used to meet increased paste backfill requirements for 2,500 t/d operation or to produce dewatered tailings. Additional paste mixing and paste pumping capacity will be required.

13.8.2 Plant Tailings Toxicity

CIL plant tailings are treated using the SO_2/O_2 cyanide destruction process, and in the 2015 campaign cyanide levels less than 5 parts per million (ppm) were consistently achieved.

In 2018, sodium metabisulphite was used as the oxidant rather than liquid SO_2. The CN destruction targets were achieved. The two operational campaigns demonstrated that either liquid SO_2 or sodium metabisulphite are viable at Phoenix.

13.8.3 Tailings Management Facility Effluent

The cyanide in the CIL tailings is destroyed using the SO_2/O_2 cyanide destruction process. Cyanate ions are produced as a product of the destruction process. The cyanate breaks down, producing ammonia. Ammonia is a regulated discharge parameter that must be kept within the allowable limits.

During initial operation in 2015, ammonia concentrations in the TMF exceeded the allowable discharge limits. The sources of ammonia were identified to be the cyanide destruction circuit, and the mine water, which was pumped from underground to the TMF. To comply with discharge limits, Rubicon implemented several mitigation measures. These included eliminating the use of ANFO explosives underground, locally treating mine water with zeolite in the mine and utilizing two tanks in the mill CIL circuit as reactors to create a temporary ammonia removal system using zeolite to lower ammonia to meet discharge limits. As a result, 91,237 m^3 of TMF effluent was successfully treated and discharged to the environment between September 2015 and November 2015.

In 2016, 66,281 m^3 was discharged from a variety of runoff collection ponds on the property, with the permission of the provincial environmental authority. This allowed for some dewatering to occur, despite ammonia levels in the TMF remaining above approved discharge limits. Sewage sludge was added to the pond in order to increase bacterial degradation of ammonia, and this increased the rate of destruction. In 2017, ammonia levels fell below discharge limits, and 221,158 m^3 of water was discharged from the TMF, returning the water elevation to levels not seen since mid-2015.

In 2018, 22,012 m^3 was discharged from the TMF. Discharge only occurred for a short time and the 2018 cyanide destruction from the bulk sample processing period. As was the case in 2015, the cyanide destruction circuit contributed a significant amount of ammonia to the TMF. Consecutive ammonia samples in effluent surpassed the discharge objectives, though the plant had already been shut down and discharging to the environment had stopped when the last sample results were received.

The existing TMF is adequate for the short-term and near future. An Actiflo® system has been installed to ensure compliance with effluent discharge limits, and a metals removal circuit was added in 2017 and commissioned in 2018. The sourcing of an acceptable ammonia treatment system remains a long-term objective. Mitigation measures taken to manage ammonia at the source (such as eliminating ANFO use in the mine) have been effective in lowering ammonia contributions to the TMF. The additional ammonia generated from cyanide destruction during short-term mill operating campaigns can be managed naturally. However, if a decision is made to bring the Phoenix mill into continuous operation, an ammonia treatment system will be required. In the future, for long-term operation, alternative tailings deposition options should be investigated to determine the optimum method for the F2 Gold Zone.

13.9 Comment on Mineral Processing

The Mineral Processing QP is of the opinion that the mill was operated in accordance with generally acceptable industry standards, belt scales were calibrated on routine basis, sampling procedures, and practice, which provided reliable data for metallurgical accounting. The recovery estimates are appropriate for the mineralized material extracted from the High-Ti Basalts within the F2 Gold Zone.

The accuracy of the future recovery and production estimates for the Phoenix project will depend on the mine's ability to predict the grade of the mineralized material that will be milled.

The QP is not aware of any processing factor or deleterious elements in the current mine resource that could have a significant effect on potential economic extraction of gold at the Phoenix project. The author is aware of the presence of an alteration zone in the area, which if mined in the future will require metallurgical testing to determine metallurgical performance and determine process parameters specific to treating this material.

Should mine exploration discover mineralization outside of the F2 Gold Zone, metallurgical testing will be required to determine the impact on the performance of the process plant. Mitigating actions such as changes in equipment or procedures can then be implemented in prior to processing.

Future mill operation will benefit from providing basic on site analytical capability to allow operators to make informed operating decisions in a timely manner.

14 MINERAL RESOURCE ESTIMATES

14.1 Introduction

TMAC has prepared a new Mineral Resource Estimate for the Phoenix Gold Project. The Mineral Resource for the Phoenix Project consists of Measured, Indicated, and Inferred Resources. Mr. Tim Maunula, P.Geo., Principal Geologist for TMAC, was the Qualified Person (QP) responsible for the completion of the 2019 Mineral Resource Estimate for the Phoenix Gold Project. The effective date of this Mineral Resource Estimate is March 18, 2019.

The Mineral Resources are based on drill hole data provided by Rubicon from surface and underground diamond drill programs completed between 2008 and 2018. The cut-off date for assay data used in the 2019 Mineral Resource estimate was December 17, 2018. All data received was in the local grid coordinate system for the Phoenix Gold Project, which is rotated 45 degrees to the east of magnetic North, with grid coordinates 10000E, 50000N corresponding to location of the Phoenix shaft.

The gold mineralization for the Phoenix Gold Project was modelled in four zones of mineralization, Zone 1 through Zone 4. The stratigraphy, or rock type groups, provided was modelled based on a Nearest Neighbour indicator for the three principal rock types: High-Titanium (High-Ti) Basalt, Ultramafic Unit, and Felsic Intrusive Unit. TMAC updated the interpretation based on the new drilling completed post-2017. Gold grades were estimated by rock type within each zone separately.

The software used for the 2019 Mineral Resource Estimate was Geovia GEMS 6.7.3 Desktop (GEMS). The Mineral Resource Estimates were classified according to the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014). The Mineral resource was reported at a 3.0 g/t Au cut-off grade for resources which are amenable to underground extraction.

14.2 Database

The Mineral Resource estimate for the Phoenix Gold Project is based on diamond drill hole data consisting of gold assays, geological descriptions and density measurements. Underground development and bulk sample stopes were also taken into consideration.

Data was provided to TMAC by Rubicon in electronic formats as in CSV and DXF file formats and imported into GEMS. The database was additionally verified using the validation tool in GEMS to determine errors and overlapping or out-of-sequence intervals. Minor errors were noted, and the database was updated.

The drill hole database received from Rubicon consisted of 1,631 drill holes totalling 551,811 m of core drilling. The database includes all drilling on the Phoenix Gold Project in proximity to the interpreted mineralization zones. The historical data of the McFinley deposit was not included in the database for this Mineral Resource estimate. This current resource included an additional 106 drill holes (Table 14-1) that were drilled post-2017. This selection consists of 104,308 gold assays that were used for modelling resource estimation.

Table 14-1: Drill Hole Header Table Coding

MA Code	Count	Description
-1	25	Drill holes within mineralization zones but excluded from resource
0	187	Drill holes outside mineralization zones
2	1313	Drill holes used in 2018 Golder resource
3	106	Additional drill holes used in 2019 TMAC resource

As recommended by Golder (2018) in the previous technical report, TMAC confirmed the exclusion of 20 surface and 5 underground drill holes. These drill holes were excluded to minimize potential bias. Table 14-2 lists the drill holes excluded from this current Mineral Resource Estimate.

Table 14-2: List of Drill Holes Excluded from the Mineral Resource Estimate

Drill Hole Numbers			
F2-01	F2-09	F2-41	244-09-04
F2-02	F2-10	F2-42	305-05-HQ1
F2-03	F2-11	F2-57	305-18
F2-04	F2-12	F2-60B	305-29
F2-06	F2-13	F2-61B	
F2-07	F2-21	F2-2012-06A-W1	
F2-08	F2-22	244-09-03	

14.2.1 Bulk Density

A total of 5,982 Specific Gravity (SG) measurements were provided from onsite drill core measurements. A full description of the measurement process is provided in Section 11.4.

An additional 50 measurements were collected in 2017 to confirm the density values assigned in the block model (Section 11.4). Check sample results confirmed the mean density values used (Table 14-3). Density values were assigned in all zones in the block model based on the Rock Type unit.

Table 14-3: Comparison of Bulk Density (t/m³) Values

Rock Type Unit	Assigned Value	As Logged	2017 Check	Based on 2019 Rock Type Update
High-Ti Basalt	2.96	2.96	2.95	2.94
Ultramafic	2.90	2.90–2.92	2.92	2.90
Felsic Intrusive	2.67	2.67	2.62	2.70

14.3 Geological Domaining

The gold mineralization for the Phoenix Gold Project is enveloped within four zones: Zone 1 to Zone 4. Gold mineralization within the deposit is primarily hosted within the High-Ti Basalt units; however, gold mineralization also occurs within ultramafic units and felsic intrusive rocks.

Rubicon identified three main basalt lenses hosting mineralization including, from west-to-east: Hangingwall (HW) Basalt, West Limb Basalt (WLB), and F2 Basalt (F2). These lenses make up most of the mineralization contained within Zone 1 (F2) and Zone 2 (HW, WLB). Zone 3 is a small, narrow zone primarily in felsic intrusive rocks between the F2 and WLB, Zone 1 and Zone 2, respectively. Zone 4 includes an extension of F2 Basalt to the north of the main mineralized area of Zone 1.

Additionally, a small zone of High-Ti and ultramafic rocks were modelled slightly outside to the east of Zone 2 (at approximately 4,600 m). This small area of gold mineralization was attributed to Zone 2.

Figure 14-1 presents the four mineralization zones of the Phoenix gold system.

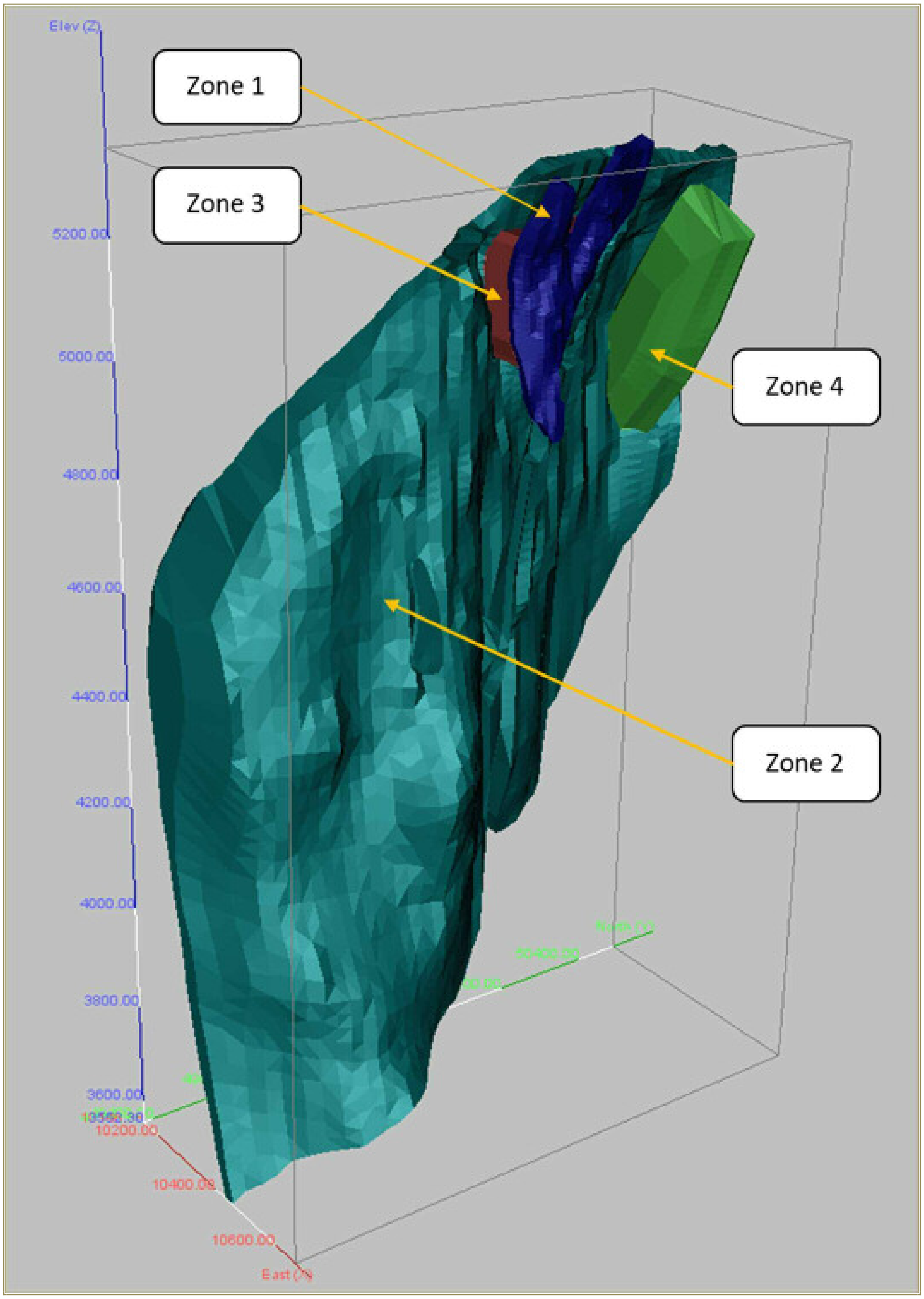


Figure 14-1: Mineralization Zones (Oblique View Facing Northwest)

The rock units comprising these mineralized zones have been subjected to deformation and as a result, have complex shapes and distributions with variable continuity. Due to contrasts in the physical characteristics (competency contrasts) between rock units, as described previously in Section 7, the soft and locally talcose altered ultramafic unit is interpreted to have deformed in a ductile manner around more competent basalt and felsic units which are believed to have deformed in a brittle-ductile manner and possibly pulled apart (boudinaged) locally. Due to the complexity of the host rock units and associated mineralization, Golder (2018b) chose to model mineralization domains as broad low-grade envelopes based on the three main lithologies. TMAC reviewed the geological model and updated the model based on the new drilling information provided post-2017.

Table 14-4 presents the Zone and Rock Type Codes assigned to the block model for the Phoenix Deposit.

Table 14-4: Codes used for the Phoenix Deposit

Zone Code	Rock Type	Description	ZR Codes
1	7	Ultramafic	107
1	9	High-Ti Basalt	109
1	17	Felsic Intrusive	117
2	7	Ultramafic	207
2	9	High-Ti Basalt	209
2	17	Felsic Intrusive	217
3	7	Ultramafic	307
3	9	High-Ti Basalt	309
3	17	Felsic Intrusive	317
4	7	Ultramafic	407
4	9	High-Ti Basalt	409
4	17	Felsic Intrusive	417

Figure 14-2 illustrates the geology block model for 5,100 m Elevation.

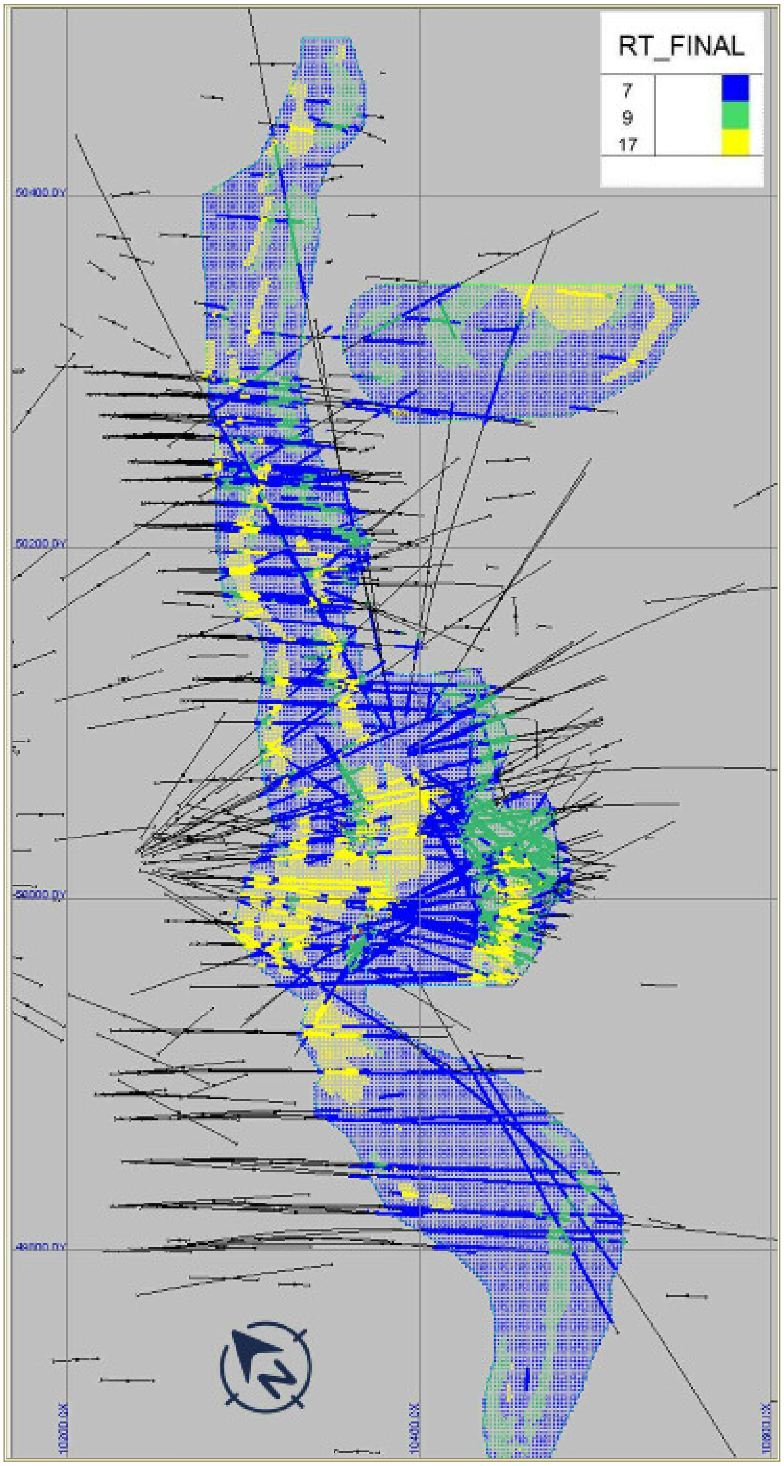


Figure 14-2: Geology Model Plan View (5,100 m Elevation Looking Grid North)

14.4 Exploratory Data Analysis

14.4.1 Raw Assays

The resource model includes gold assays from drill holes, no chip samples were used. Capped and uncapped grades are reported in the exploratory data analysis. Analysis of the gold assay values was conducted on raw drill hole data selected by mineralization zone and lithology to determine the nature of the gold grade distribution and correlation of grades with individual rock units. Through a combination of descriptive statistics, histograms, probability plots, and box plots, the gold grade values were reviewed to analyze the gold data.

Table 14-5 provides a summary of the descriptive statistics for gold and assay length for the raw sample populations captured from within each mineral zone. Zone 1 and Zone 2 contain most of the assay data. The average assay sample length is slightly less than one metre.

Table 14-5: Descriptive Statistics of Raw Assay Data by Zone

Zone	Unit	Count	Minimum (g/t Au)	Maximum (g/t Au)	Mean (g/t Au)	Std. Dev.	CV
1	Au (g/t)	21,407	0.0025	2,305.23	2.41	29.39	12.19
	Length (m)	21,407	0.10	2.80	0.85	0.21	0.25
2	Au (g/t)	74,013	0.0025	3,194.65	1.44	26.01	18.08
	Length (m)	74,013	0.08	6.90	0.90	0.20	0.22
3	Au (g/t)	6,242	0.0025	185.26	0.63	4.21	6.71
	Length (m)	6,242	0.20	2.00	0.94	0.16	0.17
4	Au (g/t)	2,646	0.0025	457.43	0.65	9.47	14.55
	Length (m)	2,646	0.27	1.34	0.92	0.17	0.19

Notes: Std. Dev. = Standard Deviation; CV = Coefficient of Variation

Table 14-6 discriminates by rock type within each zone. The coefficient of variation (CV) is high (>2) and indicates the potential for estimation bias using linear estimation methods. Capping of outliers is one method to manage the CV.

The highest average gold grade is reported for High-Ti Basalt in Zone 1 and Zone 2. However, within Zone 2, the Ultramafic and Felsic Intrusive units have high-grade outliers in excess of 2,000 g/t Au.

Table 14-6: Descriptive Statistics of Raw Assay Data by Rock Type per Zone

Zone	Rock Type	ZR Code	Count	Minimum (g/t Au)	Maximum (g/t Au)	Mean (g/t Au)	Std. Dev.	CV
1	7	107	4,338	0.0025	895.54	1.29	15.26	11.86
	9	109	15,175	0.0025	2,305.23	2.95	33.90	11.48
	17	117	1,863	0.0025	111.19	0.63	3.31	5.27
2	7	207	24,762	0.0025	2,581.67	1.27	29.99	23.57
	9	209	21,411	0.0025	2,620.70	2.14	26.69	12.49
	17	217	27,756	0.0025	3,194.65	1.05	21.26	20.29
3	7	307	3,166	0.0025	185.26	0.52	5.32	10.14
	9	309	30	0.0025	5.96	0.59	1.38	2.34
	17	317	3,046	0.0025	86.65	0.73	2.62	3.57
4	7	407	994	0.0025	73.94	0.24	2.43	10.19
	9	409	1,227	0.0025	114.53	0.71	4.13	5.81
	17	417	425	0.0025	457.43	1.44	22.25	15.45

Notes: Std. Dev. = Standard Deviation; CV = Coefficient of Variation

Box plots are shown in Figure 14-3 and Figure 14-4. Boxplots illustrate the grade distribution graphically.

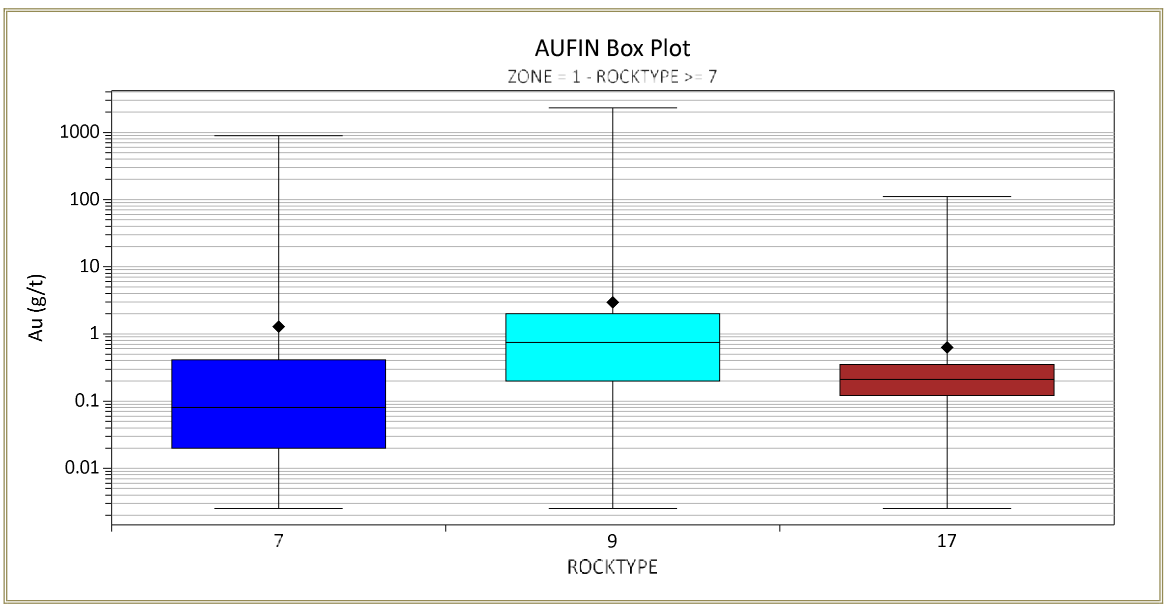


Figure 14-3: Box Plot of Rock Type for Zone 1; Uncapped Gold (g/t Au)

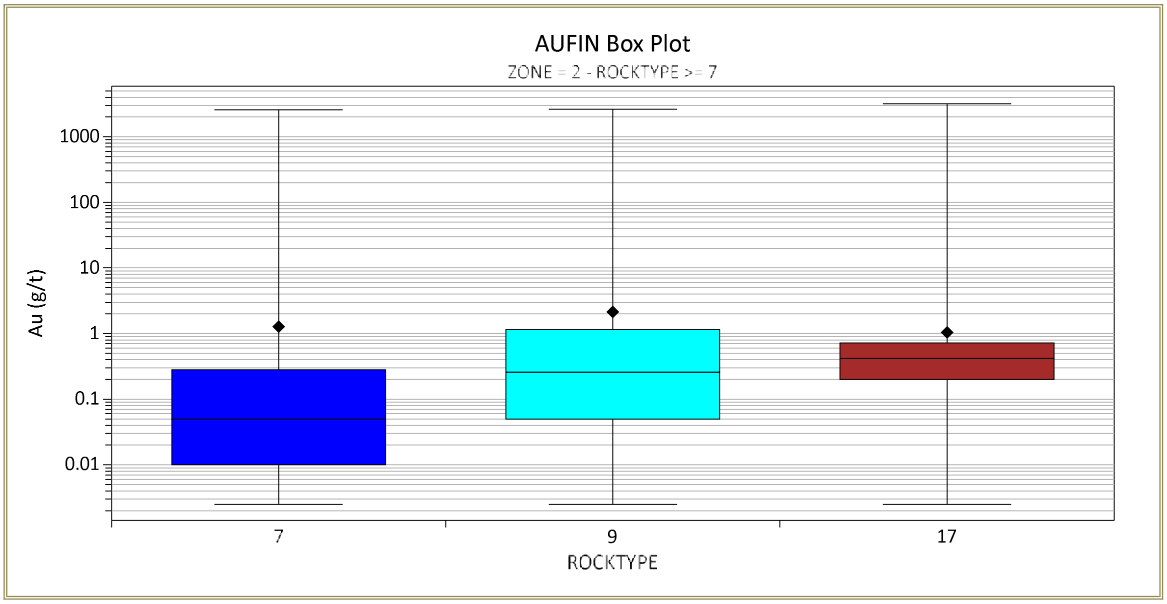


Figure 14-4: Box Plot of Rock Type for Zone 2; Uncapped Gold (g/t Au)

14.4.2 Compositing

For purposes of normalizing the assay data for further analysis, the raw assay values were composited to 1 m and 2 m intervals within the interpreted mineralized zone wireframes. Composite lengths were adjusted to avoid short remnants on the hanging wall or footwall contacts of the mineralized zones by equalizing the composite length within the interval. Unassayed intervals were assigned a grade of 0.0025 g/t Au, which is half the lower detection limit. Composite values were then tagged by zone, rock type, and ZR (combination of zone and rock type) codes. Capping analysis was carried out on the 1 m composites. The 2 m composites were used for the nearest neighbour interpolation and the 1 m composites for inverse distance and OK.

Table 14-7 shows the descriptive statistics of the uncapped 1 m composite values by mineralized zone. Descriptive statistics for gold composite grades by zone and rock type are shown in Table 14-8.

Figure 14-5 and Figure 14-6 present the box plots of the capped 1 m composite values by mineralized zone and rock type for Zone 1 and Zone 2. In general, the CV value was lower for the uncapped composites. In some cases, the CV increased because of the unassayed intervals being assigned 0.0025 g/t Au.

Table 14-7: Descriptive Statistics of 1 m Composite Values (uncapped) by Zone

Zone	Unit	Count	Minimum (g/t Au)	Maximum (g/t Au)	Mean (g/t Au)	Std. Dev.	CV
1	Au (g/t)	20196	0.0025	1,211.40	1.74	15.43	8.88
	Length (m)	20196	1.00	2.00	1.03	0.06	0.06
2	Au (g/t)	112149	0.0025	1,918.36	0.66	11.38	17.13
	Length (m)	112149	1.00	2.00	1.03	0.06	0.06
3	Au (g/t)	24363	0.0025	95.97	0.13	1.26	9.75
	Length (m)	24363	1.00	2.00	1.02	0.04	0.04
4	Au (g/t)	6036	0.0025	195.94	0.21	3.02	14.2
	Length (m)	6036	1.00	1.85	1.02	0.04	0.04

Notes: Std. Dev. = Standard Deviation; CV = Coefficient of Variation

Table 14-8: Descriptive Statistics of 1 m Composite Values (uncapped) by Rock Type per Zone

Zone	Rock Type	ZR Code	Count	Minimum (g/t Au)	Maximum (g/t Au)	Mean (g/t Au)	Std. Dev.	CV
1	7	107	5864	0.0025	415.86	0.66	6.52	9.85
	9	109	12503	0.0025	1,211.40	2.42	19.04	7.88
	17	117	1829	0.0025	53.90	0.54	1.99	3.71
2	7	207	64248	0.0025	1,918.36	0.33	11.29	34.69
	9	209	18742	0.0025	1,074.34	1.64	13.19	8.04
	17	217	29159	0.0025	1,526.67	0.78	10.22	13.04
3	7	307	20480	0.0025	95.97	0.06	1.18	20.23
	9	309	28	0.0025	3.99	0.37	0.89	2.42
	17	317	3855	0.0025	57.86	0.50	1.58	3.14
4	7	407	4408	0.0025	68.55	0.05	1.06	21.50
	9	409	1158	0.0025	72.88	0.65	3.11	4.78
	17	417	470	0.0025	195.94	0.67	9.07	13.58

Notes: Std. Dev. = Standard Deviation; CV = Coefficient of Variation

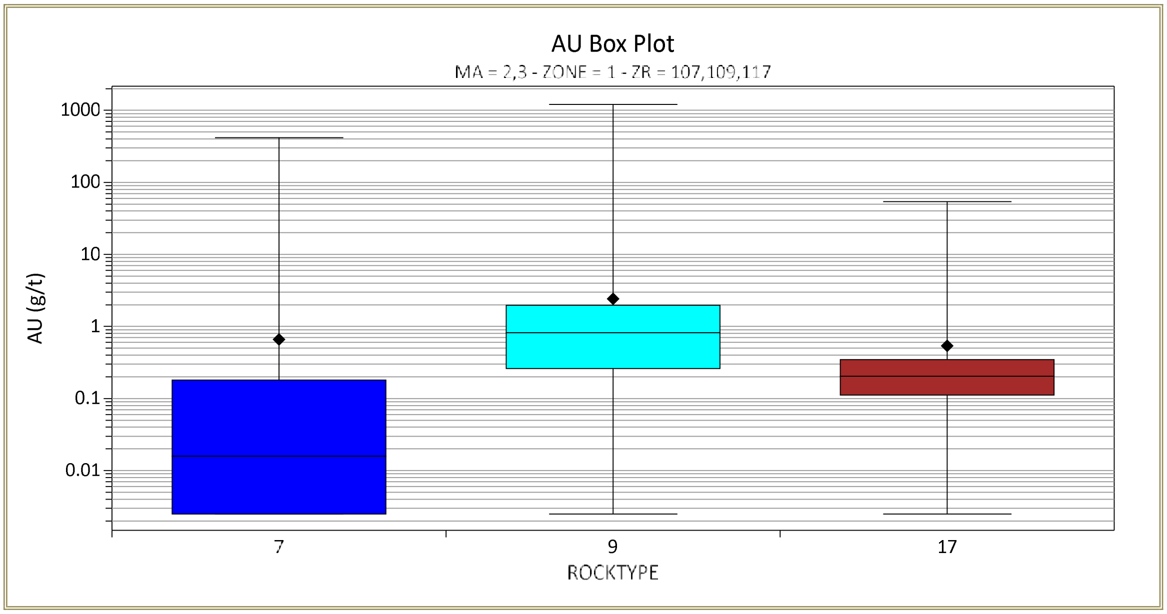


Figure 14-5: Box Plot of 1 m Composite Grades by Rock Type for Zone 1; Uncapped Gold (g/t Au)

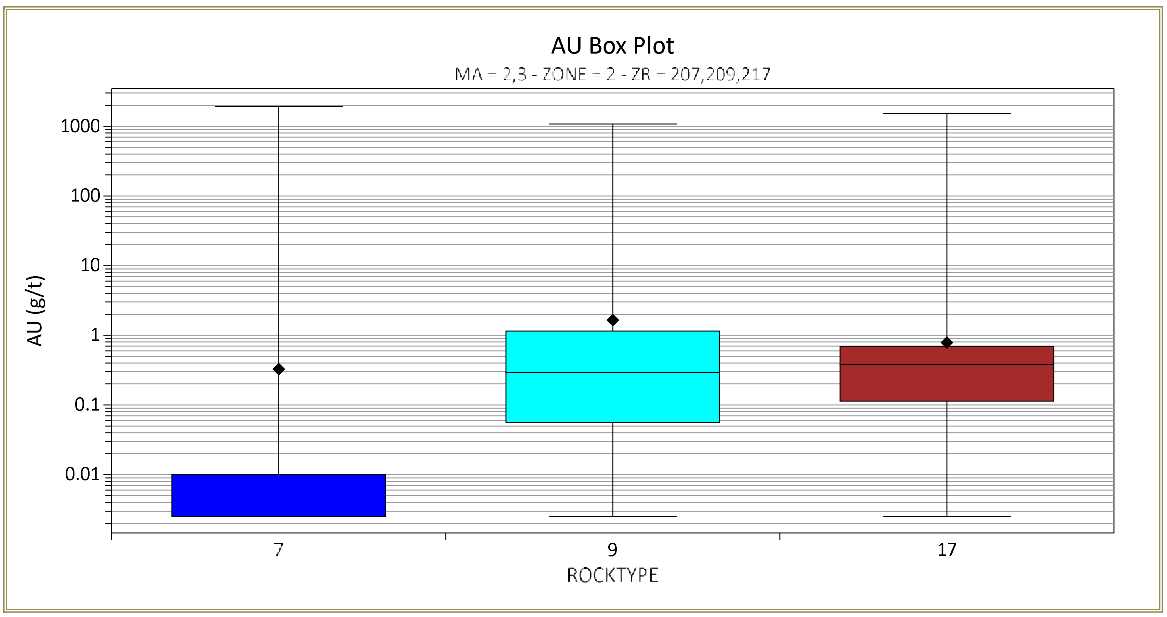


Figure 14-6: Box Plot of 1 m Composite Grades by Rock Type for Zone 2; Uncapped Gold (g/t Au)

14.4.3 Capping Analysis

In mineral deposits having skewed distributions (typically with CV >2), a few high-grade outliers can represent a large portion of the metal content. Often there is little continuity demonstrated by these outliers.

Capping analysis was carried out on 1 m composite values for the three rock types within each zone separately in the form of decile analysis, disintegration analysis, histogram, and log-probability plots.

Disintegration analysis uses a 10% to 15% step function to denote the changes in an ordered dataset and provides a degree of resolution on the plots to see more clearly the value of the population breaks that can be used for capping. It also provides a good look at the continuity of the grade dataset.

Figure 14-7 and Figure 14-8 illustrate the selection of the cap value based on disintegration analysis for High-Ti Basalt in Zone 1 and Zone 2, respectively.

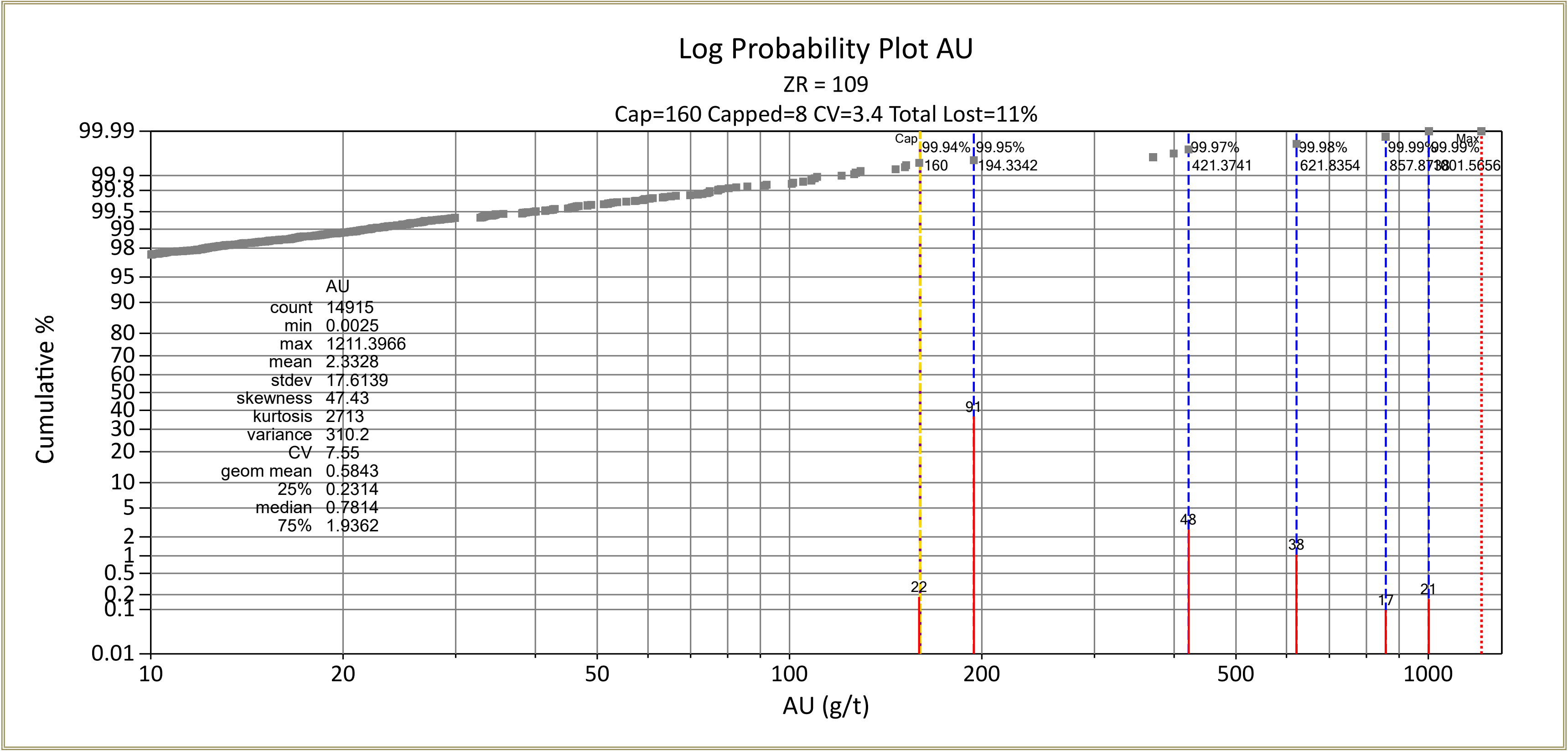


Figure 14-7: Zone 1, High-Ti Basalt Disintegration Analysis

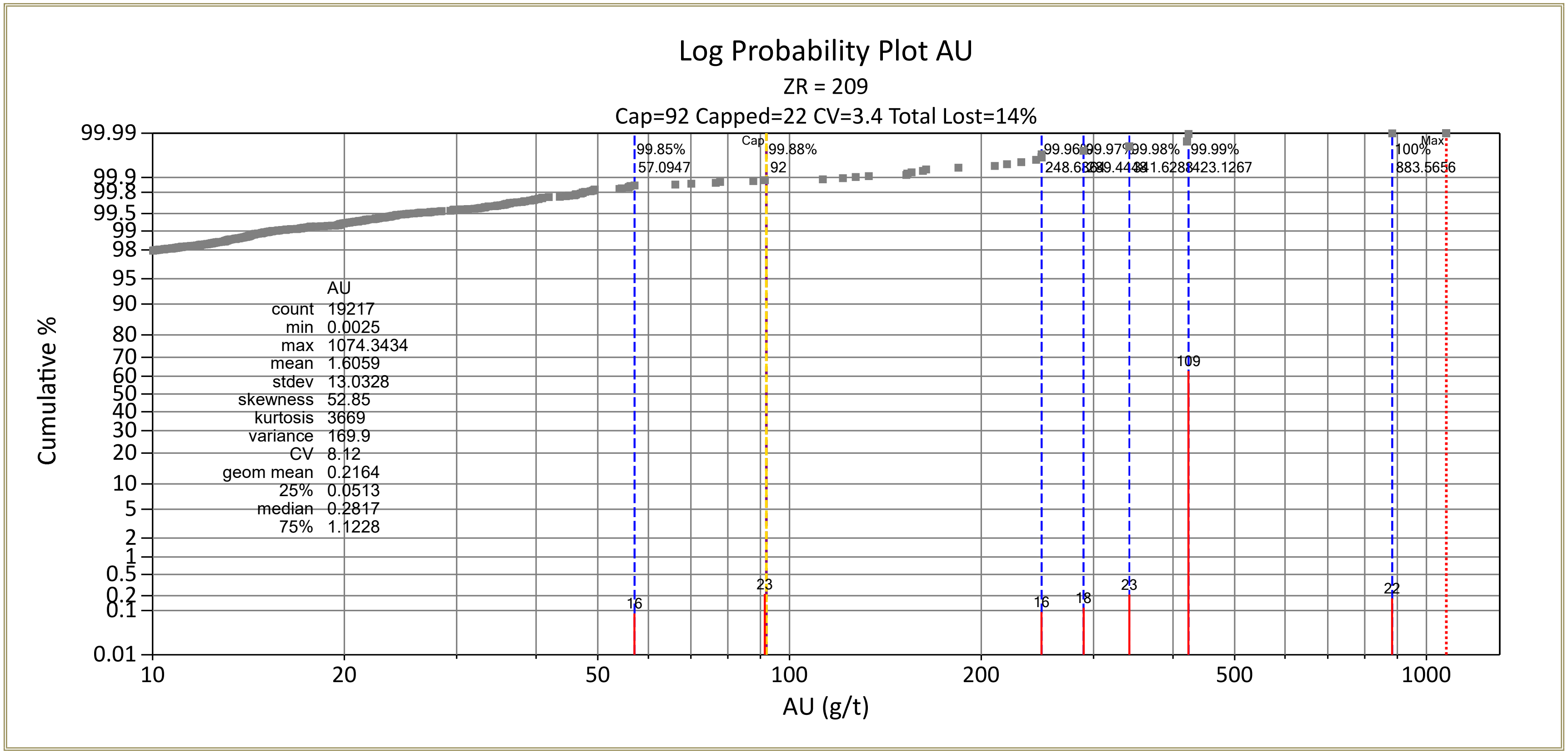


Figure 14-8: Zone 2, High-Ti Basalt Disintegration Analysis

Table 14-9 presents the selected capping levels applied to the 1 m composite values by zone and rock type. Also reported are the number of composites that were capped and the associated metal loss (%).

Table 14-9: Capping Levels by Rock Type per Zone

Zone	Rock Type	ZR Code	Capping (g/t Au)	Number Capped	Metal Loss (%)
1	7 (Ultramafic)	107	70	4	12
	9 (Basalt)	109	160	8	11
	17 (Felsic Intrusive)	117	15	5	7
2	7 (Ultramafic)	207	60	35	40
	9 (Basalt)	209	92	22	14
	17 (Felsic Intrusive)	217	80	7	11
3	7 (Ultramafic)	307	24	7	16
	9 (Basalt)	309	4	none	0
	17 (Felsic Intrusive)	317	30	2	3
4	7 (Ultramafic)	407	10	1	27
	9 (Basalt)	409	23	3	12
	17 (Felsic Intrusive)	417	13	1	58

Table 14-10 presents the descriptive statistics for the 1 m capped composite values. The uncapped composite descriptive statistics were reported in Table 14-8 and for uncapped assays in Table 14-6.

Table 14-10: Descriptive Statistics of 1 m Composite Grades (capped) by Rock Type per Zone

Zone	Rock Type	ZR Code	Count	Minimum (g/t Au)	Maximum (g/t Au)	Mean (g/t Au)	Std. Dev.	CV
1	7	107	5864	0.0025	70.00	0.59	3.27	5.59
	9	109	12503	0.0025	160.00	2.11	7.21	3.41
	17	117	1829	0.0025	15.00	0.50	1.37	2.75
2	7	207	64248	0.0025	60.00	0.20	1.84	9.41
	9	209	18742	0.0025	92.00	1.41	4.75	3.36
	17	217	29159	0.0025	80.00	0.70	2.43	3.49
3	7	307	20480	0.0025	24.00	0.05	0.67	13.72
	9	309	28	0.0025	3.99	0.37	0.89	2.42
	17	317	3855	0.0025	30.00	0.49	1.16	2.37
4	7	407	4408	0.0025	10.00	0.04	0.28	7.90
	9	409	1158	0.0025	23.00	0.57	1.77	3.11
	17	417	470	0.0025	13.00	0.28	1.03	3.70

Notes: Std. Dev. = Standard Deviation; CV = Coefficient of Variation

Figure 14-9 to Figure 14-12 present the box plots of the 1 m capped composite values for each of the zones. The boxplot splits the data into quartiles to display the grade distribution. Generally, the High-Ti Basalt demonstrates the highest grade. The exception is in Zone 3 where the majority rock type is the Felsic Intrusive.

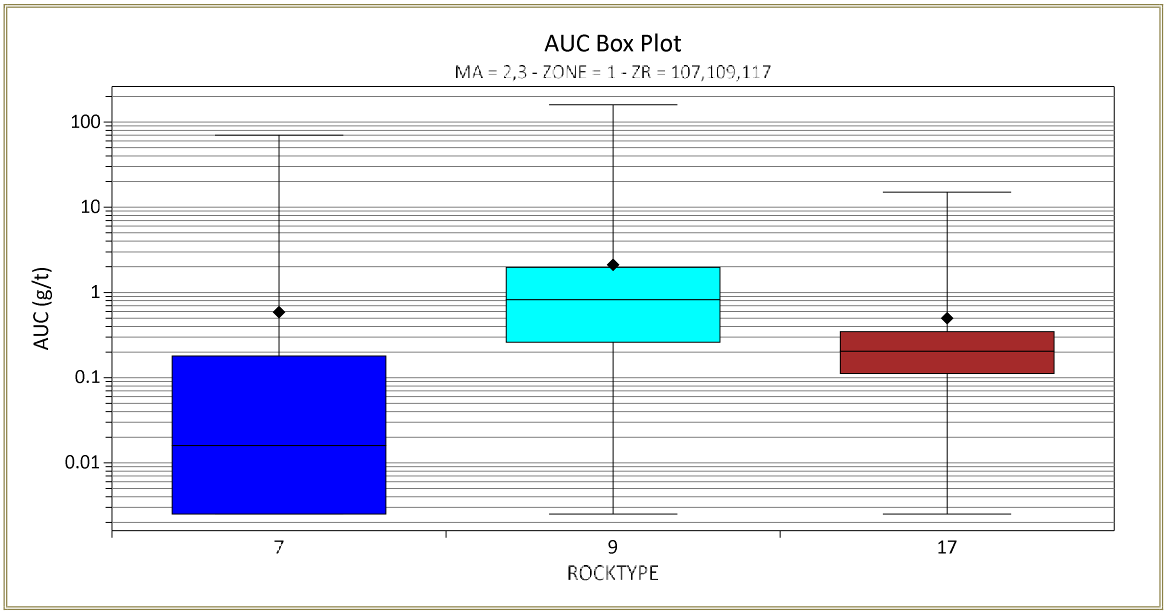


Figure 14-9: Box Plot of 1 m Composite Values by Rock Type for Zone 1; Capped Gold (g/t Au)

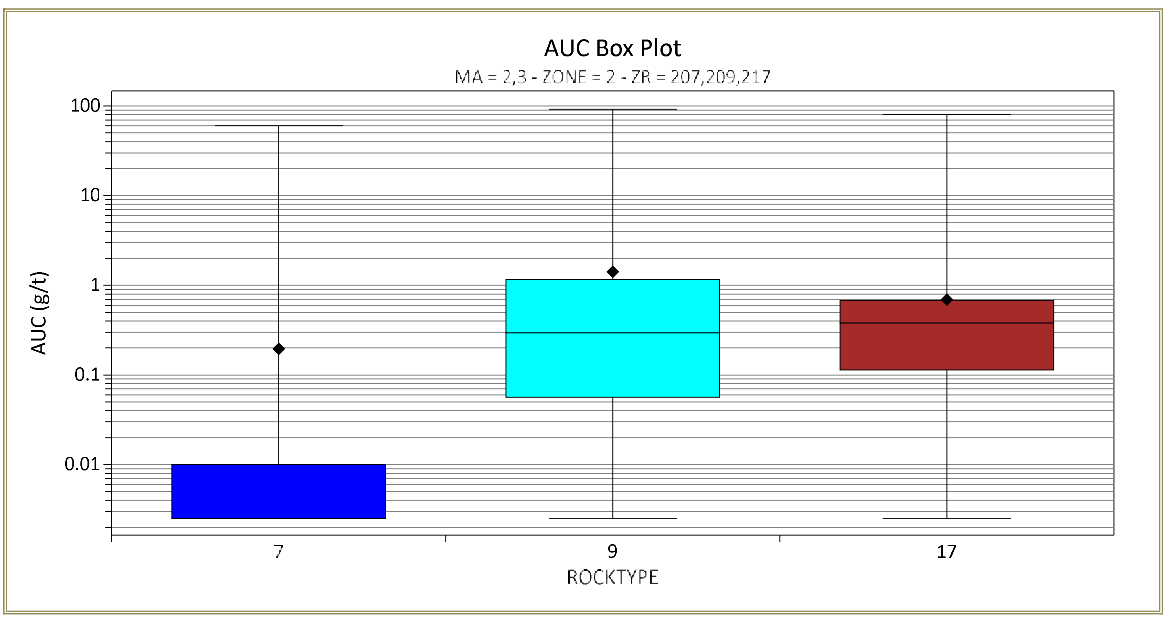


Figure 14-10: Box Plot 1 m Composite Values by Rock Type for Zone 2; Capped Gold (g/t Au)

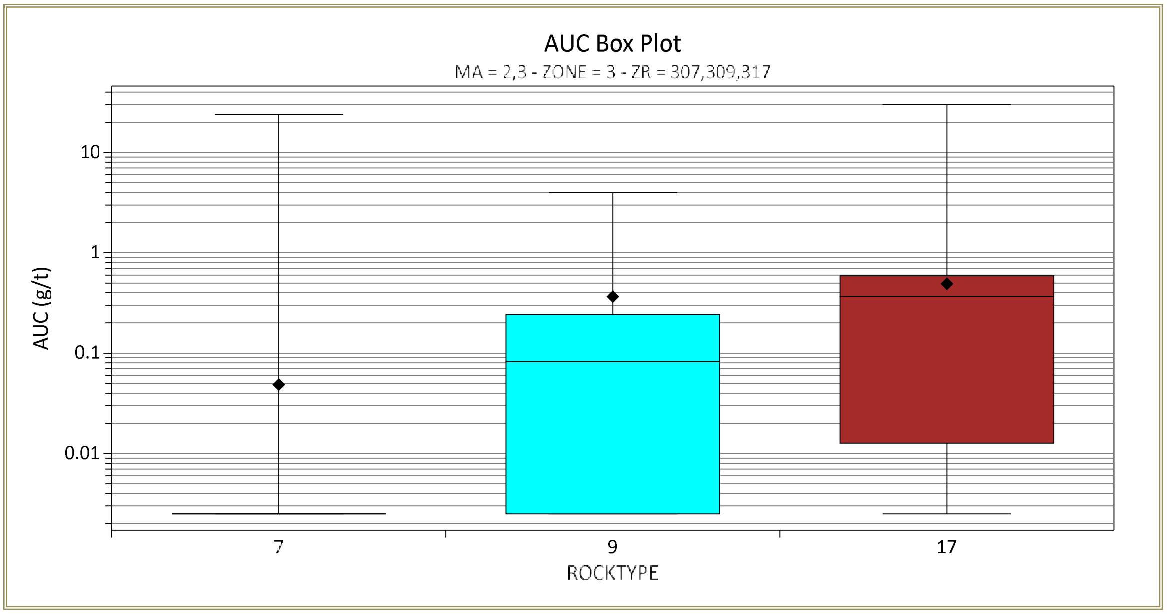


Figure 14-11: Box Plot 1 m Composite Values by Rock Type for Zone 3; Capped Gold (g/t Au)

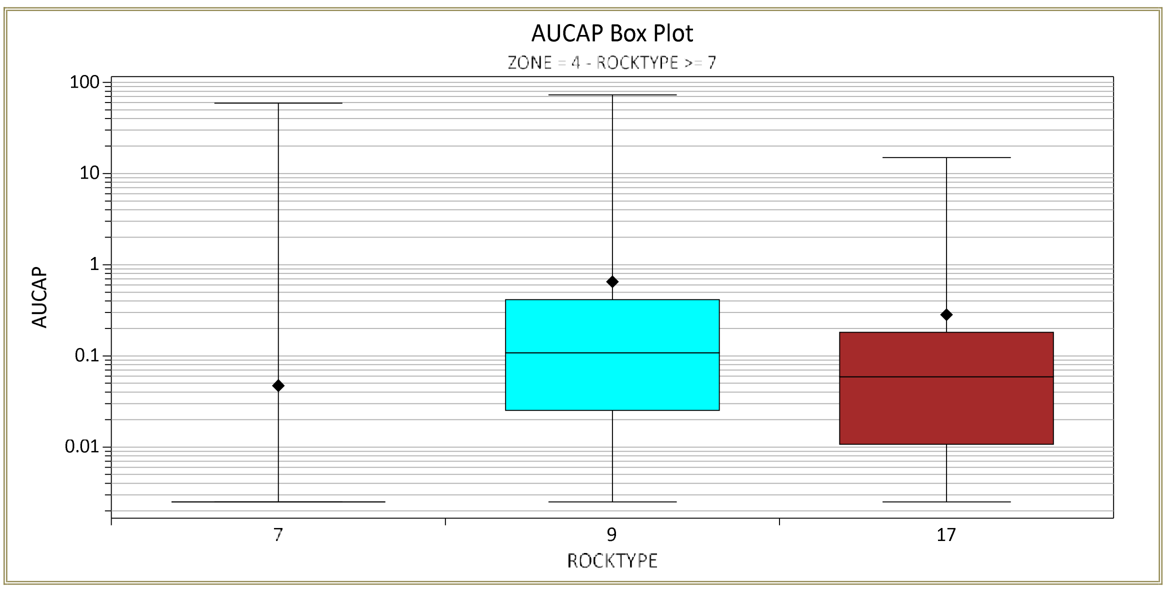


Figure 14-12: Box Plot 1 m Composite Values by Rock Type for Zone 4; Capped Gold (g/t Au)

The CV for the capped 1 m composite samples was compared to uncapped 1 m composite CV values. The CV values for the capped 1 m composite values were found to be within a more appropriate range for spatial analysis and gold grade estimation. Future work should assess the creation of high-grade domains to constrain the extrapolation of the outlier grades.

Table 14-11 presents the comparison of 1 m composite CV values.

Table 14-11: Comparison of 1 m Composite CV Values

Zone	Rock Type	Uncapped Mean 1 m Composite (g/t Au)	CV Uncapped Composite	Capped Mean 1 m Composite (g/t Au)	CV Capped Composite
1	7	0.66	9.85	0.59	5.59
1	9	2.42	7.88	2.11	3.41
1	17	0.54	3.71	0.50	2.75
2	7	0.33	34.69	0.20	9.41
2	9	1.64	8.04	1.41	3.36
2	17	0.78	13.04	0.70	3.49
3	7	0.06	20.23	0.05	13.72
3	9	0.37	2.42	0.37	2.42
3	17	0.50	3.14	0.49	2.37
4	7	0.05	21.50	0.04	7.90
4	9	0.65	4.78	0.57	3.11
4	17	0.6677	13.58	0.28	3.70

14.4.4 Contact Profiles

The contact relationship was analyzed between the three rock types: ultramafic (7), High-Ti Basalt (9) and felsic intrusive (17). The contacts between Zone 1 to Zone 4 were assumed to be hard, as they segregated the interpreted zones of mineralization.

Contact analysis determines the average grade based on the distance between the points. Figure 14-13 to Figure 14-15 illustrate the contact relationship between the three rock types. The High-Ti Basalt is interpreted as a hard contact based on the difference in grade at the contact shown in Figure 14-13 and Figure 14-15. Figure 14-14 confirms the soft contact relationship between ultramafic and felsic intrusive.

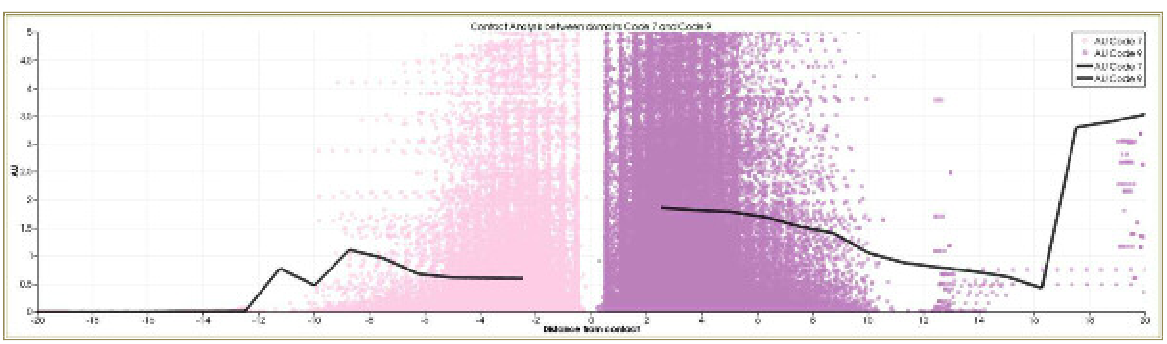


Figure 14-13: Contact Profiles – 7 UM:9 HTB

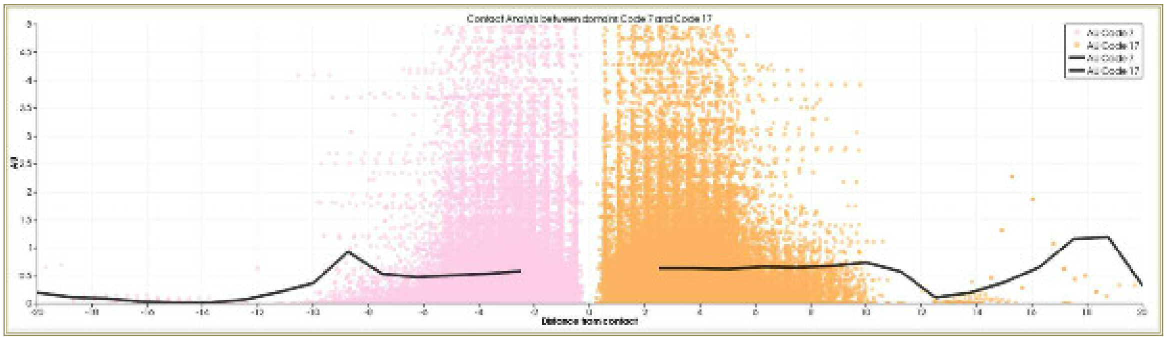


Figure 14-14: Contact Profiles – 7 UM:17 FI

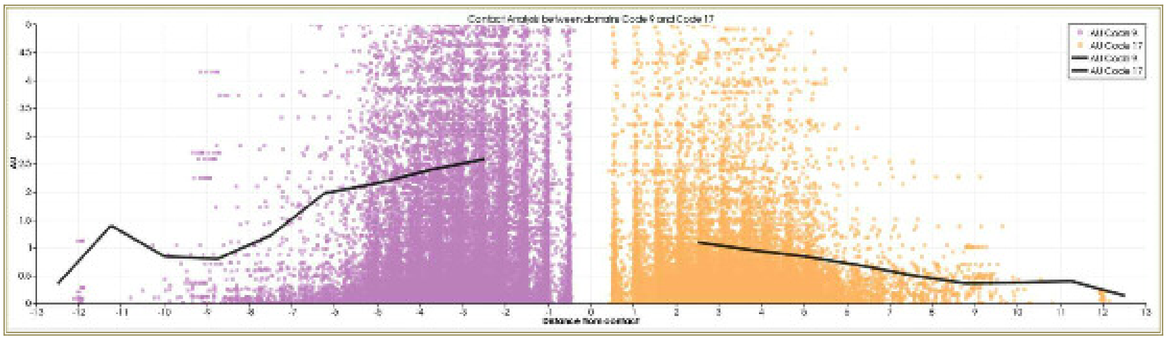


Figure 14-15: Contact Profiles – 9 HTB:17 FI

14.5 Block Model and Resource Estimation

14.5.1 Block Model

For resource estimation, the block model for the Phoenix Gold Project was set up as two block models to cover the upper and lower halves of the deposit. The MA3V2_TOP covers the model elevations between 5,390 m and 4,510 m and MA3V2_BOT covers the model elevations between 4,510 m and 3,530 m. No rotation was applied to the block models. The block matrix was selected in consideration of the geometry of the deposit (narrow zones of mineralization within the specific lithology), drill data density and selective mining unit (SMU).

Table 14-12 summarizes the block model parameters used in the GEMS project, and Figure 14-16 presents the block models referenced by the interpreted mineralization zones for the Phoenix Gold Project.

Table 14-12: Block Model Parameters for the MA3V2_TOP and MA3V2_BOT Models

	MA3V2_TOP (5390 m – 4510 m)	MA3V2_BOT (4510 m – 3,530 m)
Easting (m)	10,100	10,100
Northing (m)	49,250	49,250
Maximum elevation	5,390	4510
Rotation angle	No rotation°	No rotation°
Block size (X, Y, Z in metres)	2 x 2 x 2	2 x 2 x 2
Number of blocks in the X direction	300	300
Number of blocks in the Y direction	675	675
Number of blocks in the Z direction	440	490

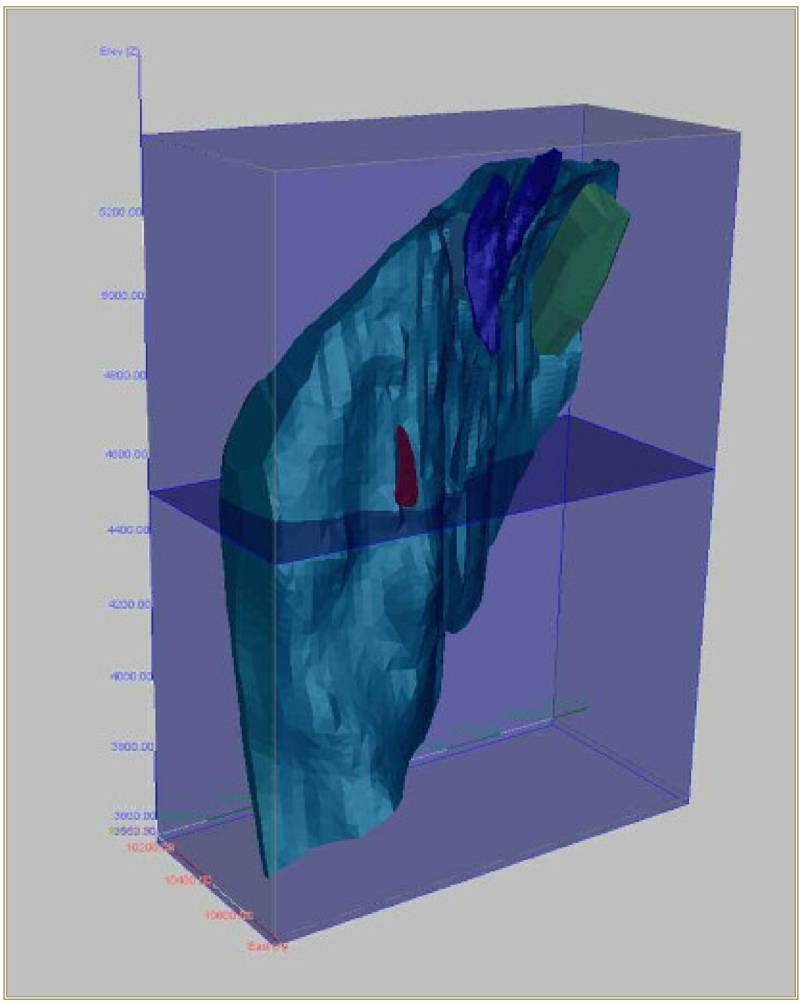


Figure 14-16: MA3V2_TOP and MA3V2_BOT Block Models; Perspective View Looking Northwest

14.5.2 Spatial Analysis

Geostatisticians use a variety of tools to describe the pattern of spatial continuity or strength of the spatial similarity of a variable with separation distance and direction. One of these is the correlogram, which measures the correlation between data values as a function of their separation distance and direction. If we compare samples that are close together, it is common to observe that their values are quite similar and the correlation coefficient for closely spaced samples is near 1.0. As the separation between samples increases, there is likely to be less similarity in the values, and the correlogram tends to decrease toward 0.0. The distance at which the correlogram reaches zero is called the range of correlation or simply the range. The range of the correlogram corresponds roughly to the more qualitative notion of the range of influence of a sample; it is the distance over which sample values show some persistence or correlation. The shape of the correlogram describes the pattern of spatial continuity. A very rapid decrease near the origin is indicative of short scale variability. A more gradual decrease moving away from the origin suggests more short scale continuity. A plot of 1-correlation is made so the result looks like the more familiar variogram plot.

The approach used to develop the variogram models employed Sage2001© software. Directional sample correlograms were calculated along horizontal azimuths of 0, 30, 60, 120, 150, 180, 210, 240, 270, 300, and 330 degrees. For each azimuth, sample correlograms were also calculated at dips of 30 and 60 degrees in addition to horizontally. Lastly, a correlogram was calculated in the vertical direction. Using the thirty-seven sample correlograms, an algorithm determined the best-fit model nugget effect and two-nested structure variance contributions. After fitting the variance parameters, the algorithm then fitted an ellipsoid to the thirty-seven ranges from the directional models for each structure. The anisotropy of the correlation was given by the range along the major, semi-major, and minor axes of the ellipsoids and the orientations of these axes for each structure. TMAC reviewed the fitted variogram and adjusted to reflect the mineralization.

Table 14-13 and

Table 14-14 present the variogram parameters for the block models MA3V2_TOP and MA3V2_BOT. Zone 3 and Zone 4 contained less data than Zone 1 and Zone 2. TMAC reviewed potential variograms and decided to use the Zone 1 variograms.

Table 14-13: Variogram Parameters for Block Model MA3V2_TOP by ZR Code

ZR	Sill = 1.00	Search Anisotropy	Azimuth (°)	Dip (°)	Azimuth (°)	X Range (m)	Y Range (m)	X Range (m)	Variogram Type
107	C_0 = 0.35	ZYZ	83	-10	88				Nugget
	C_1 = 0.55	ZYZ	83	-10	88	3.6	2.2	11.2	Spherical
	C_2 = 0.10	ZYZ	83	-10	88	41.2	55.1	75	Spherical
109	C_0 = 0.50	ZYZ	8	-66	-10				Nugget
	C_1 = 0.40	ZYZ	8	-66	-10	7	10	10	Spherical
	C_2 = 0.10	ZYZ	8	-66	-10	20	40	30	Spherical

ZR	Sill = 1.00	Search Anisotropy	Azimuth (°)	Dip (°)	Azimuth (°)	X Range (m)	Y Range (m)	X Range (m)	Variogram Type
117	$C_0 = 0.50$	ZYZ	5	-60	-10				Nugget
	$C_1 = 0.40$	ZYZ	5	-60	-10	6	10	5	Spherical
	$C_2 = 0.10$	ZYZ	5	-60	-10	21	32	12	Spherical
207	$C_0 = 0.40$	ZYZ	0	-85	-10				Nugget
	$C_1 = 0.50$	ZYZ	0	-85	-10	10	20	12	Spherical
	$C_2 = 0.10$	ZYZ	0	-85	-10	25	55	35	Spherical
209	$C_0 = 0.50$	ZYZ	30	40	-30				Nugget
	$C_1 = 0.35$	ZYZ	30	40	-30	10	20	12	Spherical
	$C_2 = 0.15$	ZYZ	30	40	-30	25	50	35	Spherical
217	$C_0 = 0.40$	ZYZ	30	50	-30				Nugget
	$C_1 = 0.50$	ZYZ	30	50	-30	10	18	11	Spherical
	$C_2 = 0.10$	ZYZ	30	50	-30	25	40	30	Spherical

Table 14-14: Variogram Parameters for Block Model MA3V2_BOT by ZR Code

ZR	Sill = 1.00	Search Anisotropy	Azimuth (°)	Dip (°)	Azimuth (°)	X Range (m)	Y Range (m)	X Range (m)	Variogram Type
207	$C_0 = 0.40$	ZYZ	0	-85	-10				Nugget
	$C_1 = 0.50$	ZYZ	0	-85	-10	10	20	12	Spherical
	$C_2 = 0.10$	ZYZ	0	-85	-10	25	55	35	Spherical
209	$C_0 = 0.50$	ZYZ	30	40	-30				Nugget
	$C_1 = 0.35$	ZYZ	30	40	-30	10	20	12	Spherical
	$C_2 = 0.15$	ZYZ	30	40	-30	25	50	35	Spherical
217	$C_0 = 0.40$	ZYZ	30	50	-30				Nugget
	$C_1 = 0.50$	ZYZ	30	50	-30	10	18	11	Spherical
	$C_2 = 0.10$	ZYZ	30	50	-30	25	40	30	Spherical

The rotation convention for the Search Anisotropy is ZYZ (right-hand rule):

- Rotation about Z-axis – Positive rotation X toward Y
- Rotation about Y-axis – Positive rotation Z toward X
- Rotation about new Z-axis – Positive rotation X toward Y.

14.5.3 Grade Interpolation

The Phoenix Gold Project block models were estimated using Inverse Distance cubed (uncapped-AUCID, capped-AUCID3). OK (capped-AUCOK) and nearest neighbour (NN) (capped-AUCNN) were also run for validation purposes. The block models were estimated in four passes. The NN used the 2 m composites, and IDW3 and OK used 1 m composites for grade interpolation.

Table 14-15 shows the estimation parameters for each pass used to estimate gold grades.

Table 14-15: Summary of Samples Controls for All Zones

Pass	Minimum No. of Samples	Maximum No. of Samples	Maximum No. Samples per Drill Hole	Minimum No. Drill Holes
1	5	11	3	2
2	5	11	3	2
3	4	8	3	2
4	3	8	3	1

14.5.4 Special Models

GEMS use Special Models to track interpolation characteristics. These Special Models were also used to evaluate resource classification. TMAC employed the following in their grade interpolation:

- NN Interpolation:
  - DISTNN – Distance to nearest composite
  - IDW3 interpolation:
  - AVGDIST – Average distance to composites used for interpolation
  - DIST1 – Distance to nearest composite for Pass 1
  - DIST2 – Distance to nearest composite for Pass 2
  - DIST3 – Distance to nearest composite for Pass 3
  - DIST4 – Distance to nearest composite for Pass 4
  - NCOMP – Number of composites used for interpolation
  - NDDH – Number of drill holes used for interpolation
  - PASS – Pass number for interpolation
- OK interpolation:
  - OKNCOMP – Number of composites used for interpolation
  - OKNDDH – Number of composites used for interpolation
  - VAR – Kriging variance.

14.5.5 Search Ellipses

Table 14-16 summarizes the search ellipse parameters for the Phoenix Gold Project. These parameters were based on the geological interpretation and variogram analysis. Similar search ellipses were used for IDW3 and OK grade interpolation. The NN estimation used Pass 1 and Pass 4.

Table 14-16: Search Ellipse Dimensions by ZR Code

ZR	Pass	Search Anisotropy	Z (°)	Y (°)	Z (°)	X Range (m)	Y Range (m)	Z Range (m)
107	1	ZYZ	-83	-10	88	20	30	40
	2					40	55	75
	3					60	80	110
	4					100	140	190
109	1	ZYZ	7.6	-66.3	-45	10	20	20
	2					20	40	30
	3					30	60	50
	4					50	100	80
117	1	ZYZ	5	-60	-45	10	20	10
	2					20	35	15
	3					30	50	20
	4					60	90	40
207	1	ZYZ	0	-85	-45	10	30	10
	2					25	55	10
	3					40	80	20
	4					60	140	30
209	1	ZYZ	-30	50	75	10	30	15
	2					25	50	20
	3					40	80	25
	4					60	130	30
217	1	ZYZ	30	40	49	20	10	20
	2					40	20	30
	3					60	25	50
	4					100	30	80

14.5.6 Outlier Controls

Additional outlier controls were applied during the interpolation passes. For Pass 1, the capped outliers were used in the normal grade interpolation. The average of the mean distance of samples used for grade estimation was 15.5 m, and the 99th percentile was 29 m.

For Pass 2 through Pass 4, the outliers were excluded and not used for grade interpolation.

14.6 Model Verification and Validation

TMAC distinguishes between verification and validation of the block model:

- Verification is a manual check (i.e., visual inspection) or quasi-manual check (i.e., spreadsheet) of the actual procedure used.
- Validation is a test for reasonableness using a parallel procedure, which may be manual or a computer-based procedure (i.e., different interpolation methods).

14.6.1 Visual Verification

The block model was validated by visually inspecting the block model results in section and plan compared with the drill hole composite data. The grades of the blocks by section agreed well with the composite data used in the interpolation.

Figure 14-17 presents a selected 5,100 m elevation plan view that shows the gold grades (AUCID3) in blocks with the gold grades from the 1 m composites. Figure 14-18 illustrates good correlation between block and composite grades on Section 51040N.

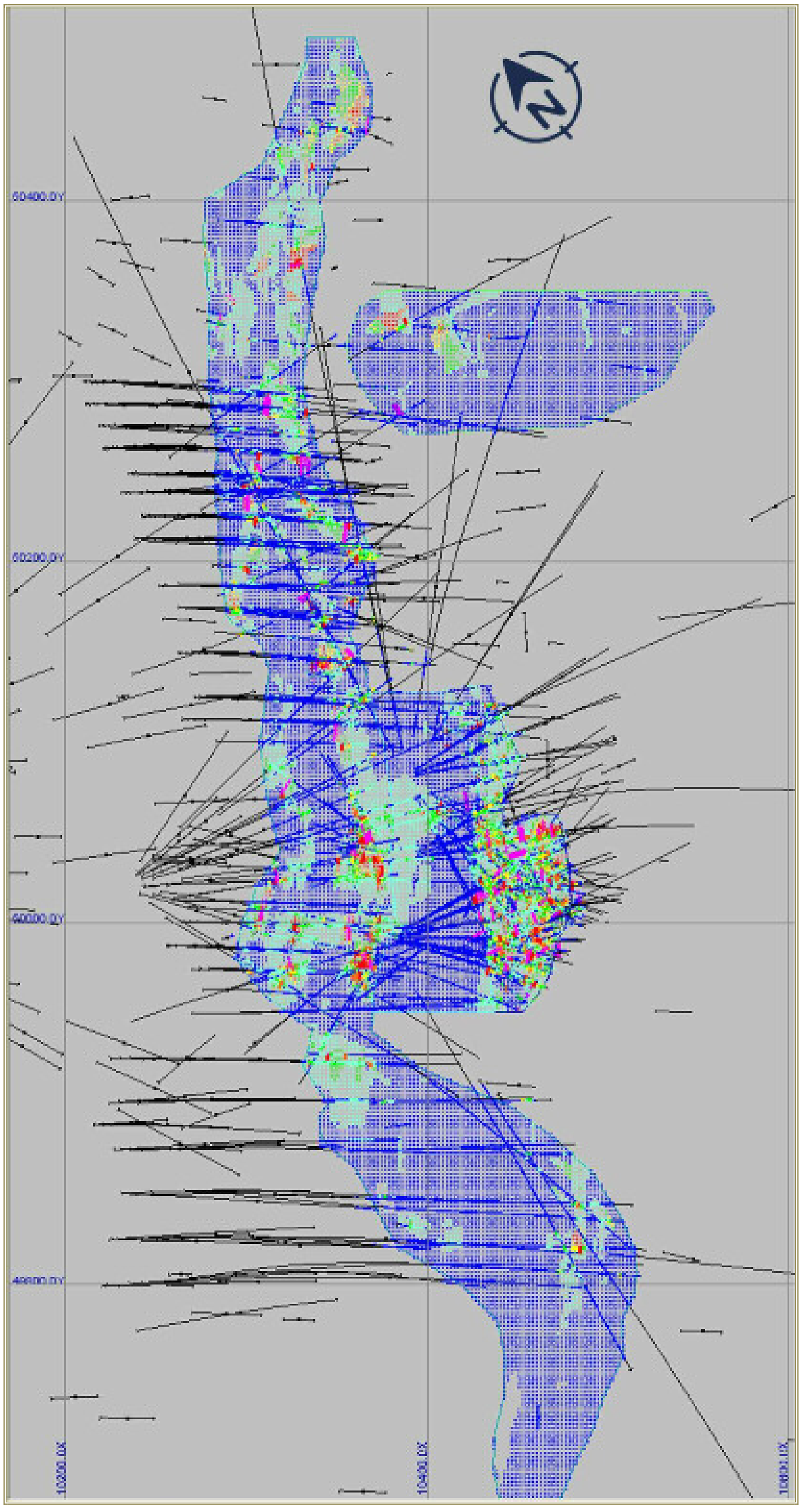


Figure 14-17: Plan View 5,100 m Elevation Comparing Block Grades with 1 m Composites (Looking Grid North)

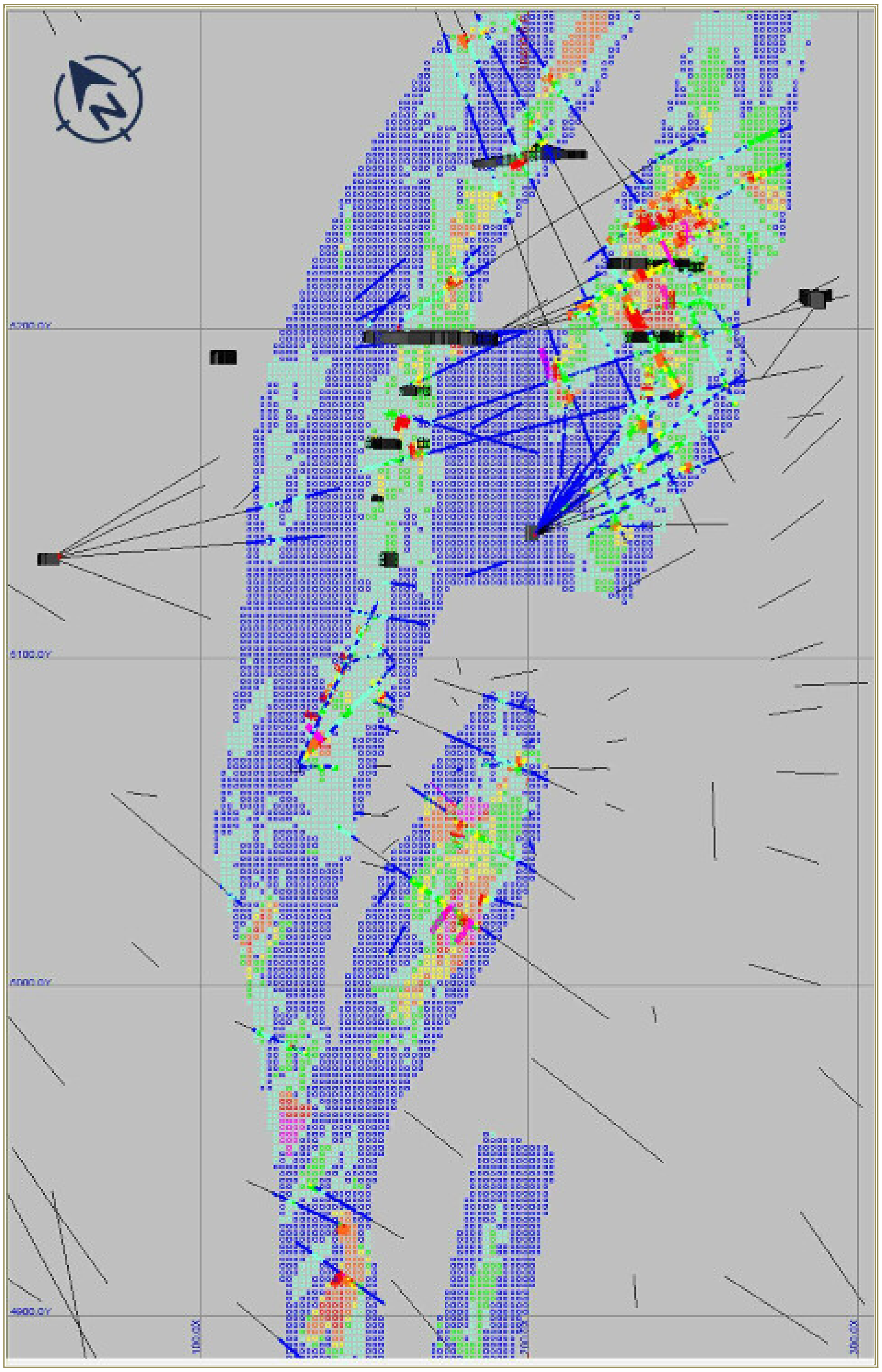


Figure 14-18: Section 50140N Comparing Block Grades with 1 m Composites (Looking Grid North)

14.6.2 Statistical Validation

The block model statistics were reviewed for each Rock Type in each Zone and no bias was found between the different interpolation methods and the 1 m composites.

Table 14-17 presents the average gold grades for Measured-Indicated-Inferred blocks in MA3V2_TOP by rock type. Minor differences are noted between the interpolation methods, but those may reflect data density and statistics generated by block count rather than weighted by tonnes.

Table 14-17: Statistical Comparison by Rock Type of Capped Interpolated Grades for MA3V2_Top

Zone	Rock Type	NN Mean (g/t Au)	IDW3 Mean (g/t Au)	OK Mean (g/t Au)
1	7	0.395	0.411	0.445
	9	1.945	1.966	1.994
	17	0.432	0.438	0.450
2	7	0.261	0.236	0.251
	9	1.174	1.113	1.134
	17	0.606	0.571	0.527
3	7	0.059	0.064	0.073
	9	0.382	0.434	0.367
	17	0.495	0.407	0.443
4	7	0.053	0.065	0.077
	9	0.477	0.475	0.499
	17	0.185	0.187	0.190

14.6.3 Swath Plots

A series of swath plots of gold grades were generated from capped gold grades for the NN, ID3, and OK interpolation methods. The grades are averaged over 20 m swaths for each of the plots.

Figure 14-19 to Figure 14-21 compared the capped gold grades for NN with the IDW3 models. Figure 14-22 to Figure 14-24 compared the capped gold grades for OK with the IDW3 models. These figures confirm a good correlation between the grade models independent of interpolation method.

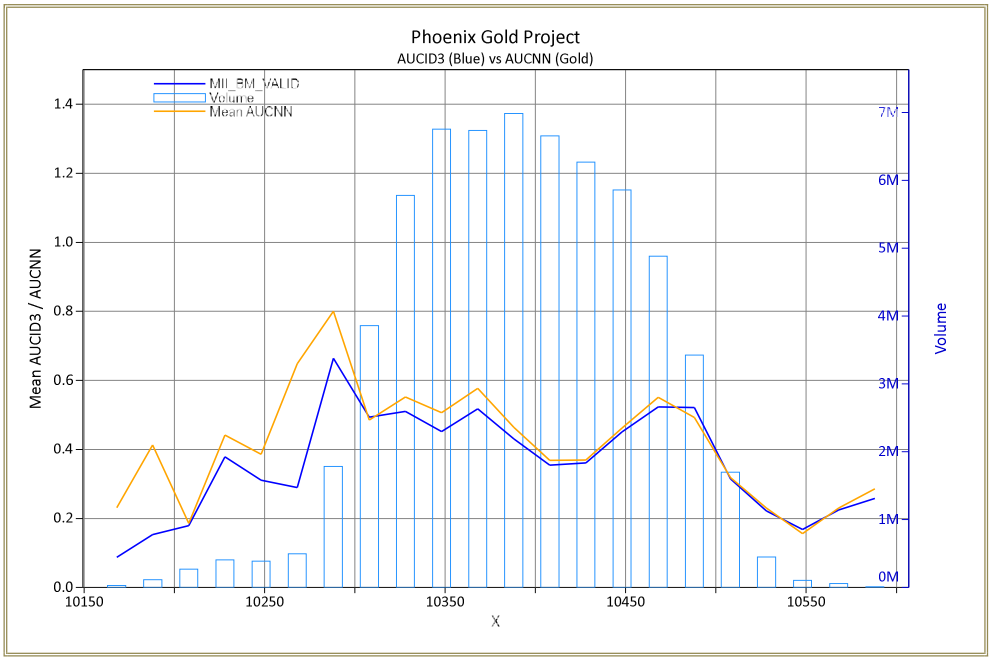


Figure 14-19: Swath Plot by Easting, AUCID3 vs. AUCNN

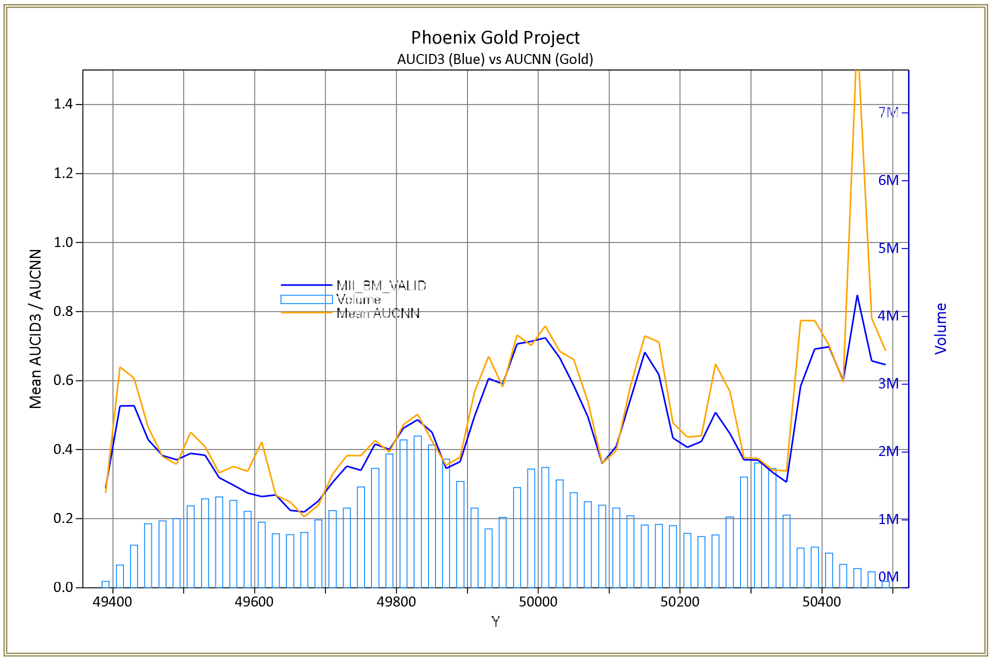


Figure 14-20: Swath Plot by Northing, AUCID3 vs. AUCNN

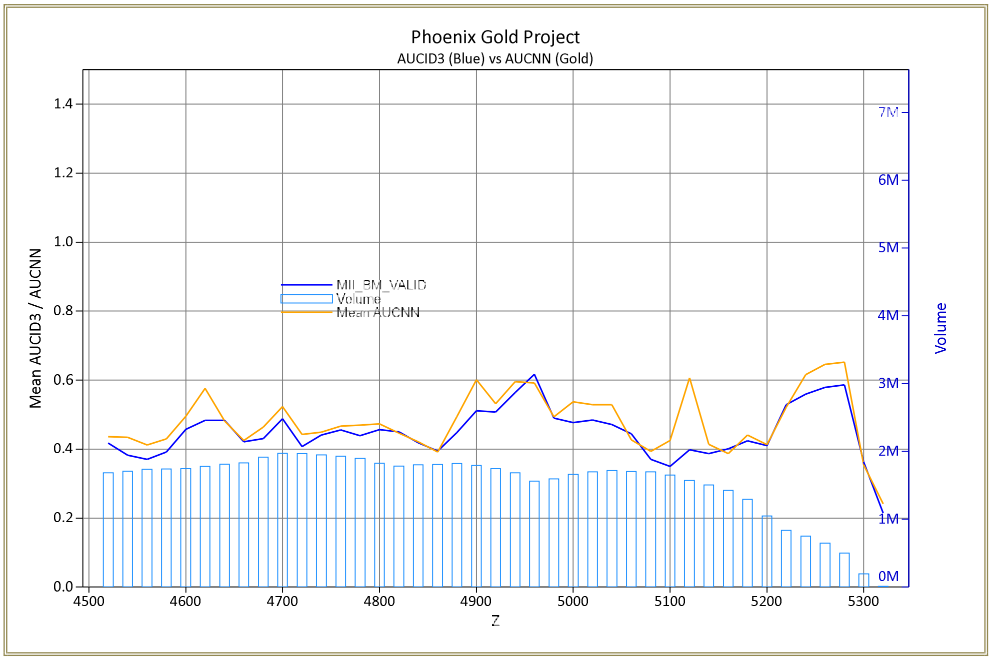


Figure 14-21: Swath Plot by Elevation, AUCID3 vs. AUCNN

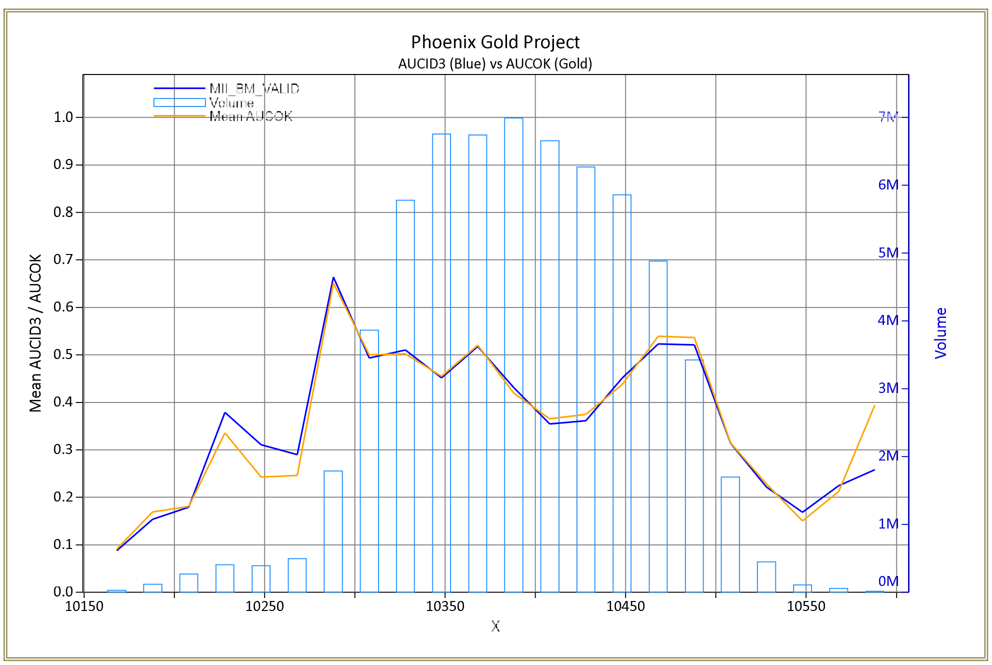


Figure 14-22: Swath Plot by Easting, AUCID3 vs. AUCOK

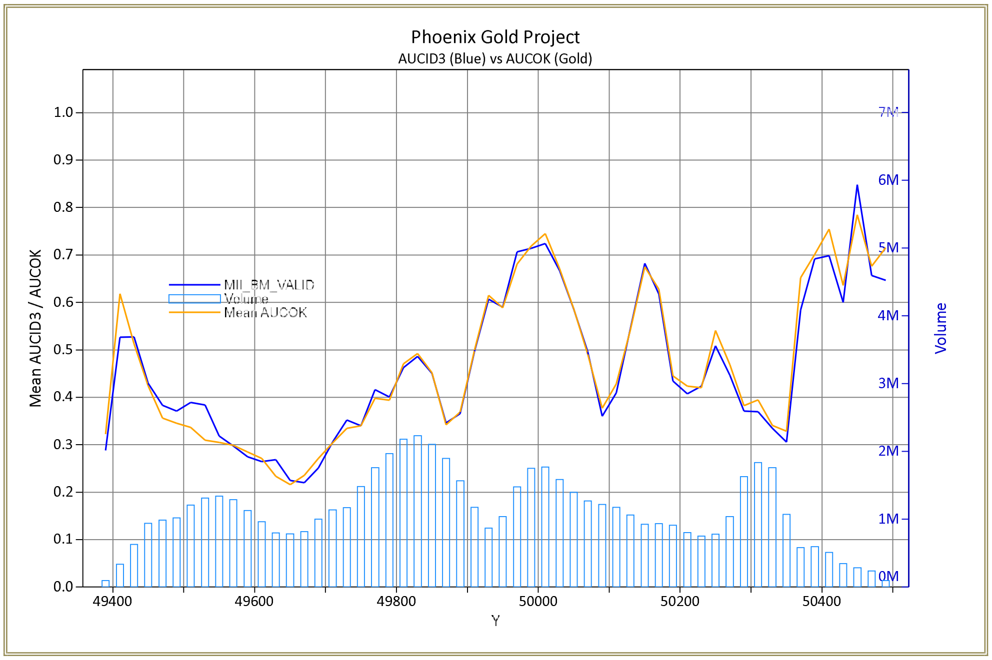


Figure 14-23: Swath Plot by Northing, AUCID3 vs. AUCOK

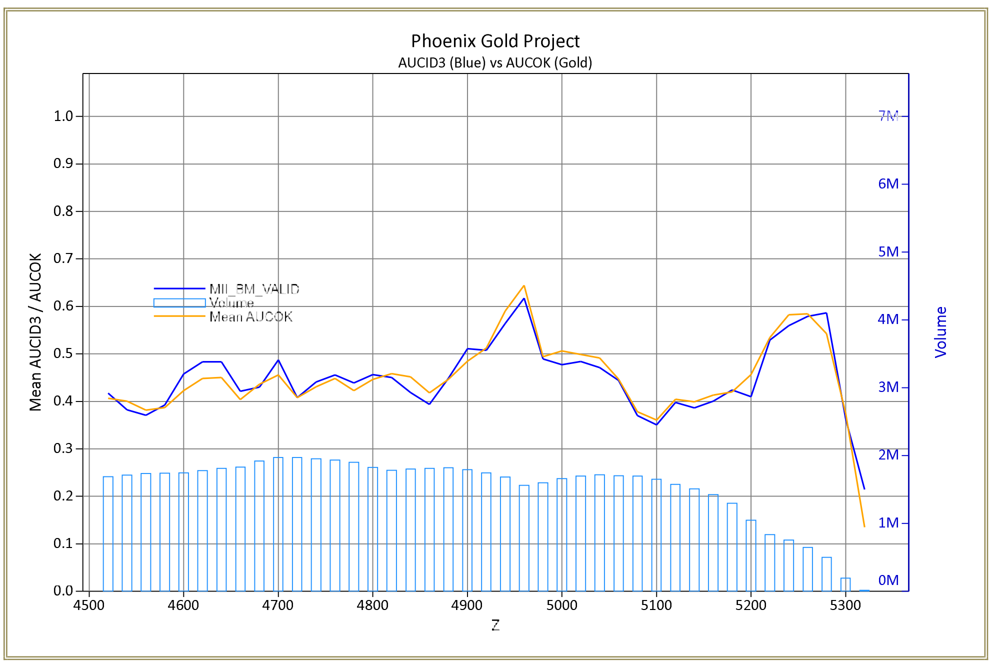


Figure 14-24: Swath Plot by Elevation, AUCID3 vs. AUCOK

14.6.4 Reconciliation of 2018 Test Mining Program

In late 2017, Rubicon commenced mining operations at the Phoenix Gold Project to extract a bulk sample and process through the existing Phoenix Mill and produce gold-bearing material.

The program consisted of three stopes located in the F2 High-Ti Basalt, one accessed from the 183 m Level and the other two from the 244 m Level. The material was sequentially mined, hoisted to surface and stored in separate stockpiles. Each stope was then batch processed through the mill. The stopes were not comingled with other stope material. There was only one mill cleanup at the end of the program.

Golder (2019) compared the tonnes and gold mined, less dilution, to judge the variance against the in-situ resource. Table 14-18 compares a calculation of undiluted tonnes derived from process tonnes less measured dilution with the current resource model. The tonnes were within 1.5% and the resource gold ounces were 12.5% less.

Table 14-18: Calculated Undiluted Bulk Sample vs. Undiluted Resource Model

	Actual Results			TMAC Resource Reporting from CMS		
Bulk Sample Stope	Tonnes	Au g/t	Au oz	Tonnes	AUCID3 g/t	AUCID3 oz
244-Z1-015	7,329	3.36	792.3	7,331	2.98	701.7
244-Z1-977	9,985	3.69	1,184.6	9,794	3.48	1,095.4
183-Z1-161 combined	18,420	5.38	3,187.6	19,136	4.42	2,722.0
Total	**35,734**	**4.50**	**5,164.5**	**36,261**	**3.88**	**4,519.2**

14.6.5 Hermitian Correction

The relative degree of smoothing in the block model estimates can be evaluated using the Discrete Gaussian or Hermitian Polynomial Change of Support method (Journel and Huijbregts, 1978).

With this method, the distribution of the hypothetical block grades can be directly compared to the estimated (OK or ID) model by using pseudograde/tonnage curves. In general, the estimated model should be slightly higher in tonnage and slightly lower in grade, compared to the Herco distribution at the projected cut-off grade. These differences account for selectivity and other potential ore-handling issues that commonly occur during mining.

The Herco distribution is derived from the declustered composite grades that have been adjusted to account for the change in support from smaller drill-hole composite samples to the large blocks in the model. The transformation results in a less skewed distribution, but with the same mean as the original declustered samples.

The Measured + Indicated resource within the High-Ti Basalt in Zone 1 and Zone 2 are smooth relative to the Herco distribution. As shown in Figure 14-25, the ID model displays less smoothing than the OK model for Zone 1 High-Ti Basalt—the tonnes were underestimated about 3% and the grade -5.3% at the 3.0 g/t Au cut-off grade.

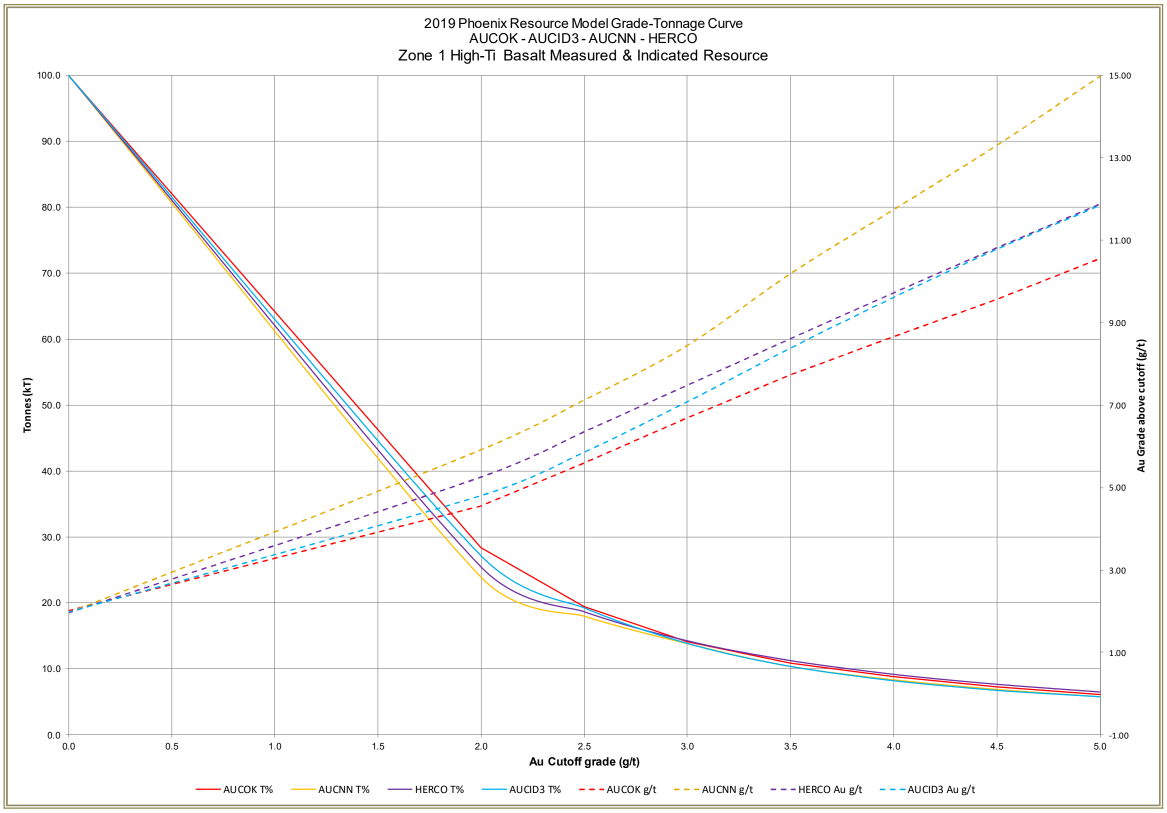


Figure 14-25: Zone 1 High-Ti Basalt Herco Grade-Tonnage Curve

Similarly, in Figure 14-26, the ID model displays less smoothing than the OK model for Zone 1 High-Ti Basalt—the tonnes were underestimated about 1% and the grade -11.7% at the 3.0 g/t Au cut-off grade.

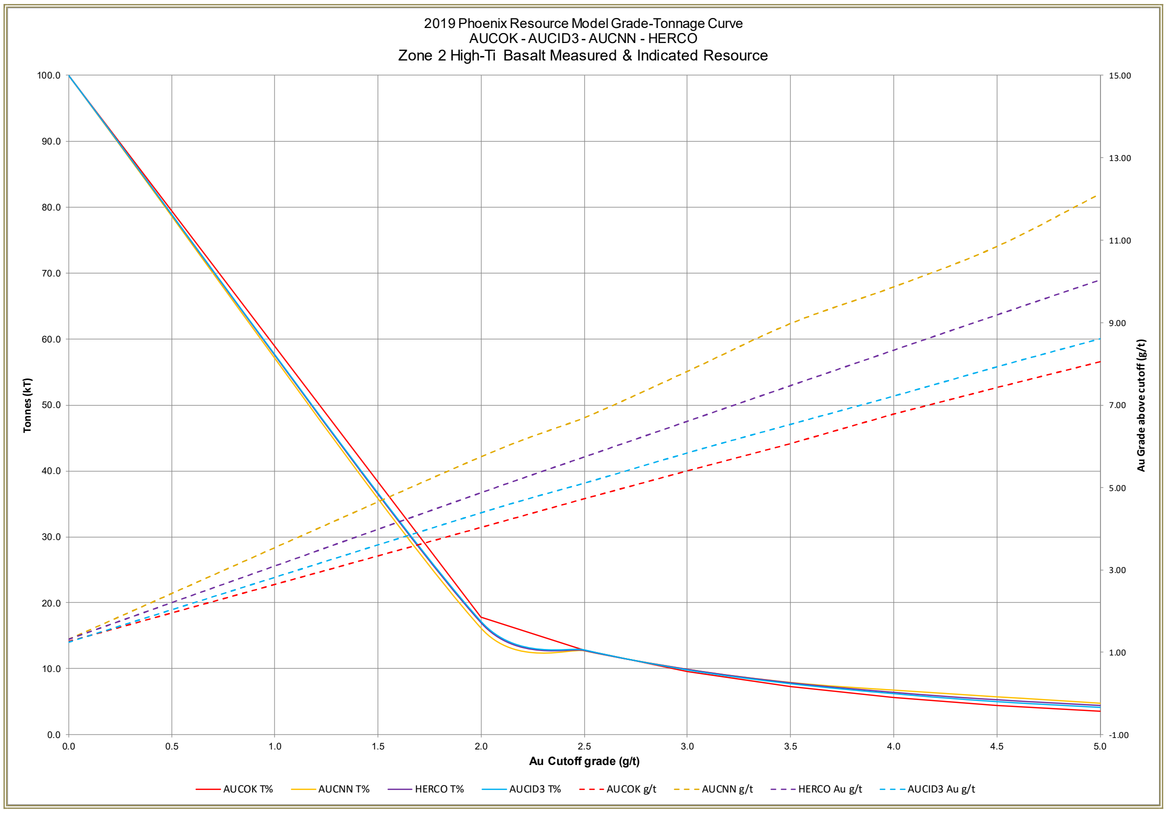


Figure 14-26: Zone 2 High-Ti Basalt Herco Grade-Tonnage Curve

14.7 Mineral Resources

14.7.1 Mineral Resource Classification

Mineral resources were classified in accordance with definitions provided by CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014). Mineral resources have an effective date of March 18, 2019.

Mineral resources were initially assigned based on data density in coordination with mineralization continuity. Resource classification was refined based on the interpolation statistics collected during interpolation. All resources were interpolated using a minimum of two drill holes and a minimum of three composites. The nominal spacing for Measured resource, based on distance to nearest composite, was 6 m with 99% less than 15.7 m. For Indicated resource, the nominal spacing was 13 m and for Inferred resource 26 m. Additional statistics are reported in Table 14-19.

Table 14-19: Additional Interpolation Statistics Reported by Resource Class

Resource Class	Avg. Distance to Nearest Composite	99th Percentile Distance to Nearest Composite	Avg. of Mean Distance of Composites Used	99th Percentile Mean Distance of Composites Used	Min. No. of Drill Holes	Avg. No. of Drill Holes Used	Min. No. of Composites Used	Avg. No. of Composites Used
Measured	6	15.7	10	21	2	4	5	11
Indicated	13	32.3	18	34	2	3	3	9
Inferred	26	60.1	33	57	2	3	3	7

Figure 14-27 illustrates the resource classification for Zone 1 and Zone 2 in plan view relative to underground development (305 m Level).

Resources were also constrained by proximity to development. Measured resources were constrained between 122 m Level and 60 m below 305 m Level.

Figure 14-28 illustrates the location of the Zone 1 resource classification relative to underground development. The Indicated resource were constrained within 90 m from the shaft bottom at 732 m Level. Inferred resource was assigned to interpolated blocks down to 1,525 m Level.

Figure 14-29 illustrates resource classification within Zone 2 in a longitudinal view relative to existing underground development.

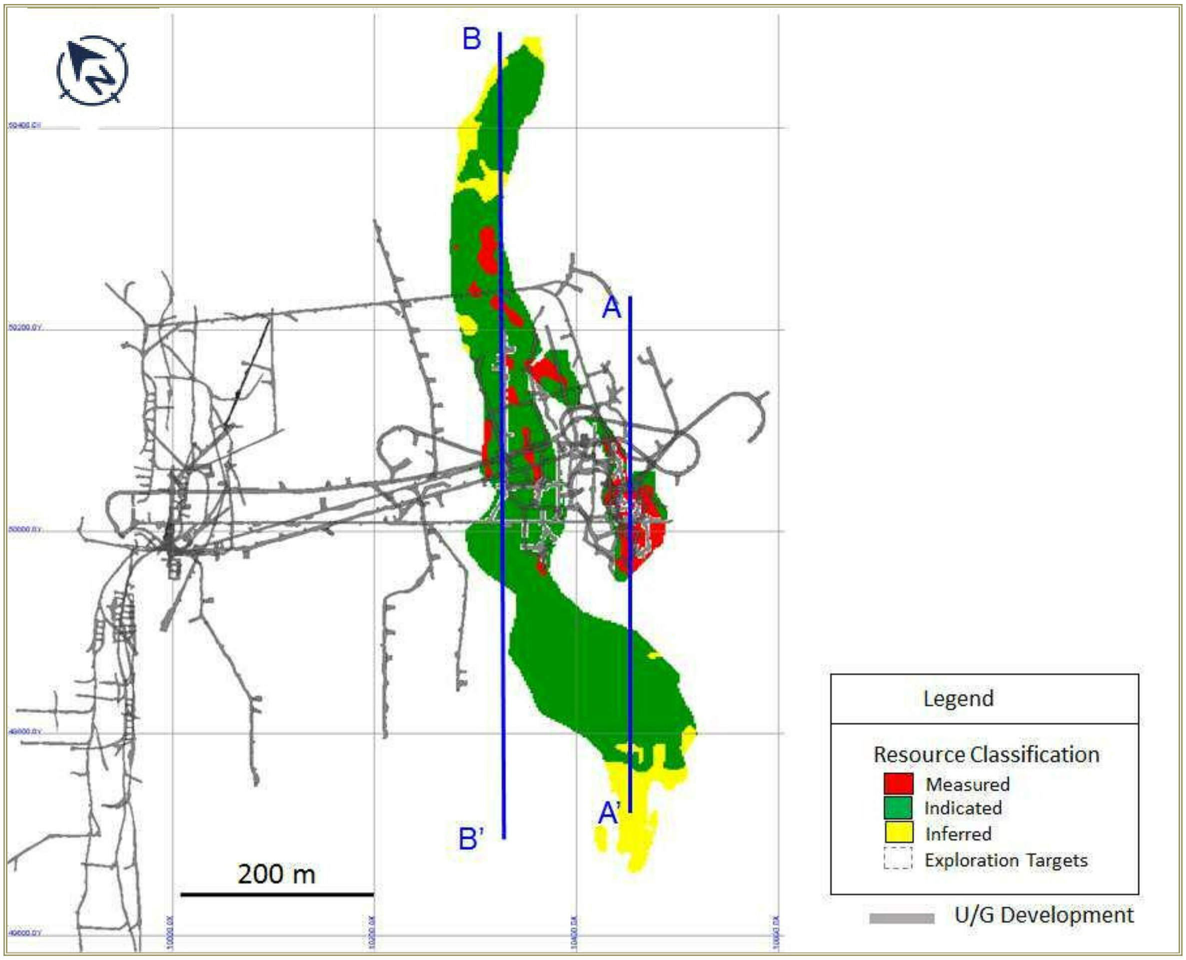


Figure 14-27: 2019 Mineral Resource Classification—Plan View, 305 m Level (Looking Grid North)

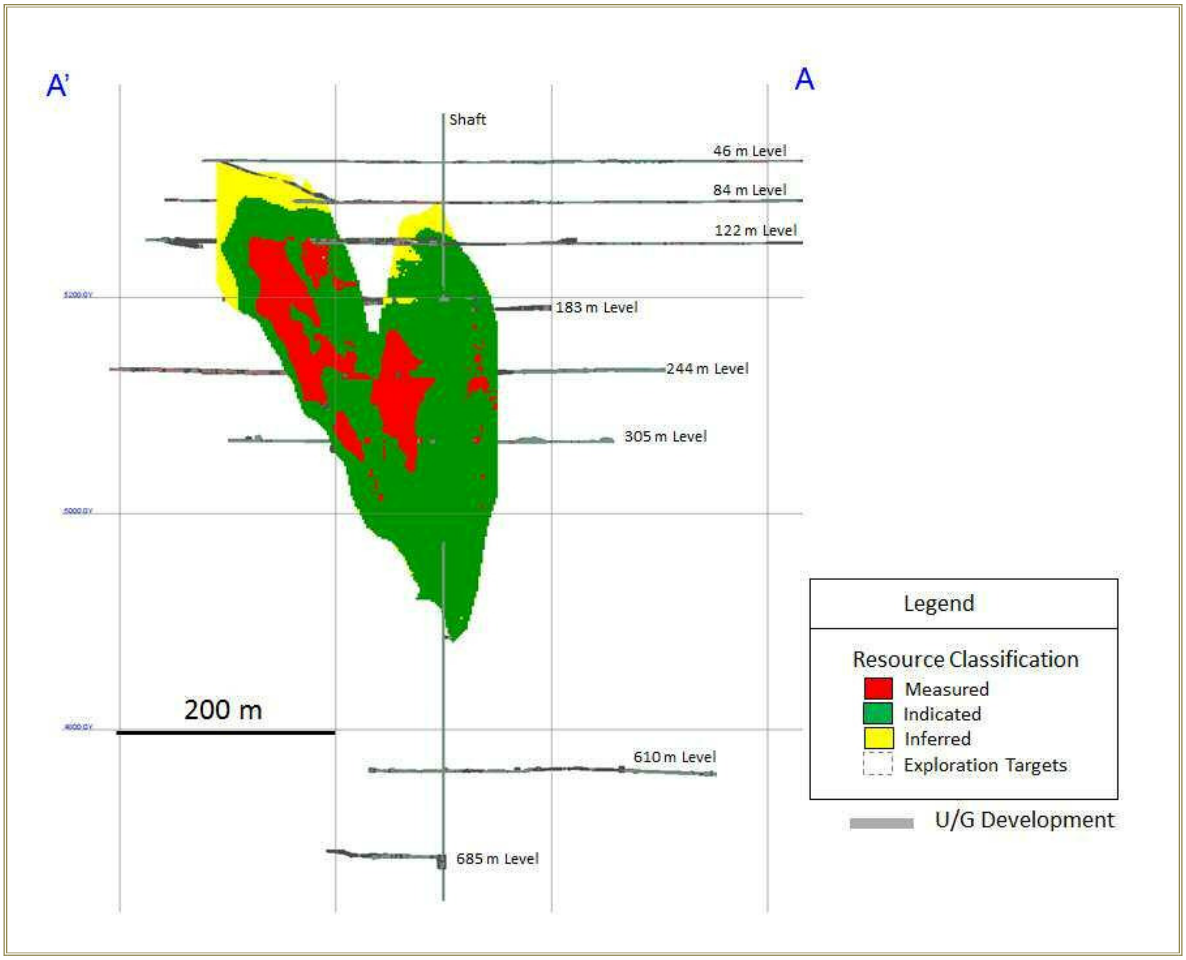


Figure 14-28: 2019 Measured, Indicated, and Inferred Mineral Resource Classification, Zone 1 (Longitudinal View Looking Grid East)

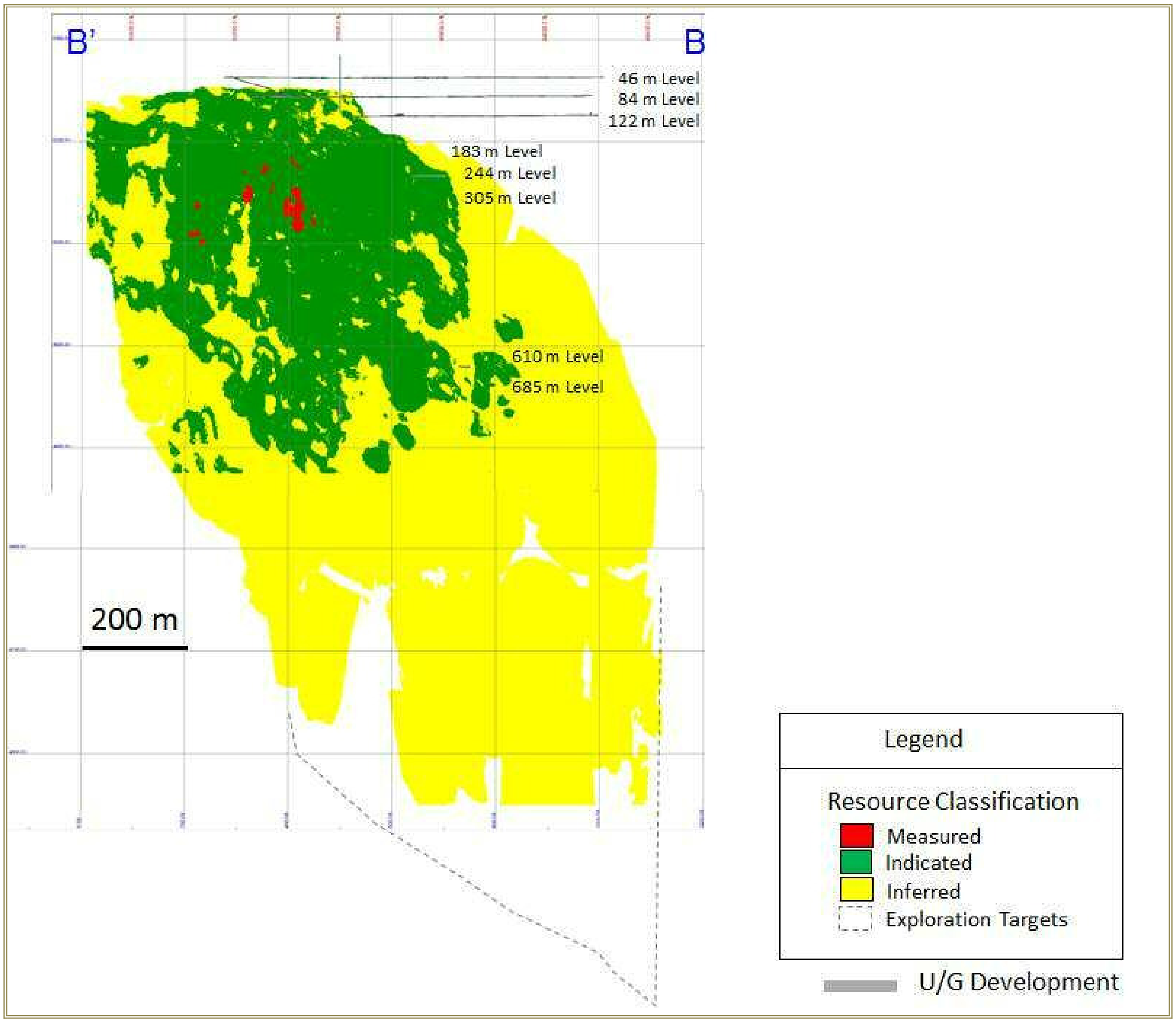


Figure 14-29: 2019 Measured, Indicated, and Inferred Mineral Resource Classification, Zone 2 (Longitudinal View, Looking Grid East)

Table 14-20 reports the 2019 Mineral Resource inventory by underground level for Measured+Indicated and Inferred Resource.

Table 14-20: Classified 2019 Mineral Resources Reported by Underground Level (Cut-off Grade 3.0 g/t Au)

Metre Level	Measured and Indicated Resource			Inferred Resource		
	Tonnes ('000s)	Grade (g/t Au)	Contained Au (oz '000s)	Tonnes ('000s)	Grade (g/t Au)	Contained Au (oz '000s)
84	8	7.70	2	8	4.90	1
122	51	7.90	13	29	9.70	9
183	170	5.50	30	21	3.86	3
244	248	6.27	50	14	7.14	3
305	284	6.39	58	25	5.68	4
366	396	7.40	94	14	4.88	2
427	429	6.69	92	61	4.81	9
488	347	6.41	71	136	5.38	23
549	274	5.58	49	96	5.56	17
610	167	5.74	31	100	7.21	23
640	208	5.48	37	147	7.22	34
671	7	5.53	1	7	9.20	2
685	95	5.87	18	79	8.23	21
732	99	5.01	16	60	4.93	9
793	124	5.79	23	162	5.88	31
854	21	5.05	3	166	5.37	29
915	-	-	-	322	6.49	67
976	-	-	-	273	8.11	71
1037	-	-	-	177	6.27	36
1098	-	-	-	112	6.59	24
1159	-	-	-	218	6.00	42
1220	-	-	-	120	6.61	26
1281	-	-	-	49	4.51	7
1342	-	-	-	71	8.88	20
1403	-	-	-	53	10.37	18

14.7.2 Cut-Off Grade

The cut-off grade used for the 2019 Mineral Resources is 3.0 g/t Au based on Rubicon's estimated break-even OPEX mining cost of C$146.83/t as outlined in Table 14-21. The OPEX cost is based on assumptions of US$1,400/oz Au, a US$ to C$ exchange rate of 0.77, and a gold recovery of 95%. Mineral Resources can be sensitive to the reporting cut-offs used.

Table 14-21: Summary of Assumptions

Item	OPEX (C$/t)
Mining	97.00
Milling	23.79
G&A	6.04
Sustaining CAPEX	20.00
Total	**146.83**

14.7.3 Mineral Resource Statement

The Mineral Resource Estimate, as prepared by TMAC, for the Phoenix Gold Project is reported in Table 14-22 (Effective March 18, 2019).

Table 14-22: Phoenix Gold Project 2019 Mineral Resource Estimate Reported at 3.0 g/t Au Cut-off Grade

Resource Category	Quantity (t '000s)	Grade (g/t Au)	Contained Gold Ounces
Measured (M)	442	6.99	99,000
Indicated (I)	2,485	6.13	490,000
M+I	2,927	6.26	589,000
Inferred	2,570	6.53	540,000

Notes: Effective date for this Mineral Resource is March 18, 2019
Mineral Resource Estimate uses a break-even economic cut-off grade of 3.0 g/t Au based on assumptions of a gold price of US$1,400/oz, an exchange rate of US$/C$ 0.77, mining cash costs of C$97/t, processing costs of C$24/t, G&A of C$6/t, sustaining capital C$20/t, refining, transport and royalty costs of C$57/oz, and average gold recoverability of 95%
Mineral Resource Estimate reported from within envelopes accounting for mineral continuity
Mineral Resources are not Mineral Reserves and do not demonstrate economic viability
There is no certainty that all or any part of this Mineral Resource will be converted into Mineral Reserve
All figures are rounded to reflect the relative accuracy of the estimates and totals may not add correctly

The base case Mineral Resource Estimate is reported at a cut-off grade of 3.0 g/t Au, other cut-off grades are provided to demonstrate tonnage and grade sensitivities.

The Mineral Resource Estimate excludes mineralization within the crown pillar located between the lake bottom and a depth of 40 m below the lake bottom. In addition, all mineralized development is assigned code 4001 in the block model and removed from the Mineral Resource Estimate. All resource blocks outside of Rubicon's claim boundaries are coded as 4002 in the block model and removed from the Mineral Resource Estimate.

Mineral Resources are not Mineral Reserves and do not necessarily demonstrate economic viability. There is no certainty that all or any part of this Mineral Resource will be converted into mineral reserve.

14.7.4 Gold Grade Sensitivity

Table 14-23 summarizes the sensitivity of the Mineral Resource Estimate to other potential mining cut-offs. The 2019 resource is reported at a cut-off grade of 3.0 g/t Au, which is highlighted in green in Table 14-23.

Table 14-23: Phoenix Gold Project 2019 Resource Sensitivities

Cut-off Grade (g/t Au)	Measured + Indicated Classification			Inferred Classification		
	Quantity (t '000s)	Grade (g/t Au)	Contained Au (oz '000s)	Quantity (t '000s)	Grade (g/t Au)	Contained Au (oz '000s)
2.0	5,237	4.57	770	4,526	4.76	692
2.5	3,861	5.41	672	3,315	5.68	605
*3.0	2,927	6.26	589	2,570	6.53	540
3.5	2,289	7.11	523	2,038	7.39	484
4.0	1,842	7.92	469	1,671	8.19	440
4.5	1,510	8.73	424	1,384	9.01	401
5.0	1,263	9.52	386	1,164	9.82	368

There is no certainty that the Measured and Indicated Mineral Resources will be converted to the Proven and Probable Mineral Reserve categories and there is no certainty that the updated Mineral Resource statement will be realized. It is reasonably expected that the majority of Inferred Mineral Resource could be upgraded to Indicated Mineral Resources with continued exploration. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. TMAC is unaware of any known environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant factors which could materially impact the 2019 Mineral Resource Estimate provided in this technical report.

14.8 Prior Mineral Resource

The new 2019 Mineral Resource for the F2 Gold Zone encompass several changes from the previous 2018 Mineral Resource (Golder, 2018b). These are:

- Update interpretation of rock types based on new drilling
- Grooming isolated blocks in geological model
- Revised outlier capping and handling during interpolation
- Addition of 106 drill holes completed post-2017
- Addition of a potentially economic area previously modelled outside of Zone 2.

Table 14-24 shows the comparison of the 2018 Mineral Resource (Golder, 2018b) versus Current Mineral Resource (Effective March 18, 2019). The 2018 Mineral Resource (Golder, 2018b) is not current and should not be relied on.

Table 14-24: Comparison between 2018 and 2019 Mineral Resource Estimates

Cut-off Grade Classification	Quantity (t '000s)			Grade (g/t Au)			Contained Gold Ounces		
	2019	2018	Change	2019	2018	Change	2019	2018	Change
3.0 g/t Au									
Measured (M)	442	188	135%	6.99	6.8	3%	99,000	41,000	141%
Indicated (I)	2,485	1186	110%	6.13	6.3	-3%	490,000	240,000	104%
Total M+I	**2,927**	**1,374**	**113%**	**6.26**	**6.37**	**-2%**	**589,000**	**281,000**	**110%**
Inferred	2,570	3,884	-34%	6.53	6	9%	540,000	749,000	-28%
3.5 g/t Au									
Measured (M)	335	155	116%	8.18	7.54	8%	88,000	38,000	132%
Indicated (I)	1,954	964	103%	6.92	7.01	-1%	435,000	217,000	100%
Total M+I	**2,289**	**1,119**	**105%**	**7.11**	**7.08**	**0%**	**523,000**	**255,000**	**105%**
Inferred	2,038	3,146	-35%	7.39	6.64	11%	484,000	672,000	-28%
4.0 g/t Au									
Measured (M)	267	129	107%	9.32	8.29	12%	80,000	35,000	129%
Indicated (I)	1,575	779	102%	7.69	7.78	-1%	389,000	195,000	99%
Total M+I	**1,842**	**908**	**103%**	**7.92**	**7.86**	**1%**	**469,000**	**230,000**	**104%**
Inferred	1,671	2,556	-35%	8.19	7.31	12%	440,000	601,000	-27%

Figure 14-30 illustrates the magnitude of the Measured+Indicated (MEA+IND) model changes (2018 depletion and model changes) between the 2018 and 2019 model using a waterfall chart.

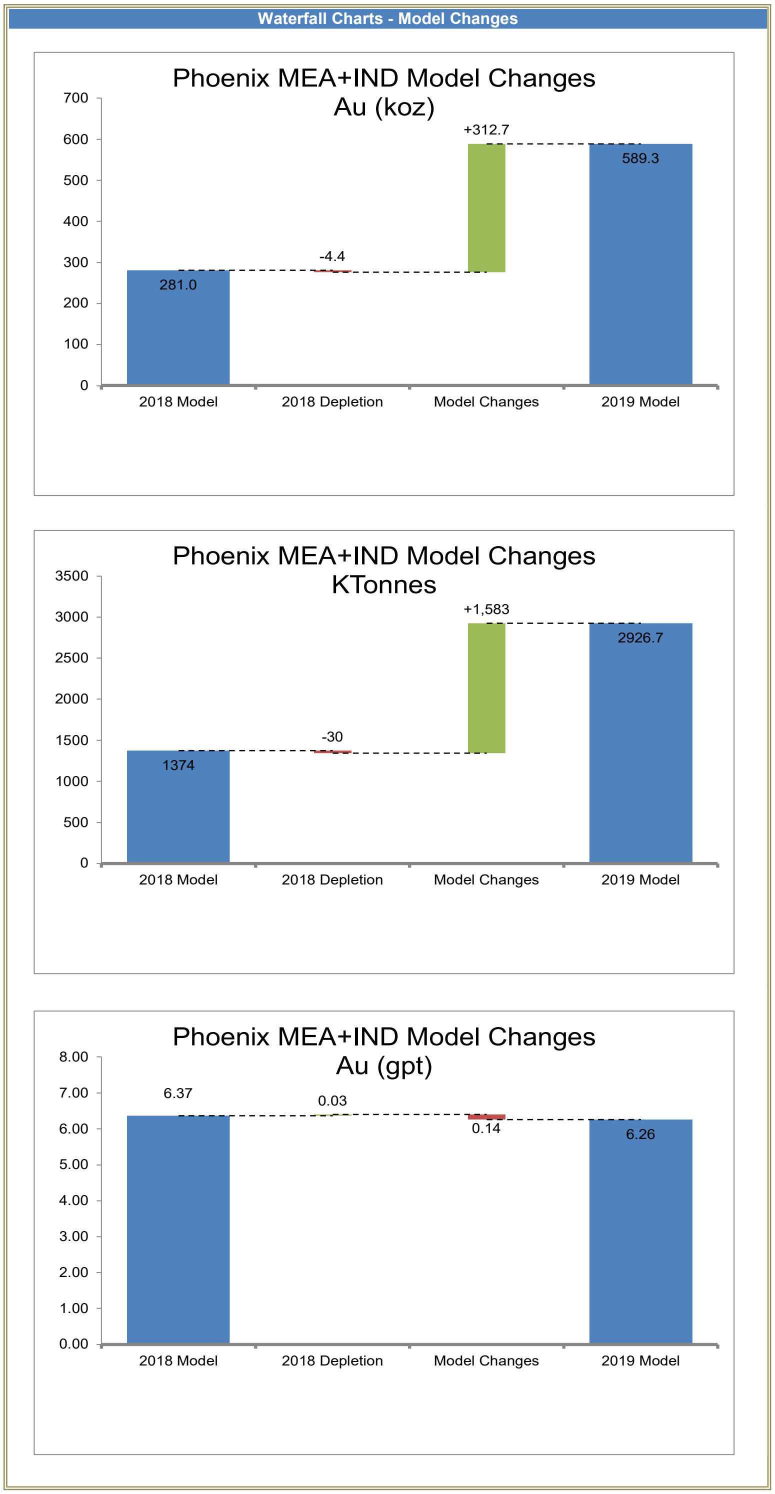


Figure 14-30: Phoenix Model Waterfall Chart

A series of swath plots (Figure 14-31 to Figure 14-33) were generated from capped gold grades to compare the 2019 capped gold grade model (AUCID3) with Golder's 2018 capped gold grade model (AU_IDC). The grades are averaged over 20 m swaths for each of the plots. Locally, differences are noted in the average gold grade but overall the swaths demonstrate a high degree of correlation even though the 2019 resource model incorporates additional drill hole data and has modified interpolation parameters and uses different resource estimation software than the 2018 mineral resource model (Golder, 2018b).

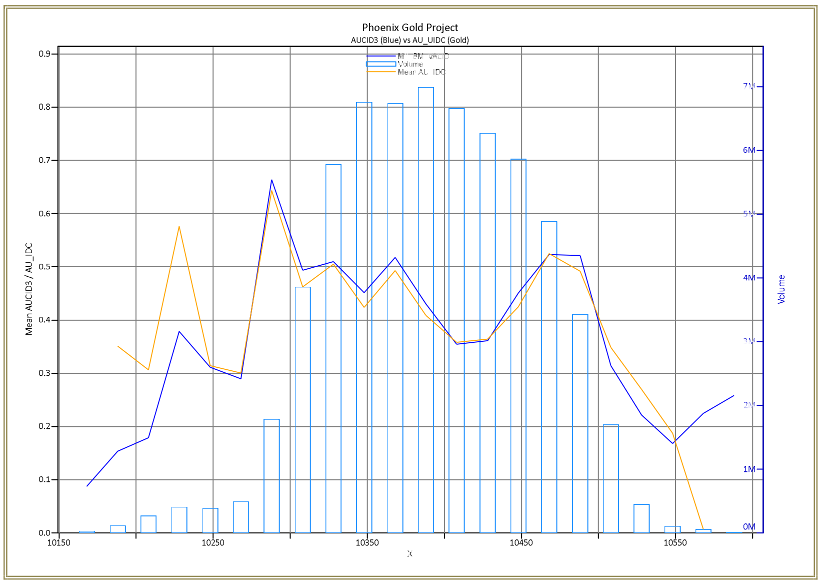


Figure 14-31: Swath Plot by Easting, AUCID3 vs. AU_IDC

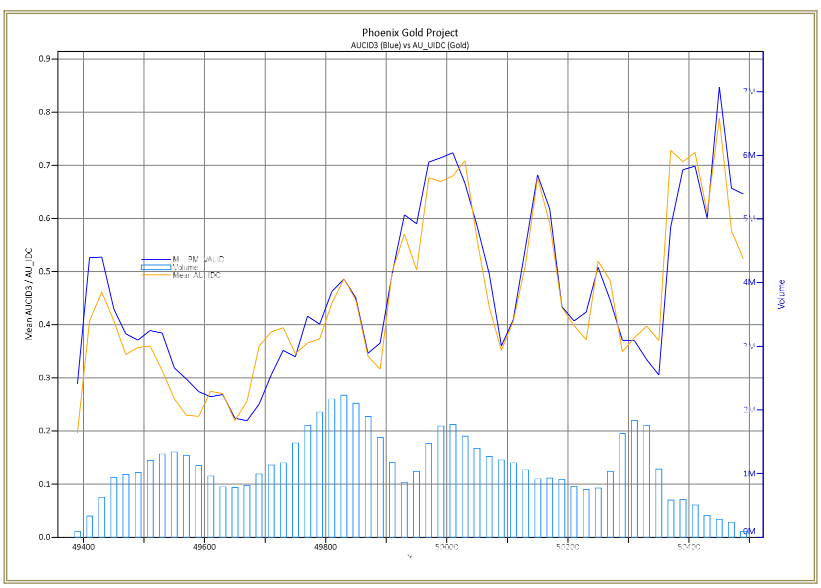


Figure 14-32: Swath Plot by Northing, AUCID3 vs. AU_IDC

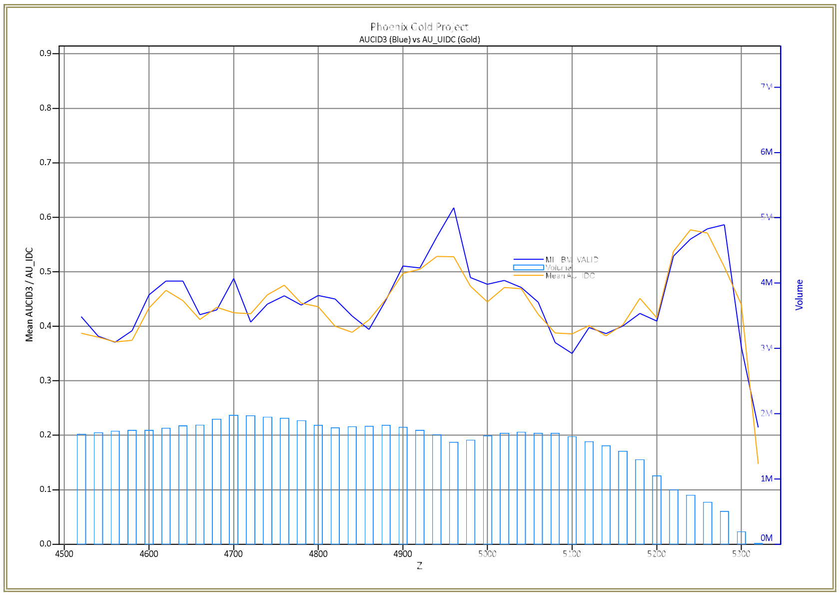


Figure 14-33: Swath Plot by Elevation, AUCID3 vs. AU_IDC

14.9 Comment on Mineral Resource

The QP is of the opinion that the Phoenix Gold Project has been interpolated using industry accepted modelling techniques in Geovia GEMS 6.7.3 Desktop Software. This included geologic input, appropriate block model cell sizes, grade capping, assay compositing, and reasonable interpolation parameters.

The results have been verified by visual review and statistical comparisons between the estimated block grades and the composites used to interpolate. The IDW3 model (AUCID3) has been selected as the best representation of the grade distribution based on the current geological understanding and gold mineralization. The IDW3 model has been validated with alternate estimation methods: NN and OK. No biases have been identified in the model.

The Mineral Resource conforms to the requirements of the CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014). TMAC is unaware of any known environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant factors which could materially impact the 2019 Mineral Resource Estimate provided in this technical report. The Mineral Resources are adequate to support mining studies.

Mineral Resources are not Mineral Reserves and do not necessarily demonstrate economic viability. There is no certainty that all or any part of this Mineral Resource will be converted into a mineral reserve.

15 MINERAL RESERVE ESTIMATE

There are no reserves currently defined for the Phoenix Gold Project.

16 MINING METHODS

Mining methods have not been evaluated for the 2019 Mineral Resource Estimate in a current preliminary economic assessment, pre-feasibility study, or feasibility study. Please refer to Section 24.6 for other information regarding conceptual mining methods.

17 RECOVERY METHODS

Recovery methods have not been evaluated for the 2019 Mineral Resource Estimate in a current preliminary economic assessment, pre-feasibility study, or feasibility study. Please refer to Section 24.8 for other information regarding conceptual recovery methods.

18 PROJECT INFRASTRUCTURE

Project infrastructure requirements have not been evaluated for the 2019 Mineral Resource Estimate in a current preliminary economic assessment, pre-feasibility study, or feasibility study. Please refer to Section 24.10 for other information regarding Project infrastructure.

19 MARKET STUDIES AND CONTRACTS

There are no current market studies.

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

These subjects are not supported by a current preliminary economic assessment, pre-feasibility study, or feasibility study. Please refer to Section 24.11 for other information regarding these subjects.

21 CAPITAL AND OPERATING COSTS

Project capital and operating costs have not been estimated as of the effective date of this Technical Report.

22 ECONOMIC ANALYSIS

An economic analysis has not been completed as of the effective date of this Technical Report.

23 ADJACENT PROPERTIES

There are no adjacent properties relevant to this technical report.

24 OTHER RELEVANT DATA AND INFORMATION

The following information reflects work completed on the Rubicon Gold Project in the past and is not supported by a current preliminary economic assessment, pre-feasibility study, or feasibility study.

24.1 Mining Methods

The mining methods discussed are conceptual, and further studies will be required to fully assess their viability. A test mining and bulk sample processing program, completed in 2018, has provided additional mining information, and the data collected will be used to potentially confirm mining methods and related parameters such as stope design, dilution, and recovery. There is no certainty that a potential mine will be realized, or that a production decision will be made. Conceptual mine design and mining schedules will require additional detailed work, economic analysis, and internal studies to ensure satisfactory operational conditions and decisions regarding future production.

24.2 Previous Mining

The Phoenix Gold Project Property has never been in commercial production to date, though several bulk samples have been taken in the past on both the F2 Gold Zone and the unrelated mineralization that was being assessed at the historical McFinley deposit. Test mining and milling was conducted in 2015 on the F2 Gold Zone at the Phoenix Gold Project. A total of 57,793 tonnes of mineralized material was processed in 2015, and during the test mining and bulk sample program completed in 2018, another 43,250 tonnes of mineralized material was processed.

In 1956, a 129 m deep exploration shaft was sunk by McFinley Red Lake Gold Mines Ltd. (McFinley) and followed up with 414 m of lateral workings on two levels, before work was suspended in mid-1957 (G.M. Hogg & Associates Ltd., 1983).

In 1984, the shaft was reopened as the Phoenix Shaft, and an additional 479 m of lateral development was completed on the 46 m (150 ft) and 122 m (400 ft) levels. After a temporary shutdown starting in February 1985, a further 1,151 m of lateral development was completed prior to the decision to take a bulk sample in 1987. The bulk sample program started in July 1988 from prepared stoping areas. Mining exploration activities on the property were terminated in 1989 after test-milling of an estimated 2,250 tonnes of material unrelated to the F2 Gold Zone. The level naming convention for the mine was originally measured in feet below the shaft collar. The 400 ft level was the original bottom Level of the McFinley mine, and is now referred to by its metric equivalent, the 122 m Level. The Phoenix Gold Project uses the metric system and all measurements are metric.

Rubicon acquired the property in June 2002 and resumed exploration work. In 2009, the existing shaft was dewatered and reconditioned to support an advanced exploration program. In June 2009, shaft sinking started to deepen the existing shaft to 350 m, and a loading pocket was installed to support development at the 305 m Level, followed by lateral and vertical development on the 244 m Level and 305 m Level. This led to two approximately 1,000-tonne bulk samples being excavated on the 305 m Level in 2011 using development methods.

Shaft sinking resumed in July 2012, after upgrading the headframe and hoisting plant. It was slowed significantly due to a zone of squeezing ground encountered during this phase of the shaft sinking through ultramafic units. The installation of concrete reinforcing rings and other measures were taken to ensure these issues would not cause potential future delays. The shaft was completed to a depth of 730 m in December 2013.

Lateral and vertical development continued from January 2014. In 2015, the Phoenix Gold Project underwent a period of trial stoping, bulk sampling, and milling. In June 2015, Rubicon announced its first gold pour from the bulk sampling. In November 2015, Rubicon announced it was suspending underground activities at the Project while it enhanced its geological model of the F2 Gold Zone.

In 2017, exploration work recommenced at the site. This consisted of an underground drilling program to provide structural geological information and infill drilling to expand the resource. The underground diamond drilling program continued for all of 2018.

Table 24-1lists total lateral development completed at the Project up to the end of 2018. Total hoisted tonnage in 2015 was 57,793 tonnes, and in 2017 and 2018 was 43,700 tonnes, as accounted for in Table 24-2.

Table 24-1: Underground Lateral Development by Level

Description	Pre-2017 Quantity*	2017–2018	Total by Level
All ramps	1,359	47	1,406
46 m Level	1,742		1,742
84 m Level	1,549		1,549
122 m Level	2,909	13	2,922
183 m Level	1,210	184	1,394
244 m Level	2,022	127	2,149
305 m Level	2,393		2,393
610 m Level	296	240	536
685 m Level	188	8	196
Total (m)	**13,669**	**619**	**14,287**

Notes: *To the nearest metre. Diamond Drill & Safety Bays Excluded

Table 24-2: Mineralized Material Hoisted in 2015, 2017, and 2018

Hoisted (wet tonnes)	2015	2017–2018	Total
Waste	181,037	11,085	192,122
Development Mineralized Material	32,390	4,873	37,263
Stope Mineralized Material	25,403	38,377	63,780
Total	**238,830**	**54,335**	**293,165**
Total Mineralized Material	57,793	43,250	101,043

Mine infrastructure (Figure 24-1) includes muck handling facilities for all levels, a ventilation system, a paste backfill plant and underground distribution system (partially completed), a mid-shaft loading pocket complete with spill pocket, and a shaft bottom loading pocket. Ramp access has been established between the 305 m and 244 m Levels. Remaining ramp connections from the 244 m Level up to the 122 m Level are within 380 m of completion. A ramp from surface to the 122 m Level has been designed which would be approximately 800 m in length. The cyan wireframe surface representing lake bottom has been included for reference.

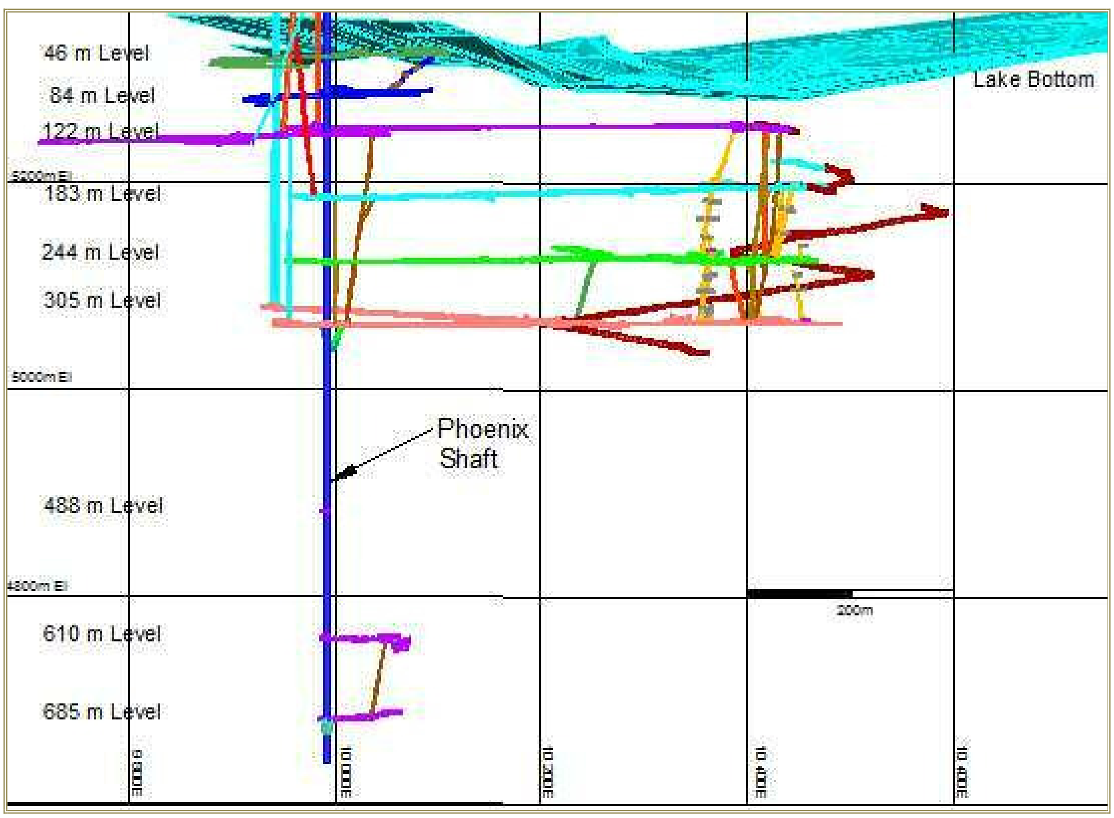


Figure 24-1: Phoenix Gold Project – Underground Workings (Looking Grid North) (Source: Rubicon, 2019)

24.3 Description of Previous Test Mining

During the initial test mining completed in 2015, eleven mining blocks were in various stages of development and mining. In November 2015, the decision was made to suspend the underground activities until further evaluation of the deposit was completed. In general, all test stopes were developed for sublevel longhole stope mining method. Access to the mining blocks (sublevels) was gained via an Alimak raise climber.

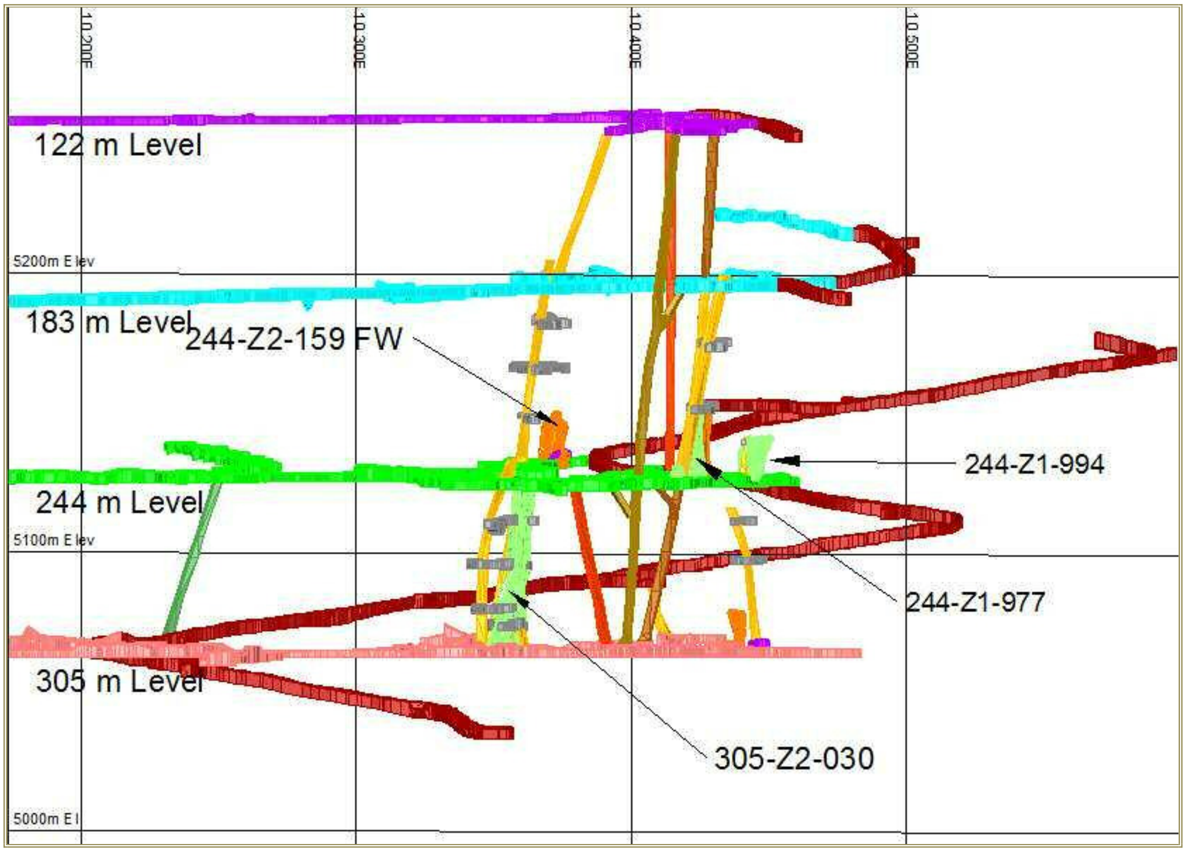


Figure 24-2: Location of Trial Stopes (Looking Grid North) – 2015 Test Mining (Source: Rubicon, 2019)

Development of longhole test stopes followed the general sequence below:

- Delineation on the stope with diamond drilling
- Development of an Alimak raise on the hanging wall contact between the ultramafic and the High-Ti Basalt from one elevation to the next
- Sublevels developed from the Alimak raise at 15 m intervals, except for the 244 m Level-977 stope, which had a sublevel interval of 20 m. All sublevels were developed using handheld pneumatic drills and Cavo loaders.

- The geology department completed geological mapping and face sampling of the development areas associated with each stope block and integrated all other relative information to produce a geological shape within the High-Ti Basalt, which then defined the mining block. Following a geotechnical evaluation, the engineering department then designed a sequence of extraction that best suited local ground conditions and production efficiencies.
- Drilling the mining blocks, from one sublevel to the next, was completed with top hammer pneumatic longhole drills.
- Typically, a slot was opened up at one end of the first block and blasted to the mucking horizon, where the mined material was removed via a remote-controlled load-haul-dump (LHD) unit. The muck was transported to either the ore pass, or direct-loaded into ore cars on the 305 m Level.
- Following completion of mining, the excavation was surveyed via a cavity monitoring system to enable comparison of the design shape to the actual excavated opening.

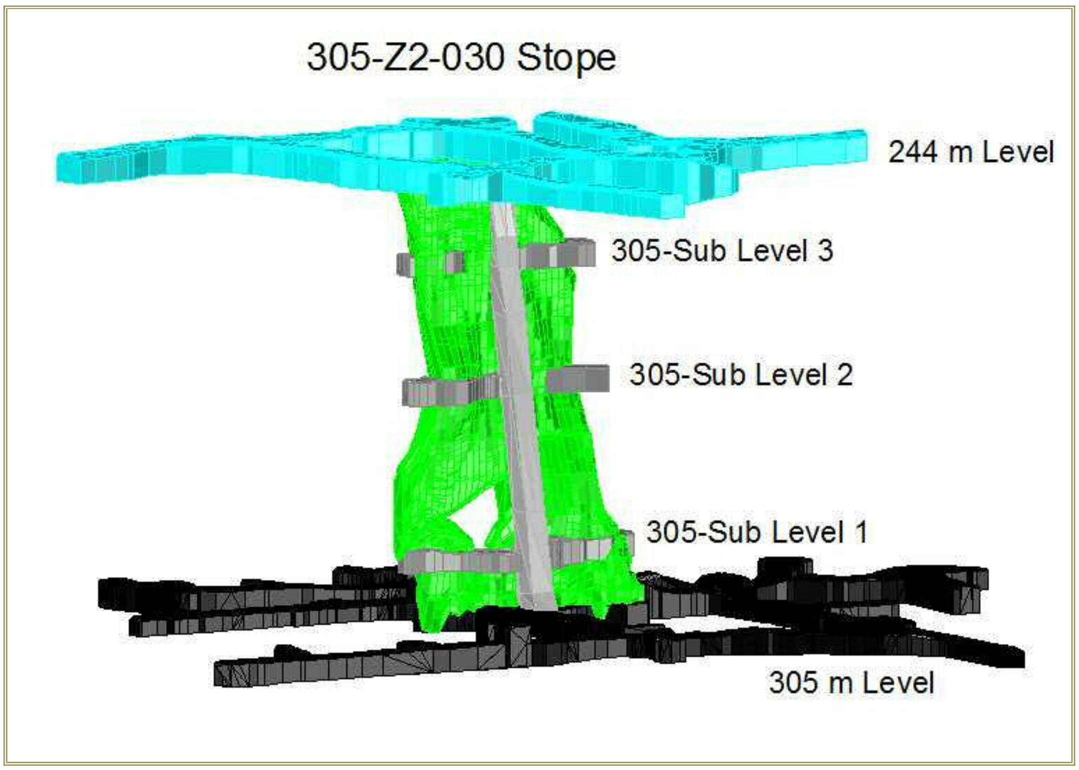


Figure 24-3: 305-Z2-030 Stope (Looking East) Mined in 2015 and Filled in 2018 (Source: Rubicon, 2019)

24.4 Description of Criteria Used For Stope Selection for Test Mining Program Completed in 2018

In 2017, plans were put in place to complete a test mining and bulk sample processing program to confirm the 2018 geological model that was completed by Golder (Golder, 2018b). A review of the eleven mining blocks that were left in various stages of development and mining from 2015 was conducted. Of these, three mining blocks were selected to be a part of the test mining program; 244-Z1-977, 244-Z1-015, and 183-Z1-161. The selection was based on several criteria:

- Proof of concept for mining methods, specifically bulk mining methods such as longhole stoping, considered the following criteria:
  - Select stopes within the F2 High-Ti Basalt Zone, 305 m Level and above
  - Viability of stoping blocks
  - Sequencing
  - Dilution
  - Need for backfill
  - Ore sterilization
- Re-evaluating partially developed stopes based on development requirements and sunk costs.

In addition, other critical areas were to be tested and confirmed:

- Geological model reconciliation
- Mill recovery and throughput optimization.

Inspecting the site's infrastructure (both underground and surface) and processes, development of the 2018 longhole test stopes followed the general sequence below:

- Identify stopes (Figure 24-4) that met the selection criteria outlined above.
- From the block model provided by Golder, the geology department produced a geological shape within the High-Ti Basalt for that stoping area.
- Using the geological shape, the engineering department further defined the mining block.
- Following a geotechnical evaluation, the engineering department then designed a sequence of extraction that best suited local ground conditions and production efficiencies for each test stope. This evaluation included driving layouts for development and stope excavation, ground support requirements, production-drilling layouts, and a schedule to cover the sequence of necessary work required to cover the preproduction, production, and post-production activities that each stope would require.

- Excavate the necessary accesses to the top and bottom of each stope block, using conventional trackless equipment, such as electric hydraulic jumbos and diesel LHD units. Ground support was installed with jacklegs and stopers (Figure 24-5).
- Drilling the mining blocks was completed with a top hammer pneumatic longhole drill.
- Typically, a slot was opened up at one end of the stope block and blasted to the drawpoints below, where the mined material was removed via a remote-controlled LHD. The muck was transported to the ore pass on the level, which transported the ore down to car loading chutes on the 305 m Level.
- The mineralized material was then loaded into ore cars and trammed across the 305 m Level to a rockbreaker/grizzly installation (Figure 24-6). From here, the mineralized material was loaded into the loading pocket and hoisted to surface for processing through the mill.
- Following completion of mining, each excavation was surveyed via a cavity monitoring system. This was to enable comparison of the design shape to the actual excavated opening, allow review of the stoping process, and calculate the dilution achieved in the test stopes.

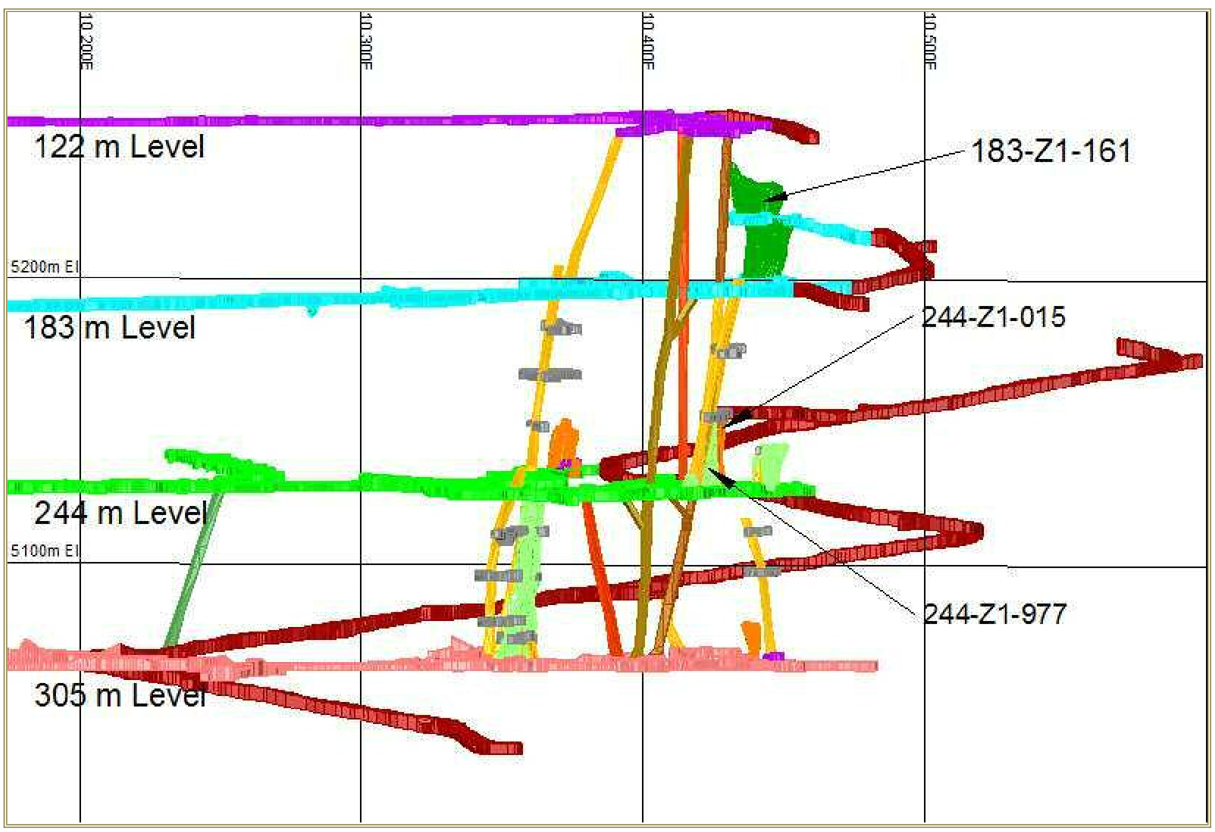


Figure 24-4: Location of Trial Stopes (Looking Grid North) – 2018 Test Mining (Source: Rubicon, 2019)

Figure 24-5: Typical Ground Support Installation (Source: Rubicon, 2019)

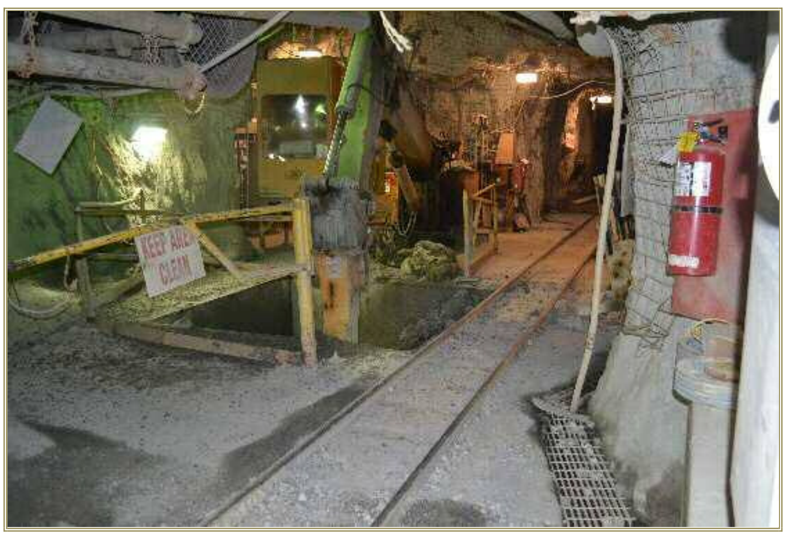


Figure 24-6: 305 m Level Shaft Ore Pass (Source: Rubicon, 2019)

During the 2018, potential test trial mining stopes were reviewed based on numerous factors with the three main factors as follows:

1. Stopes were within the F2 High-Ti Basalt
2. Development required to access the stopes for mining.
3. The stage of stope development (sunk costs).

These factors were considered because more data was required for both mining and milling within the F2 Gold Zone, the test mining and milling needed to be completed prior to the winter months of

2018 and for budgeting purposes. Using this criterion three stopes were identified as the 244-Z1-977, the 244-Z1-015, and the 183-Z1-161 stopes, all within the F2 High-Ti Basalt mineralization.

Geology department and Golder then modelled these stopes by the using the 2018 resource block model (Golder, 2018b) to come up with shapes that were within a 3 g/t cut-off. Where necessary additional short diamond drill holes were added using a Boart Longyear "Meter Eater Drill" to increase confidence in the stope shape and grade. The geological modelled shapes were then used by the site-engineering group to make minable shapes. All stopes due to their dimensions, orientation, grade, and location were deemed to be suitable for sublevel longhole open stoping as described in Section 24.1.5.

24.5 Geotechnical Evaluation

24.5.1 Introduction

In general, ground conditions at the Phoenix Gold Project can be considered good, in particular in the F2 High-Ti Basalt Zone. Cavity-monitoring surveys were completed in early 2017 on the 305-Z2-030 test stope mined in 2015, and confirmed the good ground conditions in this area, with minimal external dilution in the stope after approximately two years. Historical ground stability issues have been encountered in the ultramafic units and are largely related to geological structures. These conditions have been mitigated by the application of appropriate ground support.

Geotechnical evaluations completed to date include a scoping-level evaluation by SRK in July 2013 (SRK, 2013a), a crown pillar assessment by AMC in December 2014 (AMC, 2014), and *Ground Support Standards for Rubicon* by AMC (2009), which are currently being used at the site. Detailed information contained in these evaluations can be found in the respective documents.

24.5.2 Geotechnical Assessment by SRK

The geotechnical assessment conducted by SRK is available in the PEA for the F2 Gold Zone, issued August 9, 2013, amended and restated February 28, 2014 (SRK, 2013b). Regular monthly ground support audits of the underground workings are being completed by in-house staff, with additional assistance from LBE Group Inc.

24.5.3 Crown Pillar Assessment by AMC

In 2014, Rubicon commissioned AMC to assess the crown pillar, as the gold mineralization extends to the lake bottom. AMC has recommended a conservative minimum crown pillar thickness of 40 m, and certain other risk mitigation options. Special operating procedures are recommended outlining ground support, backfill, and instrumentation monitoring strategies in the moderate to high-risk areas. Currently, no mining work is planned relative to the crown pillar.

24.5.4 Ground Control Management Plan by Rubicon

Rubicon's ground control management plan incorporates standardized ground support applications for the various ground stability issues that are expected at the Phoenix Gold Project. This is based on the various ground support studies that have been completed at the Project, and also integrates information that has since been acquired from underground development completed and test stopes developed and mined. Standard ground support methodology used during the last test mining phase in 2018 included the use of resin rebar, split sets, omega bolts, wire mesh panels and wire mesh straps. Stope stability analysis has been conducted on all stopes to date.

24.6 Planned Mining Methods

Past technical reports described several potential mining methods that could be used to extract the gold mineralization in the F2 Gold Zone, from non-mechanized entry type methods to highly mechanized methods.

The future mining plan must accommodate a deposit that is relatively complex in nature. Recent test mining completed in 2015, and work in 2018, provided some preliminary testing of the sublevel longhole stoping method. The stopes excavated during 2015 were not filled prior to shut down and were monitored; no failures were observed in these stope openings. Several of the 2018 test stopes were not filled and are currently being monitored for wall rock activity and competency.

The primary mining method used for the 2018 test mining and bulk sample test was sublevel longhole stoping. Data was collected during the 2018 test mining exercise, and this information will assist in further assessment of mining the F2 Gold Zone. Other mining methods will be considered in the future, as mine design considerations must include flexibility to accommodate variations in grade, width, and continuity of mineralization.

A high level of geological effort will be required to properly interpret the economic mineralized zones and generate accurate stope block models. This effort will include closely-spaced stope definition drilling, geological mapping, test holes, and chip sampling. This will be key to optimizing the recovery of the Mineral Resource. During the 2018 test mining phase, short-hole diamond drilling was completed on several of the test stopes to provide additional information for proper design of the stopes.

Rubicon's engineering group will be able to optimize the extraction of the Mineral Resource through the employment of multiple mining methods, and variations on those mining methods, to progress from the stope block models to the final stope designs and associated development. Information collected from test mining in 2015 and 2018 will be used for future stope design. Once the design of a stope or group of stopes has been finalized, the computer-assisted stope outlines will be used to prepare detailed layouts for stope development and production mining. Development layouts will be executed under survey control, with adjustments made as additional geological data becomes available from mapping and sampling the exposed mineralization.

24.6.1 Conceptual Mining Method Selection

The main physical characteristics (context) of the gold mineralization that are relevant to conceptual mining method selection are:

- The deposit is located approximately 400 m east of the existing shaft.
- The deposit is located under a lake; therefore, a stable crown pillar (40 m) must be maintained.
- Any extraction from the crown pillar should wait until the end of the potential mine life.
- The deposit has been broken down into four zones of mineralization, Zone 1 to Zone 4.
- The overall mineralized zone ranges up to 200 m in width and up to 1,100 m along strike, and Inferred Resources extend down to approximately the 1,525 m Level.
- There are three predominant High-Ti Basalt Zones that comprise the F2 Gold Zone: (from west to east) HW Basalt Zone, WL Basalt Zone, and the F2 Basalt Zone.
- The geometry and distribution of the High-Ti Basalt zones are a result of regional scale deformation events, resulting in the boudinage (stretching and brittle-ductile deformation of more competent units, relative to ductile deformation of surrounding, less competent units) of the High-Ti Basalt zones in the north-south direction. The mineralized zones can pinch and swell rapidly along strike and along dip.
- The general dip at between 75° and 80°, with the shaft on the hanging wall side.
- Individual mineralized zones range in dip from 65° to vertical.
- The gold mineralization occurs in association with disseminated sulphide replacement and vein mineralization, both of which have been developed in the more competent High-Ti Basalt units, and, to a lesser degree, in the Felsic Intrusive Units.

Figure 24-7: Outstanding Ramp Development to Connect 305 m Level to 122 m Level

- The underground is very dry; water inflows do not appear to be an issue, as the known geological units have low permeability.
- The 122 m Level, 183 m Level, 244 m Level, and 305 m Level are established as main accesses from the shaft station to the F2 Gold Zone.
- An internal ramp is connected between above the 244 m Level to below the 305 m Level. The remaining ramp to connect the 122 m Level, 183 m Level and the 244 m Level requires approximately 380 m of ramp to complete (Figure 24-7).
- Muck-handling systems are established on all operating levels except the 122 m Level (ore and waste dump points are partially constructed).
- The paste backfill system has been partially completed within the underground workings, with a distribution system in place from surface down to the 244 m Level. Following commissioning of the plant, the paste backfill system will be available to deliver backfill to underground.

Conceptual mining methods that could be considered in the future are discussed in the following sections.

Sublevel Longhole Open Stoping

This method is highly productive (bulk mining), and usually applied to ore widths of 3 m and greater. It involves development of the ore body at regular vertical intervals (sublevels), typically every 15 m to 20 m. Several methods can be employed to develop the sublevels, from driving raises (as done in 2015), to excavating accesses from main ramps (as done for the test stoping completed in 2018). A blasting slot would be developed at one end of the excavation, and mining of the blocks would retreat along the strike of the stope. Mucking takes place within the undercut of the mining block via remote-controlled LHD equipment. The strike length is dictated by wall stability in the open stope and is initially determined by empirical design. This mining method is applicable to wider areas of the deposit. This method was employed on three of the test stopes in 2018: 183-Z1-161 (Figure 24-8), 244-Z1-015, and 244-Z1-977.

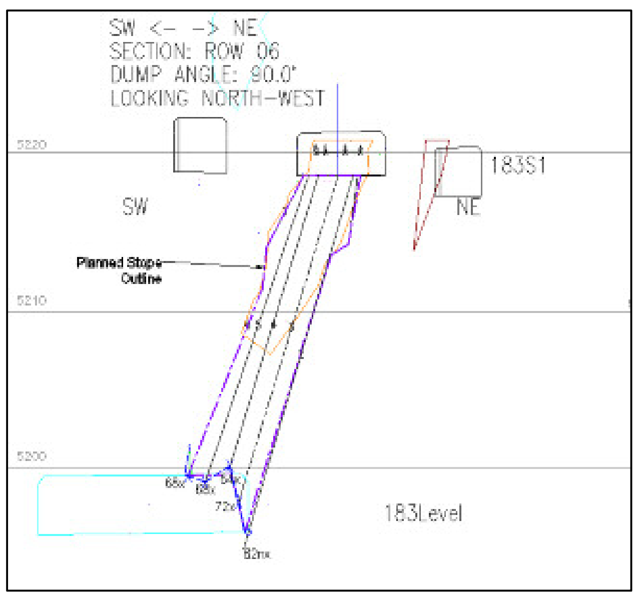


Figure 24-8: Typical Longhole Ring Layout Stope 183-Z1-161

Mechanized Cut-and-Fill

Mechanized cut-and-fill (Figure 24-9) is a moderately productive mining method, and is generally applied to ore widths greater than 2.4 m and less than 10 m. The mining sequence begins by driving an attack ramp either from a level or from a nearby ramp. The attack ramp is generally driven at a -15% gradient to access the bottom or sill cut of the mineralized zone near the centre of the stope mass, using the same development equipment as that used for ramp and level development. The mineralized zone is developed with sill drifts to the extents of the mineralization. Once the initial lift is mucked, waste is brought in and used as fill. After backfilling is complete, a section of the attack ramp is back-slashed and re-supported to gain elevation for access to the next cut. The waste rock broken while doing this will generally be left in place or stored nearby to provide a road bed in the ramp and rockfill for the next cut. This cycle is repeated until the designed number of cuts has been mined. Mining continues upward by repeating the process from a new attack ramp to access the mineralized zone at the next higher elevation.

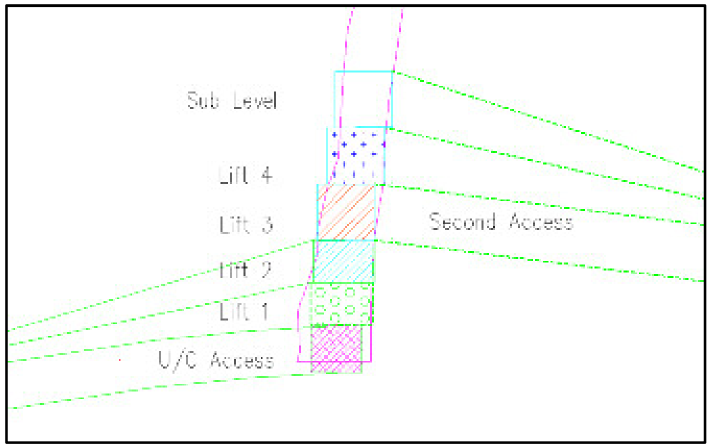


Figure 24-9: Typical Mechanized Cut-and-Fill with 4 m lifts

Conventional Captive Cut-and-Fill

This mining method has low productivity and high selectivity and can be applied to narrow mining widths of 1.8 m to 2.4 m, as dictated by mining equipment. Segregation of ore and waste is possible when combined with a grade control program and active geological input in the mining sequence. The mining sequence begins by driving one or more crosscut drifts into the mineralized zone and silling out the mineralized zone at the main level elevations at the top and bottom. Then a service raise is driven from the bottom Level to the top level. The service raise is used as an alternative escapeway from the stope and has a slide compartment for lowering materials into the stope using a tugger hoist located at the top of the raise. Services such as compressed air, water, hydraulic fill, and electric power are carried down the cribbed manway/steel slide. Once the stope infrastructure is established (installation of mill hole and associated chute), the mining sequence begins by drilling and blasting the stope breast, bolting the back off the muck pile, and mucking to the mill hole with the slusher-scraper combination. When one side is mined out, the mill hole on that side is raised, a fill wall is constructed, and that side is backfilled while mining continues on the other side of the service raise. Prior to filling the second mined side, the start of the next lift around the service raise is excavated using the cribbed manway as the escapeway. Once room is created on the filled side, the slusher is slung up to the newly poured floor, and the mill hole is extended upwards with the cribbed manway. As these are completed, filling starts to level off the two sides. The cycle is repeated until the stope breaks through to the upper level, unless a sill pillar is to be left. This method can also be used with a captive LHD in lieu of a slusher-scraper combination, if the geometry of the stope warrants it.

Shrinkage Stoping (Alimak)

This mining method can be moderately productive and moderately selective, and can be applied to narrow mining widths of 1.0 m to 8.0 m. The mining sequence begins by developing the bottom and top cut of the ore body. A bypass drift is typically developed on the footwall of the ore body, and drawpoints are driven at approximately 10 m intervals. An access raise is driven in the centre of the ore body using an Alimak. Once the raise is broken through to the top cut, the Alimak is modified to allow a longhole drilling platform to be attached. This unit is then lowered down the raise to the appropriate location where longhole breasts can be drilled and blasted. As the stope is mined upward, the muck swell is removed from the drawpoints below. Once the entire stope is blasted, the remaining broken muck can be removed from the stope. With the advent of new blasting technology over the last several years, several mines here in Canada are now starting to eliminate the top cut and blasting the entire stope from the lower level.

Uppers Longhole Method

This simple method involves driving a drift along the strike of the mineralized zone, positioning an inverse (slot) raise at the stope extremity, and production drilling of 15 m up holes at a 70° dip. Blasting and mucking will retreat towards the stope entrance. These stopes may or may not be backfilled. This method is best used where ore continuity is known, and strike length is limited. It can be used in combination with other methods as part of an overall mining strategy. This method (Figure 24-10) was employed on one of the test stopes in 2018 (183-Z1-161, second lift).

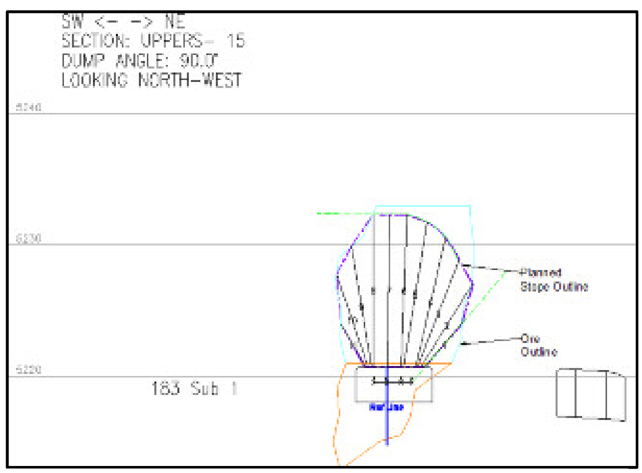


Figure 24-10: Typical Upper Ring Layout 183-Z1-161

24.7 2018 Test Mining

The following sections provide information relative to the test mining of the 244-Z1-977, the 244-Z1-015, and the 183-Z1-161 Stopes.

24.7.1 Excavation and Muck Handling:

Development was driven using a combination of mechanized one and two boom jumbos and 4-yard scoop trams. Blasting of the drift rounds were done using ANFO (ammonium nitrate/fuel oil) and non-electric detonators. All rounds were initiated with a central blasting system once all employees were on surface and tagged out and accounted for. Waste and mineralized material were trammed and dumped into their respective ore-passes. This material reported down to the 305 m Level chutes where the material was loaded into ore cars and trammed out to the shaft.

Stope mucking was done with using remote equipped 2- and 4-yard scoop trams. Manual mucking was done when brows of stopes were closed and remote mucking from remote muck stands was employed once brows became open.

Waste was handled through a waste rockbreaker/grizzly station and down into a loading pocket at the 337 m Level of the shaft. From here, the waste was hoisted and dumped into a waste bunker adjacent to the headframe, where it was picked up by a surface loader and transported to a designated location.

Mineralized material was handled through a separate rockbreaker/grizzly station and down into a loading pocket at the 337 m Level of the shaft. From here, the mineralized material was hoisted and dumped into a waste bunker adjacent to the headframe, where it was picked up by a surface loader and transported to a designated location assigned for each stope prior to crushing and mineral processing.

24.7.2 Ground Support:

Bolting was either done off a scissor lift or muck pile with stopers and jacklegs. Ground support followed ground support standards set during the 2015 Test Mining phase. Typically, resin rebar and welded mesh screen were used as minimal support. 2.4-m rebar were used in development backs and 1.8-m rebar in the walls. In major intersections 4.8-m omega bolts were employed. No cable bolts were used in stope walls for support.

24.7.3 Production Drilling and Blasting:

Production drilling was done by Boart Longyear using a BCI-2 pneumatic longhole drill, drilling 2 ½" holes. A drop raise (typically 1.8 m by 1.8 m) was used to open the slot on each stope. Ring spacing was 1.5 m with holes being drilled up to 22 m in length. Prior to the drill moving out of the stope, all drill hole collars and breakthroughs were surveyed for hole accuracy, and if the discrepancy was outside predetermined parameters, then the holes were re-drilled. Longhole stopes were blasted with packaged emulsion and a combination of non-electric detonators and electric detonators were used depending on blasting duration. All stope blasts were initiated with a central blasting system once all employees were on surface and tagged out and accounted for. Stope fragmentation was good with minimal dilution. External stope dilution was less than anticipated. An overall external stope dilution of 8.7% was achieved slightly below the 10% planned.

24.7.4 Stope Description

244-Z1-977

The 244-Z1-977 test stope (Figure 24-121) is located on 244 m Level and shared the accesses with the 244-Z1-015 stope on the level and sublevel. Approximately 50 m of drawpoint development was completed to access the bottom of the stope on the 244 m Level. An additional 28 m of development was required to connect the ramp to the first sub-level.

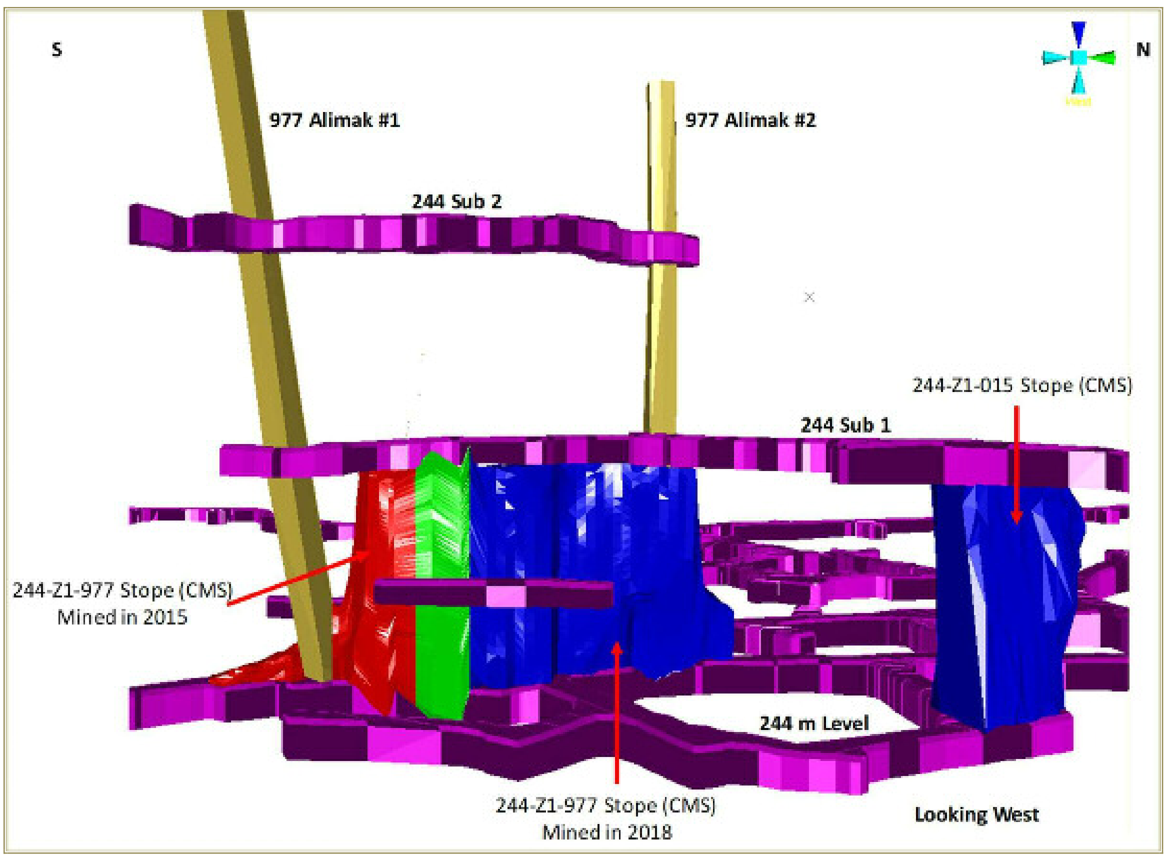


Figure 24-11: 244-Z1-977 Test Stope – Looking West (Source: Rubicon, 2019)

244-Z1-015

The 244-Z1-015 test stope (Figure 24-12) is located on 244 m Level and shared the accesses with the 244-Z1-977 stope on the level and sublevel. The average dimensions of this stope were 16 m long 6 m wide and 22 m high. The only development required to mine this stope was 26 m of drawpoint development on 244 m Level This stope was identified as material that did not have the typical F2 gold zone orientation but instead cross-cut the structure.

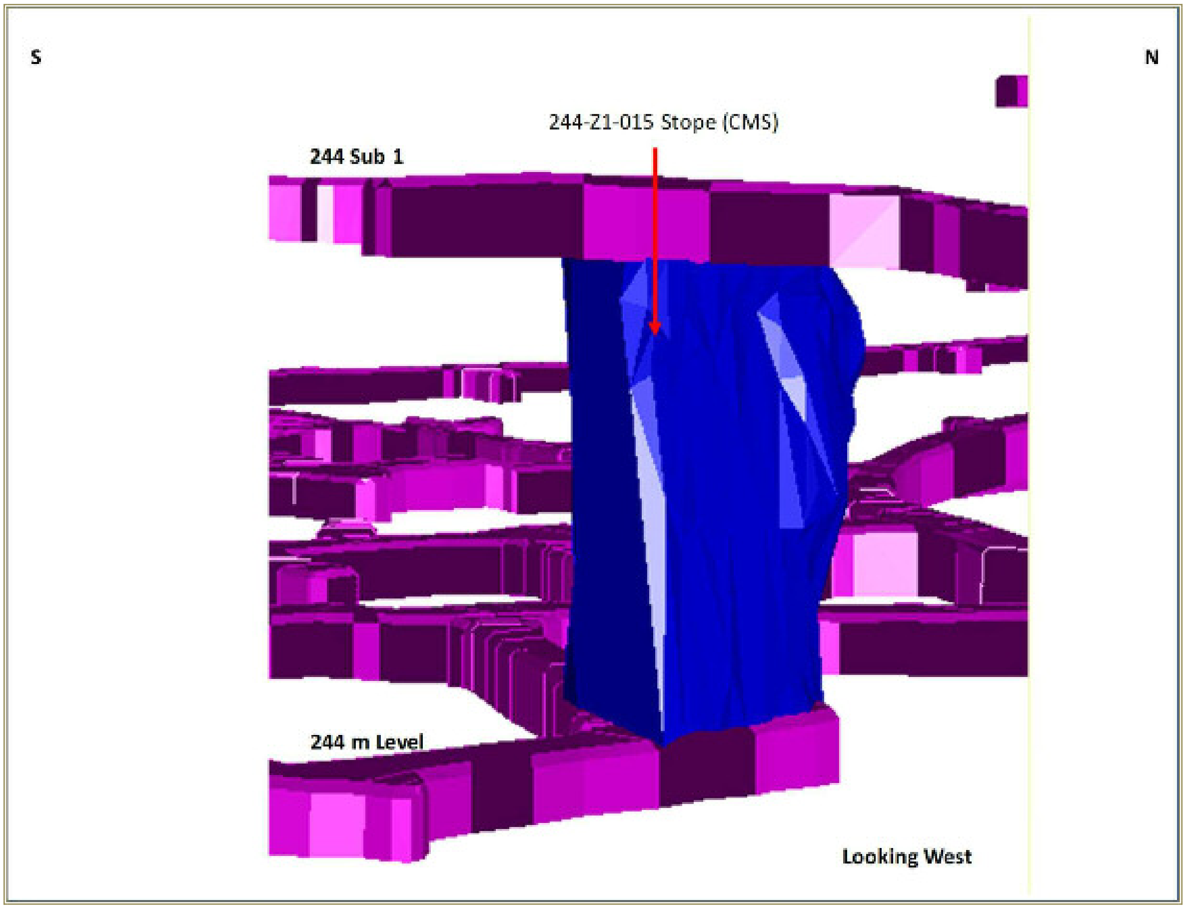


Figure 24-12: 244-Z1-015 Test Stope – Looking West (Source: Rubicon, 2019)

183-Z1-161

The 183-Z1-161 test stope (Figure 24-13) is located on 183 m Level and was mined in two sequences. The drawpoint development completed was 21 m on 183 m Level. To access the first sublevel, the ramp above the 183 m Level was extended 30 m and the access into the first sub-level required was another 54 m. An additional 57 m of ore development was done on the first sublevel.

Mining was done in two sequences with down holes being drilled, blasted and mucked first. Then the stope being filled with waste to the floor elevation of the first sublevel. Upholes, from the first sublevel were then drilled, blasted and mucked to complete the stope.

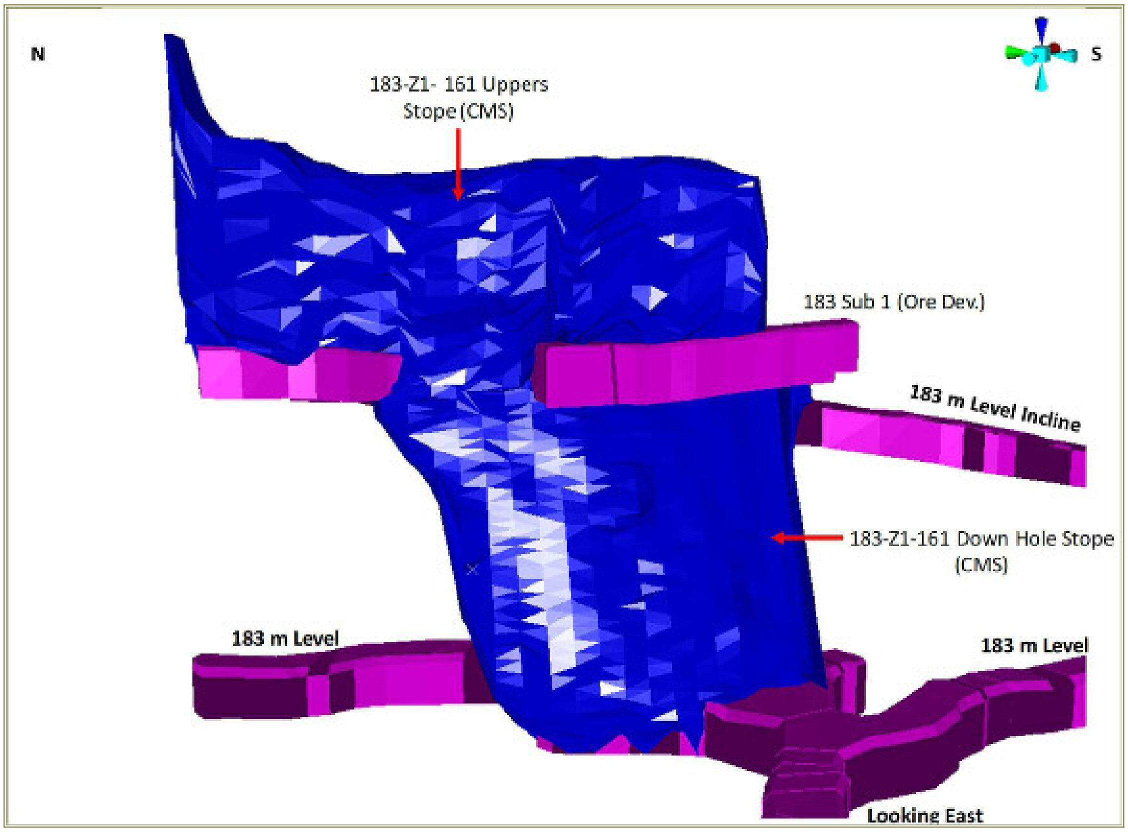


Figure 24-13: 183-Z1-161 Test Stope – Looking East (Source: Rubicon, 2019)

24.7.5 Test Stope Discussion

The stopes were sequenced so that only one stope was being mined at a time to ensure that there was no mixing of mineralized material during transportation from the stope to the surface stockpiles. Table 24-3 summarizes the tonnage and grade characteristics for the combined three test stopes.

Table 24-3: Combined Test Stopes Comparison (244-Z1-015, 244-Z1-977, and 183-Z1-161)

Stopes	Tonnes	Grade (Au g/t)	Au Grams	Au Ounces	Recovery (%)
244-Z1-015	6,730	3.66	24,643	792	95.5
244-Z1-977	10,394	3.55	36,847	1,185	94.7
183-Z1-161 Combined	18,505	5.36	99,145	3,188	95.2
Total	**35,629**	**4.51**	**160,635**	**5,165**	**95.1**

Table 24-4 summarizes the material mined in 2018 including the low-grade material.

Table 24-4: 2018 Test Mining Including Lower Grade Material

Stopes	Tonnes	Grade (Au g/t)	Au Grams	Au Ounces	Recovery (%)
244-Z1-015	6,730	3.66	24,643	792	95.5
244-Z1-977	10,394	3.55	36,847	1,185	94.7
183-Z1-161 Combined	18,505	5.36	99,145	3,188	95.2
Low Grade	7,620	2.06	15,700	505	92.0
Total	**43,250**	**4.08**	**176,335**	**5,669**	**94.8**

Overall stope external dilution was less than anticipated, with an overall external stope dilution of 8.7% achieved, slightly below the planned 10% for the three test stopes. No additional ground support, such as cable bolts were installed while doing the ore development and met our minimum support standards. Fragmentation was good with very little oversize coming off walls.

24.8 Recovery Methods

This section documents the recovery methods developed for the Phoenix Gold Project. Since the 2013 Technical Report, a processing mill was constructed on site; along with ancillary, mine waste storage, and TMF. Construction of the mill began in 2013 and was essentially completed during 2015. The principal components of the paste backfill system have been installed, but piping, electrical, and instrumentation connections remain to be completed. The mill was commissioned and operated between May 2015 and November 2015, then placed into care and maintenance. A Technical Report was prepared by SRK (2016) that included results from the 2015 mill operation. Rubicon was restructured, and exploration activity resumed at the site in January of 2017. The mill continued to be maintained, and some gold locked in the process equipment was recovered. An Actiflo® metals treatment system was installed in 2017 and commissioned mid-2018 to operate in conjunction with the previous solids removal system and ensure effluent meets discharge limits.

The mill contains an ore-handling system feeding a two-stage grinding circuit closed by hydrocyclones. Free gold is recovered by gravity concentration in the grinding section, and by cyanide leaching in a CIL circuit. Dore is produced by smelting the gravity circuit concentrate and the electrowinning sludge produced in the CIL circuit. The mill is newly constructed and was commissioned in 2015. The mill had been in care and maintenance from November 2015 to June 2018. In general, during the care and maintenance period, reasonable effort had been made to ensure that the integrity of the major equipment was preserved. Prior to start-up of the mill for the bulk test in 2018, all equipment was inspected, and any deficiencies found were corrected. These steps effectively served as recommissioning of the facility. The mill has once again been placed in care and maintenance after the 2018 test was completed. Lessons learned from the previous care and maintenance have been applied to better preserve the integrity of the equipment.

24.9 Process

The simplified process block diagram for the Phoenix Gold Project is presented in Figure 24-14. The mill was designed with an initial throughput capacity of 1,250 t/d, with provisions in the layout to increase capacity up to 2,500 t/d with modifications and additions to the existing equipment.

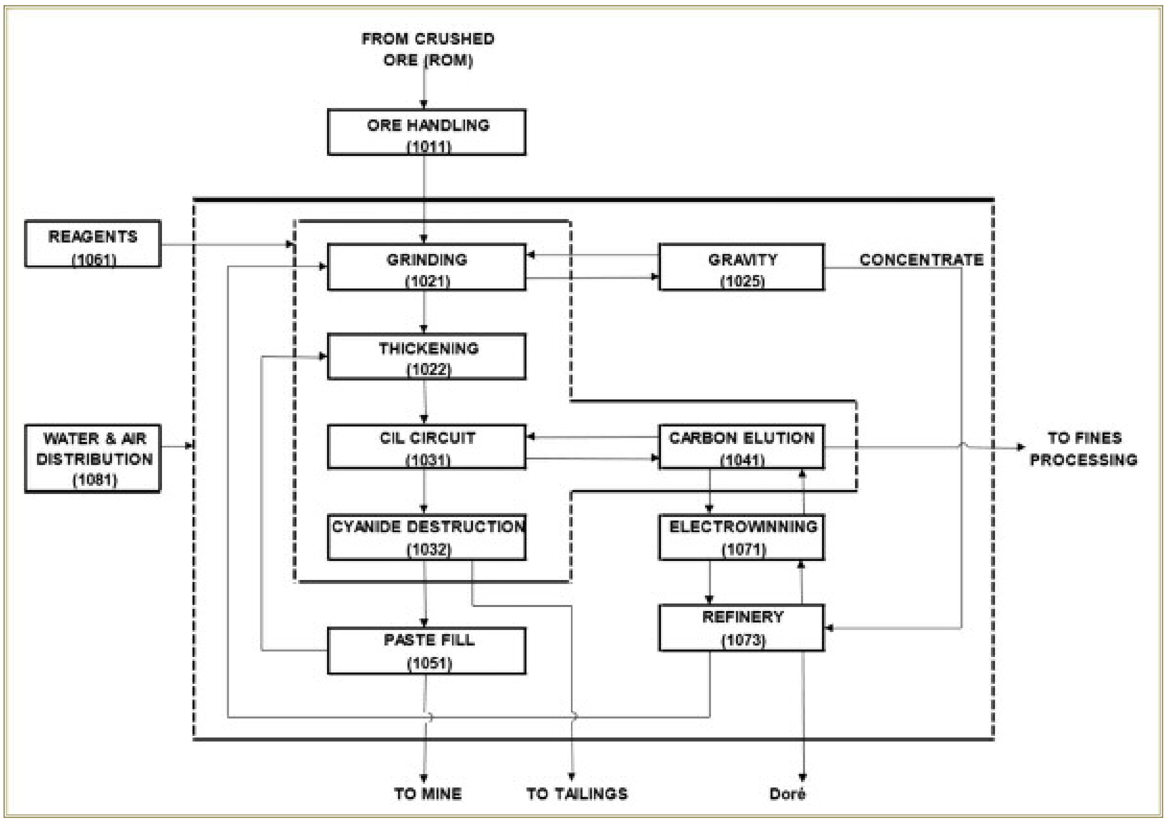


Figure 24-14: Simplified Process Block Diagram (Source: 2013 Technical Report (SRK, 2013b))

24.9.1 Simplified Process Description

The process plant construction commenced in 2013 and was essentially complete in the spring of 2015. The gold recovery plant was commissioned in 2015, and operated intermittently until November 21, 2015, when surface stockpile milling was completed. A paste backfill plant was also constructed but not commissioned to prepare paste backfill for use underground.

The unit operations installed for gold processing are essentially those described in the 2013 Technical Report (SRK, 2013b).

The process consists of a single line, starting with a SAG mill. The discharge from the SAG mill is sent to the ball mill circuit, which uses hydrocyclones in closed circuit for classification. A gravity separation circuit is included to partially recover and concentrate any gravity recoverable gold. The remaining gold is extracted in a conventional CIL circuit. The loaded carbon is washed with hydrochloric acid solution to remove carbonates. Gold is then removed from the loaded carbon by elution (stripping) followed by electrowinning. The electrowinning and the gravity circuit both produce a high-grade gold concentrate that is smelted in an electric induction furnace to produce doré. The stripped carbon is regenerated in a reactivation kiln before being reintroduced to the process. Fine carbon is constantly eliminated (and recovered) from the process to avoid gold loss, with fresh carbon being continuously added to the process.

The cyanide contained in the tailings from the CIL circuit is eliminated in a cyanide destruction tank using the SO_2/O_2 cyanide destruction process. Either liquid SO_2 or sodium metabisulphite can be used as the SO_2 source. Once the cyanide is destroyed, the tailings are pumped to the TMF for storage.

When paste backfill is required, tailings will be diverted to the paste plant, where they will be filtered to lower the water content. The filter cake will then be mixed with fly ash and cement to produce a paste, which will be pumped to the underground for backfilling. The gold recovery plant, cyanide destruction process, and TMF were commissioned and operational in 2015. The backfill plant has not yet been operated as the Project had not yet required backfill. Major equipment for the tailings filter plant and the paste plant has been installed. However, some minor piping, electrical, and instrumentation connections remain to be completed before this equipment can be commissioned.

24.9.2 Process Description

Mineralized Material Storage

An underground grizzly screen on the 305 m Level with standard 23 cm openings (9" by 9"), and a rock breaker are used to reduce the mineralized material size prior to hoisting it to the surface. The skipped mineralized material is dumped into a small coarse-ore bin adjacent to the headframe, while the waste is dumped into a waste bunker adjacent to the headframe. The mineralized material is discharged from the course-ore bin via a discharge chute onto a vibratory feeder, which then transfers the mineralized material onto the storage bin feed conveyor. A magnet fitted with a small conveyor is situated above and running perpendicular to the storage bin feed conveyor and is used to remove tramp metal from the coarse mineralized material. The tramp metal is collected in a bin for disposal. For future operation, a crusher will be installed next to the headframe which will receive mineralized material from the storage bin feed conveyor to size appropriately for the SAG mill. The mineralized material would then be conveyed to the coarse-ore bin.

Grinding and Thickening

The raw mineralized material from the coarse-ore bin is reclaimed by two apron feeders and is discharged onto a first conveyor. The material on the first conveyor is discharged to a second conveyor equipped with a belt scale, which then transfers the mineralized material to the SAG mill mobile feed chute. Mineralized material reclaimed from stockpiles can be fed through a hopper and transfer conveyor to the SAG feed conveyor, bypassing the ore bin.

The grinding circuit is a double-stage circuit consisting of a SAG mill and a ball mill. The SAG mill operates in open circuit, while the ball mill is operated in closed circuit with hydrocyclones. Process water is added to the SAG mill feed chute to achieve the correct dilution for grinding. The main portion of the hydrocyclone underflow is directed to the ball mill for regrinding, while the remaining portion goes to the gravity separation circuit. The hydrocyclone overflow pulp flows to the thickening circuit.

The thickening circuit consists of one trash screen and one thickener. The trash screen is gravity-fed from the hydrocyclone cluster overflow. The screen undersize flows by gravity, via primary and secondary samplers, to the pre-leach thickener feed box. Any oversize trash is dumped into a trash bin.

The pre-leach thickener is fed by the trash screen undersize and the thickening area sump pump. Flocculant is also added to improve the settling rate. The thickener overflow feeds by gravity to the process water tank, while the underflow is pumped to the pre-aeration tank in the CIL circuit.

Gravity Separation

The gravity circuit consists of one vibrating screen, two gravity concentrators, one gravity table, and one gravity table magnet. The hydrocyclone underflow launder is partitioned to collect underflow from three of the hydrocyclones (normally two operational and one standby) within the cluster and is sent to the gravity circuit. The underflow from the remaining five hydrocyclones (normally three or four are operational hydrocyclones) is returned to the grinding circuit

The hydrocyclone underflow flows by gravity to the gravity screen. Dilution water is added to the screen oversize to transport the material to the gravity pump box. This material is directed to the gravity tailings pump box, and then pumped to the hydrocyclone feed pump box in the grinding circuit.

The gravity screen undersize flows to the gravity concentrator, where gravity-recoverable gold is recovered. Dilution water is added directly to the gravity screen underflow to facilitate the pulp flow into the concentrator and to adjust the feed pulp percent solids. The gravity concentrator concentrate is pumped to the gravity holding tank, while the gravity concentrator tailings are directed to the gravity tailings pump box, and then pumped to the hydrocyclone feed pump box in the grinding circuit.

The gravity concentrate, stored in the gravity holding tank, is fed to the gravity table magnet, where the magnetic particles are removed and sent back to the grinding circuit. The non-magnetic portion of the stream is sent to the gravity table to produce an upgraded gold concentrate, that is then calcined in an oven prior to being smelted into doré in the on-site refinery. The gravity table tailings are pumped to the hydrocyclone feed pump box, along with the gravity screen oversize, the gravity concentrator tailings, and the magnetic particles from the gravity table magnet, for reprocessing in the grinding circuit.

Carbon-in-Leach

The underflow from the pre-leach thickener is pumped to the pre-aeration tank. Slurry from the pre-aeration tank overflows into the first of six agitated CIL tanks arranged in series. Cyanide solution and lime are added, as required, to the pre-aeration tank and to the first and fourth tanks for gold dissolution and pH control. Lead nitrate can be added in the pre-aeration tank to improve the gold leaching kinetics. Gold in the solution is adsorbed onto the activated carbon.

The six tanks have been sized to provide 36 hours of residence time at the design flow rate and solids concentration. Each tank is equipped with a single interstage screen and a carbon-transfer pump and is agitated to maintain the solids in suspension. Air is injected in the bottom of the pre-aeration tank and in each CIL tank of the other tanks for gold dissolution. Interconnecting tank launders are arranged so that any tank in series can be bypassed without having to shut down the entire CIL circuit.

On a regular basis, loaded carbon is pumped counter-current to the slurry flow through the tanks in order to increase gold loading. The carbon-forwarding pump of the first tank transfers the slurry onto the loaded carbon screen to recover the loaded carbon from the slurry. Screen undersize flows by gravity back to the first tank, while the oversize, containing the loaded carbon, flows by gravity to the acid wash column in the elution circuit. Fresh and regenerated carbon is added into the last tank.

Elution and Carbon Reactivation

Loaded carbon recovered by the loaded carbon screen gravitates to the loaded carbon tank, which is then pumped to the acid wash column of the elution circuit. The carbon elution circuit treats a 4-tonne batch in approximately 12 hours. The circuit is designed to process one elution per day.

The acid solution is prepared in the dilute acid tank and then pumped through the acid wash column. Once the acid wash is complete, the spent acid is neutralized with sodium hydroxide. The carbon is transferred from the acid wash column to the strip column for gold desorption. The solution from the barren strip solution tank flows through a series of heat exchangers and a heater in order to reach the right temperature in the strip column. The solution strips the gold loaded onto the carbon, which then exits through a Johnson screen from the upper side of the column. The pregnant solution then goes to the electrowinning cells in the refinery for gold recovery.

The stripped carbon is drawn from the bottom of the strip column and goes to the carbon reactivation kiln. After the reactivation, the carbon is discharged into the carbon quench tank. The carbon from the carbon quench tank is pumped and screened to remove (and recover) fine carbon, and then drops by gravity to the last CIL tank. Fresh carbon is added in the carbon quench tank on a regular basis to compensate for the fine carbon removal.

Electrowinning and Refinery

The pregnant solution from the strip column flows first by gravity to the electrowinning flash tank and then to two parallel electrowinning cells, where the gold is plated on cathodes. The barren solution from the electrowinning cells is recovered in a pump box and pumped back to the barren strip solution tank in the carbon elution circuit.

After a certain period, the stainless-steel wool cathodes are cleaned with high pressure water, and the gold sludge sinks to the bottom of the cells. The gold sludge is then pumped with a diaphragm pump to a filter press to remove excess water. The filtrate from the filter press flows to the electrowinning tanks or the barren solution pump box.

The filtered gold sludge from the filter press is sent to the calcination oven to remove excessive humidity. The dried gold sludge is then mixed with suitable fluxes (typically borax, soda ash, sodium nitrate, and silica sand) and is fed into the crucible of the electric induction furnace. Once the gold is melted, it is poured into the doré moulds. Doré bars are then recovered for shipment.

Cyanide Destruction

The safety screen is fed by the last CIL tank overflow. It prevents the loss of carbon in the eventuality of a failure of the last tank interstage screen. The carbon is recovered at the oversize bin.

The screen undersize flows by gravity into the cyanide destruction tank feed pump box and is pumped to the cyanide destruction tank. Oxygen is added at the bottom of the cyanide destruction tank within a dispersion cone. Sulphur dioxide (SO_2) is added in liquid form at the bottom of the tank. Alternatively, a sodium metabisulphite solution can be prepared and added to the reactor. Copper sulphate and lime are added at the top of the tank.

Once cyanide destruction is complete, the tailings are discharged into the cyanide destruction discharge distributor. When the paste plant is operating, the tailings flow by gravity to the buffer tank feed pump box and are pumped to the buffer tank. When the paste plant is not operating, the tailings flow by gravity to the tailings pump box and are pumped to the tailings pond. Service water can also be added to the tailings pump box to prevent pump surging.

Tailings Filtration (not commissioned)

The construction of the tailings filtration circuit has not yet been fully completed or commissioned. The tailings filtration system consists of two disc filters with two filter feed pumps, two vacuum pumps, two snap blow receivers, two filtrate tanks, and two filtrate pumps.

The tailings from the cyanide destruction circuit are pumped from the buffer tank feed pump box to the buffer tank. The tailings are then pumped to one of the two disc filters for filtration (one operational, one standby). The filtrate is recovered in the filtrate tank and pumped to the tailings box. The filtered tailings are discharged onto the tailings conveyor which feeds the paste mixer.

Paste Backfill Preparation (not commissioned)

The construction of the paste backfill plant has not yet been fully completed or commissioned. The disc filter tailings cake is discharged onto the tailings conveyor and then mixed with service water in the paste mixer to produce backfill paste. Fly ash and Portland cement are also added to the mixer to meet underground backfilling strength requirements. The cement and binders discharged from the storage bins are controlled to achieve the proper concentration in the backfill paste. The paste produced by the mixer is then discharged into the paste pump feed hopper.

Paste Backfill Distribution (not commissioned)

The construction of the paste backfill distribution system has not yet been fully completed or commissioned. Once the paste is prepared, one positive displacement pump is used to move the paste into the underground stopes. The pump is equipped with a hydraulic unit.

Reagents

Apart from the reagents used in relatively small quantities at the electrowinning and refinery sectors, the following reagents are those used throughout the process:

Sodium Cyanide

Sodium cyanide (NaCN) is supplied in 1-tonne bags and is mixed with water in batches on site in a controlled environment and then transferred to the cyanide distribution tank. The sodium cyanide solution is pumped to the CIL circuit and the barren elution solution tank.

Flocculant

Flocculant is used in the pre-leach thickener to improve the solids settling rate. Flocculant is supplied in bags. The preparation station consists of a wetting unit, mixing tank, and distribution tank. The flocculant is then pumped into the pre-leach thickener.

Hydrochloric Acid

Hydrochloric acid (HCl) is used for the carbon acid wash. The hydrochloric acid is supplied in totes and pumped to the acid storage tank. The acid is pumped to the dilute acid tank in the carbon elution circuit as required.

Lead Nitrate

Lead nitrate ($PbNO_3$) is sometimes used to improve the gold leaching kinetics in the CIL circuit. A $PbNO_3$ handling and addition system has been installed but was not used in 2015. The system was commissioned and used in processing the 2018 bulk sample.

Sulphur Dioxide

Liquid sulphur dioxide (SO_2) is used as an oxidizing agent in the cyanide destruction process. The sulphur dioxide is delivered by truck and stored in the sulphur dioxide tank. The sulphur dioxide tank is equipped with a pressure system to keep the sulphur dioxide in liquid form and to deliver the sulphur dioxide to the cyanide destruction tank. Liquid SO_2 was the primary oxidizing agent for the cyanide destruction system installed at the Phoenix mill as commissioned and operated in 2015. Upon mine and mill shutdown at the end of 2015, this system was decommissioned. Liquid SO_2 was not used as the oxidizing agent during the 2018 bulk sample processing.

Sodium Metabisulphite

Sodium metabisulphite ($Na_2S_2O_5$) is used as an oxidizing agent in the cyanide destruction process as an alternative to liquid SO_2. The metabisulphite is delivered by truck in bags. The metabisulphite is mixed with water in a mixing tank, and the solution is pumped to the cyanide destruction tank. This system was operated during the 2018 bulk test.

Lime

Lime, delivered as quicklime (CaO), is used to control the pH in the grinding, CIL, and cyanide destruction circuits to prevent cyanide gas (HCN) formation. The lime is delivered in bulk by truck and stored in the lime bin. A screw feed conveyor transfers the lime to the lime slaker to prepare the milk of lime. The milk of lime is stored in the lime distribution tank. Distribution pumps deliver the milk of lime to the CIL circuit and cyanide destruction circuits through a closed-loop distribution system.

Copper Sulphate

Copper sulphate ($CuSO_4$) is used as a catalyst in the cyanide destruction process. Copper sulphate is supplied in bags and mixed in batches with water on site in a controlled environment, then transferred to a distribution tank. The copper sulphate solution is pumped to the cyanide destruction tank as required.

Sodium Hydroxide

Sodium hydroxide (NaOH) is used for carbon stripping and to neutralize the residual acid in the dilute acid tank and the acid wash column. The caustic is supplied in drums and pumped to the caustic storage tank. A distribution pump transfers the caustic to the dilute acid tank and to the barren strip solution tank.

Descalant

A descalant reagent is used to reduce calcium carbonate deposits. The descalant is supplied in totes and pumped to the process water tank and barren strip solution tank as required.

Cement

Cement will be used at the paste plant to enhance the strength of the paste backfill. Cement will be delivered in bulk by truck and will be stored in a bin. A screw conveyor will deliver the cement to the paste mixer. This system has been constructed but has not yet been commissioned or operated.

Fly Ash

Fly ash will be used at the paste plant to enhance the strength of the paste backfill. Fly ash will be delivered in bulk by truck and will be stored in a bin. A screw conveyor will deliver the fly ash to the paste mixer. This system has been constructed but has not been commissioned or operated.

Utilities

Freshwater

A freshwater system is required in order to store and distribute freshwater to various areas of the mill and Project site. The existing freshwater tank is situated at the highest topographical location, south of the hoist room. The freshwater tank is fed by the redesigned pump system that draws water from East Bay of Red Lake. Two freshwater pumps (one operational, one standby) distribute freshwater to the processing plant and various other areas at the Project site. Freshwater is used for reagent preparation, cooling, and washbasins.

Reclaim Water

The water recovered from the tailings pond (reclaim water) is pumped into the service water tank by one of the two reclaim water pumps located in the pond. The remaining reclaim water pump is either used as a spare or for feeding the water treatment plant for the treatment and discharge of surplus water from the TMF to the environment.

Service Water

The service water tank is used to store reclaim water that contains low levels of cyanide. It is fed by reclaim water from the tailings pond, and by freshwater when required. The service water tank overflows into the process water tank and serves as make-up process water. The service water is also pumped and distributed throughout the concentrator.

Process Water

The process water is stored in the process water tank, located on the west side of the pre-leach thickener to allow any overflow from the thickener to gravitate into the process water tank. The process water tank is also fed by the service water tank overflow, if additional water is required. Two process water pumps (one operational, one standby) distribute the water to various process areas. Process water is used in the grinding, gravity, and thickening circuits.

Domestic Water for Emergency Showers

Domestic (potable) water feeds the domestic water heaters. Two domestic water pumps (one operational, one standby) distribute domestic water to the emergency showers throughout the concentrator as well as the rest of the Project site.

Air Service

Mine air compressors supply compressed air at 125 pounds per square inch gage (psig) to the process plant as service air, and to an air dryer. The air dryer supplies dry air to a dry air receiver, which stores and supplies dry air for instrumentation requirements. Two air blowers are used for air distribution to the CIL circuit, with one blower in service and the other on standby.

24.9.3 Concentrator Design

Design Criteria

Table 24-5 presents the main design criteria used for the concentrator design. The design criteria are identical to those described in the 2013 technical report (SRK, 2013b).

Table 24-5: Concentrator Main Design Criteria

Parameter	Unit	Value
Feed Characteristics		
Gold Head Grade (Nominal)	g/t	8.06
Gold Head Grade (Maximum)	g/t	20
Mineralized Material Moisture	% w/w	5
Mineralized Material Specific Gravity		2.9
Draw Down Angle	degree	50
Repose Angle	degree	40
Operating Schedule		
Scheduled Operating Days	d/a	365
Operating Hours	h/d	24

Parameter	Unit	Value
Plant Availability	%	92
Shifts	shift/d	2
Production Rate		
Plant Feed Rate (Nominal)	t/d	1,250
Plant Feed Rate (Operation)	t/d	1,359
Plant Feed Rate (Future Expandable)	t/d	2,500
Production Target (Dry)	t/a	456,250
Gold Recovery	%	92.5
General Characteristics		
Ambient Temperature	°C	10 to 30
Outdoor Temperature	°C	-36 to 28
Relative Humidity	%	20 to 100
Altitude Above Sea Level (shaft collar)	m	369

Mass Balance

Table 24-6 is the theoretical mass balance developed for the mill as presented in the 2013 technical report (SRK, 2013b). The mass balance is based on a concentrator availability of 92% and a nominal feed rate of 1,250 t/d. The clarifier, which is shown in the mass balance, was not installed. The effect is not material to the overall mass balance. This stream now reports directly to the tailings box.

Table 24-6: Concentrator Mass Balance

Stream Description	Solids (t/h)	Solids (m^3/h)	Solution (t/h)	Pulp (t/h)	Pulp (m^3/h)	Solids (%w/w)
Grinding Circuit						
SAG Mill						
SAG Mill Feed	56.6	19.5	2.98	59.6	22.5	95
SAG Mill Discharge	56.6	19.5	23.9	80.5	43.4	70.3
Ball Mill						
Hydrocyclone Underflow to Grinding Circuit	127.4	43.9	54.6	182	98.5	70
Ball Mill Discharge	127.4	43.9	59.6	187	103.5	68.1
Hydrocyclone Feed Pump Box						
SAG Mill Discharge	56.6	19.5	23.9	80.5	43.4	70.3
Ball Mill Discharge	127.4	43.9	59.6	187	103.5	68.1
Gravity Circuit Tailings	42.5	14.6	66	108.5	80.7	39.1

Stream Description	Solids (t/h)	Solids (m^3/h)	Solution (t/h)	Pulp (t/h)	Pulp (m^3/h)	Solids (%w/w)
Hydrocyclone						
Hydrocyclone Feed	226.4	78.1	177.9	404.4	256	56
Hydrocyclone Underflow	169.8	58.6	72.8	242.6	131.4	70
Hydrocyclone Underflow to Grinding Circuit	127.4	43.9	54.6	182	98.5	70
Hydrocyclone Underflow to Gravity Circuit	42.5	14.6	18.2	60.7	32.8	70
Hydrocyclone Overflow	56.6	19.5	105.1	161.7	124.7	35
Gravity Circuit						
Hydrocyclone Underflow to Gravity Circuit	42.5	14.6	18.2	60.7	32.8	70
Gravity Circuit Tailings	42.5	14.6	66	108.5	80.7	39.1
Gravity Table Concentrate	0.0011	0.00011	0.00006	0.001	0.0002	95
Thickening Circuit Trash Screen						
Hydrocyclone Overflow	56.6	19.5	105.1	161.7	124.7	35
Trash Screen Undersize	56.6	19.5	110.1	166.7	129.7	34
Clarifier (not installed)						
Clarifier Feed (Filtrate + Vacuum Seal Water)	0.014	0.00484	31.2	31.2	31.2	0.04
Clarifier Overflow	-	-	27.9	27.9	27.9	-
Clarifier Underflow	0.014	0.00484	4.12	4.13	4.13	0.34
Pre-Leach Thickener						
Thickener Feed	56.6	19.5	115.4	172	134.9	32.9
Thickener Overflow	0.012	0.0041	58.8	58.8	58.8	0.02
Thickener Underflow	56.6	19.5	56.6	113.2	76.1	50
CIL Circuit						
Pre-Aeration Tank A Feed	56.6	19.5	58.1	114.7	77.6	49.3
Loaded Carbon Screen Undersize	7.94	2.66	8.65	16.6	11.3	47.9
CIL Tank A Feed	56.6	19.5	59	115.6	78.5	49
CIL Circuit Tailings to Safety Screen	56.6	19.5	59	115.6	78.5	49
Loaded Carbon Screen						
Pulp Transfer (with Carbon) to the Loaded Carbon Screen	8.12	2.8	8.46	16.6	11.3	49
Carbon Feed to Acid Wash Column	0.181	0.139	0.725	0.906	0.864	20
Loaded Carbon Screen Undersize	7.94	2.66	8.65	16.6	11.3	47.9
Cyanide Destruction Safety Screen						
CIL Circuit Tailings to Safety Screen	56.6	19.5	59	115.6	78.5	49
Safety Screen Oversize	0.00068	0.000523	0.00008	0.00075	0.0006	90
Safety Screen Undersize	56.6	19.5	60.5	117.1	80	48.3

Stream Description	Solids (t/h)	Solids (m^3/h)	Solution (t/h)	Pulp (t/h)	Pulp (m^3/h)	Solids (%w/w)
Cyanide Destruction Tank						
Cyanide Destruction Tank Feed	56.6	19.5	62	118.6	81.5	47.7
Cyanide Destruction Tank Discharge	56.6	19.5	62.1	118.7	81.6	47.7
Buffer Tank Feed	31.1	10.7	35	66.1	45.7	47.1
Tailings Pond Feed	25.5	8.78	53.7	79.1	62.4	32.2
Carbon Regeneration and Attrition Carbon Reactivation Kiln						
Carbon Reactivation Kiln Feed	0.09	0.0692	0.0047	0.095	0.0739	95
Carbon Reactivation Kiln Discharge	0.09	0.0692	-	0.09	0.0692	100
Carbon Quench Tank						
Fresh Carbon Dewatering Screen Oversize	0.0935	0.072	0.0104	0.1039	0.0823	90
Carbon Reactivation Kiln Discharge	0.09	0.0692	-	0.09	0.0692	100
Regenerated Carbon Fines Screen Feed	0.184	0.141	0.734	0.918	0.875	20
Regenerated Carbon Fines Screen						
Regenerated Carbon Fines Screen Feed	0.184	0.141	0.734	0.918	0.875	20
Regenerated Carbon Fines Screen Oversize (to CIL Tank F)	0.182	0.14	0.0321	0.214	0.172	85
Regenerated Carbon Fines Screen Undersize (to carbon fines tank)	0.00152	0.00117	0.742	0.744	0.743	0.2
Acid Wash Column						
Carbon Feed to Acid Wash Column	0.181	0.139	0.725	0.906	0.864	20
Carbon Transferred to Elution	0.181	0.139	0.725	0.906	0.864	20
Acid Wash Flow	-	-	3.03	3.03	2.72	-
Acid Solution Recirculation	-	-	3.03	3.03	2.72	-
Elution Strip Column A						
Carbon Transferred to Elution	0.181	0.139	0.725	0.906	0.864	20
Eluted Carbon Transfer to Unloaded Carbon Dewatering Screen	0.0906	0.0697	0.362	0.453	0.432	20
Eluted Carbon Transfer to Fresh Carbon Dewatering Screen	0.0906	0.0697	0.362	0.453	0.432	20
Barren Strip Solution Flow rate	-	-	8.7	8.7	8.7	-
Eluate Solution to Electro winning (electrowinning feed)	-	-	8.7	8.7	8.7	-
Refinery Electrowinning						
Eluate Solution to Electro winning (electrowinning Feed)	-	-	8.7	8.7	8.7	-
Electro winning Solution Discharge Pump to Barren Strip Solution Tank	-	-	8.7	8.7	8.7	-
Sludge Filter Pump Discharge (electrowinning conc.)	0.00036	0.00002	0.0015	0.0018	0.0015	20

Stream Description	Solids (t/h)	Solids (m^3/h)	Solution (t/h)	Pulp (t/h)	Pulp (m^3/h)	Solids (%w/w)
Paste Plant Buffer Tank						
Buffer Tank Feed	31.1	10.7	35	66.1	45.7	47.1
Filter Feed	31.1	10.7	35.8	66.9	46.5	46.5
Disc Filter	-	-	-	-	-	-
Filter Feed	31.1	10.7	35.8	66.9	46.5	46.5
Cake	31.1	10.7	7.78	38.9	18.5	80
Tailings Box Feed (filtrate + vacuum seal water)	0.014	0.00484	28	28	28	0.05
Mixer						
Cake	31.1	10.7	7.78	38.9	18.5	80
Water Addition to the Mixer	-	-	2.97	2.97	2.97	-
Slag Feed *	0.903	0.31	-	0.903	0.31	100
Cement Feed	0.226	0.0717	-	0.226	0.0717	100
Paste Production	32.3	11.1	10.8	43	21.9	75
Water Management Tailings Pond						
Tailings Pond Feed	25.5	8.78	53.7	79.1	62.4	32.2
Reclaim Water from the Tailings Pond to the Service Water Tank	-	-	51.3	51.3	51.3	-

Note: *Slag not available. Fly ash will replace slag when required

Equipment List

The equipment list presented in Table 24-7 was initially developed for the conceptual mill presented in the 2013 technical report (SRK, 2013b).

The equipment was selected based on design criteria outlined in Table 24-6 above for a 1,250 t/d throughput and an availability of 92%. Some major equipment was designed for an expansion to 2,500 t/d. A major equipment list with a brief description of the equipment is presented in Table 24-7.

In the design of the mill that was constructed, certain components were added or deleted (noted with an asterisk in Table 24-7). The notable changes were:

- Installation increase in the number of cyclones from 6 to 8
- Addition of a loaded carbon tank
- Addition of a second gravity concentrator
- Addition of a gravity concentrator feed screen
- Use of a storage bin designated for slag to be used for fly ash, as a slag supply is unavailable

- Installation of one-paste pump to meet the initial requirements for paste fill.

Table 24-7: Major Process Equipment

Equipment No.	Equipment Name	Equipment Description	Changes*
1011-BIN-002	Ore Storage Bin	10.7 m (35 ft) diameter by 18.1 m (59.5 ft) high, 2,300 tonnes capacity	
1011-CVO-002	SAG Mill Feed Conveyor A		
1011-CVO-003	SAG Mill Feed Conveyor B		
1011-FED-002	Apron Feeder A		
1011-FED-003	Apron Feeder B		
1011-FED-004	Apron Feeder C		
1011-FED-005	Apron Feeder D		
1021-CLU-001	Hydrocyclone Cluster	8 cyclones installed (each 381 mm (15 in) in diameter)	
1021-MIL-001	SAG Mill	6.1 m (20 ft) diameter by 3.35 m (11 ft) (F/F), 3.0 m (10 ft) (EGL), 1,790 kW (2,400 hp)	
1021-MIL-002	Ball Mill A	3.2 m (10.5 ft) diameter by 4.9 m (16 ft) (F/F), 4.7 m (15.5 ft) (EGL), 597 kW (800 hp)	
1022-CLA-001	Loaded Carbon Tank		*
1022-SCR-005	Trash Screen	Linear, 1.2 m by 2.4 m (4 ft by 8 ft)	
1022-THK-001	Pre-Leach Thickener	High rate, 14.0 m (46 ft) diameter	
1025-GCO-001	Gravity Concentrator A & B		*
1031-SCR-006	Loaded Carbon Screen	Vibrating, 0.9 m by 1.8 m (3 ft by 6 ft)	
1031-SCR-010	Gravity Screen	Vibrating, 0.9 m by 1.8 m (3 ft by 6 ft)	*
1031-TNK-004	Pre-Aeration Tank A	8.5 m (28 ft) diameter by 9.6 m (31.5 ft) high	
1031-TNK-005	CIL Tank A	8.5 m (28 ft) diameter by 9.6 m (31.5 ft) high	
1031-TNK-006	CIL Tank B	8.5 m (28 ft) diameter by 9.6 m (31.5 ft) high	
1031-TNK-007	CIL Tank C	8.5 m (28 ft) diameter by 9.6 m (31.5 ft) high	
1031-TNK-008	CIL Tank D	8.5 m (28 ft) diameter by 9.6 m (31.5 ft) high	
1031-TNK-009	CIL Tank E	8.5 m (28 ft) diameter by 9.6 m (31.5 ft) high	
1031-TNK-010	CIL Tank F	8.5 m (28 ft) diameter by 9.6 m (31.5 ft) high	
1032-SCR-015	Safety Screen	Linear, 1.2 m by 2.4 m (4 ft by 8 ft)	
1032-TNK-011	Cyanide Destruction Tank	7.0 m (23 ft) diameter by 7.6 m (25 ft) high	
1041-COL-001	Acid Wash Column	4 tonnes	
1041-COL-002	Strip Column A	4 tonnes	
1041-KIL-001	Carbon Reactivation Kiln	2 tonnes, 7.46 kW (10 hp) (Rotation), 130 kW (heat)	
1041-TNK-012	Dilute Acid Tank		
1041-TNK-013	Barren Strip Solution Tank		
1041-TNK-016	Carbon Quench Tank	2 tonnes, 1.5 m (5 ft) diameter by 2.3 m (7.5 ft) high	
1051-BIN-011	Cement Storage Bin		
1051-BIN-012	Fly Ash Storage Bin		*
1051-FIL-002	Disc Filter A		
1051-FIL-003	Disc Filter B		
1051-MIX-001	Paste Mixer	2 motors at 56 kW (75 hp)	

Equipment No.	Equipment Name	Equipment Description	Changes*
1051-PMP-040	Paste Pump A	Putzmeister	*
1051-TNK-017	Buffer Tank		
1071-EWC-001	Electrowinning Cell A		
1071-EWC-002	Electrowinning Cell B		
1073-FUR-001	Smelting Furnace	340 kg (750 lb), 125 kW	
1073-GTA-001	Gravity Table	shaking table	

Note: *Addition and deletions in equipment from the conceptual design of the 2013 PEA

24.10 Project Infrastructure

This section updates the Project infrastructure at the site. In each section, a brief description of the infrastructure is given with an update near the end of the section.

24.10.1 Surface infrastructure

The Phoenix Gold Project site is accessed via a dedicated 8-km gravel road from Nungesser Road in the Municipality of Red Lake. The road is nominally 10 m wide within a 50 m right-of-way. Entry into the Project facilities is via a single entry point onto the property. Access to the property and plant is secured by fencing, gates and security on 24-hour service. A network of gravel roads on site provides vehicular access to the Project infrastructure.

A significant amount of infrastructure has been constructed. The main surface infrastructure, shown in Figure 24-15 and Figure 24-16 , includes:

- Hoist, headframe, and hoist house
- Processing plant
- TMF
- Effluent treatment plant
- Electric power supply and substation
- Propane storage tanks
- Fibre-optic communications cable
- Compressed air supply
- Process and potable water supplies
- Mine ventilation fans and heater house
- Offices and storage buildings
- 200-person camp (currently shuttered).

Hoisting Facility

The Phoenix shaft hoist is a Canadian Ingersoll Rand double-drum hoist, with 4.27 m (14 ft) diameter drums, and two 932 kW (1,250 hp) motors.

The hoist control system, provided by Hepburn Engineering, consists of dual Allen-Bradley programmable logic controllers operating TMEIC fully-regenerative, master/slave IGBT AC drives. The three-compartment shaft was deepened in 2013 to 730 m below surface and includes operational loading pockets at the 337 m Level and 685 m Level. The production conveyances include a skip over double deck cage combination and second identical skip/cage configuration is operated in balance. Each skip has a capacity of 10 tonnes. Development waste rock hoisted to surface is dumped into a waste bunker beside the headframe. Waste rock is currently stockpiled on site in designated areas. Mined material hoisted to surface can either be dumped into the waste bunker beside the headframe and moved to a designated surface ore storage location or hoisted and dumped in a small coarse-ore bin adjacent to the headframe, from where it can then be conveyed into the mill for processing. The following upgrade or repair work was completed during 2017 and 2018:

- Installed safety railings and screens in hoist room to restrict access to hoist machinery
- Recertified skip conveyances for a five-year duration
- Certified hoist ropes
- Repaired hoist drum, replaced bushing, and re-machined drum brake face
- Completed major hoist servicing – replaced all lubrication and filters
- Installed fire suppression system on hoist lubrication system
- Upgraded hoist control system, including updating of the slack rope system
- Repaired 337 m Level loading pocket and placed back into operation
- Repaired 337 m Level spill pocket and placed back into operation
- Repaired 685 m Level loading pocket and placed back into operation
- Commissioned rock breaker, grizzly, and waste-pass system at 337 m Level loading pocket
- Cleaned shaft timber and all catchment pits in shaft
- Completed enclosure of shaft manway
- Repaired and serviced both ore and waste pass chutes on the 305 m Level.

There are a number of alternatives for access to depths below the current shaft bottom of the 730 m Level. These include a third phase of shaft deepening, sinking of an internal winze closer to the mineralized zone, ramp access, or a new shaft. Economic and logistic viability study of each of these alternatives has not been conducted.

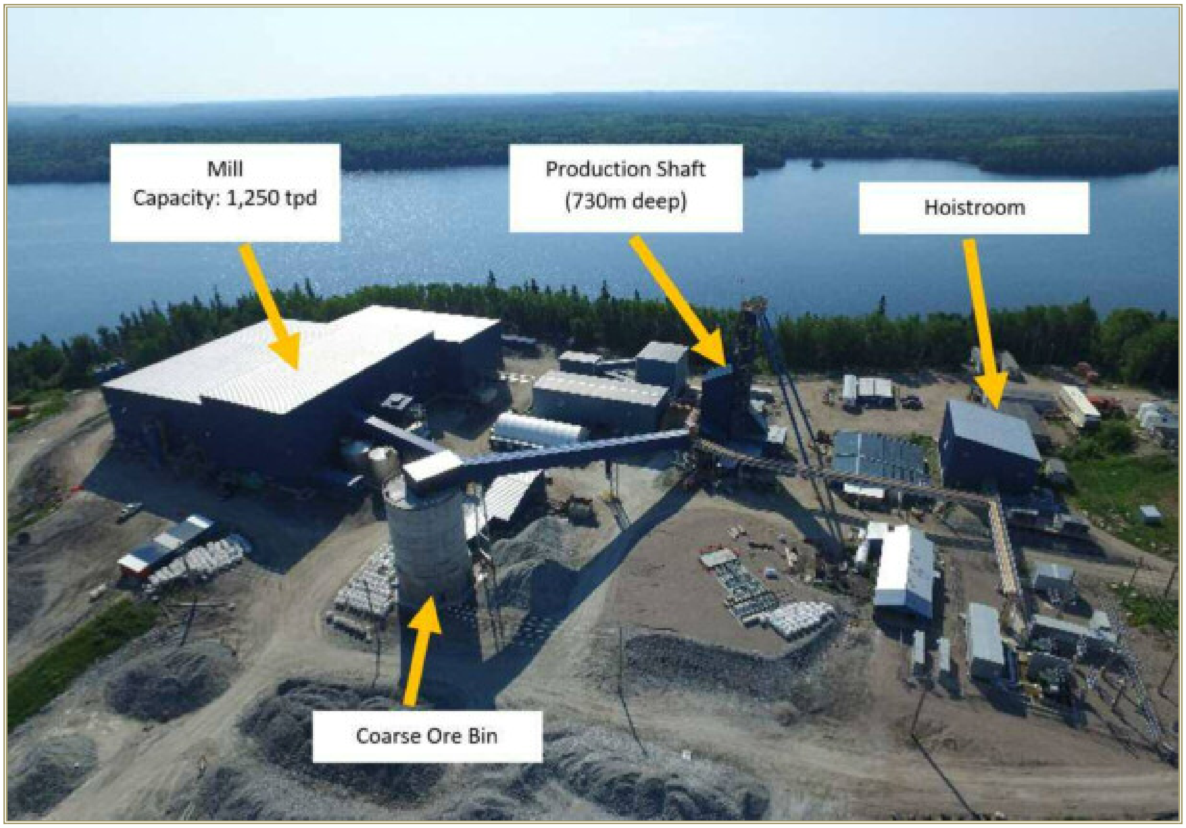


Figure 24-15: Project Site – Looking East (Source: Rubicon, 2019)

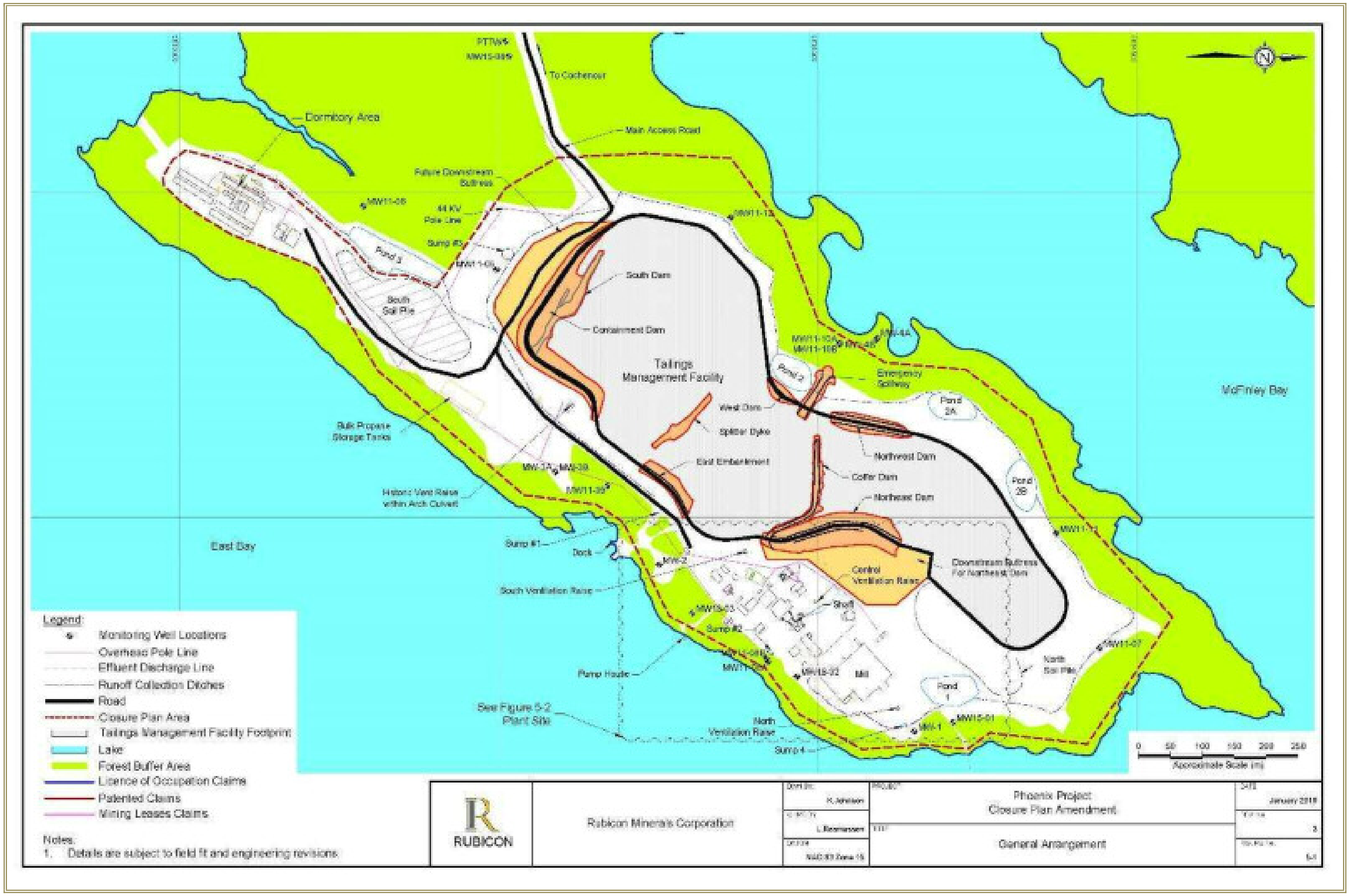


Figure 24-16: Detailed Site Plan of Project Area (Source: Rubicon, 2019)

Processing Plant

The mill is designed for a base processing rate of 1,250 t/d, and can be upgraded incrementally to handle processing rates of 1,800 t/d and 2,500 t/d. Details of the processing facility design and recovery methods are presented in Section 24.8.

The mill houses a paste backfill plant that will produce a cemented paste fill product from the tailings. The paste fill will be pumped underground for placement into voids.

Tailings Management Facility

The historical TMF consisted of a dam and pond. McFinley constructed the containment pond in 1988 and operated it under a Certificate of Approval. After test milling a bulk sample in 1989, the facility received minimal use. Rubicon upgraded and reactivated the TMF and obtained the necessary government approvals when they took over operations of the site.

The tailings dam will be raised in planned stages periodically over the life of the mine to increase the capacity of the TMF as more tailings are produced. Foundation investigation has been carried out for the current design. For future dam raises, similar foundation investigations will be required to refine the designs. The location of the TMF and related facilities are presented in Figure 24-16.

The TMF design utilizes mine rock that was hoisted to surface for the construction of the TMF dams, buttresses, and other onsite components.

The TMF is designed to withstand a 30-day duration of a 1-in-100-year rain-on-snow event. The mill has a cyanide destruction system that treats tailings slurry prior to discharge to the TMF. Discharge from the TMF is processed by an Actiflo® clarification and metals precipitation system with a capacity of between 780 m^3/d and 3,100 m^3/d. This system is designed to remove total suspended solids and metals from the water prior to discharging it to the environment. Rubicon is permitted to discharge a yearly maximum of 3,100 m^3/d of water to the environment from March 16 to November 30. The metals precipitation component of this system was installed in 2017 and commissioned in 2018.

Power and Communications

Electricity Supply

Rubicon has an agreement with Hydro One to supply power to the site and has been granted an allocation of 5.3 MW of power (this was reaffirmed with Hydro One in late 2018). The on-site electrical supply is from the 44 kV M6 Hydro One line fed from the Red Lake Distribution Station (DS). This feeds the main substation, which contains two 18 MW transformers feeding a common 5 kW bus supplying the site.

The underground electrical distribution system consists of:

- One – 3 conductor 4/0 AWG 5 kV Teck 90 cable installed in the shaft from the surface winch room to the 305 m Level (4160 V)
- One – 3 conductor 350 MCM 5 kV Teck 90 cable installed in the shaft, going from the surface winch room down to the 610 m Level (4160 V)
- One – 3 conductor 500 MCM 1 kV Teck 90 cable from surface to the 122 m Level (600 V).

The underground power distribution system will need to be upgraded once the mine goes into full production. The design necessary for the expansion includes the installation of two 500 MCM 5 kV Tech 90 cables from the surface powerhouse down drill holes to the 122 m Level, continuing down the emergency escape-way to all accessible levels. A disconnect is planned for each of the 122 m Level, 183 m Level, 244 m Level, and 305 m Level. A substation has been installed on the 610 m Level for diamond drilling in the area.

Provision for a future feeder upgrade to 13.8 kV for underground distribution has also been procured with the necessary switchgear and shaft cabling presently being stored on site.

Propane

The main propane tank farm, located at the south end of the property, has a capacity of 226,000 L. This facility is used to provide propane to the Project site for heating ventilation air going underground during the winter, and also provides heating fuel to all of the buildings used on site. There are also three 6,000-L tanks located at the dormitory (camp), and a 3,000-L tank at the pole barn, but these are not in use at this time.

Natural Gas

Natural gas supply is available in the Red Lake area and could be considered an energy alternative in the future.

Fuel Storage

A 25,000 L above-ground diesel fuel storage tank and dispensing station is currently located beside the electrical warehouse building. The facility has the requisite spill storage capacity and meets other fuel storage requirements of the Technical Standards & Safety Authority (TSSA).

There is a small (4,100 L) gasoline dispensing facility on site, adjacent to the diesel fuel storage tank. The facility has the requisite spill storage capacity and meets other fuel storage requirements of the TSSA.

Communications

Site surface communication is via a VOIP telephone system. The system is connected by a fiber-optic cable installed along the same route as the electrical power supply line. Radios are used for site-wide communications.

Communication systems underground include a leaky feeder system and FEMCO telephones located in shaft stations and refuge stations. The Emergency Control Centre, which is located in the technical services building, is also equipped with a FEMCO phone, as is the security gatehouse.

Fiber-optic cable has been installed throughout the site, including in the shaft. It is in operation with provision for additional expansion for future communications and instrumentation applications on surface and underground.

Compressed Air Supply

The Project currently has two 261 kW (350 hp) air compressors (Sullair TS32-350) rated at 3,186 m3/h (1,875 cfm) each, and a small back-up compressor unit (Atlas Copco GA160). These units provide adequate volumes for the work presently being completed at site. Additional compressors will need to be added to the system relative to the tonnages that are planned to be mined in future. The compressors are housed in a permanent structure, with temperature-controlled louvres to exhaust heat from the building. The compressors operate on a cascading system controlled by local controllers on each unit. The two larger units operate on a continuous basis, and cycle between loaded and unloaded. Status of the underground distribution system is described in Underground Infrastructure, Section 24.3.2.

Process and Potable Water Supply

Lake water is pumped from the adjacent East Bay of Red Lake to feed the process water and underground activities. The authorized pumping rate from the lake through Rubicon's Permit to Take Water 3585-85KGHG, is 695 L/min, with a maximum daily total of 1,000,000 L/d. When the mill is in operation, process water in the mill and water accumulated in the TMF will be recirculated back into the mill process water supply system, thereby minimizing the amount of water pumped from the lake.

The underground dewatering system reports to the TMF and is authorized by Permit to Take Water 3812-9C9KVF for a maximum pumping rate of 2,917 L/min, up to a maximum of 2,100,000 L/d.

Currently, water discharged to the environment from the TMF comes under regulatory control and can only be discharged between the months of March to November. It must meet objectives and limits outlined in Environmental Compliance Approval #1362-AA2HXS.

Potable water for the site is taken from East Bay and conditioned by a Culligan system of nanomembrane modules, UV bacterial disinfection, and chlorine addition prior to use.

Sewage Treatment Facility

The Project's domestic and industrial sewage systems are regulated by Environmental Compliance Approval #1362-AA2HXS.

Currently, all domestic sewage is collected on site at two collection tanks until regular pump outs are conducted by a third party and the sewage is taken off site to permitted sewage treatment facilities. This process is permitted under Provincial Officer's Order #7655-AMAQDJ.

Mine Ventilation Facilities

Mine ventilation is currently being supplied via a fresh air surface installation on the 122 m Level Fresh Air Raise. The system consists of one 54" diameter (137 cm) 250 hp fan, complete with an associated propane-fired heater and ancillary equipment. This system provides approximately 115,000 cfm to the underground workings and is adequate for the ongoing work program. When the mine is commissioned for full production, it will require up to 370,000 cfm, which will be supplied by two 72" (183 cm) diameter 250 hp fans and their associated heaters and ancillary equipment.

Other Site Buildings

Facilities provided by other buildings near the Phoenix shaft include:

- Muck handling (conveying) and coarse ore storage system for the processing plant
- Mine Dry
- Huddle room for underground crew assignments
- Technical
- Offices for Geology and Engineering
- Core handling facilities and core storage
- Maintenance shop
- Cold storage.

Waste Rock Stockpiles

The waste rock storage area is located on the northwest corner of the peninsula, in a containment area previously referred to as the quarry. All future waste will be placed there for further assessment as potential construction material.

Production Material Stockpiles

Stockpiles for ore, mineralized rock, and waste were re-established for the bulk-sampling program conducted in 2018. All mineralized material processed through the mill was discharged into the TMF. Waste development excavated during the 2018 test mining process was either stockpiled underground, used as stope fill, or hoisted to surface and stored in designated locations. Waste rock was also used as bedding material for the mill during the initial stages of bulk sample processing.

Explosives Magazines

No surface explosive magazines are planned. Upon delivery to site, explosives are moved to authorized magazines underground for storage.

Assay Laboratory

An assay laboratory is located off site in a commercial mall in Balmertown. It has facilities for crushing, pulverizing, fusion, cupellation, acid digestion, and atomic absorption analyses. The two fusion furnaces each have capacity for 42 crucibles, heated to temperatures from 850°C to 1,060°C. The laboratory is capable of processing a maximum of 252 samples every three hours. Currently, the assay lab is closed, and third-party facilities are being utilized for all assay work.

24.10.2 Underground Infrastructure

The underground infrastructure required to support production mining includes material handling facilities, mine dewatering system, paste backfill distribution system, equipment repair bays, ventilation system, supply lines for compressed air and process water, electrical power supply, and miscellaneous facilities.

Material Handling

The material handling system is divided into the upper material handling system from 122 m Level to 305 m Level, the lower material handling system from 366 m Level to 685 m Level, and the material handling below the 610 m Level.

Upper Material Handling System

The upper material handling system consists of a series of connected raises between the 122 m Level and 305 m Level where the ore and waste are then transported by rail. This system allows both ore and waste movement from each level to the mid-shaft loading pocket on the 337 m Level. Construction of ore and waste passes on the 122 m Level is 10% complete. The 183 m Level and 244 m Level's ore and waste passes are operational. Chutes are installed and operational on the ore and waste passes on the 305 m Level. Haulage to the shaft is operational, with two rock breaker/grizzly installations, one for ore and one for waste.

Lower Material Handling System

To date, a 10-tonne loading pocket has been commissioned on the 685 m Level. This system is currently in operation and handling waste material from the 610 m Level and 685 m Level. The future design includes a rock breaker/grizzly screen combination on 610 m Level, with a chute at the bottom of the waste pass raise on 685 m Level. This chute will transfer waste rock to a conveyor arrangement that will feed the 685 m Level loading pocket.

An ore system is also designed that will accept material from the 610 m Level through a rockbreaker grizzley arrangement down a raise to the 685 m Level, where the sized material goes to a chute on 685 m Level. This chute will transfer the sized mineralized material to a single conveyor arrangement (the same one that moves the waste material) which will feed the 685 m Level loading pocket.

Below 610 m Level Material Handling System

Pending continued exploration, alternatives for accessing the mineralized zone at depths deeper than the 610 m Level will be evaluated.

Mine Dewatering

Main dewatering stations are located at shaft bottom, and the 610 m Level, 305 m Level, and 122 m Level. This system is capable of pumping at a maximum flow rate of approximately 757 L/min (200 US gpm) and is adequate for the current Project work.

An upgraded system capable of pumping 3,028 L/min (800 US gpm) from the 305 m Level to surface is partially complete. The current Project permit allows dewatering at a rate of 2,917 L/min (771 US gpm) and a maximum of 2.1 ML/d (0.56 M US gpd). Further engineering work will be required to finalize the mine dewatering system for production.

Compressed Air Distribution System

The main compressed air line is installed in the shaft and consists of a 150 mm (6") line from surface to the 305 m Level, and a 200 mm (8") line from there to shaft bottom. While adequate for exploration purposes, the system will require additional capacity to accommodate expected production rates. Construction of the compressed air distribution system upgrade is approximately 20% complete and will be finished prior to commissioning of the mine.

Refuge Stations

There are four completed refuge stations located underground, on the 122 m Level, 183 m Level, 244 m Level, and 305 m Level. Additional refuge stations will be required once mine development progresses. The constructed refuge stations meet Ministry of Labour requirements.

Paste Backfill Distribution System

The paste backfill distribution system is 90% complete for supplying material to workings above the 305 m Level. Piping has been run on all but one level underground and all but one pipe interconnection has been prepared. This work will be completed prior to commissioning of the mine.

The surface plant requires final connections and initial run testing before backfill can be consistently delivered underground. The final connections will be completed prior to commissioning of the mine.

Laboratory testing of binder types and mixtures have been completed. Operational testing will be required to achieve optimal binder addition to achieve desired backfill strengths and costs.

Underground Equipment Servicing

There are three service bays areas located on the 183 m Level, 244 m Level, and 305 m Level. Equipment servicing is completed at these locations. A review of the need for an underground repair shop will be completed prior to commissioning of the mine, as it is possible to do major servicing on surface should a ramp be completed to surface.

Miscellaneous Facilities

Other underground facilities not covered above include but are not limited to: storage bays for supplies and equipment, electrical substations, diamond drill stations, local electrical panels, charging stations, and toilet facilities conveniently located adjacent to active headings.

24.11 Environmental Studies, Permitting, and Social or Community Impact

The information presented in this section is extracted from the 2018 Technical Report (Golder, 2018b) and was updated where appropriate by Rubicon, to reflect the current status of the property. There is no reason not to rely on this information.

24.11.1 General

The Phoenix Gold Project is located on the McFinley Peninsula in the East Bay of Red Lake. Neighbouring land and water are generally used for wilderness recreation, Mineral Resource development, and forestry. The Project is a brownfield site that was developed intensively in the 1980s prior to its acquisition by Rubicon in 2002. Rubicon has assumed full ownership of the site, and all known environmental liabilities have been identified and addressed by Rubicon. The Project commenced an advanced exploration phase in 2009, a development phase from 2011 to 2015, and moved to temporary suspension at the end of 2015. The Project was moved in a Development and Production status in 2018 to allow the test mining and bulk sample processing program to be completed. It is still in this status due to ongoing exploration development being done in 2019.

24.11.2 Environmental Regulatory Setting

The environmental assessment and permitting framework for metal mining in Canada is well established. The federal and Ontario provincial environmental assessment processes provide a mechanism for reviewing major projects to assess and resolve potential environmental impacts. Following a successful environmental assessment, a Project undergoes a licensing and permitting phase for the legal and environmental aspects of the Project. The Project is then regulated through all life cycle phases (construction, operation, closure, and post-closure) by both federal and provincial agencies.

Current Regulatory Status

The advanced exploration phase, which commenced in Q1 2009, was in accordance with regulatory approvals. In Q1 2011, a Form 1 Notice of Project Status was submitted to the Ontario MNDM to move the Project from advanced exploration status to production status in accordance with Section 141 of Ontario's *Mining Act*. In Q4 2015, a Notice of Project Status form was submitted to the MNDN to move the Phoenix Gold Project to temporary suspension status.

The site remained in care and maintenance in 2016 and 2017 with minimal staff on site and some minor underground development commencing in Q4 of 2017. New management implemented an 18- to 24-month plan that included a drilling campaign to characterize and confirm a new Mineral Resource model which was published in 2018. During 2018 the processing of a bulk sample was completed from selected stopes to confirm grades and test the efficacy of a variety of mining methods. Consultation with the MENDM revealed that the Project would need to re-enter production status in order to operate the mill under current legislative guidelines. Rubicon therefore submitted a Notice of Project Status form to this effect and re-entered the development and production phase effective July 1, 2018.

Approvals currently in force for the Project are presented in Table 24-8. The approvals generally relate to a 1,200 t/d production rate and amendments will be required if a production increase is required. It is specifically noted that title was secured to the access road and power line right-of-way for the connection to the grid through Section 21 of the *Public Lands Act* for the Crown land portion, and a negotiated agreement was reached with the landowners and leaseholders for the private land portion of the right-of-way.

Table 24-8: Current Approvals

Permit	Regulatory Agency	Relevant Legislation	Date of Issuance	Rationale
Permit to Take Water 3812-9C9KVF	Ministry of Environment, Conservation and Parks	*Ontario Water Resources Act*	Dec. 11, 2008 (Renewed Nov. 20, 2013)	Withdrawal of water from shaft
Permit to Take Water 3585-85KGHG	Ministry of Environment, Conservation and Parks	*Ontario Water Resources Act*	Nov. 19, 2008 (last amendment May 21, 2010)	Withdrawal of water from East Bay of Red Lake

Permit	Regulatory Agency	Relevant Legislation	Date of Issuance	Rationale
Environmental Compliance Approval 1362-AA2HXS	Ministry of Environment, Conservation and Parks	*Environmental Protection Act*	Aug. 5, 2016 (Amendment in progress)	Approve industrial and domestic sewage works
Environmental Compliance Approval 6656-8RVMES	Ministry of Environment, Conservation and Parks	*Environmental Protection Act*	Jan. 27, 2009 (last amendment Feb. 28, 2012)	Approve air emissions from site
Environmental Compliance Approval 0244-8YWLBB	Ministry of Environment, Conservation and Parks	*Environmental Protection Act*	Dec. 21, 2012 (ownership transferred to Rubicon Minerals Corporation effective Oct. 16, 2014)	Approve air emissions from the assay lab
Easement over Crown Land	Ministry of Natural Resources and Forestry	*Public Lands Act*	Sep. 2, 2011	Approve easement over Crown owned surface rights for access corridor
LRIA Approval No. RL-2014-01, RL-2014-01C	Ministry of Natural Resources and Forestry	*Lakes and Rivers Improvement Act*	Jan. 23, 2009 (last amended Nov. 6, 2015)	Approve Stage 1 construction of the TMF dams and emergency spillway
Phoenix Gold Project (production) Closure Plan	Ministry of Energy, Northern Development and Mines	*Mining Act*	Dec. 2, 2011 (Amended Jun. 16, 2016; further amendments in progress)	Approve development and closure of the production phase of the Project
Amendment to the Zoning By-Law 1277-10	Municipality of Red Lake	Municipal By-Law 1277-10	Process completed in Feb. 2011	Necessary to change the zoning of the Project site to mineral mining from hazard land. The new zoning is more appropriate because the entire Project site is now subject to a filed closure plan and is no longer considered an abandoned mine site. The amended zoning will also allow the issuance of building permits for the subject land
Land Use Permit 1204-1010939	Ministry of Natural Resources and Forestry	*Public Lands Act*	Oct. 1, 2015 (Expires Sep. 30, 2020)	Approve use of crown land for monitoring water wells at Project Site
Land Use Permit 1204-1010951	Ministry of Natural Resources and Forestry	*Public Lands Act*	Feb. 1, 2016 (Expires Jan. 31, 2021)	Approve use of crown land for effluent discharge pipeline

In addition to the approvals noted above, Rubicon completed a Class Environmental Assessment pursuant to *O. Regulation 116/01* to allow it to seek and ultimately be issued an Air Environmental Compliance Approval (ECA) for contingency diesel-fired generators (<5 MW cumulative capacity). In addition, Rubicon completed Class Environmental Assessments in accordance with the environmental assessment for Resource Stewardship and Facility Development projects for the activities within the access corridor. The environmental assessment process was also completed for the 2015 application to relocate the effluent discharge line to an optimized location in East Bay, where improved mixing would be provided. This new discharge location was commissioned in the summer of 2016, with the land currently tenured under a Land Use Permit. A legal survey of the shoreline and lake bottom was completed in 2017 in support of the acquisition of the crown shoreline and the easement for the lake bottom where the discharge pipe lies. Both of these land tenure projects remain underway and will be finalized in 2019.

In May of 2017, Rubicon received a Provincial Officer's Order (number 7655-AMAQDJ) relative to the lack of domestic sewage treatment at the site. The main peat moss treatment system was inoperable during winter months due to low flows into the system (with reduced staff on site), and other approved treatment systems were never installed as planned due to the shut down in 2015. The Order allows Rubicon to continue using septic tanks as temporary holding tanks until such time as an approved sewage disposal system is installed and operational. All tanks have high-level alarms installed, and Rubicon has entered into a service contract with a licensed sewage hauler as per the Order. The Ministry of Environment, Conservation and Parks (MECP) has confirmed that Rubicon can operate with these temporary holding tanks until a permanent production state is reached. At this time, Rubicon must have appropriate and approved sewage treatment in place and operational at the Project Site prior to entering commercial production, as per the Order.

There are no other outstanding environmental compliance issues on the Phoenix Gold Project Site. Rubicon is currently in material compliance and has fulfilled the monitoring and reporting obligations of the approvals listed in Table 24-8. The obligations under federal and provincial legislation, including the *Metal Mining and Effluent Regulations* (MMER) and the *Environmental Protection Act*, have been fulfilled to date. On September 8, 2015, a Director's Order was received from the Ontario Ministry of Environment and Climate Change (last amended on January 25, 2016). The requirements of the Order to date have been completed within the specified timelines. However, as outlined in the Order, there are still some sections that need to be complied with, including the requirement to install and commission a long-term ammonia treatment plant if the Project proceeds to mine production and development status, as defined in the *Mining Act*.

Federal Environmental Assessment Process

In 2011, the Canadian Environmental Assessment Agency confirmed that the 1,250 t/d production phase of the Project will not trigger an environmental assessment pursuant to the *Canadian Environmental Assessment Act* (CEAA). The Project has been advanced since this time, is currently regarded as a mine, and is therefore subject to mining sector legislation, including the MDMER that have been promulgated under the *Fisheries Act*.

In the spring of 2012, the 1992 CEAA was amended and replaced by Canadian Environmental Assessment Agency, 2012 (CEAA 2012). Two significant results of the updated *Act* were the redefinition of conditions that would trigger a federal environmental assessment and the introduction of legislated time periods within the federal environmental assessment process. With respect to the Phoenix Gold Project, there are two reasons why a federal environmental assessment could be required under CEAA 2012, as follows:

1. A proposed Project will require an environmental assessment if the Project is described in the Regulations Designating Physical Activities
2. Section 14(2) of CEAA 2012 allows the Minister of Environment (by order) to designate a physical activity that is not prescribed by regulation if, in the Minister's opinion, either the carrying out of that physical activity may cause adverse environmental effects or public concerns related to those effects may warrant the designation.

With respect to the first method above, the Regulations Designating Physical Activities (2012) have been amended. The Regulations Amending the Regulations Designating Physical Activities state:

> *17. The expansion of an existing*
>
> *(a) metal mine, other than a rare earth element mine or gold mine, that would result in an increase in the area of mine operations of 50% or more and a total ore production capacity of 3 000 t/d or more*
>
> *(b) metal mill that would result in an increase in the area of mine operations of 50% or more and a total ore input capacity of 4 000 t/d or more*
>
> *(c) rare earth element mine or gold mine, other than a placer mine, that would result in an increase in the area of mine operations of 50% or more and a total ore production capacity of 600 t/d or more*

Federal environmental assessment requirements would have to be satisfied prior to seeking any permits in the event that an increased production rate is desired. Due to the required increase in the area of operations and given that the site occupies a peninsula with little to no opportunity for material expansion to the operations area, a federal environmental assessment is not likely to be required under 17(a) above.

With respect to the second method above, it is not anticipated that the federal Minister of the Environment would designate the Project for environmental assessment due to the relatively small footprint, the benign nature of concerns expressed by the public to date, and the absence of discernible, significant adverse environmental effects during the operations to date and in the foreseeable future.

In preparation for potential future increases to the production rate, the engineering work that is required to support planning and environmental permitting for increasing the throughput to 2,500 t/d is materially complete.

Provincial Environmental Assessment Process

The *Environmental Assessment Act* is administered by Ontario's Ministry of the Environment, Conservation and Parks (MECP) and the Ministry of Natural Resources and Forestry[3] (MNRF). The *Environmental Assessment Act* promotes responsible environmental decision-making and ensures that interested parties have an opportunity to comment on projects that may affect them. Interested parties may make a designation request to the MECP to have a Project referred to an individual environmental assessment. The MECP assesses the merits of the request, and may make a recommendation to the Minister, as outlined on the MECP's website under the tab titled Environmental Assessments under Designating Regulations and Voluntary Agreements.

The consultation for the advanced exploration permits, as well as the numerous other permits issued to date (Table 24-8), have not resulted in designation requests for an individual environmental assessment.

A Class Environmental Assessment for Resource Stewardship and Facility Development Projects was completed in 2011 for a portion of the corridor to connect the Project site to Nungesser Road and the work associated therein. No negative comments were received during this process, which was conducted in accordance with the MNRF process outlined in 2003. An environmental assessment process was completed in relation to the shoreline land tenure that Rubicon continues to pursue, as well as the 2015 application to relocate the effluent discharge line to an optimized location in East Bay, where improved mixing would be provided.

A Class Environmental Assessment was completed in 2011 pursuant to *Ontario Regulation 116/01* for the use of less than 5 MW of diesel generation at the Project site. No negative comments were received during the process.

Environmental Assessment Requirements for the Project

The Project is currently permitted for a production rate of 1,200 tonnes per day. Federal and provincial environmental assessment requirements would have to be satisfied prior to seeking any permits in the event that an increased production rate is desired.

24.11.3 Environmental Approvals Process

This section describes the federal and provincial approvals processes for potential production rate increases that may be contemplated in future economic assessments.

[3] Formerly Ministry of Natural Resources (MNR).

Federal Approvals Process

Federal environmental assessment requirements would have to be satisfied prior to seeking any permits in the event that an increased production rate is required.

Permits would need to be maintained pursuant to the *Nuclear Source Control Act* for the use of density gauges in the mill concentrator that utilize nuclear sources. These permits are currently up to date.

Provincial Approvals Process

Provincial environmental assessment requirements would have to be satisfied prior to seeking any permits in the event that an increased production rate is required.

In preparation for a potential future increase to the production rate, the engineering work that is required to support planning and environmental permitting for increasing throughput to 2,500 t/d is materially complete. However, limited refined engineering is required to determine the nature of the amendments to the provincial approvals required to increase the production rate. As a minimum, it is envisioned that amendments would be required to the approvals as listed in Table 24-9.

Table 24-9: Anticipated Amendments to Approvals

Permit	Regulatory Agency	Relevant Legislation	Rationale for Permit Issuance	Rationale for Amendment
Permit to Take Water 3585-85KGHG	Ministry of Environment, Conservation and Parks	*Ontario Water Resources Act*	Withdrawal of water from East Bay of Red Lake	Increased withdrawal of fresh water from East Bay
Environmental Compliance Approval 1362-AA2HXS	Ministry of Environment, Conservation and Parks	*Environmental Protection Act*	Approves industrial and domestic sewage works	Increased production rate (administrative amendment), potential changes associated with changes to water balance, approve engineering design for TMF modifications during late stages of the mine life
Environmental Compliance Approval 6656-8RVMES	Ministry of Environment, Conservation and Parks	*Environmental Protection Act*	Approve air emissions from site	Modifications to mine ventilation and increased return air volume; additional potential sources of fugitive dust and gaseous emissions from increased mill production rate
LRIA Approval No. RL-2014-01, RL-2014-01C	Ministry of Natural Resources and Forestry	*Lakes and Rivers Improvement Act*	Approve Stage 1 construction of the TMF dams and Emergency Spillway	Ongoing TMF construction
Phoenix Gold Project (production) Closure Plan	Ministry of Energy, Northern Development and Mines	*Mining Act*	Approve development and closure of the production phase of the project	Increased production rate and modified dimensions of the TMF upon closure, along with modified financial assurance requirement. The spatial extent of the Project footprint will not be materially affected by the increased production rate.

24.11.4 Environmental Studies and Management

Environmental Studies

The Project closure plan describes current conditions at the property. Baseline monitoring activities and areas of study to date are listed below and have been incorporated into the closure plan, annual environmental performance reports, and other submissions to regulatory agencies:

- Monthly surface water monitoring since 2007 in the vicinity of the Project site
- Semi-annual sampling of groundwater monitoring wells since 2009
- Archaeological assessment by Ross Archaeological Research Associates (Ross Associates)
- Annual species-at-risk assessment by Northern Bioscience
- Background conditions study by BZ Environmental
- Aquatic biological assessment by EAG Inc. (EAG)
- Effluent mixing and plume delineation studies by EAG and Story Environmental
- Assessment of risks to the downstream environment from the Project by Novatox
- Hydrogeological characterization by AMEC Earth and Environmental
- Phase 1 and Phase 2 environmental site assessments by True Grit Engineering
- Risk assessment of the groundwater and soils at the Project site in accordance with *O. Regulation 153/04* by Novatox
- Geochemical characterization of development rock associated with the Advanced Exploration phase by AMEC Earth and Environmental
- Geochemical characterization of development rock, ore, tailings and quarried surface rock by Chem-Dynamics
- Geotechnical assessments of underground workings by AMEC Earth and Environmental and AMC Mining Consultants (Canada) Ltd. (AMC)
- Project reviews by Water and Earth Science Associates Ltd. (WESA), A division of BluMetric Environmental Inc. and ArrowBlade Consulting Services.

No biological values that would preclude the redevelopment of the Project site (i.e., species at risk, ecologically significant features, regionally significant wetlands, significant wildlife habitat, or environmentally sensitive areas) have been identified to date. Ongoing field studies have been conducted with input from the MNRF to ensure adherence to the provincial *Endangered Species Act, Public Lands Act, Crown Forest Sustainability Act,* and the Provincial Policy Statement that has been issued pursuant to Section 3 of the *Planning Act*.

Consultation to date with Aboriginal communities has not identified the presence of cultural heritage values in the vicinity of the Project site. In addition, the desktop and field work by Ross Associates did not identify any areas with a high potential to host cultural heritage values on McFinley Peninsula (Ross Associates, 2010). As the Project involves the redevelopment of the existing footprint, with only moderate expansion, the potential for impacts to cultural heritage values as a result of the redevelopment of the brownfield Project site are considered to be negligible.

Environmental Management

Rubicon has developed and adheres to an environmental management system for the Project (Rubicon, 2017). The environmental management system is a simple, plain-language tool that has been prepared internally to identify and help manage environmental compliance obligations for the Phoenix Project. The extent of the property covered by the environmental management system includes the Project site on McFinley Peninsula as well as off-site areas within the larger Phoenix Project lands and along the access corridor.

The elements of the environmental management system are:

- Lists of the relevant legislation, approvals, agreements, and documents that delineate Rubicon's environmental obligations
- Division of the property into discrete environmental management areas, each area having a description of the environmental obligations and the corresponding inspection frequencies
- Designated inspectors and documented inspection protocols
- Procedures to deal with non-compliance issues and conditions
- Guidance for documentation requirements, regular updates, and regular internal reporting on performance and auditing.

The environmental management system identifies the Project's compliance obligations and outlines inspection and audit protocols to ensure compliance issues are identified, reported, mitigated, and documented. The environmental management system also addresses community engagement and consultation obligations and includes a commitments registry of Aboriginal agreements and community commitments. The environmental management system is expected to evolve into a tool to manage corporate social responsibility commitments and obligations.

24.11.5 Social Setting

This section summarizes Rubicon's consultation and outreach program, which began on a formal basis in 2008.

Aboriginal Consultation

Rubicon has undertaken consultation with Aboriginal communities under the guidance of government agencies. To supplement the guidance, Rubicon commissioned an independent traditional use study that concluded the Project site is within the traditional territory of the Lac Seul First Nation and Wabauskang First Nation (Forbes, 2011).

An archaeological study of the McFinley Peninsula was commissioned by Rubicon. The study did not identify any sites with a high potential to have cultural heritage value within the development footprint (Ross Associates, 2010). Also, as the Project involved the redevelopment of the existing footprint with only moderate expansion, the potential for impacts to cultural heritage value sites as a result of the redevelopment of the area were considered to be negligible.

Rubicon commissioned an independent conservative risk assessment to quantify the potential risks to valued environmental components identified in Forbes (2011), and to human habitations downstream of Red Lake. The study identified effluent discharge as the sole credible pathway for exposure of the downstream valued environmental components and communities to potential contaminants of concern. The study concluded that the additional, incremental ecological and human health risk that the planned operation of the Project poses to the environment downstream of Red Lake is not significant (Novatox, 2011). Accordingly, Rubicon has not engaged Aboriginal communities with traditional territory downstream of Red Lake regarding potential impacts as a result of the Project.

Rubicon believes in the value of establishing and maintaining meaningful relationships with Aboriginal communities in the Red Lake district, where the Project is located. In January 2010, Rubicon became the first public company in the Red Lake district to sign an Exploration Accommodation Agreement with the Lac Seul First Nation. In 2014, Rubicon signed an Exploration Accommodation Agreement with Wabauskang First Nation, and also settled the judicial review of the closure plan that was launched in 2012. Rubicon has established a successful history of consultation with the local Aboriginal communities and is committed to continued consultation over the life of the Project. Rubicon has set a goal to establish benefits agreements with the two affected Aboriginal communities as the Project moves forward.

Public Consultation

Public information sessions have been held annually in the Red Lake community since 2008. No unresolved negative comments have been received to date during these sessions. Rubicon maintains an open-door policy to proactively identify and address stakeholder concerns regarding the Project. Formal public consultation to date is summarized in Table 24-10.

Table 24-10: Summary of Public Consultation

Date	Summary of Public Consultation Undertaken	Summary of Information Provided	Summary of Comments Received (if any)
Dec. 2008	Public information session in Cochenour, in accordance with Section 140 *Mining Act* and Section 8 *O. Regulation 240/00*.	Overview PowerPoint presentation of the project, including the diesel generator aspect.	No comments received in relation to any aspect of the Project. There was a general discussion regarding the modernization of the *Mining Act*.
Dec. 2009	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of *O. Regulation 240/00*.	Overview PowerPoint presentation of the project, including the diesel generator aspect.	No comments received in relation to any aspect of the Project.
2008 to 2010	Class environmental assessment in accordance with MNR (2003) and Environmental Registry postings.	The Environmental Registry postings include that associated with Air Certificate of Approval 9500-7NGTTC, which included diesel generators.	One comment was received by MNR as part of their Class environmental assessment process in March – Apr. 2010. The comment was positive, in support of the Project.
Sep. 2010 to Mar. 2011	Notice of Commencement of Screening and Notice of Completion, Class environmental assessment process pursuant to *O. Regulation 116/01*.	Publish newspaper article, mail notices to nearby landowners, notify relevant government agencies.	No comments received in relation to the supplemental diesel generators or the Project.
Dec. 2010	Public information session in Red Lake, in accordance with Section 141 *Mining Act* and Section 8 *O. Regulation 240/00*. This session was also held as part of the Class environmental assessment process required pursuant to *O. Regulation 116/01*.	Publish newspaper article, mail notices to nearby landowners, notify relevant government agencies.	No written comments. The sole question posed following the session was to inquire if water sampling would be conducted in East Bay and in the future TMF.
Dec. 2011	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of *O. Regulation 240/00*.	Overview PowerPoint presentation of the project, the potential production phase, road upgrades and the PEA.	No comments received in relation to any aspect of the Project.
Dec. 2012	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of *O. Regulation 240/00*.	Published newspaper notice of meeting. Overview PowerPoint presentation of the Project highlighting infrastructure updates (mill foundation and camp), consultation and anticipated update and optimization of the PEA.	Comments and questions regarding employment opportunities associated with Project.
Dec. 2013	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of *O. Regulation 240/00*.	Published newspaper notice of meeting. Overview PowerPoint presentation of the project, the potential production phase, the updated PEA, schedule for upcoming work and anticipated milestones.	Comments and questions regarding employment opportunities associated with project, economic viability of Project and market conditions.

Date	Summary of Public Consultation Undertaken	Summary of Information Provided	Summary of Comments Received (if any)
Dec. 2014	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of *O. Regulation 240/00*.	Overview PowerPoint presentation of the Project, the potential production phase, schedule for upcoming work and anticipated milestones.	Comments and questions regarding employment opportunities associated with project, mining methods, economic viability of Project.
Dec. 2015	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of O. Regulation 240/00.	Local community outreach prior to the information session. Overview PowerPoint presentation to provide an infrastructure update, suspension of mining activities, initiation of Phoenix Gold Project Implementation Plan.	Comments were received regarding employment and business concerns if the Project does not re-start.
Jan. 2017	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of O. Regulation 240/00.	Overview PowerPoint presentation of the Project, discussed health, safety and environment, CEO vision and strategy, exploration path forward, and proposed development and trial mining.	
Feb. 2018	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of O. Regulation 240/00.	Overview PowerPoint presentation of the Project, discussed test mining and bulk sample plans for 2018 (including move to Mine Development and Production as required by MENDM).	
Feb. 2019	Voluntary Annual Public Information Session. Notice was in general accordance with Section 8 of O. Regulation 240/00.		Questions regarding proceeds of 2018 bulk sample

Rubicon has not received any noise complaints relative to the site operation at its Phoenix Project during 2017 and 2018.

Rubicon maintains an issues-tracking matrix as part of its environmental management system to effectively track and manage potential concerns as they arise.

24.11.6 Tailings Disposal

McFinley Red Lake Mines Ltd. constructed a TMF consistent with contemporary regulatory requirements at the Project site in 1988 in preparation for a bulk-sampling program. The site chosen was an extensive topographic depression lying immediately west of the shaft site, and a retaining dam was constructed to impound tailings and effluent prior to ultimate drainage south into the waters of East Bay. The disposal area received a Certificate of Approval in 1988. The termination of activities on the Project in 1989, after test-milling of an estimated 2,500 tonnes of the bulk sample, resulted in minimal use of this area.

The TMF, and other sewage works, have been reactivated and approved by an ECA issued pursuant to the *Environmental Protection Act*. The TMF has been constructed to Stage 1 design elevation in accordance with an approval issued pursuant to the Ontario *Lakes and Rivers Improvement Act*. Approximately 57,000 tonnes of tailings were deposited in 2015, during mill operation. A further approximate 43,000 tonnes of tailings were added to the TMF in 2018 when the bulk sample was processed.

24.11.7 Environmental Sensitivities

The Phoenix Gold Project site is situated on a peninsula in a valued recreational lake. As such, emphasis has been placed on potential off-site discharges of water and fugitive dust, and noise issues.

24.11.8 Water Discharge

Responsible management of water discharges will be a priority during production and closure. Project features related to mitigating potential risks to local water quality are summarized below.

- An engineered runoff collection system has been constructed around the perimeter of the Project site to effectively collect runoff from the operations area where ore, tailings, and waste rock will be handled. Collected runoff is pumped to the TMF prior to use as process water or treatment and discharge to the environment, in accordance with regulatory requirements. The effluent treatment system, combined with the storage capacity in the TMF, has the ability to contain and manage a robust environmental design flood.
- The effluent treatment system that treats surplus water from the TMF is regarded as best-in-class and has been proven to be effective for the removal of metals and suspended solids at other sites in Canada.
- The TMF has been designed in accordance with appropriate design criteria based on the Hazard Potential Classification that was determined in accordance with MNR 2011 and Canadian Dam Association (CDA) 2007.
- Cyanide will be destroyed in tailings slurry using a proven SO_2/O_2 cyanide destruction process prior to the tailings being discharged from the mill building envelope.
- Ammonia in the TMF water that is present is due to underground water inputs and the hydrolysis of cyanate generated by the SO_2/O_2 cyanide destruction process. Rubicon continues to pursue a viable and permanent ammonia treatment system, and it will be incorporated into the operation prior to the restart of production.
- Ammonia in mine water due to blasting products will be managed by worker education and good housekeeping practices, good blasting practices with regular audits, product selection, biological treatment, and other approved treatment methods. During the 2018 test mining

and bulk sample program, ammonia generation was negligible, due to controls put on the handling of explosives, and the use of non-ammonia-generating explosives.

- Mine water pumped from underground and water reclaimed from the TMF will be recycled for use in the mill to the maximum extent practical to reduce water intake from East Bay.

24.11.9 Fugitive Dust

Air emission sources comprise diesel-fired equipment, emergency diesel generators, propane-fired combustion heating units, return air from the underground workings, and fugitive dust emissions from vehicle operation, tailings, and crushing and material handling typically associated with an underground mining and milling operation. Rubicon has implemented a best-practices management plan for the control of fugitive dust.

Practices to minimize fugitive dust are listed below:

- Minimize vehicle speed and travel time, use dust suppressants on travelled roads, minimize track-out of fines from material handling areas
- Minimize stockpile sizes and use buildings and treelines as windbreaks to the maximum extent practical
- Frequent relocation of the tailings discharge location in order to maintain a wetted tailings surface
- Tackifier and/or binder (cement or fly ash) could be added to deposited tailings to bind together the tailings solids and prevent entrainment by wind
- Enclose material transfer points and use water sprays to suppress dust
- Employ other applicable best practices listed in Ministry of the Environment and Climate Change (2009) and Environment Canada (2009).

24.11.10 Noise

There are seasonal residential interests on East Bay with potential for exposure to noise. Rubicon has designed infrastructure for the Project so that noise emissions from the site are largely controlled in order to protect the residential interests. Modern noise abatement measures have been integrated into the Project design.

24.11.11 Closure Plan

Rubicon has planned and intends to execute the Project in a manner that is consistent with industry best practices and conducive to a walk-away closure condition. Chemical and physical stability requirements will be satisfied and monitored in accordance with regulatory requirements and the amended closure plan, which was filed with the MNDM on June 16, 2016, in accordance with Section 141 of the *Mining Act*.

Close-out rehabilitation activities will be completed within approximately 36 months of Project closure. Major activities are presented below in general chronological order:

- Buildings, trailers, intermodal shipping containers, storage tanks, equipment, and any chemicals or consumables will be removed and salvaged, recycled, or disposed of in accordance with applicable legislation. Concrete foundations will be demolished to grade as necessary and used to backfill local depressions.
- Hydrocarbon-contaminated soil will be identified and remediated in accordance with applicable legislation (*Environmental Protection Act*).
- Equipment in the underground workings will be purged of all operating fluids and salvaged to the maximum extent practicable. Consumables will be removed from the underground workings and salvaged.
- Mine openings will be sealed to prevent access, in accordance with *O. Regulation 240/00*.
- Impounded water within the TMF may be partially treated to reduce metal concentrations, based on consultation with the MECP and the MENDM, and directed to the underground workings. The dewatered tailings surface will be covered with a dry cover and native topsoil from the established stockpiles and revegetated. Downstream embankments will be progressively rehabilitated during the production phase to the extent practical to reduce work that will be required at closure. Post-closure, the spillway channel will be lowered to prevent ponding of runoff water. An engineered overflow channel will be constructed to direct runoff from the surface of the TMF to the downstream toe of the existing dam to effectively return the local drainage pattern to the redevelopment condition. While the dry cover is being constructed, the small volume of residual seepage that is expected to be collected in the runoff collection system will be pumped underground. The operation of the TMF runoff collection system will cease in consultation with the MECP and the MENDM post-closure, once the seepage rate decreases and has been demonstrated to not pose an environmental risk.
- Ancillary areas within the closure plan area that are overlain with development rock will be scarified and any modest embankments sloped for long-term physical stability. These prepared areas will be revegetated after placement of native soil from the established stockpiles on McFinley Peninsula. Accumulations of soil-sized particles in rock embankment crevices will be planted with native tree seedlings in accordance with established silvicultural practices.
- Site roads will be rehabilitated in general accordance with Ministry of Natural Resources (1995). Power lines will be removed.
- Pipelines (water, compressed air) on site will be purged and left in place. Fuel pipelines (propane or natural gas) will be decommissioned as per legislative requirements and TSSA standards, as applicable.

- Domestic sewage disposal system components will be salvaged. The septic tanks will be purged of their contents and backfilled with locally available soil and/or rock.
- Remaining liquid and solid waste at the Project site will be removed for recycling or disposal with licensed contractors, in accordance with legislative requirements. No mineralized material will be left on site at mine closure.
- The long-term chemical and physical stability-monitoring program will be continued to completion, in accordance with the closure plan.

Closure Cost Estimate

Approximately C$7.71 million in financial assurance was previously provided to the MENDM as part of the closure plan, and this was confirmed by an independent professional engineer in January 2016 to be adequate to rehabilitate the current, as-built site.

25 INTERPRETATION AND CONCLUSIONS

25.1 Interpretations

The Phoenix Gold Project is located in the Uchi Subprovince of the Superior Province of the Canadian Precambrian Shield. Within the Uchi Subprovince, the Red Lake Greenstone Belt is host to one of Canada's preeminent gold districts.

The stratigraphy in the East Bay area, where the Phoenix Gold Project is located, comprises submarine tholeiitic basalt, komatiite and komatiitic basalt with minor felsic intrusive volcanic rock, iron formation, and fine-grained clastic metasedimentary rocks, all of which constitute the Balmer Assemblage. Extensive mapping, trenching, core drilling, and geophysical surveys have defined a consistent geological sequence that can be correlated along the length of the property for over 4 km.

The Balmer Assemblage basalt flows are tholeiitic and distinguished from other basaltic sequences in the Red Lake Belt by their relatively high TiO_2 contents (commonly >2 wt.%), and as a result the unit is termed High-Ti Basalt by Rubicon.

The local geology comprises a series of mine grid N-S trending, steeply dipping to sub vertical alternating panels of talc-altered komatiitic ultramafic flows and biotite and silica altered basaltic mafic volcanic flows. Three main panels of High-Ti Basalt are observed namely the F2 Basalt Zone, West Limb Basalt Zone, and the Hanging Wall Basalt Zone; in addition to these three main basalt panels, there are other less continuous or less well-defined panels of basalt located in the deposit area. The volcanic units are intruded by a series of quartz-feldspar porphyry felsic dykes and sills as well as less abundant intermediate and mafic dykes and sills.

Gold mineralization occurs primarily within High-Ti Basalt in the form of mineralized quartz-actinolite veins and occurs in association with disseminated sulphides in the High-Ti Basalt, with lesser mineralization in felsic dykes and sills. A higher-grade second mineralization event occurs in association with disseminated sulphide mineralization in the High-Ti Basalt and also in gold-bearing quartz-actinolite veins in the High-Ti Basalt and Felsic Intrusive units.

Rubicon initiated an advanced exploration program beginning in early 2017. With the 2017 restart of the Phoenix Gold Project, Rubicon undertook an ambitious underground exploration drilling campaign with 28,995 m of NQ oriented core drilled primarily on 244 m Level, 305 m Level, 610 m Level, and 685 m Level. Of the total metres drilled in 2017, approximately 3,500 m was structural core drilling, and this was to provide information to update the structural interpretation of the mineralized zones. The remainder of the metres was used for to provide additional information to update the Mineral Resource which was completed in early 2018.

In 2018, Rubicon continued its underground drilling program. It drilled a total of 20,159 m of NQ oriented core from the 244m Level, the 305 m Level, the 610 m Level, and the 685 m Level (Figure 10-1). This infill drilling is being used to update the current Mineral Resource.

The gold mineralization for the Phoenix Gold Project is enveloped within four zones: Zone 1 to Zone 4. Gold mineralization within the deposit is primarily hosted within the High-Ti Basalt units; however, gold mineralization also occurs within ultramafic units and felsic intrusive rocks.

According to the 2018 interpretation (Golder, 2018a), the primary controls on the gold mineralization are the dextral Riedel vein system of quartz-actinolite veins that occur within the High-Ti Basalt and Felsic Intrusive units. The Riedel vein system demonstrates greater continuity of gold mineralization within the High-Ti Basalt compared with 2016 structural interpretation (Golder, 2018b).

Rubicon identified three main basalt lenses hosting mineralization including, from West-to-East: Hangingwall (HW) Basalt, West Limb Basalt (WLB), and F2 Basalt (F2). These lenses make up most of the mineralization contained within Zone 1 (F2) and Zone 2 (HW, WLB). Zone 3 is a small, narrow zone primarily in felsic intrusive rocks between the F2 and WLB, Zone 1 and Zone 2, respectively. Zone 4 includes an extension of F2 Basalt to the north of the main mineralized area of Zone 1.

Risk factors potentially impacting the reported Mineral Resource Estimate are:

- Revision of geological interpretation impacting rock type and volume
- Possible variation in continuity and grade of gold mineralization, especially with reference to outlier grades
- Assumptions for criteria used to determine reasonable prospect for eventual economic extraction
- Poor ground control may reduce recovery within Ultramafic unit.

25.2 Conclusions

The Mineral Resource Estimate for the Phoenix Gold Project, as prepared by TMAC, is reported in Table 25-1 (Effective March 18, 2019).

Table 25-1: Phoenix Gold Project 2019 Mineral Resource Estimate Reported at 3.0 g/t Au Cut-off Grade

Resource Category	Quantity (t '000s)	Grade (g/t Au)	Contained Gold Ounces
Measured (M)	442	6.99	99,000
Indicated (I)	2,485	6.13	490,000
M+I	2,927	6.26	589,000
Inferred	2,570	6.53	540,000

Notes: Effective date for this Mineral Resource is March 18, 2019
Mineral Resource Estimate uses a break-even economic cut-off grade of 3.0 g/t Au based on assumptions of a gold price of US$1,400/oz, an exchange rate of US$/C$ 0.77, mining cash costs of C$97/t, processing costs of C$24/t, G&A of C$6/t, sustaining capital C$20/t, refining, transport and royalty costs of C$57/oz, and average gold recoverability of 95%
Mineral Resource Estimate reported from within envelopes accounting for mineral continuity
Mineral Resources are not Mineral Reserves and do not demonstrate economic viability
There is no certainty that all or any part of this Mineral Resource will be converted into Mineral Reserve
All figures are rounded to reflect the relative accuracy of the estimates and totals may not add correctly

The Mineral Resource Estimate excludes mineralization within the crown pillar located between the lake bottom and a depth of 40 m below the lake bottom. In addition, all mineralized development is removed from the Mineral Resource Estimate. All resource blocks outside of Rubicon's claim boundaries are removed from the Mineral Resource Estimate.

Mineral resources were classified in accordance with definitions provided by CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014). Mineral resources have an effective date of March 18, 2019. Mineral Resources are not Mineral Reserves and do not necessarily demonstrate economic viability. There is no certainty that all or any part of this Mineral Resource will be converted into mineral reserve.

26 RECOMMENDATIONS

26.1 Mineral Resource

TMAC believes that Rubicon can potentially improve or increase the 2019 Mineral Resource Estimate with the following recommendations:

- Target infill and step-out drilling in areas containing Inferred Resources (about 40 m centres drill spacing) to upgrade resource classification and Exploration Targets (>80 m centres) to convert to Mineral Resources. Drilling is proposed from the 244 m Level, 610 m Level and 685 m Level. The Exploration Targets could potentially contain between 0.9 Mt to 1.2 Mt with potential grades between 5.0 to 7.0 g/t Au[4].
- Evaluate McFinley Deposit and Close Proximity Targets (specifically PEN Zone) which could potentially be included in a future Mineral Resource Estimate.

Table 26-1 summarizes a proposed exploration budget of $2.46 million for the F2 Gold Zone.

Table 26-1: 2019 Exploration Budget – F2 Gold Zone

Items	Levels	Metres	Units	Cost/Unit (C$)	Total Cost (C$ '000s)	Grand Total (C$ '000s)
Drilling	244 m Level	825	-	90	74	
	610 m Level	12,475	-	90	1,123	
	685 m Level	7,830	-	90	705	1,902
Assaying	244 m Level	-	413	40	17	
	610 m Level	-	6,238	40	250	
	685 m Level	-	3,915	40	157	423
Consumables	244 m Level	-	-	-	5	
	610 m Level	-	-	-	80	
	685 m Level	-	-	-	50	136
						2,460

Note: All figures are rounded to reflect the relative accuracy of the cost estimate and totals may not add correctly

4 According to NI 43-101 Section (2)(a), the potential quantity and grade of the Exploration Target is conceptual in nature and there has been insufficient exploration to define a mineral resource. It is uncertain if further exploration will result in the Exploration Target material being delineated as a mineral resource. The Exploration Target has been defined based on blocks estimated using >80 m drill centres, lower confidence based on decreased data density and increased cut-off grade with depth.

The budget of C$451,000 for the McFinley Deposit and the PEN Zone is included in Table 26-2.

Table 26-2: 2019 Exploration Budget – McFinley Deposit and PEN Zone

Items	Levels	Metres	Units	Cost/Unit (C$)	Total Cost (C$ '000s)	Grand Total (C$ '000s)
Drilling	685 m Level (McFinley)	1,170	-	90	105	
	244 m Level (PEN Zone)	2,700	-	90	243	348
Assaying	685 m Level (McFinley) 685 m Level	-	585	40	23	
	244 m Level (PEN Zone)	-	1,350	40	54	77
Consumables	685 m Level (McFinley)	-	-	-	8	
	244 m Level (PEN Zone)	-	-	-	17	25
					-	**451**

Note: All figures are rounded to reflect the relative accuracy of the cost estimate and totals may not add correctly

26.2 Operations

The extension of the exploration drift 200 m southward on the 610 m Level (parallel to the F2 Gold Zone) to provide additional drilling platforms for step-out drilling. Table 26-3 shows the potential cost of C$1.1 million for this underground development.

Table 26-3: 2019 Operations Budget

Items	Levels	Metres	Units	Cost/Unit (C$)	Total Cost (C$ '000s)	Grand Total (C$ '000s)
Development	610 m Level	200	-	5,500	1,100	1,100

Note: All figures are rounded to reflect the relative accuracy of the cost estimate and totals may not add correctly

27 REFERENCES

AMC Mining Consultants (Canada), 2009. Phoenix Gold Project – Provisional Ground Support Standards; Internal Report for Rubicon Minerals Corporation, 13 pages.

AMC Mining Consultants (Canada), 2011. F2 gold deposit - Phoenix Gold Project. Bateman Township. Red Lake, Canada. Technical report prepared for Rubicon Minerals Corporation. August 8, 2011. Available at www.sedar.com.

AMC Mining Consultants (Canada), 2013. 712022 Rubicon Phoenix PEA Optimization: Preliminary Stope Stability Assessment. Internal report prepared for Rubicon Minerals Corporation.

AMC Mining Consultants (Canada), 2014. Rubicon Crown Pillar Assessment, 10 December 2014. Internal report prepared for Rubicon Minerals Corporation.

Andrews, A.J., Hugon, H., Durocher, M., Corfu, F., and Lavigne, M., 1986. The anatomy of a gold-bearing greenstone belt: Red Lake, North-Western Ontario; Proceedings of GOLD '86, An International Symposium on the Geology of Gold, (ed.) A.J. Macdonald, Konsult International Inc., Toronto, Ontario, p. 3-22.

Card, K.D. and Poulsen, K.H., 1988. Geology and mineral deposits of the Superior Province of the Canadian Shield. In: Geology of the Precambrian Superior and Grenville Provinces and Precambrian Fossils in North America. Geological Survey of Canada; Geology of Canada, Number 7, pages 15-232.

Dubé, B., Balmer, W., Sanborn-Barrie, M., Skulski, T., and Parker, J., 2000. A preliminary report on amphibolite-facies, disseminated-replacement style preliminary report on amphibolite-facies mineralization at the Madsen gold mine, Red Lake, Ontario. Geological Survey of Canada, Current Research 2000-C17, 12p.

Dubé, B., Williamson, K., and Malo, M., 2001. Preliminary report on the geology and controlling parameters of the Goldcorp Inc. High Grade Zone, Red Lake mine, Ontario. Geological Survey of Canada, Current Research 2001-C18, 13p.

Dubé, B., Williamson, K., and Malo, M., 2003. Gold mineralization within the Red Lake mine trend: example from the Cochenour-Willans mine area, Red Lake, Ontario, with new key information from the Red Lake mine and potential analogy with the Timmins camp; Geological Survey of Canada, Current Research 2003-C21, 15p.

Dubé, B., Williamson, K., McNicoll, V., Malo, M., Skulski, T., Twomey, T., and Sanborn-Barrie, M., 2004. Timing of Gold Mineralization at Red Lake, Northwestern Ontario, Canada: New

Constraints from UPb Geochronology at the Goldcorp High-Grade Zone, Red Lake Mine, and the Madsen Mine. Economic Geology. 99. 1611-1641. 10.2113/99.8.1611.

Forbes and Associates, 2011. A Desktop Review of Traditional Land Use (TLU) For the Red Lake Area with Specific Interest to the Phoenix Gold Project Location. Internal report prepared for Rubicon Minerals Corporation.

GeoEx Limited, 2011a. Mineral Resource and Geological Potential Estimates, F2 gold system – Phoenix Gold Project. Technical Report prepared for Rubicon by George, P.T., dated: January 11, 2011. Available at www.sedar.com.

GeoEx Limited, 2011b. Mineral Resource and Geological Potential Estimates, F2 gold system – Phoenix Gold Project. Technical Report prepared for Rubicon by George, P.T., dated: 11 April 2011. Available at www.sedar.com.

Golder Associates Ltd. (DeWolfe, J, 2017): Phoenix Gold Project – Supplemental Core Logging Protocol; Report Number: 1671445-008-R [In-house draft report, March 2017.]

Golder Associates Ltd., 2017. Phoenix Gold Project: 2017 Updated Structural Geology Report. Report No. 1671445-008-R-Rev0, Dated February 9, 2018. 44 p.

Golder Associates Ltd., 2018a. Phoenix Gold Project: 2017 Updated Structural Geology Report, Report Number: 1671445-008-R-Rev0, Dated: February 8, 2018, 387 p.

Golder Associates Ltd., 2018b. National Instrument 43-101 Technical Report for the Rubicon Phoenix Gold Project. Golder Project No. 1671445-Rev B. June 13, 2018. 206 pages.

Golder Associates Ltd., 2019. Phoenix Gold Project Bulk Sample Gold Reconciliation. Golder Project No. 18105476. Dated: January 7, 2019.

Groves, D. I., Goldfarb, R. J., Gebre-Mariam, M., Hagemann, S. G., Robert, F., 1998. Orogenic gold deposits: A proposed classification in the context of their crustal distribution and relationship to other gold deposit types; Ore Geology Reviews, V. 13, p. 7-27.

G&T Metallurgical Services, 2010. Preliminary Evaluation of the Phoenix Project, Report KM2550, July 2010.

G&T Metallurgical Services, 2011. Bulk Sample Grade Assessment – Phoenix Gold Project, Report KM2814, October 2011.

G&T Metallurgical Services, 2012. Analysis of Gold from Bulk Samples – Phoenix Gold Project, Report KM3264, March 2012.

Harris, J.R., Sanborn-Barrie, M., Panagapko, D.A., Skulski, T., and Parker, J.R., 2006. Gold prospectivity maps of the Red Lake greenstone belt: application of GIS technology. Canadian Journal of Earth Sciences, Volume 43, pages 865-893.

Hogg, G.M., & Associates Ltd., 1983. A report on the McFinley Red Lake Gold Property of Sabina Industries Ltd. and McFinley Mines Ltd., Bateman TWP., Ontario.

Hogg, G.M., 2002a. Technical Report on the McFinley Gold Project of Rubicon Minerals Corporation, Red Lake, Ontario. 17 May 2002. Internal report prepared for Rubicon Minerals Corporation.

Hogg, G. M., 2002b. Technical Report on the McFinley Mine Property of Rubicon Minerals Corporation, Red Lake, Ontario. 15 October 2002. Internal report prepared for Rubicon Minerals Corporation.

Hogg, G.M. & Associates, 2003: Exploration Activities of Rubicon Minerals Corporation on the McFinley Property, Red Lake, Ontario by D.M. Rigg and G.M. Hogg, Dated May 12, 2003; 71 p.

JKTech Pty, 2011. JKDW Test Report on Two Samples from Rubicon Phoenix Project, JKTech Job No. 11017/P4, March 2011.

Journel, A.G. and Huijbregts, C. J, 1978. Mining Geostatistics, Academic Press.

NovaTox, 2011A. Risk Assessment for the Phoenix Advanced Exploration Project. Prepared for Rubicon Minerals Corporation. NovaTox Project 10846.

NovaTox, 2011B. Assessment of Risk to Humans and the Environment from Phoenix Project Effluent. Internal report prepared for Rubicon Minerals Corporation.

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release-Data 126-Revision 1.

Parrott, D.F., 1995. The Gold Mines of Red Lake, Ontario, Canada. Derksen Printers, Steinbach, Manitoba, 256 p.

Pirie, J., 1981. Regional geological setting of gold deposits in the Red Lake area, northwestern Ontario. Miscellaneous Paper. Ontario Ministry of Northern Development and Mines, Ontario Geological Survey.

Ross Archaeological Research Associates (Ross Associates), 2010. Stage 1 Archaeological Assessment and Property Inspection, Rubicon Minerals Phoenix Mine Property. Internal report prepared for Rubicon Minerals Corporation.

Sanborn-Barrie, M., Skulski, T., and Parker, J., 2004. Geology, Red Lake Greenstone Belt, western Superior Province, Ontario. Geological Survey of Canada, Open File 4594.

Smee and Associates Consulting Ltd., 2009a. Results of a Quality Control Data Review, Phoenix Project, Red Lake, Ontario. Internal report prepared for Rubicon Minerals Corporation.

Smee and Associates Consulting Ltd., 2009b. Results of an Audit of the SGS Laboratory, Red Lake, Ontario. Internal report prepared for Rubicon Minerals Corporation.

Smee and Associates Consulting Ltd., 2011: Results of an Audit of the SGS Laboratory, Red Lake, Ontario. Internal report prepared for Rubicon Minerals Corporation in October 2011.

Soutex Inc., 2013. Phoenix Gold Scoping Study, Bulk Sample Processing. Phoenix Gold Scoping Study (draft version), Project 2220; internal report prepared for Rubicon Minerals Corporation, July 11, 2013. 181 p.

SRK, 2012. Interim Report on 3D Structural, Lithological and Alteration Modelling of the F2 Core Zone, Red Lake, Ontario, prepared by SRK Consulting (Canada) Inc. (SRK) in December 2012

SRK, 2013a. Preliminary Geotechnical Assessment of the Phoenix Gold Project. Report prepared for Rubicon Minerals Corporation, July 2013.

SRK, 2013b. Preliminary Economic Assessment for the F2 gold deposit, Phoenix Gold Project, Red Lake, Ontario; Report (amended and restated) Prepared for Rubicon Minerals Corporation, Effective date: June 25, 2013, Issue date: August 9, 2013. Amended and Restated: February 28, 2014. 263 p. Available at www.sedar.com.

SRK, 2016. Technical Report for the Phoenix Gold Project, Red Lake, Ontario; Report for Rubicon Minerals Corporation, Effective date: January 11, 2016, Issue date: February 25, 2016. 221 p. Available at www.sedar.com.

Vancouver Petrographics Ltd., 2008. Petrographic Report on Samples: CRL Series: 16511, 16516, 14735, 20340, 15422, 9324 (3 sections), 19137, 19156. 19145 (2 sections), 19331 (3 sections); Internal report prepared for Rubicon Minerals Corporation. 48 p.

Internet References

Data products, 2016 Census. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/index-eng.cfm

Ontario Ministry of Northern Development and Mines (OMNDM), 2013. MDI File MDI52N04SE00005 report.
http://www.geologyontario.mndm.gov.on.ca/dtSearch/dtisapi6.dll?cmd=getdoc&DocId=497596&Index=%2a%7baa6fcec0bc49cb0cca8bfcb488289a8a%7d%20MDI&HitCount=3&hits=5+17+c13+&SearchForm=%2findex%2ehtml.

28 CERTIFICATE OF AUTHORS

28.1 Tim Maunula, P.Geo.

I, Tim Maunula, P.Geo., of Chatham, Ontario, a Qualified Person (QP) of this Technical Report titled "National Instrument 43-101 Technical Report for the Phoenix Gold Project, Cochenour, Ontario," dated April 18, 2018 (this Technical Report), do hereby certify the following statements:

I am Principal Geologist of T. Maunula & Associates Consulting Inc., 15 Valencia Drive, Chatham, Ontario, N7L 0A9, Canada.

I graduated with a H.B.Sc. degree in Geology from Lakehead University in 1979. In addition, I obtained a Citation in Geostatistics from the University of Alberta in 2004.

I am a member of the Association of Professional Geoscientists of Ontario (Registration Number 1115).

I have worked as a Geologist for a total of 40 years since my graduation from university. I have resource estimation experience in gold, base metals, industrial minerals and diamonds throughout Canada and internationally.

I have read the definition of QP set out in NI 43-101 and certify that by reason of education, affiliation with a professional association, and past relevant work experience, I fulfill the requirements to be a QP for the purposes of NI 43-101.

I am responsible for 1.1 to 1.4, 1.6, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 23, 25, 26.1, and 27 of this Technical Report.

I have visited the Property between 2017 and 2019 with the most recent on February 18, 2019.

I have prior involvement as the author of portions of the 2018 National Instrument 43-101 Technical Report for the Rubicon Phoenix Gold Project, prepared by Golder Associates Ltd.

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

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

I have read National Instrument 43-101 and Form 43-101F1, and this Technical Report has been prepared in compliance with that instrument and form.

I consent to the filing of this Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of this Technical Report.

Dated this 23rd day of April 2019 in Chatham, Ontario.

"Original Signed and Sealed"

Tim Maunula, P.Geo.

28.2 John Frostiak, P.Eng.

I, John William Frostiak, P.Eng., of Balmertown, Ontario, a Qualified Person (QP) of this Technical Report titled "National Instrument 43-101 Technical Report for the Phoenix Gold Project, Cochenour, Ontario," dated April 18, 2019 (this Technical Report), do hereby certify the following statements:

I am an Independent Mining Engineer (mineral processing) Consultant with an address at 56 McManus St., Balmertown, Ontario, Canada, POV 1CO.

I am a "Qualified Person" for the purposes of National Instrument 43-101 (the "Instrument"). My qualifications as a qualified person are as follows: I am a graduate of Queen's University (Kingston, Ontario) with a Bachelor of Science in Mining Engineering (Mineral Processing) in 1973. I am a member of the Professional Engineers Ontario (PEO No. 15150014), the Ontario Society of Professional Engineers (OSPE No. 11389251), the Society for Mining, Metallurgy & Exploration (SME Member ID 4019986), and a life member of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM No. 92165). I have worked as an engineer for a total of 40 years since graduating from university. During that time, I gained operational, management and project and study management experience in Canada, the USA, Australia, Chile, Peru, Tanzania, and South Africa.

I have been to the Phoenix project site and visited the mill and tailing management facility on numerous occasions. My last visit to the mill specifically was on September 7, 2018.

I am responsible for Sections 1.5, 13, 17, 24.8, and 24.9 of this Technical Report.

I am independent of the issuer as described in Section 1.5 of the instrument.

My prior involvement with the property that is the subject of the Technical Report is as follows: In October 2015, I was retained by Rubicon Minerals Corporation to assist in the preparation of the report entitled "Technical Report for the Phoenix Gold Project, Red Lake, Ontario" dated February 25, 2016. In 2018 April 2018, I was retained by Rubicon Minerals Corporation to assist in the preparation of the report titled "National Instrument 43-101 Technical Report for the Rubicon Phoenix Project" with an effective date of: June 11, 2018.

I have read the instrument. The parts of the Technical Report for which I am responsible have been prepared in compliance with this Instrument.

At the effective date of the Technical Report, to the best of my knowledge, information, and belief, the parts of Technical Report for which I am responsible, contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Balmertown, Ontario this 23rd day of April 2019.

"Original Signed and Sealed"

John William Frostiak, P.Eng.

28.3 Michael Willett, P.Eng.

I, Michael Willet, P.Eng., of Toronto, Ontario, a Qualified Person (QP) of this Technical Report titled "National Instrument 43-101 Technical Report for the Phoenix Gold Project, Cochenour, Ontario," dated April 18, 2019 (this Technical Report), do hereby certify the following statements:

I am the Director of Projects of Rubicon Minerals Corporation, 121 King Street West, Suite 830, Toronto, Ontario, Canada, M5H 3T9.

I am a "qualified person" for the purposes of National Instrument 43-101 (the "Instrument"). My qualifications as a qualified person are as follows: I am a graduate of Queen's University (Kingston, Ontario) with a Bachelor of Science (Mining Engineering) in 1981. I am a professional mining engineer and am registered in the Province of Ontario with the Professional Engineers Ontario as a P.Eng. (Licence number 100511340). I have worked as a Mining Engineer for a total of 38 years since my graduation.

I have been at the Phoenix Project site since January 2017. I am currently located there.

I am responsible for Sections 1.7,15, 16, 18, 19, 20, 21, 22, 24.1, 24.2, 24.3, 24.4, 24.5, 24.6, 24.7, 24.10, 24.11, and 26.2 of this Technical Report.

I am not independent of the issuer as described in Section 1.5 of the Instrument.

I have been directly involved with the Phoenix Project since January 2017.

I have read the Instrument. The parts of the Technical Report for which I am responsible has been prepared in compliance with this Instrument.

At the effective date of the Technical Report, to the best of my knowledge, information, and belief, the parts of Technical Report for which I am responsible, contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Cochenour, Ontario this 23rd day of April 2019.

"Original Signed and Sealed"

Michael Willett, P.Eng.
Director of Projects, Rubicon Minerals Corporation