NI 43-101 TECHNICAL REPORT:

Preliminary Economic Assessment
Rodeo Project
Rodeo, Durango, Mexico

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1 SUMMARY

This Preliminary Economic Assessment report on the Rodeo Project has been developed for Golden Minerals Company. The property is currently held by Minera de Cordilleras S.A. de C.V., a wholly owned subsidiary of Golden Minerals Company. This report is dependent on the estimation of mineral resources completed by Tetra Tech for the Rodeo Property in March of 2017.

1.1 LOCATION, PROPERTY DESCRIPTION AND OWNERSHIP

The figures enclosed in this report are based on NAD27 (North American Datum of 1983) unless otherwise noted.

The Rodeo Project is located 2 km east of the town of Rodeo in Durango State, Mexico, ***Figure 1-1*** *(Blanchflower, 2010). Basic amenities are available in the town of Rodeo. Large regional cities with full services are located within driving distance of the project; Torreon is located 189 km to the east, and Durango 157 km to the south. The center of the Rodeo deposit can be located using the following coordinate: latitude 25°9'2.7"N, longitude 105°31,4.2"W (WGS84). (Elson, 2017).*

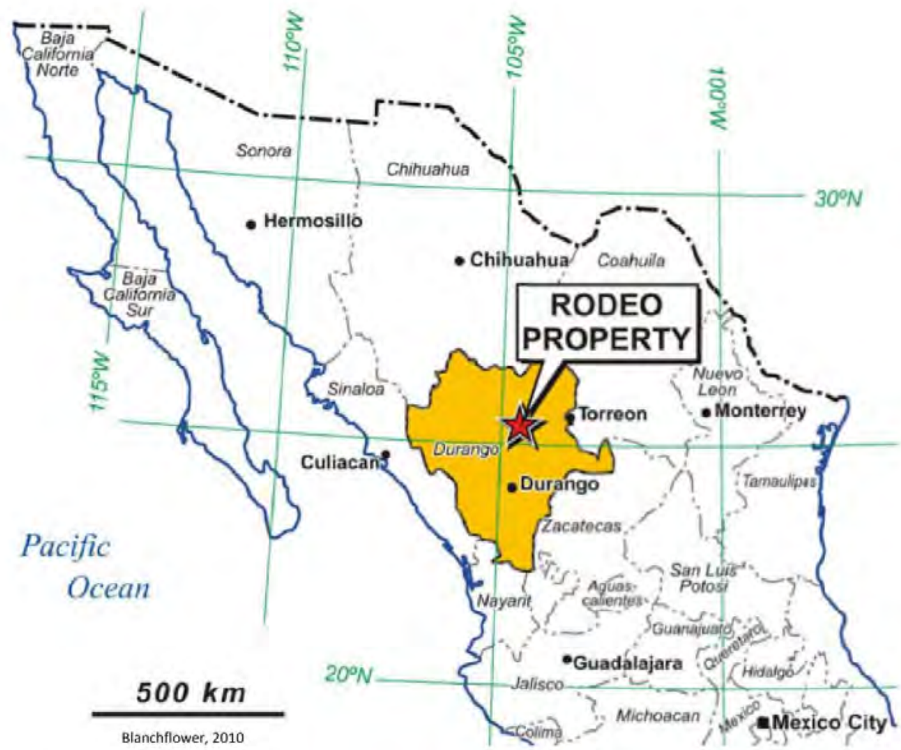


FIGURE 1-1: LOCATION MAP

The property contains two mineral concessions totaling 1,865.7 hectares under purchase agreement with La Cuesta International, S.A. de C.V. a wholly owned subsidiary of La Cuesta International Inc. (Elson 2017)

1.2 GEOLOGY AND MINERALIZATION

The following description of the deposit geology is from a 1997 non-public report for the Rodeo concession by Hillemeyer and Durning for La Cuesta.

At the Rodeo prospect, the "Rodeo" fault system consists of 3 major parallel shear zones and wall-rock fracture systems that are the principal feeder conduits for a high-level, Au-Ag epithermal mineral system. These major vein-filled structures appear to be feeder conduits responsible for the 1 km. X 4 km. area of silicified, clay altered and gold anomalous rocks forming resistant NNW-trending ridges at the Rodeo Prospect. All three of the structures are wide, laterally persistent, well-developed feeder vein swarms with high-level, locally banded agate to chalcedonic quartz veins, stockworks and silicified breccias. In the area of principal interest, the structures are strongly veined, silicified, brecciated, and mineralized for over 4 kilometers, and the shear zones and hydrothermal system can be traced for 8 kilometers on the property. Individual feeder vein and breccia systems are up to 60 meters thick. Flexures in the vein swarms and/or structural intersections provide brecciation and open conduits for intense, episodic fluid flow and silica deposition with the potential for ore-grade concentrations of precious metals, especially gold.

The immediate Rodeo deposit area is approximately 300 m along strike and 200 m wide and extends to a depth of 200 m below surface. The deposit strikes at 330° and dips to the ENE with various vein phases dipping from sub-vertical to 30°. The deposit is entirely hosted within Tertiary Rodeo volcanics that are strongly silicified and brecciated. The deposit is bound to the East by the Rodeo fault, however drilling to date has not demonstrated that the deposit reaches or is truncated by the fault. Along strike to the north and south, the mineralization is offset slightly by near vertical faulting; mineralization does not terminate at these faults but the intensity of the trend is either diminished or has yet to be located. Figure 1-2 shows the surface geology of the deposit area as well as where the majority of the drilling has been concentrated.

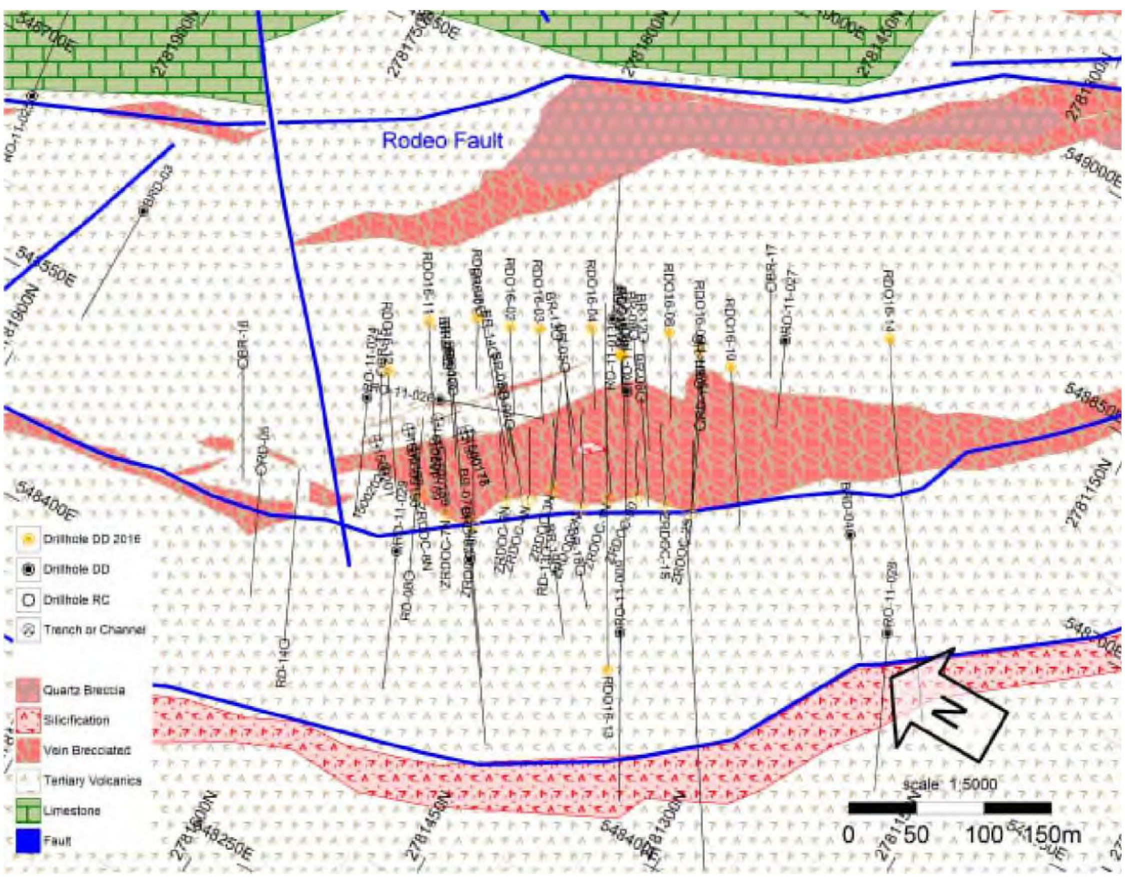


FIGURE 1-2: DEPOSIT SURFACE GEOLOGY

1.3 EXPLORATION, DRILLING, SAMPLING & QA/QC

The following section of the Exploration, Drilling, Sampling & QA/QC is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

1.3.1 EXPLORATION

Exploration activities conducted by Minera Cordilleras consist of:

- *Surface geologic mapping of the property and immediate deposit area;*
- *Creation of a topographic surface through point surveying; and*
- *Trench sampling.*

Activities conducted by previous operators include:

- *Surface geologic mapping of the property at 1:25,000 scale and immediate deposit area;*
- *Alteration intensity mapping;*
- *Airborne magnetic and radiometric survey, 1,519 line-kilometers in 2010 and 2011 (raw data has not been located or provided to the author);*
- *Induced polarization geophysical surveying, 42 line-kilometer in 2010 and 2011 (raw data has not been located or provided to the author);*
- *Large scale magnetic surveys are available from GSM;*
- *Using Landsat false color imagery to look for alteration signatures;*
- *Spectral analysis to determine alteration types; and*
- *The collections of approximately 1,800 rock and soil samples throughout the area.*

1.3.2 DRILLING

The project database contains 84 drill holes, totaling 13,964 m, drilled from 1995 to 2016. Of the total, 9,287 m were drilled using diamond equipment and 4,677 m with RC equipment. ***Table 1-1*** *summarizes the project drilling by company, year, and equipment type.*

TABLE 1-1: PROJECT DRILLING BY COMPANY AND TYPE

Company	Year	Type	Length (m)
Monarch Resources	1995	RC	2,289
Canplats Resources Corp.	2004	RC	2,387
Canplats Resources Corp.	2004	DD	78
Canplats Resources Corp.	2007	DD	1,034
Camino Minerals Corp.	2011	DD	6,090
Minera Cordilleras	**2016**	**DD**	**2,084**
Total			**13,964**

1.3.3 SAMPLING

The property has experienced exploration and sampling by several companies and several campaigns. Descriptions of the activities from previous explorers are available in reports by Pryor and Blackwell, McNaughton, Durning and Hillemeyer, and Blanchflower. Table 1-2 summarizes the various sampling activities from 1995 to present.

TABLE 1-2: PROJECT SAMPLING CAMPAIGNS

Company	Year	Type	No. of Samples	Analytical Lab	Au Procedure	ICP Procedure	QA/QC	Comment
La Cuesta\ Monarch	1995	Rock	~1,400	Bondar Clegg	Unknown	Unknown	Unknown	Sub-crop sampling on 200 by 25 grid
Monarch	1995	RC	1,076	Bondar Clegg	Unknown	Aqua Regia?	Mentioned, no records available	Half split of 2 m intervals at the rig further reduced to 5 kg
Canplats	2003	Rock	422	Bondar Clegg	Unknown	Unknown	Unknown	2 km along Rodeo fault
Canplats	2004	RC	2,161	Chemex	Au-AA23, Au-GRA21,	ME-ICP61, four acid	5% duplication, no records available	Two eighth splits of 1 m interval using 10 ft rods
Canplats	2004	Pulp Au Screen	189	Chemex	Au-SCR21	NA	NA	Testing of BR series drill holes pulps
Canplats	2007	Core	437	Chemex	Au-AA23, Au-GRA21	ME-ICP61, four acid	"Standard practice" no records available	Half splits of HQ and NQ core
Camino	2011	Core	1,886	ALS Chemex	Unknown	ME-ICP41, Aqua Regia	Unknown	2010 Technical Report pre-dates drilling
Minera Cordilleras	2015	Trench	178	ALS Chemex	Au-AA24, Au-GRA22	ME-ICP41, Aqua Regia	See Text	1 inch wide channel cut with saw chipped with hammer
Minera Cordilleras	2016	Core	1,756	ALS Chemex	Au-AA24, Au-GRA22	ME-ICP61, four acid	See Text	Half splits of HQ and NQ core
Minera Cordilleras	2016	Pulp Duplicate	94	ALS Chemex	Au-AA24, Au-GRA22	ME-ICP61, four acid	NA	Duplicate testing of BR series drill hole pulps

1.3.4 QA/QC

Minera Cordilleras' quality assurance (QA) measures involve the use of standard practice procedures for sample collection for both drill core and channel sampling as described above, and include oversight by experienced geologic staff during data collection. Quality control (QC) measures implemented by Minera Cordilleras include in-stream sample submittal of standard reference material, blank material and duplicate sampling.

1.4 MINERAL RESOURCES ESTIMATE

The following section of Mineral Resource Estimation is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

Resources have been estimated for the Rodeo deposit using a block model rotated to fit the deposit strike. Sub-blocking was used within the single high-grade domain only. Au and Ag grades have been estimated using Ordinary Kriging on parent blocks independently within and also outside of wireframe constrained domains. Reporting of estimated blocks has been constrained by a base case pit optimization using costs unique to mining followed by road trucking and processing at Golden Minerals' Velardeña cyanidation plant (Plant #2). An alternative standalone case using indicative heap leach processing costs is also shown to represent on site heap leach processing option.

Although the mineral resources are pit constrained using reasonable cost assumptions, detailed costing and economic evaluations have not been performed. The pit optimizations include resources that do not have demonstrated economic value and include inferred resources that are too speculative for definition of reserves.

*Estimated indicated mineral resource within the base case pit constraint is shown in **Table 1-3**. Estimated indicated and inferred mineral resources within the alternative case pit constraint is shown in **Table 1-4**. Preliminary metallurgy suggests the Rodeo material may be amenable to cyanidation; differentiations between oxide and sulfide material has not been made*.

TABLE 1-3: MINERAL RESOURCE ESTIMATE BASE CASE (MILL PROCESSING PIT CONSTRAINED)

Classification	Cutoff AuEq g/t	Tonnes (M)	Au g/t	Ag g/t	Au toz (1000)	Ag toz (M)	Waste: Resource
Indicated	0.83	0.4	3.3	11	46	0.2	0.91
Inferred	-	-	-	-	-	-	-

Notes:

(1) Cutoff grade and Au equivalent calculated using metal prices of $1,220 and $17 per troy ounce of Au and Ag, recoveries of 77% and 90% Au and Ag;

(2) Mineral Resources have been pit shell constrained using the Lerch Grossman algorithm with inputs of $7.5 mining, $10 trucking, and $20 processing costs per Tonne. A breakeven cutoff including trucking and processing costs per block was applied to a block model within the optimized shell;

(3) Metal prices do not exceed three-year trailing average as of the end of December 2016, per SEC guidance; and

(4) Reported indicated mineral resources are equivalent to mineralized material under SEC Industry Guide 7; and

(5) Columns may not total due to rounding.

1.5 EXTRACTABLE RESOURCE

The extraction plan for the Rodeo Project resource contains three categories of material:

- **ROM** – Run of Mine mineralized material, which will be excavated, shipped to, and processed at Golden Minerals' agitated leach plant located in Velardeña, Durango.
- **Low Grade** – Material that does not qualify for shipment to the plant in Velardeña with the current operating plan; the material does have enough gold and silver grade to potentially pay for shipping and processing sometime in the future.
- **Waste** – Material that will most likely never be economical for shipping to the plant in Velardeña.

The distribution of waste and ROM material for each bench was manually determined by outlining the areas of ROM material and waste material on each bench. The tonnes and grade for each bench were then determined by importing the manually drawn wireframes into standard mining software so that the Tetra Tech block model would populate the imported wireframes; this method assured that the values of the Tetra Tech block model were used as a basis for the mine planning. **Table 1-4** summarizes the mineralized material from the block model which is extractable in the current mine plan.

TABLE 1-4: BLOCK MODEL TONNES AND GRADE

ROM Tonnes	Grade Au (gpt)	Grade Ag (gpt)	Waste Tonnes
343,125	3.59	10.44	635,246

It is not common to run a dilution routine on an open pit resource that has been generated from Kriging. However, the proposed Rodeo open pit warrants the addition of a dilution routine because more than 10 percent of the ROM tonnes are derived from blocks that are adjacent to blocks below the cutoff grade. Because of the high percentage of ROM blocks adjacent to below cutoff grade blocks, substantial dilution will occur. The dilution is calculated as a percentage of sub cutoff grade material added to the ROM material generated from the block model. **Table 1-5** outlines the final diluted resource.

TABLE 1-5: DILUTED RESOURCE TONNES AND GRADE

ROM Tonnes	Grade Au (gpt)	Grade Ag (gpt)	Waste Tonnes
381,247	3.31	9.65	635,246

In summary, the dilution accounts for an 11.1 percent increase in the ROM tonnage, a 7.7 percent decrease in the gold grade of the ROM, and a project stripping ratio of 1.7:1waste to ROM.

The bench quantities were gained by manually developing wireframes that outlined the ROM and waste material for each of the proposed 11 benches. **Table 1-6** summarizes the tonnes and grades associated with the 11 benches planned for the Rodeo Project.

TABLE 1-6: FINAL TONNES AND GRADE BY BENCH

Designated Bench	ROM Tonnes	Grade Au (gpt)	Grade Ag (gpt)	Waste Tonnes
1425 Level	14,598	2.66	9.49	0
1430 Level	59,760	3.52	11.27	2,874
1435 Level	61,506	3.46	11.37	28,401
1440 Level	62,222	4.10	11.40	65,723
1445 Level	53,202	3.92	11.59	110,020
1450 Level	55,388	2.84	7.40	109,198
1455 Level	37,650	2.71	7.33	97,771
1460 Level	22,726	2.19	4.42	82,403
1465 Level	14,196	2.04	3.85	64,756
1470 Level	0	0.00	0.00	46,540
1475 Level	0	0.00	0.00	27,561
Totals	**381,247**	**3.31**	**9.65**	**635,246**

1.6 MINING, PROCESSING, AND INFRASTRUCTURE

1.6.1 MINING

The strategy for mining the resource is to initially access the higher-grade areas down slope and to complete the excavation of the entire resource with three phases (pushbacks). The mining of the first pushback will commence at the 1450 Bench working upwards to the 1470 Bench and downwards to the 1440 Bench simultaneously. Starting at the 1450 Bench will enable the operation to quickly access the better gold grades that exist in the 1445 and 1440 Benches.

The Rodeo Project mine plan depends on delivering high grade material to Golden Minerals' oxide plant in Velardeña. A diligent ore control program will be required to ensure that the mining delivers the estimated ROM material grade to the processing plant. An ongoing reconciliation program is essential to the planning department's success in being able to continually plan the extraction of the resource and achieve the desired results.

Golden Minerals' Velardeña agitated leach processing plant has a capacity of 168,000 TPY (350 operating days per year), and the mining of the Rodeo resource is estimated to utilize 100% of the plant's capacity. The Rodeo surface mine will be excavated and transported by utilizing contractors: a civil or mining contractor will be used for the extraction of the mine material, and the Confederation of Mexican Workers (Confederacion de Trabajadores de Mexico (CTM)) will supply trucks used for the transportation of material away from the mine.

1.6.2 PROCESSING

Golden Minerals' Plant II is in Velardeña, Durango, approximately 115 km from the Rodeo Project. Plant II has a design capacity of 550-tpd of oxide mineral. The plant is a typical agitated leach processing facility with 72 hours of retention time in the agitation circuit. The refinery has sufficient capacity to accommodate Rodeo's required doré production.

The high-grade sample described in Section 13.1, RDi's Metallurgical Testing, had a Bond's Ball Mill Work Index of 25.3-kwh/st. The high Work Index could result in marginal ball mill performance if the ball mill feed is not appropriately sized. The ball mill motor has more than 25 percent excess capacity to meet the required grinding demand however the size of the ball mill and the capacity of the cyclone cluster may present constraints on mill throughput due to the possible large circulating load that may be present because of the material's elevated Work Index. Additional Work Index determinations on representative ROM are recommended to establish the average and actual range of expected Work Index values However to accommodate the existing Work Index determination two solutions to increase the ball mill efficiency have been included in the planning and analysis should there be a problem with the grinding circuit attaining a steady 480-tpd production rate.

A gold extraction of 83.8% and silver extraction of 76.3% have been used for the design basis of this PEA. These recovery values are based on achieving an overall grind of P_{80} 150 mesh (80% passing 150 mesh).

1.6.3 INFRASTRUCTURE

Figure 1-3 displays the existing access road (and upgrading of this road). The existing access road is 2.8 km in length and the plan is to upgrade the existing road to a 7-meter wide graded road.

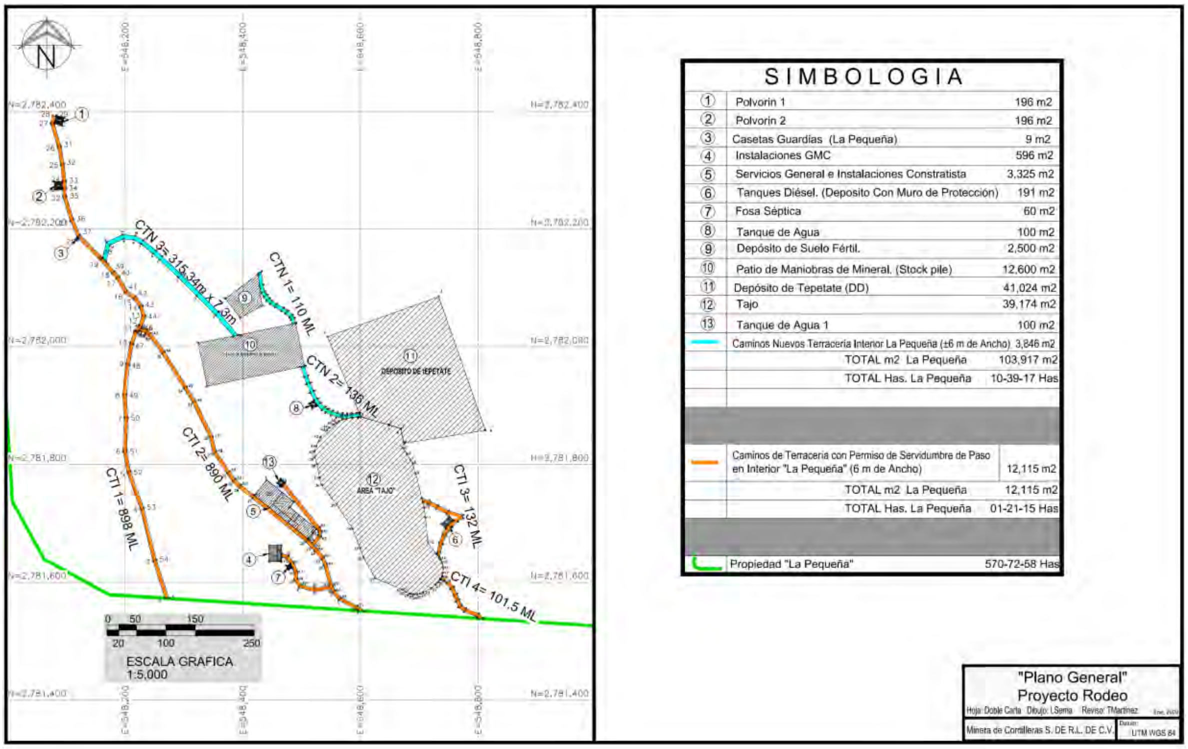


FIGURE 1-3: INFRASTRUCTURE PAD AND ACCESS ROAD

The mine operations pad will house the fuel storage, maintenance area, portable warehouses, mobile offices and other essential services and support units.

1.7 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

1.7.1 MINING RELATED PERMITTING

The following list of permits, registrations and permissions apply to the mining operations phase of the Rodeo Project. Golden Minerals is currently completing the permitting process and their advance is listed below:

- **Baseline Development** – The collection of this information is in process, but the completion of this activity does not affect the start of the project.
- **Temporary Occupation Permit** – Completed temporary occupation agreement for mining with La Pequeña ranch owner in February 2020.
- **RAN Registration** – The registration of the agreement with the landowners with the RAN agency. This is only required with Ejidos. Notice of temporary occupation to conduct exploration and the extraction of material within the confines of the "La Pequeña" ranch.
- **Temporary Occupation Permit Certification** – Register the same agreement that was submitted to RAN with a notary public.this activity is in process and scheduled for completion in May 2020.
- **Environmental Impact Assessment (MIA)** – NOM-120-SEMARNAT-2011 is in process. The document was completed in April 2020. Filing and acceptance is dependent on SEMARNAT

- **Justification for Change of Land Use ETJ** – Technical study submitted to SEMARNAT to satisfy the LGDF (Ley General de Desarollo Forestal), Articles 117 and 118, which is the general development of forest lands in Mexico. This activity was completed in April 2020.
- **Temporary Occupation Permit Ejido Francisco Marquez**– Permission from Ejido Francisco Marquez for access of personnel and equipment in the south side of the "La Pequeña" ranch. Completed in April 2020.
- **General Permits for the Purchase, Storage, and Consumption of Explosives (SEDENA)** – Explosive permits issued by SEDENA. These permits are reliant on the MIA evaluation with SEMARNAT.
- **Permit for the Consumption of Water** – The permit is gained through CONAGUA. The other option to gain the required water for the project is to purchase the water through a private owner/Ejido. This activity has not started.
- **Payment for Environmental Disturbance** - Payment submitted to SEMARNAT, Articles 117 and 118, the general development of forest lands. Not completed.
- **Single Environmental License (LAU)** – Not applicable to the project.

1.7.2 SOCIAL OR COMMUNITY IMPACT

Rodeo is a small ranching and farming community. The Rodeo mining operation, although short lived, will give the local economy a boost with a small number of employment opportunities, the rent of vacant houses and buildings, restaurant business, and an increase in businesses such as at hardware stores, markets, rental housing, gas stations, and pharmacies.

1.8 OPERATING AND CAPITAL COSTS, AND ECONOMIC ANALYSIS

1.8.1 OPERATING COSTS

The total estimated operating cost with royalty is $70.56 per tonne, which includes the pre-production costs that are capitalized in the financial model cash flow. **Table 1-7** summarizes the overall operating cost per tonne for the Rodeo Project.

TABLE 1-7: OPERATING COSTS

	Total Cost		Fixed Costs		Unit Costs	
Cost Variable	**Project Total Cost**	**US$/ROM Tonne**	**Project Total Cost**	**US$/ROM Tonne**	**Project Total Cost**	**US$/ROM Tonne**
Contractor Cost- ROM	$1.44 M	$3.77			$1.44 M	$3.77
Contractor Cost - Waste	$1.54 M	$4.05			$1.54 M	$4.05
GM Mine Fixed Costs	$0.82 M	$2.16	$0.82 M	$2.16		
Ore Haulage to Plant II	$5.69 M	$14.93			$5.69 M	$14.93
Oxide Plant	$13.34 M	$35.00			$13.34 M	$35.00
Home Office Charges	$0.45 M	$1.18	$0.45 M	$1.18		
Contingency @ 10%	$2.25 M	$5.89	$2.25 M	$5.89		
Property NSR Royalty	$1.09 M	$2.87			$1.09 M	$2.87
Mexican NSR Royalty	$0.27 M	$0.72			$0.27 M	$0.72
Total Operating Cost	**$26.90 M**	**$70.56**	**$3.52 M**	**$9.24**	**$23.38 M**	**$61.33**

1.8.2 CAPITAL AND PRE-PRODUCTION COSTS

The Rodeo Project is estimated to require the capital expenditures that are outlined in **Table 1-8**.

TABLE 1-8: CAPITAL EXPENDITURE WITH PRE-PRODUCTION COSTS

Capital Item	Cost US$
Golden Minerals Mob	$25,000
Environmental Concerns	$25,000
Beneficiation Modification	$150,000
Contractor Mobilization	$155,841
Contractor Demobilization	$51,488
Access Road	$79,072
Reclamation Allowance	$50,000
Contingency	$161,913
Pre Production	$814,533
Total Capital Costs	**$1,512,847**
Capital Cost per ROM Tonne	**$3.97**

Pre-production capital expenditures include an $815,000 allowance which includes one-month's operating cost to cover the lag time that will exist between mining, processing, doré production, and payment from the refiner for the first shipment of metal.

Table 1-9 outlines the pre-production cost allowance.

TABLE 1-9: PRE-PRODUCTION ALLOWANCE

Pre-Production Item	Cost US$
Contractor Cost- ROM	$53,471
Contractor Cost - Waste	$82,128
GM Mine Fixed Costs	$30,504
Ore Haulage to Plant II	$211,762
Oxide Plant	$420,000
Home Office Charges	$16,667
Total Capital Costs	**$814,533**

1.8.3 ECONOMIC ANALYSIS

Table 1-10 outlines the market assumptions used to estimate the Rodeo Project's financial model. The precious metal spot prices quoted April 1, 2020 were selected as more representative of likely future gold prices rather than the three-year trailing average (silver $16.28/oz. and gold $1336.63/oz.). The sensitivity analysis performed for the Rodeo Project uses a +/-30% precious metal price range, which encompasses the three-year trailing average metal prices.

TABLE 1-10: MARKET ASSUMPTIONS

Description	Units	Value	Basis
Gold price	$/oz.	$1,621.80	April 1, 2020 Kitco Spot price
Silver price	$/oz.	$14.38	April 1, 2020 Kitco Spot price
MXP per USD Exchange	MXP	$24.20	April 1, 2020 Kitco Spot price
Property NSR Royalty	percent	2.00%	Golden Minerals
Mexican NSR Royalty	percent	0.50%	Golden Minerals

Table 1-11 summarizes the financial results for the Rodeo Project. The results indicate an after tax $NPV_{8\%}$ of US$22.5 million. The capital payback is estimated to occur in the first quarter of operation. The following inputs are the basis of the LOM plan and economics:

- The Rodeo extractable resource for processing ROM is 381,247 tonnes.
- The life of the project is 10 quarters (30 months).
- The average recovery for gold is 83.8% and for silver is 76.3% in an agitated leach plant.
- $1.3 million is the recommended funding required to start the project and includes contractor mobilization, project setup, mining area preparation, access road improvement, Plant II modifications and pre-production costs.
- The cash operating cost is $70.56/tonne.
- The project total capital costs are estimated to be US$1.51 million which includes $0.81 million for pre-production costs.
- The mine closure cost (reclamation) is estimated to be US$50,000.
- $798 is the cash cost per payable ounce of gold, and $843 is the all-in cash cost per payable ounce of gold.
- There is no salvage value associated with the operation.

TABLE 1-11: FINANCIAL MODEL RESULTS

Description	Units	Value	Per Payable oz. AuEq
Production			
ROM Material Processed	tonnes	381,247	
Payable Gold Produced	ounces	33,540	
Payable Silver Produced	ounces	88,871	
Payable AuEq produced	Eq-ounces	34,328	
Market			
Gold Price	$/ounce	$1,621.80	
Silver Price	$/ounce	$14.38	
Gross Revenue	**US$000's**	**$55,674**	**$1,621.80**
Freight, TC's, Insurance	US$000's	$1,048	$30.52
Net Revenue (NSR)	**US$000's**	**$54,626**	**$1,591.28**
Property NSR Royalty	US$000's	$1,093	$31.83
Mexican NSR Royalty	US$000's	$273	$7.96
Net After Royalties	**US$000's**	**$53,260**	**$1,551.50**
Mining Contractor	US$000's	$2,844	$82.86
GM Mine Fixed Costs	US$000's	$793	$23.10
Ore Haulage to Plant II	US$000's	$5,479	$159.61
Oxide Plant	US$000's	$12,924	$376.47
Head Office Charges	US$000's	$433	$12.62
Contingency	US$000's	$2,247	$65.47
Operating Costs	**US$000's**	**$24,721**	**$720.13**
Operating Margin	**US$000's**	**$28,539**	**$831.37**
Pre-production Cost	US$000's	$815	$23.73
Site Work	US$000's	$104	$3.03
Setup and Mobilizations	US$000's	$232	$6.77
Crusher modifications	US$000's	$150	$4.37
Reclamation	US$000's	$50	$1.46
Contingency	US$000's	$162	$4.72
Capital Costs	**US$000's**	**$1,513**	**$44.07**
Pre-Tax cash Flow	**US$000's**	**$27,027**	**$787.30**
Total Taxes	US$000's	$2,140	$62.35
Cash Flow	**US$000's**	**$24,886**	**$724.94**
NPV at 8%	**US$000's**	**$22,457**	

The sensitivity analysis detailed in **Table 1-12** suggests that the project is most sensitive to revenue generation (metal prices, recoveries, and grade). The project is least sensitive to capital costs.

TABLE 1-12: PROJECT SENSITIVITY (NPV 8% US$ MILLIONS)

VARIATION FROM BASE CASE	-30%	-20%	-10%	BASE CASE 0%	10%	20%	30%
Revenues	$9.02	$13.50	$17.98	$22.46	$26.94	$31.41	$35.89
Operating Costs	$28.93	$26.77	$24.61	$22.46	$20.30	$18.15	$15.99
Capital Costs	$22.90	$22.75	$22.60	$22.46	$22.31	$22.16	$22.02

Note: The Base Case After Tax $NPV_{8\%}$ is US$22.46M, which is projected from the project's estimated revenue, operating costs, capital costs, and calculated taxes based on Golden Minerals Co. current Mexican tax structure.

1.9 INTERPRETATIONS AND CONCLUSIONS

The Rodeo Project offers a unique opportunity because of the small amount of capital and pre-production costs required to put the mine into production. The capital is less than 6% of the project's estimated total operating margin. The mine plan exploits the resource's relation to the existing terrain (topography) for early access to some of the higher-grade material. The mine plan continues to prioritize the higher-grade material with the final two pushbacks that follow the initial pushback.

The metallurgical report prepared by RDi (Resource Development Inc.) for the Rodeo Project provides data that is sufficient for a PEA level analysis. The RDi measured hardness (Bond's Work Index) raises a concern that the sample may not be representative of the ROM material that will be transported to the Velardeña agitated leach plant for processing. The author agrees with Golden Minerals' current plan to drill several additional drill holes into the resource to gain fresh material for further testing of the hardness and recoveries. The tailing pond at Plant II was expanded in 2019 making available enough room for the storage of the Rodeo Project's tailing.

The current permitting/environmental work being performed by Golden Minerals staff and outside consultants are consistent with international mining best practices and mining operations in Mexico. The author agrees with the effort being made by Golden Minerals to identify (1) the required reclamation of disturbed land, (2) air quality protection, (3) ensuring adequate water supply for the project and (4) impact on the local communities. The allowances used in the PEA for the implementation of the mitigation measures and monitoring programs should prevent or minimize any impacts.

1.10 RECOMMENDATIONS

The author recommends the following points:

- There are some opportunities to expand the resource with additional drilling, and there are some areas that the confidence level of the resource could be increased with additional drilling.
- A preliminary bid package, based on the current resource and mine plan, be constructed and let out for preliminary bid with regional mining/civil contractors.
- Further testing of the typical ROM material to determine the Bond's Work Index and additional bottle roll tests to solidify the projected recoveries at a grind of P_{80} 150 mesh.
- Golden Minerals should continue with the accumulation of the required Rodeo Project's permits as outlined in Section 19.

2 INTRODUCTION

This report has been prepared for Golden Minerals Company (Golden Minerals) and pertains to their Rodeo Project that is held by Minera de Cordilleras S.A. de R.L. de C.V. (Minera Cordilleras), a wholly owned subsidiary of Golden Minerals.

This report has been prepared for the purposes of developing a preliminary mining and processing plan based on the available drilling and exploration supplied by Golden Minerals and their subsidiaries to Tetra Tech for the construction of a NI 43-101 Technical Report Mineral Resource Estimate prepared by Tetra Tech and issued in March of 2017.

Tetra Tech performed a review of the project's technical information including locations, orientations, mapping and analytical data that has been supplied by Minera Cordilleras, and Tetra Tech, in part, verified through spot checking conducted by the author of the Tetra Tech technical report while visiting the project. Information pertaining to title, environment, permitting and access was supplied by Minera Cordilleras and the author of this PEA report has relied on the experts supplying this information. Introductory summaries pertaining to location, geology and mineralization have been primarily sourced from the previous Nl 43-101 Technical Report for the property titled "Technical Report on the Rodeo Property State of Durango, Mexico" issued by Camino Minerals Corporation (Camino) in 2010 by J. Douglas Blanchflower (Blanchflower) of Minorex Consulting Ltd. (Minorex), text and figures from the report have been included and adapted in this report where appropriate along with citations.

The author of this Preliminary Economic Assessment inspected the Rodeo Project site on June 11th of 2019. The inspection entailed observations of drill hole collar locations and orientations, drill core, trench sample locations, mineralized outcrops, and geologic discussions with project staff.

2.1 UNITS OF MEASURE

All references to dollars in this report are to US dollars (US$) unless otherwise noted. Distances, areas, volumes, and masses are expressed in the metric system unless indicated otherwise.

The common measurements in this report are given in metric units. All tonnages shown are in tonnes (1,000 kilograms), precious metal grade values are given in grams per tonne (gpt), and precious metal quantity values are given in troy ounces (oz).

2.2 ABBREVIATIONS

The following is a list of abbreviations used in this report.

Abbreviation	Unit or Term
2D	two dimensional
3D	three dimensional
Ag	silver
As	arsenic
Au	gold
BCM	Bank Cubic Meter
BCY	Bank Cubic Yard
°C	Centigrade

Abbreviation	Unit or Term
cm	centimeter
cm3	cubic centimeter
CONAGUA	National Water Commission (Comision Nacional del Agua)
Cu	copper
CUSTF	Change in Forestry Land Use (Cambio de uso del suelo enterrenos forestales)
ER	Risk Study (Estudio Riesgo)
ETJ	Technical Justification Study (Estudio Tecnico-Justificativo)
G	grams
gpt	grams per tonne
g/cm3	grams per cubic centimeter
GxT	grade multiplied by thickness
Golden Minerals	Golden Minerals Company, Golden, Colorado
ha	hectare
ID	identification
IMMSA	Industrial Mineral de Mexico S.A.
INAH	National Institute of Archaeology and History (Instituto Nacional de Arqueologia e Historia)
kg	kilogram
km	kilometer
km2	square kilometers
kph	kilometer per hour
LAU	Comprehensive Environmental License (Licencia Ambiental Unica)
LCM	Loose Cubic Meter
LCY	Loose Cubic Yard
LGDFS	General Law of Sustainable Forestry Development (Ley General de Desarrollo Forestal Sustentable)
LGEEPA	General Law of Ecological Equilibrium and Environmental Protection (Ley General del Equilibrio Ecologico y la Protection al Ambiente)
LGPGIR	General Law for the Prevention and Integrated Waste Management (Ley General para la Prevention y Gestion Integral de los Residuos)
LOM	Life Of Mine
m	meter
M	million
MIA	Environmental Impact Statement (Manifestation de Impacto Ambiental)
Minera de Cordilleras	Minera de Cordilleras S.A. de R.L. de C.V.
mm	millimeter
mm/yr	millimeters per year
mya	million years before present
NOM	Official Mexican Standard (Norma Oficial Mexicana)
Nl 43-101	Canadian Securities Administrators' National Instrument 43-101
NOM-120-SEMARNAT-1997	Mexican Official Standard
NSR	Net Smelter Return

Abbreviation	Unit or Term
Pb	Lead
PEA	Preliminary Economic Assessment
PMLU	Post Mining Land Use
PPA	Accident Prevention Plan
ppm	parts per million
PROFEPA	Federal Bureau of Environmental Protection
QA/QC	quality assurance/quality control
ROM	Run of Mine mineralized material
Sb	antimony
SEDENA	Secretariat of National Defense (Secretaria de la Defensa Nacional)
SEMARNAT	Secretariat of Environment and Natural Resources (2001-) (Secretaria de Medio Ambiente y Recursos Naturales (2001-))
SMT	Special Mining Tax
t	metric tonnes
st	short ton (2000 pounds)
oz	troy ounce
tpd	metric tonnes per day
US$	United States currency
V	volts
Zn	zinc
/	per

3 RELIANCE ON OTHER EXPERTS

The author is relying on statements by Golden Minerals concerning legal and environmental matters included in Section 4.0 and 5.0 of this report.

The author is relying on statements and documents provided by Warren Rehn, President and CEO of Golden Minerals; Joaquin Rodriguez, Principal Geologist for Minera Cordilleras; Aaron Amoroso, Sr. Geologist Golden Minerals; and Mathew Booth, Exploration Manager Minera Cordilleras, regarding:

- Compliance requirements to continue exploration activities,
- Permitting requirements to initiate mining,
- Location of the concessions,
- Concession standing,
- Surface access agreements,
- Royalty and purchase agreements relating to the concessions, and
- Importation and exportation of Tetra Tech's block model data relative to the mine model's bench design.

4 PROPERTY DESCRIPTION AND LOCATION

The Rodeo Project is located 2 km east of the town of Rodeo in Durango State, Mexico, Figure 4-1 (Blanchflower, 2010). Basic amenities are available in the town of Rodeo. Large regional cities with full services are located within driving distance of the project; Torreon is located 189 km to the east, and Durango 157 km to the south. The center of the Rodeo deposit can be located using the following coordinate: latitude 25°9'2.7"N, longitude 105°31,4.2"W (WGS84). The figures enclosed in this report are based on NAD83(North American Datum of 1983).

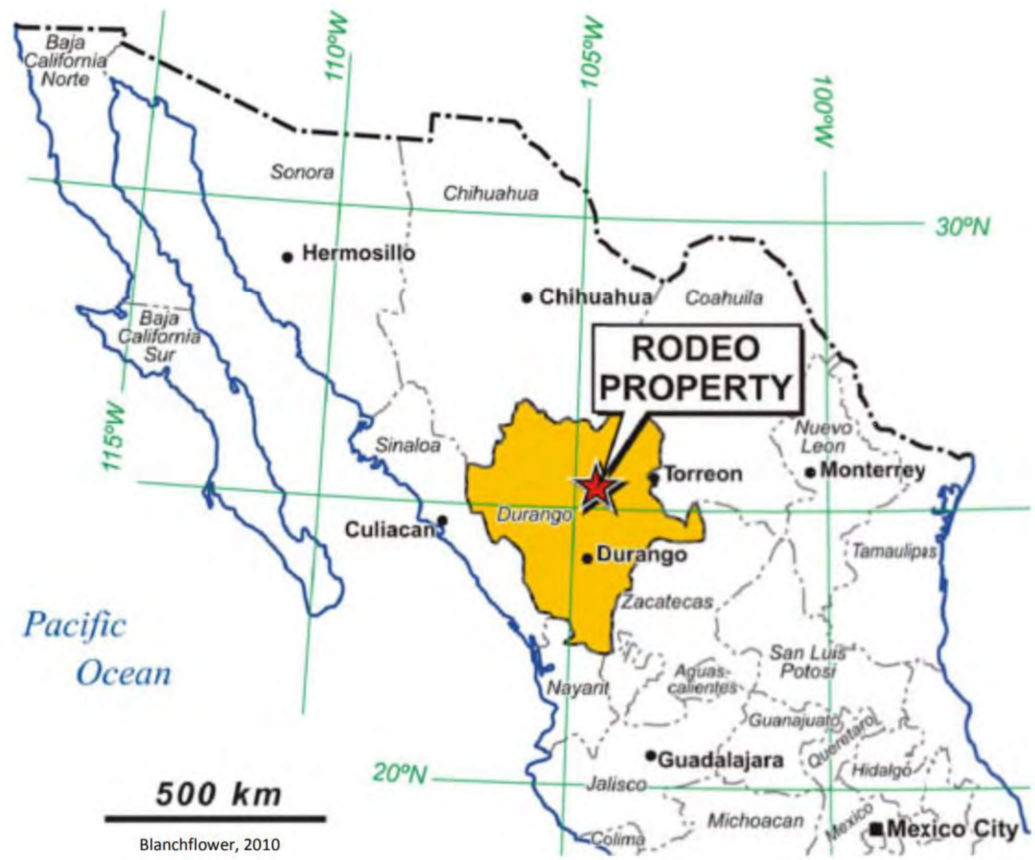


FIGURE 4-1: LOCATION MAP

4.1 PROPERTY CONCESSIONS

The property contains two mineral concessions totaling 1,865.7 hectares. The Rodeo concession is held under a purchase agreement subject to advance royalty payments of $40,000 per year with La Cuesta International, S.A. de C.V., a wholly owned subsidiary of La Cuesta International Inc. (La Cuesta). The Rodeo 2 concession was purchased by Minera de Cordilleras from Rojo Resources. On commencement of commercial production, La Cuesta is entitled to a 2% NSR royalty from production. After $5.0 million dollars has been paid under the royalty agreement the royalty reduces to 1% NSR. **Figure 4-2** shows the concession boundary and **Table 4-1** details the concession information.

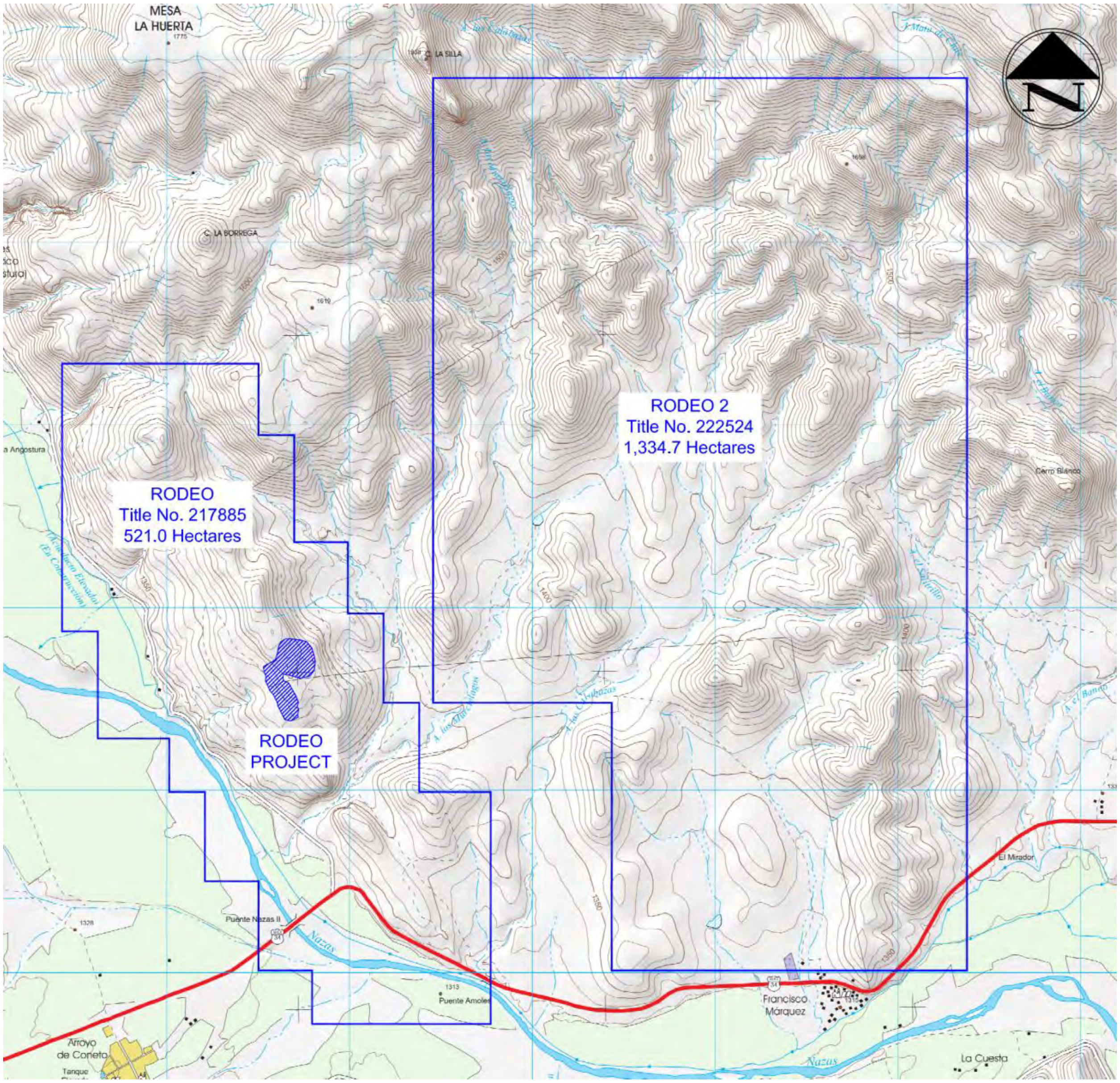


FIGURE 4-2: CONCESSION BOUNDARY

TABLE 4-1: RODEO CONCESSION GROUP CONTROLLED BY MINERA CORDILLERAS

Concession	Title No.	Concession Holder	Filing Date	Filing No.	Expiry (Good Standing)	Minera Cordilleras Arrangement	Hectares
Rodeo	217885	LA CUESTA INTERNACIONAL, S.A. de C.V.	11 June 2002	30748	17 September 2052	Lease Agreement	521.0
Rodeo 2	222524	Rojo Resources, S.A. de C.V. (Pending Transfer to Minera Cordilleras)	6 February 2004	31305	20 July 2054	Purchase Agreement	1,344.7

4.2 Significant Risk Factors

The claims are located on the Ejido Francisco Marquez, Ejido Animas and Rancho La Pequeña (Private). Past exploration drilling by Minera Cordilleras has been conducted in the Rancho La Pequeña area only. Access to the claim block is granted by an agreement between the current concession holder and the Ejido Francisco Marquez and Rancho La Pequeña. Neither group has a direct interest in the mineral claims. The author is unaware of any other significant risk factors that may affect access, title, or right or ability to perform work on the property.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

The following section has been adapted from Blanchflower, 2010.

5.1 ACCESSIBILITY

The property covers the hills and flatlands bordering the Nazas River valley. Year-round vehicular access to the property is possible via Mexican Highway 45 that links the major cities of Durango in Durango State with Parral in Chihuahua State (see Figure 2). Approximately 6 km south of the town of Rodeo, near the village of Hidalgo de San Antonio, there is a junction of Mexican National Highways 45 and 34.

Approximately 3 km northeast of this junction along paved Highway 34 there is a gravel road, about 500 m east of the Nazas River bridge, that leads north northwesterly along the eastern side of the river to the village of Heroes de Mexico. A gated gravel access road that provides access to all of the drill sites within the property joins the Nazas River road about 500 m northwest of Highway 34. The access road crosses the Los Murcielagos arroyo and may be impassable for short periods following a heavy rainfall.

5.2 PHYSIOGRAPHY, CLIMATE AND VEGETATION

FIGURE 5-1: PHOTO THE RODEO PROPERTY LOOKING NORTH

The Rodeo property is situated within the Mesa Central physiographic region, between the mountain ranges of the Sierra Madre Occidental and Sierra Madre Oriental. The Nazas River valley is locally bounded to the west by the rugged mountains of the 'Pilar Sierra de San Francisco' and to the east by the rolling hills and rounded mountains of the 'Pilar Sierra de Nazas'. Bedrock exposures are common along ridge crests, road cuts and drainages (aka 'arroyos'). Relief within the property is moderate with elevations ranging from approximately 1,310 to over 1,800 m amsl.

The climate is typical of the high-altitude Mesa Central region, dry and semi-arid. Annual precipitation for the area is approximately 700 mm, mostly during the rainy season in June and July. Temperatures commonly range from 20° to 45° C in the summer and 15° to 0° C in the winter.

The vegetation is dominantly scrub bushes with various types of cacti, maguey, sage, coarse grasses and yucca, Figure 5-1. The natural grasses are used to locally graze domestic livestock. Wild fauna is not abundant, but several varieties of birds, rabbits, coyote, lizards, snakes and deer reportedly inhabit the area.

5.3 Local Resources and Infrastructure

There is a good network of roads in the region. Road access to the drilled areas and much of the western portion of the property is possible via multiple gravel roads from both Highways 45 and 34. The eastern portion of the property is accessible via gravel ranch roads or by hiking.

The Nazas River flows year-round despite the water extraction supporting local agricultural operations. The concessions are contained within the Rancho La Pequeña and the Francisco Marquez and Animas Ejidos

The city of Rodeo with a population of just under 4,000 people is situated to the northwest of the concession on the western side of the Nazas river. It is an agricultural supply and commercial center on National Highway 45 between the major cities of Durango, to the south, and Parral, Chihuahua to the north. Most of the services and supplies required for exploration work in the area can be obtained locally or from the nearby historic mining cities of Durango, Parral, Torreon, and Chihuahua. Experienced mining personnel are also available throughout the region.

There is a 43.5 kilovolt power line that crosses the property and services the villages of Hidalgo de San Antonio and Buena Vista. The availability of the power line or potential power requirements of the project have not been investigated.

There are several sites within the property that would provide adequate space for future development of mining and associated facilities. Surface rights are owned by local cooperative farmers, landowners and ranchers, and their permission is required to conduct any physical work. Drilling access roads should be planned to benefit the local ranchers with access. Gates and/or cattle guards would be required.

There is no permanent year-round water source in the immediate vicinity of the deposit. Drilling waters could be purchased from owners of the local water rights and trucked to the site.

6 HISTORY

The following section has been adapted from Blanchflower, 2010.

Romas and Rios (2003) documented two prospects, called the 'Los Murcielagos' gold-silver-lead-copper and "Francisco Marquez" gold-copper prospects, in the vicinity of the Los Murcielagos arroyo on the Rodeo property. Little information is available on these historic prospects other than gold- and silver-bearing mineralization was apparently extracted from short adits driven in sheared and altered rhyolitic volcanic rocks.

Recent exploration work on the Rodeo property was carried out by La Cuesta and Monarch Resources de Mexico, S.A. de C.V. (Monarch) in the 1990's and by Canplats de Mexico, S.A. de C.V. (Canplats Mexico) a wholly owned subsidiary of Canplats Resource Corporation (Canplats) Mexico in 2003, 2004 and 2007. This work is summarized in Table 6-1 which has been modified after McNaughton, 2004 and Charre, 2007.

The following section has been prepared by M. Booth, Golden Minerals Company, 2020.

In 2015 the property was acquired by Minera de Cordilleras, a subsidiary of Golden Minerals Inc. from La Cuesta international. In 2016, Golden Minerals drilled 14 holes, totaling 2083.7m exploring the NE down-dip continuation of the high-grade mineralization, conducted regional mapping and sampling, and conducted metallurgical test work on the Rodeo mineralization and completed a preliminary assessment report on the deposit.

In 2019, Golden minerals conducts a regional mapping and sampling program that identified additional exploration targets and received permits to conduct a resource definition program at Rodeo.

TABLE 6-1: SUMMARY OF EXPLORATION HISTORY

Year	Description of Work
1994	La Cuesta discovers Rodeo prospect and explores the showing under contract for Monarch Resources de Mexico, S.A. de C.V. (Hillemeyer, 1997).
1995	La Cuesta completes 1:5000 scale geological mapping.
1995	Explominerals is contracted to collect 109 rock chip samples using grid and selective sampling methods in February and March, 1995. The samples are sent to Bondar-Clegg Lab for geochemical analysis (Durning and Hillemeyer, 1995b).
1995	Monarch completes a Phase I drilling program, including sixteen reverse circulation ('RC') drill holes totaling 2,251 m (Hillemeyer, 1997). The drilling confirms strongly anomalous gold and silver values at shallow depths, but does not adequately test the mineralization at depth.
2003	Canplats acquires the Rodeo Property from La Cuesta, and conducts a rock geochemical sampling program comprising 422 chip samples, including 24 samples covering the area previously drilled by Monarch (Canplats News Release, 2004a).
2004	Canplats carries out an initial reverse circulation drilling program including 9 RC drill holes (1,123.7 m) that tested approximately 130 m of strike length along the 'West Vein Swarm' zone. A Phase II diamond drilling program was completed in September 2004. It included the drilling of an additional twelve holes (BR-10 to -21) totaling 1,291.47 m (Davis, 2004e). It confirmed the presence of gold mineralization along 200 m of the West Swarm Vein zone and discovered buried gold mineralization at the new 'Ridge Zone'.
2007	Canplats conducts a diamond drilling program to test the depth extent of known near-surface mineralization. Four diamond drill holes (BRD-01 to -04), totaling 1,070.75 m, were completed during the program. The drill holes intersected gold-silver mineralization over widths of a few metres to over 8 m with grades ranging up to 1.065 gpt gold and 93.9 gpt silver.

2010	Camino Minerals Corporation is formed as a result of the acquisition of Canplats by Goldcorp Inc. ("Goldcorp") on February 3, 2010. The newly created Camino Minerals Corporation holds all of the properties that Canplats held before acquisition, except for the Camino Rojo property. Rojo, a wholly-owned subsidiary of Camino, acquired its interest in the 'Rodeo' and 'Rodeo 2' concessions on February 3, 2010 pursuant to the terms of an asset transfer agreement between Canplats Mexico and Rojo, and a statutory plan of arrangement involving Canplats, Goldcorp Inc. and Camino that became effective on February 4, 2010.
2010	Camino issues Technical Report for the property.
2011	Camino conducts a drilling program that included 6,238.2 meters of diamond drilling in 29 holes located within a 7.0 by 2 kilometer alteration footprint hosting the Rodeo Epithermal Vein System. The purpose of this program was to investigate the extension of the known mineralization to the north and south of the main mineralized zone as well as at depth.
2012	On March 16, 2012, Camino purchased the back-in rights that Silver Standard held with respect to each of the El Rincon Gold Project and the Mecatona Gold-Silver Project, and Silver Standard's right of first offer with respect to the Rodeo Gold Project (collectively, the "Rights"). In consideration for the transfer of the Rights, the Company issued to Silver Standard 500,000 of its common shares. (Camino MDA November, 2012)
2014	Camino relinquishes its right to acquire the Rodeo concessions and the concessions reverted back to La Cuesta. Rodeo 2 staked by Camino during the option period with La Cuesta reverted to La Cuesta under the existing agreement.
2015	Golden Minerals acquires control of the concessions from La Cuesta.
2016	Golden Minerals drilled 14 core holes totaling 2083.4m, conducts regional exploration on the Rodeo and Rodeo 2 concessions
2017	Golden minerals conduct metallurgical testing on Rodeo ore and completes an initial preliminary economic assessment on the deposit.
2019	Golden Minerals conducts regional exploration and mapping campaign, receives environment permits to conduct drilling.

7 GEOLOGICAL SETTING AND MINERALIZATION

7.1 REGIONAL GEOLOGY

The following description of the regional geology is from the 1996 interim drilling report for the Rodeo concession by Blackwell and Pryor for Monarch.

The Rodeo Concession lies on the eastern boundary of the Sierra Madre Occidental morphotectonic province (de Cserna, 1989). The Sierra Madre Occidental is a dissected volcanic plateau elongated in an NNW direction. It is approximately 1,200 km long and its average altitude is a little under 2,000 m amsl. The geology of the province has been divided into two principal volcanic groups, the upper and lower. The groups have been summarized below after de Cserna, 1989.

- *Upper Volcanic Supergroup (27-34 Mya): Rhyolitic and rhyodacitic ignimbrites, caldera complex with associated high level intrusives, minor andesites and mafic lavas.*
- *Lower Volcanic Complex (45-100 Mya): Andesitic to rhyolitic extrusives, intruded by batholithic complexes.*

The formation of these volcanic complexes can be related to late Mesozoic and Tertiary subduction processes along the Middle America Trench. The dominant structural event affecting these rocks, particularly the Upper Volcanic Supergroup, is a tensional one, possibly coeval with the spreading episode which was opening the Gulf of California to the North West. This event led to the formation of a complex of normal faults within and on the margins of the volcanics. Displacements on these faults is never very great, particularly on the eastern margin of the Sierra Madre Occidental but tilting of structural blocks was extensive. Wedges of coarse clastic rocks now fill the associated half grabens. A number of these faults have been the loci of possible late-stage volcanic alteration/silicification /mineralization events which are the targets exploration effort.

To the East of Rodeo lies the morphotectonic province of the Sierra Madre Oriental. This is largely composed of Mesozoic sedimentary rocks, evolving from a mixed clastic continental and marine succession with minor volcanics in the early part of the era, to platform and basinal carbonates by the Cretaceous. These rocks were subjected to a strong compressional tectonism oriented WSW-ENE at the end of the Cretaceous. Again, this can be related to the subduction of the Cocos Plate beneath the North American Plate.

The boundary between the two tectonomorphic provinces, with their highly contrasting regional facies and structural style, is marked by a NNW trending normal fault or complex of faults. On the property that is the subject of this report, the structural trend is expressed by the Rodeo Fault, also known as the Falla Heroes de Mexico.

7.2 LOCAL AND PROPERTY GEOLOGY

The following description of the local and property geology is from a 1997 non-public report for the Rodeo concession by Hillemeyer and Durning for La Cuesta.

The Rodeo Prospect is located along a major northwest-trending system of basin-and-range normal faults juxtaposing silicified, iron-stained and locally clay altered Tertiary intermediate-to-felsic volcanic and sub-volcanic rocks against altered, silicified and brecciated Cretaceous silty limestones and shales. In the southern portion of the property, the Cretaceous rocks are on the NE side of the fault system (footwall) and the volcanic rocks are on the SW side of the fault system (hanging wall). At the north end of the property, the fault system juxtaposed volcanic rocks against volcanic rocks.

The following description of the local and property geology has been adopted from a 1996 interim drilling report for the Rodeo concession by Blackwell and Pryor for Monarch.

Mapping carried out by Monarch indicated the geology consists primarily of Tertiary (Oligocene?) acidic volcanics to the WSW separated from Mesozoic (Cretaceous?) carbonates by the NNW trending Rodeo Fault. The latter have been ascribed to the Indidura Formation (Durning and Hillemeyer, 1994 & 1995) and the former, while having no strict stratigraphic assignation, are referred as the Rodeo Volcanics.

- ***Rodeo Volcanics*** *(Oligocene? 23-34 Mya): Rhyolitic, rhyodacitic and andesitic (?) lithologies; including welded and non-welded (ash flow?) tuffs, ash flow breccias (?) to volcanic breccias.*
- ***Rodeo Fault:*** *Normal fault, dipping l/l/SW.*
- ***Grupo Mezcalera*** *(Cretaceous 97.5-124 Mya): Thinly interbedded carbonates and clastics, ranging from and gradational between; limestones, argilaceous limestones, calcareous shales to black shales. Possibly interfingered with welded to non-welded tuffs in the northern port of the concession*

Generally, exposure of the Rodeo Volcanics is good, particularly in the East-West oriented arroyos and canyons on the western margin of the concession. The topography in the Indidura Formation is not as dramatic and the exposure poorer. The structural style of this unit is, however, easily seen in rood cuttings on Highway 34 in the extreme South-eastern part of the concession.

(Note that the terminology for the naming of the volcaniclastic rocks follows that suggested by Cas and Wright, 1987.).

The Rodeo Fault, which locally may vary from a single fracture to a multiple structure, dips at approximately 60° to the WSW (shallowing to 25° at depth), with a downthrow in the same direction, i.e. it is a normal fault. This dip, however, may not be regular and is possibly offset by smaller scale antithetic faults. It has not been possible to determine the approximate amount of movement on this structure os the thickness of the stratigraphic units in the area is not known. In addition to separating rocks of differing ages and origins, the rocks on either side of the Rodeo Fault also belong to totally different structural regimes. The broad characteristics of each structural domain are summarized below. (Note that here the terminology is after Ramsey and Huber, 1987.).

Rodeo Volcanics *(Tensional): Unfolded, dip at low angles (5-15 degrees) to West. Systematic and nonsystematic joint sets with the dominant trend sub-parallel to the Rodeo Fault, i.e., NNW.*

Rodeo Fault: *(Tensional): Rodeo fault, strikes NNW, dips 60-25 degrees WSW.*

Grupo Mezcalera *(Compressional): Highly folded. Recumbent, sub-horizontal tight to isoclinal folds in thinly interbedded limestones and clastics to gently inclined sub-horizontal close chevron folds in more thickly interbedded units. Complex joint systems related to fold geometries. WSW-ENE compression.*

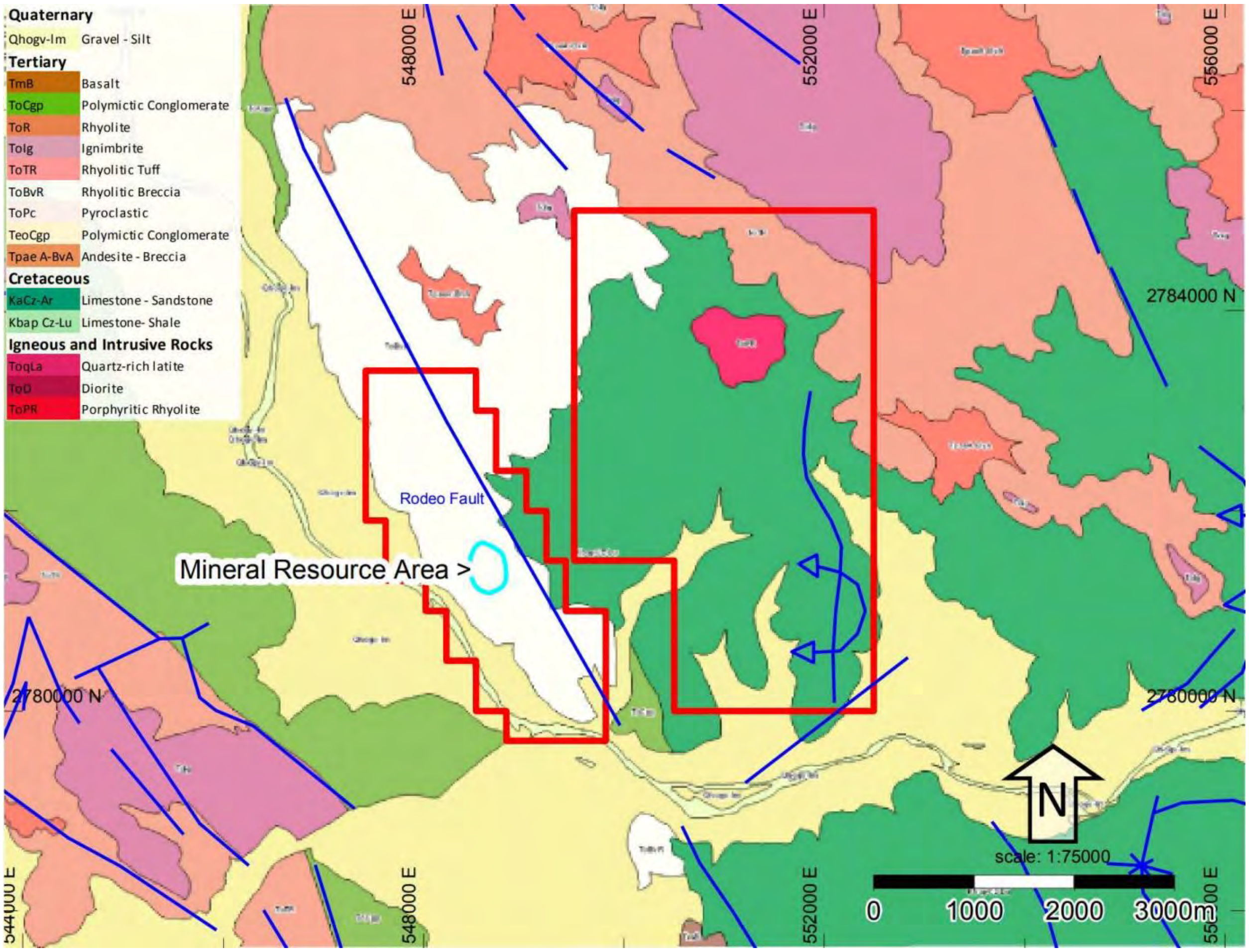


FIGURE 7-1:LOCAL AND PROPERTY SURFACE GEOLOGY (MODIFIED FROM GSM G13-D42, 2003)

7.3 DEPOSIT GEOLOGY

The following description of the deposit geology is from a 1997 non-public report for the Rodeo concession by Hillemeyer and Durning for La Cuesta.

At the Rodeo prospect, the "Rodeo" fault system consists of 3 major parallel shear zones and wall-rock fracture systems that are the principal feeder conduits for a high-level, Au-Ag epithermal mineral system. These major vein-filled structures appear to be feeder conduits responsible for the 1 km. X 4 km. area of silicified, clay altered and gold anomalous rocks forming resistant NNW-trending ridges at the Rodeo Prospect. All three of the structures are wide, laterally persistent, well-developed feeder vein swarms with high-level, locally banded agate to chalcedonic quartz veins, stockworks and silicified breccias. In the area of principal interest, the structures are strongly veined, silicified, brecciated, and mineralized for over 4 kilometers, and the shear zones and hydrothermal system can be traced for 8 kilometers on the property. Individual feeder vein and breccia systems are up to 60 meters thick. Flexures in the vein swarms and/or structural intersections provide brecciation and open conduits for intense, episodic fluid flow and silica deposition with the potential for ore-grade concentrations of precious metals, especially gold.

The immediate Rodeo deposit area is approximately 300 m along strike and 200 m wide and extends to a depth of 200 m below surface. The deposit strikes at 330° and dips to the ENE with various vein phases dipping from sub-vertical to 30°. The deposit is entirely hosted within Tertiary Rodeo volcanics that are strongly silicified and brecciated.

The deposit is bound to the East by the Rodeo fault, however drilling to date has not demonstrated that the deposit reaches or is truncated by the fault. Along strike to the north and south, the mineralization is offset slightly by near vertical faulting; mineralization does not terminate at these faults, but the intensity of the trend is either diminished or has yet to be located. ***Figure 7-2*** *shows the surface geology of the deposit area as well as where the majority of the drilling has been concentrated.*

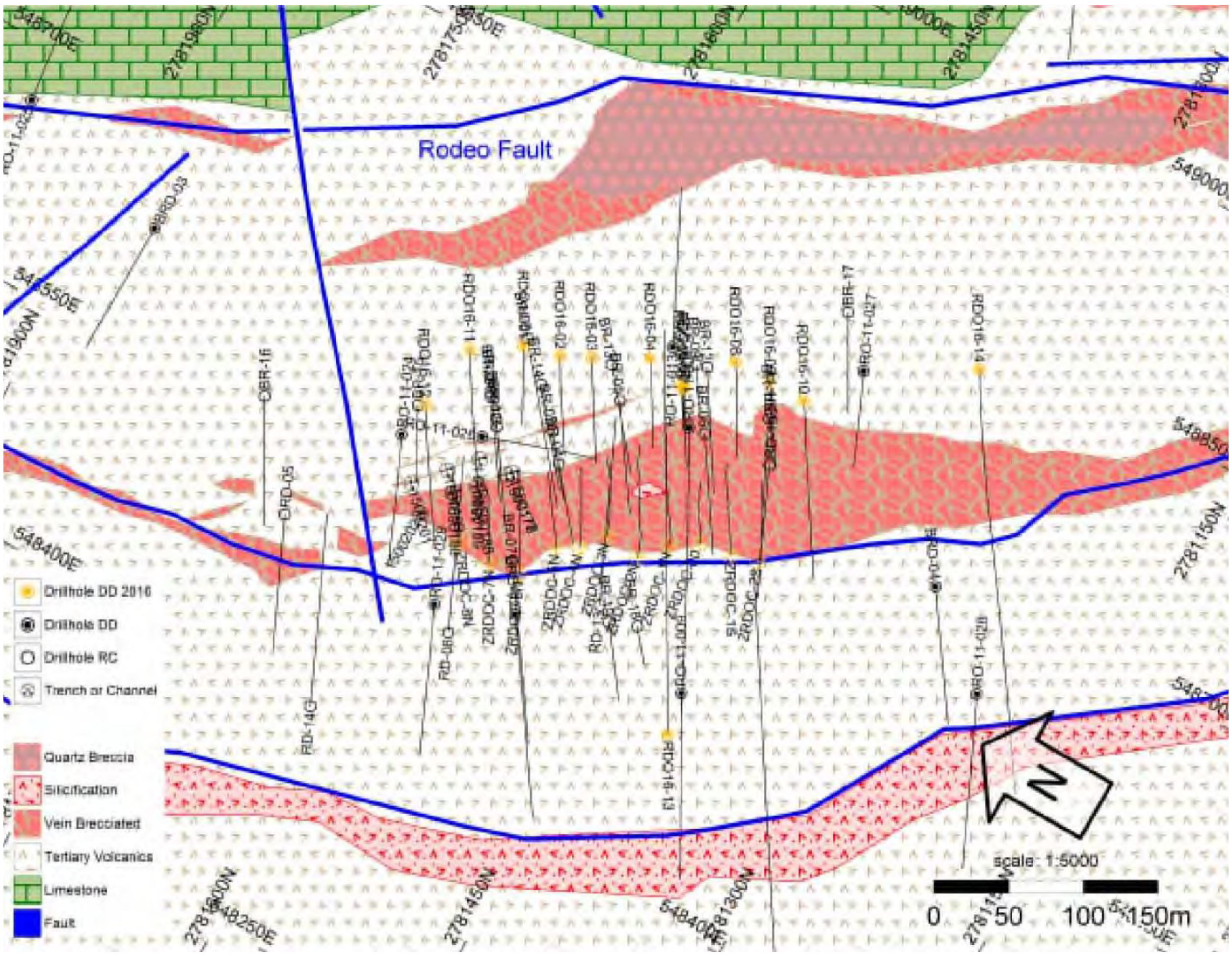


FIGURE 7-2: DEPOSIT SURFACE GEOLOGY

7.4 MINERALIZATION AND VEINING

The following has been adapted and updated from Gaboury and Magallanes, 2012.

The Rodeo deposit belongs to the epithermal Low Sulfidation (Quartz Adularia) type. The hydrothermal system was emplaced along major faults and various veins developed along several parallel structures in the hanging wall of the Rodeo Fault but at the Rodeo deposit very little mineralization is hosted in or centered on the Rodeo Fault itself. As the most significant structure locally, it is likely that the Rodeo Fault played a role as a pathway at depth for the Rodeo deposit.

Quartz veins up to 15 meters or more in width displaying classical epithermal textures such as complex banding, bladed calcite replacement and several stages of vein injection and brecciation have been encountered in several *holes throughout the property however high-grade Au mineralization appears to be limited to a distinct veining event, ancillary events both pre and postdating the high-grade event carry low-grade to anomalous levels of Au mineralization that could play an important role in evaluating the deposit for bulk tonnage potential.*

The gold event (stage 4 or high-grade) is associated to a restricted vein stage characterized by small smoky quartz veinlets cut by banded blue opaline quartz and later brecciated and cemented by glassy smoky quartz hosting very fine disseminated pyrite. The fine pyrite often found associated to intense silica alteration of the host rock is possibly related to this event as anomalous gold is reported from the sampling of these zones. This stage is restricted to the main zone of the deposit and appears to form semi-horizontal envelopes with shallow dips to the east. In the main zone, the veinlets generally trend NNW and dip steeply to the east and west as most of the other vein stages but the core angle in some holes suggest these veins may also have developed along ENE to EW structures. This stage is also weakly developed along some of the structures to the west of the main zone where it also appears to extend only to shallow depths. The envelope of the high-grade event appears to be restricted to a preferential volcanic layer or elevation (or both) movement on the Rodeo Fault is likely responsible for the current orientation of the envelope.

Gaboury and Magallanes identified several vein types and stages following Comino's 2011 drill hole exploration program. The characteristics of the stages have been arranged in chronological order from earlies to latest:

- ***Stage 1:*** *The first stage included classical epithermal veins characterized by moderately to well banded milky white quartz (adularia?) with locally well-developed bladed calcite replacement textures. These range from a few centimeters to as much as 15. Examples are shown in* ***Figure 7-3*** *and* ***Figure 7-4****;*

FIGURE 7-3: BOULDER OF STAGE 1 WHITE BRANDED QUARTZ VEIN WITH BLADED CALCITE REPLACEMENT TEXTURES

FIGURE 7-4: BLADED CALCITE REPLACEMENT TEXTURE IN STAGE 1 VEIN

- ***Stages 2 and 3:*** *The 2 other stages in the form of small gray glassy quartz veinlets. These generally display weak banding and don't appear to host any sulphide. They clearly cut the first white quartz veins, Figure 7-5. These veins are thought to be only weakly anomalous in gold but some may be richer in silver. In many cases they appear to overprint the textures in the large milky quartz veins which suggest some of them could be closely related in time with the early stage. Core angles suggest these occur as a multidirectional stockwork like array;*

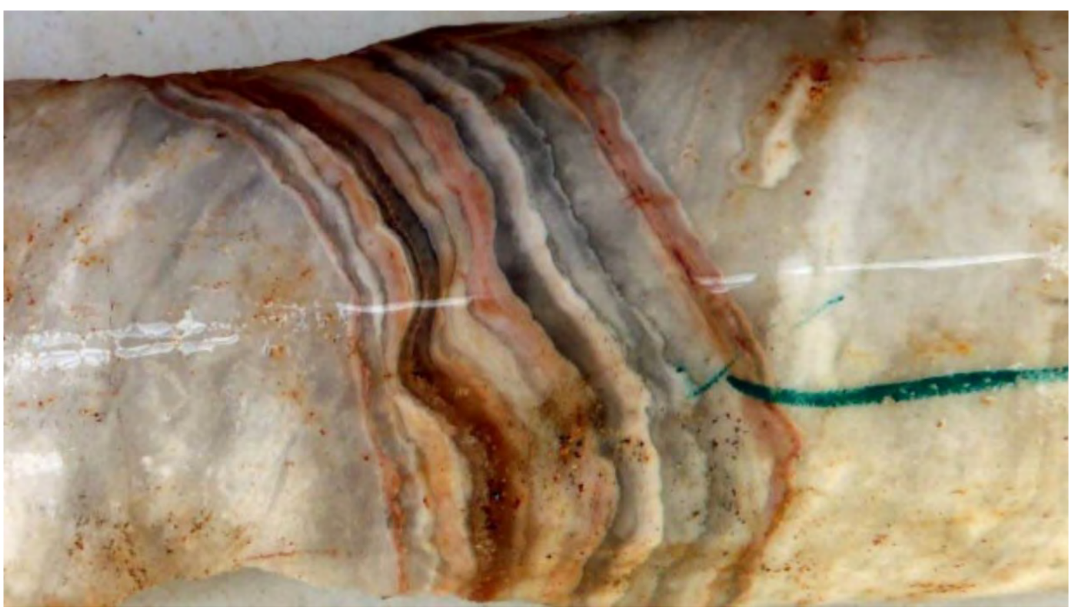


FIGURE 7-5: BANDED VEIN CUTTING STAGE 1 WHITE VEIN

- ***Stage 4 (High-Grade):*** *The main high-grade stage is characterized by small smoky quartz veinlets cut by banded blue opaline quartz and later brecciated and cemented by glassy smoky quartz hosting very fine disseminated pyrite, Figure 7-6 and Figure 7-7. High-grade mineralization exists as anomalous intervals in other stages types but this stage is consistently observed to occur along with high-grade;*

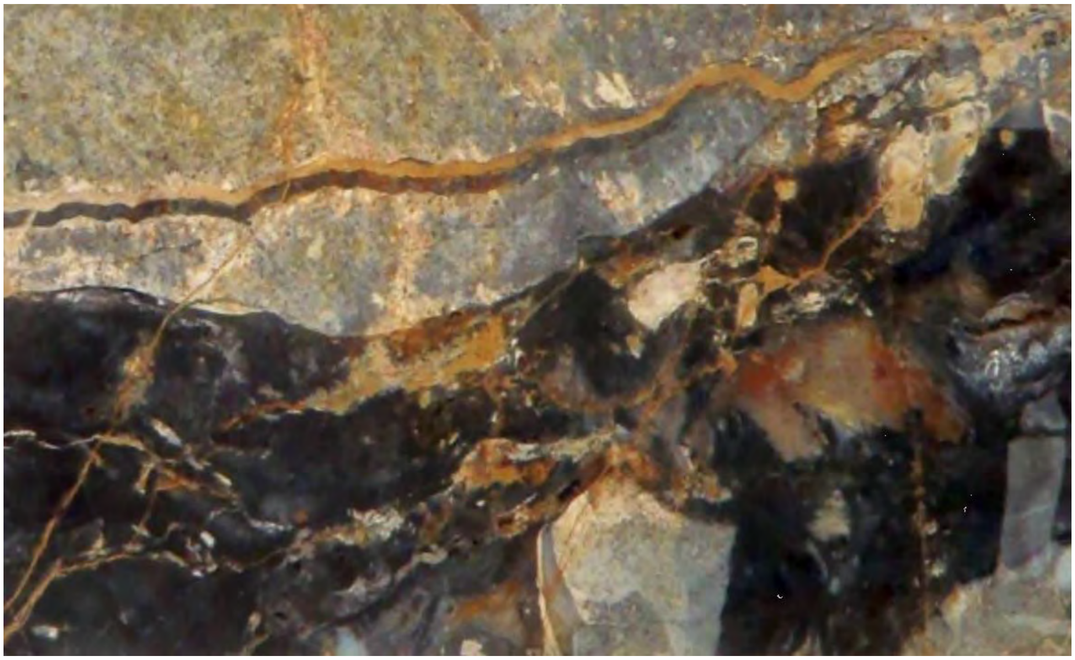


FIGURE 7-6: STAGE 4 BLACK VEIN (MAIN HIGH-GRADE STAGE)

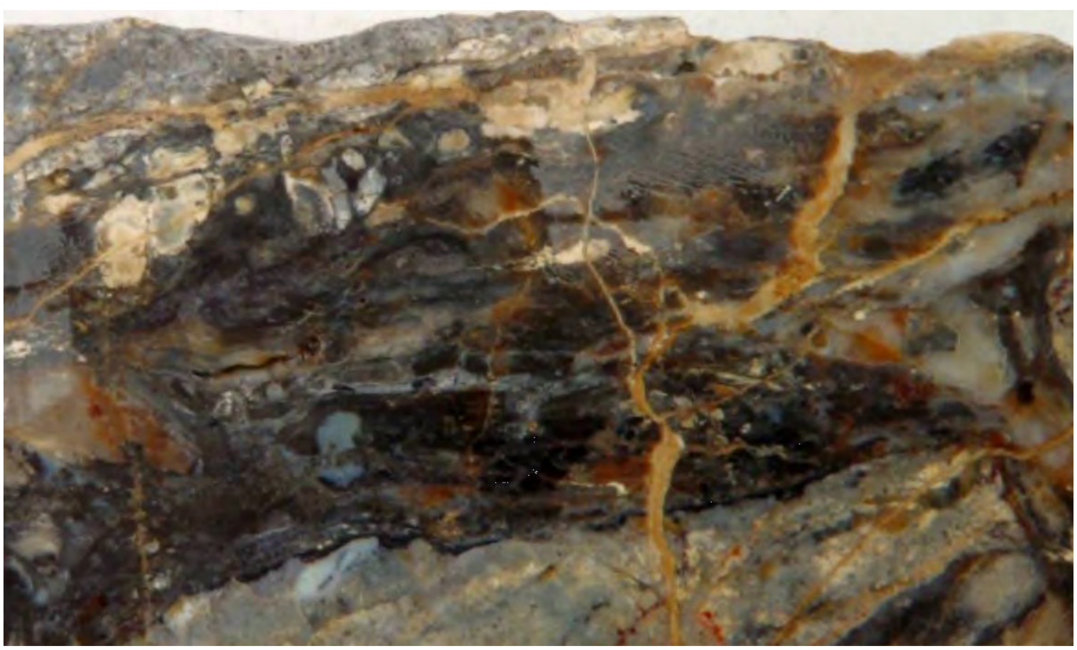


FIGURE 7-7: STAGE 4 BLACK VEIN (MAIN HIGH-GRADE STAGE) CUT BY BLUE OPALINE QUARTZ AND BRECCIA AND CEMENTED BY SMOKY QUARTZ HOSTING FINE DISSEMINATED PYRITE (RO-11-OO1 37.3 AU G/T)

- ***Stage 5:*** *Several vein injection stages clearly postdates the smoky quartz veinlets high-grade stage. These include at least one other stage of gray poorly banded veins as well as silica flooding often cementing small crackle breccias. This late stage of silica flooding often varies in color from beige to gray to almost black. Traces of very fine disseminated pyrite have been reported from this stage. These appear to be barren stages.*

FIGURE 7-8: SEVERAL STAGES OF LATE SILICA CEMENTING BRECCIAS

- ***Stage 6:*** *One last "post" mineral stage cuts all previously mentioned events. It is characterized by widespread pyrite-marcasite veinlets often cementing open space in small crackle breccias. Closer to surface, these veinlets are generally completely replaced by jarosite, limonite and hematite. These oxide veinlets are very well developed in the main zone and clearly cut all previous vein stages. However, they appear to be only weakly anomalous in gold to barren. Disseminated pyrite-marcasite is often associated to the veinlets. This vein stage is one of the most widespread and the one that appears to extend to greater depths along with the silica flooding stage. It may be responsible in part for the large zones of low-grade gold found below the main zone and along its extension to the north.*

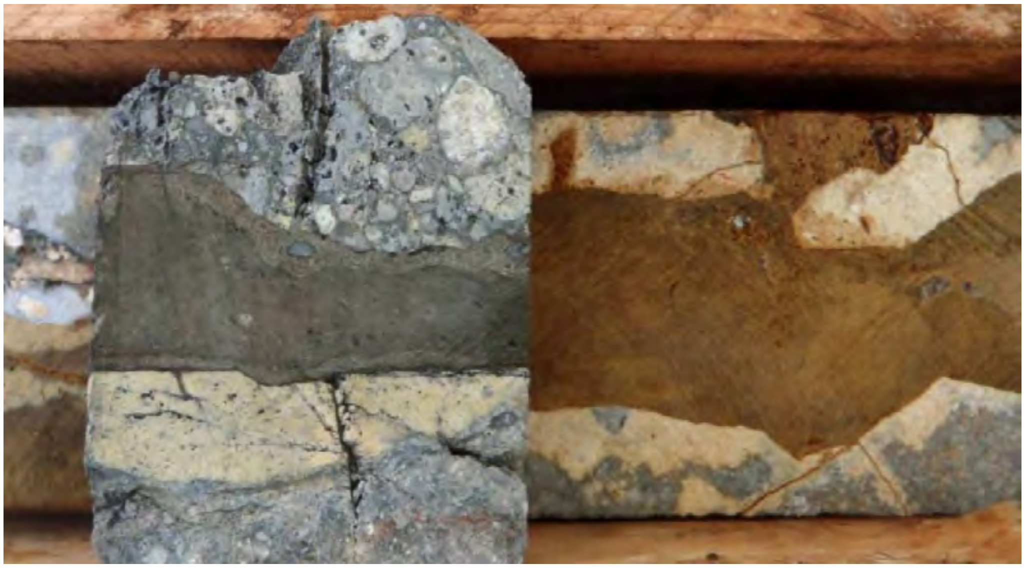


FIGURE 7-9: LATE STAGE PYRITE-MARCASITE MINERALIZATION AND ITS OXIDIZED EQUIVALENT

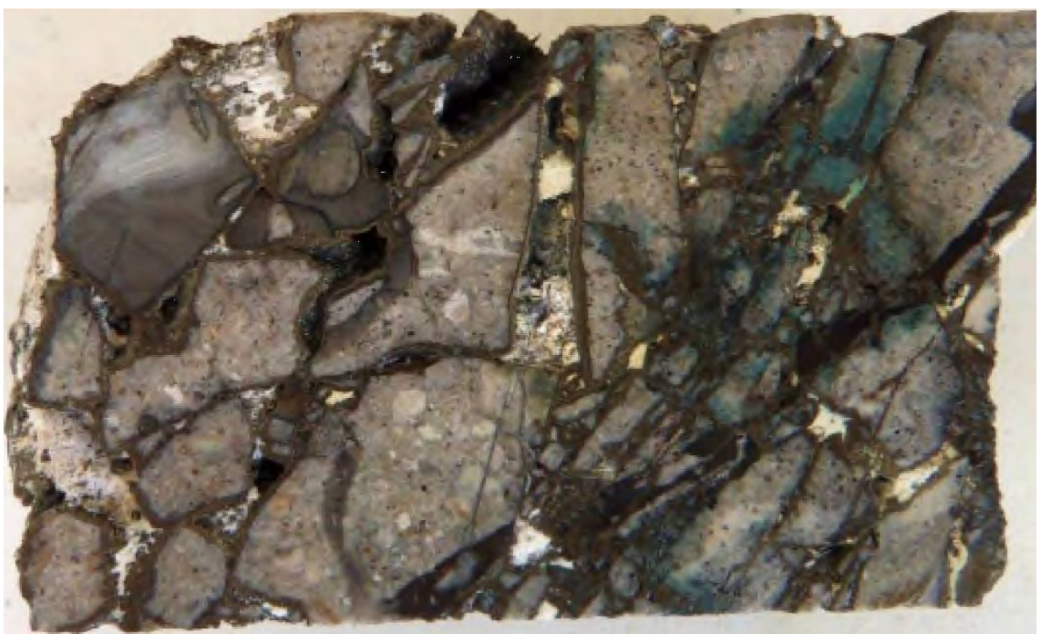


FIGURE 7-10: LATE PYRITE-MARCASITE CEMENTING BRECCIAS IN SILICIFIED VOLCANICLASTICS

8 DEPOSIT TYPES

The following section has been adapted from Blanchflower, 2010.

The Rodeo property hosts gold- and silver-bearing mineralization with metallogenic characteristics commonly associated with a low-sulphidation (adularia-sericite) epithermal mineralizing system. Epithermal or high-level hydrothermal systems are defined to occur from depths of less than 2 km to surficial hot spring settings hosted by a variety of geological environments but usually by Tertiary-age volcanic rocks associated with subduction zones at plate boundaries (Panteleyev, 1996).

Volcanic rocks of calc-alkaline andesitic composition are the most common host rocks, usually in areas with bimodal volcanism and extensive subaerial ash flow deposits and less commonly associated with alkalic intrusive rocks, shoshonitic volcanics, or clastic and epiclastic sediments in intra-volcanic basins (Panteleyev, 1996). Epithermal systems can be of any age, usually related to their host volcanic rocks but invariably slightly younger in age (0.5 to 1 Ma, more or less). Older epithermal deposits are less common due to the effects of erosion or metamorphism (Sillitoe, 1993).

Regional tectonic settings for epithermal systems comprise volcanic island and continent-margin magmatic arcs or continental volcanic fields with extensional structures. Regional-scale fracture systems are common structural controls related to grabens, resurgent calderas, flow-dome complexes and, rarely, maar diatremes. Extensional structures in volcanic fields (normal faults, fault splays, ladder veins, cymoid loops, etc.) ore common, as are local graben or caldera-fill clastic rocks. High-level (subvolcanic) stocks and/or dykes and pebble breccia diatremes may be present in the deposition environment, in addition to locally resurgent or domal structures related to underlying intrusions (Panteleyev, 1996).

Low-sulphidation epithermal mineral deposits form in both subaerial, predominantly felsic, volcanic fields in extensional and strike-slip structural regimes and island arc or continental andesitic stratovolcanoes above active subduction zones. Near-surface hydrothermal systems are localized by structurally- and permeability-focused fluid flow zones where there are relatively dilute and cool mixtures of magmatic and meteoric fluids with temperatures between 200°C and 300°C (Sillitoe, 1993). Mineral deposition occurs as the fluids undergo cooling and degassing by fluid mixing, boiling and decompression (Panteleyev, 1996).

Mineralization is typically localized in structures but may occur in permeable lithologies. Upward-flaring mineralized zones centred on structurally controlled hydrothermal conduits are common. Large (> 1 m wide and hundreds of metres in strike length) to small veins and stockworks are common with lesser disseminations and replacements. Vein systems can be laterally extensive, but ore shoots hove relatively restricted vertical extent. Higher grade mineralization is commonly found in dilational zones in faults at flexures and splays (Panteleyev, 1996).

Quartz veins, stockworks and silicified tectonic breccias commonly host gold, silver, electrum, argentite and pyrite with lesser and variable amounts of sphalerite, chalcopyrite, galena, rare tetrahedrite and sulphosalt minerals. The mineralization commonly exhibits open-space filling textures and is associated with volcanic-related hydrothermal to geothermal systems. Mineral deposits are commonly zoned vertically over 250 to 350 metres from a base metal-poor, gold- and silver-rich top to a relatively silver rich base metal zone and an underlying base metal-rich zone grading at depth into a sparse base metal, pyritic zone.

Open-space filling, symmetrical and other layering, crustification, comb structure, colloform banding and multiple brecciation are common vein textures. Repetitive generations of quartz and chalcedony ore commonly accompanied *by adularia and calcite, and pervasive silicification in vein envelopes is usually flanked by sericite-illite-kaolinite assemblages. Intermediate argillic alteration (kaolinite-illite-montmorillonite + smectite) may form adjacent to veining and advanced argillic alteration (kaolinite) may form along the tops of mineralized zones. Propylitic alteration dominates at depth and peripherally. Weathered bedrock exposures are often characterized by resistant quartz 'ledges' and extensive flanking bleached, clay-altered zones with jarosite and other limonite minerals (Panteleyev, 1996).*

There are many documented examples of low-sulphidation epithermal-type mineral deposits. Since the early 1980's exploration for these types of deposits has focused along the Cordillera and Andean tectonic belt from Alaska to southern Chile. There are a number of international examples of low-sulphidation epithermal mineral deposits including: Toodoggone district deposits in British Columbia, Canada; Comstock and Aurora deposits in Nevada, USA; El Bronce, Chile; Guanajuato, Mexico; Colgui, Peru; and Ladolam in Lihir, Papua-New Guinea.

The Rodeo property is situated in the highly productive central Mexican silver belt on the same regional structural feature that extends northwesterly to the gold-silver (± Pb, Zn) districts of Inde and Magistral del. (Hillemeyer, 1997).

A schematic cross-section of the epithermal deposit model after Berger and Eimon, 1983 is shown in ***Figure 8-1****.*

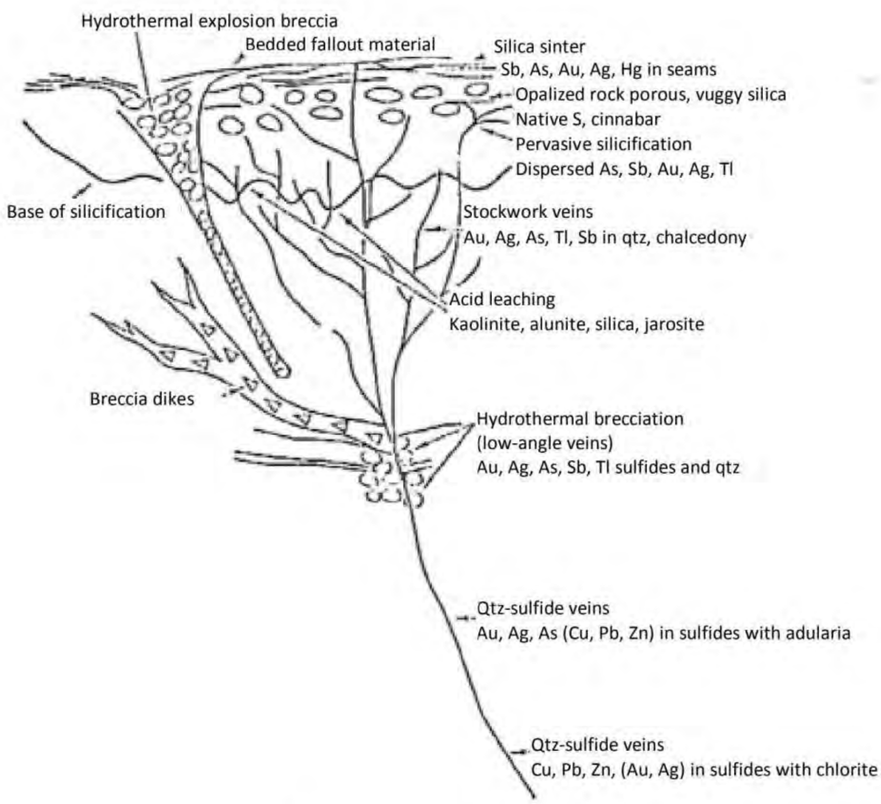


FIGURE 8-1: SCHEMATIC CROSS-SECTION OF THE EPITHERMAL DEPOSIT MODEL (AFTER BERGER AND EIMON, 1983)

9 EXPLORATION

The following section of the Exploration activities is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

Exploration activities conducted by Minera Cordilleras consist of:

- *Surface geologic mapping of the property and immediate deposit area;*
- *Creation of a topographic surface through point surveying; and*
- *Trench sampling.*

Activities conducted by previous operators include:

- *Surface geologic mapping property at 1:25,000 scale and immediate deposit area;*
- *Alteration intensity mapping;*
- *Airborne magnetic and radiometric survey, 1,519 line-kilometers in 2010 and 2011 (raw data has not been located or provided to the author);*
- *Induced polarization geophysical surveying, 42 line-kilometer in 2010 and 2011 (raw data has not been located or provided to the author);*
- *Large scale magnetic surveys are available from GSM;*
- *Using Landsat false color imagery to look for alteration signatures;*
- *Spectral analysis to determine alteration types; and*
- *The collections of approximately 1,800 rock and soil samples throughout the area.*
    - *Few of the rock samples have recorded length and direction information, samples that do have this information have been used where appropriate.*

The Rodeo and Rodeo 2 concession boundaries have been reduced since their initial staking, therefore portions of the activities of previous explorers have taken place outside the current concession boundaries.

Minera Cordilleras cut eleven trenches in 2015. The trenches were cut perpendicular to the strike of the Rodeo deposit using a gasoline powered diamond saw and chipped into sample bags using a rock hammer. Care was taken to cut continuous samples but in many cases the terrain and vegetation caused gaps to exist in the lines. The trench lines are assumed to be continuous with only few runs of with unsampled lengths greater than approximately 1 m. Trenches were mapped during collection followed by location corrections with a total station surveying instrument, as well as correction to the topographic surface.

The trenches are located 40 m west of the where the highest-grade portion of the deposit is expected to outcrop because the silicification and mineralization does not outcrop through an apparently impermeable/less permeable volcanic layer. In the area of the trench samples this volcanic layer is absent and the silicification and mineralization is visible in outcrop however the Au grade is less than observed in the drilling in the best portion of the deposit. Figure 9-1 shows the trench sample lines as well as colored coded Au grades. Figure 9-2 shows two photos taken in the field of cut trench samples.

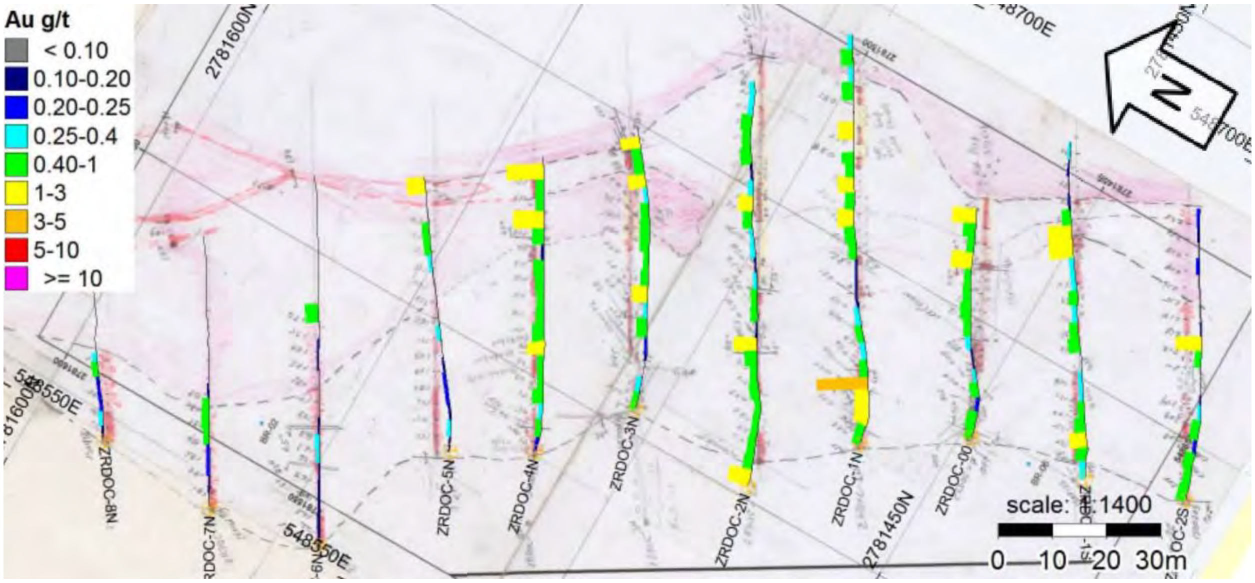


FIGURE 9-1: TRENCH SAMPLE LOCATION MAP

FIGURE 9-2: TRENCH SAMPLE PHOTOS

*The location details of the trenches are shown in Table 9-1. A total of 178 samples were collected from the trenches and submitted to ALS Chemex for Au-AA24 and ICP ME-41 analysis. The samples have a mean Au grade of 0.55 Au g/t and a mean Ag grade of 1.4 Ag g/t. A summary of the significant trench samples is shown below in **Table 9-1**. Rock samples collected on the concessions are color coded based on Au grade in **Figure 9-3**.*

TABLE 9-1: TRENCH LOCATIONS

Trench Id	Easting	Northing	Elevation	Length (m)
ZRDOC-00	548630	2781448	1436.8	46.820
ZRDOC-1N	548619	2781465	1440	79.220
ZRDOC-1S	548634	2781426	1435.4	65.260
ZRDOC-2N	548602	2781479	1440.5	79.140
ZRDOC-2S	548640	2781408	1435.8	56.160
ZRDOC-3N	548604	2781504	1448.5	54.690
ZRDOC-4N	548588	2781516	1447.7	58.040
ZRDOC-5N	548580	2781530	1449.8	54.150
ZRDOC-6N	548553	2781542	1444.6	73.020
ZRDOC-7N	548549	2781563	1448.2	54.960
ZRDOC-8N	548550	2781586	1453.8	53.520

TABLE 9-2: SIGNIFICANT HIGH GRADE TRENCH INTERVALS

Trench Id	Sample ID	From	To	Au g/t	Ag g/t
ZRDOC-1N	1500024	11.98	14.22	3.76	14.9
ZRDOC-4N	1500121	53.88	56.71	2.74	6.6
ZRDOC-4N	1500117	44.84	48.02	2.21	1.5
ZRDOC-2S	1500212	29.07	32.05	1.9	1.9
ZRDOC-00	1500019	43.79	46.69	1.765	3.8
ZRDOC-1S	1500135	43.96	47.07	1.74	2.7
ZRDOC-1S	1500136	47.07	50.04	1.73	2.3
ZRDOC-2N	1500054	26.94	29.73	1.7	4.9
ZRDOC-2N	1500045	0	3.46	1.61	7.6
ZRDOC-00	1500016	35.11	38.17	1.505	1.3
ZRDOC-3N	1500091	50.72	52.72	1.405	3.6
ZRDOC-5N	1500159	51.11	54.15	1.33	1.1
ZRDOC-3N	1500087	43.31	45.92	1.26	0.4
ZRDOC-4N	1500098	19.76	23.04	1.26	1.3
ZRDOC-1S	1500124	6.6	9.74	1.235	1.8
ZRDOC-1N	1500036	50.24	52.99	1.165	1.3
ZRDOC-1N	1500034	43.9	47	1.15	3.5
ZRDOC-1N	1500039	59.98	63.14	1.14	0.9
ZRDOC-3N	1500079	21.41	24.56	1.14	2.4
ZRDOC-2N	1500064	54.63	57.58	1.075	2
ZRDOC-1N	1500022	3.68	6.88	1.055	5.3
ZRDOC-1N	1500023	6.88	11.97	1.03	3.3
ZRDOC-1N	1500024	11.98	14.22	3.76	14.9
ZRDOC-4N	1500121	53.88	56.71	2.74	6.6
ZRDOC-4N	1500117	44.84	48.02	2.21	1.5
ZRDOC-2S	1500212	29.07	32.05	1.9	1.9
ZRDOC-00	1500019	43.79	46.69	1.765	3.8
ZRDOC-1S	1500135	43.96	47.07	1.74	2.7
ZRDOC-1S	1500136	47.07	50.04	1.73	2.3
ZRDOC-2N	1500054	26.94	29.73	1.7	4.9
ZRDOC-2N	1500045	0	3.46	1.61	7.6
ZRDOC-00	1500016	35.11	38.17	1.505	1.3

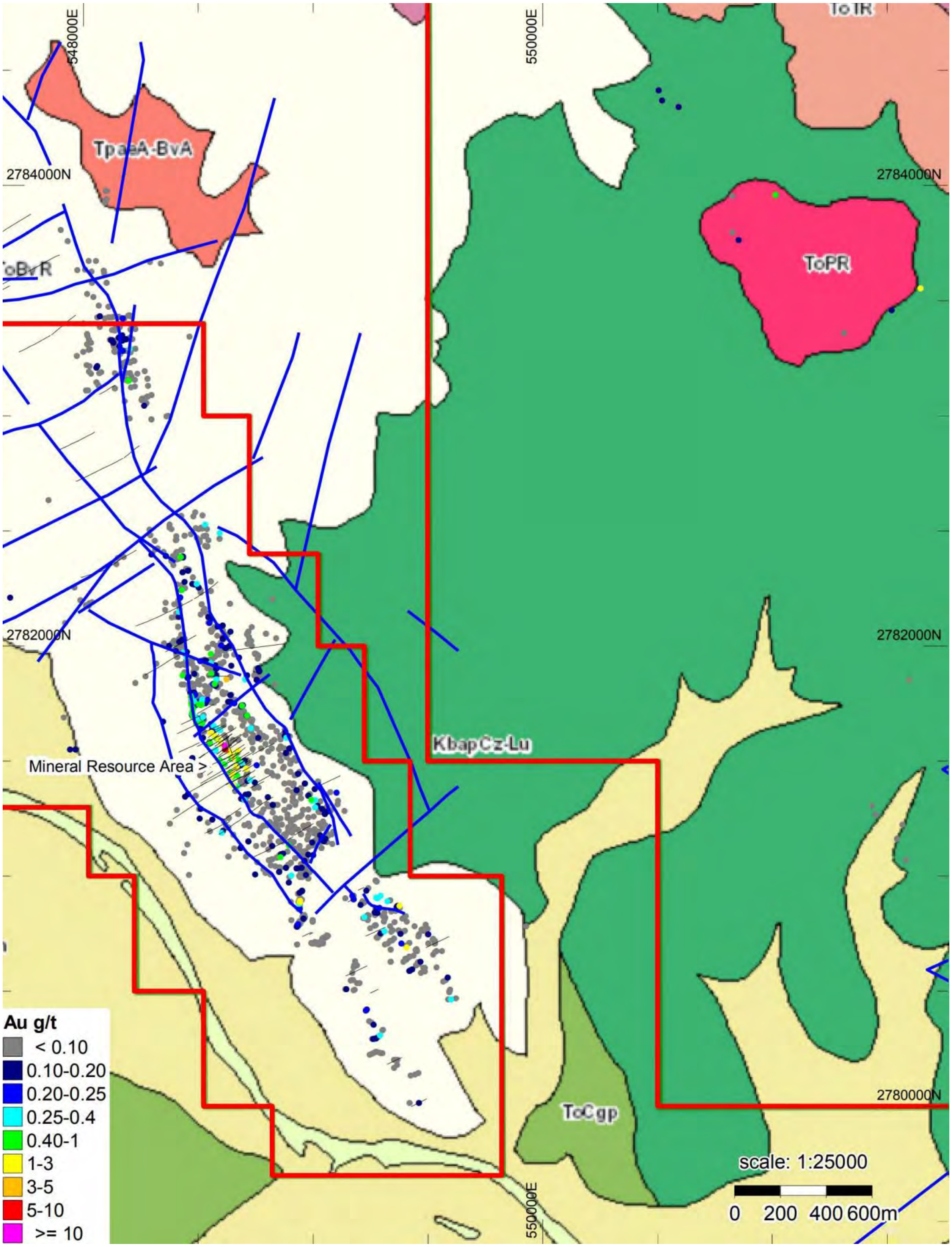


FIGURE 9-3 : CONCESSION ROCK SAMPLES

10 DRILLING

The following section of the Drilling activities is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

The project database contains 84 drill holes, totaling 13,964 m, drilled from 1995 to 2016. Of the total, 9,287 m were drilled using diamond equipment and 4,677 m with RC equipment. ***Table 10-1*** *summarizes the project drilling by company, year, and equipment type.*

TABLE 10-1: PROJECT DRILLING BY COMPANY AND TYPE

Company	Year	Type	Length (m)
Monarch Resources	1995	RC	2,289
Canplats Resources Corp.	2004	RC	2,387
Canplats Resources Corp.	2004	DD	78
Canplats Resources Corp.	2007	DD	1,034
Camino Minerals Corp.	2011	DD	6,090
Minera Cordilleras	**2016**	**DD**	**2,084**
Total			**13,964**

The 2016 drill program by Minera was completed by Moles Drilling S.A. de C.V. of Jalisco, Mexico utilizing a track-mounted rig with a 1000 m depth capacity. Drill holes started as HQ size and reduced to NQ where necessary. Surface drill hole collar locations were surveyed by handheld GPS and then by a professional surveyor with the aid of a Differential GPS and Total Station. Drill hole orientations were established by measurements of casing using a field compass and then down hole surveyed using a magnetic Reflex instrument.

Drill holes have primarily been oriented perpendicular to strike and inclined at approximately 55 degrees. The prevailing silicification of the Rodeo deposit dips from 35 to 55 degrees ESE along with the volcanic host; drill orientations have been aligned to intersect this strike and dip. Varying vein stages and structural controls cause the mineralization to exist at a range of dips from 35 degrees to near vertical.

Drilling is reported to be slow and difficult given the high level of silicification. Recovered core is broken with many zones of ruble. Measurements indicate recovery is high but based on visual review, rock quality designation (RQD) is low. ***Figure 10-1*** *shows typical recovery and RQD.* ***Figure 10-2*** *shows core recovery vs. Au g/t for the 2016 drilling by Minera Cordilleras.*

FIGURE 10-1: TYPICAL DRILL HOLE RECOVERY AND RQD (RDO16-07 17 M)

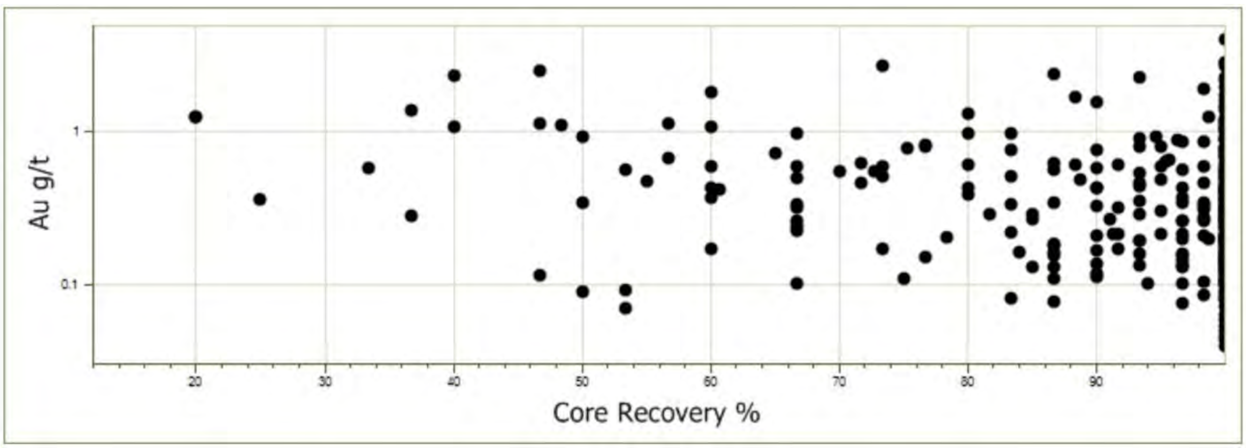


FIGURE 10-2: CORE RECOVERY VS. GRADE 2016 DRILLING

*Significant drill hole intercepts at shown in **Table 10-2**.*

TABLE 10-2: SIGNIFICANT HIGH GRADE DRILL HOLE INTERVALS

Hole Id	From	To	Length (m)	Au g/t	Ag g/t
BR-01	37.592	40.64	3.048	8.133	38
BR-02	2.032	6.096	4.064	2.622	6.1
BR-02	9.144	19.304	10.16	5.276	4.5
BR-02	25.4	29.464	4.064	2.923	10.4
BR-03	5.08	10.16	5.08	3.182	6.8
BR-03	13.208	27.432	14.224	5.341	16.5
BR-05	16.256	24.384	8.128	5.987	24.6
BR-05	27.432	33.528	6.096	2.297	15.4
BR-06	8.128	27.432	19.304	6.363	10.6
BR-06	31.496	35.56	4.064	3.13	19.8
BR-10	6.9	10.65	3.75	2.784	0
BR-11	15.24	21.336	6.096	3.533	3.3
BR-14	24.384	29.464	5.08	2.35	15.5
BR-18	44.704	47.752	3.048	1.972	21.9
BR-19	44.704	47.752	3.048	4.23	61.7
BR-21	29.464	32.512	3.048	4.463	26.2
BR-21	38.608	44.704	6.096	2.629	25.5
RDO16-02	20.5	23.5	3	2.181	3.6
RDO16-02	55.25	59.4	4.15	3.016	45.8
RDO16-04	31	36.6	5.6	2.329	10.1
RDO16-05	15.5	20.3	4.8	2.499	5.6
RDO16-06	11.5	29.4	17.9	2.529	8.6
RDO16-07	16	22	6	3.5	8.3
RDO16-07	47	50.9	3.9	1.781	28.2
RDO16-08	64	67.55	3.55	3.41	63.5
RO-11-001	12.5	36.3	23.8	7.484	14.1
RO-11-026	9.35	15.35	6	2.854	7.1
RO-11-026	21	27	6	4.398	2
RO-11-026	46.6	49.6	3	2.955	21.5
RO-11-026	54.6	60.1	5.5	2.758	32.7

*Drill holes located on the concession are shown in **Figure 10-3**. **Figure 10-4** shows the 2016 Minera Cordilleras drilling along with color coded Au grade intervals and the surface topography. Table 10-3 details the name, location and associated surface information for the Project drilling.*

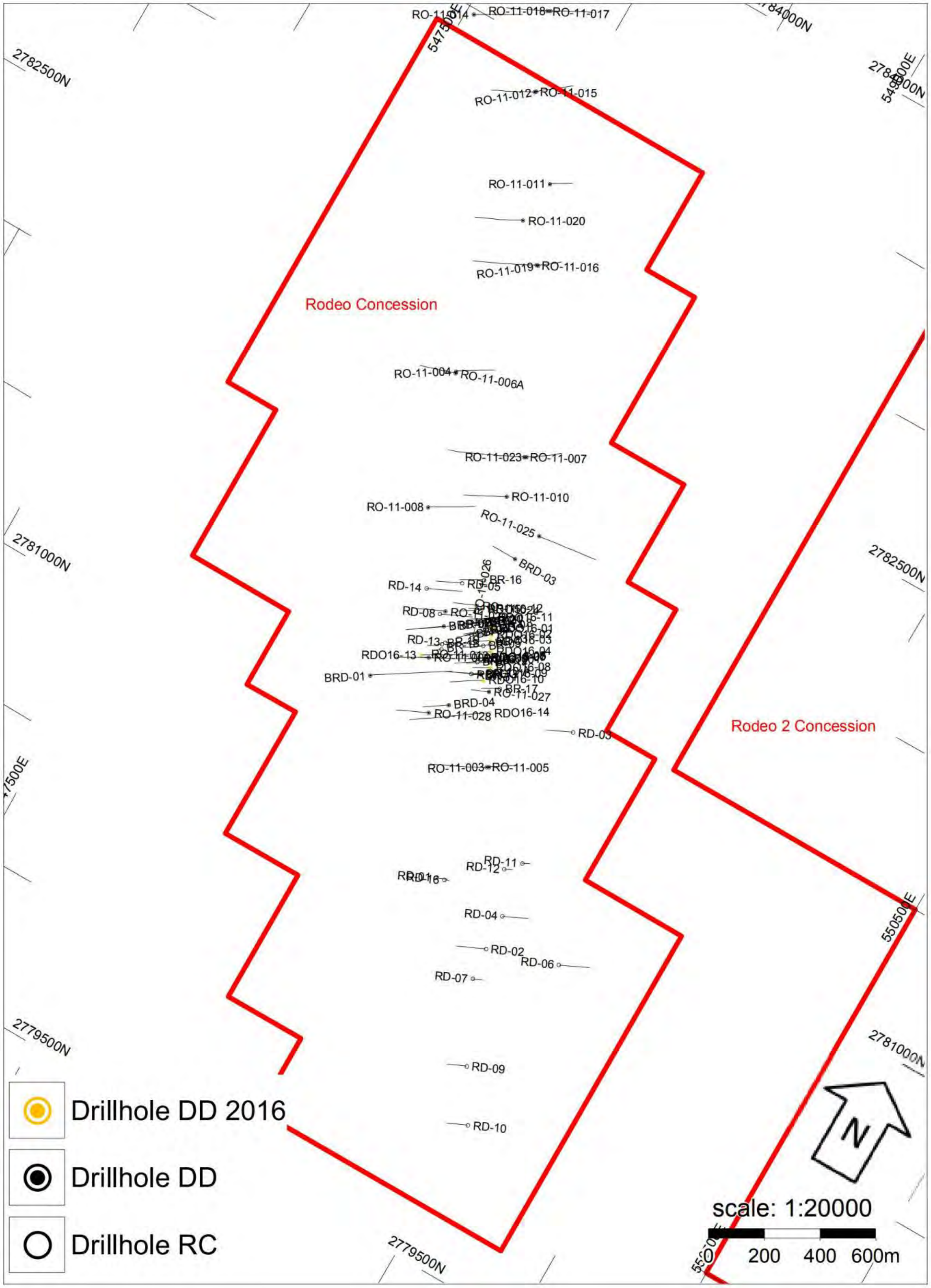


FIGURE 10-3: CONCESSION DRILL HOLE LOCATION MAP

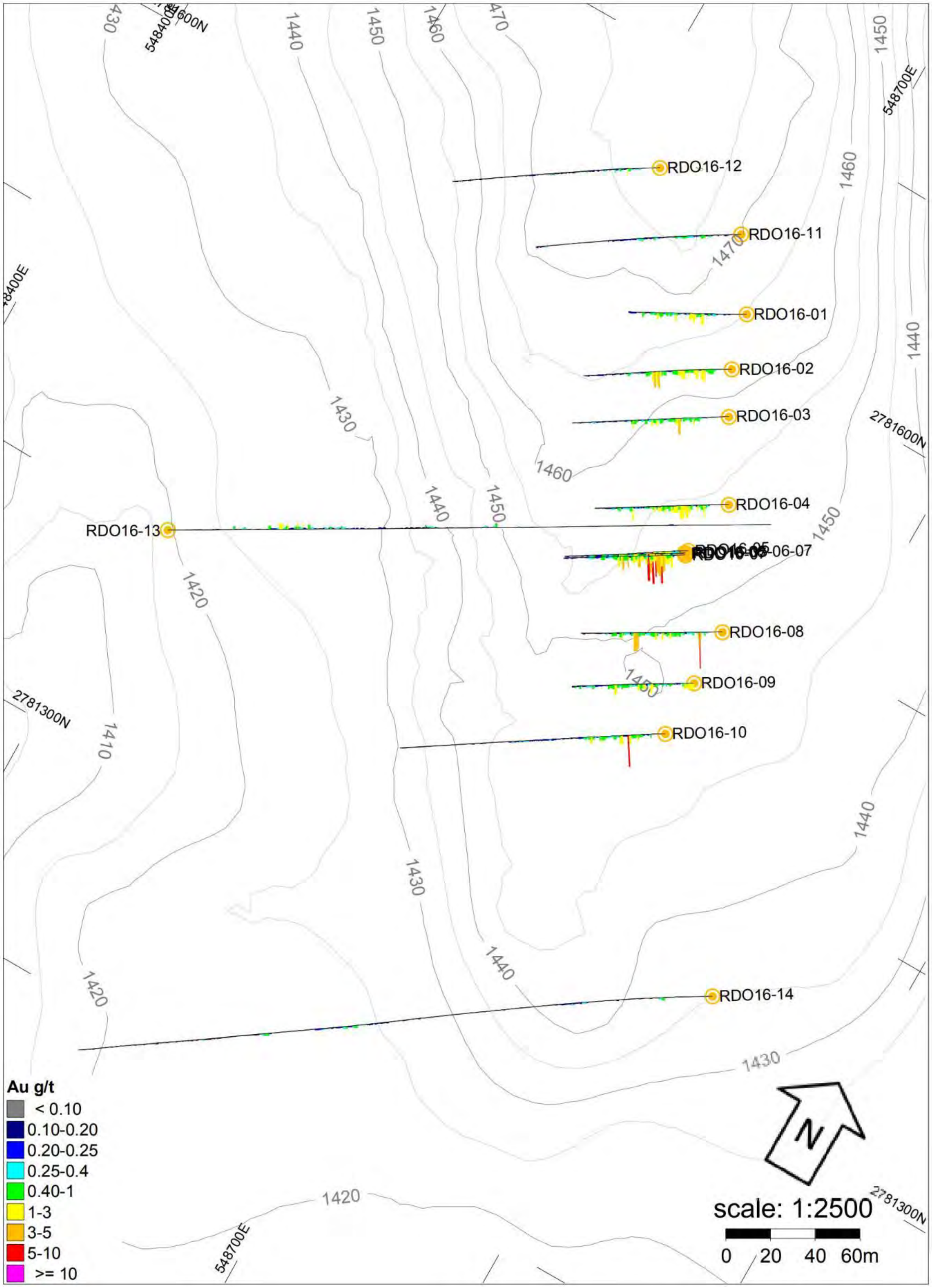


FIGURE 10-4: DRILL HOLE LOCATION MAP MINERA CORDILLERAS 2016

TABLE 10-3: DRILL HOLE LOCATIONS AND INITIAL ORIENTATIONS

Hole Id	Easting	Northing	Elevation	Total Depth (m)	Initial Azimuth	Initial Dip	No. of Surveys	Type	Company	Year
BR-01	548634.8	2781607	1470.16	132	235	-55	1	RC	Canplats	2004
BR-02	548630.8	2781604	1469.81	58	235	-57	1	RC	Canplats	2004
BR-03	548646.4	2781570.6	1465.57	81	230	-55	1	RC	Canplats	2004
BR-04	548629.7	2781555.5	1464.9	126	230	-65	1	RC	Canplats	2004
BR-05	548686.7	2781541.5	1457.11	133	235	-55	1	RC	Canplats	2004
BR-06	548696.1	2781481.6	1453.4	142.2	236	-55	1	RC	Canplats	2004
BR-07	548558.6	2781550.4	1447.9	215	235	-55	1	RC	Canplats	2004
BR-08	548691.9	2781615.7	1463.41	178	230	-50	1	RC	Canplats	2004
BR-09	548733	2781509.3	1451.79	62	236	-55	1	RC	Canplats	2004
BR-10	548730.3	2781450.3	1450.64	20.35	235	-50	1	DD	Canplats	2004
BR-10-A	548730.3	2781450.3	1450.64	58.05	235	-50	1	DD	Canplats	2004
BR-11	548726.2	2781449.2	1450.07	127	244	-50	1	RC	Canplats	2004
BR-12	548735	2781502.3	1450.79	131	237	-50	1	RC	Canplats	2004
BR-13	548704.7	2781558.2	1456.63	114	230	-50	1	RC	Canplats	2004
BR-14	548669.6	2781592.6	1464.82	125	230	-55	1	RC	Canplats	2004
BR-15	548616.5	2781656.9	1479.89	78	241	-50	1	RC	Canplats	2004
BR-16	548570.7	2781748.5	1484.8	122	240	-45	1	RC	Canplats	2004
BR-17	548814	2781439.2	1443.35	104	240	-50	1	RC	Canplats	2004
BR-18	548562.7	2781456.5	1428.42	103	230	-74	1	RC	Canplats	2004
BR-19	548555.3	2781474.1	1428.8	156	233	-70	1	RC	Canplats	2004
BR-20	548648.5	2781618.8	1473.96	69.09	235	-58	1	RC	Canplats	2004
BR-21	548645.8	2781617.1	1472.13	131	235	-58	1	RC	Canplats	2004
BRD-01	548388	2781248	1385	457.9	57	-50	1	DD	Canplats	2007
BRD-02	548528.8	2781531.2	1433.8	213.4	235	-50	1	DD	Canplats	2007
BRD-03	548631	2781868	1448	142.9	270	-50	1	DD	Canplats	2007
BRD-04	548685.1	2781297.2	1426.79	220	235	-65	1	DD	Canplats	2007
RD-01	548953	2780738	1295	91	65	-60	1	RC	Monarch	1995
RD-02	549236	2780609	1356	147.4	245	-45	1	RC	Monarch	1995
RD-03	549120	2781436	1340	150	245	-51	1	RC	Monarch	1995
RD-04	549229	2780739	1350	188	65	-60	1	RC	Monarch	1995
RD-05	548509.3	2781697.4	1472.75	146	245	-50	1	RC	Monarch	1995
RD-06	549491	2780690	1310	224	65	-60	1	RC	Monarch	1995
RD-07	549249	2780492	1380	60	65	-50	1	RC	Monarch	1995
RD-08	548495.9	2781563.5	1436.72	184	65	-50	1	RC	Monarch	1995
RD-09	549386	2780212	1292	166	245	-65	1	RC	Monarch	1995
RD-10	549495	2780031	1280	152	245	-60	1	RC	Monarch	1995
RD-11	549196	2780939	1269	60	65	-60	1	RC	Monarch	1995
RD-12	549151	2780888	1265	60	65	-60	1	RC	Monarch	1995
RD-13	548562	2781485.3	1430.71	220	65	-55	1	RC	Monarch	1995
RD-14	548406.8	2781618.6	1434.36	225	65	-55	1	RC	Monarch	1995
RD-15	548699.3	2781433.8	1447.95	178	245	-60	1	RC	Monarch	1995
RD-16	548984	2780747	1290	38	65	-60	1	RC	Monarch	1995
RDO16-01	548685.9	2781615.4	1464.98	89.4	239	-55	4	DD	MC	2016
RDO16-02	548692.5	2781590.9	1461.61	112.5	239	-55	3	DD	MC	2016

TABLE 10-3: DRILL HOLE LOCATIONS AND INITIAL ORIENTATIONS

Hole Id	Easting	Northing	Elevation	Total Depth (m)	Initial Azimuth	Initial Dip	No. of Surveys	Type	Company	Year
RDO16-03	548701.9	2781571.9	1458.94	119.1	239	-54	2	DD	MC	2016
RDO16-04	548721.5	2781537.8	1454.41	100	239	-55	2	DD	MC	2016
RDO16-05	548716	2781510.8	1453.01	46.7	239	-55	2	DD	MC	2016
RDO16-06	548715.1	2781509	1453.07	34	239	-55	2	DD	MC	2016
RDO16-07	548715.8	2781508.5	1452.88	91	239	-55	3	DD	MC	2016
RDO16-08	548747.5	2781487.1	1449.7	106.5	239	-55	2	DD	MC	2016
RDO16-09	548747.9	2781461	1449.04	91.5	239	-55	4	DD	MC	2016
RDO16-10	548748.1	2781434.9	1448.63	201	239	-55	4	DD	MC	2016
RDO16-11	548666	2781645.1	1470.28	155.5	239	-55	3	DD	MC	2016
RDO16-12	548619.6	2781652.7	1479.78	157	239	-55	4	DD	MC	2016
RDO16-13	548509.8	2781402.4	1419.18	380	60	-45	8	DD	MC	2016
RDO16-14	548824.9	2781343.9	1435.07	400	239	-45	9	DD	MC	2016
RO-11-001	548694.4	2781492.7	1455.1	304.5	240	-50	4	DD	Camino	2011
RO-11-003	548921	2781179	1415	144.5	58	-45	2	DD	Camino	2011
RO-11-004	548111	2782343	1408	218.2	57	-50	3	DD	Camino	2011
RO-11-005	548914	2781172	1409	310.5	240	-50	2	DD	Camino	2011
RO-11-006A	548113	2782337	1404	208	250	-50	3	DD	Camino	2011
RO-11-007	548477	2782201	1440	370.5	242	-45	5	DD	Camino	2011
RO-11-008	548268	2781873	1423	268.5	60	-50	3	DD	Camino	2011
RO-11-009	548538.2	2781408.4	1424.62	192.2	240	-50	3	DD	Camino	2011
RO-11-010	548492	2782046	1450	212	241	-45	2	DD	Camino	2011
RO-11-011	548068	2783092	1470	129.8	60	-50	2	DD	Camino	2011
RO-11-012	547860	2783352	1495	204.5	50	-50	3	DD	Camino	2011
RO-11-013	548735.3	2781528.4	1452.28	163.4	62	-50	2	DD	Camino	2011
RO-11-014	547528	2783479	1493	278.5	60	-50	3	DD	Camino	2011
RO-11-015	547857	2783348	1495	231.2	241	-50	3	DD	Camino	2011
RO-11-016	548172	2782815	1450	305	242	-45	3	DD	Camino	2011
RO-11-017	547751	2783622	1550	220	243	-50	3	DD	Camino	2011
RO-11-018	547760	2783626	1550	229	60	-50	3	DD	Camino	2011
RO-11-019	548177	2782817	1450	121.6	51	-45	2	DD	Camino	2011
RO-11-020	548050	2782930	1478	262.5	240	-50	3	DD	Camino	2011
RO-11-021	547637	2783793	1544	245.5	58	-50	2	DD	Camino	2011
RO-11-022	547162	2784378	1464	323.3	60	-45	4	DD	Camino	2011
RO-11-023	548483	2782205	1440	187.5	60	-50	2	DD	Camino	2011
RO-11-024	548594.5	2781656.4	1476.33	124.5	245	-50	2	DD	Camino	2011
RO-11-025	548663.8	2781981.6	1436.82	328.5	82	-47	3	DD	Camino	2011
RO-11-026	548620.1	2781609.1	1471.41	108.6	160	-45	2	DD	Camino	2011
RO-11-027	548785.2	2781410.4	1443.83	93	245	-45	2	DD	Camino	2011
RO-11-028	548636.5	2781237.4	1422.21	162	244	-45	2	DD	Camino	2011
RO-11-029	548507.2	2781581	1442.2	143	245	-45	2	DD	Camino	2011

11 SAMPLE PREPARATION, ANALYSIS AND SECURITY

The following section of Sample Preparation, Analysis and Security is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

Data summarized in this section and utilized for estimation of resources was collected by Minera Cordilleras staff. The sample preparation, analyses and security procedures implemented by Minera Cordilleras meet standard practices. The data collected is of adequate quality and reliability to support the estimation of mineral resources. Only project level staff are involved with the selection, preparation and delivery of samples to the laboratory.

The property has experienced exploration and sampling by several companies and several campaigns. Descriptions of the activities from previous explorers are available in reports by Pryor and Blackwell, McNaughton, Durning and Hillemeyer, and Blanchflower. ***Table 11-1*** *summarizes the various sampling activities from 1995 to present.*

TABLE 11-1: PROJECT SAMPLING CAMPAIGNS

Company	Year	Type	No. of Samples	Analytical Lab	Au Procedure	ICP Procedure	QA/QC	Comment
La Cuesta\ Monarch	1995	Rock	~1,400	Bondar Clegg	Unknown	Unknown	Unknown	Sub-crop sampling on 200 by 25 grid
Monarch	1995	RC	1,076	Bondar Clegg	Unknown	Aqua Regia?	Mentioned, no records available	Half split of 2 m intervals at the rig further reduced to 5 kg
Canplats	2003	Rock	422	Bondar Clegg	Unknown	Unknown	Unknown	2 km along Rodeo fault
Canplats	2004	RC	2,161	Chemex	Au-AA23, Au-GRA21,	ME-ICP61, four acid	5% duplication, no records available	Two eighth splits of 1 m interval using 10 ft rods
Canplats	2004	Pulp Au Screen	189	Chemex	Au-SCR21	NA	NA	Testing of BR series drill holes pulps
Canplats	2007	Core	437	Chemex	Au-AA23, Au-GRA21	ME-ICP61, four acid	"Standard practice" no records available	Half splits of HQ and NQ core
Camino	2011	Core	1,886	ALS Chemex	Unknown	ME-ICP41, Aqua Regia	Unknown	2010 Technical Report pre-dates drilling
Minera Cordilleras	2015	Trench	178	ALS Chemex	Au-AA24, Au-GRA22	ME-ICP41, Aqua Regia	See Text	1 inch wide channel cut with saw chipped with hammer
Minera Cordilleras	2016	Core	1,756	ALS Chemex	Au-AA24, Au-GRA22	ME-ICP61, four acid	See Text	Half splits of HQ and NQ core
Minera Cordilleras	2016	Pulp Duplicate	94	ALS Chemex	Au-AA24, Au-GRA22	ME-ICP61, four acid	NA	Duplicate testing of BR series drill hole pulps

11.1 SAMPLE PREPARATION

11.1.1 DRILL CORE

Diamond drill core is transported by truck from the rig to the core preparation site located in the city of Rodeo, by truck. Following geotechnical logging by field assistants, geologists log the core and select sample intervals. Sample intervals are selected only where the geologist anticipates mineralization to exist. In practice, the core is sampled *extensively, but is not sampled continuously from top to bottom. Drill core that is selectively unsampled can be considered waste, however no numeric value or null place holder is inserted in the project database. Sample selection begins and terminates at alteration or lithologic contacts, sampled at a minimum length of 20 cm and maximum of 2 m, with few exceptions up to 4.05 m. During the process of sample selection the geologist draws a centerline to guide the core cutters. The center line is rotated by the geologist to align with the apex of observable vein structures to minimize sample selection bias.*

A sample sheet is provided to the core cutters containing sample numbers and from, to intervals. In addition to a cut sheet the sample number and meters are annotated on the white plastic core box using a marker, ***Figure 11-1****. Sample numbering begins where the previous sample batch left off. The core cutters have been instructed to cut the core down the marked centerline using an electric powered wet diamond saw, and to always place the right-hand portion of the cut core in the sample bag. Sections of broken core or low recovery are carefully divided to reduce bias, however these sections are inherently less reliable than sections of competent core. The core cutters write the sample number using a marker on a clear plastic bag and tie off the bag using twine when complete. A tear-away sample tag system has not be implemented, but is recommended in the future. Five samples are grouped and placed in a large rice sack. The beginning and ending number of the five samples contained in the sack is written on the outside of the bag. The sack is also tied shut with twine when full.*

FIGURE 11-1: DRILL CORE SAMPLING

11.1.2 TRENCHES

Trench samples were cut using a gasoline powered diamond saw and chipped into sample bags using a rock hammer. Care was taken to cut continuous samples but in many cases the terrain and vegetation caused gaps to exist in the lines. The trench lines are assumed to be continuous with only runs of unsampled lengths greater than approximately 1 m being identified. Preparation, analyses, and security of trench and drill hole sampling are the same from placing the material in a clear plastic bag onward, with the one exception being the trench samples were analyzed with ME ICP41 using aqua regia, a partial digestion. The results of the multi-element analysis are not equivalent to the drill hole data that was analyzed using ME ICP61 that used four acid near complete digestion. Testing for Au was the same and is equivalent.

11.2 Security

The core preparation facility is located in the town of Rodeo and is enclosed by a cement wall and locked gate. Samples awaiting delivery to the ALS preparation facility in Chihuahua further stored within locked building in the facility when staff is not present. Samples are delivered to ALS Minerals in Chihuahua City, Chihuahua, Mexico (ALS Chihuahua) by Minera Cordilleras staff by road as needed, typically every two weeks during the drill hole campaign.

11.3 Analyses

Sample batches are delivered to ALS Chihuahua for preparation and then shipped to Vancouver, British Columbia, Canada (ALS Vancouver) for analysis. The ALS Vancouver laboratory is independent of Golden Minerals and Minera Cordilleras and is ISO 17025 accredited, the accreditation of ALS Vancouver encompasses preparation processes completed at ALS Chihuahua.

Samples are initially analyzed for Au using fire assay with atomic absorption spectroscopy finish (AA24) with re-run for values exceeding 10 g/t Au using fire assay with gravimetric finish (GRA22), however only quality control standard samples triggered the GRA22 rerun.

Drill hole samples were analyzed for the basic multi-element suite using four acid digestion followed by inductively coupled plasma - atomic emission spectroscopy (ME-ICP61). Trench samples were analyzed for the basic multi-element suite using aqua regia followed by inductively coupled plasma – atomic emission spectroscopy ME- (ICP41). Samples initially exceeding 100 g/t Ag are rerun using (Ag-OG62). Analysis flow is further described in graphic form in ***Figure 11-2****.*

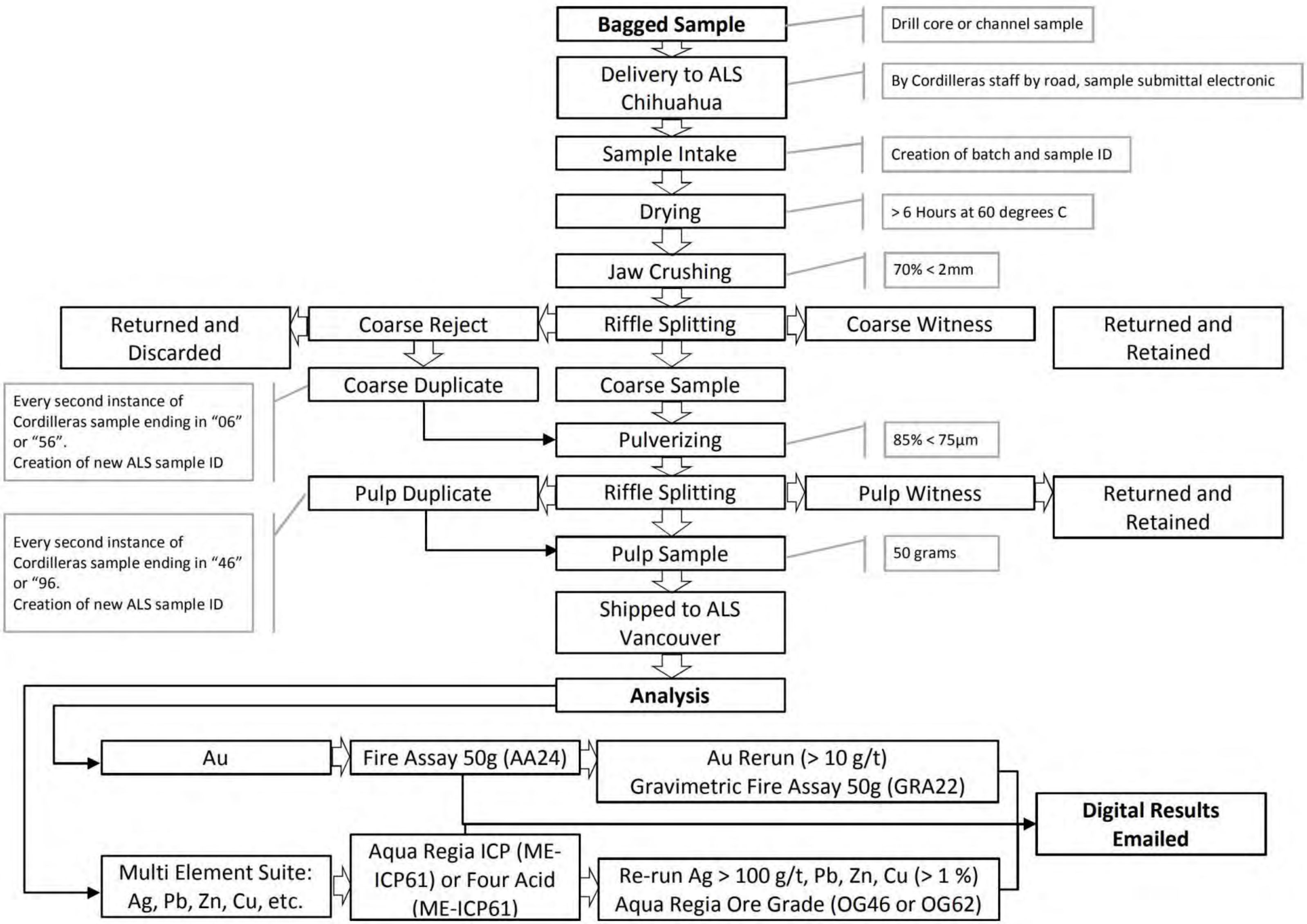


FIGURE 11-2: SAMPLE ANALYSIS FLOW DIAGRAM

11.4 Quality Assurance and Quality Control for Sample Analysis

Minera Cordilleras' quality assurance (QA) measures involve the use of standard practice procedures for sample collection for both drill core and channel sampling as described above; and include oversight by experienced geologic staff during data collection. Quality control (QC) measures implemented by Minera Cordilleras include in-stream sample submittal of standard reference material, blank material and duplicate sampling.

The insertion of control samples is dictated by the last digit of the sample id number, the sequence is independent of the drill hole or channel sample set and is continuous through the sampling campaign. For example, the first instance of a drill core sample id ending in "36" or "86" is a blank sample and is placed in a sample bag rather than a collected core sample. On the next instance of a "46" or "96" the lab is instructed on the sample submittal sheet to create and test a fine duplicate following pulverizing. The next instance of a "06" or "56" the lab is instructed to create a coarse duplicate at the crushing stage. On the next instance of "16" or "66" a low grade standard sample is placed in the sample bag instead of a collected sample and the next "26" or "76" a high grade standard. For the 2016 drill campaign 1,756 core samples were submitted and 188 control samples were submitted for a submittal rate of about one control sample for every ten normal sample.

TABLE 11-2: CONTROL SAMPLE SUBMITTAL COUNT DRILL HOLE CAMPAIGN

Control Sample Type	Count
Standard High-Grade SP-49	38 (10 invalid, not rerun)
Standard Low-Grade SE-44	38
Fine Duplicate	37
Coarse Duplicate	38
¼ Core Field Split	-
Blank	37
Total	**188**

11.4.1 Quality Control Sample Performance

*QC sample performance was generally tracked throughout the campaign by Minera Cordilleras staff and no major issues were observed but results suggest standard control sample strategies could be refined. It is recommended that standard reference material with a grade closer to the resource average for Au and Ag be sourced and tested more frequently to provide a consistent baseline. The use of standard Ap-49 should be discontinued because no instream samples trigged the +10 Au g/t rerun however this SP-49 is 18.3 Au g/t and tests the performance of the GRA22 only, submitting this standard did not track relevant lab performance. Relevant QC sample performance is summarized below. Two standard references were implemented for testing, the certified values for each is shown in **Table 11-3** and **Table 11-4** below.*

TABLE 11-3: AU STANDARD REFERENCE MATERIAL CERTIFIED VALUES

Standard	Source	Standard Grade g/t	95% Confidence Interval	Standard Deviation	Tested Count	Tested Mean	Tested Median
SE-44	RockLabs	0.61	0.006	0.017	38	0.58	0.60
SP-49	RockLabs	18.34	0.120	0.340	38	18.20	18.18

TABLE 11-4 : AG STANDARD REFERENCE MATERIAL CERTIFIED VALUES

Standard	Source	Standard Grade g/t	95% Confidence Interval	Standard Deviation	Tested Count	Tested Mean	Tested Median
SE-44	RockLabs	NA	NA	NA	38	NA	NA
SP-49	RockLabs	60.2	1	2.5	38	61	60

*Standard performance is shown in **Figure 11-3** and **Figure 11-5**. Three failures based on poor performance for SE-44 were considered batch failures, the batches were evaluated by Minera Cordilleras staff.*

TABLE 11-5: AU STANDARD REFERENCE MATERIAL CONTROL ANALYSIS

Standard	Count	Outliers	Failures
SE-44	38	1	3
SP-49	38 (10 not reran)	6	0

TABLE 11-6: AG STANDARD REFERENCE MATERIAL CONTROL ANALYSIS

Standard	Count	Outliers	Failures
SE-44	38	0	0
SP-49	38	6	0

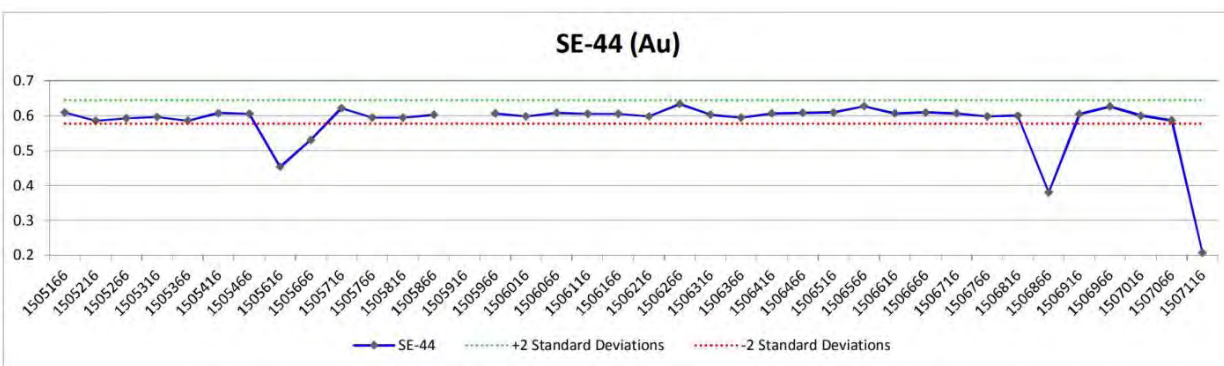


FIGURE 11-3: STANDARD PERFORMANCE SE-44 AU

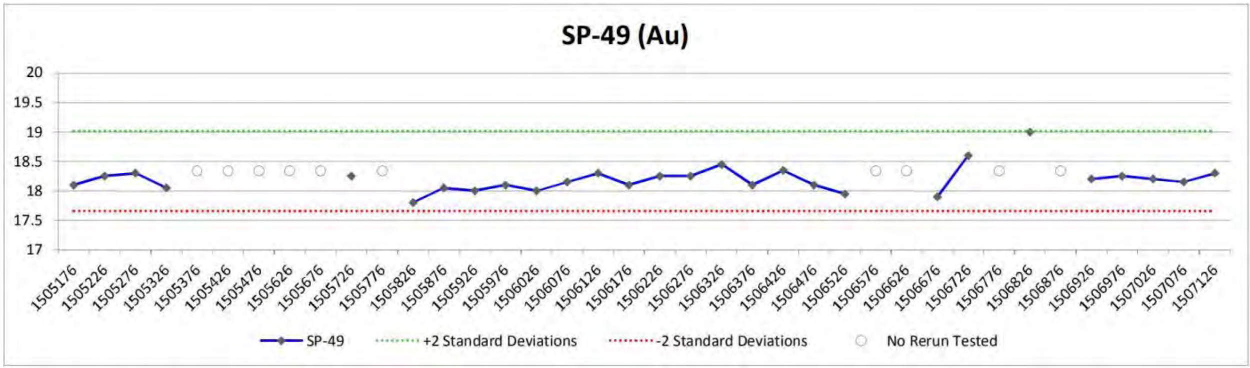


FIGURE 11-4: STANDARD PERFORMANCE SE-49 AU

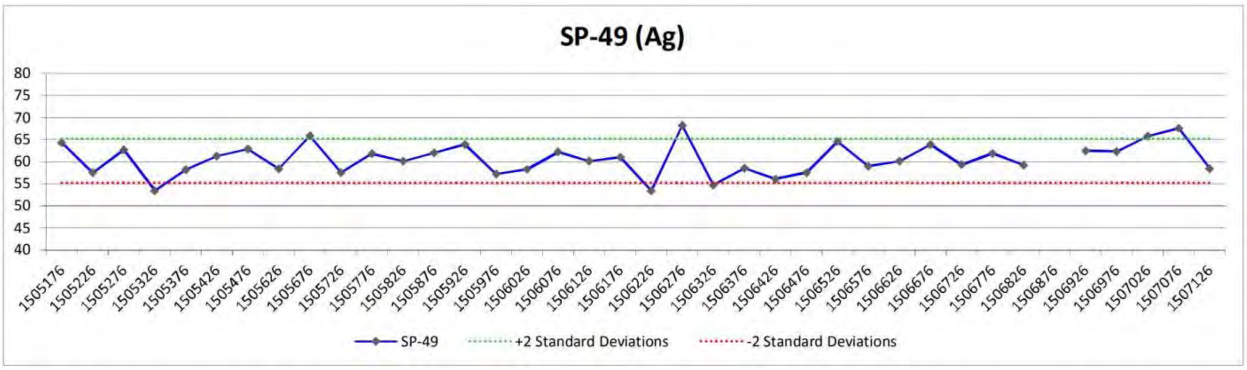


FIGURE 11-5: STANDARD PERFORMANCE SE-49 AG

The blank material was sourced from barren coarse sand. The performance of the 37 blanks submitted show no failures for Au or Ag.

Figure 11-6 *shows coarse and fine duplicate performance for Au and* ***Figure 11-7*** *shows coarse and fine duplicate performance for Ag. The performance of the fine and coarse duplicates show good reproducibility for both Au and Ag.*

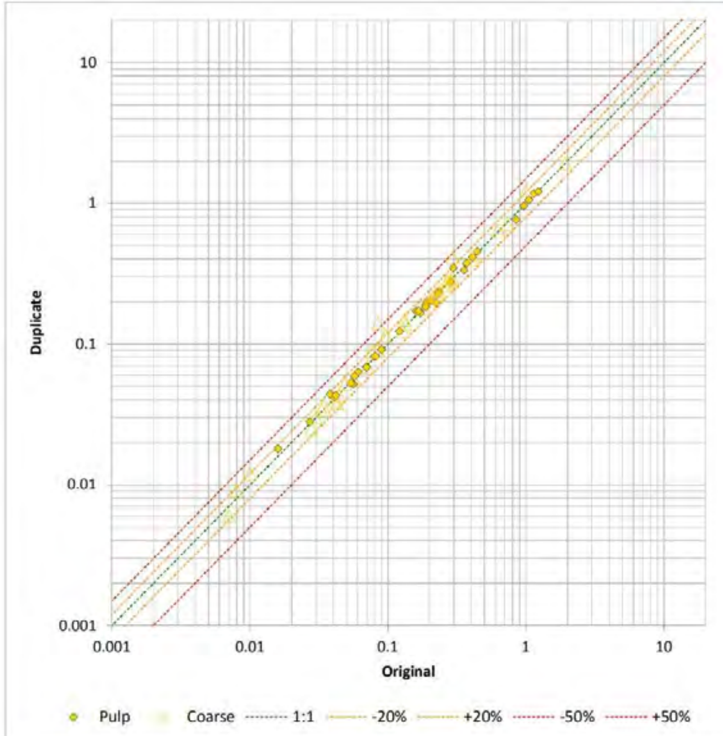


FIGURE 11-6: DUPLICATES COARSE AND FINE AU

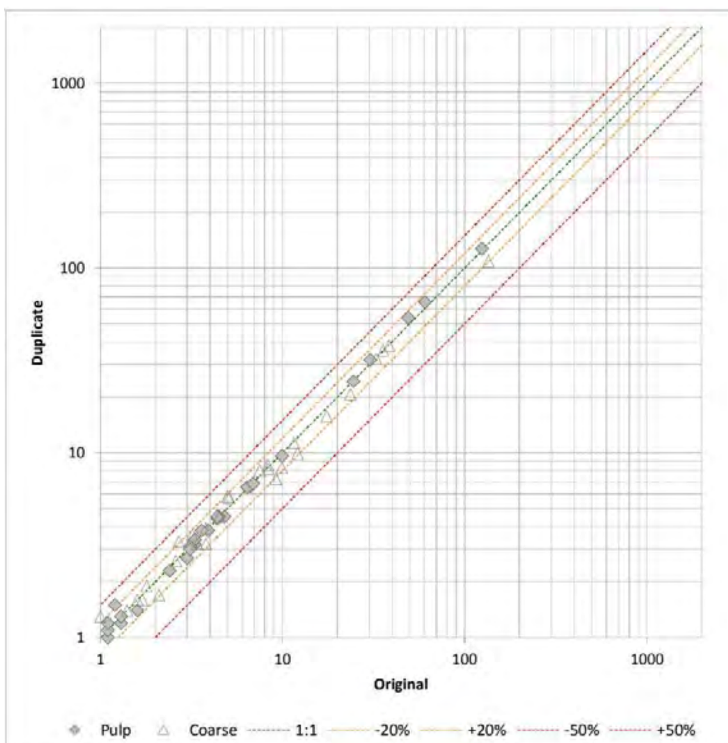


FIGURE 11-7: DUPLICATES COARSE AND FINE AG

12 DATA VERIFICATION

The following section of Data Verification is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

The quality of data collected by Minera Cordilleras meets industry standard practice and is sufficient to support the estimation of mineral resources. Data collected by previous operators has in part been verified by the corroborating data collected by Minera Cordilleras, as well as existing physical and digital records and verification sampling performed by Minera Cordilleras, as well as the previous operators. Coupled with the data collected by Minera Cordilleras, data from previous explorers is sufficient to support the estimation of mineral resources, however details regarding QA/QC protocols and performance were not available for review.

The following section describes steps taken by the author of this report to verify data provided by the company. Data verification conducted during the site visit included observations of drill hole collar locations and orientations, drill core, trench sample locations, review of previously drilled core, recently drilled core, and RC chip trays. Mineralization was witnessed in outcrop and orientations were observed. Confirmatory sampling of drill core while conducting the site visit was not deemed necessary because several generation of exploration by past explorers and the 2016 drilling campaign have confirmed the presence of mineralization, limited core resampling has been completed by previous authors and is included in ***Table 12-2****.*

Drill hole collars and their orientations were observed in the field and a handheld global positioning system (GPS) was used to check their location. Verification of collars locations and orientations were found to correspond to those provided by Minera Cordilleras. Core boxes from the following drill holes were reviewed along with the drill logs and analytical results: RDO16-06, RDO16-05, RDO16-13, and RO-ll-Ol. The following chip trays were also reviewed: BR-03, BR-06, and BR-14. The textures observed are typical of epithermal veins including banding of quartz, quartz flooding, brecciation, and minor oxidation. In addition to visually reviewing core on site, the author has reviewed core photos of mineralized intervals and spot checked the assay database with the laboratory certificates provided.

At the time of the site visit, several physical sample witnesses were available in the Rodeo storage and logging facility. ***Table 12-1*** *details the availability and conditions of physical samples.*

TABLE 12-1: SAMPLE WITNESS AVAILABILITY

Item	Condition	Availability at Rodeo Storage Facility
BR Series Pulps	Poor, damaged stacked boxes	Yes
BR Series RC Chips	Chip trays, reasonable condition	Yes
RD Series RC Chips	Chip trays, reasonable condition	Yes
BR and BRD Series Drill Core	NA	No
BRD Series Pulps	NA	Possibly with BR Pulps
RO-11 Series Drill Core	Intact half core in stacked wooden boxes, covered	Yes
RO-11 Series Pulps	Good, stacked boxes	Yes
RDO16 Series Drill Core	Intact half core in stacked plastic boxes, covered	Yes
RDO16 Series Pulps	Good, stacked boxes	Yes

For purposes of data verification collected by previous explorers and at the request of the author, Mineral Cordilleras reanalyzed 94 pulps from Canplats BR series holes. For both Au and Ag, the duplicated values compared well on a cases by case basis with the original values stored in the project database. ***Figure 12- 1*** *shows a scatter plots of the original values vs the duplicated pulp values, Au is shown on the left and Ag on the right.* ***Figure 12-2*** *compares the populations by way of a box plots.*

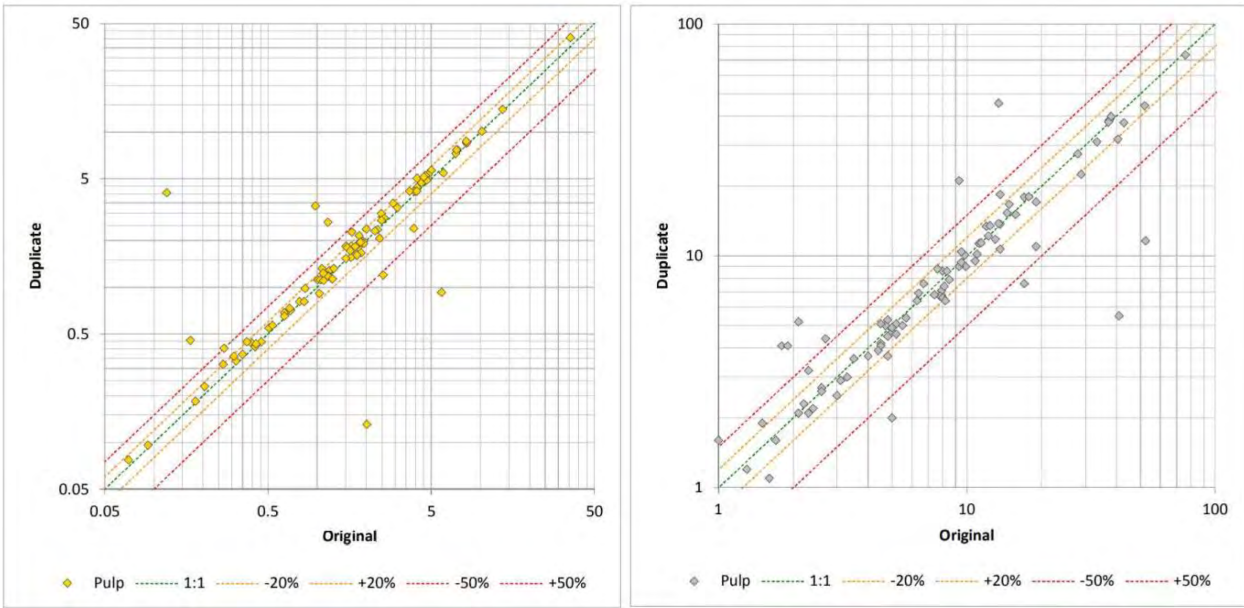


FIGURE 12-1: SCATTER PLOT PULP DUPLICATES

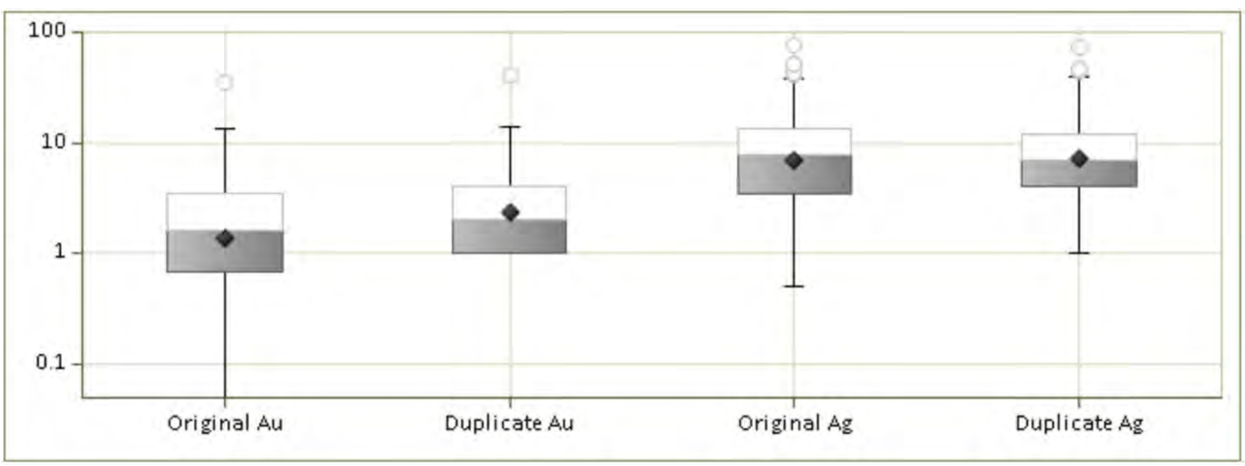


FIGURE 12-2: BOX PLOT PULP DUPLICATES

Canplats analyzed 189 pulps from the BR drill hole series at Chemex with Au-SCR21 to determine if there was a grade bias between + and - 100 micron fractions of the pulps. Based on the limited data set, ***Figure 12-3*** *indicates that the undersized (-100 micron fraction) is biased slightly higher. The undersized fraction had a geometric mean of 1.32 and median of 1.2 where the oversized fraction had a geometric mean of 0.99 and median of 1.04.* ***Figure 12-4*** *shows a scatter plot on a sample by sample basis.*

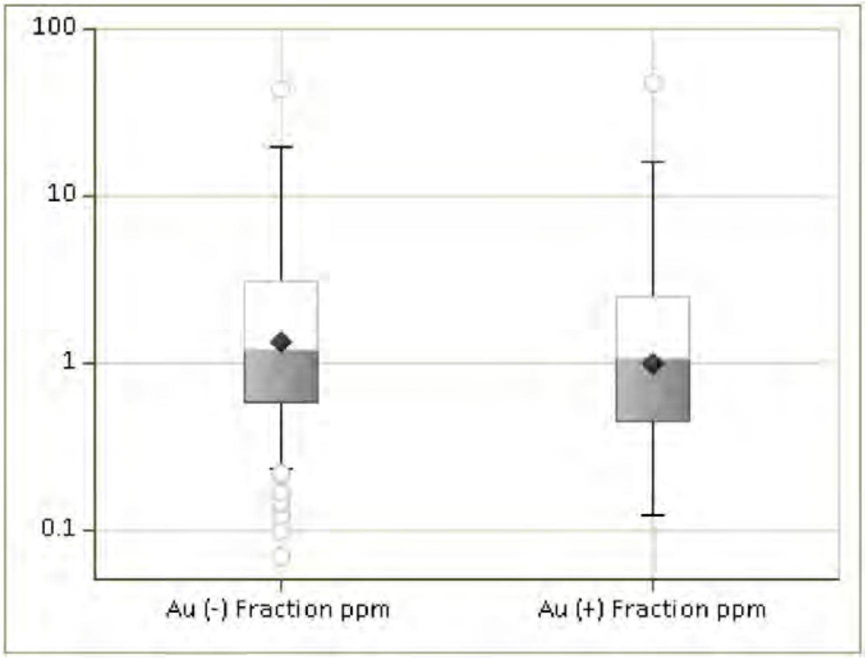


FIGURE 12-3: BOX PLOT AU SCREEN ANALYSIS FRACTION COMPARISON

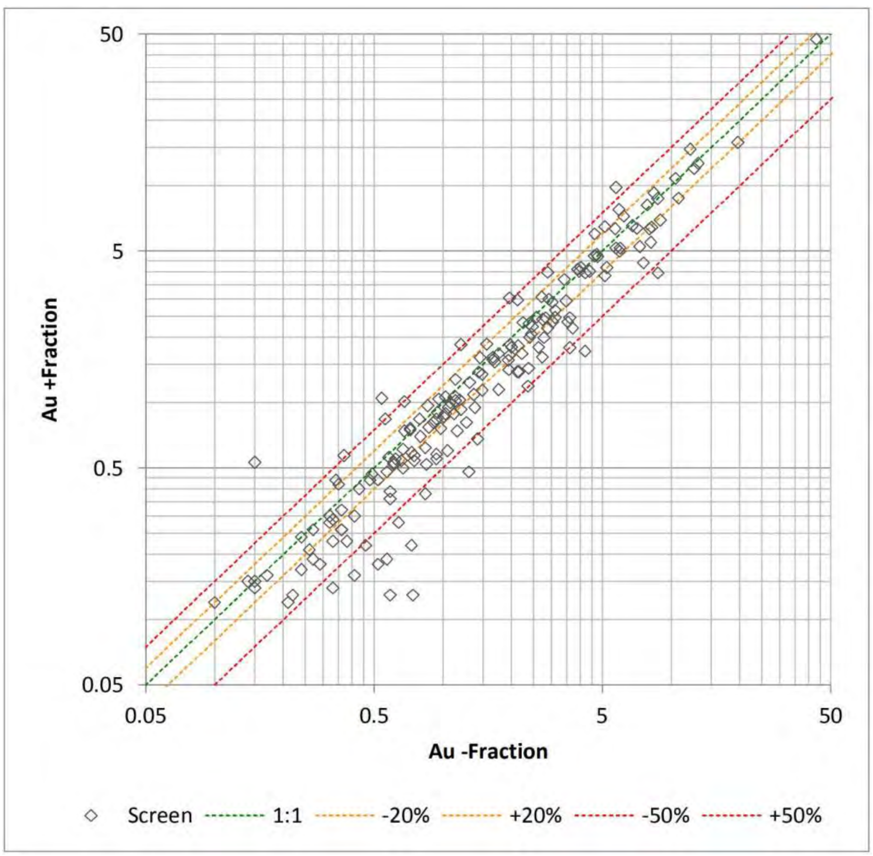


FIGURE 12-4: SCATTER PLOT AU SCREEN ANALYSIS FRACTION COMPARISON

In terms of duplicate sampling for verification purposes, the screen analysis verified the original assays. A scatter plot comparing the original sample values to the weighted combined screen value is shown in ***Figure 12-5****.*

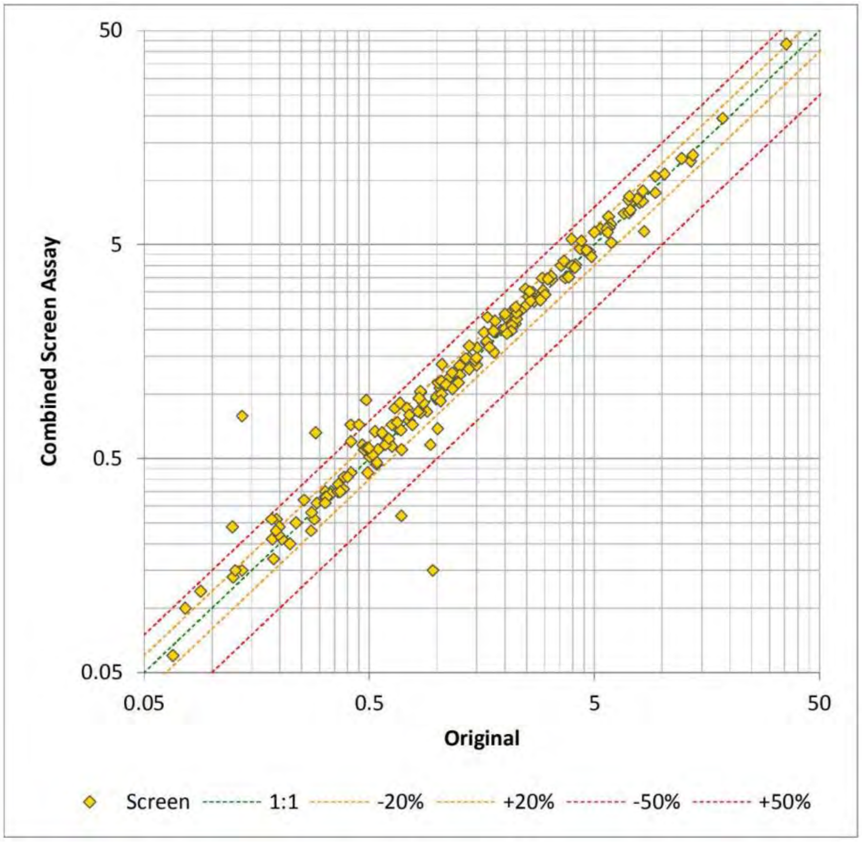


FIGURE 12-5: SCATTER PLOT SCREEN DUPLICATES AU

Table 12-2 *compares original sample values to verification samples collected by Blanchflower in 2009*

TABLE 12-2: VERIFICATION CORE SAMPLING (BLANCHFLOWER, 2010)

Hole Id	Verification ID	Original ID	From	To	Original Au g/t	Duplicate Au g/t	Original Ag g/t	Duplicate Ag g/t
BRD-01	E014764		312.90	314.10	0.048	0.030	3.5	4.60
BRD-02	E014769	355189	91.8	92.8	1.585	0.677	2.4	4.6
BRD-02	E014770	355194	96.4	97.1	0.679	0.731	13.4	18.1
BRD-02	E014771	355214	117	118.8	1.210	1.445	41.9	61.8
BRD-03	E014772	355310	20.2	21.1	0.236	0.249	3.8	2.4
BRD-03	E014773	355314	23.85	25.35	0.341	0.272	9.5	8.2
BRD-04	E014774	355401	72.35	73.35	1.105	0.677	4.4	3.8
BRD-04	E014775	355451	150.6	152.15	1.800	1.835	+100	130

13 Mineral Processing and Metallurgical Testing

Two metallurgical studies have been performed on the Rodeo Project resource material: a study by PRA in 2011, and a study by Resources Development Inc. (RDi) in 2017. Both PRA and RDi found that the material was not amenable to a heap leach process. RDi's testing showed a maximum gold extraction of 24.2%, and a maximum silver extraction of 14.1% with a static heap leach test. However, both groups (PRA and RDi) testing showed positive results for an agitated leach circuit, and RDi's testing shows a maximum gold extraction of 85.7% and silver extraction of 76.3%.

A gold extraction of 83.8% and silver extraction of 76.3% have been used for the design basis of this PEA. These recovery values are based on achieving an overall grind of P_{80} 150 mesh.

The following section of RDi Test Work Program is from the Report: Leach Test Program Rodeo Project, Golden Minerals, issued April 19, 2017 by RDi – Resource Development Inc.

13.1 2017 RDi Test Work Program

The 2017 RDi test work was performed on a 30 kg samples received from Golden Minerals. The samples were split into 1 kg charges for various tests and samples were used to determine the head analysis. ***Table 13-1*** *is RDi's head analysis of the two samples.*

TABLE 13-1: RDI HEAD GRADE ANALYSIS

Element	Low Grade	High Grade
Au, g/mt	1.370	3.310
Ag, g/mt	5.6	14.0
Organic C, %	0.03	0.02
Inorganic C, %	0.01	<0.01
Total C, %	0.04	0.02
Sulfide S %	0.31	0.85
Sulfate S %	0.16	0.73
Total S %	0.46	1.59
ICP Data		
%		
Al	2.13	0.94
Ca	0.06	0.01
Fe	0.90	4.00
K	1.63	1.48
Mg	0.03	<0.01
Na	0.05	0.06
Ti	0.04	0.01
ppm		
As	70	165
Ba	954	318
Bi	<10	<10
Cd	<1	4
Co	22	45
Cr	193	111
Cu	19	4
Mn	82	26
Mo	6	7
Ni	8	<5
Pb	<10	<10
Sr	52	35
V	32	32
W	<10	<10
Zn	36	19

The primary minerology for the samples was quartz; the low-grade sample is 92% quartz and the high-grade sample is 76% quartz. The high-grade sample contained 20% jarosite. Both samples contained a small amount of pyrite and the gold occurs as 2.5 to 5-micron grains locked in the quartz.

A Bond's Ball Mil Work Index test was completed with the sample at a closed size of 10 mesh (150 microns). The work index was determined to be 25.3 kwh/st which indicates that the sample is very hard.

A flotation test was completed with a high grade composite; the recoveries were poor, 56.3% for the gold and 46.7% for the silver.

13.1.1 BOTTLE ROLL LEACH TESTING

A series of cyanide bottle roll leach tests were completed with the high grade composite to determine the effect of grind size on precious metal recovery. Bottle roll leaches were completed at primary grinds of P_{80} 100, 150, and 200 mesh. The material was slurried to 40% solids and the pH was adjusted to 11 with hydrated lime. Cyanide was then added to a calculated level of 1 g/L NaCN and maintained throughout the 72 hour test. ***Table 13-2*** *summaries the bottle roll leach test results.*

TABLE 13-2: BOTTLE ROLL LEACH TEST RESULTS

Grind (P_{80})	Extraction %		Residue Grade		Calc Head Grade		NaCN Consumption (kg/mt)	Lime Consumption (kg/mt)
	Au	Ag	Au (g/mt)	Ag (g/mt)	Au (g/mt)	Ag (g/mt)		
100 mesh	80.0	72.1	0.54	2.8	2.70	10.1	1.648	9.114
150 mesh	83.8	76.3	0.47	2.4	2.90	10.1	1.584	9.227
200 mesh	85.7	73.4	0.40	3.0	2.79	11.3	1.786	11.102

The leach results indicate the following:

- *The gold extraction appears to be size dependent. The lowest gold extraction was observed at a grind of 100 mesh (80.0%), while the highest extraction was observed at a grind of 200 mesh (85.7%). Silver extractions ranged from 72.1% to 76.3% for all three tests.*
- *The precious metals readily leached from the sample with a minimum of 97% of the overall extraction occurring within the first 24 hours of leaching.*
- *Reagent consumptions averaged 1.67 kg/mt for NaCN and 9.81 kg/mt for lime.*

13.1.2 STATIC LEACH TESTING

Static leach tests were completed with the low grade composite sample to determine the leach characteristics at various crush sizes. Static leach test results are predictive of column leach results and can provide leach information with les sample, decreased cost and schedule as compared to a full set of column tests.

The static leach tests were conducted at three different crush sizes (P80 1", P80 3/4", and P80 1/2") for each composite sample. Each test charge of material was placed in a bucket and covered with 1.0 g/L sodium cyanide solution. Solution samples from each leach test were taken every day for the first four days, and then every 2 to 3 days for the duration of the test. The material was gently mixed prior to sampling. The pH was adjusted and sodium cyanide was added to return the concentration to 1.0 g/L for each test, if necessary. Al tests were conducted for a total of 21 days. The leach residue was then filtered, washed, and prepared for assay of gold and silver. Solution samples were also submitted for gold and silver analysis. The gold and silver recovery was determined based on the calculated head assay for each test. ***Table 13-3*** *summarizes the static leach test results.*

TABLE 13-3: STATIC LEACH TEST RESULTS

Crush Size (P_{80})	Extraction % (21 Days)		Residue Grade		Calc Head Grade		NaCN Consumption (kg/mt)	Lime Consumption (kg/mt)
	Au	Ag	Au (g/mt)	Ag (g/mt)	Au (g/mt)	Ag (g/mt)		
1/2 inch	24.2	14.1	0.67	2.6	0.88	3.0	1.953	1.798
3/4 inch	21.1	12.4	0.55	2.4	0.70	2.7	1.982	1.747
1 inch	17.3	10.1	0.69	2.8	0.83	3.1	1.821	1.811

The leach results indicate the following:

- *The precious metal extraction was poor for all tests. The maximum gold extraction was 24.2% after 21 days of leaching, while the maximum silver extraction was 14.1%.*
- *The gold extraction appears to be dependent upon crush size. The lowest gold extraction was observed at a crush of 1 inch (17.3%), while the highest extraction was observed at a crush of 1/2 inch (24.2%). Silver*

extractions ranged from 10.1% to 14.1% for all three tests. Reagent consumptions averaged 1.93 kg/mt for NaCN and 1.79 kg/mt for lime.

13.1.3 CONCLUSIONS

The following conclusions can be drawn from the test work:

- *The low grade and high grade samples have similar mineralogy, with the high grade sample containing significantly more jarosite (20% by weight). The low grade sample assayed 1.37 g/mt Au and 5.6 g/mt Ag while the high grade sample assayed 3.31 g/mt Au and 14.0 g/mt Ag.*
- *The high grade sample is considered very hard with a Bond's Ball Mill Work Index of 25.3 kwh/st.*
- *The high grade sample did not respond favorably to flotation. Only 56.3% of the gold and 46.7% of the silver was recovered in the flotation concentrate.*
- *Bottle roll cyanide leach testing of the high grade sample resulted in gold extractions of 80.0% to 85.6%. The gold extraction is size dependent with the lowest extraction at a grind of 100 mesh and the highest extraction at a grind of 200 mesh. Silver extractions ranged from 72.1% to 76.3% for al tests. The precious metals readily leached from the sample within 24 hours. Reagent consumptions averaged 1.67 kg/mt for NaCN and 9.81 kg/mt for lime.*
- *Static cyanide leach testing of the low grade sample resulted in por gold extractions ranging from 17.3% to 24.2%. The gold extraction is size dependent with the lowest extraction at crush of 1 inch and the highest extraction at a crush of 1/2 inch. Silver extractions ranged from 10.1% to 14.1% for al tests. Reagent consumptions averaged 1.93 kg/mt for NaCN and 1.79 kg/mt for lime.*

13.2 2004 PRA TEST WORK PROGRAM

The following sections of 2004 PRA Test Work Program is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

The 2004 PRA test work program consisted of preliminary sample characterization, as well as bottle roll cyanidation of 7 samples under "as received" particle sizes alongside testing at a P8o of 200 mesh. Seven samples were sourced from eight continuous intervals from RC rejects from four drill holes for testing. Sample intervals are located in ***Table 13-1****.*

TABLE 13-4: 2004 SAMPLE MATERIAL DRILL HOLE INTERVALS (PRA 2004)

Sample ID	Hole ID	From	To	Head Au g/t	Head Ag g/t
BR2 02 to 29	BR-02	2	29	2.45	4.65
BR3 06 to 13, 24 to 38	BR-03	6	13	1.83	7.63
BR3 14 to 23	BR-03	14	23	6.8	13.5
BR3 06 to 13, 24 to 38	BR-03	24	38	1.83	7.63
BR5 17 to 24	BR-05	17	24	5.64	19.6
BR5 25 to 38	BR-05	25	38	1.91	10.3
BR6 9 to 24	BR-06	9	24	12.8	13.9
BR6 25 to 35	BR-06	25	35	3.04	8.82

13.2.1 CHARACTERIZATION OF FEED SAMPLES

Amongst the seven samples tested, in all but one case, the gold grades appeared uniform across various size fractions. However, silver grades were noticeably elevated in the minus 37 pm fraction for all as received samples tested.

No additional mineralogy was performed, nor was the "as received" particle size distribution provided beyond the reported P80 values. No size by size fraction testing was performed for the ground samples, either pre or post leaching. In the absence of size fraction analysis on ground samples, it is premature to assess the degree to which liberation of gold and silver aided or hindered subsequent leaching responses. However, as discussed later in regards to the bottle roll testing, extraction of both gold and silver was noticeably improved at a P80 of 200 mesh, suggesting that liberation could potentially be a factor.

Based on input provided by Golden Minerals, it is also believed that the higher grade samples selected are more heavily silicified. If this were to prove applicable, specifically in regards to the gold and silver mineralogy, then it is possible that low grade materials may exhibit higher recoveries than their high grade counterparts under otherwise identical conditions. As no low grade material has been tested, this assumption is preliminary. For purposes of resource estimation, it is believed that this is sufficient justification for the use of higher recovery values for a lower grade resource than was obtained on the "as received" high grade samples from the 2004 PRA program. Follow up testing, in addition to that mentioned in the PRA report, is required to confirm the validity of this assumption.

13.2.2 BOTTLE ROLL TESTING

Bottle roll testing was performed at a sodium cyanide concentration of 1 g/L at a pH of 10.5 for 48 hours for as received and ground samples.

*For the coarse as-received samples (1500 to 4200 microns), at a retention time of 48 hours gold extraction ranged from 17% to 41% and silver extraction ranged from 27% to 56%, **Table 13-2**. Given the comparatively short retention times in relation to heap leaching conditions, it is not clear if extraction had plateaued or if further increases would have occurred with additional time. As discussed in regards to characterization, it is believed that these high grade samples were more heavily silicified, and potentially more refractory than low grade materials.*

TABLE 13-5: BOTTLE ROLL RESULTS - AS RECEIVED (PRA 2004)

Sample ID	Head Au g/t	Head Ag g/t	P80 µm	Au Extraction %	Au Residue g/t	Ag Extraction %	Ag Residue g/t
BR2 02 to 29	2.45	4.65	3932	41.8	1.3	43.1	2.6
BR3 06 to 13, 24 to 38	1.83	7.63	1512	37.7	1.25	44.1	4.8
BR3 14 to 23	6.8	13.5	1548	41.3	3.69	51.9	7
BR3 06 to 13, 24 to 38	1.83	7.63	1512	37.7	1.25	44.1	4.8
BR5 17 to 24	5.64	19.6	3599	32.6	3.32	46.1	9.3
BR5 25 to 38	1.91	10.3	2276	31.2	1.38	53.8	8.8
BR6 9 to 24	12.8	13.9	1898	27.8	9.58	56.3	6.5
BR6 25 to 35	3.04	8.82	4182	17.1	3.13	27.7	7.6

*For the ground material (P80 = 74 microns), gold extraction ranged from 71% to 82%, and silver extraction ranged from 84% to 92%, **Table 13-3**. These conditions are more analogous to milling rather than heap leaching, and thus form the basis for the mill recoveries. In the case of both gold and silver, neither metal appeared to have plateaued at 48 hours, which implies that longer retention times of 72 or 96 hours could potentially result in a higher recovery.*

TABLE 13-6: BOTTLE ROLL RESULTS - GROUND (PRA 2004)

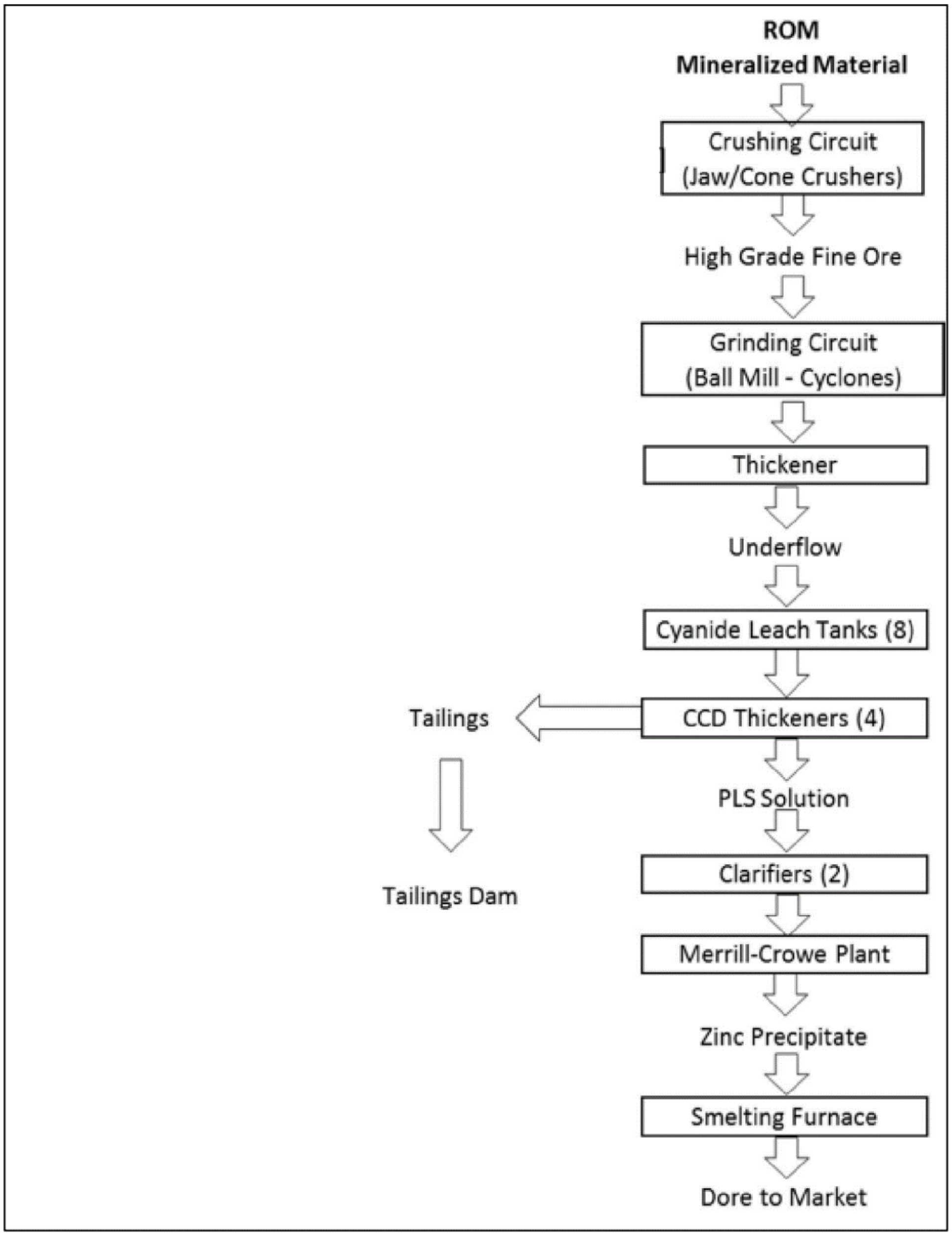
Sample ID	Head Au g/t	Head Ag g/t	P80 µm	Au Extraction %	Au Residue g/t	Ag Extraction %	Ag Residue g/t
BR2 02 to 29	2.45	4.65	89	82.4	0.5	85.6	0.8
BR3 06 to 13, 24 to 38	1.83	7.63	81	74.7	0.51	86.9	1.3
BR3 14 to 23	6.8	13.5	69	78.1	1.55	85.4	2.4
BR3 06 to 13, 24 to 38	1.83	7.63	81	74.7	0.51	86.9	1.3
BR5 17 to 24	5.64	19.6	82	82.5	1.02	87.3	2.3
BR5 25 to 38	1.91	10.3	78	75.5	0.55	84.9	1.8
BR6 9 to 24	12.8	13.9	77	71.2	3.9	84.2	2.7
BR6 25 to 35	3.04	8.82	80	72.5	0.94	92.1	0.9

13.2.3 Reagent Consumptions

While the report indicated that reagent consumptions for sodium cyanide (NaCN) and lime were measured during the test work, this detailed data was not available for review. However, while the values were not explicitly given, the report did not affirmatively indicate consumptions were either high or low. For purposes of resource estimation it was assumed the reagent consumptions were considered "average" given the absence of discussion in the report.

Two process options are being contemplated for the Rodeo gold and silver bearing material. These options consist of constructing a heap leaching operation on site, or transporting the material to an existing mill facility at Velardena. As detailed in Section 13, the lower grade material is potentially more amenable to heap leaching due to a lesser degree of silicification, however this has not been tested as of the time of this report. However, the high grade material exhibits favorable enhanced extractions under typical milling conditions, thus better justifying the costs to deliver it to a remote mill facility. A simplified process flowsheet is shown below in ***Figure 13-1****. The mill features a conventional gold and silver cyanide leaching and Merrill-Crowe precipitation circuit.*

FIGURE 13-1: PROCESS PLANT FLOW SHEET FOR VELARDEÑA PLANT #2



14 MINERAL RESOURCE ESTIMATE

The following section of Mineral Resource Estimate is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

Resources have been estimated for the Rodeo deposit using a block model rotated to fit the deposit strike. Sub-blocking was used within the single high-grade domain only. Au and Ag grades have been estimated using Ordinary Kriging on parent blocks independently within and also outside of wireframe constrained domains. Reporting of estimated blocks has been constrained by a base case pit optimization using costs unique to mining followed by road trucking and processing at Golden Minerals' Velardeña cyanidation plant (Plant #2). An alternative standalone case using indicative heap leach processing costs is also shown to represent on site heap leach processing option.

Although the mineral resources are pit constrained using reasonable cost assumptions, detailed costing and economic evaluations have not been performed. The pit optimizations include resources that do not have demonstrated economic value and include inferred resources that are too speculative for definition of reserves.

*Estimated indicated mineral resource within the base case pit constraint is shown in **Table 14-1**. Estimated indicated and inferred mineral resources within the alternative case pit constraint is shown in **Table 14-2**. Preliminary metallurgy suggests the Rodeo material may be amenable to cyanidation; differentiations between oxide and sulfide material has not been made.*

TABLE 14-1: MINERAL RESOURCE ESTIMATE BASE CASE (MILL PROCESSING PIT CONSTRAINED)

Classification	Cutoff AuEq g/t	Tonnes (M)	Au g/t	Ag g/t	Au toz (1000)	Ag toz (M)	Waste: Resource
Indicated	0.83	0.4	3.3	11	46	0.2	0.91
Inferred	-	-	-	-	-	-	-

Notes:
(1) Cutoff grade and Au equivalent calculated using metal prices of $1,220 and $17 per troy ounce of Au and Ag, recoveries of 77% and 90% Au and Ag;
(2) Mineral Resources have been pit shell constrained using the Lerch Grossman algorithm with inputs of $7.5 mining, $10 trucking, and $20 processing costs per Tonne. A breakeven cutoff including trucking and processing costs per block was applied to a block model within the optimized shell;
(3) Metal prices do not exceed three-year trailing average as of the end of December 2016, per SEC guidance; and
(4) Reported indicated mineral resources are equivalent to mineralized material under SEC Industry Guide 7;

TABLE 14-2: MINERAL RESOURCE ESTIMATE ALTERNATIVE CASE (HEAP LEACH PROCESSING PIT CONSTRAINED)

Classification	Cutoff AuEq g/t	Tonnes (M)	Au g/t	Ag g/t	Au toz (1000)	Ag toz (M)	Waste: Resource
Indicated	0.17	3.6	0.8	12	94	1.4	0.53
Inferred	0.17	3.6	0.4	11	47	1.3	0.53

Notes:
(1) Cutoff grade and Au equivalent calculated using metal prices of $1,220 and $17 per troy ounce of Au and Ag, recoveries of 60% and 70% Au and Ag;

(2) Mineral Resources have been pit shell constrained using the Lerch Grossman algorithm with inputs of $3.4 mining cost, and $3.1 processing cost per Tonne. A cutoff including mining and processing costs per block was applied to a block model within the optimized shell;
(3) Metal prices do not exceed three-year trailing average as of the end of December 2016, per SEC guidance;
(4) Reported indicated mineral resources are equivalent to mineralized material under SEC Industry Guide 7; and
(5) Columns may not total due to rounding.

14.1 INPUT DATA

The project database contains 4,008 core, 3,209 RC and 193 trench sample intervals. Of those 2,613 core, 2,274 RC and 193 trench sample intervals are within the relevant resource area and were subsequently used for resource modeling. ***Table 14-3*** *shows grade statistics for intervals within the resource modelling area. Figure 14-1 shows the location of the input data intervals as AgEq g/t in plan view for both drill holes and channels before on mineral domain selections were made.*

TABLE 14-3: INPUT DATA STATISTICS RAW INTERVALS

Dataset	Count	Mean Au	Mean Ag
RC	2,274	0.34	6.7
Diamond	2,613	0.27	5.1
Trenches	193	0.58	1.4
All	**5,080**	**0.31**	**5.7**

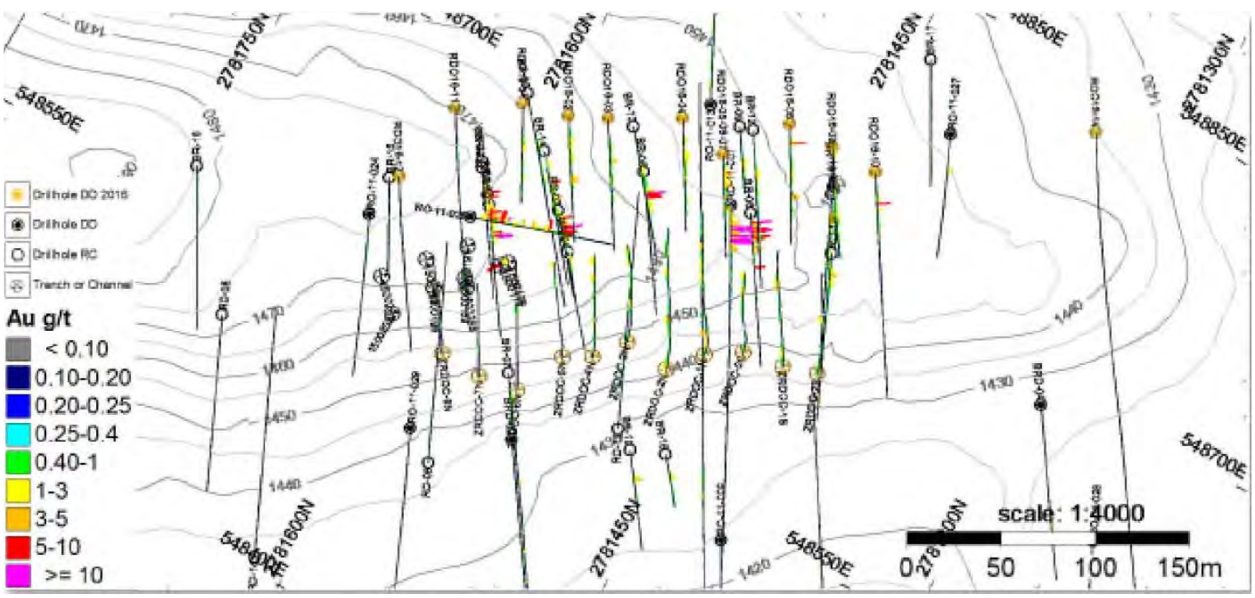


FIGURE 14-1: PLAN VIEW MAP INPUT DATA INTERVALS AUEQ

14.2 Grade Capping

Intervals from the combined drill hole and trench sample database that were within the mineral zones were analyzed as a natural log transformed population to determine upper grade limits. Upper limits were applied to raw sample values prior to compositing. The upper limit chosen for Au was 18 g/t and 150 g/t for Ag. ***Table 14-4*** *shows capping statistics and the effects on the population mean.* ***Figure 14-2*** *and* ***Figure 14-3*** *show probability plots for Ag and Au respectively. The figures show the erratic tails for both Au and Ag are relatively limited.*

TABLE 14-4: CAPPING STATISTICS IN MINERALIZED ZONES

Element	Uncapped Mean g/t	Upper Limit g/t	Number Capped	Capped Mean g/t
Au	0.691	18	3	0.648
Ag	10.9	150	4	10.3

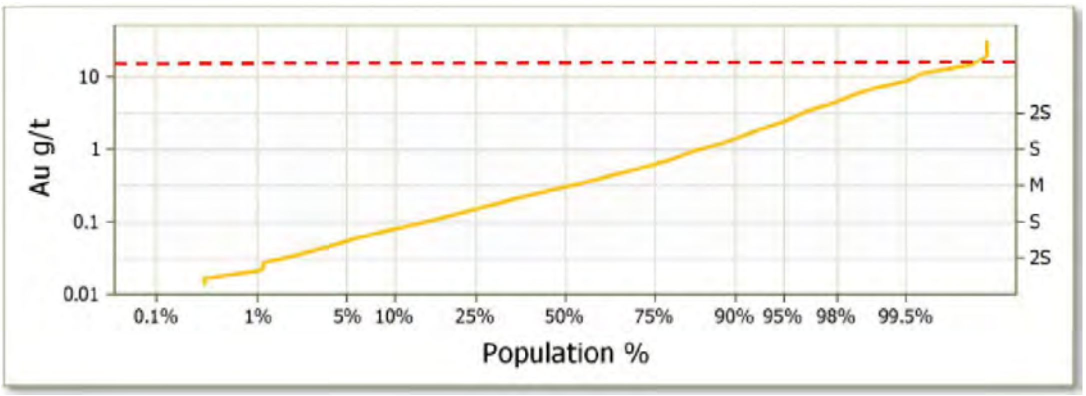


FIGURE 14-2: UPPER LIMIT ANALYSIS PROBABILITY PLOT AU

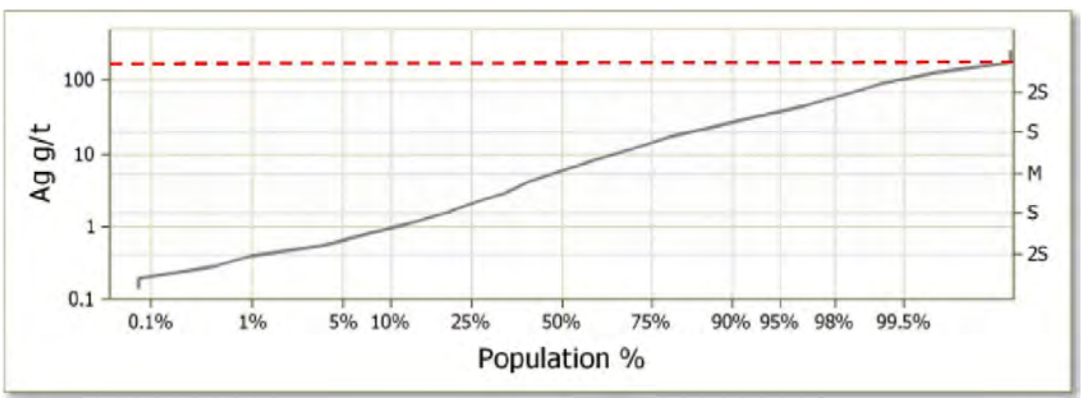


FIGURE 14-3: UPPER LIMIT ANALYSIS PROBABILITY PLOT AG

14.3 Compositing

Each drill hole and trench that intersected the modeled mineral zones was composited into 2 m intervals and centroid coordinates were generated. New composites initiate at the mineral zone boundaries. Resulting composites less than 0.25 m were rejected.

14.4 MINERAL ZONE MODELING

The Rodeo deposit is interpreted to be a highly silicified epi-thermal deposit with multi-phase stockwork and massive veining preferentially deposited in amenable gently dipping volcanic horizons. The mineral zones have been modeled with the same strike and dip as the host volcanics.

The deposit was first divided into two fault areas based on a fault hypothesized immediately west of the trenches striking parallel to the deposit. Intervals to the west of the high angle fault were labeled "west" and intervals to the east as "main". Following this division, intervals on the main side were domained initially by a broad domain of 0.1 g/t Au and above as a minimum boundary of mineralization, followed by a domain constraining 0.5 g/t Au grade population and above and finally a flat lying tubular domain containing the +1-2 g/t Au population. ***Figure 14-4*** *shows the domains described above. The domains are listed in* ***Table 14-5****.*

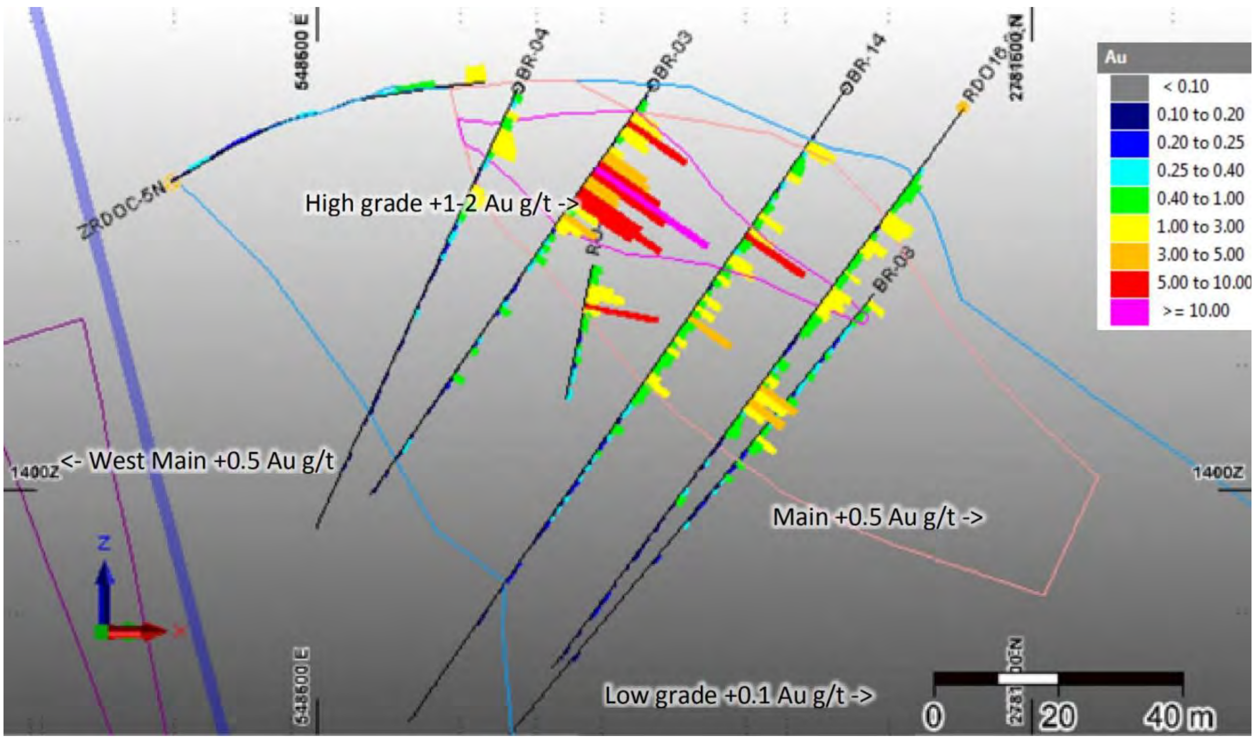


FIGURE 14-4: CROSS-SECTION MINERAL DOMAINS

TABLE 14-5: MINERAL DOMAINS

Area	Mineral Zone	Count	Au Mean	Au Variance	Ag Mean	Ag Variance
All	All	2874	0.69	2.4	10.91	273.2
Main	High	326	2.8	13.83	10.8	103.73
Main	Main	451	0.81	0.55	12.06	341.32
Main	Low	1736	0.31	0.19	10.9	301.67
West	Main	189	0.54	0.38	9.72	233.62
West	1	93	0.35	0.06	11.73	273.64
West	2	31	0.38	0.12	5.43	31.73
West	4	48	0.39	0.08	7.76	44.64

Figure 14-5 *is a box and whisker plot comparing the population statistics of the resulting domains.*

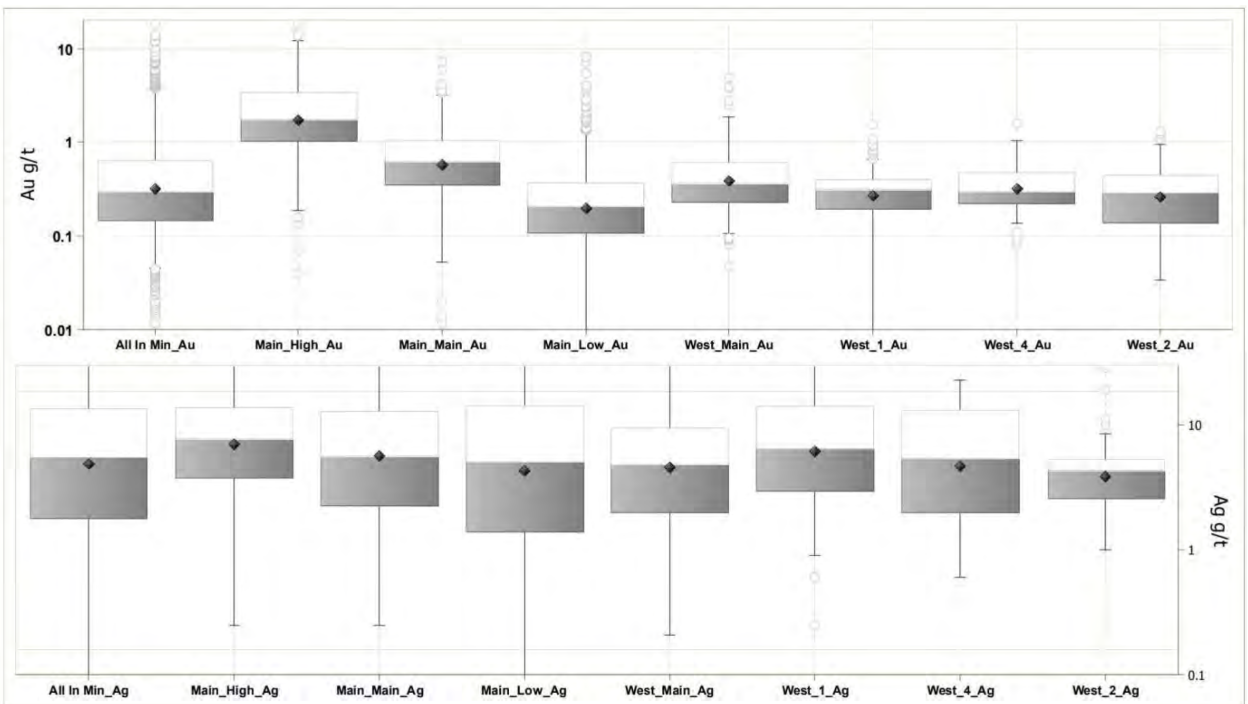


FIGURE 14-5: BOX AND WHISKERS MINERAL DOMAIN

14.4.1 Density Determination

Minera Cordilleras' geologists have made 488 measurements of core using the hanging in air and hanging in water method, the core was not coated.

Measurements within the mineral zones were evaluated for each domain and also as a group. There appeared to be little difference between those samples within the different mineral domains. A fixed value of 2.5 g/cm3 was used to define blocks within the mineralization and a value of 2.41 g/cm3 was used to define waste. ***Figure 14-6*** *shows the measurements plotted in a box plot.*

The samples were sourced from five holes drilled by Minera Cordilleras in 2016; holes: RDO16-01, 02, 04, 08, and 10. At present the dataset provides adequate coverage but does not allow for 3D modeling of SG. Additional samples to facilitate 3D modeling of SG is recommended.

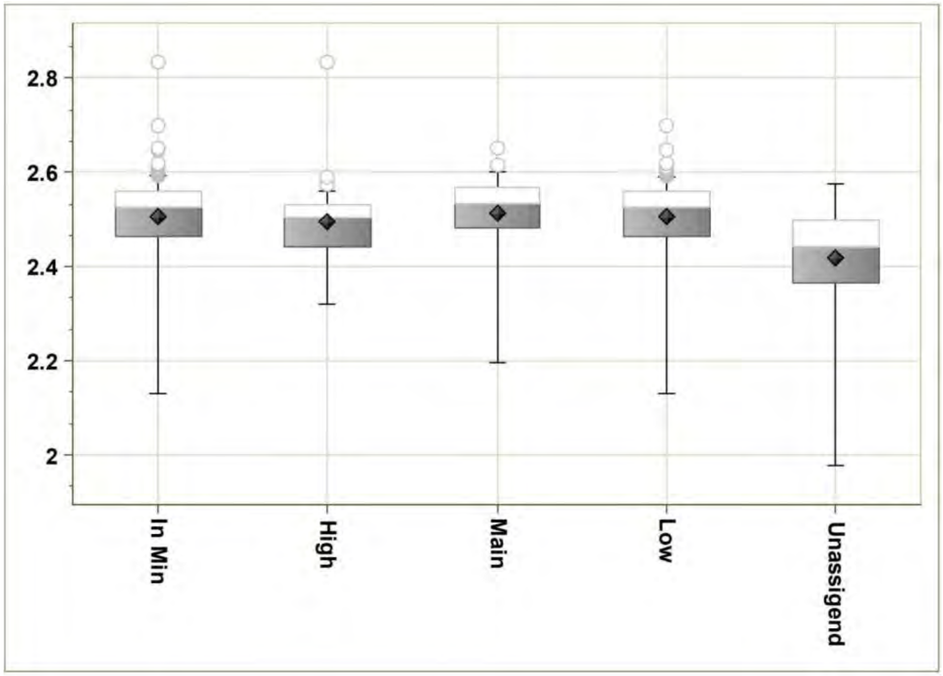


FIGURE 14-6: BOX AND WHISKERS DENSITY MEASUREMENTS

14.5 Estimation Methods and Parameters

Resources have been estimated for the Rodeo deposit using a block model rotated to fit the deposit strike. Sub-blocking was used within the single high-grade domain only. Au and Ag grades have been estimated using Ordinary Kriging on parent blocks independently within and also outside of wireframe constrained domains.

14.5.1 Variography and Search

Search orientation and preliminary experimental variography were explored through semivariogram mapping. Composites in the main area that are within any of the three mineral zones were used as input data for the analysis. Figure 14-7 and Figure 14-8 show the resulting semivariogram maps for strike and dip. In the figures cooler colors represent lower semi variance, meaning better correlation.

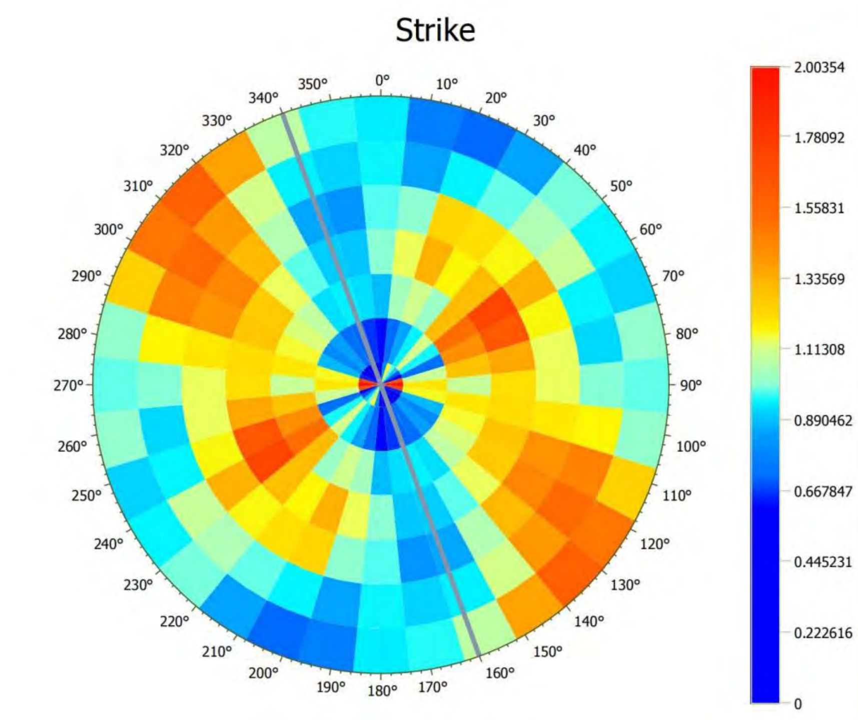


FIGURE 14-7: SEMIVARIOGRAM MAP STRIKE

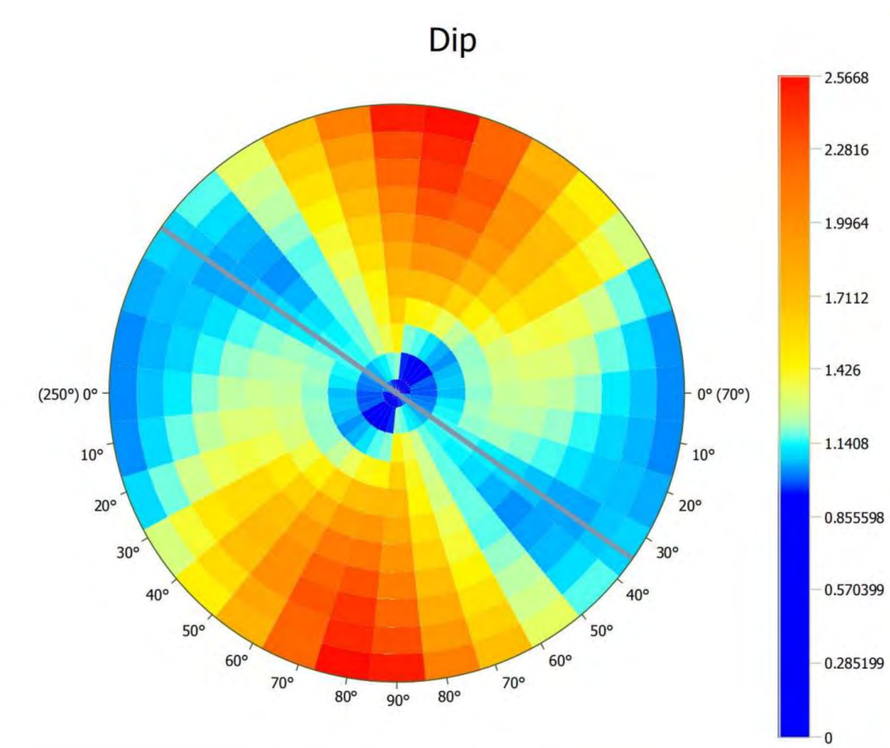


FIGURE 14-8: SEMIVARIOGRAM MAP DIP

*Down hole semivariograms were used to establish the nugget, **Figure 14-9**, and omnidirectional variograms were used to optimize the bin spacing.*

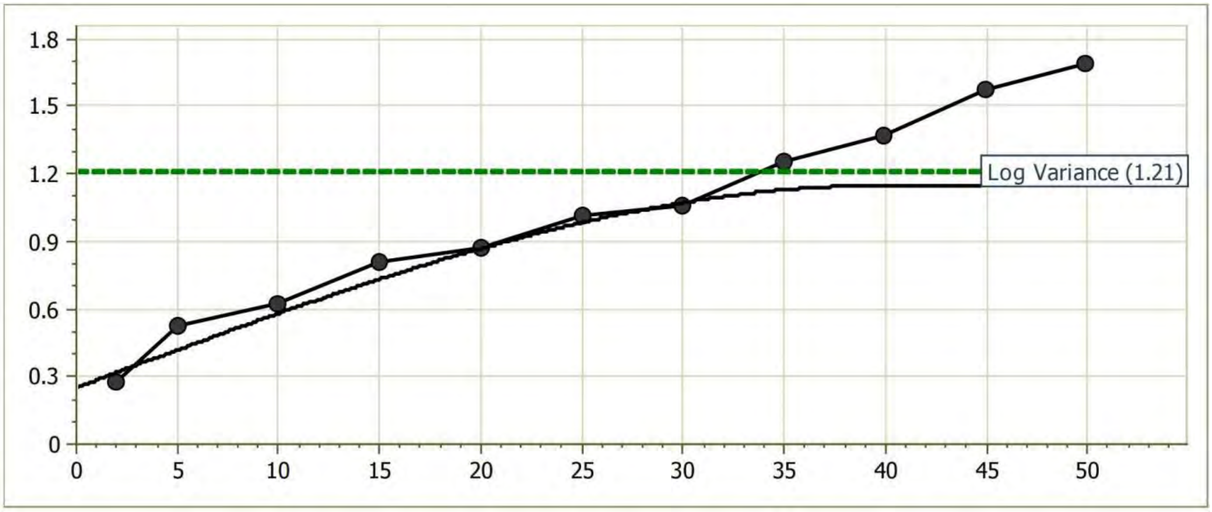


FIGURE 14-9: NATURAL LOG TRANSFORMED DOWNHOLE VARIOGRAPHY AU

*Orientations determined from the semivariogram maps were used as inputs for semivariogram modeling. The grade distance relationship was investigated for Au and Ag using natural log transformed directional variography on composited intervals. Experimental and modelled semivariograms for Au and Ag are shown in **Figure 14-10** and **Figure 14-11**, **Table 14-6** details the modelled components. Nugget and sill portions have not been relativized to a total sill of 1 or 100% to correspond with the graphical output presented.*

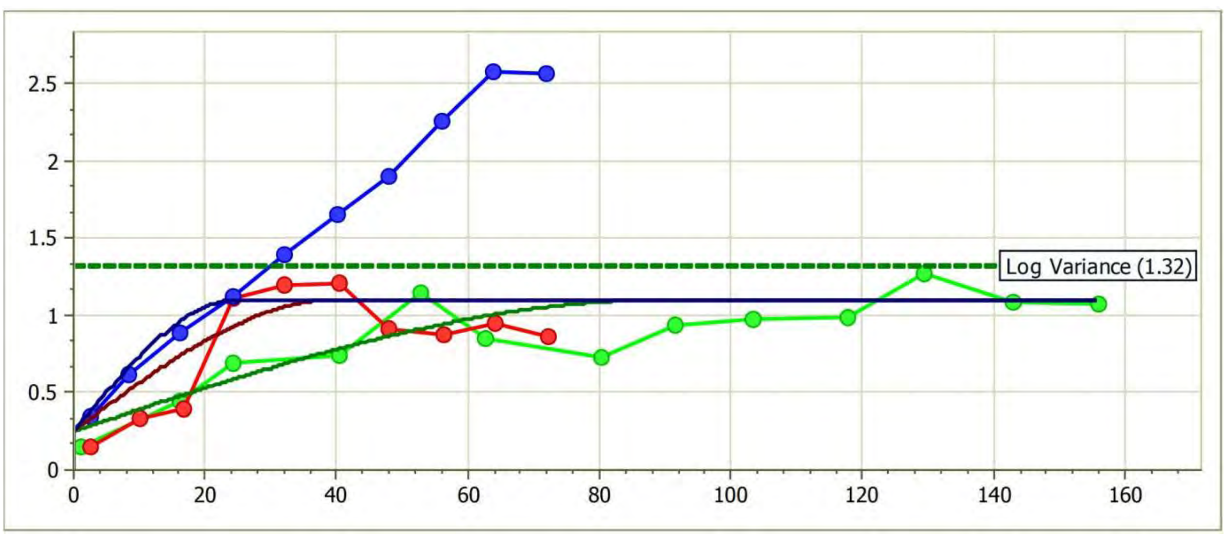


FIGURE 14-10: NATURAL LOG TRANSFORMED DIRECTIONAL VARIOGRAPHY AU

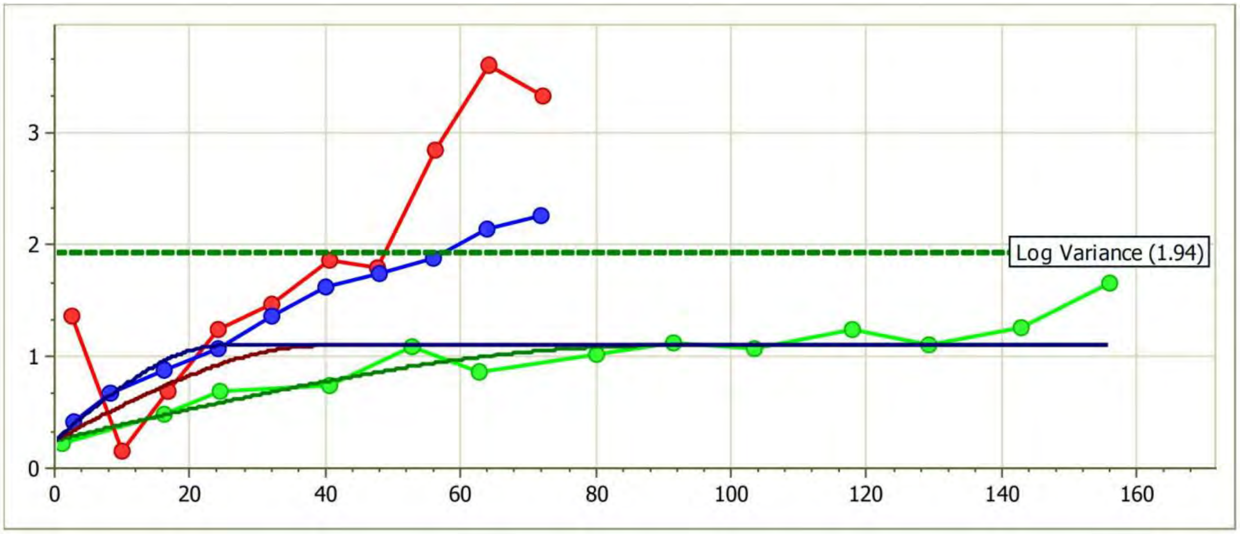


FIGURE 14-11: NATURAL LOG TRANSFORMED DIRECTIONAL VARIOGRAPHY AG

TABLE 14-6: MODELLED VARIOGRAMS

Element	Azi	Plunge	Fit Type	Nugget	Partial Sill	Range	Total Sill
Au Primary	340	0	Spherical	0.25	0.85	90	1.1
Au Secondary	70	35	Spherical	0.25	0.85	40	1.1
Au Tertiary	250	55	Spherical	0.25	0.85	25	1.1
Ag Primary	340	0	Spherical	0.25	0.85	90	1.1
Ag Secondary	70	35	Spherical	0.25	0.85	40	1.1
Ag Tertiary	250	55	Spherical	0.25	0.85	25	1.1

Although grade distance relationships were investigated and used as a guide the ultimate search distances, classifications, orientations and anisotropies implemented were based on visual review of the mineralization and professional judgment.

A rotated block model was fit to the extents of the mineral domains with the parameters shown in ***Table 14-7****. The block model was sub-blocked only to the high-grade domain, the remaining blocks were assigned to domains based on the location of the block centroid relative to the domain wireframe.*

TABLE 14-7: BLOCK MODEL SETUP PARAMETERS

Direction	Origin (Corner)	Block Size m	Length m	Blocks Parent	Rotation About (Clockwise)	Sub-Block Min
X	548500	10	700	70	-	5
Y	2780980	20	700	35	-	10
Z	1200	10	300	30	-30	2.5

Grade attributes were estimated in three passes from small to large. Estimation for Au and Ag were limited to the size of the original parent block. Multiple sub-blocks with the same original parent block share the same estimations for Au and Ag. Sub-blocks were not amalgamated following estimation. Au and Ag was independently estimated within each modeled domain. ***Table 14-8*** *details the search ellipse sizes, and orientations along with sample selection criteria for each estimation pass.*

TABLE 14-8: ORDINARY KRIGING PASS PARAMETERS

Area	Mineral Zone	Strike	Dip	Pitch	Radius m	Aniso 2nd	Aniso 3rd	Drill Hole Min	Samples /DH Max	Samples Min	Samples Max
Main	High Grade	340	35	0	90	0.6	0.2	2	3	4	7
Main	Main	340	35	0	30	0.6	0.25	2	2	6	12
Main	Main	340	35	0	60	0.6	0.2	1	2	3	12
Main	Main	340	35	0	90	0.6	0.1	1	2	3	12
Main	Main	340	35	0	200	0.6	0.1	1	2	2	12
Main	Low Grade	340	35	0	100	0.6	0.25	1	2	3	12
Main	Low Grade	340	35	0	150	0.6	0.1	2	2	2	12
Main	Low Grade	340	35	0	250	0.6	0.1	1	2	4	12
Main	Unassigned	340	35	0	300	0.6	0.5	1	2	3	6
West	Main	340	80	20	90	0.6	0.25	1	2	3	12
West	Main	340	80	20	200	0.6	0.1	2	2	2	12
West	1	340	80	20	90	0.6	0.25	1	2	3	12
West	1	340	80	20	200	0.6	0.1	2	2	2	12
West	2	340	80	20	90	0.6	0.25	1	2	3	12
West	2	340	80	20	200	0.6	0.1	2	2	2	12
West	4	340	80	20	90	0.6	0.25	1	2	3	12
West	4	340	80	20	200	0.6	0.1	2	2	2	12
West	Unassigned	160	25	0	300	0.6	0.5	1	2	3	6

14.5.2 MINERAL RESOURCE CLASSIFICATION

Mineral resource classification was established by evaluating the drill hole spacing of the composites and the distance to the nearest composite from a block. All blocks were initially classified as inferred. Following estimation, blocks greater than 90 m to the composite were set to zero Au and Ag. The remaining blocks were eligible for classification to indicated. Blocks were flagged as indicated that fell within an indicated triangulation. To construct the triangulation, the block model was filtered for blocks less then 25m to the nearest sample. The average drill hole spacing within the constructed triangulation is 13 m. ***Figure 14-12*** *shows an example cross-section with block distance to the nearest composite, composite drill hole spacing and the boundary of the indicated classification triangulation.* ***Figure 14-13*** *shows a stacked histogram of block distance to the nearest composite for indicated and inferred blocks.* ***Figure 14-13*** *shows all blocks in the model, further classification refinement is made when the blocks are constrained by the pit shell optimization, blocks outside of both the base case and alternative case pit shell optimization are not considered resource.*

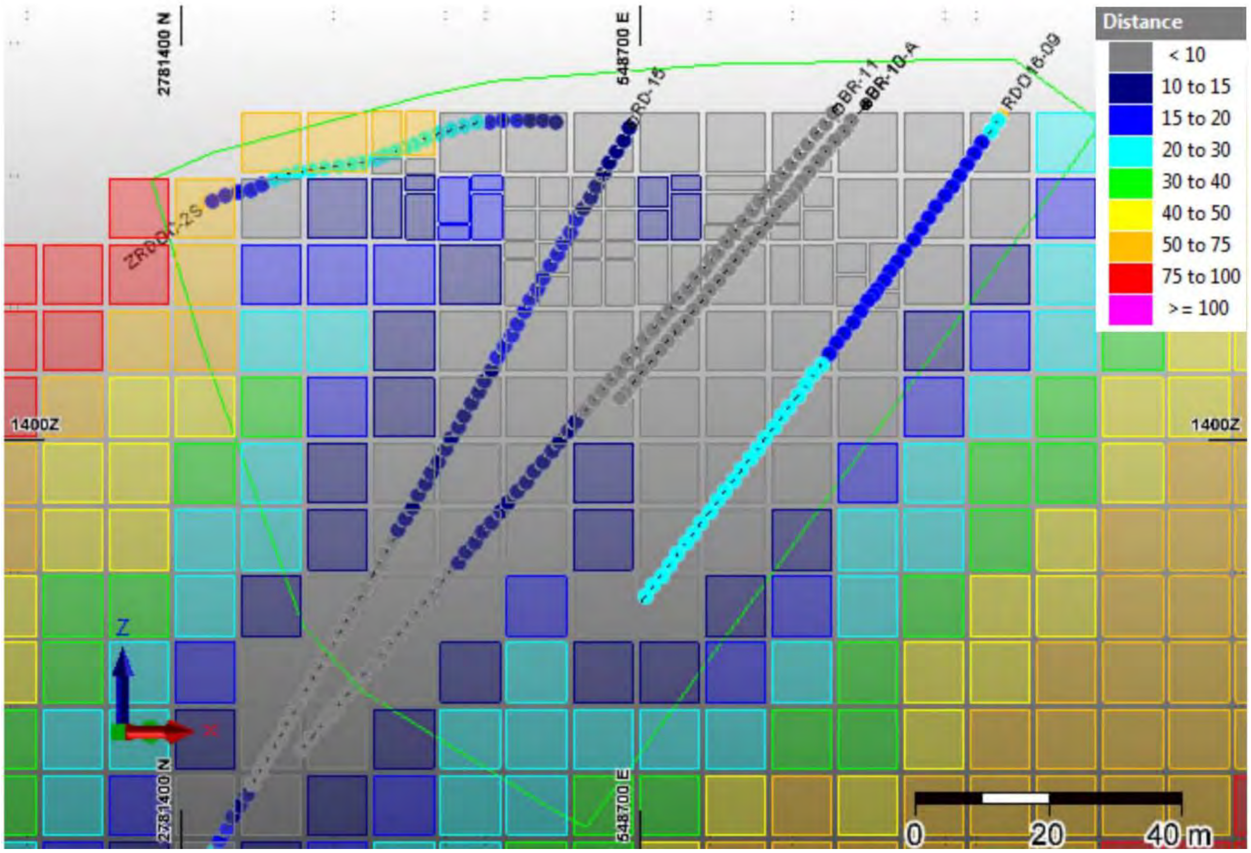


FIGURE 14-12: DRILL HOLE SPACING AND DISTANCE TO NEAREST COMPOSITE

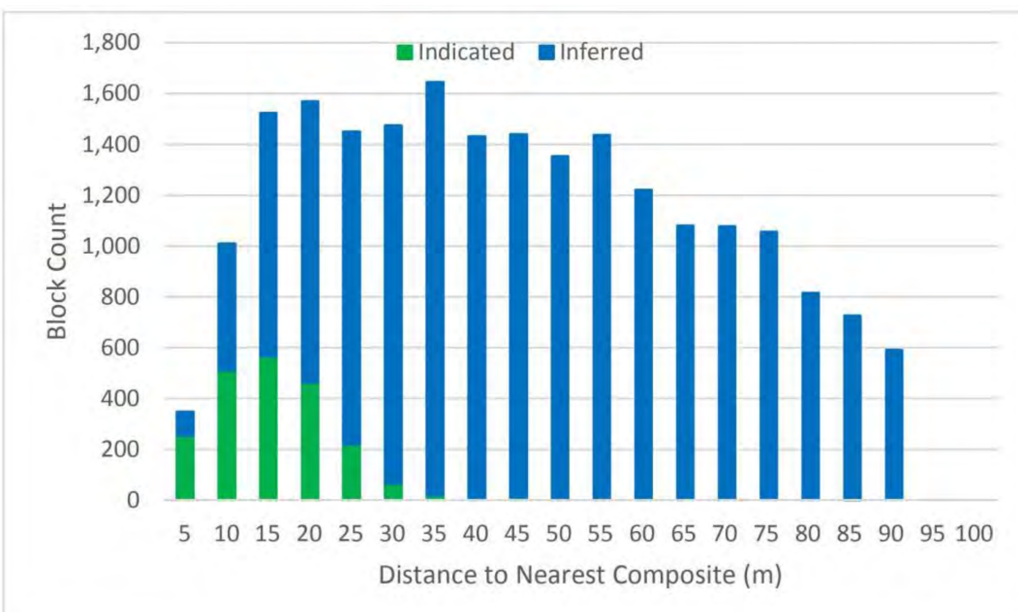


FIGURE 14-13: BLOCK CLASSIFICATION DISTANCE TO NEAREST COMPOSITE

14.5.3 Cutoff Grade and Pit Shell Optimization

Cutoff grade has been calculated as Au equivalent accounting for Au and Ag grade and recovery, as well as reasonable cost and metal prices assumptions.

The base and alternative case cutoff grade was determined using the three-year trailing average prices for Au and Ag, through December 2016, and set slightly below the calculated three-year trailing average as mandated by the United States Securities and Exchange Commission (SEC).

*Estimated blocks were constrained to two pits using the Lerch Grossman algorithm, the first representing the base trucking and mill cyanidation case and the second an onsite heap leaching case. The cutoff grade was applied to the blocks within both pit optimization case with the assumptions shown in **Table 14-9**.*

TABLE 14-9: CUTOFF GRADE AND PIT OPTIMIZATION ASSUMPTIONS

Assumption	Base Case	Alternative Case
Process Type	Mill Cyanidation	Onsite Heap Leach
Au Price $/troy ounce	1,220	1,220
Ag Price $/troy ounce	17	17
Metallurgical Recovery Au	77%	60%
Metallurgical Recovery Ag	90%	70%
Mining $/T Material	7.5	3.4
Process $/T Resource	30	3.1
Pit Slope	45°	45°
Sell Cost $/troy ounce	10	10
Mining Dilution/Recovery	1%/98%	1%/98%
Cutoff Grade $/T	32.5*	6.5
Cutoff Grade AuEq	**0.85***	**0.17**

(*) Cutoff only includes truck and process costs.

Three-dimensional views of the resulting pit shell optimizations are shown at the same scale and vantage point, looking to the northeast from above, the base case in shown in **Figure 14-14** and the alternative case in **Figure 14-15**.

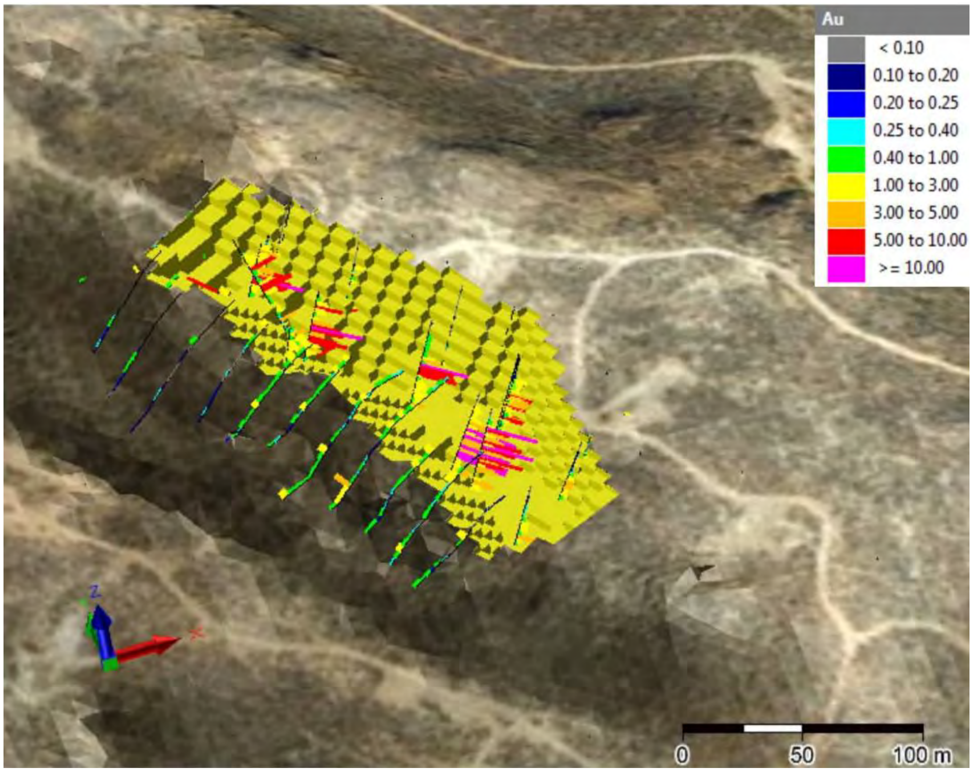


FIGURE 14-14: 3D VIEW OPTIMIZED PIT SHELL AND AU DRILL HOLE INTERVALS BASE CASE

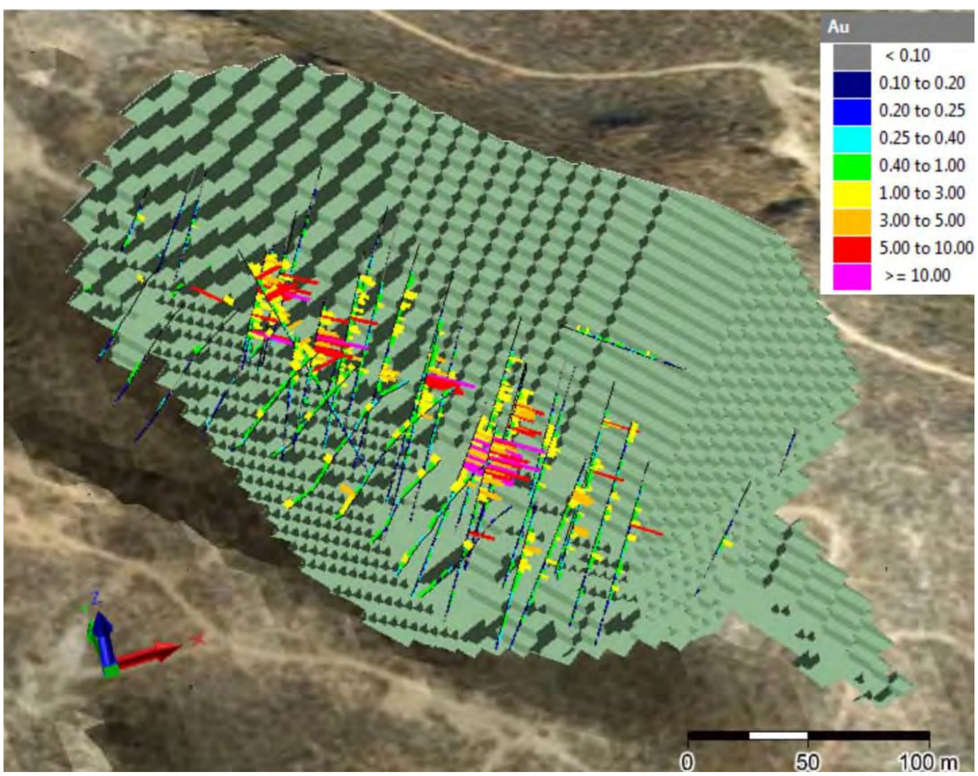


FIGURE 14-15: 3D VIEW OPTIMIZED PIT SHELL AND AU DRILL HOLE INTERVALS ALTERNATIVE CASE

14.6 MODEL VERIFICATION

Resource estimations have been verified by visual review, population analysis, swath plots, and alternative estimation methods. Cross-section review of composite and block grades verify the estimation respects the input data. Verification figures have been included below. ***Figure 14-16*** *shows box and whiskers plots that compare the assay, composite, and block grade populations for both Au and Ag.*

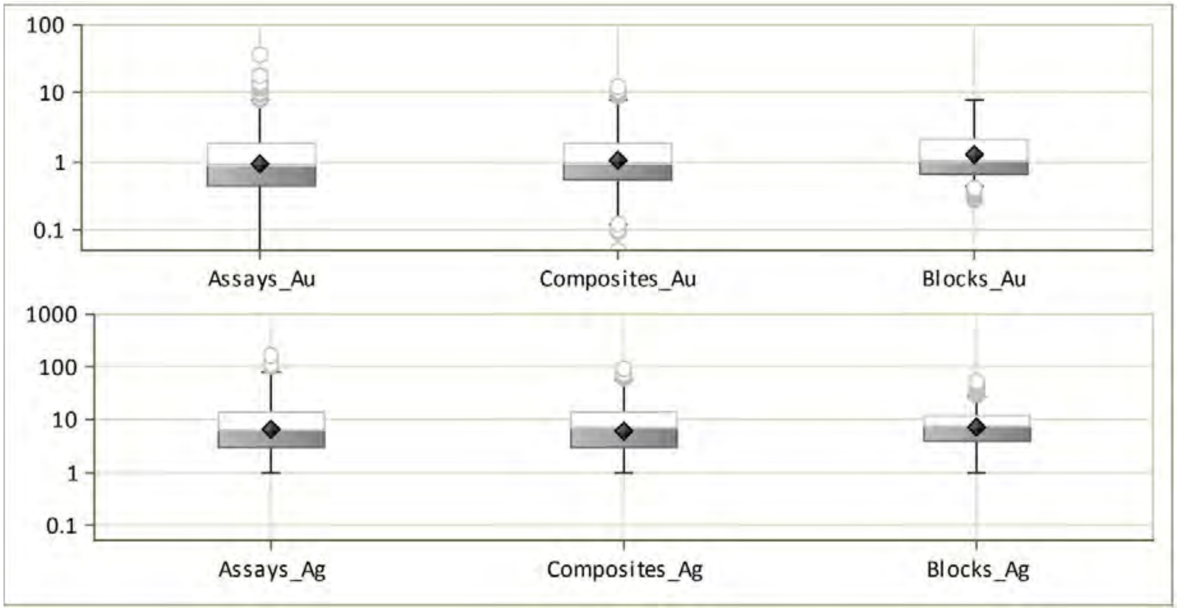


FIGURE 14-16: BOX PLOT POPULATION COMPARISON AU AND AG

Figure 14-17 *shows swath plots for assay, composite, and block Au grades rotated to align with the strike of the deposit. Figure 14-18 shows swath plots for assay, composite, and block Au grade rotated and inclined to fit the strike and the dip of deposit.*

Figure 14-19 *shows an example cross-section of the resource model that includes drill hole data, the mineralized envelope boundaries, indicated resource classification boundary, resource pit constraints, and resulting Au block grades.*

Figure 14-20 *shows an example cross-section of the distance from a block centroid to the nearest drill hole composites in reference to the indicated resource classification boundary.*

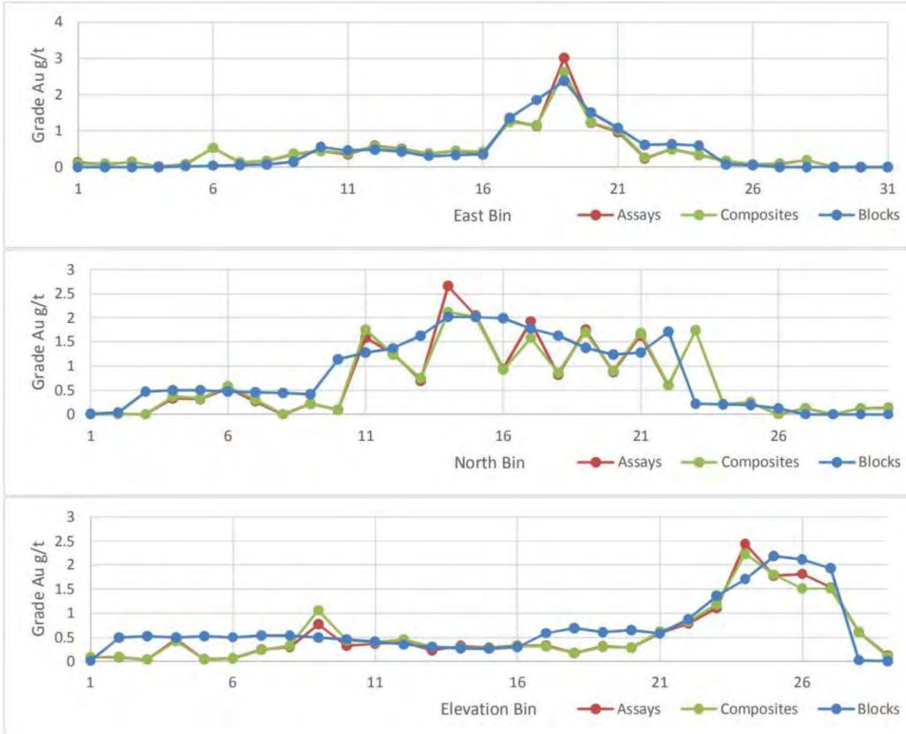


FIGURE 14-17: SWATH PLOTS AU – ORTHOGONAL

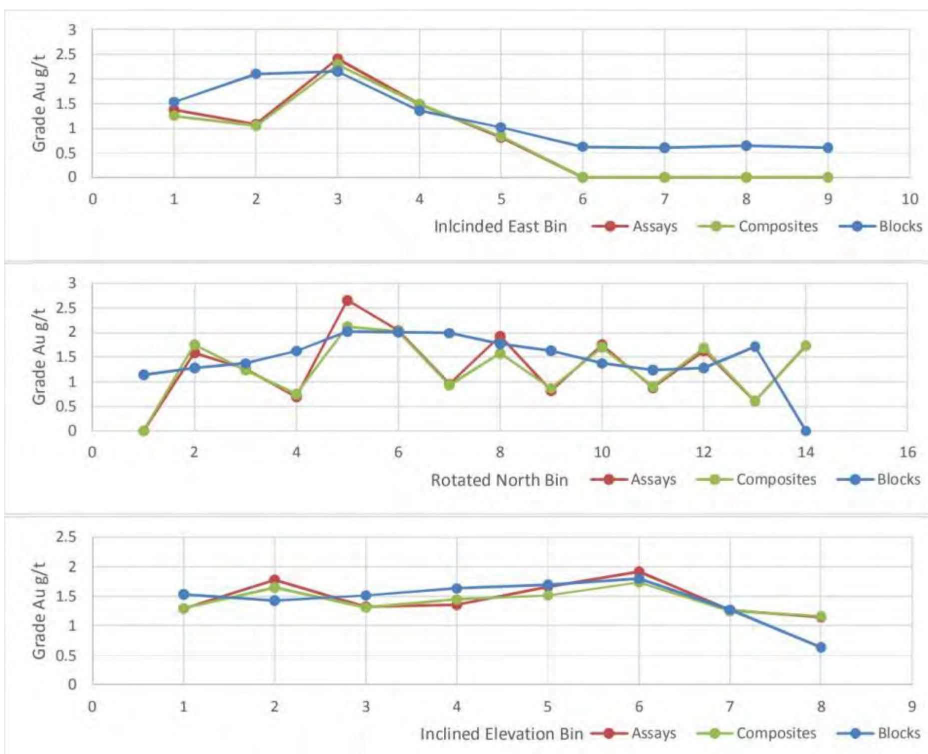


FIGURE 14-18: SWATH PLOTS AU - STRIKE AND DIP ALIGNED

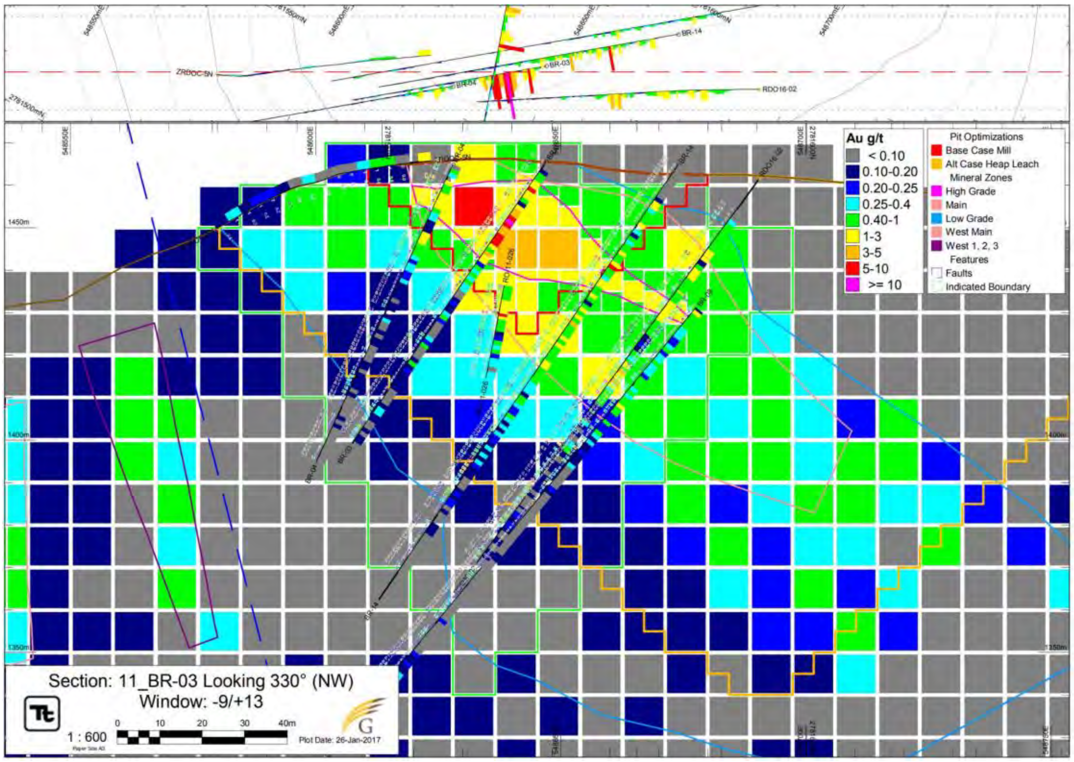


FIGURE 14-19: CROSS-SECTION 11_BR-03 AU

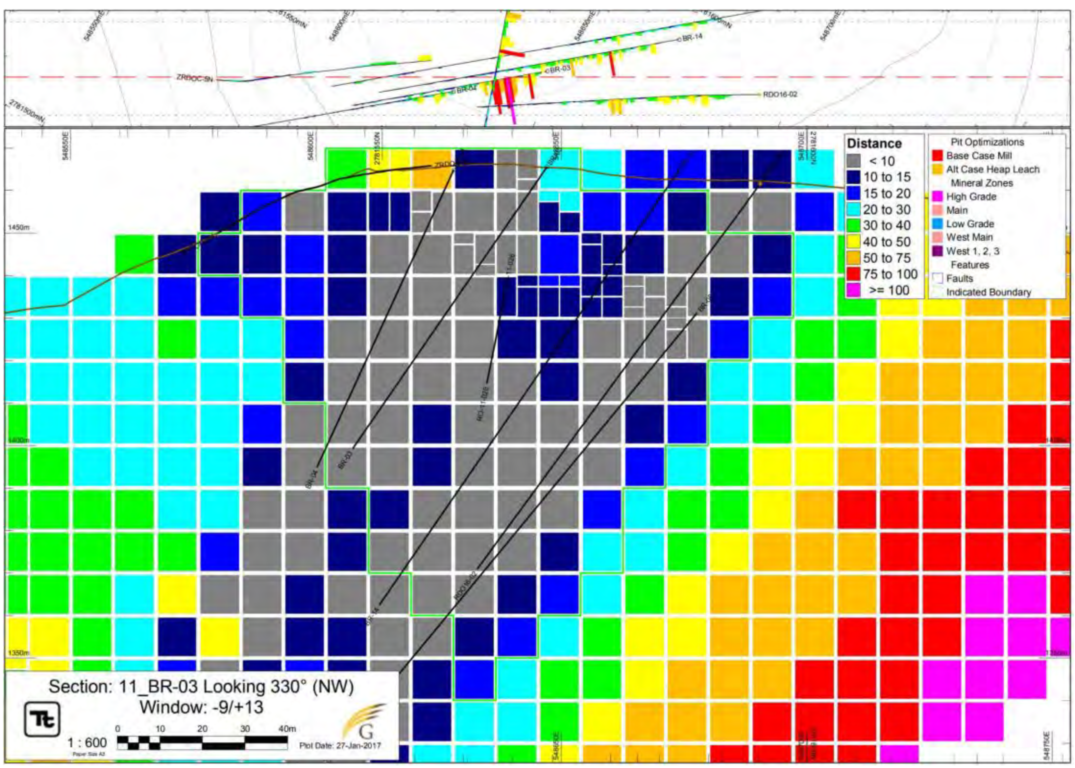


FIGURE 14-20: CROSS-SECTION 11_BR-03 DISTANCE TO NEAREST COMPOSITE

14.7 RELEVANT FACTORS

The inferred resources are primarily extrapolated down-dip from drill hole intersections. The down-dip extension of the deposit has not been observed and there is no known geologic reason why the mineralization would terminate before the Rodeo fault to the East. Additional down-dip drilling could alter the current estimation of inferred resources. Additional drilling is recommended to demonstrate the down-dip continuation of the mineralization. Additional infill drilling could lead to improved understanding of stockwork veining and preferred mineralization horizons which could alter the interpretation of the mineralizing controls and the estimation of resources.

The mining and processing costs used to constrain the resources by a pit shell are generalized industry costs. Mining, metallurgical, and geotechnical studies could materially alter the costs used to generate the pit constraints either positively or negatively.

*There are no additional environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other relevant factors that the author of this report is aware of that could materially affect the mineral resource estimate. The project is not considered an advanced property; therefore many of the above factors require further investigation. It is possible that, with detailed investigation, complications with any or all of the above mentioned factors could arise, but currently no material complications are kno*wn.

15 EXTRACTABLE RESOURCE

The plan for extraction of the resource contains three categories of material:

- **ROM** – Run of Mine mineralized material, which will be excavated, shipped to, and processed at Golden Minerals' oxide plant in Velardeña, Durango.
- **Low Grade** – Material that does not qualify for shipment to the plant in Velardeña with the current operating plan; the material does have enough gold and silver grade to possibly pay for shipping and processing sometime in the future.
- **Waste** – Material that will most likely never be economical for shipping to the plant in Velardeña.

15.1 BLOCK MODEL TONNES AND GRADE

The Tetra Tech block model[1], issued in 2017, is the basis for all resource-based mine planning. Four mine plan iterations using different cutoff grades were completed during the initial mine planning effort. The cutoff grades used in the four preliminary mine plan versions were developed to attain the most favorable economic results in the shortest operating period. Cutoff grades are typically developed to maximize: the consumption of an in-situ resource, to extend a project's life, or to provide an opportunity to increase the unit production rate of an operation. The Rodeo Project's production rate is capped at 168,000-tonnes per year, which is the processing capacity of Golden Minerals' agitated leach plant located in Velardeña, Durango, Mexico. Golden Minerals' design basis is to develop an operation with a high net present value for a two year operating period.

The distribution of waste and ROM material for each bench was manually determined by outlining the areas of the ROM material and the waste material on each bench. The following methodology was used to develop the four versions of the mine plan.

- Tetra Tech's block model blocks were exported on five-meter vertical centers for manual bench design.
- Each of the 11 benches were designed by outlining the material that would be classified as ROM material, and material that would be classified as waste.
- Two sets of wireframes, ROM and waste material, were developed from the design benches and imported into a specialized mining software.
- The wireframes were populated with Tetra Tech's block model data, enabling the generation of Tonnes and Grades reports.

The cutoff grade, which is a gold value in gpt, designates material that will be shipped to and processed in the plant in Velardeña. The following are the cutoff grades, used in the four mine plan iterations:

- Version-1; Gold (Au) cutoff 0.85-gpt for "must ship material", 1.00-gpt for "ROM bench design".
- Version-2; Gold (Au) cutoff 1.20-gpt for "must ship material", 1.80-gpt for "ROM bench design".
- Version-3; Gold (Au) cutoff 1.60-gpt for "must ship material", 2.00-gpt for "ROM bench design".
- Version-3; Gold (Au) cutoff 2.00-gpt for "must ship material", 2.40-gpt for "ROM bench design".

[1] Geoffrey Elson, *NI 43-101 Technical Report Mineral Resource Estimate Rodeo Project*, March 10, 2017

Notes:

(1) "Must ship material" is that material that has to be excavated regardless of the gold grade; the material has a gold grade that should pay for the cost of shipping from the mine to the Velardeña plant and pay for the cost of processing at the Velardeña plant.

(2) "ROM bench design" is that material that has a gold grade that should yield revenue greater than the estimated operating costs associated with mining, shipping, processing, and fixed costs.

The grade-tonnage results for each mine plan version were installed in identical models, with respect to precious metal pricing, unit and fixed costs, plant recovery values, and taxation. The four models were then compared to determine which model/mine plan delivers the best economic and operating characteristics. **Table 15-1** displays the comparison of the four models and Version 3 appears to have the most favorable model results; Gold (Au) cutoff 1.60-gpt for "must ship material", 2.00-gpt for "ROM bench design".

TABLE 15-1: PRELIMINARY MINE PLAN RESULTS BY VERSION

Preliminary Mine Plan	ROM Tonnes	Grade Au (gpt)	Grade Ag (gpt)	Waste Tonnes	Project Life Quarters	Pre-Tax Cash Flow ($US-M)
Version 1	481,000	2.69	10.07	730,000	11.0	$19.22
Version 2	430,000	3.05	8.99	871,000	9.8	$20.88
Version 3	381,000	3.31	9.65	635,000	8.7	$22.23
Version 4	333,000	3.43	9.75	551,000	7.6	$21.35

Table 15-2 summarizes the block model material generated from the final mine plan, which is based on Version 3 above.

TABLE 15-2: BLOCK MODEL TONNES AND GRADE

ROM Tonnes	Grade Au (gpt)	Grade Ag (gpt)	Waste Tonnes
343,125	3.59	10.44	635,246

15.2 DILUTION MODEL

It is not common to run a dilution routine on an open pit resource that has been generated from Kriging. However, the proposed Rodeo open pit warrants the addition of a dilution routine because more than 10 percent of the ROM tonnes are derived from blocks that are adjacent to blocks below the cutoff grade. Because of the high percentage of ROM blocks adjacent to below cutoff grade blocks, substantial dilution will occur. The dilution is calculated as a percentage of sub cutoff grade material added to the ROM material generated from the block model. The below cutoff grade material that is diluting the above cutoff grade material in an adjacent block is estimated to carry a gold grade of 1 gpt and a silver grade of 3.0 gpt. The dilution routine also assumes that there will be a material gain of 1.0 percent of the ROM total material to account for waste gain from loading activities; the gained material is estimated to carry a gold grade of 0.5 gpt and a silver grade of 1.5 gpt. And lastly, the dilution routine assumes a 0.5 percent loss of material which accounts for operation errors during the excavation operation. **Table 15-3** outlines the final diluted resource.

TABLE 15-3: DILUTED RESOURCE TONNES AND GRADE

ROM Tonnes	Grade Au (gpt)	Grade Ag (gpt)	Waste Tonnes
381,247	3.31	9.65	635,246

In summary, the dilution accounts for an 11.1 percent increase in the ROM tonnage, a 7.7 percent decrease in the gold grade of the ROM, and a project stripping ratio of 1.7:1 (waste to ROM).

15.3 Mine Planning Quantities

The diluted quantities outlined in the preceding section are the sum of the bench quantities outlined in this section. The bench quantities were defined by manually developing wireframes that outlined the ROM and waste material for each of the proposed 11 benches. The wireframes were quantified by Golden Minerals using a mining software to determine the tonnes and grade predicted with the mining of each bench based on Tetra Tech's block model.

Table 15-4 summarizes the tonnes and grade associated with the 11 benches planned for the Rodeo Project. **Figures 15-1 thru 15-11** displays the planned extraction and block model outline on each of the proposed 11 benches.

TABLE 15-4: FINAL TONNES AND GRADE BY BENCH

Designated Bench	ROM Tonnes	Grade Au (gpt)	Grade Ag (gpt)	Waste Tonnes
1425 Level	14,598	2.66	9.49	0
1430 Level	59,760	3.52	11.27	2,874
1435 Level	61,506	3.46	11.37	28,401
1440 Level	62,222	4.10	11.40	65,723
1445 Level	53,202	3.92	11.59	110,020
1450 Level	55,388	2.84	7.40	109,198
1455 Level	37,650	2.71	7.33	97,771
1460 Level	22,726	2.19	4.42	82,403
1465 Level	14,196	2.04	3.85	64,756
1470 Level	0	0.00	0.00	46,540
1475 Level	0	0.00	0.00	27,561
Totals	**381,247**	**3.31**	**9.65**	**635,246**

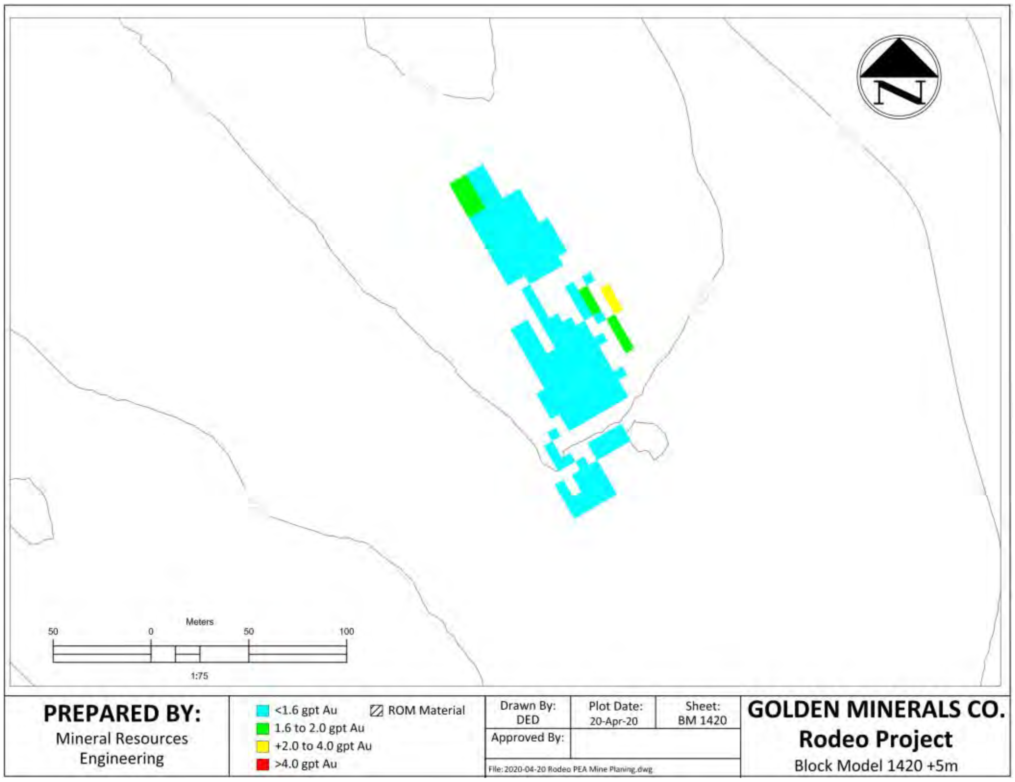


FIGURE 15-1: 1420 BENCH WITH BLOCK MODEL

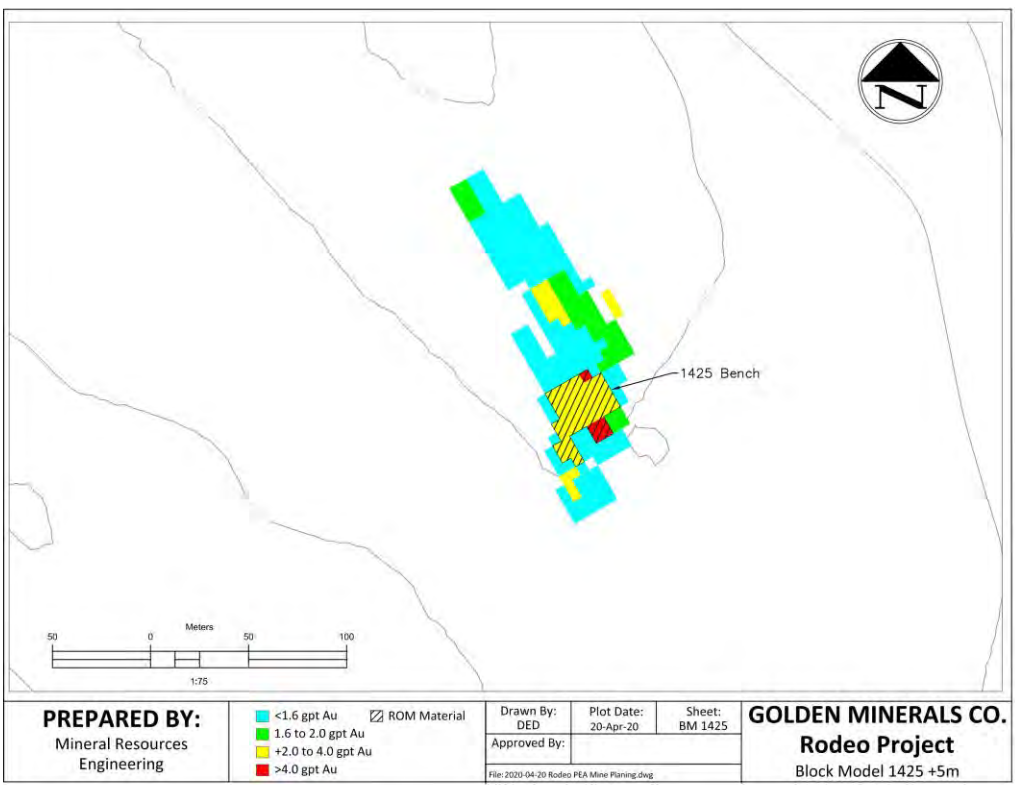


FIGURE 15-2: 1425 BENCH WITH BLOCK MODEL

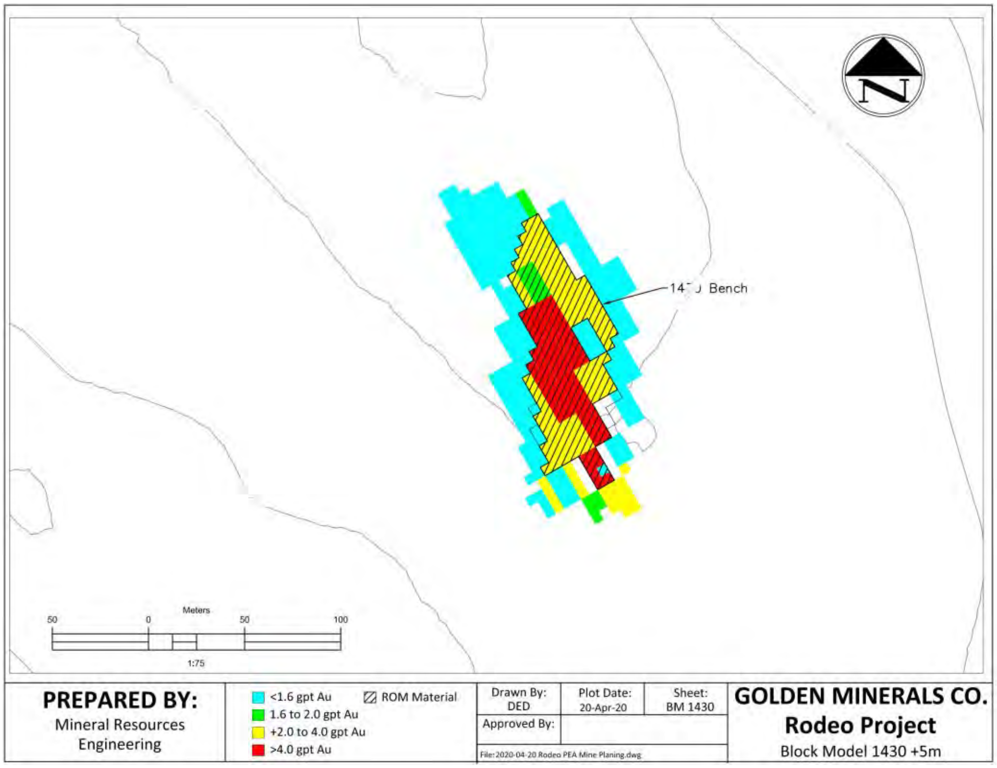


FIGURE 15-3: 1430 BENCH WITH BLOCK MODEL

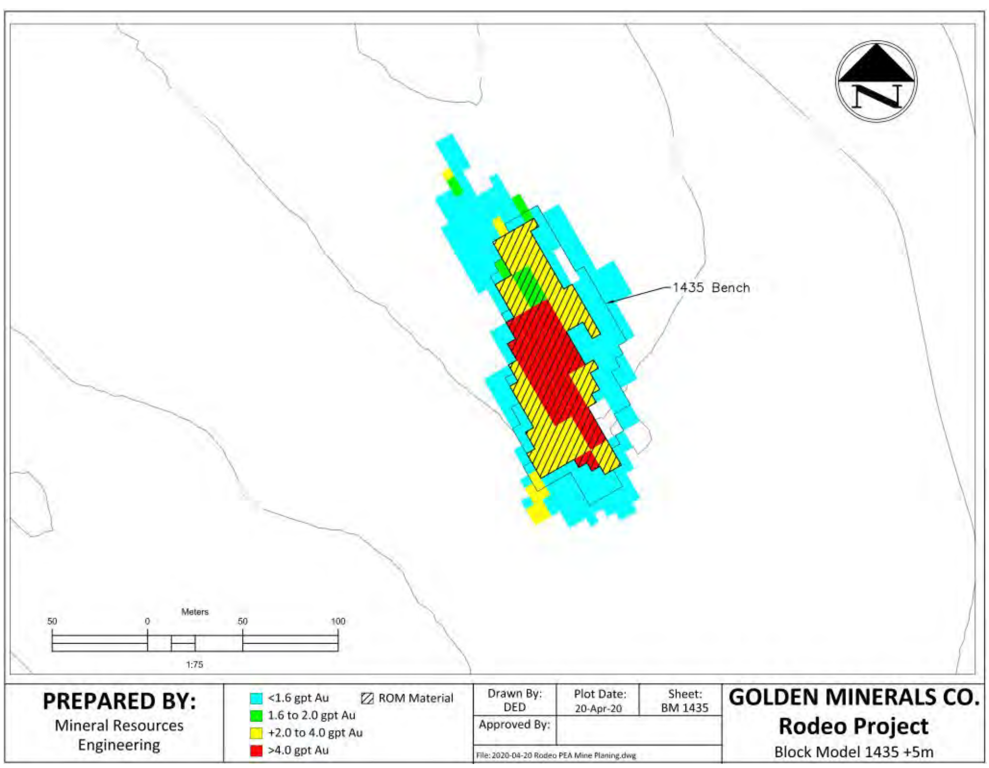


FIGURE 15-4: 1435 BENCH WITH BLOCK MODEL

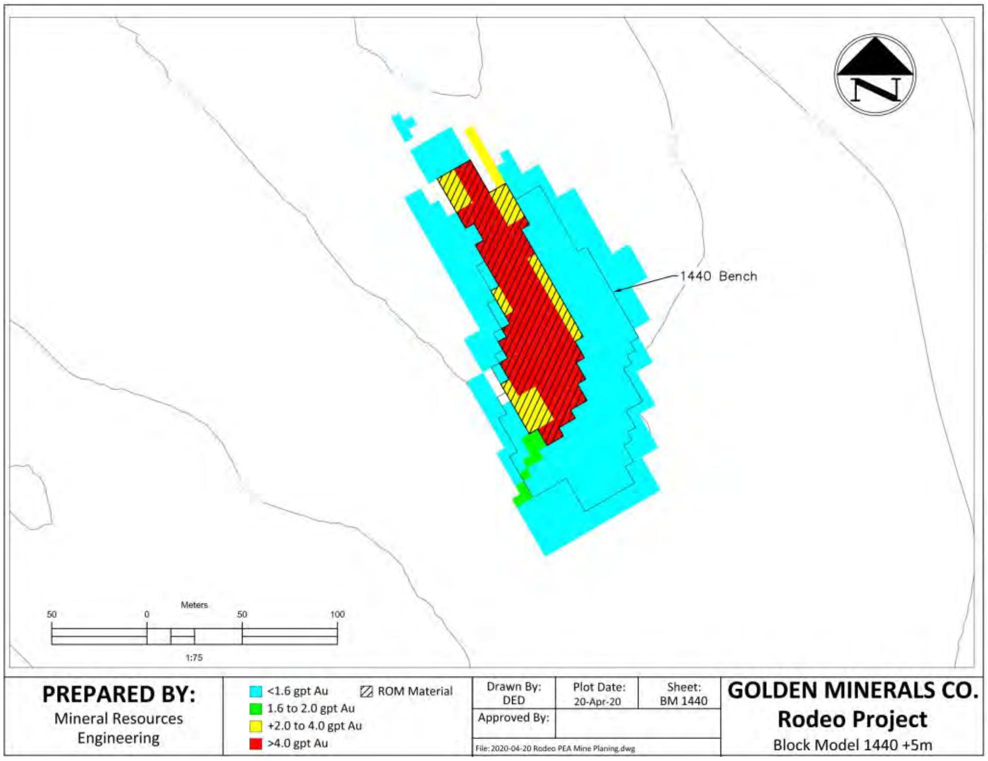


FIGURE 15-5: 1440 BENCH WITH BLOCK MODEL

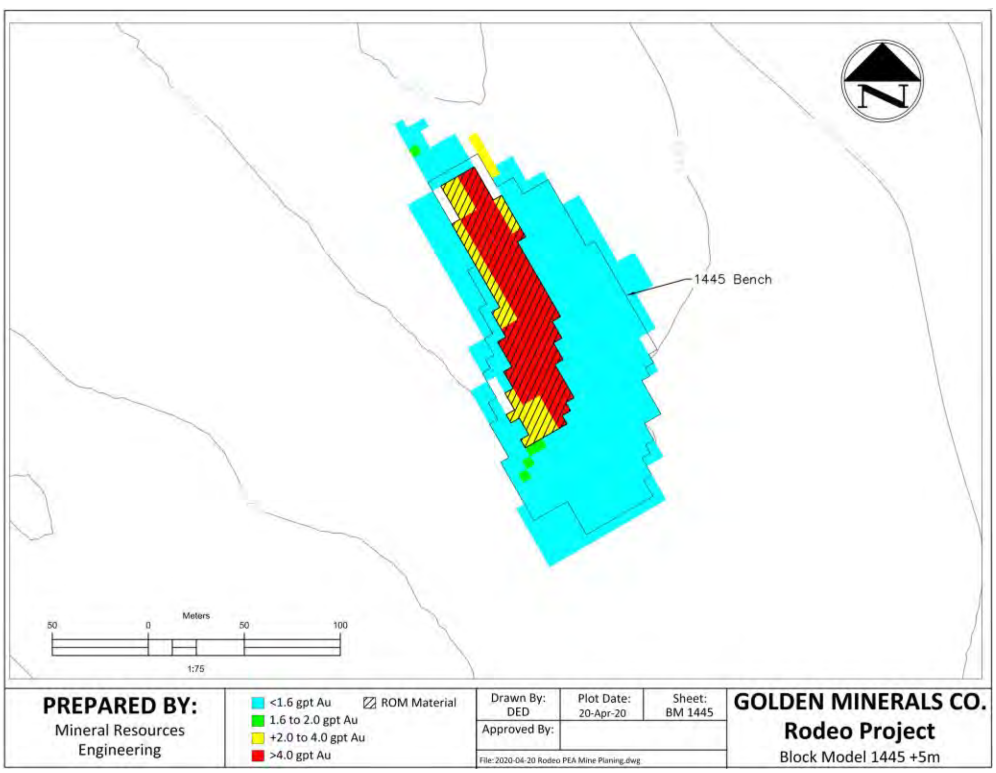


FIGURE 15-6: 1445 BENCH WITH BLOCK MODEL

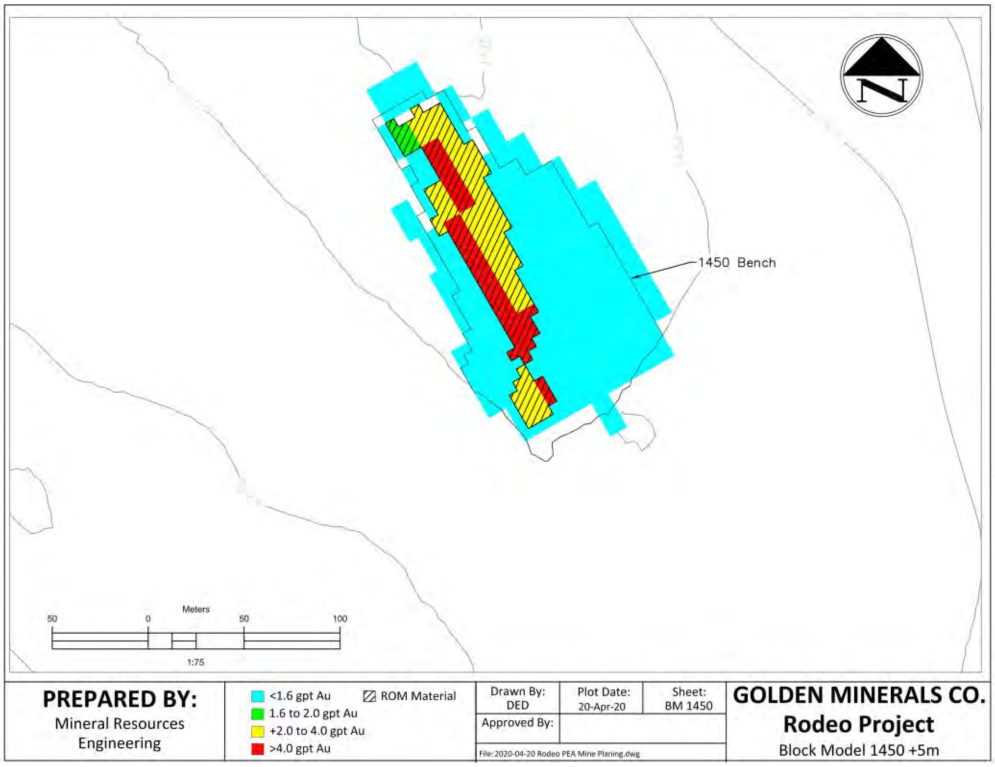


FIGURE 15-7: 1450 BENCH WITH BLOCK MODEL

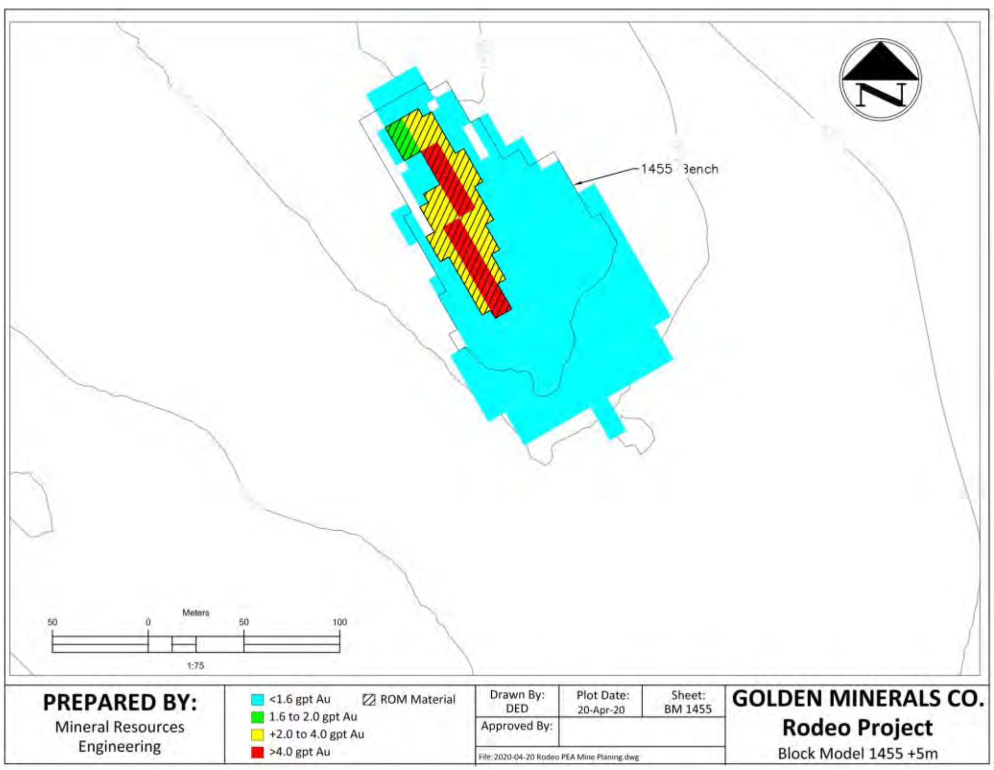


FIGURE 15-8: 1455 BENCH WITH BLOCK MODEL

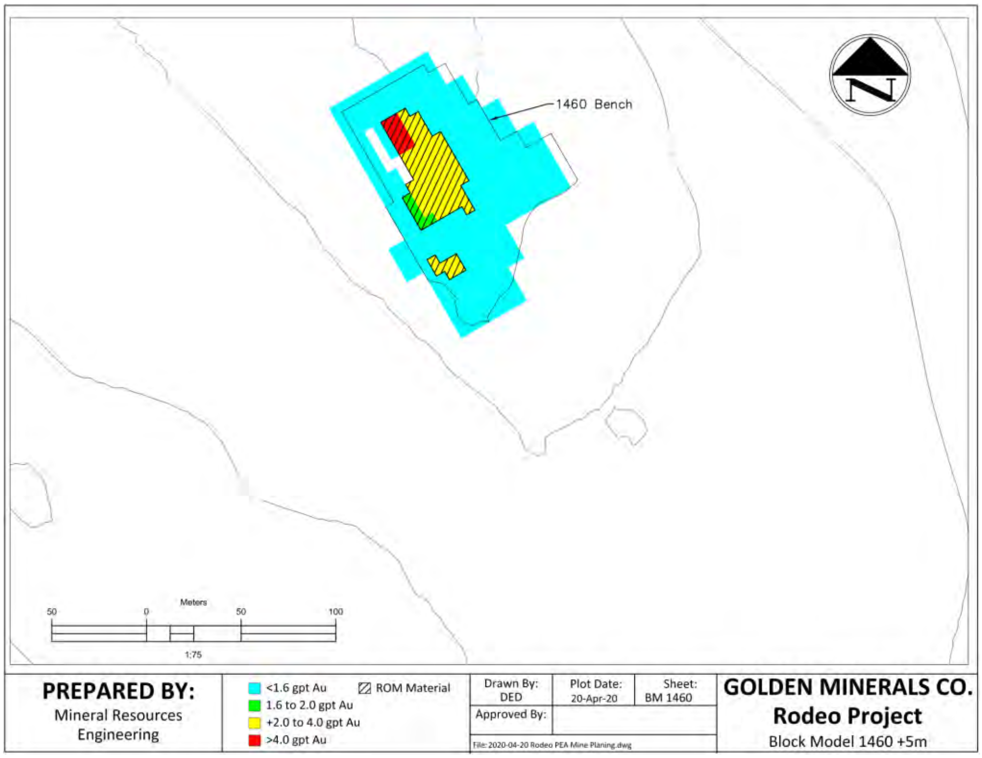


FIGURE 15-9: 1460 BENCH WITH BLOCK MODEL

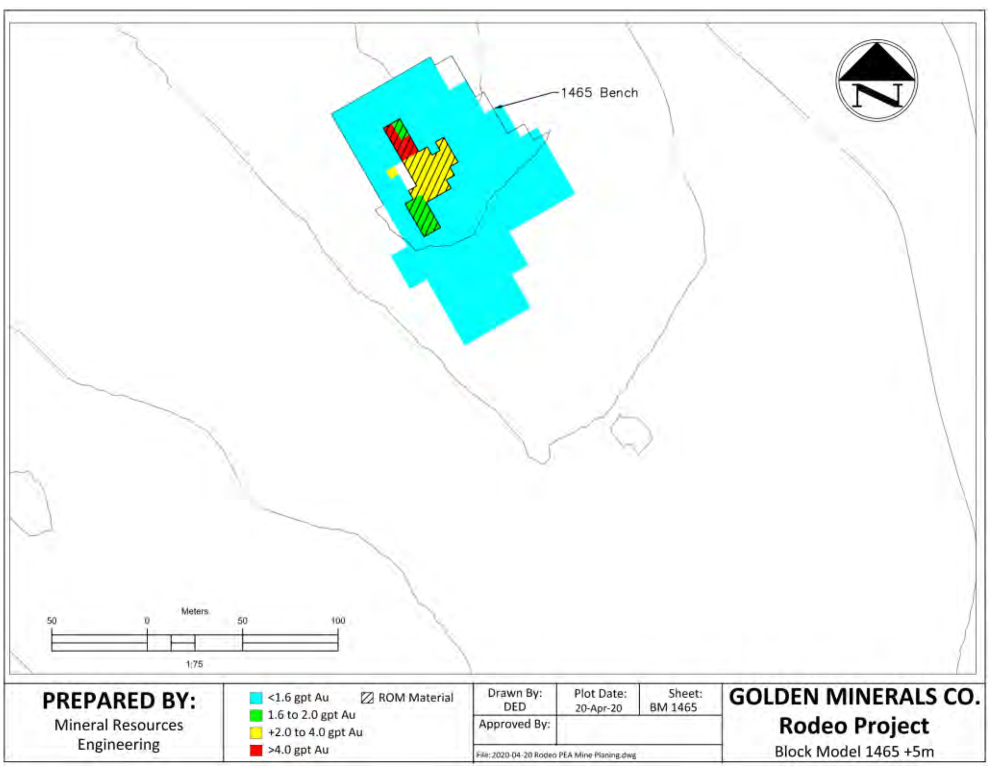


FIGURE 15-10: 1465 BENCH WITH BLOCK MODEL

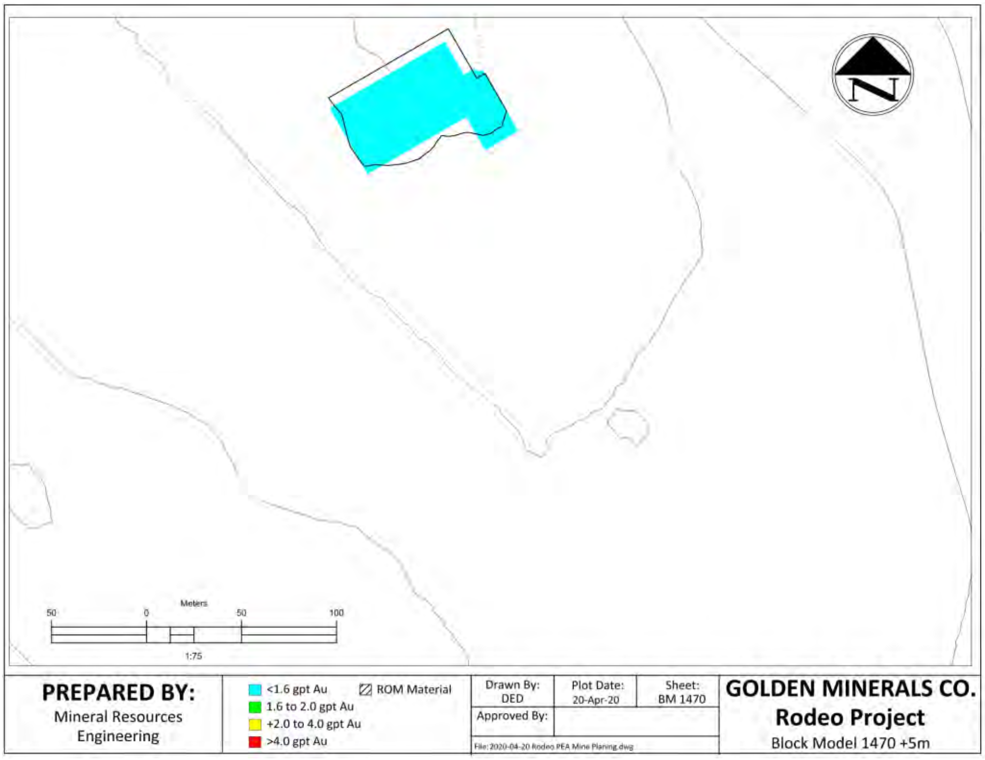


FIGURE 15-11: 1470 BENCH WITH BLOCK MODEL

16 MINING

The strategy for mining the resource is to access the higher-grade areas as quickly as possible and to complete the excavation of the entire resource with three phases (pushbacks). The mining of the first pushback will commence at the 1450 Bench working upwards to the 1470 Bench and downwards to the 1440 Bench simultaneously. Starting at the 1450 Bench will enable the operation to quickly access the better gold grades that exist in the 1445 and 1440 Benches.

16.1 MINE OPERATION

16.1.1 DRILLING AND BLASTING

The drilling and blasting program developed for this report is based on empirical blasting formulas. A comparison study to determine the most favorable bench height for the project was completed by calculating and reviewing bench heights that ranged from 2.5 meters to 5.0 meters. A 5.0-meter bench height was selected due to the economics and mining ease associated with this height. It is assumed that the final pit wall's slope is 45 degrees, however the walls may be able to be steepened due to the competency of the rock strata. The explosives and timing are designed to attain a high pile (minimal scatter), wall control, best possible fragmentation, minimal air blast, no fly-rock, and less than the legal limit of vibration. Drilling will be completed using either air or hydraulic track mounted drill units. **Table 16-1** displays the calculated variables for the proposed drilling and blasting program at the Rodeo Project.

TABLE 16-1: DRILLING AND BLASTING PARAMETERS

Variable	No. Units
Bench Height (meters)	5.0
Burden (meters)	2.3
Spacing (meters)	2.5
Sub drilling (meters)	0.6
Hole Depth (meters)	5.6
Stemming (meters)	2.1
Hole Diameter (inches)	3.5
Cubic-meters per Hole	28.6
lbs Explosive per BCY	1.10
Explosive Cost per BCM	$1.59

Notes:

(1) Explosive cost is generated from an Austin Powder quotation issued in January 2020.

16.1.2 ORE CONTROL AND RECONCILIATION

The Rodeo Project mine plan depends on delivering high grade material to Golden Minerals' agitated leach plant in Velardeña. A diligent ore control program will be required to ensure that the mining does deliver the estimated ROM material grade to the processing plant. The ore control program is comprised of the following steps:

a) A portion of each production drill hole cuttings will be gathered as a single sample. The samples will be transported to the Golden Minerals Velardeña lab for assaying, and the reports will be made available to the project personnel working on the blasting plan
b) The assay results for each drill hole will be used to either outline the ROM material perimeter with flagging before the blast, or flagging the perimeter of the ROM material after the blast. The blasting criteria is to design a blast that will result in high piles and little lateral movement; this design criteria gives the ROM segregation with flagging the best result.
c) A Face Technician is a person that has been trained to visually determine waste from mineral grade material at the Rodeo Project. Every excavation unit working at the Rodeo Project will have a Face Technician overseeing the excavation unit's operation; the use of the Face Technician should reduce the risk of the excavation unit's operator misdirecting either ROM or waste material while loading.

An ongoing reconciliation program is key to the planning department's success in being able to continually plan the extraction of the resource and gain the desired results. The reconciliation program will be comprised of the following steps:

a) The final Rodeo pre-production block model will be the basis for the reconciliation. The pre-production block model will include all final drilling and sampling, up to the start of production.
b) The blocks mined during a reporting period will have a calculated tonnes and grade that is considered the anticipated production.
c) A monthly metallurgical balance will be developed for the operation of the Velardeña Oxide Plant (Plant II). The "met-balance" is the final determination of the tonnes and grade associated with a month's production.
d) The "met-balance" final determination will be compared to the anticipated production developed from the final block model. The anticipated production is corrected using a weighted value correction system so that the anticipated production matches the actual metallurgical results.
e) The "met-balanced" calculated anticipated values are compared to the original anticipated production values to help determine: the level of dilution that is gained during production, the inaccuracies that may be affecting the construction of the block model, and the inaccuracies that may be present because of low drill hole density.

16.1.3 Excavation and Transportation

The Rodeo surface mine will be excavated and transported utilizing contractors. A civil or mining contractor will be used for the exaction of the mine material. The Confederation of Mexican Workers *(Confederacion de Trabajadores de Mexico (CTM))* will supply trucks used for the transportation of material away from the mine.

The drilling and blasting of the mine material will be completed using the mining contractor. Golden Minerals will purchase the explosives used to ensure the correct explosive components are maintained, and Golden Minerals will supervise the loading of the shot (the contractor's labor will perform the physical work). The excavation will be completed using 1-LCM class excavators that are loading typical 15-tonne highway rated haulage trucks. The highway trucks will either deliver the material to the plant in Velardeña, the established low-grade stockpile, or to the established waste dump. **Figure 16-1** displays the location of the surface mine relative to the low-grade stockpile and the waste dump. ROM stockpiling, if required, will be done in an area at the agitated leach plant that has been used for stockpiling in the past.

The contractor's equipment fleet will contain a water truck, road grading unit and a D8 or D9 class bulldozer. The in-pit ramps are planned to be temporary in nature: 5-meters wide at a grade of 10 to 15 percent and constructed with nearby available material. The ramps are excavated and re-done with each of the three scheduled pushbacks. **Figures 16-2, 16-3, and 16-4** display the three planned pushbacks. The material used to construct the ramps is homogeneous: all ROM, all low grade, or all waste. However, the use of highway trucks in the mine demands that the mine's continual road maintenance program is excellent.

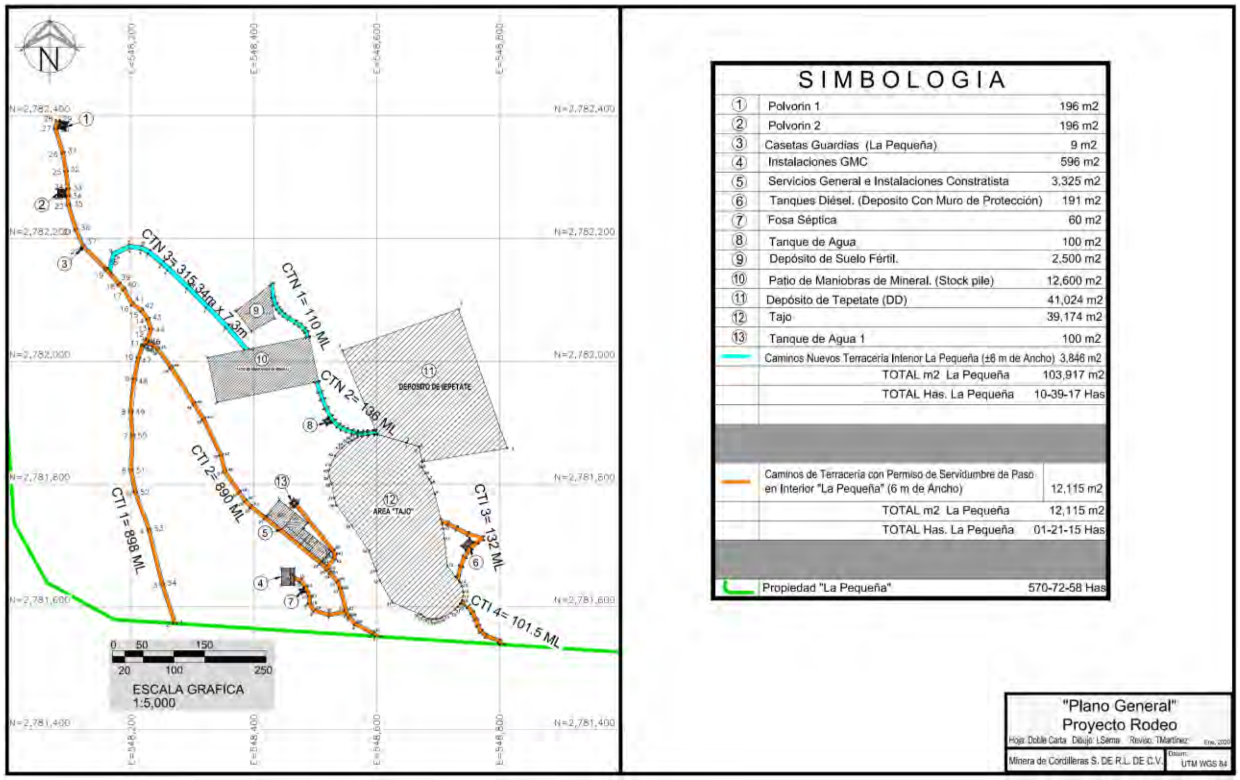


FIGURE 16-1: RODEO PROJECT GENERAL LAYOUT

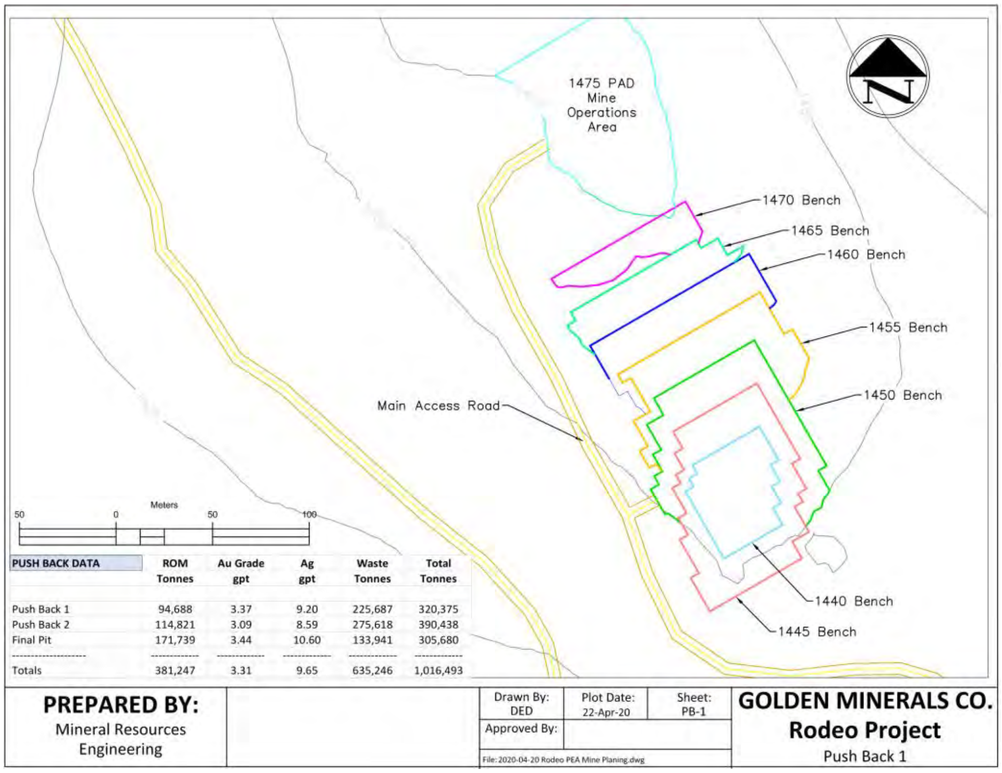


FIGURE 16-2: PUSH BACK 1

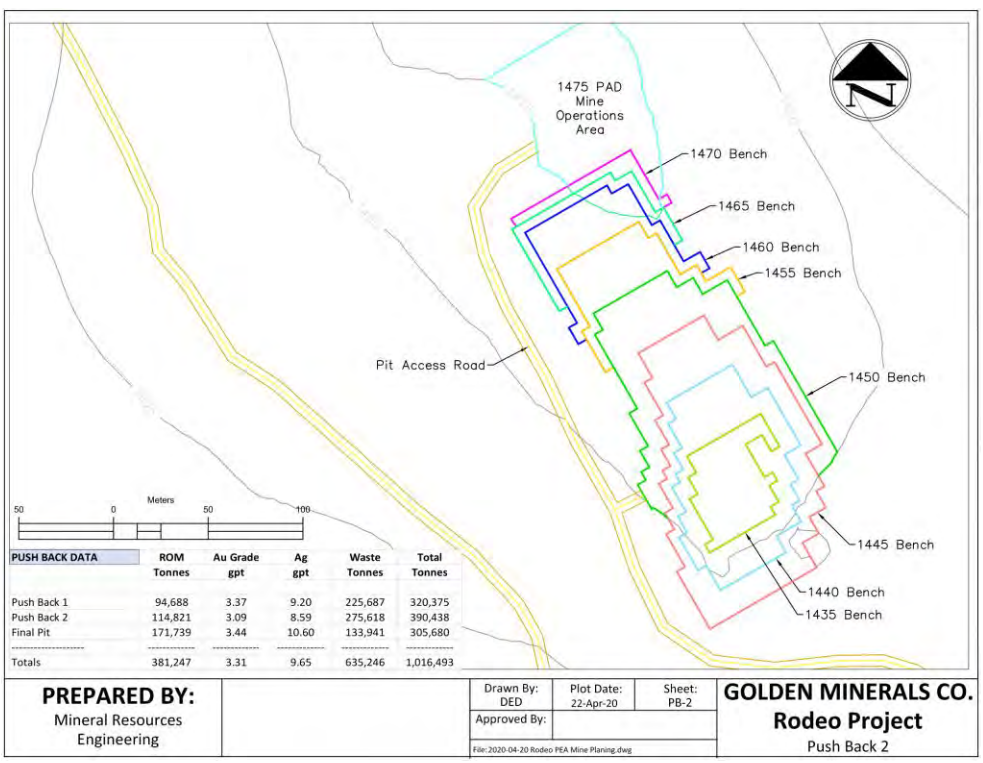
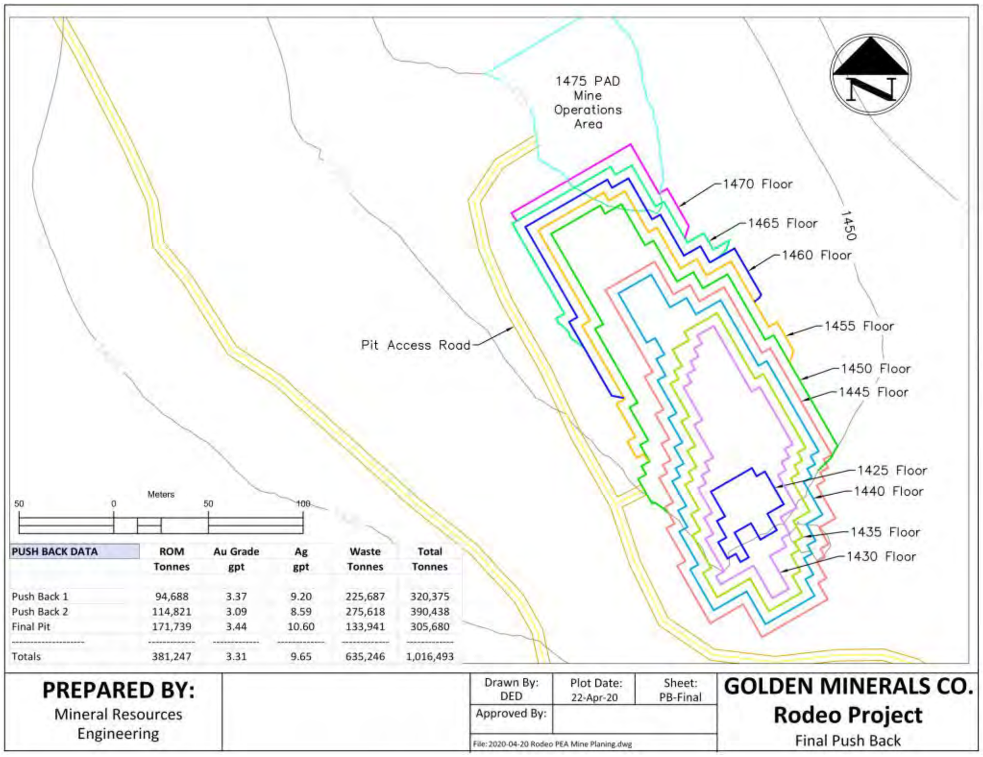


FIGURE 16-3: PUSH BACK 2



PUSH BACK DATA	ROM Tonnes	Au Grade gpt	Ag gpt	Waste Tonnes	Total Tonnes
Push Back 1	94,688	3.37	9.20	225,687	320,375
Push Back 2	114,821	3.09	8.59	275,618	390,438
Final Pit	171,739	3.44	10.60	133,941	305,680
Totals	381,247	3.31	9.65	635,246	1,016,493

FIGURE 16-4: FINAL PUSH BACK

16.1.4 Production Schedule

Table 16-2 displays the Rodeo Project's production schedule by Quarter (three-month period). The mining operation is anticipated to operate at 1,600-tpd (ROM material plus waste material) for the initial five quarters and then reduce to 900-tpd for the final four quarters. The use of a stockpile at the oxide plant in Velardeña will enable the contractor to operate at a static production level with the total material mined.

TABLE 16-2: RODEO PROJECT PRODUCTION SCHEDULE

	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9
Mine Products (tonnes)									
ROM Production	42,560	43,032	43,334	43,289	41,893	46,014	46,519	46,519	28,087
Waste production	101,440	102,568	103,866	103,911	93,107	35,886	36,281	36,281	21,906
Total Excavation	144,000	145,600	147,200	147,200	135,000	81,900	82,800	82,800	49,993
Ore Stockpile (tonnes)									
Beginning Balance	0	6,560	5,912	5,086	4,215	2,908	5,241	7,600	9,959
Added to Stockpile	42,560	43,032	43,334	43,289	41,893	46,014	46,519	46,519	28,087
Consumed at Plant	36,000	43,680	44,160	44,160	43,200	43,680	44,160	44,160	38,047
Ending Balance	6,560	5,912	5,086	4,215	2,908	5,241	7,600	9,959	0
ROM Plant Feed									
Tonnes	36,000	43,680	44,160	44,160	43,200	43,680	44,160	44,160	38,047
Au Grade (gpt)	3.37	3.37	3.17	3.10	3.12	3.42	3.44	3.44	3.44
Ag Grade (gpt)	9.20	9.20	8.78	8.61	8.79	10.49	10.59	10.60	10.60

Note: The strategy for gaining higher grade material in the initial quarters is achieved; the result of the first push back that utilizes accessing the mine at the 1450 Bench level

17 PROCESSING

17.1 PLANT II DESCRIPTION

Golden Minerals' agitated leach plant in Velardeña, Durango, is approximately 115 km from the Rodeo Project and has a design capacity of 550-tpd of oxide mineral. The plant is currently operating, as of the writing of this report, with feed from Hecla Mining Company's San Sebastian project at approximately 400 tpd. The plant is in excellent operating condition and the author last visited the plant in July of 2019. The tailing pond was recently expanded and should have adequate capacity for the tailing generated by the Rodeo Project.

The high-grade sample outlined in Section 13.1, RDi's Metallurgical Testing, had a Bond's Ball Mill Work Index of 25.3-kwh/st. A problem could arise in the grinding circuit if the ROM material does average 25.3-kwh/st. The high Work index results in a calculated marginal ball mill performance. The ball mill motor is not a concern because it has more than a 25 percent excess capacity to meet the required grinding demand, however the size of the ball mill and the capacity of the cyclone cluster may limit the throughput due to the large circulating load that could be present due to increased grinding time because of the material's high Work Index. Additional Work Index determinations on representative ROM are recommended to establish the average and actual range of expected Work Index values However to accommodate the existing Work Index determination two solutions to increase the ball mill efficiency, have been included in the planning and analysis should there be a problem with the grinding circuit attaining a steady 480-tpd production rate:

(1) The project model capital includes US$150,000 to install a small used tertiary cone crusher circuit that will further reduce the size of the ball mill feed. The current plant arrangement has sufficient power and space to accommodate this modification.
(2) The grind specification for this PEA study of the Rodeo Project's material has been set at P_{80} -150 mesh, rather than P_{80} -200 mesh. The test results suggest that the decrease in grinding from P_{80} 200 mesh to P_{80} 150 mesh will result in 2.2 percent less in gold recovery.

ROM material is received from the Rodeo Project by truck and unloaded in an area near the Plant II coarse ore bin. The ROM material is reclaimed by a front-end loader and fed onto a 12" passing grizzly over a bin that feeds an apron feeder that controls the material flow to a jaw crusher for primary crushing. The primary crushed material is sized by a vibrating screen operating in closed-circuit with a secondary standard cone crusher. The crushed fine material is conveyed to a 500-t fine ore bin ahead of grinding. The final product from the crushing and screening circuit is minus 3/8". The fine material is ground in a ball mill operating in closed circuit with cyclones for size classification. The cyclone undersize reports to the primary thickener where the pregnant solution overflow is pumped to the solution storage and the slurry underflow is pumped to the agitation train. The agitation tank train has seven tanks (72 hours of retention time; RDi's testing found that a minimum of 97 percent of the precious metals' extraction occurred in the first 24-hours) available, before arriving at the CCD wash circuit. The CCD wash circuit is comprised of four circular rake clarifiers with the overflow of the clarifiers running counter to the underflow of the four clarifiers; the CCD system washes the tailing and separates the pregnant solution from the slurry tailing. The four clarifier CCD circuit has a calculated wash efficiency of 99% using a wash ratio of 1.3 to 1 (tonnes wash water to tonnes solid feed). The tailing is pumped to the nearby tailing pond and the solution that is available at the tailing pond after settling is pumped back to the plant to be introduced into the ball mill circuit. The pregnant solution is filtered in two large horizontal filters using diatomaceous earth and then stored in a filtered pregnant solution tank. The filtered pregnant solution is processed in the Merrill-Crowe circuit with the precipitate produced with typical 36x36 plate and frame filter assemblies. The refinery uses a precious metal induction furnace and 20-kilogram molds.

The Merrill-Crowe section was upgraded and modernized in 2012, and the refinery has more capacity than that required by the Rodeo Project's demand.

A gold extraction of 83.8% and silver extraction of 76.3% have been used for the design basis of this PEA. These recovery values are based on achieving an overall grind of P_{80} 150 mesh.

Figure 17-1, on the following page, is a flowsheet of Plant II with the equipment sizes.

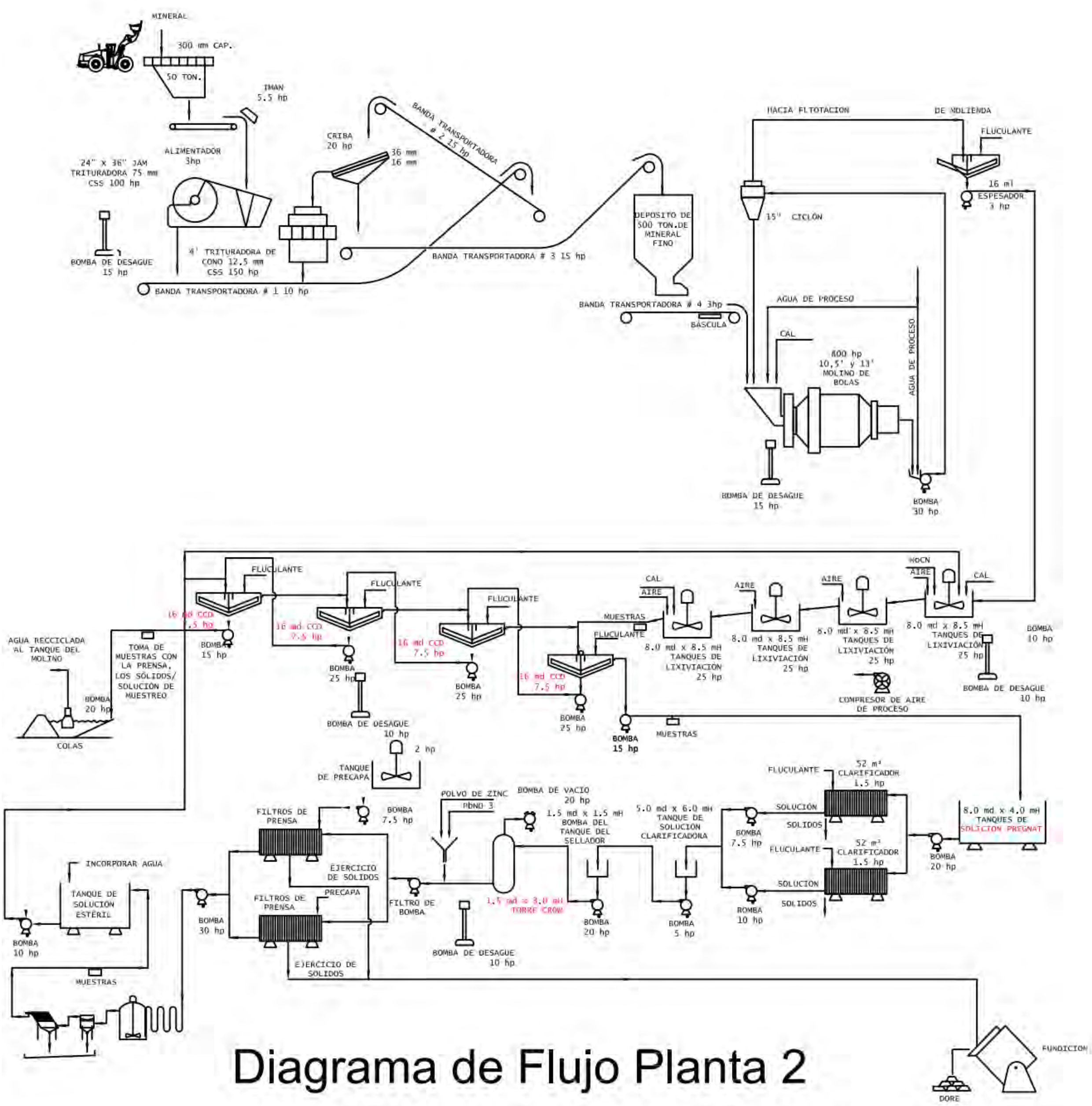


FIGURE 17-1: PLANT II EQUIPMENT SIZE FLOWSHEET

17.2 PLANT II PRODUCTION

The calculation of doré products generated at Plant II includes a 0.5 percent product loss that accounts for refining losses and small weighing discrepancies between Golden Minerals and the chosen refiner. **Table 17-1** is a summary of the Plant II production and products generated.

TABLE 17-1: PLANT II PRODUCTION AND PRODUCTS

	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9
ROM Tonnes	36,000	43,680	44,160	44,160	43,200	43,680	44,160	44,160	38,047
ROM Contained Au (oz)	3,897	4,729	4,503	4,394	4,336	4,803	4,880	4,882	4,207
ROM Contained Ag (oz)	10,652	12,924	12,461	12,223	12,211	14,733	15,032	15,045	12,964
Kg of Dore' Produced	383	465	447	438	436	514	523	524	451
Au oz in Dore' Product	3,250	3,943	3,755	3,664	3,616	4,005	4,069	4,071	3,507
Ag oz in Dore' Product	8,087	9,812	9,460	9,280	9,270	11,185	11,412	11,422	9,842

Table 17-2 summarizes the Rodeo Project's projected total production:

TABLE 17-2: RODEO PROJECT TOTAL PRODUCTION

	Totals
ROM Tonnes	381,247
ROM Contained Au (oz)	40,632
ROM Contained Ag (oz)	118,244
Kg of Dore' Produced	4,180
Au oz in Dore' Product	33,879
Ag oz in Dore' Product	89,769

18 PROJECT INFRASTRUCTURE

18.1 ACCESS ROAD

Figure 18-1 displays the existing access road (and upgrading of this road). The existing access road is 2.8 km in length. The existing road will be upgraded to a 7-meter wide graded road; the upgrade will require cut and fill work, most of which can be done with a bulldozer and/or road grader. The access road Daylight specifications, which are the required cutting or filling of the existing terrain where it intercepts the road's edges, are a 1:1 Cut and a 1.6:1 Fill. Any drainage issues with the main access road will be addressed using direct bury culverts to eliminate road damage during rain events.

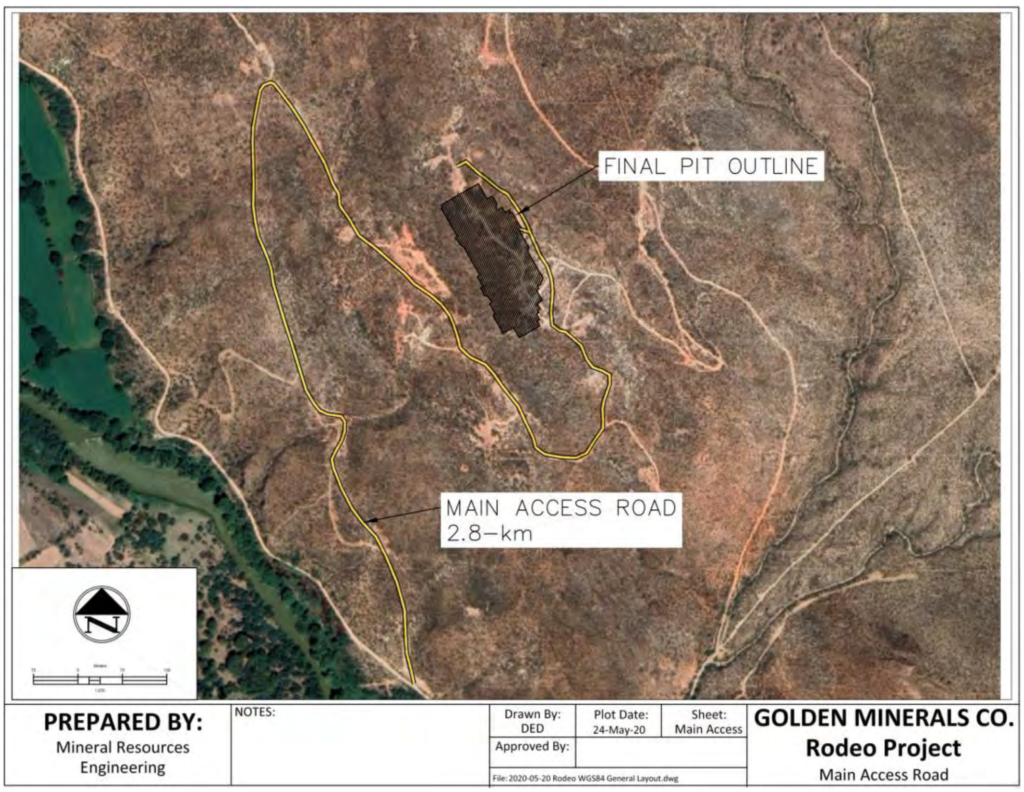


FIGURE 18-1: ACCESS ROAD FROM MAIN HIGHWAY

18.2 SERVICES AND INFRASTRUCTURE

The Rodeo Project requires a small amount of infrastructure due to the size and duration of the operation. **Figure 16-1** outlines the pad, at the 1475 elevation, that has been designated as the area for the project's infrastructure. The infrastructure will include:

- Mobile project office
- Portable restrooms
- Diesel and lubricant storage
- A small maintenance structure to perform work on the mobile equipment
- 20' and 40' Shipping containers for temporary warehousing

- Small generator for power to maintenance area and the mobile office
- The truckloads of water used for wetting roadways will be purchased from local farmers/ranchers
- Rental houses in Rodeo will provide temporary camp facilities for the project personnel who are transient
- Rodeo is equipped with an IMSS clinic and the nearest hospital is 187 km from Rodeo in Gomez Palacio
- Rodeo has small basic markets, banking, pharmacies and small hardware stores

19 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

19.1 MEXICAN PERMITTING FRAMEWORK

The following dialogue of Mexican Permitting Framework is from the Technical Report: Mineral Resource Estimate Rodeo Project issued March 10, 2017 by Tetra Tech, authored by Geoffrey Elson.

Environmental permitting of the mining industry in Mexico is mainly administered by the federal government body SEMARNAT, the federal regulatory agency that establishes the minimum standards for environmental compliance. Guidance for the federal environmental requirements is largely held within the General Law of Ecological Equilibrium and Environmental Protection (Ley General Del Equilibrio Ecologico y la Proteccion al Ambiente, or LGEEPA). Article 28 of the LGEEPA specifies that SEMARNAT must issue prior approval to parties intending to develop a mine and mineral processing plant. An environmental impact assessment (by Mexican regulations called a Manifestation de Impacto Ambiental, or "MIA") must be filed with SEMARNAT for its evaluation and, if applicable, further approval by SEMARNAT through the issuance of an Environmental Impact Authorization; the document specifies approval conditions where works or activities have the potential to cause ecological imbalance or have adverse effects on the environment. Further requirements for compliance with Mexican environmental laws and regulations are supported by Article 27 Section IV of the Ley Minera and Articles 23 and 57 of the Reglamento de la Ley Minera. Article 5 Section X of the LGEEPA authorizes SEMARNAT to provide the approvals for the works specified in Article 28. The LGEEPA also contains articles for soil protection, water quality, flora and fauna, noise emissions, air quality, and hazardous waste management.

The National Water Law (Ley de Aguas Nacionales) provides authority to the National Water Commission (Comision Nacional del Agua or CONAGUA), an agency within SEMARNAT, to issue water extraction concessions, and specifies requirements to be met by applicants.

Another important piece of environmental legislation is the General Law of Sustainable Forestry Development (Ley General de Desarrollo Forestal Sustentable - LGDFS). Article 117 of the LGDFS indicates that authorizations must be granted by SEMARNAT for land use changes to industrial purposes. An application for change in forestry land use (CUSTF) must be accompanied by a technical study that supports the Technical Justification Study (Estudio Tecnico-Justificativo - ETJ). In cases requiring a CUSTF, a MIA for the change of forestry land use is also required.

Mining projects also must include a Risk Study (ER) and an Accident Prevention Plan (PPA) filed with SEMARNAT.

The General Law for the Prevention and Integrated Waste Management (Ley General para la Prevention y Gestion Integral de los Residuos- LGPGIR) also regulates the generation and handling of hazardous waste coming from the mining industry. Guidance for the environmental legislation is provided in a series of Official Mexican Standards (Norma Oficial Mexicana - NOMs). These regulations provide specific procedures, limits and guidelines and carry the force of law.

19.1.1 EXPLORATION RELATED

The following list of permits, registrations and permissions apply to the exploration phase of the Rodeo Project. Golden Minerals is currently completing the permitting process and their advance is listed below:

- **Environmental Impact Assessment (MIA)** – NOM-120-Semarnat-2011 completed and submitted in December of 2019.
- **Land Use Change (CUSTF)** – NOM-120-Semernat-2011 completed and submitted in December of 2019.

19.1.2 Mining Related

The following list of permits, registrations and permissions apply to the mining operations phase of the Rodeo Project. Golden Minerals is currently completing the permitting process and their advance is listed below:

- **Baseline Development** The collection of this information is in process, but the completion of this activity does not affect the start of the project.
- **Temporary Occupation permit** –
- **Temporary Occupation Permit** – Completed temporary occupation agreement for mining with La Pequeña ranch owner in February 2020.
-
- **RAN Registration** – The registration of the agreement with the landowners with the RAN agency. This is only required with Ejidos. Notice of temporary occupation to conduct exploration and the extraction of material within the confines of the "La Pequeña" ranch.
- **Temporary Occupation Permit** – Permission from Ejido Francisco Marquez for access of personnel and equipment in the south side of the "La Pequeña" ranch. Completed in April 2020.
- **Temporary Occupation Permit** – **Certification** – Register the same agreement that was submitted to RAN with a notary public. This activity is in process and scheduled for completion in May 2020.
- **Environmental Impact Assessment (MIA)** – NOM-120-SEMARNAT-2011 is in process. The document was completed in April 2020. Acceptance is dependent on SEMARNAT.
- **Justification for Change of Land Use ETJ** – Technical study submitted to SEMARNAT to satisfy the LGDF (Ley General de Desarollo Forestal), Articles 117 and 118, which is the general development of forest lands in Mexico. This activity was completed in April 2020.
- **General Permits for the Purchase, Storage, and Consumption of Explosives (SEDENA)** – Explosive permits issued by SEDENA. These permits are reliant on the MIA evaluation with SEMARNAT.
- **Permit for the Consumption of Water** – The permit is gained through CONAGUA. The other option to gain the required water for the project is to purchase the water through a private owner/Ejido. This activity has not started.
- **Payment for Environmental Disturbance** - Payment submitted to SEMARNAT, Articles 117 and 118, the general development of forest lands. Not completed.
- **Single Environmental License (LAU)** – Not applicable to the project.

19.2 Golden Minerals Permit Schedule

Table 19-1 outlines the required permits, permissions, documents and work required to start the Rodeo Project.

TABLE 19-1: GOLDEN MINERALS RODEO PROJECT PERMITTING

RODEO PROJECT : ENVIRONMENTAL SCHEDULE (April 14 2020)

#	Permit / Activity	(2019: OCT–DEC; 2020: JAN–DEC; 2021: JAN–MAR)	NORMATIVIDAD
	EXPLORING		
1	Environmental Impact Assessment (MIA)		NOM-120-SEMARNAT-2011
2	Land Use Change Cambio de uso de suelo (CUSTF)		
3	MINING		
4	Project Planning to mining		Se considera indispensable
5	Baseline Development (LB)	Does not affect to start operations	Aún no hay Normatividad pero está muy cerca
6	Negotiation of surface land owners on Temporary Occupation Permit to mining	completed	NO APLICA
7	Registration of the agreement with the owners of the land in the RAN to accredit the temporary occupation permit to exploring and mining the economic mineral in the "La Pequeña" ranch	is not necessary, only to Ejido	Ley agraria, su reglamento y art 120 del reglamento de la ley general de desarrollo forestal.
8	Certify with a notary public the TEMPORARY OCCUPATION PERMIT of Superficial Land of Interest		
9	Development of environmental impact manifestation. (MIA)	completed	LGEEPA y su Reglamento en materia de Impacto Ambiental
10	MIA evaluation and DIAGNOSIS	depends of SEMARNAT	
11	Develompment of technical study Justification for the change of land use. (E T J)		Ley general de desarrollo forestal (art 117 y 118) Reglamento de la **LGDF**.
12	Evaluation and opinion of a justifying technical study for the change of land use(SEMARNAT)	depends of SEMARNAT	
13	**General Permits for the Purchase, Storage, Consumption of EXPLOSIVE Material (SEDENA)**	depends of SEMARNAT	Ley Federal de Armas de fuego y Explosivos y su Reglamento. (SEDENA
14	**Construction permits. From Polvorines, offices, and others.**	depends of SEMARNAT	
15	Processing of permits or concessions to dispose and consumtion of Water (CNA and / or Ejidos)		C N A
16	Economic payment ($) for environmental compensation.		Ley general de desarrollo forestal (art 117 y 118) Reglamento de la **LGDF**.
17	Topographically identify the defined and authorized area.	Does not affect for start of operations	
18	Rescue of Flora and Fauna species listed in NOM 059.		NOM-059-SEMARNAT-2010
19	Clean the topsoil in the areas of interest.	Does not affect to start operations	
20	Hauling and accommodating vegetail soil .	Does not affect to start operations	
21	Compliance with environmental compensation works (filter dams, reforestation, etc.).	Does not affect to start operations	Art 121 fracción VIII del reglamento de la LGDF
22	Single Environmental License (LAU)	Does not affect to start operations	**NO APLICA**
23	Mining process (drilling, blasting , mucking and hauling to Plant II in Velardeña		**Etapa de producción**
24	Hazardous Waste Management Plan (includes Registration as a Hazardous Waste Generator)	Does not affect for start operations	NOM 157 SEMARNAT
	Negotiation with surface land owners(Ejido Francisco Marquez) to Temporary Occupation Permit of roads to ACCESS PEOPLE AND EQUIPEMENT MOBILE in south side from "La Pequeña" ranch.	completed	
	Note: the single environmental License (22) and the annual Operation Certificate, at the start time does not apply. The Elaboration of the BASE LINE includes the physical and biological characterization of the area of influence of the project BEFORE START ,DURING AND END THE LIFE PROJECT.	OCT NOV DEC (2019); ENE FEB MAR ABR MAY JUN JUL AGO SEPT OCT NOV DEC (2020); ENE FEB MAR (2021)	
	Elaboración de la LINEA BASE incluye la caracterización física y biológicamente del área de influencia del proyecto).		

Program | Completed | Mining Process

19.3 SOCIAL OR COMMUNITY IMPACT

Rodeo is a small ranching and farming community. The Rodeo mining operation, although short lived, will give the local economy a boost with a small number of employment opportunities, the rent of vacant houses and buildings, restaurant business, and an increase in business such as at hardware stores, markets, rental housing, gas stations, and pharmacies.

20 CAPITAL AND OPERATING COSTS

The estimate is in United States dollars (US$) and based on prices and market conditions as of April 1, 2020.

Preliminary general arrangement drawings were produced with enough detail for estimating the engineering quantities required for determining the mine schedule and costs associated with the proposed mine production. The unit mining rates used reflect the current market conditions for mining contractors, labor, and operating supplies and materials. **Table 20-1** displays the general operating parameters for the project.

TABLE 20-1: GENERAL OPERATING PARAMETERS

Operating Variables	Totals
Daily Process Tonnes	480
Daily Mined Tonnes	1,240
Annual Operating Days	350
Total Process Tonnes - ROM	381,247
ROM Contained Au (oz)	40,632
ROM Contained Ag (oz)	118,244
Au Payable oz. Produced	33,540
Au Payable oz. Produced	88,871

Notes:

(1) Daily mined tonnes is the sum of the waste and ROM process tonnes combined.

20.1 OPERATING COSTS

The following points outline each of the operating costs used in developing the economic assessment.

- The contract mining costs were generated using actual current contractor costs for mining a similar operation in the region. The mining cost includes the in-pit haul to a dump location of 2,000 meters or less. Factors were estimated and used to eliminate the discrepancy between the contractor's current operation and the known variables associated with the Rodeo resource. Primarily, the Rodeo resource's material is harder and more abrasive than the material in contractor's current operation. **Table 20-2** displays the contractor unit mining cost for ROM, Cutoff +, and waste materials.

TABLE 20-2: CONTRACTOR MINING COST

US$ per Bank Cubic Meter	ROM	Cutoff +	Waste
Excavation w/o Explosives	$4.02	$4.02	$1.75
Hard/Abrasive Allowance	$1.01	$1.01	$0.44
Explosives	$1.59	$1.59	$1.59
Drilling	$1.39	$1.39	$1.39
Hard/Abrasive Allowance	$0.70	$0.70	$0.70
Drill hole Sampling	$0.72	$0.72	$0.00
Total Cost per BCM	**$9.42**	**$9.42**	**$5.85**
Cost per Tonne	$3.77	$3.77	$2.43

- Golden Minerals will supply project site management, engineering, geologic modeling personnel, and face control technicians in the pit. This fixed cost is estimated to be $91,513 per quarter.
- The haulage cost was generated using actual current contractor costs for haulage at a similar operation in the region. The contractor's current cost was increased by 15 percent for the Rodeo Project to account for the difference in road conditions along the two routes. The haulage from the Rodeo Project to Golden Minerals Plant II in Velardeña is estimated to cost $14.93 per tonne. Each truck will be weighed at Plant II using the existing truck scales located at the plant.
- The cost of processing the ROM material at Plant II is $35.00 per tonne. This cost is based on current operating costs, including the projected consumption levels of critical reagents.
- An allowance of $50,000 per quarter is used to pay for the incremental cost of the Rodeo Project's demand on the Golden Minerals Mexican Business Unit. This allowance covers human resources, project accounting, purchasing, and corporate safety and environmental costs.
- A contingency of 10 percent was applied to the preceding costs. The purpose of the contingency is to create a provision for the uncertainties that exist within the project scope. The contingency makes no allowance for a change in scope, escalation, or exchange rate fluctuations. The author believes that a 10 percent contingency for the operating costs is justified because of the nature of the costs used in the analysis, historical costs; and current contractor costs.
- A 2.0 percent property Net Smelter Return royalty was applied to the NSR credit.
- A 0.5 percent Mexican Government Net Smelter Return royalty was applied to the NSR credit.

The total estimated operating cost with royalty is $70.56 per tonne, which includes the pre-production costs that are capitalized in the financial model cash flow shown in **Table 21-5**. **Table 20-3** summarizes the overall operating cost per tonne for the Rodeo Project.

TABLE 20-3: OPERATING COST

	Total Cost		Fixed Costs		Unit Costs	
Cost Variable	**Project Total Cost**	**US$/ROM Tonne**	**Project Total Cost**	**US$/ROM Tonne**	**Project Total Cost**	**US$/ROM Tonne**
Contractor Cost- ROM	$1.44 M	$3.77			$1.44 M	$3.77
Contractor Cost - Waste	$1.54 M	$4.05			$1.54 M	$4.05
GM Mine Fixed Costs	$0.82 M	$2.16	$0.82 M	$2.16		
Ore Haulage to Plant II	$5.69 M	$14.93			$5.69 M	$14.93
Oxide Plant	$13.34 M	$35.00			$13.34 M	$35.00
Home Office Charges	$0.45 M	$1.18	$0.45 M	$1.18		
Contingency @ 10%	$2.25 M	$5.89	$2.25 M	$5.89		
Property NSR Royalty	$1.09 M	$2.87			$1.09 M	$2.87
Mexican NSR Royalty	$0.27 M	$0.72			$0.27 M	$0.72
Total Operating Cost	**$26.90 M**	**$70.56**	**$3.52 M**	**$9.24**	**$23.38 M**	**$61.33**

20.2 Capital, Pre-Production and Reclamation

The following points outline each of the capital costs used in developing the economic assessment.

- A $25,000 allowance for Golden Minerals to establish residence and a small business unit in the pueblo of Rodeo.
- A $25,000 allowance to have sensitive plants relocated from areas that will be disturbed in the mining and stockpiling process.

- A $150,000 allowance to install a tertiary cone crusher circuit should the Work Index of the ROM material cause a grinding problem with the current beneficiation circuit at Plant II. This problem is discussed in detail in Section17-1.
- A $155,000 allowance for the mobilization and setup of the mining contractor.
- A $79,000 allowance for the rehabilitation of the main access road.
- An $815,000 allowance for the operation's pre-production cost: one-month's operating cost to cover the lag time that will exist between mining, processing and doré production, and receiving payment from the refiner for the first shipment of metal.
- A $50,000 allowance for the demobilization of the mining contractor.
- A $50,000 reclamation allowance to clean up the mine operations area and plant native shrubs in areas of disturbance. The reclamation allowance does not include backfilling or fencing the perimeter of the pit or placing topsoil and planting vegetation on the waste dump (or low-grade stockpile).
- The capital costs have a 15 percent contingency applied to the preceding costs. The purpose of the contingency is to create a provision for the uncertainties that exist within the project scope. The contingency makes no allowance for a change in scope, escalation, or exchange rate fluctuations.

Table 20-4 Summarizes the project's capital cost.

TABLE 20-4: CAPITAL COSTS

Capital Item	Cost US$
Golden Minerals Mob	$25,000
Environmental Concerns	$25,000
Beneficiation Modification	$150,000
Contractor Mobilization	$155,841
Contractor Demobilization	$51,488
Access Road	$79,072
Reclamation Allowance	$50,000
Contingency	$161,913
Pre Production	$814,533
Total Capital Costs	**$1,512,847**
Capital Cost per ROM Tonne	**$3.97**

Table 20-5 Summarizes the pre-production costs.

TABLE 20-5: PRE-PRODUCTION ALLOWANCE

Pre-Production Item Item	Cost US$
Contractor Cost- ROM	$53,471
Contractor Cost - Waste	$82,128
GM Mine Fixed Costs	$30,504
Ore Haulage to Plant II	$211,762
Oxide Plant	$420,000
Home Office Charges	$16,667
Total Capital Costs	**$814,533**

21 ECONOMIC ANALYSIS

The financial model constructed by Mineral Resources Engineering assesses the project costs and revenues generated for the Preliminary Economic Assessment study.

21.1 MARKETS AND COMMERCIAL TERMS

The gold price is the key parameter to the project's success. The following factors influence the gold market:

- International economic and political conditions.
- Expectations of inflation.
- Interest rates.
- Speculative activities
- Supply and demand

Table 21-1 outlines the market assumptions and **Table 21-2** outlines the commercial terms used in the construction of the financial model.

TABLE 21-1: MARKET ASSUMPTIONS

Description	Units	Value	Basis
Gold price	$/oz.	$1,621.80	April 1, 2020 Kitco Spot price
Silver price	$/oz.	$14.38	April 1, 2020 Kitco Spot price
MXP per USD Exchange	MXP	$24.20	April 1, 2020 Kitco Spot price
Property NSR Royalty	percent	2.00%	Golden Minerals
Mexican NSR Royalty	percent	0.50%	Golden Minerals

TABLE 21-2: COMMERCIAL TERMS

Description	Units	Value
Gold Payable	percent	99.00%
Silver Payable	percent	99.00%
Treatment Charge	$/kg	$0.00
Gold Refining Charge	$/oz.	$5.60
Silver refining Charge	$/oz.	$0.28
Shipping, Selling, Insurance	percent	1.50%
Penalty Elements	$/kg	$0.00

21.2 FINANCIAL ASSUMPTIONS

The project has been modeled using 100 percent equity financing. Working capital is set to $0 because a pre-production allowance was calculated and used in the required capital calculations.

Taxable income was estimated in the model and was calculated by deducting the depreciation, permitting/development costs, and NOLs from the operating margin. The maximum income tax rate is 30 percent. The project has no depreciation or salvage value because there are no buildings, stationary or mobile equipment. The model allows the use of the NOLs (Tax Loss Carried Forward in Mexico). A 7.5 percent rate is used for the calculation of Mexico's SMT (Special Mining Tax); The calculation of the SMT for the project is the tax rate (7.5

percent) applied to the taxable income before the NOLs allowance because the project has no depreciation allowances that would further reduce the SMT tax basis. The model includes a financial analysis using the assumptions shown in **Table 21-3**.

TABLE 21-3: FINANCIAL ASSUMPTIONS

Description	Units	Value
Project Equity	percent	100.00
Discount rate	percent	8.00
Working Capital Required	millions	$0.00 M
Income Tax Rate	percent	30.00
NOL's Available	millions	$80.00 M
VAT Payable	percent	15.00
SMT Tax Rate	percent	7.50
CUCA Beginning Balance	millions	$0.14 M
Depreciation	millions	$0.00 M
Salvage Value	millions	$0.00 M

21.3 MODEL PARAMETERS

The model assumptions listed in **Table 21-4** are discussed in detail throughout the preceding sections.

TABLE 21-4: TECHNICAL MODEL PARAMETERS

Parameter	Units	Input
Pre-production Period	Quarter	1.00
Mine Life	Quarter	9.00
Project Life	Quarter	10.00
Gold Price	$/oz.	$1,621.80
Silver Price	$/oz.	$14.38
Payable Gold Produced	ounces	33,540
Payable Silver Produced	ounces	88,871
Dore' Produced	kg	4,180

Note:

(1) Quarter refers to a three-month period.

The pre-production period allows for the setup of the site, the mobilization of the contractor, the upgrading of the access road, the relocation of sensitive plants and shrubs away from the areas of disturbance, and the establishment of a small business unit in the pueblo of Rodeo. An estimated 33,540 ounces of gold are estimated to be produced over the life of the project.

21.4 PROJECT FINANCIALS

Table 21-5 summarizes the financial results for the Rodeo Project. The results indicate an after-tax $NPV_{8\%}$ of US$22.5 million. The capital payback is estimated to occur in the first quarter of operation. The following inputs are the basis of the LOM plan and economics:

- The Rodeo extractable resource for processing ROM is 381,247 tonnes.

- The life of the project is 10 quarters.
- The average recovery for gold is 83.8% and for silver is 76.3% in an agitated leach plant.
- $1.4 million is the recommended funding required to start the project.
- The cash operating cost is $70.56/tonne.
- Capital costs are estimated to be US$1.51 million, including $0.81 million for pre-production costs.
- The mine closure costs (reclamation) are estimated to be US$50,000.
- $798 is the cash cost per payable ounce of gold, and $843 is the all-in cash cost per payable ounce of gold.
- There is no salvage value associated with the operation.

TABLE 21-5: FINANCIAL MODEL RESULTS

Description	Units	Value	Per Payable oz. AuEq
Production			
ROM Material Processed	tonnes	381,247	
Payable Gold Produced	ounces	33,540	
Payable Silver Produced	ounces	88,871	
Payable AuEq produced	Eq-ounces	34,328	
Market			
Gold Price	$/ounce	$1,621.80	
Silver Price	$/ounce	$14.38	
Gross Revenue	**US$000's**	**$55,674**	**$1,621.80**
Freight, TC's, Insurance	US$000's	$1,048	$30.52
Net Revenue (NSR)	**US$000's**	**$54,626**	**$1,591.28**
Property NSR Royalty	US$000's	$1,093	$31.83
Mexican NSR Royalty	US$000's	$273	$7.96
Net After Royalties	**US$000's**	**$53,260**	**$1,551.50**
Mining Contractor	US$000's	$2,844	$82.86
GM Mine Fixed Costs	US$000's	$793	$23.10
Ore Haulage to Plant II	US$000's	$5,479	$159.61
Oxide Plant	US$000's	$12,924	$376.47
Head Office Charges	US$000's	$433	$12.62
Contingency	US$000's	$2,247	$65.47
Operating Costs	**US$000's**	**$24,721**	**$720.13**
Operating Margin	**US$000's**	**$28,539**	**$831.37**
Pre-production Cost	US$000's	$815	$23.73
Site Work	US$000's	$104	$3.03
Setup and Mobilizations	US$000's	$232	$6.77
Crusher modifications	US$000's	$150	$4.37
Reclamation	US$000's	$50	$1.46
Contingency	US$000's	$162	$4.72
Capital Costs	**US$000's**	**$1,513**	**$44.07**
Pre-Tax cash Flow	**US$000's**	**$27,027**	**$787.30**
Total Taxes	US$000's	$2,140	$62.35
Cash Flow	**US$000's**	**$24,886**	**$724.94**
NPV at 8%	**US$000's**	**$22,457**	

Cash costs per payable gold ounce, net of by-product credits, include all direct and indirect costs associated with the physical activities that would generate concentrate and doré products for sale to customers, including mining to gain access to mineralized materials, mining of mineralized materials and waste, milling, third-party related treatment, refining and transportation costs, on-site administrative costs and royalties. Cash costs do not include depreciation,

depletion, amortization, exploration expenditures, reclamation and remediation costs, sustaining capital, financing costs, income taxes, or corporate general and administrative costs not directly or indirectly related to the Velardeña Properties. By-product credits include revenues from silver contained in the products sold to customers during the period. Cash costs, after by-product credits, are divided by the number of payable gold ounces generated by the plant for the period to arrive at cash costs, after by-product credits, per payable ounce of gold. All-in sustainable costs per payable gold ounce, net of by-product credits, begins with cash costs per payable gold ounce, net of by-product credits, and also includes pre and post-production capital and sustaining capital.

21.5 Sensitivity Analysis

The NPV project sensitivity analysis detailed in **Table 21-6** suggests that the project is most sensitive to revenue generation (market prices, recoveries, and grade). The project is least sensitive to capital costs.

TABLE 21-6: PROJECT SENSITIVITY (NPV 8% US$ MILLIONS)

VARIATION FROM BASE CASE	-30%	-20%	-10%	BASE CASE 0%	10%	20%	30%
Revenues	$9.02	$13.50	$17.98	$22.46	$26.94	$31.41	$35.89
Operating Costs	$28.93	$26.77	$24.61	$22.46	$20.30	$18.15	$15.99
Capital Costs	$22.90	$22.75	$22.60	$22.46	$22.31	$22.16	$22.02

Notes:

(1) Note: The Base Case After Tax $NPV_{8\%}$ is US$22.46M, which is projected from the project's estimated revenue, operating costs, capital costs, and calculated taxes based on Golden Minerals Co. current Mexican tax structure.

The LOM economic result shows that operating costs represent 48% of the gross revenues, which is slightly higher than the typical metric of 35 – 40% for similar operations. An inordinate haulage cost is the primary contributing factor skewing this metric; overall, the haulage cost, as high as it is, is more than offset by not having to build a processing plant at the Rodeo site.

22 INTERPRETATION AND CONCLUSIONS

22.1 GEOLOGY AND RESOURCE ESTIMATION

The author has reviewed the core from the Rodeo drill holes and agrees with Tetra Tech's assessment of the core. The author also reviewed Tetra Tech's review of the sample preparation and analytic methods utilized during the drilling and sampling campaigns that have been conducted on the project, and is of the opinion that the results are of good quality and suitable for use in the estimation of the Rodeo Project resource. The author also conducted a review of the 2017 resource model that is the basis for the current mineral resource and is of the opinion that the model has been constructed using acceptable industry methods, and that the model is reasonable to use as the basis for this PEA study.

22.2 MINING

The Rodeo Project presents a unique opportunity because of the small amount of capital and pre-production costs required to put the mine into production: capital is less than 6% of the project's estimated total operating margin.

The author is of the opinion that the mine plan and associated production schedule has been developed to a level that exceeds PEA requirements. The mine plan exploits the resource's relation to the existing terrain for early access to some of the higher-grade material. The mine plan continues to prioritize the higher-grade material with the final two pushbacks that follow the initial pushback.

The direct mining cost of $7.46/tonne ROM, which includes a 1.7:1 waste to ROM stripping ratio, is supported by actual costs of a regional contractor at a similar sized operation. Following the outlined ore control plan and cutoff grades are critical for Golden Minerals to gain the projected economics of the project.

22.3 METALLURGICAL AND PROCESSING

The metallurgical report prepared by RDi for the Rodeo Project provides data that is sufficient for a PEA level analysis. The high value of the RDi measured hardness (Bond's Work Index) taken from a single composite sample raises a concern that the sample may not be representative of the ROM material that will be transported to the Velardeña plant for processing. The hardness of the material drives whether the current crushing and screening circuit at Golden Minerals' Plant II is going to be able to reduce the material to the grind size required to gain the prescribed levels of precious metal recoveries. The author agrees with Golden Minerals' current plan to drill several additional drill holes into the resource to gain fresh material for further testing of the hardness and recoveries.

The tailing pond at Plant II was expanded in 2019 making available enough room for the storage of the Rodeo Project's tailing. Golden Minerals has a permit that will allow further expansion of the tailing pond if required. The author's opinion is that the sensitivity analysis fully absorbs the risk of Golden Minerals' having to expand the tailing pond during the operation of the project.

22.4 ENVIRONMENTAL

The current permitting/environmental work being performed by Golden Minerals staff and outside consultants is consistent with international mining best practices and mining operations in Mexico. The author agrees with the effort being made by Golden Minerals to identify (1) the required reclamation of disturbed land, (2) air quality protection, (3) ensuring adequate water supply for the project and (4) impact on the local communities. The allowances used in the PEA for the implementation of the mitigation measures and monitoring programs should prevent or minimize any impacts.

23 RECOMMENDATIONS

23.1 RESOURCE

Based on the author's review of the resource drilling and block model, the following suggestions are recommended:

There are some opportunities to expand the resource with additional drilling, and there are some areas that the confidence level of the resource could be increased with additional drilling. Golden Minerals is currently planning a drilling program that addresses these two recommendations. Condemnation drill holes beneath the proposed waste dump are also recommended.

23.2 MINING

The author recommends that a preliminary bid package, based on the current resource and mine plan, be constructed and let out for preliminary bid with regional mining/civil contractors. The bid package should include the two options of (1) the contractor providing explosives under their permit, or (2) having Austin Powder bid the explosive service where no on-site magazines are required.

An investigation should be undertaken and completed to determine the availability and cost to satisfy the project's small water requirement with local ranchers or farmers.

23.3 METALLURGY AND PROCESS

Based on the authors review of the metallurgical testing, the following suggestions are recommended:

- The Bond's Work Index test results are 25.3 kwh/st, a hard material that could have a negative effect on the processing plant's crushing and milling circuit. Additional Bond's Work Index testing should be considered to determine if the current value of 25.3 kwh/st is typical of the Rodeo resource or if the ROM material BWI is less. This test should be completed promptly so that modifications to the plant can be completed before the mining of the Rodeo resource is started.
- A small program of core drilling is planned to further define the high-grade resource before advancing the Rodeo Project to production. Another series of bottle roll tests to confirm the extraction and reagent consumptions would be beneficial using the newly drilled core.

23.4 ENVIRONMENTAL AND PERMITTING

Golden Minerals should continue with the accumulation of the required permits for the Rodeo Project as outlined in Section 19. The current environmental permitting process is scheduled to be completed by the start of 2021

23.5 OPPORTUNITIES

The current recommended/proposed drilling campaign has an opportunity for growing the mining resource, which would increase the project's production life.

It is recommended that the mining contract be offered via a competitive bidding process to a minimum of three mining contractors; this process would likely achieve a low-cost bid for the mining of the Rodeo resource.

24 REFERENCES

Berger, B. R. and Eimon, P, 1983: Conceptual models of epithermal precious metal deposits, Shanks, W. L., editor, Volume on Unconventional Mineral Deposits, American Institute of Mining, Metallurgical and Petroleum Engineers, Inc. (1983), pp. 191 - 205.

Blanchflower, J.D., 2010: Technical Report on the Rodeo Property State of Durango, Mexico; prepared for Camino Minerals Corporation.

Blackwell, M. and Pryor, M. J., 1996: Interim Drilling Report, Rodeo Concession; private drilling report prepared for Monarch Resources de Mexico, S.A. De C.V., 32 p. plus maps and sections.

Buchanan, L. J., 1981: Precious Metal Deposits associated with Volcanic Environments in the Southwest; in Relations of Tectonics to Ore Deposits in the Southern Cordillera; Arizona Geological Society Digest, Volume 14, pp. 237 - 262.

Camino Minerals Corporation, 2009: Various private reports, maps and concession data.

Canplats Resources Corporation, 2009: Various private geological and drilling reports, maps and data prepared for Canplats Resources Corporation.

Charre, C., 2007: Various private geological and drilling reports, maps and data prepared for Canplats Resources Corporation.

Davis, Gordon, 2003a: 'Canplats Stakes Drill-Ready Epithermal Gold Project in Mexico', Canplats Resources Corp. News Release Feb 24, 2003, 2 p.

Davis, Gordon, 2003b: 'Canplats Commences Field Work On Mexican Gold Projects', Canplats Resources Corp. News Release September 22, 2003, 2 p.

Davis, Gordon, 2004a: 'Canplats Commences Drilling at Rodeo Gold Property in Mexico', Canplats

Resources Corp. News Release January 13, 2004, 2 p.

Davis, Gordon, 2004b: 'Canplats Reports Significant Gold Intercepts From Initial Drilling at Rodeo in Mexico', Canplats Resources Corp. News Release February 10, 2004, 3 p.

Davis, Gordon, 2004c: 'Canplats Reports Further Gold Intercepts in Phase I Drilling at Rodeo in Mexico', Canplats Resources Corp. News Release February 24, 2004, 2 p.

Davis, Gordon, 2004d: 'Drilling at Rodeo Gold Project Underway in Mexico', Canplats Resources Corp. News Release March 23, 2004, 2 p.

Davis, Gordon, 2004e: 'Rodeo Drilling Intersects Gold Mineralization Over Significant Intervals', Canplats Resources Corp. News Release September 7, 2004, 3 p.

Davis, Gordon, 2004f: 'Drilling at Rodeo Intersects 2.0 grams of Gold per Tonne over 29.0 Meters; New Zone Discovered', Canplats Resources Corp. News Release October 5, 2004, 2 p.

Davis, Gordon, 2007a: 'Canplats Reports Drilling Underway At Rodeo In Mexico', Canplats Resources Corp. News Release April 23, 2007, 2 p.

Davis, Gordon, 2007b: 'Canplats Updates Property Activities', Canplats Resources Corp. News Release September 20, 2007, 2 p.

de Cserna, I., 1989: An outline of the geology of Mexico, in Bally, A. W., and Palmer, A. R., eds., The Geology of North America - An overview: Boulder, Colorado, Geological Society of North America, v. A, pp. 233 - 264.

Dufresne, R., 2009: Personal communications including property status and legal agreement information. Dufresne, R., 2010: Personal communications regarding drilling data, contractors and results.

Dunne, K. P. E., 2005: Petrographic Report, Rodeo Project, Durango, Mexico; private report prepared for Canplats Resources Corporation, January 24, 2005, 4 p. plus appendices and map.

Durning, P. and Hillemeyer, B., 1994: Reconnaissance summary, Rodeo Prospect, Unpublished. Report, 14 p.

Durning, P. and Hillemeyer, B., 1995a: Brief Review of Findings from Geologic Mapping at the Rodeo Project, Durango, Mexico. La Cuesta International, Inc.

Durning, P. and Hillemeyer, B., 1995b: Additional Rock-Chip Sampling at the Rodeo Project, Durango, Mexico. La Cuesta International, Inc.

Faure, K. et al., 2002: The Hishikari Au-Ag Epithermal Deposit, Japan: Oxygen and Hydrogen Isotope Evidence in Determining the Source of Paleohydrothermal Fluids; Economic Geology, V. 97, pp. 481 - 498.

Francois Gaboury and Abraham Magallanes, March 2012: Internal Report On 2011 Drilling Program and Results Rodeo Project State of Durango, Mexico, for Rojo Resources S.A. de C.V.

Heald, P., Foley, N. K. and Hayba, D. O., 1987: Comparative Anatomy of Volcanic-Hosted Epithermal Deposits: Acid-Sulfate and Adularia Sericite Types; Economic Geology, Volume 82, pp. 1 - 26.

Hillemeyer, F. L., 1997: Rodeo Epithermal Gold-Silver Prospect, Durango, Mexico; private executive summary report prepared for La Cuesta International Inc.

Imlay, R. W., 1938: Studies of the Mexican Geosyncline, Bull. Geol Soc. America, Vol. 49, No. 11, pp. 1651 - 1694.

Konya, C. J., 1985: Rock Blasting, McLean, Va.: U.S. Department of Transportation, Federal Highway Administration

McCrea, J. A., 2007: Technical Report on the La PitarriI la Property, Durango, Mexico, for Silver Standard Resources Inc. dated May 21, 2007.

McNaughton, K., 2004: Technical Report on the Rodeo Project, Durango, Mexico; private report prepared for Canplats Resources Corp., March 12, 2004,13 p. plus appendices.

Morrison, G. et al. (1990): Textural Zoning in Epithermal Quartz Veins; Klondike Exploration Services, Townsville, Queensland, Australia, 19 p.

Olguin, J. M. G., 2008: Title Opinion on the Camino Rojo Property, prepared on behalf of De Ovando Y Martinex Del Campo, S.C., Lawyers for Canplats Resources Corporation, 6 p.

Panteleyev, A., 1991: Gold in the Canadian Cordillera - A Focus on Epithermal and Deeper Deposits; in Ore Deposits, Tectonic and Metallogeny in the Canadian Cordillera, B.C. Ministry of Energy, Mines and Petroleum Resources, Paper 1991-4, pp. 163 - 212.

Panteleyev, A., 1996: Epithermal Au-Ag: Low Sulphidation, in Selected British Columbia Mineral Deposit Profiles, Volume 2 - Metallic Deposits, Lefebure, D. V. and Hoy, T, Editors, British Columbia Ministry of Employment and Investment, Open File 1996-13, pp. 41 - 44.

Roman, R. A. and Rios, V. M. F., 2003: Informe de la Cartografia Geologico-Minera, Carta Rodeo, Clave G13D42; Scale 1:50 000, 71 p. plus geology map.

Samilpa, M., 2009: Personal communications.

Saunders, I. A., 1994: Silica and Gold Textures in Bonanza Ores of the Sleeper Deposit, Humboldt County, Nevada: Evidence for Colloids and Implications for Epithermal Ore-Forming Processes; Economic Geology, V. 89, pp. 628 - 638.

Schott, R. 2017: Petrographic Analysis, pp. 1 – 7.

Servicio Geologico Mexicano, 2003: Geological Map of the Rodeo Map-Sheet G13-D42, scale: 1:50 000.

Shi, A., 2004: Preliminary Cyanidation Scoping test on Samples from Rodeo Project May 31, 2004. Process Research Associates Ltd. (Appendix-Test Results not available for review)

Sillitoe, R. H., 1993: Epithermal Models: Genetic Types, Geometrical Controls and Shallow Features; in Mineral Deposit Modeling, Kirkham, R. V., Sinclair, W. D., Thorpe, R.l. and Duke, J. M., Editors, Geological Association of Canada, Special Paper 40, pp. 403 - 417.

White, N. C. and Hedenquist, J. W., 1990: Epithermal Environments and Styles of Mineralization; Variations and their Causes and Guidelines for Exploration; in Epithermal Gold Mineralization of the Circum-Pacific; Geology, Geochemistry, Origin and Exploration, II; Hedenquist, J. W., White, N.C. and Siddeley, G., Editors, Journal of Geochemical Exploration, Volume 36, pp. 445 - 474.

Youngman, B., 2009: Personal communications.

Youngman, B., 2010: Personal communications.

25 DATE AND SIGNATURE PAGE

CERTIFICATE OF AUTHOR

David E. Drips, Principal, Mineral Resources Engineering
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I David E. Drips do hereby certify that:

a) I am currently employed by Mineral Resources Engineering, Murray, Utah.
b) This certificate applies to the Technical Report titled "Nl 43-101 Technical Report: Preliminary Economic Assessment, Rodeo Project, Rodeo, Durango, Mexico" (Technical Report), effective April 1, 2020, issued May 27, 2020.
c) I graduated with a Bachelor of Science degree in Mining Engineering from Colorado School of Mines in 1980. I have worked in the mining and civil construction industry for the last 46 years. I am a Member of the Society for Mining, Metallurgy, and Exploration (SME) (#04267555), the Mining and Metallurgical Society of America (MMSA) (01525QP Mining and Minerals Project Costing, Infrastructure, Management), and (01525QP Mining). I have read the definition of "qualified person" set out in National Instrument 43-101 (Nl 43-101) and certify that by reason of my education, affiliation with a professional association and relevant work experience, I fulfill the requirements of a "qualified person" for the purposes of Nl 43-101.
d) I visited and inspected the subject property on June 11, 2019.
e) I am responsible for all sections of this Technical Report that require responsibility.
f) I satisfy all the requirements of independence according to Nl 43-101.
g) I have not had prior involvement with Golden Minerals on the property that is the subject of this Technical Report.
h) I have read Nl 43-101, Form 43-101 Fl, and the Companion Policy to Nl 43-101 (43-101 CP) and this Technical Report has been prepared in compliance with Nl 43-101, Form 43-101 Fl, and 43- 101 CP.
i) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
j) I consent to the filing of the Technical Report with any stock exchanges or other regulatory authority and any publication by them, including electronic publication in the public company files on the websites accessible by the public, of the Technical Report.

Dated May 27, 2020.

"David E. Drips" – Signed
Signature of Qualified Person

David E. Drips
Print name of Qualified Person