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LUNDIN MINING CORPORATION

TECHNICAL REPORT ON THE CHAPADA MINE, GOIÁS STATE, BRAZIL

NI 43-101 Report

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TABLE OF CONTENTS

PAGE

1 SUMMARY 1-1
Executive Summary 1-1
Economic Analysis 1-8
Technical Summary 1-8
2 INTRODUCTION 2-1
3 RELIANCE ON OTHER EXPERTS 3-1
4 PROPERTY DESCRIPTION AND LOCATION 4-1
Land Tenure 4-1
Surface Tenure 4-9
Environmental Considerations 4-9
5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY 5-1
Accessibility 5-1
Climate 5-1
Local Resources 5-1
Infrastructure 5-2
Physiography 5-2
6 HISTORY 6-1
Exploration and Development History 6-1
7 GEOLOGICAL SETTING AND MINERALIZATION 7-1
Regional Geology 7-1
Local Geology 7-5
Property Geology 7-16
Mineralization 7-25
8 DEPOSIT TYPES 8-1
Copper-Gold Porphyry System – Chapada 8-3
Skarn System – Suruca 8-3
Brasiliano Orogen Fluids 8-4
9 EXPLORATION 9-1
Chapada 9-1
Suruca 9-4
Regional Targets 9-5
10 DRILLING 10-1
Chapada 10-1
Suruca 10-2
Regional Targets 10-4
11 SAMPLE PREPARATION, ANALYSES, AND SECURITY 11-1

Core Logging ... 11-2
Bulk Density ... 11-2
Sample Security ... 11-4
Laboratory Sample Preparation ... 11-5
Sample Analysis ... 11-5
Historical Sample Analysis and QA/QC ... 11-5
Re-Sampling of Santa Elina Core ... 11-6
Quality Assurance and Quality Control ... 11-6
Conclusions ... 11-30

12 DATA VERIFICATION ... 12-1

13 MINERAL PROCESSING AND METALLURGICAL TESTING ... 13-1
Chapada ... 13-1
Suruca ... 13-10

14 MINERAL RESOURCE ESTIMATE ... 14-1
Database ... 14-2
Geological Interpretation ... 14-5
Raw Assays ... 14-11
Compositing and Exploratory Data Analysis ... 14-12
Outlier Treatment ... 14-14
Density ... 14-15
Variography ... 14-16
Block Model ... 14-18
Grade Interpolation ... 14-18
Block Model Validation ... 14-22
Cut-Off Grade and Optimized Pit Shell ... 14-28
Classification ... 14-29
Mineral Resources ... 14-32

15 MINERAL RESERVE ESTIMATE ... 15-1
Dilution and Ore Loss ... 15-2
Cut-Off Grade ... 15-3
Reconciliation ... 15-4

16 MINING METHODS ... 16-1
Ground Conditions/Slope Stability ... 16-1
Mine Design ... 16-11
Life of Mine Plan ... 16-14
Waste Rock ... 16-17
Mine Equipment ... 16-17
Manpower ... 16-21
Mine Infrastructure ... 16-21

17 RECOVERY METHODS ... 17-1
Chapada Concentrator Performance – 2018 and 2019 ... 17-1
Current Process Description ... 17-4
Study for the Expansion of the Mine and Mill ... 17-10

Suruca Deposit Oxide and Sulphide Ores 17-13
18 PROJECT INFRASTRUCTURE 18-1
Power Supply and Distribution 18-1
Water Supply 18-2
Concentrate Storage and Shipping 18-2
19 MARKET STUDIES AND CONTRACTS 19-1
20 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT 20-1
Environmental Studies 20-1
Permitting 20-2
Social or Community Requirements 20-5
Water Management 20-7
Mine Waste and Tailings 20-10
Closure 20-13
21 CAPITAL AND OPERATING COSTS 21-1
Capital Costs 21-1
Operating Costs 21-2
Manpower 21-5
22 ECONOMIC ANALYSIS 22-1
23 ADJACENT PROPERTIES 23-1
24 OTHER RELEVANT DATA AND INFORMATION 24-1
25 INTERPRETATION AND CONCLUSIONS 25-1
26 RECOMMENDATIONS 26-1
27 REFERENCES 27-1
28 DATE AND SIGNATURE PAGE 28-1
29 CERTIFICATE OF QUALIFIED PERSON 29-1

LIST OF TABLES

PAGE

Table 1-1 Chapada Mineral Resources - June 30, 2019 1-2
Table 1-2 Chapada Mineral Reserves - June 30, 2019 1-3
Table 1-3 Total Capital Cost 1-17
Table 1-4 Total Operating Cost 1-18
Table 1-5 Suruca Oxide - Total Operating Cost 1-18
Table 1-6 C1 Cash Cost 1-19
Table 4-1 Mineral Claims 4-2
Table 6-1 Historical Ownership and Exploration Activities 6-1
Table 6-2 Historical Chapada Drill Holes by Company 6-2

Table 6-3 Historical Chapada Drill Holes by Series 6-3
Table 6-4 Suruca History Summary 6-3
Table 6-5 Past Production 6-4
Table 7-1 Events and Structural Features of Brasiliano Deformation in the Mine Area ... 7-13
Table 9-1 Soil and Chip Sampling 9-6
Table 10-1 Chapada Drill Holes 10-1
Table 10-2 Historical Suruca Drill Holes 10-2
Table 10-3 Suruca Drill Intercepts of Interest 10-3
Table 10-4 Suruca Drill Holes 10-3
Table 10-5 Regional Drill Holes 10-4
Table 11-1 Specific Gravity to Density Conversion Factors 11-3
Table 11-2 Density Log Database Example 11-4
Table 11-3 Analytical Procedures 11-5
Table 11-4 2008 to 2017 Certified Reference Materials for Gold 11-9
Table 11-5 2008 to 2017 Certified Reference Materials for Copper 11-10
Table 11-6 Summary Statistics for Original and Field Duplicates Assay Results for Gold . 11-13
Table 11-7 Summary Statistics for Original and Field Duplicates Assay Results for Copper 11-13
Table 11-8 2018 Certified Reference Materials for Gold 11-16
Table 11-9 2018 Certified Reference Materials for Copper 11-16
Table 11-10 2009 to 2017 Certified Reference Materials for Gold 11-19
Table 11-11 2009 to 2017 Certified Reference Materials for Copper 11-20
Table 11-12 Summary Statistics for Original and Field Duplicates Assay Results for Gold 11-21
Table 11-13 Summary Statistics for Original and Field Duplicates Assay Results for Copper 11-21
Table 11-14 2018 Certified Reference Materials for Gold 11-26
Table 11-15 2018 Certified Reference Materials for Copper 11-26
Table 13-1 Lakefield 1997 Projected Metallurgy 13-3
Table 13-2 Suruca Ore Characteristics 13-10
Table 14-1 Chapada Mineral Resources - June 30, 2019 14-1
Table 14-2 Description of Chapada and Suruca Database 14-2
Table 14-3 Summarized Raw Statistics 14-11
Table 14-4 Summarized Composite Statistics 14-13
Table 14-5 Chapada and Suruca Capping 14-15
Table 14-6 Bulk Density 14-16
Table 14-7 Variogram Parameters Chapada - Copper and Gold 14-17
Table 14-8 Chapada and Suruca Block Model Definitions 14-18
Table 14-9 Suruca Interpolation Parameters 14-20
Table 14-10 NSR Parameters - Chapada 14-28
Table 14-11 NSR Parameters - Suruca 14-29
Table 14-12 Mineral Resources - June 30, 2019 14-32
Table 15-1 Chapada Mineral Reserves - June 30, 2019 15-1
Table 15-2 Suruca Mineral Reserves - June 30, 2019 15-2
Table 15-3 NSR Parameters 15-3
Table 15-4 January - June 2019 Mine to Plant Reconciliation 15-4
Table 16-1 Cava Norte Slope Design Recommendations 16-2
Table 16-2 Corpo Principal Slope Design Recommendations 16-2
Table 16-3 Cava SW Slope Design Recommendations 16-7
Table 16-4 Corpo Sul Slope Design Recommendations 16-7
Table 16-5 Pit Design Parameters 16-12

Table 16-6 Suruca Oxide Pit Optimization Parameters 16-13
Table 16-7 Suruca Sulphide Pit Optimization Parameters 16-13
Table 16-8 Life of Mine Plan 16-15
Table 16-9 Suruca Oxide Life of Mine Plan 16-16
Table 16-10 Suruca Sulphide Life of Mine Plan 16-16
Table 16-11 Chapada Mine Equipment Fleet 16-17
Table 16-12 Chapada Mine Equipment Fleet Replacement Schedule 16-20
Table 16-13 Suruca Oxide Mine Equipment Fleet 16-21
Table 21-1 Total Capital Cost 21-2
Table 21-2 Total Operating Cost 21-3
Table 21-3 Total Operating Cost – Suruca Oxide 21-3
Table 21-4 C1 Cash Cost 21-4
Table 21-5 Manpower 21-5

LIST OF FIGURES

PAGE

Figure 4-1 Location Map 4-4
Figure 4-2 Zones at Chapada and Suruca 4-5
Figure 4-3 Claim Map 4-6
Figure 7-1 Regional Geology 7-3
Figure 7-2 Geological Map of the Chapada Region 7-4
Figure 7-3 Local Geology with Cross Sections A-A' and B-B' 7-6
Figure 7-4 Typical Stratigraphical Sequence of the Chapada and Suruca Deposits 7-10
Figure 7-5 Schematic Sketch of the Structural Geology in the Chapada Region 7-12
Figure 7-6 A-A' Cross Section Showing the Arrangement of Baru, Sucupira and Chapada Deposits 7-14
Figure 7-7 B-B' Cross-Section Showing the Litho-Structural Setting of the Santa Cruz Deposit 7-15
Figure 7-8 Sucupira Domains 7-18
Figure 7-9 Suruca Deposit Domains 7-24
Figure 8-1 Schematic of Chapada Mineralization System 8-2
Figure 10-1 Drill Hole Location Map 10-6
Figure 11-1 Re-sampling of Suruca Core Results 11-6
Figure 11-2 Gold Blank Control Chart 11-8
Figure 11-3 Accuracy Results for Copper 11-11
Figure 11-4 Precision Results for Gold 11-12
Figure 11-5 Scatter Plot - Field Duplicates Analyzed for Copper 11-14
Figure 11-6 Sterile Samples for Gold (Exploration Program) 11-15
Figure 11-7 Scatter Plot - Pulp Duplicates Analyzed for Copper 11-17
Figure 11-8 Scatter Plot - Pulp Duplicates Analyzed for Gold 11-18
Figure 11-9 Scatter Plot - Field Duplicates Analyzed for Gold 11-22
Figure 11-10 Scatter Plot - Field Duplicates Analyzed for Copper 11-23
Figure 11-11 Scatter Plot - Pulp Duplicates Analyzed for Gold 11-24
Figure 11-12 Scatter Plot - Pulp Duplicates Analyzed for Copper 11-24
Figure 11-13 Sterile Samples for Gold 11-25
Figure 11-14 zScore Chart – Gold (g/t) – ALS Chemex 11-27
Figure 11-15 zScore Chart – Copper (%) – ALS Chemex 11-28

Figure 11-16 Scatter Plot - Field Duplicates Analyzed for Gold....................................11-29
Figure 11-17 Scatter Plot - Field Duplicates Analyzed for Copper................................11-29
Figure 14-1 Resource Drilling Map 14-4
Figure 14-2 Isometric View Through Chapada...14-7
Figure 14-3 Typical Vertical Section Through Chapada 14-8
Figure 14-4 Typical Vertical Section Through Suruca 14-9
Figure 14-5 Vertical Section Through Chapada and Resource Pit Shell 14-10
Figure 14-6 Blocks Versus Drill Hole Grades Corpo Sul 14-23
Figure 14-7 Swath Plot of OK Versus NN Block Values – Au – Corpo Sul 14-24
Figure 14-8 Swath Plot of OK Versus NN Block Values – Au – Sucupira......................14-25
Figure 14-9 Swath Plot of OK Versus NN Block Values – Cu – Corpo Sul....................14-26
Figure 14-10 Swath Plot of OK Versus NN Block Values – Cu – Sucupira....................14-27
Figure 14-11 Suruca Classification for Oxide and Sulphide Domains 14-31
Figure 16-1 Cava Norte Pit Geotechnical Zones..16-3
Figure 16-2 Corpo Principal Pit Geotechnical Zones..16-4
Figure 16-3 Cava SW Pit Geotechnical Zones...16-5
Figure 16-4 Corpo Sul Pit Geotechnical Zones..16-6
Figure 16-5 Chapada Reserve Pit Design..16-8
Figure 16-6 Suruca Oxide Reserve Pit Design...16-9
Figure 16-7 Suruca Sulphide Reserve Pit Design 16-10
Figure 17-1 Monthly Mill Production for 2018 and 2019 17-1
Figure 17-2 Monthly Copper and Gold Recoveries for 2018 and 2019...........................17-2
Figure 17-3 Copper and Gold Recovery vs Copper Concentrate Grade 17-3
Figure 17-4 Material and Power Consumptions for 2018 and 2019................................17-4
Figure 17-5 Chapada Concentrator Process Flow Sheet 17-5
Figure 17-6 Relocation of Equipment and Facilities for Mining the Sucupira Pit............17-12
Figure 17-7 Suruca Oxide Process Flow Sheet 17-16
Figure 18-1 General Layout...18-4
Figure 20-1 Tailings Storage Facility Layout...20-12

1 SUMMARY

EXECUTIVE SUMMARY

Roscoe Postle Associates Inc. (RPA) was retained by Lundin Mining Corporation (Lundin) to prepare an independent Technical Report on the Chapada Copper-Gold Mine (the Project or Chapada), located in Goiás State, Brazil. The purpose of this report is to support the disclosure of Mineral Resources and Mineral Reserves for the Project with an effective date of June 30, 2019. This Technical Report conforms to National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101). RPA visited the Project on August 20 and 21, 2019.

Lundin is a diversified Canadian base metal mining company with operations in Chile, the USA, Portugal, Sweden, and Brazil, primarily producing copper, nickel, and zinc.

On April 15, 2019, Lundin announced that it had entered into a definitive purchase agreement with Yamana Gold Inc. (Yamana) to purchase 100% ownership in Mineração Maracá Indústria e Comércio S/A (MMIC), the owner of the Chapada Copper-Gold Mine, in Brazil. Lundin's acquisition of MMIC's Chapada Mine was completed on July 5, 2019. The Project includes the Chapada copper-gold deposit and the Suruca gold deposit. Suruca is located six kilometres northeast of the Chapada deposit. Production commenced at Chapada Corpo Principal in 2007.

The Chapada concentrator is designed to process copper sulphide ore at a nominal rate of 65,000 tonnes per day (tpd) for a total of 24.0 million tonnes per annum (Mtpa). In 2018, the mill processed 22.9 million tonnes (Mt) or 62,800 tpd of ore with average recoveries for copper and gold of 82.4% and 63.3% respectively. In the months of January through June 2019 the mill processed 11.2 Mt (62,003 tpd) of ore with average recoveries for copper and gold of 81.6% and 59.7% respectively. Average concentrate grades for 2018 were 24.1% Cu and 15.5 g/t Au and for January through June 2019 were 23.7% Cu and 13.8 g/t Au.

The effective date of technical information in this report is June 30, 2019.

All currency in this report is US dollars (US$) unless otherwise noted.

The Mineral Resources estimated for the Project, inclusive of Mineral Reserves, with an effective date of June 30, 2019, are summarized in Table 1-1. The Mineral Resource estimate conforms to Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Mineral Reserves (CIM (2014) definitions).

TABLE 1-1 CHAPADA MINERAL RESOURCES - JUNE 30, 2019
Lundin Mining Corporation – Chapada Mine

Deposit	Category	Tonnes (000 t)	Cu (%)	Au (g/t)	Contained Cu (000 t)	Contained Au (Moz)
Copper/Gold						
Chapada	Measured	328,948	0.25	0.16	807	1.65
	Measured – Stockpile	107,488	0.22	0.16	234	0.54
	Indicated	654,393	0.24	0.15	1549	3.06
Sub-Total	**Measured + Indicated**	**1,090,829**	**0.24**	**0.15**	**2,590**	**5.24**
	Inferred	162,769	0.22	0.08	360	0.41
Gold Only						
Suruca	Measured	12,737		0.42		0.17
	Indicated	134,780		0.54		2.32
Sub-Total	**Measured + Indicated**	**147,518**		**0.53**		**2.49**
	Inferred	12,565		0.48		0.19

Notes:
1. CIM (2014) definitions were followed for Mineral Resources.
2. Chapada and Suruca SW copper/gold Mineral Resources are estimated at an NSR cut-off value of US$4.08/t.
3. Suruca gold only Mineral Resources are estimated at a cut-off grade of 0.16 g/t Au for oxide material and 0.23 g/t Au for sulphide material.
4. Mineral Resources are estimated using a long-term gold price of US$1,600/oz and a long-term copper price of US$4.00/lb.
5. Mineral Resources at Chapada are constrained by an optimized pit and the June 2019 topographic surface.
6. Mineral Resources are inclusive of Mineral Reserves.
7. Chapada copper/gold Mineral Resources include resource estimates for Cava Central/SW, Corpo Sul, Sucupira, Baru, Santa Cruz and Suruca SW.
8. Chapada gold only Mineral Resources include resource estimates for Suruca Oxide and Suruca Sulphide.
9. Numbers may not add due to rounding.

The Mineral Reserves for the Project, as of June 30, 2019, are summarized in Table 1-2.

TABLE 1-2 CHAPADA MINERAL RESERVES - JUNE 30, 2019
Lundin Mining Corporation - Chapada Mine

Deposit	Category	Tonnes (000 t)	Cu (%)	Au (g/t)	Contained Cu (000 t)	Contained Au (Moz)
Copper/Gold						
Chapada	Proven	292,446	0.24	0.16	706	1.46
	Proven – Stockpile	107,448	0.22	0.16	234	0.50
	Probable	338,855	0.24	0.14	817	1.52
Sub-Total	**Proven & Probable**	**738,789**	**0.24**	**0.15**	**1,757**	**3.52**
Gold Only						
Suruca	Proven	11,454		0.42		0.15
	Probable	53,741		0.53		0.92
Sub-Total	**Proven & Probable**	**65,195**		**0.51**		**1.07**

Notes:
1. CIM (2014) definitions were followed for Mineral Reserves.
2. Chapada copper/gold Mineral Reserves are estimated at an NSR cut-off value of $4.08/t.
3. Chapada copper/gold Mineral Reserves are estimated using an average long-term gold price of US$1,250/oz and a long-term copper price of $3.00/lb.
4. Suruca gold only Mineral Reserves are estimated at a cut-off grade of 0.19 g/t Au for oxide material and 0.30 g/t Au for sulphide material.
5. Suruca oxide and Suruca sulphide Mineral Reserves are estimated using an average long-term gold price of US$1,250/oz.
6. Numbers may not add due to rounding.

RPA is not aware of any known environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other relevant factors that could materially affect the June 30, 2019 Mineral Resource and Mineral Reserve estimates.

CONCLUSIONS

Based on review of the available documentation, RPA offers the following conclusions:

GEOLOGY AND MINERAL RESOURCES

- The mineralization at Chapada is interpreted as a porphyry and epithermal system.
- The procedures for drilling, sampling, sample preparation, and analysis are appropriate for estimation of Mineral Resources.
- Mineral Resources conform to CIM (2014) definitions.
- RPA reviewed the following items and finds the estimation methods and classification criteria adopted by Lundin to be reasonable and sufficient to support Mineral Resource disclosure:
  - o The Mineral Resource database
  - o The geological interpretations

  - Exploratory data analysis
  - Composites and compositing strategy
  - Capping grades applied
  - Bulk density
  - Variography
  - Block model parameters
  - Interpolation strategy
  - Classification criteria determination and designation

- Measured and Indicated Mineral Resources of copper/gold inclusive of Mineral Reserves are estimated at 1,091 Mt grading 0.24% Cu and 0.15 g/t Au and containing approximately 2.6 Mt Cu and 5.2 million ounces (Moz) Au. Measured and Indicated Mineral Resources of gold only are estimated at 147.5 Mt grading 0.53 g/t Au containing approximately 2.5 Moz Au.

- Inferred Mineral Resources of copper/gold are estimated at 163 Mt grading 0.22% Cu and 0.08 g/t Au and containing approximately 360,000 t Cu and 400,000 oz Au. Inferred Mineral Resources of gold only are estimated at 12.6 Mt grading 0.5 g/t Au containing approximately 200,000 oz Au.

MINING AND MINERAL RESERVES

- The Mineral Reserve estimates have been prepared utilizing acceptable estimation methodologies and the classification of Proven and Probable Mineral Reserves conform to CIM (2014) definitions.

- Proven and Probable Mineral Reserves of copper/gold, including existing stockpiles scheduled for processing, are estimated to be 738.8 Mt grading 0.24% Cu and 0.15 g/t Au, containing approximately 1.8 Mt of copper and 3.5 Moz Au. Proven and Probable Mineral Reserves of gold only, are estimated to be 65.2 Mt grading 0.51 g/t Au, containing approximately 1.1 Moz Au.

- Economic analysis of the Life of Mine (LOM) plan generates a positive cash flow and, in RPA's opinion, meets the requirements for the statement of Mineral Reserves. In addition to the Mineral Reserves in the LOM plan, there are Mineral Resources and exploration potential that represent opportunities for the future.

- Reconciliation of the ore mined from January to June 2019 comparing the Mineral Reserve block model to the plant feed substantiates the Mineral Reserve estimate at Chapada.

MINERAL PROCESSING

- From 2015 through 2017, the process plant went through an optimization program that included throughput improvements through further automation of the grinding circuit, improved recoveries by flotation cell retrofits, and on-line analysis of sample streams.

- The most recent test programs include pilot plant and in-plant testing to support optimization and process improvements in the existing grinding and flotation circuits and testing to support the potential expansion of the processing facilities from the current 65,000 tpd or 24.0 Mtpa to approximately 87,000 tpd or 32.0 Mtpa, potentially in stages.

- Woodgrove Technologies completed three phases of pilot plant testing with its Staged Flotation Reactor (SFR) and Direct Flotation Reactor (DFR) technology using samples from the Chapada concentrator.

- Based on the results of the pilot plant testing program, the following changes in the Chapada concentrator were made including with commissioning underway at the time of report writing:
  - Installation of two SFR cleaner scalpers and four SFR cleaner scavengers.
  - Installation of a pump on the flotation column tailings to direct the flow to the SFR scalper feed tank instead of the regrind circuit.
  - Installation of two rows of three DFR cells in parallel to treat the exiting scavenger tailings. The concentrate from the DFR cells will be pumped to the existing concentrate regrind circuit.
  - Recalibration of the flotation circuit, Advanced Process Control System
  - The predicted improvement in overall plant recovery was projected to be an increase of 2.5% Cu and 1.9% Au.

ENVIRONMENTAL, PERMITTING AND SOCIAL CONSIDERATIONS

- There are environmental monitoring programs and water management practices in place. Currently, water sampling at control points downstream of the mine indicate water quality standards are being met. Seepage from some waste rock dumps could be acidic and, in the future, plans for more robust a water management controls at these locations will be implemented. Collection of acid seepage may increase the volume of contact water requiring management within the mine site. Depending on the additional amount of contact water, it may not be possible to continue relying solely on the tailings pond to store contact water. New water management ponds may be required. Furthermore, the current negative water balance could turn into a positive water balance where excess water must be treated and discharged to the environment.

- Chapada has assessed potential displaced landowners resulting from the mine expansion. The site has established a Land Management Committee based on the International Finance Corporation (IFC) standards.

- Chapada has obtained the necessary permits and licenses for operation and requires multiple license extensions and new licenses for planned operations, some of which are currently in progress and based on the data provided and responses to requests, these are not at risk of being delayed or rejected. No license or permit violations have been provided or discovered and as a result the Project and operations are believed to be in good standing. A discharge permit is not required for the site at this time.

- The historic tailings storage facility (TSF) design criteria have been set according to Brazilian regulations and practice and not necessarily using the Canadian Dam Association (CDA) (2014) hazard potential classification and corresponding earthquake and flood criteria. All future TSF raises will be designed according to CDA, guidelines, which are recognized as international best practice.

- The TSF is currently permitted to a dam crest elevation of 378 m which is sufficient for approximately 2.5 years of tailings deposition at the current production rate. Design and permitting is currently underway to raise the dam crest elevation to 382 m. Conceptual designs have been developed to raise the dam crest to 398 m elevation to meet expansion requirements.

- Mine closure planning is an on-going activity at Chapada. A mine closure plan was filed in 2008 specifically for the TSF, mine sites, waste pile; this plan was most recently updated in 2015. In 2015, the forecasted mine closure cost for the Project was estimated at $126.7 million; at this time, these estimates do not appear to include potential future mine expansions.

RECOMMENDATIONS

Based on the site visit and subsequent review of the available documentation, the following recommendations are offered:

GEOLOGY AND MINERAL RESOURCES

- Cap individual assays as opposed to composites.
- Execute the significantly increased exploration program over the next three years, largely focused on near mine targets.
- Review the copper price used in the reported Mineral Resources applying a similar price as other Lundin operations.

MINING AND MINERAL RESERVES

- Previous owner developed pit optimization to maximize metal content for pit design, Lundin should explore pit optimization to maximize net present value (NPV) of the operation possibly resulting in smaller pits and reduced TSF requirement.
- Suruca gold only Mineral Reserves should be revised with updated parameters in order to maximize the NPV of the Project.

MINERAL PROCESSING

- Commissioning and optimization work should continue to obtain the best performance of the new processing and flotation equipment and to determine the effects of the equipment on the overall system, such as the effect of the new recycle streams in the flotation circuit.
- Continue to verify the plant production and recoveries through mine, mill, and final concentrate reconciliation as the operation continues on an on-going basis. The reconciliations will provide feedback for value assurance from the optimization program and continuous improvement initiatives.
- The mining and processing of the Sucupira mineralization will require relocation of some of the process systems and site infrastructure. The relocation will require advancement of the engineering and procurement work performed in the expansion/basic engineering study. Detailed planning will be required to do the relocations without loss of production.

ENVIRONMENTAL, PERMITTING, AND SOCIAL CONSIDERATIONS

- Consider inclusion of results of monitoring of flora, terrestrial fauna, and fish in the annual environmental control reports.

- Continue additional static and kinetic geochemical testing on tailings and waste rock samples to enhance the geochemical characterization of the waste materials to verify or improve the waste disposal management practices.

- Additional water balance modelling work should be carried out considering a range of climate scenarios (i.e. wet and dry years) to identify water storage requirements based on estimates of acid seepage rates that may have to be collected from the waste dumps in the future. The capacity of the TSF to store water will vary as the mine operation progresses. Simulation of water balance scenarios for future years of operations will indicate if the TSF would have capacity to store additional contact water and if additional water management ponds will be required.

- According to the March 2019 environmental control report, the monitoring results on water quality, air quality, and noise are compliant with applicable standards and regulations. Water quality results should continue to be tracked with particular attention to geochemical testing and characterization, along with seepage from waste dumps.

- Implement a water balance for ongoing operations to be updated by mine operations personnel using meteorological and water monitored data on a regular basis (currently being developed on site). The water balance is an important tool to track trends and conduct short term predictions through simulation of variable operating and/or climatic scenarios to support decision making associated with tailings pond operation (e.g., maintaining adequate freeboard at all times).

- The operation should confirm the designed 100 m stand off distance between the open pit and the TSF is adequate. The site should also investigate future alternative tailings deposition options, including the potential for in-pit tailings deposition or co-disposal.

- Further work is required on the acid generating potential of the current and proposed LOM tailings and waste rock including practical data interpretation by qualified professionals, which may result in additional recommendations for additional waste characterization estimate initiatives.

- A blast control monitoring program should be designed to mitigate concerns over TSF A blast control monitoring program should be designed to mitigate concerns over TSF dam stability and expansion pit proximity.

- Evaluate closure cover alternatives, and associated costs, for the waste rock dumps and TSF.

- The TSF seismic design event and emergency spillway capacity should be re-evaluated for compliance with the CDA guidelines, which are recognized as international best practice.

- Tailings beach development should be monitored as a critical control during operations.

- The Project should update the forecasted closure costs estimate should a mine expansion project be approved.

ECONOMIC ANALYSIS

Under NI 43-101 rules, producing issuers may exclude the information required in Section 22, Economic Analysis on properties currently in production, unless the Technical Report includes a material expansion of current production. RPA notes that, as of the effective date of the report, Lundin is a producing issuer, the Chapada Mine is in production, and a material expansion is not being planned. RPA has performed an economic analysis of the Chapada Mine using the estimates presented in this report and confirms that the outcome is a positive cash flow that supports the statement of Mineral Reserves.

TECHNICAL SUMMARY

PROPERTY DESCRIPTION AND LOCATION

The Chapada Mine is located in northern Goiás State, approximately 320 km north of the state capital of Goiania and 270 km northwest of the national capital of Brasilia. The Chapada deposit is situated at latitude 14° 14′ S and longitude 49° 22′ W. The Chapada deposit comprises Chapada Cava Central, Chapada SW, Sucupira, Baru, Baru NE, Corpo Sul, and Santa Cruz zones, while the Suruca deposit comprises Suruca Oxide, Suruca Sulphide, and Suruca SW zones.

LAND TENURE

The Chapada Mine consists of 38 claims totalling 43,391.10 ha held in the name of Mineração Maracá Indústria e Comércio S/A (MMIC), a 100% owned subsidiary of Lundin. The Suruca deposit is located on claim number 860.595/2009 (Mining Licence) totalling 845.75 ha. The Chapada and Corpo Sul deposits are located on claim numbers 808.931/1994, 808.923/1974, and 860.273/2003 (all Mining Licences) encompassing 3,830.19 ha. Adjacent claims 861.383/2009 and 861.797/2010 (totalling 942.19 ha) are in the application process for Mining Licences.

HISTORY

The Chapada deposit was discovered in 1973 by INCO Ltda. (INCO) during a regional program of stream sediment sampling. Follow-up work by INCO was conducted in 1974 and 1975 including detailed stream sediment surveys, soil geochemistry, geophysics, trenching, and broadly spaced drilling.

There are few outcrops in the mine area due to laterite-saprolite cover. Consequently, deposit definition required extensive diamond drill exploration. Development drilling of the deposit occurred in several campaigns from 1976 through 1996 by INCO, Parsons-Eluma Projetos e Consultoria S/C (Parsons-Eluma), Eluma- Noranda, Santa Elina Gold (Santa Elina), and Santa Elina-Echo Bay.

Yamana purchased the Project in 2003 and began production in 2007. In 2019, Lundin acquired Chapada from Yamana with completion of the acquisition on July 5, 2019. Total material processed up to the end of June 2019 includes 246.2 Mt grading 0.33 g/t Au and 0.38% Cu.

GEOLOGY AND MINERALIZATION

The Chapada area is located between the Amazonian craton to the northwest and the San Francisco craton to the southeast, within the north-northeast striking metavolcano-sedimentary Mara Rosa Magmatic Arc, which is part of a large system of mobile belts that have a complex, multi-phased history of deformation.

The Chapada and Suruca deposits are located in the Eastern Belt of the Mara Rosa Volcano-sedimentary Sequence. The Eastern Belt in the vicinity of the Mine comprises a thick package of amphibolites succeeded by volcanic and volcanoclastic rocks overlying metasedimentary rocks.

The copper-gold deposit at Chapada comprises products of hydrothermal alteration of the copper-gold porphyry system. Alteration styles include biotitization, sericitization, argillitization, and propylitization. The primary copper-gold mineralization at Chapada is epigenetic. Copper is principally present as chalcopyrite with minor amounts of bornite. Fine grained gold is closely associated with the sulphide mineralization and was likely to be contemporaneous with the copper.

The gold at Suruca is related to folded quartz vein/veinlets with sericitic and biotite alteration, rather than high sulphide concentrations. The second generation of quartz veins/veinlets with sulphides (sphalerite + galena + pyrite), carbonates, and epidote also host gold which is related to zinc. Mineralization predominately pre-dates deformation so the gold (Suruca) and copper-gold (Suruca SW) are associated with skarn features, however, some structurally controlled features are also observed.

The mine area is covered by a 30 m thick lateritic profile.

EXPLORATION STATUS

The exploration at Chapada mainly consisted of drilling; a total of 1,268 holes for 257,487 m has been completed by Chapada and its predecessors to June 30, 2019. This included initial drilling in the Chapada Corpo Principal deposit with the objective of delineating an Inferred Mineral Resource, condemnation drilling to sterilize the location of waste dumps, and infill drilling in Corpo Sul to upgrade Indicated to Measured Mineral Resources and Inferred to Indicated Mineral Resources. Subsequently, drilling has delineated the main deposits at a spacing of 100 m by 50 m, with a tighter 50 m pattern in the central portion of the deposits.

At Suruca in 2009, a geophysical survey was carried out (induced polarization and magnetics) in addition to drilling. The 2010 drilling program focused on delineation of the Suruca deposit followed by infill drilling at 200 m by 200 m and 100 m by 100 m spacings. In 2016, an extensive drill program was completed to convert Indicated Mineral Resources (100 m x 50 m) to Measured (35 m x 35 m). This infill drilling was focused on the oxide mineralization.

The Suruca SW mineralization was discovered in 2017 exhibiting similar geological features to the Chapada deposit. The mineralization was delineated along a 2.1 km strike, 650 m width, and average depth of 50 m, and was partially exposed on surface. The resources of Suruca SW were converted to Indicated Mineral Resources with a 100 m x 100 m drill grid.

In 2018, a drill campaign was performed to extend the sulfide mineralization on strike and down-dip. Additionally, an extensive delineation drilling program was carried out throughout 2018 to upgrade the remaining sulphide Inferred Mineral Resource to Indicated.

In the first half of 2019, 33 exploratory drill holes were completed. These holes were designed to extend the gold mineralization in the outcropping oxide layer.

To June 30, 2019, 1,037 holes for 85,164 m have been drilled at Suruca. A total of 230 holes (32,736 m) have been drilled to explore regional targets.

Following the acquisition of Chapada by Lundin, an exploration targeting review was undertaken and it is anticipated that there will be a significant increase in exploration expenditures in the next three years, largely focused on near mine targets. A Mineral Inventory Range Analysis study will be completed in the fourth quarter 2019. Expected expenditures in 2020 will be approximately $10 million. The 2020 program will focus on drilling, geophysics, and regional structural geology study.

MINERAL RESOURCES

RPA has reviewed the updated Mineral Resource estimates for the Chapada and Suruca deposits completed by Lundin. The Mineral Resource estimate is based on open pit mining scenarios and Chapada Mineral Resources are constrained by optimized pit shells which are based on a copper and gold net smelter return (NSR) cut-off value. Chapada and Suruca SW copper/gold Mineral Resources are estimated at an NSR cut-off value of US$4.08/t. Suruca gold only Mineral Resources are estimated at a cut-off grade of 0.16 g/t Au for oxide material and 0.23 g/t Au for sulphide material.

Measured and Indicated Mineral Resources of copper/gold are estimated at 1,091 Mt grading 0.24% Cu and 0.15 g/t Au and containing approximately 2.6 Mt Cu and 5.2 Moz Au. Measured and Indicated Mineral Resources of gold only are estimated at 147.5 Mt grading 0.53 g/t Au containing approximately 2.5 Moz Au. These Mineral Resources are stated inclusive of Mineral Reserves.

Inferred Mineral Resources of copper/gold are estimated at 163 Mt grading 0.22% Cu and 0.08 g/t Au and containing approximately 360,000 t Cu and 413,000 oz Au. Inferred Mineral Resources of gold only are estimated at 12.6 Mt grading 0.5 g/t Au containing approximately 194,000 oz Au.

Chapada personnel developed mineralization and lithology wireframes using Vulcan software, with refinements in Leapfrog 3D software. Block models were generated in MineSight measuring ten metres in each direction for Chapada (Baru, Baruzinho, Cava Central, Cava Norte, Corpo Sul, Sucupira and SW Mina) and five metres in each direction for the Suruca deposits. Block grades were estimated using ordinary kriging (OK) in areas where sufficient composites were available to produce reliable variograms. In the absence of reliable variograms, block estimates were performed using inverse distance to the third power (ID^3).

Classification for Chapada, Suruca Sulphide, and Suruca SW was based on a 50 m by 50 m drill pattern for the Measured Mineral Resources, 100 m by 100 m drill pattern for Indicated, and 200 m by 200 m drill pattern for Inferred. For Suruca Oxide, classification was based on a 35 m by 35 m drill pattern for Measured Mineral Resources, 100 m by 50 m for Indicated, and 200 m by 200 m drill pattern for Inferred.

RPA is not aware of any environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other relevant issues that would materially affect the June 30, 2019 Mineral Resource estimate.

MINERAL RESERVES

Mineral Resource estimates were prepared using industry standard methods and provide an acceptable representation of the deposit. RPA reviewed the reported Mineral Resources, production schedules, and factors for conversion from Mineral Resources to Mineral Reserves. Based on this review, RPA is of the opinion that the Measured and Indicated Mineral Resources within the final pit designs at Chapada can be classified as Proven and Probable Mineral Reserves.

Total Proven and Probable copper/gold Mineral Reserves for Chapada are estimated at 738.8 Mt grading 0.24% Cu and 0.15 g/t Au. Total Proven and Probable gold only Mineral Reserves for Suruca are estimated at 65.2 Mt grading 0.51 g/t Au.

RPA is not aware of any mining, metallurgical, infrastructure, permitting, or other relevant factors that could materially affect the Mineral Reserve estimate.

MINING METHOD

Chapada is a traditional open pit truck/shovel operation that has been in continuous operation since 2007. There are two main open pit mining areas to be developed on the property, Chapada and Suruca. Production is entirely from Chapada, including the Corpo Principal, Cava Norte, and Corpo Sul pits. These pits are planned to eventually join into a single pit and

Sucupira pit is planned as an additional series of pushbacks. The Suruca mining area includes Suruca Oxide and Suruca Sulphide gold Mineral Reserves.

Chapada is located in gently undulating terrain at elevations between 340 MASL and 400 MASL. The Chapada open pit has ultimate design dimensions of approximately eight kilometres along strike, up to 1.5 km wide, and 380 m deep. The Suruca deposit is located approximately seven kilometres northeast of the Chapada open pit. Final pit dimensions for Suruca will be approximately two kilometres along strike and approximately one kilometre wide.

The processing plant is located at the northwest end of the Chapada pit rim. The TSF is located to the northwest of the Chapada open pit, with the pond as close as 0.5 km to the pit rim and the tailings dam being up to five kilometres to the northwest.

The LOM plan is based on Mineral Reserves, as of June 30, 2019. The LOM plan is based on a processing rate 24.0 Mtpa. The ore stockpile will be processed intermittently throughout the mine life. The mine life is 24 years plus an additional eight years at the end of the mine life for processing the remainder of the ore stockpile.

MINERAL PROCESSING

The Chapada concentrator is designed to process copper sulphide ore at a nominal rate of 65,000 tpd for a total of 24.0 Mtpa. In 2018, the mill processed 22.93 Mt (62,820 tpd) of ore with average recoveries for copper and gold of 82.4% and 63.3% respectively. In the months of January through June 2019 the mill processed 11,2 Mt (62,003 tpd) of ore with average recoveries for copper and gold of 81.6% and 59.7% respectively. Average concentrate grades for 2018 were 24.1% Cu and 15.5 g/t Au and for January through June 2019 were 23.7% Cu and 13.8 g/t Au. The plant is operating consistently.

In 2018, Yamana commissioned a study and basic engineering report, which combined the information gained in the series of studies that were performed with respect to process plant upgrading, optimization and ultimately the expansion of the mine and processing facilities from the current 24.0 Mtpa to approximately 32.0 Mtpa.

In order to mine the Sucupira deposit, some elements of the processing plant and site infrastructure will require relocation. The plant expansion has not been approved as proposed by Lundin at this time, however, the mining plan includes development of the Sucupira pit. The 3,900 tph (32.0Mtpa) Expansion Project basic engineering study is the basis for cost estimates for the relocation of the processing equipment.

Woodgrove Technologies (Woodgrove) conducted pilot plant studies which were positive and the installation of the new flotation equipment and process control systems to optimize the plant has been completed.

The execution plan for the Woodgrove equipment was divided into phases, of which the following have been completed.

- Phase 1 – 2017: included the installation of two SFR cleaner scalpers and four SFR cleaner scavengers.
- Phase 2 - 2019: included the installation of six DFR (Direct Flotation Reactors) as re-scavengers, consisting of two rows of three reactors operating in parallel. This equipment was installed and was being commissioned during the RPA site visit in August 2019.

SURUCA DEPOSIT OXIDE AND SULPHIDE ORES

Run of mine (ROM) material from the Suruca deposit, which consists of oxide and sulphide mineralization will be processed separately; the oxide ore will be processed using conventional heap leaching technology, and the sulphide ore will be processed in the existing concentrator after some modifications.

SUCUPIRA DEPOSIT DEVELOPMENT

The current mine plan includes the development and mining of the Sucupira deposit. The Sucupira mineralization extends beneath the Chapada processing facilities. The following facilities will be relocated:

- Primary gyratory crusher and conveying system
- Primary jaw crusher and conveying system
- Pebble crushing system
- Truck shop and fuel station
- Chemical and process laboratories
- Warehouse facilities.
- 230 kV transmission line.

- Main power substation

PROJECT INFRASTRUCTURE

As of the effective date of this report, Chapada operates an open pit mine and process plant and has all the required infrastructure necessary for a mining complex including:

- Open pit mine and mine infrastructure including truck shop, truck wash facility, warehouse, fuel storage and distribution facility, explosives storage and magazine sites, and electrical power distribution and substations to support construction projects and mine operations.
- A conventional flotation mill for processing sulphide ore and mill infrastructure including assay laboratory, maintenance shops, and offices.
- Mine and mill infrastructure including office buildings, shops, and equipment.
- A TSF comprising a centreline raised dam constructed with cyclone tailings with current permitted capacity for 2.5 years and plans for further expansion.
- Local water supplies as required.
- Electric power from the national grid.
- Haulage roads from the mines to the plant.
- Stockpile areas for high grade and low grade ore and waste dumps.
- Maintenance facilities.
- Administrative office facilities.
- Core storage and exploration offices.
- Access road network connecting the mine infrastructure to the town site and to public roads.

POWER SUPPLY AND DISTRIBUTION

Chapada is connected to the National Electric Grid through a 230 kV Transmission Line connected to the CELG electric substation at the city of Itapaci, GO. The Chapada power line is an 84 km private line that connects to the mine's 230 kV/13.8 kV main power substation with three 42 MVA transformers. The current power demand at Chapada is 46.5 MW. The capacity limit for the power line is 100 MVA. In 2017 a 230 kV power line was completed from Serra de Mesa to Itapaci via Barro Alto, duplicating the original line and increasing the regional capacity.

The alignment of the power line through the Chapada site includes a section that passes through the future TSF footprint. In the current engineering study, it is planned that this section of the line will be rerouted outside the TSF boundary as part the plant equipment and infrastructure relocation to accommodate the mining of the Sucupira deposit. The main substation will be relocated to the northeast of the plant and powerline will be rerouted outside of the TSF and will follow the perimeter from the west to the east around the northern extent.

WATER SUPPLY

Water Catchment System – Tailings Dam

Process water is pumped from a water pumping station located in the water reservoir adjacent to Dike II in the TSF area to the process water reservoir at the process plant.

Fresh/Make-Up Water Supply

Fresh/make-up water is supplied from two sources, the Rio dos Bois pump station, and the Cava Central mine. The Cava mine pits are the primary source of fresh/process water and have been used exclusively for the past several years. Water is pumped from the pit using submersible pumps and a booster pump station to transfer the water to the water reservoir in the tailings dam. From there it is pumped to the process water reservoir at the process plant.

The water storage capacity in the bottom of the mine pits are used to maintain the overall site water balance. Water can be pumped from one pit to the other and to the TSF and process plant, providing flexibility in controlling the site water balance.

CONCENTRATE STORAGE AND SHIPPING

Concentrate is filtered and stored in the Chapada concentrate warehouse which has approximately 6,000 t of storage capacity. The concentrate is loaded into end dump transport trucks in the Chapada warehouse using a frontend loader. The loaded trucks are weighed, tarped, and sealed and then travel from Chapada, approximately 1,630 km to the Multilift Logistics warehouse in the Port of Vitoria in the State of Espirito Santo. The concentrate is then shipped to copper smelters.

ENVIRONMENTAL, PERMITTING, AND SOCIAL CONSIDERATIONS

Chapada has developed Environmental Management Plans to monitor potential impacts. The potential operating life for Chapada is 24 years plus additional processing of ore from stockpile. Environmental permits and licenses required to operate Chapada appear to be in place with on-going permitting to support future operations. Based on reports provided, there appears to be no risk of permits being delayed or rejected.

The closure plan consists of three major types of activity: decommissioning, closure and rehabilitation, and post-closure monitoring and reporting. Decommissioning involves permanently ending the mining and mineral processing operations and removing all equipment and facilities not designated for future use. Reclamation includes reclaiming the mine site, when possible, to other sustainable uses as defined in respective closure management plans. Reclamation activities include regrading of slopes, the placement of cover material, the construction of stormwater controls, and revegetation. Post-closure monitoring and reporting is intended to be conducted to verify the measures taken meet closure objectives.

In 2015 the forecasted closure cost for the Project was estimated at $126.7 million.

CAPITAL AND OPERATING COST ESTIMATES

CAPITAL COST

Estimated capital cost at Chapada for the next 5 years are tabulated below in 2019 US dollars using an exchange rate of 3.75 R$/US$ (Table 1-3). It is noted that over 80% of the capital costs are forecast to be locally denominated in R$. The Project capital includes primarily mobile equipment rebuilds and replacements, while the TSF capital costs includes routine dam raises and distribution pipeline raises and relocations. The infrastructure and plant relocations necessary for the mining of the Sucupira deposit currently commence in 2021 and total an estimated $161.9m at the time of anticipated completion in 2027.

TABLE 1-3 TOTAL CAPITAL COST
Lundin Mining Corporation – Chapada Mine

Capital Cost ($ million)	2020-24	2020	2021	2022	2023	2024
Sustaining						
Mine	66.9	8.7	18.5	12.5	19.7	7.5
Mill	18.9	13.5	0.8	0.8	2.7	1.1
Tailings	22.7	5.4	4.4	4.0	4.2	4.7
General & Administration (G&A)	11.0	1.4	3.8	1.5	3.4	0.9
Sub-Total Sustaining	**119.5**	**29.0**	**27.5**	**18.8**	**30.0**	**14.2**
Relocate Infrastructure	122.7	-	2.0	35.9	69.9	15.0
Capitalized Stripping	**171.2**	**16.9**	**31.1**	**32.7**	**25.6**	**64.9**

The Suruca oxide pit and heap leach initial capital cost is estimated to be $57.3 million, sustaining capital $5.3 million, and closure cost $4.1 million. The LOM capital cost is $66.7 million and includes initial, sustaining, and closure costs.

OPERATING COST

Chapada has been in continuous production since 2007 and operating costs are tracked and well understood. Forecast unit operating costs for the next 5 years are summarized in Table 1-4. For Suruca oxide, the overall operating cost is estimated at approximately $7.19/t ore feed, as shown in Table 1-5.

TABLE 1-4 TOTAL OPERATING COST
Lundin Mining Corporation – Chapada Mine

Cost	Unit	Average 2020-24	2020	2021	2022	2023	2024
Mining	$/t material moved	2.06	2.04	2.01	2.06	2.04	2.18
Mining	$/t milled (excludes capitalized stripping)	4.79	5.38	4.73	4.81	5.01	4.04
Processing	$/t milled	3.31	3.28	3.32	3.33	3.30	3.30
G&A	$/t milled	1.02	1.18	1.05	1.00	0.94	0.94
Total	**$/t milled**	**9.12**	**9.84**	**9.10**	**9.14**	**9.25**	**8.28**

Notes:
1. Numbers may not add due to rounding.

TABLE 1-5 SURUCA OXIDE - TOTAL OPERATING COST
Lundin Mining Corporation – Chapada Mine

Cost	Units	Value
Mining	$/t mined	1.27
	$/t placed	2.61
Processing	$/t processed	4.16
G&A	$/t processed	0.42
Total (Processed +G&A)	$/t processed	**7.19**

Notes:
1. Numbers may not add due to rounding.

The forecast average C1 cash cost for Chapada over the next 5 years is $1.38/lb Cu, net of the precious metal by-product credits, assuming $1,300/oz Au and $16.0/oz Ag pricing and an exchange rate of 3.75 R$/US$. The forecast C1 cash cost for the following 5 years are shown below in Table 1-6.

TABLE 1-6 C1 CASH COST
Lundin Mining Corporation – Chapada Mine

Cost	Unit	Average 2020-24	2020	2021	2022	2023	2024
C1 Cash Cost	$/lb Cu	1.38	1.21	1.34	1.17	1.69	1.49

2 INTRODUCTION

Roscoe Postle Associates Inc. (RPA) was retained by Lundin Mining Corporation (Lundin) to prepare an independent Technical Report on the Chapada Copper-Gold Mine (the Project or Chapada), located in Goiás State, Brazil. The purpose of this report is to support the disclosure of Mineral Resources and Mineral Reserves for the Project. This Technical Report conforms to National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101).

Lundin is a diversified Canadian base metal mining company with operations in Chile, the USA, Portugal, Sweden and now Brazil, primarily producing copper, nickel, and zinc.

On April 15, 2019, Lundin announced that it had entered into a definitive purchase agreement with Yamana Gold Inc. (Yamana) to purchase its 100% ownership in Mineração Maracá Indústria e Comércio S/A (MMIC), the owner of the Chapada Copper-Gold Mine, in Brazil. Lundin's acquisition of Chapada was completed on July 5, 2019. The Project includes the Chapada copper-gold deposit and the Suruca sulphide and oxide deposits. Suruca is located six kilometres northeast of the Chapada deposit. Production commenced at Chapada Corpo Principal in 2007.

The effective date of technical information in this report is June 30, 2019.

SOURCES OF INFORMATION

Site visits were carried out by Chester M. Moore, P.Eng., RPA Principal Geologist, Hugo M. Miranda, ChMC(RM), RPA Principal Mining Engineer, Andrew P. Hampton, P.Eng., RPA Principal Metallurgist, and Stephan Theben, Dipl.-Ing., Mining Sector Lead and Managing Principal with SLR Consulting (Canada) Ltd. (SLR) on August 20 and 21, 2019.

Discussions were held with the following personnel from Lundin and Chapada:

- Steve Gatley, Lundin, VP Technical Services
- Graham Greenway, Lundin, Group Resource Geologist
- Tim Walmsley, Lundin, Director, Exploration & New Business Development, South America
- Daniel Daher, Chapada Mine, Managing Director
- Ediney Drummond, Chapada Mine, Director Operations

- Paulo Porto, Chapada Mine, Manager Finance and Cost Control
- Guillherme Zavaglia, Chapada Mine, Manager Geology, Mine Planning and R&R
- Gustavo Marques, Chapada Mine, Manager Exploration
- Dirley Costa, Chapada Mine, Manager Technical Services and Projects
- Guillherme Pimental, Chapada Mine, Director HSEC, Safety and Sustainability
- Felipe Araujo, Chapada Mine, Resources Manager
- Luiz Pignatari, Edem Engenharia de Minas, Mining Engineer

This Technical Report was prepared by Messrs. Moore, Miranda, Hampton, and David G. Ritchie M.Eng., P.Eng. of SLR Consulting (Canada) Ltd. Mr. Moore is responsible for preparation of Sections 2 to 12, 14, and 23; Mr. Miranda is responsible for Sections 15, 16, 18, 19, 21, 22, and 24; Mr. Hampton is responsible for Sections 13, 17; and parts of 20 (other than mine waste and tailings aspects) and Mr. Ritchie is responsible for parts of Section 20 (mine waste and tailings aspects). All authors contributed to Sections 1, 25, 26, and 27.

The documentation reviewed, and other sources of information, are listed at the end of this report in Section 27 References.

LIST OF ABBREVIATIONS

Units of measurement used in this report conform to the metric system. All currency in this report is US dollars (US$) unless otherwise noted.

a	annum
A	ampere
bbl	barrels
btu	British thermal units
°C	degree Celsius
C$	Canadian dollars
cal	calorie
cfm	cubic feet per minute
cm	centimetre
cm^2	square centimetre
d	day
dia	diameter
dmt	dry metric tonne
dwt	dead-weight ton
°F	degree Fahrenheit
ft	foot
ft^2	square foot
ft^3	cubic foot
ft/s	feet per second
g	gram
G	giga (billion)
Gal	Imperial gallon
g/L	grams per litre
Gpm	Imperial gallons per minute
g/t	grams per tonne
gr/ft^3	grains per cubic foot
gr/m^3	grain per cubic metre
ha	hectare
hp	horsepower
hr	hour
Hz	hertz
in.	inch
in^2	square inch
J	joule
k	kilo (thousand)
kBa	kilobar
kcal	kilocalorie
kg	kilogram
km	kilometre
km^2	square kilometre
km/h	kilometres per hour
kPa	kilopascal
kVA	kilovolt-amperes
kW	kilowatt
kWh	kilowatt-hour
L	litre
lb	pound
L/s	litres per second
m	metre
M	mega (million); molar
m^2	square metre
m^3	cubic metre
µ	micron
MASL	metres above sea level
µg	microgram
m^3/h	cubic metres per hour
mi	mile
min	minute
µm	micrometre
mm	millimetre
mph	miles per hour
MVA	megavolt-amperes
MW	megawatt
MWh	megawatt-hour
oz	Troy ounce (31.1035g)
oz/st, opt	ounces per short ton
ppb	parts per billion
ppm	parts per million
psia	pounds per square inch absolute
psig	pounds per square inch gauge
RL	relative elevation
s	second
st	short ton
stpa	short tons per year
stpd	short tons per day
t	metric tonne
tpa	metric tonnes per year
tpd	metric tonnes per day
US$	United States dollar
USg	United States gallon
USgpm	US gallons per minute
V	volt
W	watt
wmt	wet metric tonne
wt%	weight percent
yd^3	cubic yard
yr	year

3 RELIANCE ON OTHER EXPERTS

This report has been prepared by RPA for Lundin. The information, conclusions, opinions, and estimates contained herein are based on:

- Information available to RPA at the time of preparation of this report
- Assumptions, conditions, and qualifications as set forth in this report

The Brazilian government department responsible for mining land, Agencia Nacional de Mineração (ANM), maintains an internet-based system for accessing information on exploration concessions granted in Brazil. MMIC has a claim management system and employees that monitor this site regularly and update claim data as required. RPA has not researched property title or mineral rights for Chapada and expresses no opinion as to the ownership status of the property.

RPA has relied on Lundin for guidance on applicable taxes, royalties, and other government levies or interests, applicable to revenue or income from Chapada.

Except for the purposes legislated under provincial securities laws, any use of this report by any third party is at that party's sole risk.

4 PROPERTY DESCRIPTION AND LOCATION

Chapada is located in northern Goiás State, approximately 320 km north of the state capital of Goiania and 270 km northwest of the national capital of Brasilia. The Chapada deposit is situated at latitude 14° 14′ S and longitude 49° 22′ W (Figure 4-1). The Suruca deposit is located six kilometres northeast of Chapada at approximately latitude 14° 11′ S, longitude 49° 20′ W. The Chapada deposit comprises Chapada Cava Central, Chapada SW, Sucupira, Baru, Baru NE, Corpo Sul, and Santa Cruz zones, while the Suruca deposit comprises Suruca Oxide, Suruca Sulphide, and Suruca SW zones (Figure 4-2).

The Suruca small miners' (garimpeiros) historic workings are located approximately three kilometres east of Alto Horizonte. It is characterized by an elongated excavation, 600 m long N30ºE within an average width of 50 m and depth of 10 m depth (locally up to 18 m). Garimpeiros who worked at Suruca in the 1980s estimated that approximately 200 kg of gold was mined.

LAND TENURE

The Project is divided into 38 claims totalling 43,391.10 ha (Table 4-1 and Figure 4-3). The claims are held in the name of Mineração Maracá Indústria e Comércio S/A (MMIC), a 100% owned subsidiary of Lundin. The Suruca deposit is located on claim number 860.595/2009 (Mining Licence) totalling 845.75 ha. The Chapada and Corpo Sul deposits are located on claim numbers 808.931/1994, 808.923/1974, and 860.273/2003 (all Mining Licences) encompassing 3,830.19 ha. Adjacent claims 861.383/2009 and 861.797/2010 (totalling 942.19 ha) are in the application process for Mining Licences.

In Brazil, property boundaries are filed electronically with ANM rather than physically marked. The Project claims incorporate Exploration and Mining Licences, as described below.

TABLE 4-1 MINERAL CLAIMS
Lundin Mining Corporation – Chapada Mine

DNPM Process No.	City State	Area (ha)	Permit No.	Granted (DOU)	Renewal Application	Renewal Approval	New Renewal Application	Final Report Approval	Application for Mining Concession	Mining Concession No.	Date of Mining Licence (DOU)	Licence Type
808.923/74	Alto Horizonte	3,000.12	316	08/03/76	23/06/76	01/08/78	01/08/79	09/10/79	18/10/79	2394	11/12/79	Mining Concession
860.931/94	Alto Horizonte	571.79	351	29/07/97	-	-	-	17/10/01	16/10/02	351	26/10/09	Mining Concession
860.273/03	Alto Horizonte	258.28	2620	23/04/03	16/02/06	30/12/10	30/12/13	02/07/14	05/09/14	262	15/06/15	Mining Concession
860.595/09	Alto Horizonte	845.72	7686	14/07/09	-	-	-	22/12/11	18/12/12	92	07/06/18	Mining Concession
861.383/09	Alto Horizonte	842.46	657	21/01/2010	19/11/2012	13/06/2013	13/06/2016	15/02/2017	-	-	-	Application For Mining Concession
861.797/10	Alto Horizonte	99.73	3192	31/03/2011	10/01/2014	20/05/2014	20/05/2017	06/06/2018	-	-	-	Application For Mining Concession
860.163/16	Nova Iguacu de Goias	173.68	3,940	22/05/2017	-	-	-	-	-	-	-	Final Report Submission
861.327/13	Alto Horizonte	938.43	1740	11/03/2014	07/01/2016	01/06/2016	01/06/2018	-	-	-	-	Final Report Submission
862.683/11	Santa Terezinha de Goias	1,998.28	9,978	24/09/2015	07/06/2018	03/08/2018	03/08/2021	-	-	-	-	Exploration
860.065/12	Santa Terezinha de Goias	1,785.68	8,306	14/09/2015	07/06/2018	03/08/2018	03/08/2021	-	-	-	-	Exploration
860.210/15	Alto Horizonte	1,773.60	6,646	28/08/2015	07/06/2018	09/07/2018	09/07/2021	-	-	-	-	Exploration
860.966/10	Alto Horizonte	1,996.74	5,588	11/08/2015	07/06/2018	17/07/2018	17/07/2021	-	-	-	-	Exploration
860.990/14	Mara Rosa	1,766.04	5,601	11/08/2015	07/06/2018	09/07/2018	09/07/2021	-	-	-	-	Exploration
860.992/14	Mara Rosa	1,998.38	5,602	11/08/2015	07/06/2018	09/07/2018	09/07/2021	-	-	-	-	Exploration
860.768/15	Mara Rosa	1,809.75	10,146	24/09/2015	07/06/2018	09/07/2018	09/07/2021	-	-	-	-	Exploration
860.769/15	Mara Rosa	1,880.5	10,147	24/09/2015	07/06/2018	09/07/2018	09/07/2021	-	-	-	-	Exploration
860.770/15	Alto Horizonte	1,949.86	10,148	24/09/2015	07/06/2018	09/07/2018	09/07/2021	-	-	-	-	Exploration

DNPM Process No.	City State	Area (ha)	Permit No.	Granted (DOU)	Renewal Application	Renewal Approval	New Renewal Application	Final Report Approval	Application for Mining Concession	Mining Concession No.	Date of Mining Licence (DOU)	Licence Type
861.350/12	Nova Iguacu de Goias	1,999.77	17,520	11/03/2014	06/01/2017	26/01/2017	26/01/2020	-	-	-	-	Exploration
861.602/13	Alto Horizonte	446.83	7,211	03/09/2015	26/06/2017	23/10/2017	23/10/2019	-	-	-	-	Exploration
860.881/15	Nova Iguacu de Goias	1,977.52	14,451	19/11/2015	18/09/2018	19/11/2018	19/11/2021	-	-	-	-	Exploration
860.882/15	Nova Iguacu de Goias	1,915.21	14,452	19/11/2015	18/09/2018	19/11/2018	19/11/2021	-	-	-	-	Exploration
860.496/12	Nova Iguacu de Goias	1,927.06	15,048	08/12/2015	18/09/2018	19/11/2018	19/11/2021	-	-	-	-	Exploration
860.821/12	Santa Terezinha de Goias	44.8	1,560	24/02/2016	18/12/2018	25/02/2019	25/02/2022	-	-	-	-	Exploration
860.822/12	Pilar de Goias	128.42	1,561	24/02/2016	18/12/2018	25/02/2019	25/02/2022	-	-	-	-	Exploration
860.823/12	Alto Horizonte	140.08	1,562	24/02/2016	18/12/2018	25/02/2019	25/02/2022	-	-	-	-	Exploration
860.878/15	Mara Rosa	1,786.81	14,449	19/11/2015	18/09/2018	19/11/2018	19/11/2021	-	-	-	-	Exploration
860.880/15	Mara Rosa	945.23	14,450	19/11/2015	18/09/2018	19/11/2018	19/11/2021	-	-	-	-	Exploration
860.485/16	Santa Terezinha de Goias	1,950.99	11,361	19/10/2016	-	-	-	-	-	-	-	Exploration
860.229/17	Alto Horizonte	1,917.31	2,473	30/03/2017	-	-	-	-	-	-	-	Exploration
860.230/17	Alto Horizonte	1,974.16	2,474	30/03/2017	-	-	-	-	-	-	-	Exploration
861.275/15	Mara Rosa	45.56	12,522	29/11/2016	18/09/2018	19/11/2018	19/11/2020	-	-	-	-	Exploration
860.188/17	Alto Horizonte	15.31	3,935	22/05/2017	-	-	-	-	-	-	-	Exploration
861.601/13	Alto Horizonte	644.81	895	15/02/2018	-	-	-	-	-	-	-	Exploration
860.086/17	Amaralina	1,576.81	1374	13/03/2017	-	-	-	-	-	-	-	Exploration
860.081/18	Alto Horizonte	1,999.4	7708	04/10/2018	-	-	-	-	-	-	-	Exploration
861.297/16	Mara Rosa	1,957.14	2519	30/03/2017	-	-	-	-	-	-	-	Exploration
860.346/18	Santa Terezinha de Goias	1,256.91	8102	29/10/2018	-	-	-	-	-	-	-	Exploration
860.092/18	Alto Horizonte	51.93	7709	04/10/2018	-	-	-	-	-	-	-	Exploration

The islands of Trinidade, Martin Vaz, Arquipelago de Fernando de Noronha, Atol das Rocas, and Penedos de Sao Pedro a Sao Paulo are not shown.

Trinidade and Martin Vaz are administered by Espirito Santo; Arquipelago de Fernando de Noronha by Pernambuco.

Figure 4-1

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Location Map

October 2019

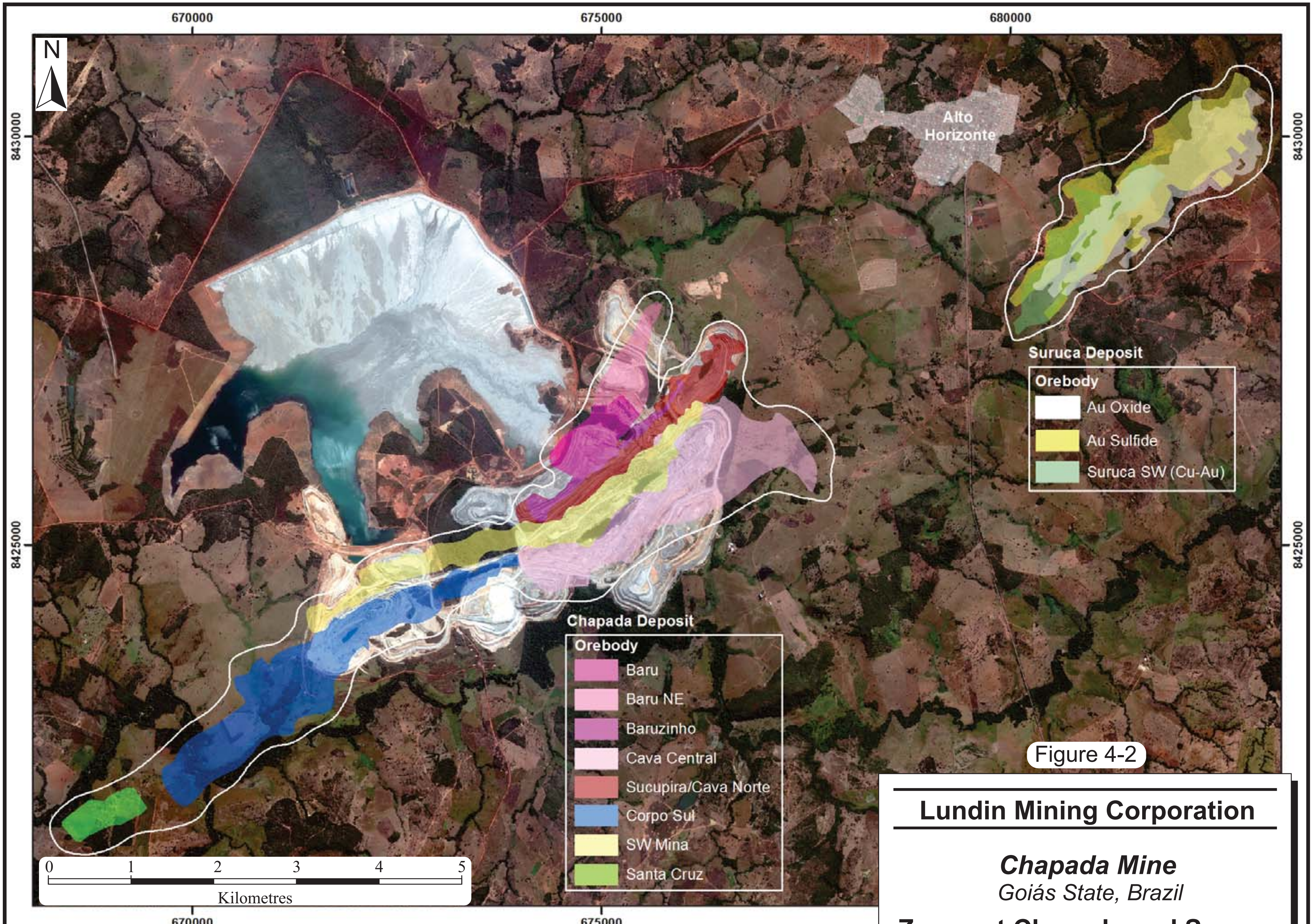

Figure 4-2

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Zones at Chapada and Suruca

October 2019

Source: Lundin, 2019.

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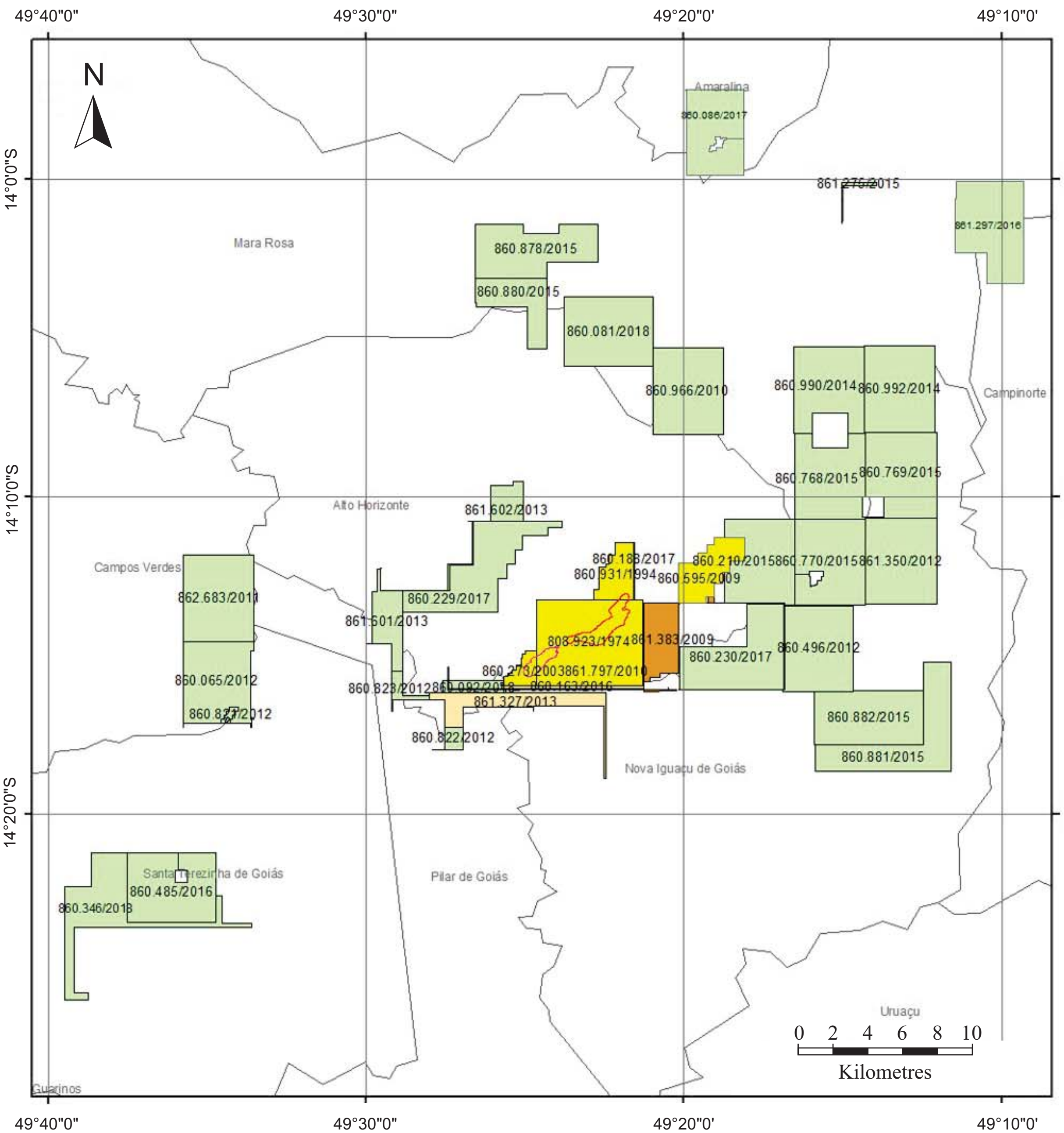


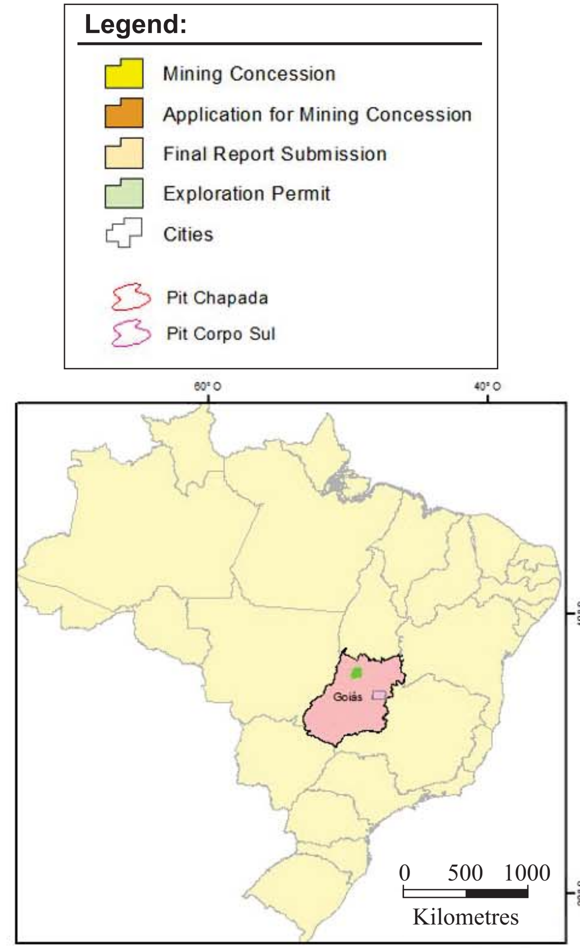


Figure 4-3

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Claim Map

October 2019

Source: Lundin, 2019.

PROSPECTING LICENCE

A Prospecting Licence entitles the holder to explore for minerals in the area of the licence, but not to conduct commercial mining. A Prospecting Licence may remain in force for up to five years. The holder may apply for a renewal of the Prospecting Licence, which is subject to approval by the ANM. The period of renewal may be up to a further five years.

EXPLORATION LICENCE

An Exploration Licence entitles a holder to explore for minerals in the area of the licence, but not to conduct commercial mining. The maximum area of an Exploration Licence is 2,000 ha outside of the Amazonia region and 10,000 ha within the Amazonia region (Amazonas, Para, Mato Grosso, Amapá, Rondônia, Roraima, and Tocantins States). An Exploration Licence remains in force for a maximum period of three years and can be extended by no more than a further three year period. Any extension is at the ANM's discretion and will require full compliance with the conditions stipulated by the Mining Code, which must be outlined in a report to the ANM applying for the extension of the licence.

Once all legal and regulatory requirements have been met, exploration authorization is granted under an Exploration Licence, granting its holder all rights and obligations relating to public authorities and third parties. An Exploration Licence is granted subject to conditions regulating the conduct of activities, which includes the obligation to commence exploration work no later than 60 days after the Exploration Licence has been published in the Federal Official Gazette and not to interrupt it without due reason for more than three consecutive months or 120 non-consecutive days. Exploration work on the licence should be completed under the responsibility of a geologist or mining engineer, legally qualified in Brazil. The ANM should be informed of the occurrence of any other mineral substance not included in the exploration permit and of the start or resumption of the exploration work and any possible interruption.

If the holder of an Exploration Licence proves the existence of a commercial mineral deposit on the granted Exploration Licence, the ANM cannot refuse the grant of a Mining Licence with respect to that particular tenement if the licence holder has undertaken the following:

- An exploration study to prove the existence of a mineral deposit.
- A feasibility study (FS) on the commercial viability of the mineral deposit.
- The granting of an Environmental Licence to mine on the particular tenement.

MINING LICENCE

A Mining Licence entitles the holder to work, mine, and take minerals from the mining lease subject to obtaining certain approvals. Mining rights can be denied in very occasional circumstances, where a public authority considers that a subsequent public interest exceeds that of the utility of mineral exploration, in which case the Federal Government must compensate the mining concession holder.

A Mining Licence covers a maximum area ranging from 2,000 ha to 10,000 ha, depending on the geographical area as detailed under Exploration Licence, and remains in force indefinitely. The holder must report annually on the status and condition of the mine.

As with other mining tenements, a Mining Licence is granted subject to conditions regulating activities. Standard conditions regulating activities include:

- The area intended for mining must lie within the boundary of the exploration area.
- Work described in the mining plan must be commenced no later than six months from the date of official publication of the grant of the Mining Licence, except in the event of a force majeure.
- Mining activity must not cease for more than six consecutive months once the operation has begun, except where there is proof of force majeure.
- The holder must develop the deposit according to the mining plan approved by the ANM.
- The holder must undertake the mining activity according to environmental protection standards detailed in an Environmental Licence obtained by the holder.
- The holder must pay the landowner's share of mining proceeds according to values and conditions of payments set forth by law, which is a minimum of 50% of CFEM (see below), but it is usually agreed to be higher under a contract between the holder of the Mining Licence and the landowner.
- The holder must pay financial compensation to states and local authorities for exploring mineral resources by way of a Federal royalty, the Financial Compensation for the Exploitation of Mineral Resources (CFEM), which is a maximum of 3% of revenue, but varies from state to state.

An application for a Mining Licence is granted solely and exclusively to individual firms or companies incorporated under Brazilian law, which will have a head office, management, and administration in Brazil, and are authorized to operate as a mining company.

SURFACE TENURE

Lundin (via MMIC) holds all of the surface rights in the area of the Project, which incorporates all of the proposed locations of buildings, fixed installations, waste dumps, and tailing disposal in the current mine plan. Lundin is of the opinion that it can acquire the right to dispose of waste rock and tailings on additional surface property, if and when required. The land ownership is registered with the Registrar of Real Estate in Mara Rosa, Goiás.

Chapada is not subject to any rights, agreements, or encumbrances which could adversely affect the value of the property or Lundin's ownership interest. Gold production from Suruca is subject to a two percent net smelter return royalty payable by MMIC to Yamana Gold Inc.

ENVIRONMENTAL CONSIDERATIONS

CHAPADA DEPOSIT

A substantial amount of environmental study, analysis, and regulatory review has been made for the Chapada deposit, including the November 1996 Geomina Consultants Environmental Impact Study (EIA). The EIA Report was used for public comment and to support the permit applications. Yamana obtained the three environmental permits required for mine operations at the Chapada deposit as follows:

- The first Environmental Licence (LP) was issued in December 1999.
- The Construction Licence (LI) was issued in April 2001 and was renewed in April 2003 and April 2006.
- The Operation Licence was published in November 2006, and it was valid until April 2008. Chapada opened in November 2006.

On December 2007, Chapada submitted to the State of Goiás Environmental Agency all necessary documents to obtain the operational environmental licence renewal and the mine possesses all the licences (operation, deforest, water use permit, etc.) needed to operate.

No current environmental liabilities have been identified within the mine area. Ongoing items such as waste stockpiles, depleted heap leach piles, and tailings storage facilities (TSF) will be rehabilitated during the mine life or at the time of mine closure.

SURUCA

The exploration leases held at the Suruca Project were covered by exploration permits and a mining licence has been granted by the ANM. Lundin reports that no environmental permits are required at this stage of permitting for Suruca.

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

ACCESSIBILITY

The Project is located in northern Goiás State, approximately 320 km north of the state capital of Goiania and 270 km northwest of the national capital of Brasilia. Access to the Project from Brasilia is via BR-153 (Belem/Brasilia) to Campinorte (GO) and then via GO-465 (Campinorte/Santa Terezinha) west to Alto Horizonte. The town of Alto Horizonte lies between the Suruca and Chapada deposits.

Chapada Airport, suitable for small aircraft with an 800 m long airstrip, is located close to Alto Horizonte, approximately four kilometres northeast of the mine.

Suruca is located six kilometres northeast of Chapada.

CLIMATE

The region has a tropical climate characterized by two well defined seasons; the rainy season from November to March and the dry season from April to October, with an annual average rainfall of 1,500 mm. The average annual temperature is approximately 22°C. Mining operations occur throughout the year.

LOCAL RESOURCES

The local economic activity is principally agropastoral, however, there are some small scale mining activities related to gold in alluvium and quartz veins, and for clay used to make bricks.

The most important towns in the region are Uruaçu, Campinorte, Porangatu, Mara Rosa, Alto Horizonte, and Nova Iguaçu de Goiás. All have good infrastructure to support exploration activities. The closest municipality, Alto Horizonte, has a population of approximately 5,800 and the nearby towns (within 50 km) of Campinorte, Mara Rosa, and Uruaçu have estimated populations of 12,300, 10,200, and 36,600, respectively.

INFRASTRUCTURE

Currently, the major assets and facilities associated with the mining operations are:

1. The open pit mines with production of approximately 200,000 tonnes per day (tpd) of ore and waste from several mineralized structures including stockpiles and waste dumps.

2. The plant site including administrative offices complex and associated facilities, the mill, and associated facilities such as laboratories, coarse ore storage, workshops, warehouses, and dry facilities.

3. Facilities providing basic infrastructure to the mine including access roads, electric power distribution system, water treatment and supply and sewage treatment.

4. Access to the surrounding area including the national road infrastructure.

Electrical power is provided by the Brazilian National Grid. The power line (230 kV) is 85 km long and taps into the national grid near Itapaci in Goiás State.

The mine has a permit allowing the capture of up to 10.3 million m^3/yr of water from the near by Rio dos Bois. Water has not been drawn from the river for the last two years with mine drainage water, rainfall, industrial drainage together with stored water making up the required supply.

PHYSIOGRAPHY

The average elevation of the Project area is approximately 300 MASL. The topography is characterized by low rolling hills, with large contiguous flat areas.

The vegetation is referred to as “cerrado”, a tropical savannah eco-region which comprises a diverse variety of low tropical trees, shrubs, and native grasses, most of which have been cleared, and serves as cattle grazing land owned by local landowners.

The main river locally is the Rio dos Bois and there are four small creeks, Mutuzinho, Goncalves, Seriema, and Suruca. A lateritic mantle related to the peneplain is common in the region and is five metres to 30 m thick.

6 HISTORY

EXPLORATION AND DEVELOPMENT HISTORY

CHAPADA

The Chapada deposit was discovered in 1973 by a Canadian company, INCO Ltda. (INCO), during a regional program of stream sediment sampling. Follow-up work by INCO was conducted in 1974 and 1975 including detailed stream sediment surveys, soil geochemistry, geophysics, trenching, and broadly spaced drilling. Historical ownership and exploration activities are summarized in Table 6-1.

TABLE 6-1 HISTORICAL OWNERSHIP AND EXPLORATION ACTIVITIES
Lundin Mining Corporation – Chapada Mine

Date	Owner	Activity
1973	INCO	Chapada discovery.
1975-1976	INCO & Parsons	2,000 m x 500 m grid drilling program. Parsons-Eluma Projetos e Consultoria S/C (Parsons), a Brazilian copper company, acquires a 50% interest in the Project.
1976-1979	INCO & Parsons	200 m x 100 m drill grid. A 92 m deep shaft is completed with 255 m of crosscuts for exploration and metallurgical sampling.
1979	INCO & Parsons	Mining concession No. 2394 covering 3,000 ha is issued to Mineracao Alonte by the Departamento Nacional da Producao Mineral.
1980-1981	INCO & Parsons	Soil drilling completed in the plant, tailing ponds, and potential water dam areas.
1981	Parsons	Feasibility Study completed.
1994-1995	SERCOR	A 4,500 m drilling program re-evaluation of a near surface gold deposit. Preliminary Feasibility Study by Watts, Griffis and McOuat.
May 1994	SERCOR	Mineração Santa Elina Industria e Comercio S/A (SERCOR) acquires the Chapada deposit through a subsidiary, Mineracao Maracá.
July 1994	SERCOR and Echo Bay	Echo Bay acquires an initial interest in Santa Elina Gold (Santa Elina), SERCOR's subsidiary, by purchasing 5% of the outstanding shares from SERCOR
Dec 1994		Santa Elina completes its initial public offering.
Sep 1995		Santa Elina and Echo Bay approve the Chapada Project Joint Venture. Santa Elina issues approximately 3% of the outstanding shares to Echo Bay. Echo Bay receives the option to acquire 50% interest in the Project.
May 1996		Santa Elina is privatized, and Santa Elina and Echo Bay become equal owners of the company.
Dec 1996		Santa Elina completes an in-fill drilling program.
Dec 1997		Independent Mining Consultants, Inc. reviews the Echo Bay model and completes a mine Feasibility Study.
Jan 1998		Kilborn Holdings Inc. (now SNC-Lavalin Group Inc.) completes the Chapada Project Bankable Feasibility Study.
Apr 2001		Construction licence issued.
May 2000	PINUS	PINUS acquires 100% of MMIC.
2003		Yamana purchases the property.

Date	Owner	Activity
2004		The Feasibility Study is completed.
2007		Commercial production begins.
2019		Lundin acquires Chapada from Yamana

Yamana purchased MMIC in 2003 and began production in 2007. In 2019, Lundin acquired Chapada from Yamana with completion of the acquisition on July 5, 2019. Mine production to the end of June 2019 totals 246.2 million tonnes (Mt) grading 0.38% Cu and 0.33 g/t Au. Past production by year is detailed in Table 6-5.

As there were few outcrops in the Project area due to laterite-saprolite cover, the deposit definition required extensive diamond drill exploration. Development drilling of the deposit occurred in several campaigns from 1976 through 1996 by INCO, Parsons-Eluma, Eluma-Noranda, Santa Elina, and Santa Elina-Echo Bay.

The historical Chapada drill hole database includes 856 drill holes totalling 67,315 m (Table 6-2).

TABLE 6-2 HISTORICAL CHAPADA DRILL HOLES BY COMPANY
Lundin Mining Corporation – Chapada Mine

Date	Company	No. Drill Holes	Total Drilling Length (m)
1976	INCO	6	919
1976 - 1979	INCO/Eluma	78	10,573
1979 - 1981	Eluma/Noranda	86	11,140
1989	Eluma	6	569
1995	Santa Elina	416	6,631
1996	Santa Elina/Echo Bay	264	37,482
Total		**856**	**67,315**

The historical drilling results from two programs; the “CHD” holes were short and designed to test the saprolite material and the longer “M” series were typically drilled vertically and were 150 m long (Table 6-3).

TABLE 6-3 HISTORICAL CHAPADA DRILL HOLES BY SERIES
Lundin Mining Corporation – Chapada Mine

Drill Series	No. of Holes	Metres	No. of Sample Intervals
“CHD”	416	6,630	7,731
“M”	440	60,685	40,208
Total	**856**	**67,315**	**47,939**

In 1995 and 1996, Santa Elina/Echo Bay drilled 680 holes which were NQ or NX core size. All collar locations were surveyed. Approximately 5% of the holes were angled (inclined) and were subjected to downhole surveys; the vertical holes were not surveyed.

SURUCA

The Suruca deposit has been explored by various companies since the 1970s, as summarized in Table 6-4, and was exploited by garimpeiros in the 1980s. It is reported that garimpeiros produced approximately 200 kg of gold in the 1980s.

TABLE 6-4 SURUCA HISTORY SUMMARY
Lundin Mining Corporation – Chapada Mine

Date	Ownership
1980 - 1981	INCO/Eluma
1987 - 1988	Cominco
1993 - 1994	WMC
1996 - 1997	Santa Elina/Echo Bay
2009 – June 2019	Yamana

Much of the activity targeted oxide mineralization.

HISTORICAL ESTIMATES

The Suruca resources identified by Santa Elina in mid-1990s were estimated to be 11 Mt grading 0.56 g/t Au, totalling 199,400 oz Au. This estimate is considered to be historical in nature and should not be relied upon. A qualified person has not completed sufficient work to classify the historical estimate as a current Mineral Resource or Mineral Reserve and Lundin is not treating the historical estimates as current Mineral Resources or Mineral Reserves.

PAST PRODUCTION

Chapada is a traditional open pit truck and shovel operation that has been in continuous operation since 2007. Table 6-5 summarizes the processing history through June 2019.

TABLE 6-5 PAST PRODUCTION
Lundin Mining Corporation – Chapada Mine

Year	Tonnes (millions)	Grade	
		Au (g/t)	Cu (%)
2007	13.5	0.58	0.48
2008	14.9	0.44	0.47
2009	17.3	0.41	0.43
2010	19.2	0.35	0.41
2011	20.6	0.32	0.42
2012	21.6	0.29	0.39
2013	21.8	0.26	0.35
2014	20.4	0.28	0.37
2015	19.9	0.33	0.37
2016	19.8	0.30	0.34
2017	23.0	0.29	0.32
2018	22.9	0.26	0.31
To June 30, 2019	11.3	0.23	0.29
Total	**246.2**	**0.33**	**0.38**

7 GEOLOGICAL SETTING AND MINERALIZATION

REGIONAL GEOLOGY

The Chapada and Suruca deposits are situated in Goiás Magmatic Arc, Central Brazil, which is part of an accretionary orogen with tectonic evolution between 900 Ma and 600 Ma during the Brasiliano Orogeny.

The Goiás Magmatic Arc is located in western Goiás and Tocantins and represents an approximately 1,000 km north-northeast trending belt of Neoproterozoic juvenile orthogneisses associated with arc-type volcano-sedimentary sequences. Two discontinuous areas of Neoproterozoic juvenile continental crust form the Goiás Arc: the northern Mara Rosa Magmatic Arc and the southern Arenópolis Magmatic Arc (Figure 7-1), which are both comprised of dioritic to granitic orthogneisses exposed between narrow north-northeast anastomosed volcano-sedimentary belts.

The Mara Rosa Magmatic Arc is represented by two domains with distinct timing in geologic evolution: the eastern domain is called Mara Rosa Metavolcano-Sedimentary Sequence, which is interpreted as a typical island arc setting that developed 900 Ma to 800 Ma ago, while the western domain, denominated Santa Terezinha Sequence, is interpreted as a continental arc that evolved during 670 Ma to 630 Ma ago. A geological map of Mara Rosa Magmatic Arc is shown in Figure 7-2.

Arantes (1991) divided the Mara Rosa Metavolcano-Sedimentary Sequence into three belts: East, Central, and West, separated from each other by Neoproterozoic tonalitic orthogneisses domains. Oliveira et al. (2006) proposed to update and rename this classification according to spatial association between the outcropping lithologies. As a result, the East belt was renamed metavolcano-sedimentary sub-unit, the Central belt was renamed mafic metavolcanic sub-unit, and the West belt, now interpreted as part of Santa Terezinha Sequence, was renamed the metasedimentary sub-unit.

The Chapada and Suruca deposits are located within the metavolcano-sedimentary sub-unit, which comprises varying compositions of metavolcanic rocks, from mafic to felsic composition, metavolcaniclastic rocks, fine to medium grained metagreywacke, and a large variety of pelitic/psammitic metasedimentary rocks.

The amphibolites described in the Chapada deposit are characterized by low rare earth element (REE) contents and enrichment in the light REE (LREE) compared with heavy REE (HREE) typical of island arc mafic magmas. The geochemical characteristics of the amphibolites and associated plutonic rocks of the Chapada deposit suggest an origin in a tectonic setting similar to modern volcanic arcs. On the other hand, clinopyroxene amphibolites from the same study area are more similar to those of mid-ocean ridge basalts and may have originated in a back-arc spreading environment. The most probable geological context of the Chapada and Suruca deposits is remnants of a volcanic arc–back-arc basin pair. Additionally, tonalitic to dioritic rocks have signatures similar to primitive island arc M-type granitoids and some display characteristics similar to those of modern adakites.

The last magmatic event is represented by late to post tectonic granitic (e.g., the Faina, Angelim, Estrela, and Amador granites) as well as gabbro-dioritic bodies (e.g., diorite close to Chapada). The granite bodies include mainly biotite granites and two mica leucogranites, with local granodioritic facies. The mafic intrusions are dioritic and, to a lesser extent, gabbroic in composition and very commonly display magma mixing structures. The Precambrian geological evolution of the Mara Rosa Arc culminated with an important bimodal magmatic event, which has been interpreted to be associated with final uplift and collapse of the Brasiliano Orogen.

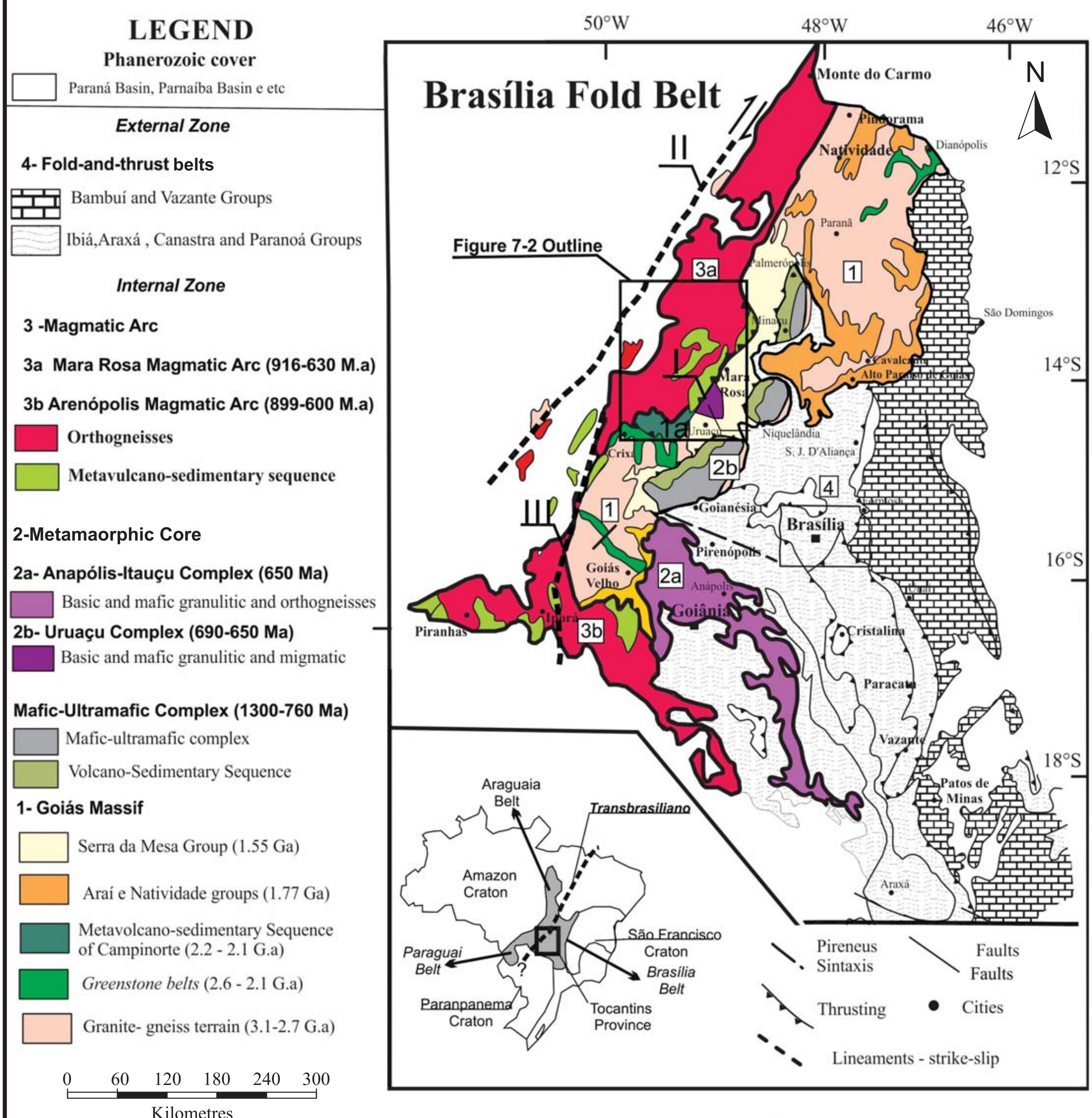


Figure 7-1

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Regional Geology

October 2019

Source: Lundin, 2019.

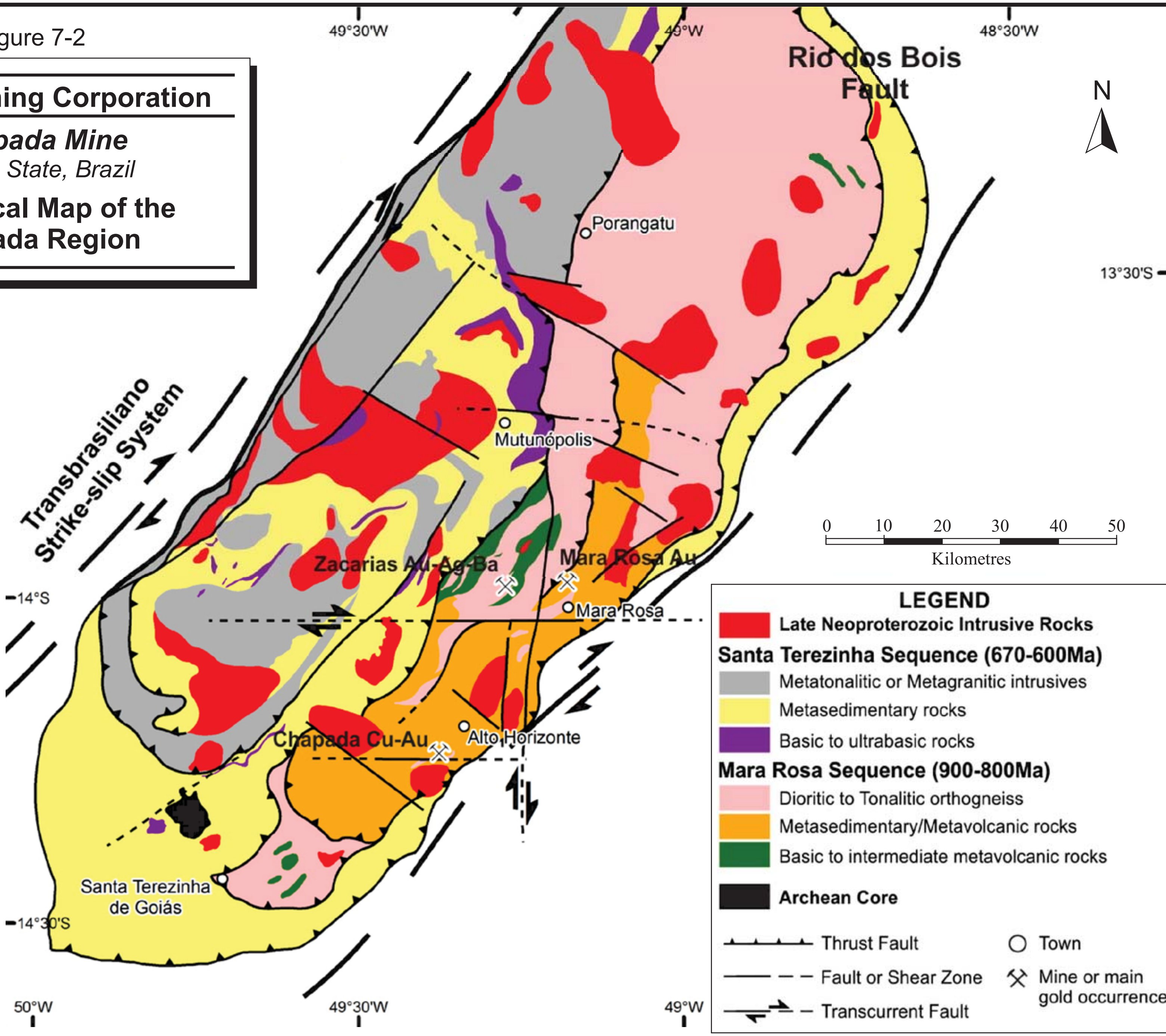
Figure 7-2

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Geological Map of the Chapada Region



October 2019

Source: Lundin, 2019.

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LOCAL GEOLOGY

The Chapada and Suruca deposits are located in the metavolcano-sedimentary sub-unit of Mara Rosa Sequence. The local geological map and location of Chapada and Suruca deposits are shown in Figure 7-3. The local stratigraphy comprises five layers as described below, from top to bottom.

METASEDIMENTARY LAYER

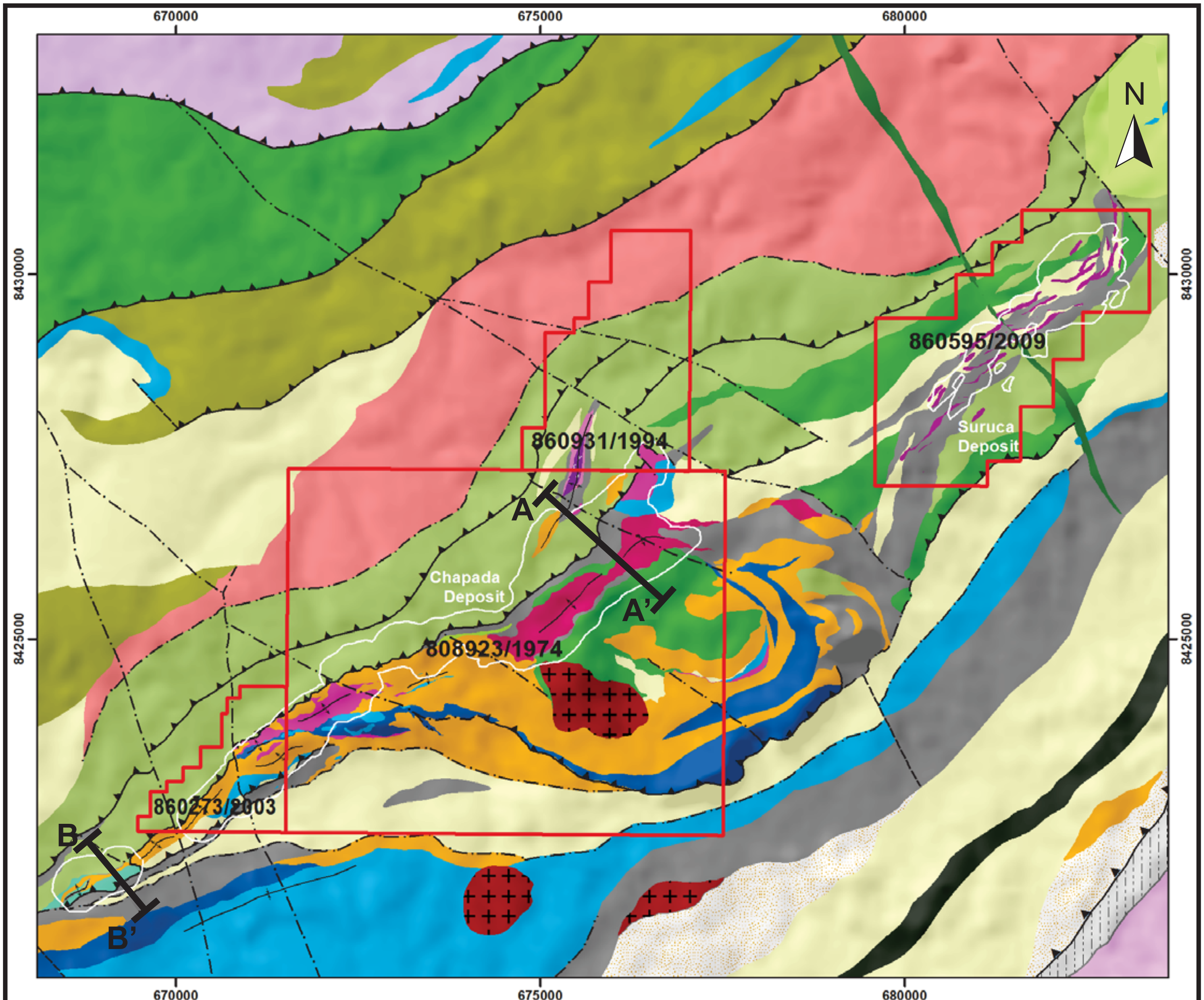
The metasedimentary layer is composed of garnet-biotite-quartz schist with small variations in composition, such as the presence of muscovite, staurolite, epidote, or amphibole. The garnet as well as some hornblende and kyanite occur as syn-tectonic porphyroblasts. The remaining minerals comprise a fine grained matrix with granolepidoblastic texture. The large amount of quartz (30%) suggests a metasedimentary protolith for these schists. Sulphides occur as disseminated pyrrhotite and less pyrite. No economic mineralization is recognized in the metasedimentary layer.

UPPER METAVOLCANO-SEDIMENTARY LAYER (A LAYER)

The A layer is defined by interlayering of several lithotypes, such as garnet-biotite-quartz schist (same as in the metasedimentary layer), amphibole-quartz schist, biotite-quartz schist, biotite-gneiss, amphibole-biotite gneiss, and metatuff.

The amphibole-quartz schist is composed by euhedral porphyroblasts of gedrite and hornblende in a fine grained granoblastic matrix of quartz, plagioclase, and lesser amounts of biotite. This lithotype can also present garnet porphyroblasts and some staurolite, apatite, and epidote. The mineral assembly combined with whole rock lithogeochemistry suggest an impure sedimentary protolith, probably derived from the erosion of igneous rocks of the magmatic arc.

The biotite gneiss and amphibole-biotite gneiss are fine grained, vary in composition, with the presence of muscovite and epidote. These rocks are the most important host rocks of the Chapada deposit. Whole rock lithogeochemistry combined with petrography suggest an intermediary metavolcanic protolith for this lithotype.



Legend:

Hydrothermal Alteration
- Muscovite-chlorite schist

Argillic alteration
- Kyanite-muscovite schist
- Kyanitites, Kyanite quartzites

Sericitic alteration
- Muscovite-quartz schist

Potassic alteration
- Biotite-muscovite schist
- Kfeldspar-biotite-quartz schist
- Magnetite-carbonate-biotite schist

- Mining Concession

Structure
- Antiform
- Sinform
- Thrust Fault
- Shear Zones

Geology
- Post-tectonic ultramafic dike
- Syn-tectonic intrusions (630 Ma)

Mara Rosa Sequence (900 - 800 Ma)
- Intermediate metaplutonic
- Metaquartz diorite porphyry
- Biotite-amphibole Metatonalite
- Gondite
- Intermediate metavolcanic rocks
- Metadiorite
- Amphibole-quartz Schist
- Metavolcano-sedimentary rocks
- Amphibolite

Campinorte Sequence (2.19 Ga)
- Quartz Vein
- Indiscriminate Unit

A - A' shown in Figure 7-6

B - B' shown in Figure 7-7

0 1 2 3 4 5
Kilometres

Figure 7-3

Lundin Mining Corporation

Chapada Mine
Goiás State, Brazil
Local Geology with Cross Sections A-A' and B-B'

October 2019 **Source: Lundin, 2019.**

The metatuff is a fine-grained biotite schist commonly with mylonitic texture, which contains sigmoidal porphyroclastic quartz-feldspar aggregates immersed in a sulphide-bearing sericitized matrix. U-Pb dating revealed age of 908 Ma, which coincides with the timing of volcanic activity within the Mara Rosa Arc.

The A layer hosts the mineralization at Baruzinho, Chapada SW, and Suruca.

METAVOLCANIC LAYER (B LAYER)

The B layer is defined by a 50 m to 200 m thick layer of biotite-quartz schist, biotite-gneiss, and amphibole-biotite gneiss (same as described in the metavolcano-sedimentary layer).

Intrusive rocks with porphyritic to equigranular texture and dioritic composition are usually associated with the metavolcanic layer. The intrusive rocks display geochemical affinity with M-type granitoids of immature island arcs. Three intrusive facies are observed: metaquartz diorite porphyry, metadiorite porphyry, and intermediate metaplutonic rock. The metaquartz diorite porphyry represents early- to inter-mineral porphyry stocks, which are related to copper-gold mineralization at most orebodies of the Chapada deposit. The metadiorite is interpreted as inter- or late-mineral porphyry stocks and occur throughout the Chapada and Suruca deposits. Only at Suruca, however, are they the host rock of both copper-gold and gold only mineralization. The intermediate metaplutonic lithotype represents late-mineral porphyry stocks that crosscut the copper-gold mineralization at the Baru, Sucupira, Corpo Sul, and Santa Cruz orebodies. U-Pb data in zircon yielded an 884 ± 5 Ma age for an early-mineral metaquartz diorite porphyry in Corpo Sul and an 879± 5 Ma age for a late-mineral intermediate metaplutonic in Sucupira.

The early- and inter-mineral stocks are associated with the magmatic fluids responsible for copper-gold and gold only mineralization and occur at the centre of thicker zones (>10 m) such as the Chapada deposit, or as several apophyses concordant to the main foliation, as at the Suruca deposit.

The difference between the number of porphyry stocks in the metavolcanic layer compared to other layers is the main reason this layer hosts the majority of the resources at Chapada and Suruca.

Several lithotypes derived from metamorphism of porphyry or skarn hydrothermal halos occur at the metavolcanic layer:

- Biotite schist, muscovite-biotite schist, feldspathic-biotite schist, feldspathic muscovite-biotite schist, and quartz-biotite schist interpreted as the metamorphosed potassic halo.
- Biotite-muscovite-quartz schist and muscovite-quartz schist interpreted as the metamorphosed sericitic halo.
- Kyanite-muscovite-quartz schist, muscovite-kyanite-quartz schist, kyanite quartzite, muscovite quartzite, and kyanitite interpreted as metamorphosed advanced argillic halo.
- Epidote-rich rocks, e.g., epidosite and epidote bearing schists with more than 20% epidote interpreted as metamorphosed calcic halo.
- Unaltered wall rocks with sparse concordant epidote veins or with chloritized matrix interpreted as metamorphosed propylitic halo.

A well-defined concentric sulphide zonation is observed in the orebodies, with an outer zone of pyrite-only, ranging through pyrite>chalcopyrite, chalcopyrite>pyrite, chalcopyrite-only, and, in some orebodies, chalcopyrite±bornite.

LOWER METAVOLCANO-SEDIMENTARY LAYER (C LAYER)

An interlayer of metavolcanic and metasedimentary rocks identical to the upper metavolcano-sedimentary A layer is located below the metavolcanic layer. No mineralization is observed in this layer.

MAFIC METAVOLCANO-SEDIMENTARY LAYER

This layer is interpreted as the basal unit of the local geology. A thick sequence of fine grained amphibolites interlayered with metasedimentary lithotypes occur to northwest of the Corpo Sul deposit. No mineralization is observed in this unit.

SYN-TECTONIC TO POST-TECTONIC INTRUSIONS

The syn-tectonic and post-tectonic intrusions are represented by metadiorite, bimodal deformed dikes, and pegmatites.

The metadiorite is deformed medium grained diorite with salt-and-pepper texture, locally named as Chapada Diorite. U-Pb data in zircon indicates a 635 ± 7 Ma age for this intrusion (Oliveira et al., 2015).

Bimodal syn- to post-tectonic dikes are observed throughout the Chapada and Suruca deposits with an average thickness of one metre to ten metres. The dikes are generally subconcordant to the main foliation. The mafic component is represented by fine grained amphibolites with nematoblastic texture, whereas the felsic component is fine grained metadacites with granoblastic texture. U-Pb data in zircon of a metadacite yielded an age of 614 ± 8 Ma.

Three phases of pegmatite crystallization are observed: pre-, syn-, and post-tectonic. The pre- and sin-tectonic phases are concordant or subconcondant to the main foliation, and the post-tectonic phase is generally discordant. These pegmatite intrusions vary from one metre to 30 m in thickness.

The bimodal dikes and pegmatite intrusions are commonly located close to faults and shear zones.

WEATHERING EVENT

The mine area is covered by a 30 m thick lateritic profile composed of a coarse saprolite, mottled zone or argillic zone, lateritic duricrust, and pisolitic soils (products of alteration of duricrust) from bottom to top.

A typical stratigraphic column of the local geology for the Chapada and Suruca deposits is shown in Figure 7-4.

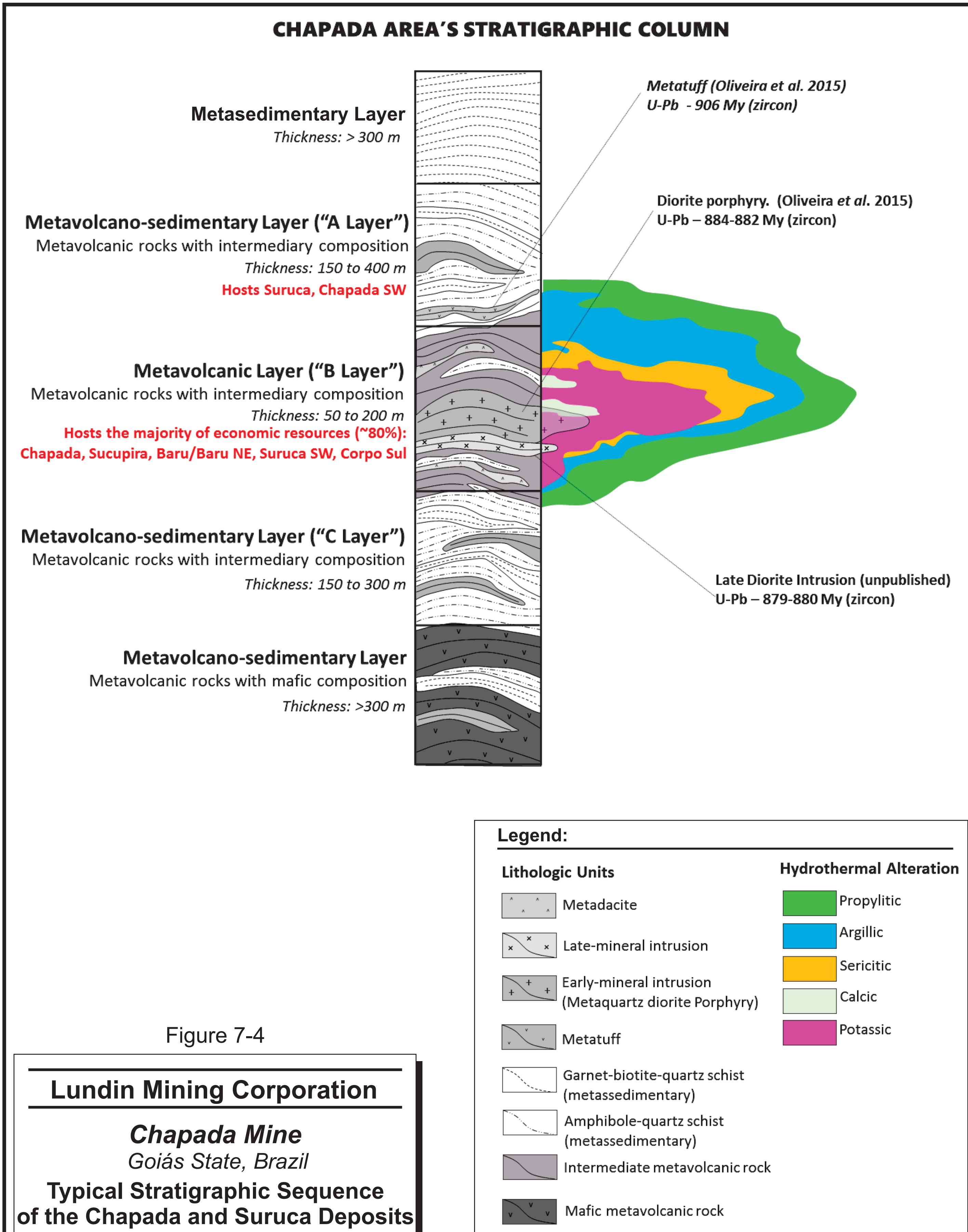


Figure 7-4

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Typical Stratigraphic Sequence of the Chapada and Suruca Deposits

October 2019

Source: Lundin, 2019.

STRUCTURAL GEOLOGY

The structural setting of the Chapada and Suruca area is mainly associated with the Brasiliano Orogeny, which took place between 930 Ma and 570 Ma (Giustina, 2009), culminating in the closure of Brasiliano Ocean. During this period, large scale, low angle thrust faults were developed, such as the Rio dos Bois Fault, which is the major structure in the Mara Rosa Magmatic Arc. The Rio dos Bois Fault is responsible for the overlapping the Neoproterozoic Mara Rosa Metavolcano-sedimentary Sequence over the Archean granite-greenstone terrains.

The structures described at the Chapada and Suruca deposits were developed during three stages:

D_{N-1} PHASE

The D_{n-1} ductile deformation phase is represented by S_{n-1} penetrative foliation, which is commonly subparallel to the S_0 foliation. The S_{n-1} foliation was generated by intrafolial isoclinal folding. It is estimated that the D_{n-1} phase took place around 760 Ma to 730 Ma, associated with Mara Rosa Magmatic Arc collision with the São Francisco Craton. Peak metamorphic conditions associated with the D_{n-1} phase have been estimated at 650°C and 9 kBa, which is consistent with regional medium to high amphibolite facies.

D_N PHASE

The D_n phase is coaxial and progressive to the D_{n-1} phase. The D_n phase developed under ductile conditions and is represented by recumbent folding of early foliation. This recumbent folding generated the penetrative S_n foliation (Figure 7-5a). The interaction between the S_{n-1} and S_n foliations generated a strong intersection lineation, which plunges in a southwest direction with 30° (Figure 7-5c). Additionally, mylonitic foliations are observed at local and regional scale, with a N20°E to N50°E trend and low to moderate dip to the northwest (290° to 320° dip direction / 10° to 40° dip). The stretching lineation associated with the mylonitic foliation is plunging at 320° azimuth with a 10° to 30° dip (Oliveira et al, 2015).

The D_n phase is related to the development of the Rio dos Bois Fault, a first order shear zone that comprises a set of thrust to reverse faults formed in response to north-northwest to south-southeast crustal shortening. Peak metamorphic conditions associated with the D_n phase are estimated at 460°C and 5 kBa (Kuyumjian, 1989).

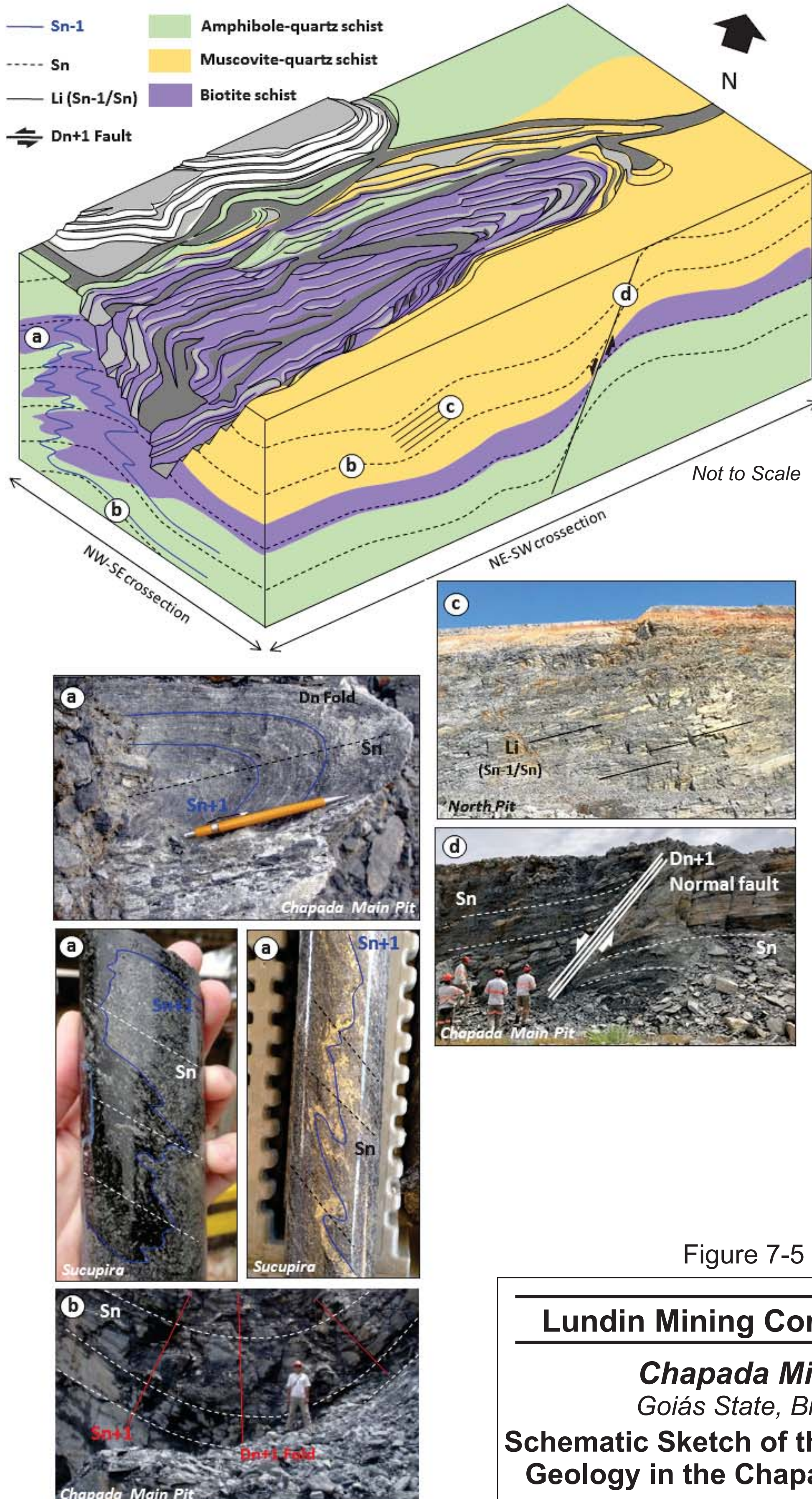


Figure 7-5

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Schematic Sketch of the Structural Geology in the Chapada Region

Source: Lundin, 2019.

October 2019

D_{N+1} PHASE

The D_{n+1} phase is represented by open to slightly asymmetric anticlines and synclines with northeast and northwest axes, imprinting a dome-and-keel regional pattern (Figure 7-5b). A S_{n+1} spaced cleavage is developed by this folding pattern. Second-order northwest brittle-ductile faults occur frequently, which represent new or existing reactivated faults that locally displace the mineralization and remobilize chalcopyrite and pyrite. An east-west ductile-brittle dextral shear zone is responsible for the offset of the southwest part of Chapada Cava Central from northeast-southwest to east-west. Additionally, northwest extensional faults are related to late the D_{n+1} phase (Figure 7-5d). The D_{n+1} phase represents the final stage of collision between the Amazon and São Francisco plates, which developed under brittle-ductile conditions.

The Chapada and Suruca deposits are mainly controlled by D_{n+1} phase and are slightly open folded with low angle plunges normally to the southwest. The D_n stage, however, may locally control the mineralization by thickening the high grade mineralization by repetition of layers through recumbent folding.

The phases of deformation and associated structures are synthetized in Table 7-1 below. Cross-sections of Baru-Sucupira-Chapada and Santa Cruz showing the structural control and geology of each area are illustrated in the Figures 7-6 and 7-7, respectively.

TABLE 7-1 EVENTS AND STRUCTURAL FEATURES OF BRASILIANO DEFORMATION IN THE MINE AREA
Lundin Mining Corporation – Chapada Mine

Phase	Foliation	Lineation	Faults	Folds
D_{n-1}	S_{n-1} (Penetrative)			Intrafolial folds
D_n	S_n (Penetrative)	Li (S_{n-1}/S_n); Lx (10/320)	Thrust faults (Rio dos Bois)	Recumbent folds
D_{n+1}	S_{n+1} (Spaced Cleavage)		E-W dextral shear zone; NW-SE shear zones	Broad to open folds; dome-and-kneel pattern

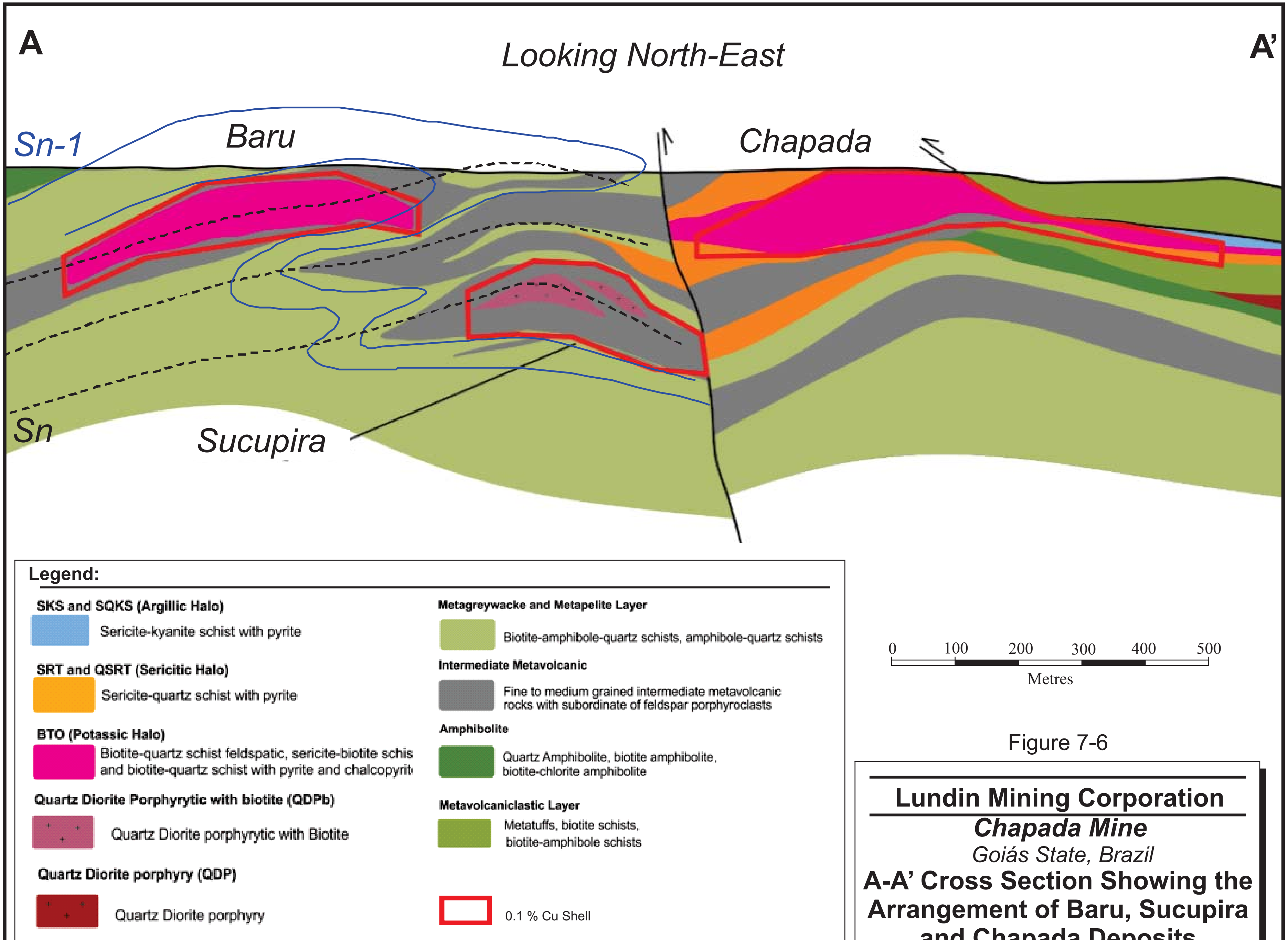


Figure 7-6

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

A-A' Cross Section Showing the Arrangement of Baru, Sucupira and Chapada Deposits

October 2019

Source: Lundin, 2019.

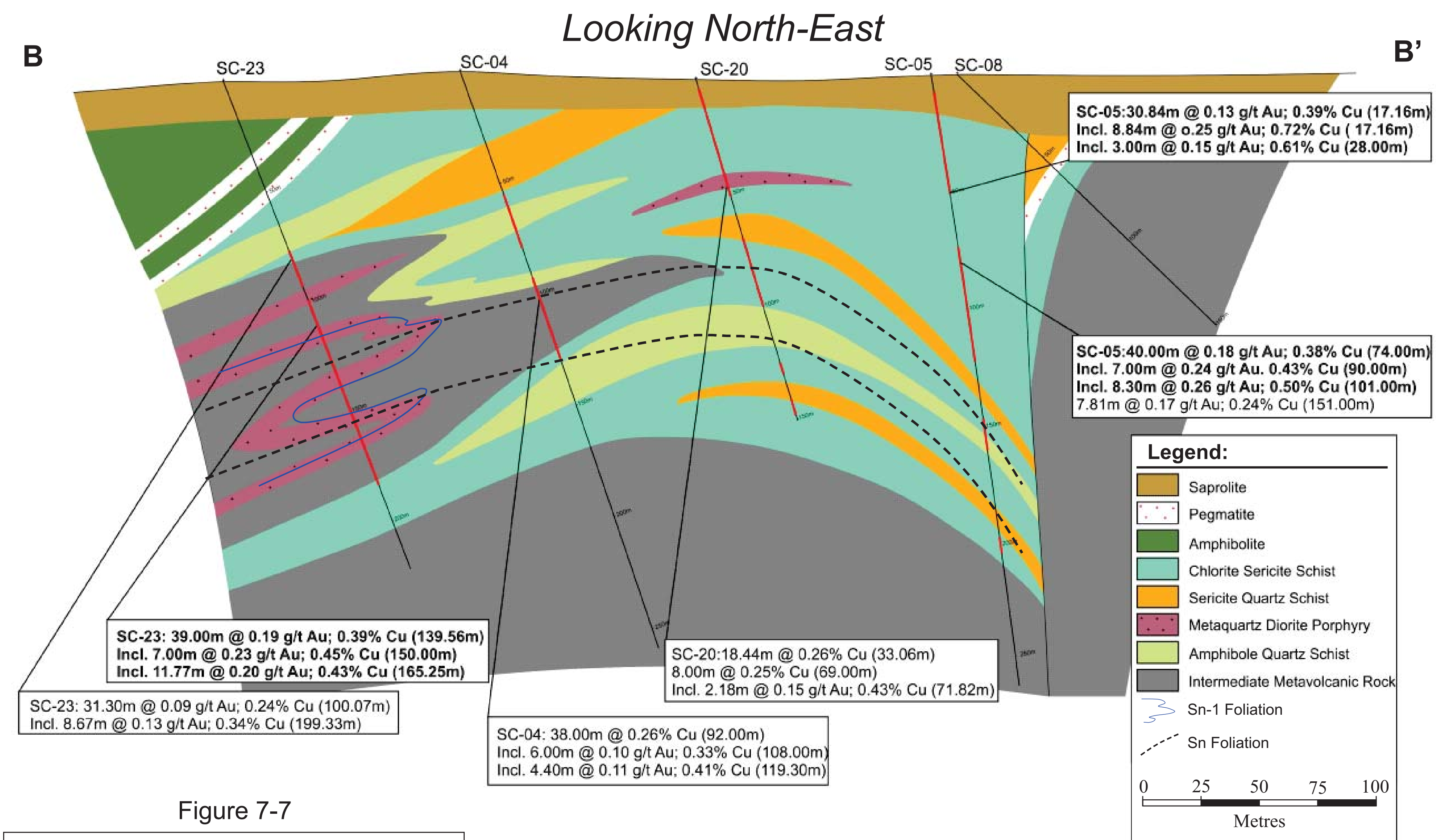


Figure 7-7

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

B-B’ Cross Section Showing the Litho-Structural Setting of the Santa Cruz Deposit

October 2019

Source: Lundin, 2019.

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PROPERTY GEOLOGY

CHAPADA

The Chapada deposit lithologies were grouped in “litho-structural domains” to assist mine operations. These domains are classified based on lithological relationships, intensity of hydrothermal alteration, and intensity of weathering.

MIX DOMAIN

This domain is characterized by a moderately weathered rock horizon and/or structured saprolite containing portions of fresh rock. Its delimitation does not depend on the protolith and is distinctive due to its high clay mineral content.

ANF DOMAIN

This domain occurs in the northwestern region of Chapada Cava Central, associated with the CRT domain. It consists of amphibolite interlayered with biotite schists and amphibole schists.

CRT DOMAIN

This domain is located in the northwest region of Chapada Cava Central and is characterized by the interlayering of biotite schists, biotite-kyanite schists, and amphibole schists. The CRT domain is closely associated with the mineralization and presents a cigar-shaped geometry with a N45°E direction and 8°SW plunge.

ANX DOMAIN

Correlated to the A layer described in Local Geology, this domain occurs in the northwest region of the Chapada Cava Central pit and consists of amphibole-quartz schist with subordinate layers of biotite-quartz schist, and lenses of amphibolite. Epidote and carbonate may occur in the fracture planes.

The sulphide content depends on the lithotype. Amphibole-quartz schist generally presents lower amounts of disseminated pyrite and chalcopyrite, whereas the biotite-quartz schist generally displays high amounts of pyrite recrystallized along the S_n foliation

The geomechanical classification assigns rock mass classes of II to III to this domain. The best rock mass class usually is related to a low degree of hydrothermal alteration.

BTO DOMAIN

The BTO domain is mainly composed of biotite bearing rocks such as biotite-quartz schist, quartz-biotite schist, feldspathic-biotite schist, biotitite, etc. This domain represents a large group of lithotypes in terms of hardness, thus it was divided into two sub-domains. Figure 7-8 shows a cross-section of the Sucupira deposit where both sub-domains occur.

Foliated BTO Subdomain

Represented by rocks with moderate to high amounts of mica (>40%), the Foliated BTO subdomain is a relatively soft domain, especially when compared with the ANX domain. Common lithotypes are biotitite, biotite schist, feldspathic-biotite schist, muscovite-biotite schist, quartz-biotite schist, and quartz-muscovite-biotite schist, which are products of hydrothermal alteration, especially from the potassic halo. Thus, the Foliated BTO subdomain is closely associated with the mineralization and generally hosts higher grade copper mineralization. The muscovite-biotite schist and the quartz-muscovite-biotite schist are interpreted as sericitic overprint over the potassic halo, and they occur more frequently in the southwest region of Chapada Cava Central pit. The Foliated BTO subdomain also occurs closely associated with the Corpo Sul deposit. The Sucupira deposit, however, is associated mainly with the Silicified BTO subdomain, and the Foliated BTO occurs only as lenses (Figure 7-8).

The geomechanical classification assigns rock mass classes of II to III in this domain. The hydrothermal alteration, followed by metamorphism, developed high amounts of mica with moderate to high porosity (probably due to the dissolution of disseminated anhydrite), commonly found at Corpo Sul, Chapada Cava Central, and Baru deposits. Due to these characteristics, rock mass classification is generally better with lower porosity (or anhydrite).

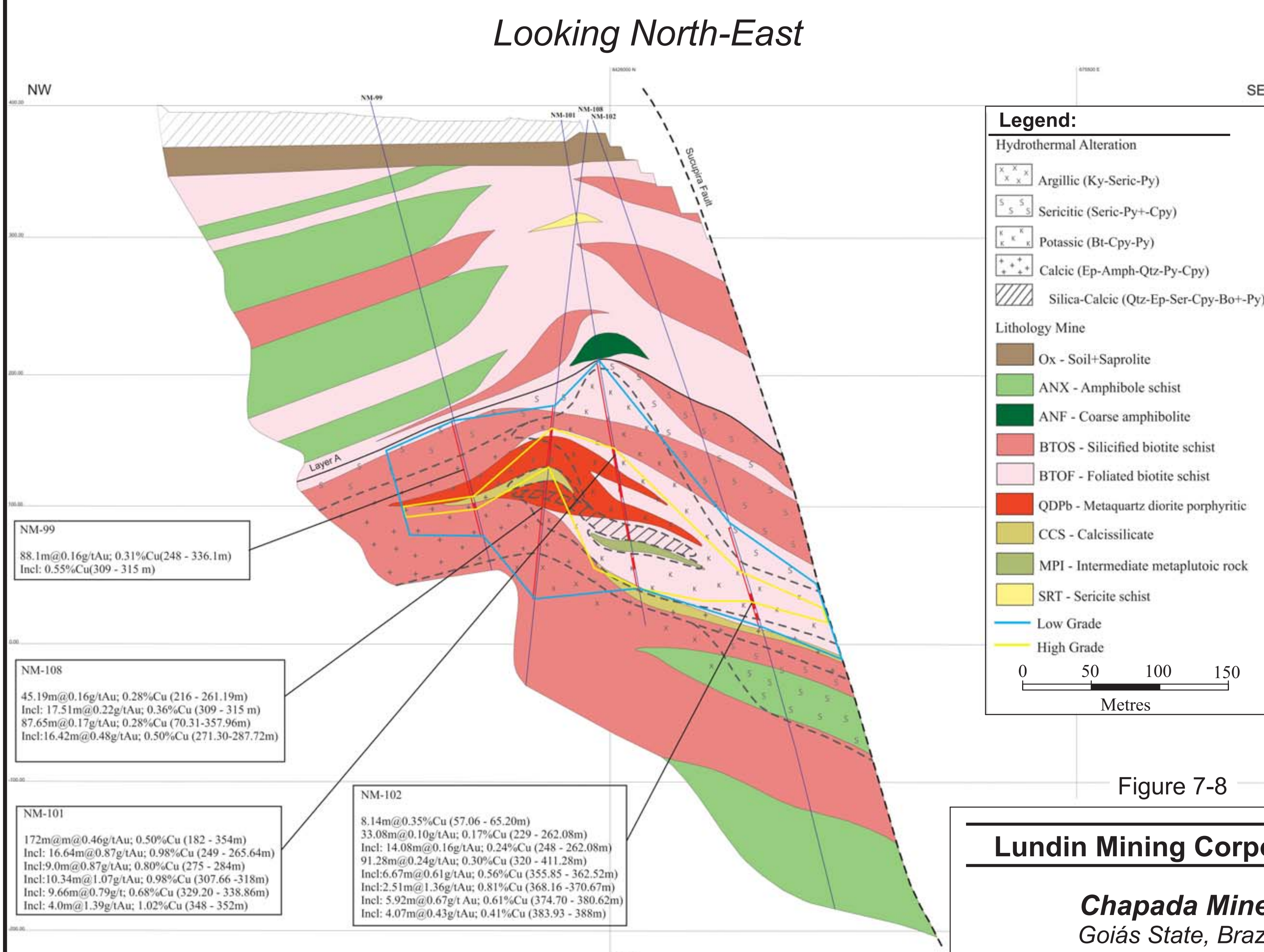

Figure 7-8

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Sucupira Domains

October 2019

Source: Lundin, 2019.

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Silicified BTO Subdomain

The Silicified BTO subdomain occurs mainly in the southwest regions of the Chapada pit and in the Corpo Sul deposit but is more frequently associated with the Sucupira deposit. In comparison to the Foliated BTO subdomain, the Silicified BTO has relatively more quartz and less mica in its composition, presenting higher hardness and higher resistance to crushing. Biotite-quartz schist with lower amounts of mica and fine grained biotite-quartz schist are the main lithotypes of this subdomain. Subordinate chlorite, muscovite, carbonate, and sericite can also occur with varying amounts. An increase in quartz content also occurs associated with mylonitic rocks in the Chapada pit. Generally, high grades of copper and gold are associated with an increase of density of recrystallized and deformed quartz veins; at the Chapada pit, it is also possible to observe an increase of chalcopyrite precipitation along quartz veins.

The geomechanical classification assigns rock mass classes II to III in this subdomain.

GNS DOMAIN

Represented by biotite gneiss with carbonate veinlets subparallel to the S_n foliation, this unit generally displays layers of muscovite-biotite gneiss and biotite-muscovite schist. The GNS domain is mainly found in the Chapada pit and also occurs at the Baru and Baru NE deposits. At Baru NE, the GNS domain displays intense quartz and quartz-feldspar veining, which is associated with the high grade oreshoot of the deposit.

Sulphides are mainly pyrite and chalcopyrite, generally with higher amount of chalcopyrite than pyrite. Almost 2% to 3% bornite also occurs in Baru NE, associated with the quartz and quartz-feldspar veins.

A geomechanical classification of rock mass classes of IV and V are assigned in this domain. However, in Baru NE, due to the increase in quartz-feldspar and quartz veining, rock mass classes III or II are assigned.

SRT DOMAIN

This domain is characterized by muscovite bearing rocks, such as biotite-muscovite schist, muscovite schist, quartz-muscovite schist, kyanite-muscovite schist, and chlorite-muscovite schist. It occurs in the southwest portion of the Chapada pit and in the northeast portion of the Corpo Sul deposit. In these places, the SRT domain occurs as a thick layer on the top and bottom of the GNS and BTO domains. At Sucupira, Baru, and Baru NE, the SRT domain occurs as thin lenses, generally less than 10 m thick.

The SRT domain is interpreted as a product of metamorphism of an intense sericitic halo. Pyrite is the main sulphide mineral and occurs as medium to coarse crystals along the S_n foliation. Traces of chalcopyrite are also common.

The SRT is a soft domain, with rock mass class ranging between III and IV, depending on the amount of quartz.

QSRT DOMAIN

The QSRT domain mainly occurs in the southeast part of the Chapada pit and in the northwest portion of the Corpo Sul pit. In comparison to the SRT domain, the QSRT domain has a higher amount of quartz, represented by lithotypes such as muscovite-quartz schist and kyanite-quartz schist. At Chapada Cava Central, the contact with the nucleus of the mineralization is delineated by a greenish, mylonitic corridor, having a matrix that is composed of fine quartz crystals, sericite, muscovite, and epidote with porphyroblasts of feldspar.

The sulphide minerals are similar to the SRT domain, with large amounts of disseminated medium to coarse grained pyrite and traces of chalcopyrite, controlled mainly by the S_n foliation.

The QSRT is a hard domain, with a rock mass class ranging between II and III, depending on the amount of quartz present.

QDPB DOMAIN

The QDPB domain represents the intrusive rock group, which has strong association with the magmatic fluids that developed the Chapada deposit. Metaquartz diorite porphyry displays phenocrysts or porphyroclasts of plagioclase, which have been replaced by an aggregate of albite, muscovite, and quartz. The matrix of this unit is formed mainly by muscovite, quartz, biotite, and epidote with disseminated pyrite and chalcopyrite. Locally, quartz veining associated with chalcopyrite are observed, which are related with highest grades of this domain. Recent dating work conducted by the University of Brasília suggested an age of 884 ± 5 Ma for this unit.

The intermediate metaplutonic unit is a deformed equigranular plutonic rock with quartz, plagioclase, and biotite forming the major rock constituents, with muscovite and epidote occurring in varying amounts. This unit is spatially associated with the mineralization, however, no mineralization is observed in this unit (Figure 7-8) except at Chapada SW, where it is associated with a calcic hydrothermal alteration with an increase in the amount of epidote.

SURUCA

The Suruca deposit comprises three distinct zones, divided according to the contained metals and oxidation zones: Suruca Oxide (Au-only), Suruca Sulphide (Au-only), and Suruca SW (Cu-Au).

The Suruca Oxide zone is hosted in a thick weathering mantle with an average thickness of 35 m to 40 m, with a well defined zoning from top to the bottom composed of soil, mottled rock, fine saprolite, coarse saprolite, and altered rock.

The remaining mineralization is hosted in the Suruca Sulphide zone and the lithologies are grouped into five domains as described below, from top to bottom.

ANF DOMAIN

The ANF domain is represented by medium grained to finer grained amphibolite to quartz amphibolite, in which epidote and chlorite are common accessory minerals. The hydrothermal alteration imprinted on the ANF domain generated epidosite and amphibole epidosite zones with thickness ranging from few centimetres up to one metre. These features are compatible with confined propyllitic alteration.

This domain has incipient sulphide content, represented by pyrite and/or pyrrhotite.

MTS DOMAIN

The MTS domain encompasses lithotypes from the metasedimentary layer and upper metavolcano-sedimentary layer (A layer). The top of MTS metasedimentary layer is represented by a thick layer of fine grained biotite-quartz schist marked by porphyroblasts of garnet. Pyrrhotite is the main disseminated sulphide, although pyrite may occur in veinlets.

The metavolcano-sedimentary layer (A layer) is represented by garnet-amphibole-quartz schist and biotite-quartz schist as well as the garnet-biotite-quartz schist. Most of the Suruca Sulphide mineralization is hosted in this domain, associated with a large increase in epidote and sericite, as well as in the density of veins with a calcic assemblage and polymetallic veinlets. The polymetallic veinlets are composed of quartz, biotite, pyrite, sphalerite, and galena, whereas the calcic hydrothermal alteration is composed of garnet, amphibole, epidote, zoizite, quartz, carbonate, and pyrite.

Although the high density of polymetallic veinlets are good indicators of high grade gold mineralization, microprobe images have shown that the gold is mainly associated with pyrite crystals.

MVI DOMAIN

The MVI domain is correlated with the metavolcano-sedimentary layer (B layer). The wall rock lithotype is biotite-quartz schist, while epidote-muscovite schist, biotite-epidote-muscovite-quartz schist, and biotite-muscovite schist are the common hydrothermal rocks that host the Suruca copper-gold mineralization. The copper-gold mineralization in these schists is directly associated with the presence of grey quartz veins with pyrite and chalcopyrite. The grey veins may occur both concordant to the foliation or as stockwork veining.

The gold in Suruca SW is associated mainly with chalcopyrite crystals instead of pyrite.

QDP DOMAIN

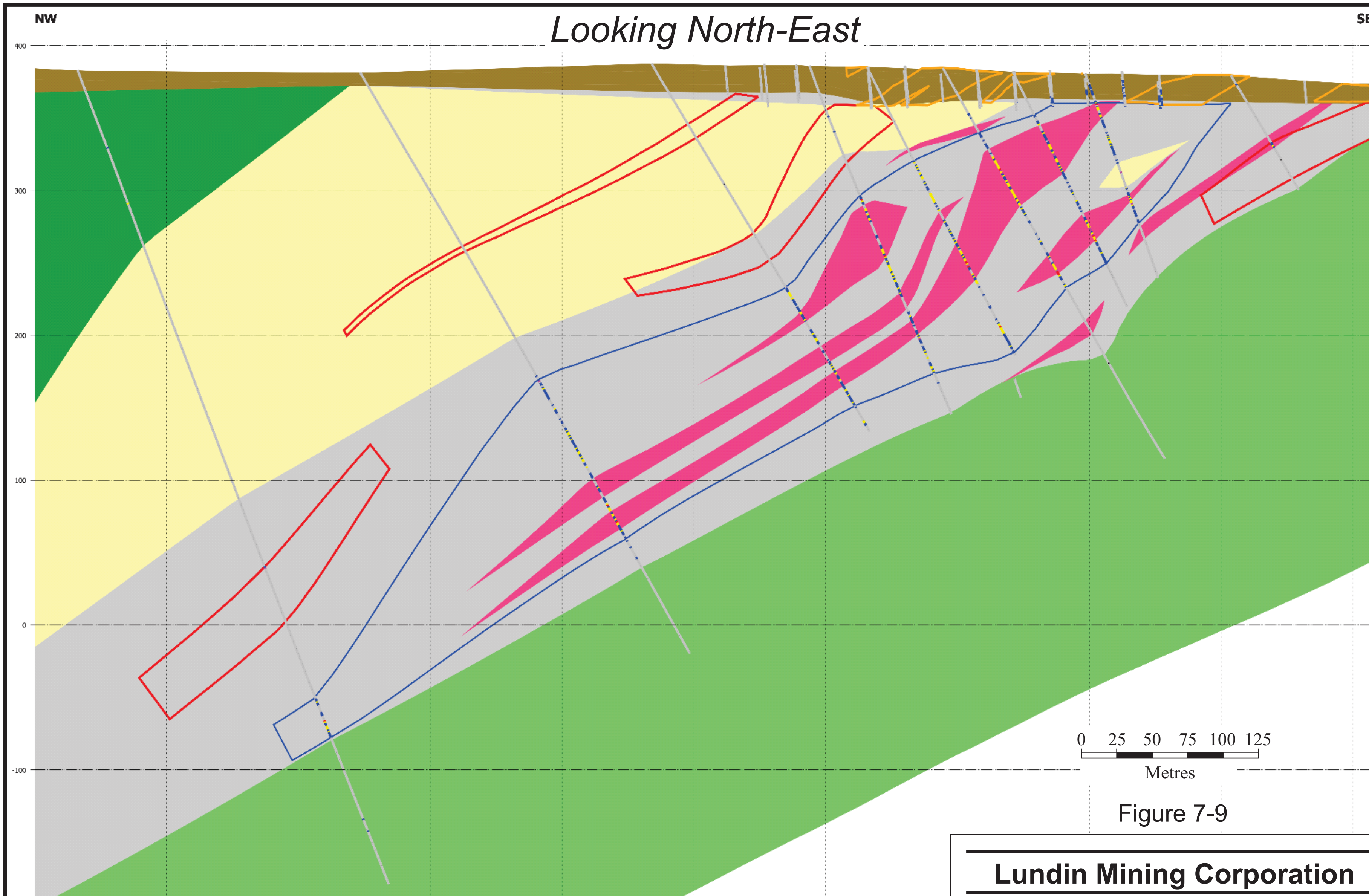
The QDP domain comprises intrusions of porphyritic metadiorite composed of quartz, biotite, and plagioclase. The plagioclase phenocrysts have been replaced by a mass of muscovite, epidote, and carbonate.

The porphyritic metadiorite ranges from five metres to 10 m in thickness and generally displays hydrothermal alteration represented by disseminated epidote. Locally, porphyritic metadiorite intrusions host copper gold mineralization with disseminated chalcopyrite and pyrite. The QDP domain is interpreted as deformed porphyry stock, which may be related with the same intrusion event as Chapada.

AQS DOMAIN

The AQS domain is similar to the MTS domain, where it is found as an interlayering between lithotypes with metasedimentary protoliths (e.g., garnet-biotite-quartz schist and garnet-amphibole-quartz schist) and metavolcanic protolith (e.g., biotite-quartz schist).

This domain hosts discontinuous gold only mineralized zones, associated with weakly altered intervals showing epidosite and garnet-amphibole episosite veins normally a few centimetres thick. Figure 7-9 shows a cross-section of Suruca SW with the five domains defined for the Suruca deposit.



Suruca Deposit's Orebodies
- Suruca SW orebody (>0.1%)
- Suruca Sulfide orebody (>0.1 g/t)
- Suruca Oxide orebody (>0.18 g/t)

Lithologic Domains (Geological Model)
- Weathering Mantle
- ANF
- MTS
- MVI
- QDP
- AQS

Copper Grades (Drilling)
- < 0.1%
- < 0.2%
- < 0.4%
- <0.5%
- >0.5%

October 2019

Source: Lundin, 2019.

Figure 7-9

Lundin Mining Corporation

Chapada Mine
Goiás State, Brazil

Suruca Deposit Domains

MINERALIZATION

CHAPADA

Copper is principally present as chalcopyrite with minor amounts of bornite. Fine grained gold is closely associated with the sulphide mineralization and was likely to be contemporaneous with the copper.

The mineralization at the Chapada deposit is represented predominantly by sulphide disseminations along foliation plans (or axial surfaces of folds) and, to a lesser extent, in small massive concentrations in the hinges of folds. In general, the ore is formed predominantly by chalcopyrite, pyrite and magnetite, where chalcopyrite-magnetite (magnetite rich ore) and chalcopyrite-pyrite (pyrite rich ore) are the prevailing associations, in which pyrite is the most abundant mineral, magnetite (including hematite, ilmenite and rutile) is subordinate, and galena, bornite, sphalerite, and molybdenite are rarely reported.

The copper mineralization and grade are somewhat better in the central zone of the deposit along the anticline axis than in the surrounding anticlinal limbs, however, copper mineralization is pervasive over a broad area.

SURUCA

The gold at Suruca is related to folded quartz veins/veinlets with sericitic and biotite alteration, rather than high sulphide concentrations. The second generation quartz veins/veinlets with sulphides (sphalerite + galena + pyrite), carbonates, and epidote also host gold which is related to zinc. The copper mineralization in the Suruca SW displays same features as Chapada, with sulphide disseminations and sulphides associated with stockwork quartz veinlets. In general, Suruca SW mineralization is formed predominantly by chalcopyrite and pyrite, with subordinate sphalerite and molybdenite.

Mineralization predominately pre-dates deformation so the gold (Suruca) and copper-gold (Suruca SW) zones are associated with skarn features, however, some structurally controlled features are also observed.

8 DEPOSIT TYPES

Several genetic models have been suggested for Chapada, including: (i) a deformed and metamorphosed porphyry-type copper-gold deposit (Richardson et al., 1986; Oliveira et al., 2015), (ii) a deformed and metamorphosed volcanogenic disseminated sulphide deposit (Silva and Sá, 1986; Kuyumjian, 1989), and (iii) epithermal copper-gold deposit overprinted by metamorphic remobilization (Kuyumjian, 2000).

Currently, the most accepted metallogenetic model for Chapada is a metamorphosed porphyry model associated with skarn system. The magmatic hydrothermal system was generated in island arc stage setting (approximately 884 Ma to 879 Ma) and posteriorly overprinted by remobilization of orogenic fluids during Brasiliano events (ca. 630 Ma). This model is based on the works of Sillitoe (2008), Espada (2010), Sillitoe (2014), and Oliveira et al. (2015). The deposit types in Chapada were separated into distinctive mineralization styles (Figure 8-1).

The porphyry, skarn, and epithermal system can be separated into three distinct mineralization styles, based on hydrothermal alteration and metal association:

- Copper-Gold Porphyry System (Chapada Corpo Principal, Corpo Sul, and Sucupira);
- Gold (Silver-Lead-Zinc) Distal Skarn (Suruca);
- Copper-Gold Proximal Skarn (Suruca SW).

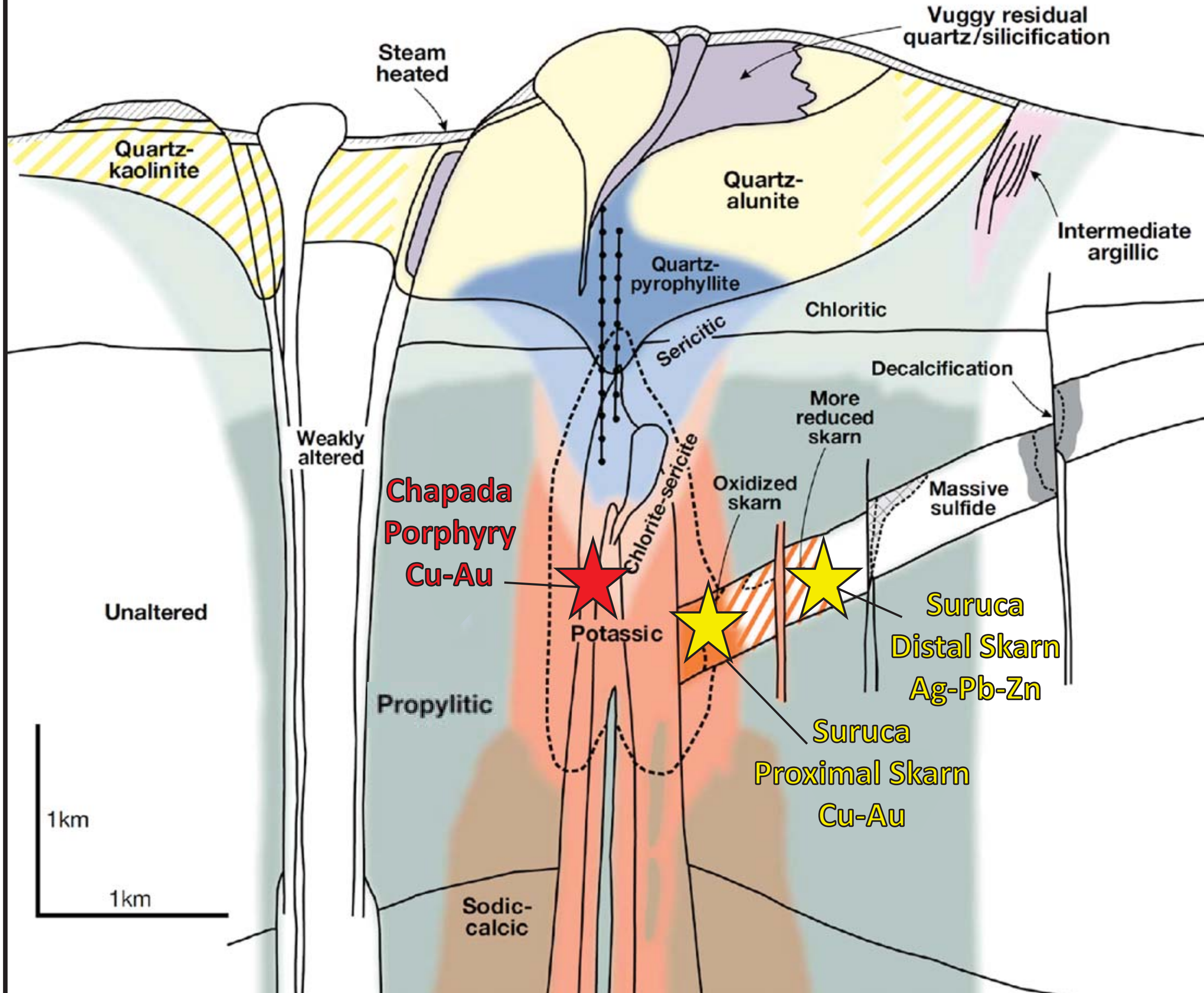


Figure 8-1

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Schematic of Chapada Mineralization System

October 2019

Source: Modified from Sillitoe, 2010.

COPPER-GOLD PORPHYRY SYSTEM – CHAPADA

The Chapada copper-gold porphyry deposit is a typical porphyry system prior to extensive modification during the D_{n-1} and D_n deformation event. The characteristics of the copper-gold porphyry mineralization are:

- Association of copper, gold, and molybdenum.
- Transposed remnants of A-type quartz, D-type sericite-bordered pyrite and anhydrite veinlets are recognizable in the biotite-rich gneiss and schist, which is interpreted as a former zone of biotitic alteration.
- The highest copper and gold values are found in biotite-rich metamorphic rocks containing disseminated chalcopyrite and magnetite, but little pyrite (a typical situation in porphyry copper-gold deposits).
- The hydrothermal alteration of potassic (biotite), sericitic, propylitic, and argillic fit with the alteration of younger copper-gold system.

The biotite-plagioclase gneiss (GNS) biotite schist (BFS) hosts most of the copper-gold mineralization and, with the lower grade mineralization, is believed to correspond to a standard biotitic alteration zone prior to the intense contractional deformation under amphibolite facies metamorphic conditions. Granular A-type quartz veinlets with magnetite and chalcopyrite characterize biotitic alteration zones and, notwithstanding the intense deformation, are still identifiable in the biotite rich gneiss and schist at Chapada.

The upper parts of biotite alteration zones are commonly overprinted by sericitic alteration, either as a stockwork of D-type veinlets or, in more pervasive form, as the transposed muscovite veinlets. The latter are thought to represent a D-type event, whereas the SQS in the southern part of the pit is considered as a former sericitic zone.

The quartz-muscovite-kyanite schist (SQKS) is a metamorphosed argillic alteration zone. The propylitic system is represented by the association of epidote + chlorite + carbonate in ANF and MVI rocks of the Mara Rosa Sequence.

SKARN SYSTEM – SURUCA

The Suruca deposit is host to gold-zinc mineralization associated with sericite-chlorite-epidote carbonate (- biotite) and the argillic to propylitic alteration which corresponds to a skarn system.

According to Sillitoe (2014), the Suruca metal concentrations marked by zinc (sphalerite), lead (galena), and gold associated to epidote/calcite and/or garnet/amphibole rich schists, point to a distal gold (Ag-Zn-Pb) skarn system. These epidote-calcite rich schists are interpreted as skarns, which were subjected to amphibolite and subsequent greenschist facies regional metamorphism. Also, the possible presence of deformed and metamorphosed diorite porphyry in the copper-gold zone suggests that Suruca may be related to a discrete porphyry centre represented by Suruca SW.

BRASILIANO OROGEN FLUIDS

The disseminated, low grade character of the mineralization at Chapada is relatively unusual for porphyry and epithermal deposits, which tend to occur more frequently as vein systems or breccia pipes. It is believed that the deformation, mainly D_n phase, was responsible for epigenetic hydrothermal processes, associated with the Rio dos Bois shear zone at the end of the Brazilian Orogeny, between 600 Ma and 560 Ma.

The epigenetic hydrothermal fluids are responsible for the remobilization of gold and base metals in both systems (Chapada and Suruca). Chapada is characterized by the transformation of magnetite-biotite gneiss to biotite schist (biotitization) and, in Suruca, the mineralization is disseminated in a propylitic halo that is not usually a skarn system. However, it is not clear if these epigenetic hydrothermal processes contributed new gold and copper metal to the Chapada and Suruca deposits.

9 EXPLORATION

CHAPADA

The following is taken, for the most part, from Rodriguez (2012). Pre-Yamana exploration is described in Section 6, History.

As there are few outcrops in the mine area due to the 30 m thick laterite-saprolite cover, exploration includes mostly drilling.

In 2007, nine diamond drill holes were completed totalling 1,924 m in the eastern portion of the Chapada deposit to confirm mineralization intersected in 1996 by the Santa Elina-Echo Bay joint venture and to test the east syncline area for volcanogenic massive sulphide mineralization.

In early 2008, in collaboration with Richard Sillitoe, a genetic model of mineralization was proposed with a typical porphyry copper-gold system (Cu-Au-Mo association), that underwent intense isoclinal folding and amphibolite facies metamorphism during continental collision at the end of the Neoproterozoic for the Chapada region. The new model considered that the original mineralogy may not have been profoundly changed, because of the stability of minerals such as quartz, anhydrite, pyrite, chalcopyrite, magnetite, and biotite under amphibolite facies conditions. The economic mineralization is structurally controlled by the axial zone of an asymmetric D2 anticlinal fold, due to the remobilization of chalcopyrite.

Sillitoe (2008) noted that porphyry copper-gold deposits worldwide have a strong tendency to occur in clusters, with as many as a dozen discrete centres being known in some districts (e.g., North Parkes, New South Wales, Australia). The marker for these deposits is a quartz-muscovite kyanite schist horizon which is believed to be a former advanced argillic lithocap.

The 2008 drill program was designed to discover another deposit in the vicinity of the Project and to test for possible extensions of known resources. To achieve these objectives, regional geological mapping and detailed geological mapping of the open pit were carried out, and geological model of the mine was prepared. Additionally, historic drill holes were re-logged, chip/soil samples were taken, and 5,530 m of diamond drilling was carried out in the vicinity of the Project.

During 2010, 16 holes were drilled in the southwest pit area and completed ten infill diamond drill holes in the northeast area. Samples from both the exploration and infill program were analyzed in a commercial and accredited laboratory. All the quality assurance/quality control (QA/QC) and the protocol applied during the previous drilling programs were carried out and followed by the exploration team.

In 2011, the drilling program continued in the southwest pit area consisting of 14,362 m in 63 holes. Total drilling for the 2011 campaign was 19,305 m.

In 2013, seven exploration holes were drilled for 1,704.09 m in the northeast section of Chapada Corpo Principal with the objective of delineating an Inferred Mineral Resource. Several historic JVE series holes were used to estimate the resource. In the same area, condemnation holes were drilled to sterilize the location of waste dumps in the northeastern portion of the main pit. In Corpo Sul, an infill drilling program was carried out in the southwest portion of the deposit on a 50 m by 50 m grid to upgrade Indicated Mineral Resources to Measured and on a 100 m by 100 m grid to convert Inferred Mineral Resources to Indicated.

In 2014, the exploration team restarted the generative exploration activities at Chapada working with a deformed/metamorphosed copper-gold porphyry/skarn model for the region. Consultant Richard Sillitoe assisted with the understanding of the regional geological model and district exploration strategy in early 2014. Based on this exploration information, the following work was completed: integration of previous drilling data, geological mapping with focus on hydrothermal halos, and sampling (soil, chip, and auger). As a result, in mid-2014, the MMIC claims were extended to cover the areas covered by soil and chip sampling. The main result in 2014 was the discovery of Sucupira target close to the main Chapada deposit. The Sucupira target displays similar mineralogical features to Chapada deposit (chalcopyrite, pyrite, -/+ bornite) but with higher gold grade and a Cu/Au ratio less than 1.

The discovery hole was NM-101 which intersected 172 m grading 0.46 g/t Au and 0.50% Cu, including 16.64 m grading 0.87 g/t Au and 0.98% Cu (1.41% CuEq) at 249 m; 9.0 m grading 0.87 g/t Au and 0.80% Cu (1.23% CuEq) at 275 m; 10.34 m grading 1.07 g/t Au and 0.98% Cu

(1.51% CuEq) at 307.66 m; 9.66 m grading 0.69 g/t Au and 0.68% Cu (1.07% CuEq); and 4.0 m grading 1.39 g/t Au and 1.02% Cu (1.72% CuEq) at 348.0 m. The total amount of soil and chip sampling is summarized in Table 9-1, under Regional Targets.

In 2015, the mineralization in the Sucupira was delineated with a drill grid of 100 m by 50 m along a 1,700 m northeast-southwest strike length, 260 m width, and an average thickness of 110 m. The mineralization has an average vertical depth between 180 m and 240 m from surface. Several holes returned average grade above 0.7% CuEq, which is higher than the current reserve grade at Chapada.

In 2016, the Baru target was discovered. It comprises a large tonnage and low grade envelope of 0.1% Cu with a richer gold core. Typical Baru mineralization was intersected by drill hole NM-237: 82.6 m grading 0.12 g/t Au, 0.25% Cu at 114 m; and 30 m grading 0.2 g/t Au, 0.35% Cu at 150 m.

In 2017, no significant exploration work was done near the Chapada deposit.

In 2018, the Baru NE target was discovered very close to the Chapada plant facilities as the extension of Baru mineralization. It comprises a low tonnage and high grade envelope of 0.3% Cu. Typical Baru NE mineralization was intersected by drill hole NM-288: 60.77 m grading 0.23 g/t Au, 0.57% Cu at 60 m; and 23 m grading 0.5 g/t Au, 1.21% Cu at 93 m. Baru NE was delineated with a drill grid of 100 m by 50 m along a 900 m northeast-southwest strike length, 150 m width, and an average thickness of 50 m.

Additionally, in 2018, the Santa Cruz mineralization was outlined in the south extension of Corpo Sul. It comprises a high tonnage mineralization with an envelope of 0.2% Cu. Typical Santa Cruz mineralization was intersected by drill hole SC-24: 45.48 m grading 0.15 g/t Au, 0.39% Cu at 60 m; 9.66 m grading 0.31 g/t Au, 065% Cu at 93 m; and 0.15 g/t Au, 0.39% Cu at 126.52 m. Santa Cruz was delineated with a drill grid of 200 m by 100 m along a 950 m northeast-southwest strike length, 350 m width, and an average thickness of 130 m.

Up to June 30, 2019, exploration drilling was focused on the Corpo Sul extension target, which comprises a potential resource between the Santa Cruz and Corpo Sul with high tonnage mineralization in an envelope of 0.3% Cu. Typical mineralization was intersected by drill hole

CS-498 with 74.44 m grading 0.14 g/t Au; 0.34% Cu grading 238.47 m, including 18 m grading 0.19 g/t Au; and 0.43% Cu grading 248 m. This drilling at Corpo Sul Extension established Inferred Mineral Resources; as well, the continuity of the deposit and the grade of the copper envelope has been confirmed.

Also, in the first half of 2019, two drill holes were executed in the southwest extension of Sucupira, where a mineralized layer was intercepted with typical hydrothermal biotitic and sericitic alteration containing disseminated chalcopyrite. The typical mineralization intersected by NM-359 returned 0.09 g/t Au at 75 m; 0.22% Cu at 350 m, including 42.35 m grading 0.11 g/t Au and 0.26% Cu at 371.65 m.

SURUCA

The pre-1997 exploration is described in Section 6, History.

Exploration work at Suruca began in 2008 with geological mapping, chip sampling, and shallow drilling at Suruca South. The exploration work was based on the new exploration model which focused on the discovery of hydrothermal halos and structures. In 2009, the exploration claims were renewed to carry out geophysical surveys (induced polarization and magnetics) and drilling. The 2009 drilling program tested a magnetic anomaly and the area of the garimpeiro workings. Positive results were achieved. The 2010 drilling program focused on delineation of the Suruca deposit at 400 m by 200 m spacing followed by infill drilling at 200 m by 200 m spacing. An infill program of 100 m by 100 m spacing was completed in the north portion of deposit.

From 2011 to 2015, no significant exploration was carried out at Suruca.

In 2016, an extensive drill program was completed to upgrade Indicated Mineral Resources (100 m x 50 m) to Measured Mineral Resources (35 m x 35 m) at Suruca. This infill drilling was focused at the oxide mineralization.

The Suruca SW mineralization was discovered in 2017 exhibiting similar geological features to the Chapada deposit. The mineralization was delineated along a 2.1 km strike, 650 m width, and average depth of 50 m, and was partially exposed on surface. The resources of Suruca

SW were converted to Indicated Mineral Resources with a 100 m x 100 m drill grid. Typical Suruca SW mineralization was intercepted in drill hole SU-943: 21.93 m grading 0.27 g/t Au and 0.26% Cu at 55.05 m; and 16.66 m grading 0.44 g/t Au and 0.40% Cu at 114.38 m.

In 2018, a drill campaign was performed to extend the sulphide mineralization on strike and down-dip. Typical Suruca extension sulphide mineralization was intercepted in drill hole SU-1018: 66.00 m grading 0.90 g/t Au at 238.0 m; and 19.33 m grading 2.18 g/t Au at 261.52 m. Additionally, an extensive delineation drilling program was carried out throughout 2018 to convert the remaining sulphide Inferred Mineral Resource to Indicated.

In the first half of 2019, 33 exploratory drill holes were completed. These holes were designed to extend the gold mineralization in the outcropping oxide layer. The best intersection was five metres grading 0.39 g/t Au at six metres in SU-1061, located in the north extension of the gold deposit.

REGIONAL TARGETS

In 2014, the exploration team restarted the district exploration activities at Chapada working with a deformed/metamorphosed copper-gold porphyry/skarn model for the region. Consultant Richard Sillitoe assisted with the understanding of the regional geological model and district exploration strategy in early 2014. Several chip and soil sampling were done in 2014. Additionally, a systematic geological mapping has been started in this period. As result of integration of this data, several targets were identified in the Chapada region, as summarized in Table 9-1.

TABLE 9-1 SOIL AND CHIP SAMPLING
Lundin Mining Corporation – Chapada Mine

Year	Soil Samples	Chip Samples	Target Zones
2014	1,171	172	Curica, Formiga, Bom Jesus
2015	3,112	49	Bandeira, Bom Jesus, Caraiba, Formiga, Taquarucu
2016	8,626	1,602	Amarolandia, Bom Jesus, Caraiba, Formiga, Formiga Sul, Pedra Preta, Siriema, Suruca NE, Taquarucu
2017	10,015	1,766	Agua Branca, Buriti, Jacutinga, Curicaca, Formiga, Guara, Santa Cruz W, Suruca NE
Total	**22,924**	**3,589**	

In 2015, the exploration team identified the Formiga target based on positive chip sampling and regional mapping. The first drill holes at Formiga intercepted typical skarn alteration comprising hydrothermal assemblage of garnet-epidote-amphibole-diopside in metasedimentary rocks.

Soil sampling in 2016 in the Chapada region identified several targets (Table 9-1). Also, in 2016 at Formiga, disseminated copper-gold mineralization was identified in metadiorite with hydrothermal alteration similar to Chapada.

In 2017, ten exploration targets were drilled with the objective of delineating new potential. Additionally, the Buriti target was discovered three kilometres south of the Chapada main pit. The Buriti target comprises copper-gold sulphide mineralization in a 2.0 km long copper geochemical anomaly. The Buriti hydrothermal alteration is similar to Chapada with a flat geometry close to surface, gently plunging to northwest. Inferred Mineral Resources were delineated with a 500 m northeast-southwest strike length, a width of 50 m, and a 150 m depth.

In 2018 and to the end of June 2019, no significant regional exploration work was completed in the Chapada area.

Following the acquisition of Chapada by Lundin, an exploration targeting review was undertaken and it is anticipated that there will be a significant increase in exploration expenditures in the next three years, largely focused on near mine targets. A Mineral Inventory Range Analysis study will be completed in the fourth quarter 2019. Expected expenditures in 2020 will be approximately $10 million. The 2020 program will focus on exploration drilling, geophysics, and a regional structural geology study.

10 DRILLING

CHAPADA

Drilling at the Chapada deposit commenced in 2008. To June 30, 2019, 2,425 holes have been drilled for 346,701 m (Tables 10-1, 10-2, and 10-4 and Figure 10-1) at Chapada and Suruca. Drilling has delineated the main deposits at a spacing of 100 m by 50 m, with a tighter 50 m pattern in the central portion of the deposits. Some typical drill hole vertical sections are shown in Section 14, Mineral Resources.

TABLE 10-1 CHAPADA DRILL HOLES
Lundin Mining Corporation – Chapada Mine

Year	# Drill Holes	Total Depth (m)
1976 - 1996	435	59,956
1996	4	383
2001	4	1,089
2007	8	1,337
2008	30	5,126
2009	8	3,217
2010	18	4,373
2011	87	20,470
2012	155	33,789
2013	112	21,994
2014	60	15,792
2015	122	35,970
2016	73	18,703
2017	31	7,055
2018	68	15,678
To June 30, 2019	53	12,555
Total	**1,268**	**257,487**

The 2008 and 2009 drilling campaigns were concentrated in the region named “Near Mine” and on the south portion of the area. The 2010 and 2011 campaigns targeted the Near Mine and Corpo Sul areas.

The drill holes were collared at HW diameter, reduced to HQ (63.5 mm) core diameter at the top of the saprolite, and changed to NQ2 (50.6 mm) core diameter when fresh rock was encountered. The drill rods were three metres long.

The majority of holes were drilled at an azimuth of 130° and an 85° dip. Drill holes with inclination between 45° and 85° were surveyed every three metres downhole using Devico DeviFlex electronic surveying instrument. No significant deviation issues were found to date.

Collar surveys were taken by a Total Station global positioning system (GPS) in UTM co-ordinates, SAD 69 Brazil datum, 22 South Zone.

SURUCA

One hundred and twenty drill holes totalling 4,050 m were drilled at Suruca by previous owners however, the database only contains details of the 1997 Santa Elina/Echo Bay holes with minimal data regarding the WMC reverse circulation (RC) drill holes.

TABLE 10-2 HISTORICAL SURUCA DRILL HOLES
Lundin Mining Corporation – Chapada Mine

Company	No. Holes	Metres (m)
INCO/Eluma	4	649.3
EDEN/COMINCO	7	623.6
WMC	91	2,241.0
Santa Elina/Echo Bay	18	536.4
Total	**120**	**4,050.3**

The majority of the historical holes were drilled within the saprolite which was characterized by low grade zones (0.1 g/t Au to 0.5 g/t Au), with occasional high grade intersections ranging between 0.5 g/t Au and 6.0 g/t Au.

The drilling in the Suruca area commenced in 2008 with seven holes for 440 m. Table 10-3 summarizes the best intersections.

TABLE 10-3 SURUCA DRILL INTERCEPTS OF INTEREST
Lundin Mining Corporation – Chapada Mine

Hole ID	Depth (m)	Interval (m)	Grade (g/t Au)
SU-11	112.0	81.0	1.22
	203.0	28.0	1.20
SU-13	7.0	6.0	1.35
	83.6	55.4	0.41
SU-15	52.5	74.7	0.87
	140.3	39.7	0.37
	203.0	30.0	0.55
	248.0	20.0	0.35

The 2009 and 2010 drill programs used a 400 m by 200 m grid, with infill drilling at 200 m by 200 m. They extended the geometry of the deposit to a known strike length to 2,100 m, a width of 1,000 m, and 500 m depth. An infill grid of 100 m by 100 m was drilled in the northern portion of the deposit (between lines L500S and L1500S).

To the end of June 2019, 1,037 holes were drilled for 85,164 m at Suruca.

TABLE 10-4 SURUCA DRILL HOLES
Lundin Mining Corporation – Chapada Mine

Year	# Drill Holes	Total Depth (m)
2008	7	440
2009	21	7,420
2010*	120	24,368
2011	48	9,607
2013	63	4,359
2014	3	938
2016	497	15,943
2017	225	13,691
2018	35	7,862
To June 2019	0	-
Total	**1,019**	**84,628**

Note:
1. *Includes 11 metallurgical holes for 1,014 m

The drill holes were collared at HW diameter, reduced to HQ diameter at the top of the saprolite and changed to NQ when fresh rock was encountered. The drill rods were three metres long and the wireline core drilling method was employed.

The majority of holes were drilled at an azimuth of 130° and a 60° dip, however, some holes were drilled at an azimuth of 310°. Downhole surveys were taken by the drilling contractor upon completion of the drill hole. Drill holes with inclinations between 45° and 85° were surveyed every three metres downhole using a Reflex Maxibor II or Devico DeviFlex electronic surveying instrument. In sub-vertical holes, a PeeWee or EZ-Shot instrument were used. Generally, the deviation was below 5% and no significant deviation issues were found to date.

Collar surveys were taken by a Total Station GPS in UTM co-ordinates, SAD 69 Brazil datum, 22 South Zone.

Drill hole collars were cased and protected at surface with a cement block affixed with a metal tag stamped with the drill hole number, final depth, inclination, azimuth, and start and finish dates.

REGIONAL TARGETS

Drilling in the regional targets commenced in 2014 with 31 holes totalling 5,458 m. The 2014 and 2017 drill programs used a wide-spaced grid in order to test several targets
To the end of 2017, 230 holes had been drilled for 32,736 m in regional targets (Table 10-5 and Figure 10-1). No regional drilling was completed in 2018 or 2019.

TABLE 10-5 REGIONAL DRILL HOLES
Lundin Mining Corporation – Chapada Mine

Year	No. Holes	Metres (m)	Main Targets
2014	31	5,458	Santa Cruz
2015	33	5,525	Formiga
2016	102	12,576	Formiga
2017	64	9,177	Buriti
Total	**230**	**32,736**	

The drill holes were collared at HW diameter, reduced to HQ diameter at the top of the saprolite, and changed to NQ when fresh rock was intercepted. The drill rods were three metres long and the wireline core drilling method was employed.

Drill holes with inclination between 45° and 85° were surveyed every three metres downhole using a Reflex Maxibor II or Devico DeviFlex electronic surveying instrument. In sub-vertical holes, a PeeWee or EZ-Shot instrument was used. Generally, the deviation was below 5% and no significant deviation issues were found to date.

Collar surveys were taken by a Total Station GPS in UTM co-ordinates, SAD 69 Brazil datum, 22 South Zone.

Drill hole collars were cased and protected at surface with a cement block affixed with a metal tag stamped with the drill hole number, final depth, inclination, azimuth, and start and finish dates.

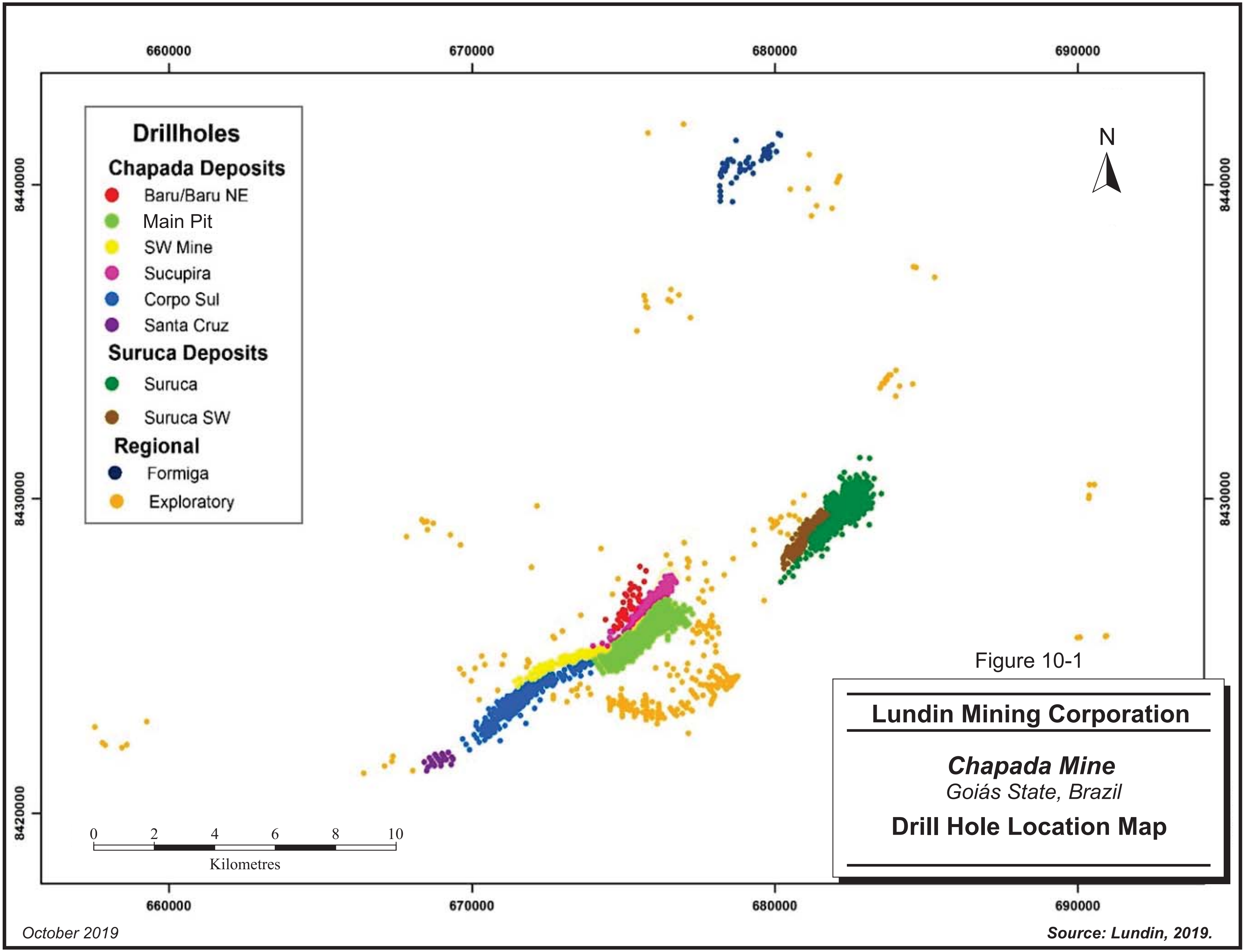


Figure 10-1

Lundin Mining Corporation

Chapada Mine
Goiás State, Brazil

Drill Hole Location Map

October 2019

Source: Lundin, 2019.

11 SAMPLE PREPARATION, ANALYSES, AND SECURITY

No details regarding historical sampling, analysis, and security are available. The following pertains to drilling performed during the period when Yamana owned MMIC up to the effective date of this report for the Chapada Mine (Chapada Corpo Principal, Sucupira, and Corpo Sul) and Suruca deposit.

Drill core was stored under an open sided roofed structure at the exploration camp. The core was stored in plastic core boxes with a nominal capacity of approximately four metres for NQ or NQ2 sized drill core and three metres for HQ or HW sized core. The boxes were labelled with drill hole number, project name, box number, and downhole depths on a plastic tag affixed to the box. Plastic downhole core depth markers were placed in the core box by the driller and labelled by pen marker with the depth, the length of the interval, and the length of the recovered sample.

Upon arrival of the core at the core logging facility, the hole was checked and marked for lithological contacts. Samples were marked down the entire length of the hole at one metre intervals, adjusted for lithological contacts. A red square marked on the box with a pen indicated the start and end of the sample interval, after the bar codes were placed in the core box next to the corresponding sample.

Samples were selected down the entire length of the drill hole core, sawn in half with an electric diamond bladed core saw and sampled prior to logging. Half core samples were selected by a geology technician or trained sampler. The samples were then placed in a numbered plastic bag along with a paper sample tag and tied closed with a piece of string. Sample weight was approximately 3.5 kg. Six to eight samples were placed in a larger plastic bag, loaded onto a truck owned and driven by a locally based transport company, and driven to the ALS Chemex laboratory sample preparation facility in Goiania, State of Goiás.

CORE LOGGING

After sampling, the geologist completed a graphic log and logs the core in detail for lithology, structure, mineralization, and alteration. Codes were assigned for the oxidation state, consistency, and alteration including alteration halo, sulphides, silicification, biotite, sericite, epidote, amphibolite, garnet, carbonate, rhodochrosite, chlorite, and kyanite content. Angles of structures such as foliation and faults were recorded, although drill holes were not oriented. Sample intervals and sample numbers were also recorded on the exploration hole log. When the drill hole was an infill hole, the core was quick logged, according to the alteration with fewer details, and no structural drawings.

Core sample recovery was not recorded by the geologist, although a record of the drill hole recovery on a run by run basis was recorded manually by the driller.

The logged information was collected using a handheld Tablet in digital files using Keep Logging v3.6 software (developed by the exploration team during 2018) for each hole. The recovery in the mineralized zones was generally very good, on average better than 95%.

BULK DENSITY

Approximately four samples from each alteration halo per drill hole were selected for density test work by three different methods after sampling and logging.

The first method used was the water displacement method, performed in the logging shed. This method uses half core samples from eight to twelve centimetres long, coated with Vaseline to prevent water impregnation, and placed in a plastic beaker containing 500 ml of water to determine the volume of water displacement. The density value is measured using the following formula:

Density = Weight of sample (g) / (Displaced water volume (ml) – Original water volume (ml))

The second method is the Archimedes water immersion method, and measurements were completed in the density room. This method uses samples of core 10 cm to 15 cm in length. Samples are waterproofed with paraffin (oxidized) or Vaseline (sulphide) and dried and subsequently submerged in deionized water, collecting each sample at the water temperature. The density value was measured using the following formula:

Density (g / cm³) = (weight of the dry sample (g) X Water Density defined by the temperature) / (weight of the dry sample (g) - Weight of sample inside water (g))

The third method, gravimetric, was used in the laboratory on pulverized samples. A prepared sample (three grams) was weighed into an empty pycnometer which was filled with methanol and weighed. From the weight of the sample and the weight of the methanol displaced by the sample, the specific gravity was calculated according to the formula below:

Specific Gravity = Weight of sample (g) / Weight of solvent displaced (g) x Specific gravity of solvent

Specific gravity was converted to density using the following formula:

Density = Specific Gravity x Density of water (at temperature t°C)

The factors utilized for converting specific gravity to density are presented in Table 11-1.

TABLE 11-1 SPECIFIC GRAVITY TO DENSITY CONVERSION FACTORS
Lundin Mining Corporation – Chapada Mine

Temperature (°C)	Density (g/cm^3)	Temperature (°C)	Density (g/cm^3)
19	0.9984	23	0.9975
20	0.9982	24	0.9973
21	0.9980	25	0.9970
22	0.9978	26	0.9968

The most recent density measurements were carried out using the Archimedes method. The sampling interval for density analysis was selected by the geology team according to lithology and type of mineralization, at one sample every 40 m in unmineralized material and two samples every ten metres in a mineralized zone.

The density tests were taken in fresh, mixed, and oxidized material, in all mineralized weathered zones, lithologies, and alteration halos. Density analyzes were carried out on 6,144 samples representing 9% of the total samples from Chapada. At Sucupira, a total of 2,517 density analyses were performed, representing approximately 2.5% of the total samples of the target and at Suruca, a total of 4,309 density determinations were performed, representing approximately 5% of the total samples from the deposit. Table 11-2 presents an example of the density data collected.

TABLE 11-2 DENSITY LOG DATABASE EXAMPLE
Lundin Mining Corporation – Chapada Mine

Sample ID	Target	Drill Hole	Interval (m)			Sample Point		Data				d_C
			From	To	Length	At	ID	$m_{C(g)}$	$m_{AP(g)}$	T_{water}°C	d_{LH_2O}	
001	SUCUPIRA	NM_162	178.24	178.37	0.13	178.24	214164	373.70	258.51	24	0.9973	3.2354
002	SUCUPIRA	NM_162	180.00	180.13	0.13	180.00	214168	320.49	206.99	24	0.9973	2.8161
003	SUCUPIRA	NM_162	182.95	183.08	0.13	182.95	214170	272.77	174.60	24	0.9973	2.7710
004	SUCUPIRA	NM_162	186.11	186.22	0.11	186.11	214173	211.43	130.94	24	0.9973	2.6197
005	SUCUPIRA	NM_162	188.00	188.12	0.12	188.00	214175	297.51	185.40	24	0.9973	2.6466
006	SUCUPIRA	NM_162	190.00	190.14	0.14	190.00	214177	318.27	201.40	24	0.9973	2.7159
007	SUCUPIRA	NM_162	192.15	192.28	0.13	192.15	214179	299.34	186.38	24	0.9973	2.6428
008	SUCUPIRA	NM_162	186.87	187.00	0.13	186.87	214173	331.44	219.59	24	0.9973	2.9553
009	SUCUPIRA	NM_162	211.63	211.74	0.11	211.63	214203	277.31	179.12	24	0.9973	2.8166
010	SUCUPIRA	NM_162	212.68	212.79	0.11	212.68	214204	259.53	164.72	24	0.9973	2.7300
011	SUCUPIRA	NM_162	215.00	215.14	0.14	215.00	214206	318.55	204.18	24	0.9973	2.7777
012	SUCUPIRA	NM_162	218.32	218.44	0.12	218.32	214212	285.84	187.19	24	0.9973	2.8897
013	SUCUPIRA	NM_162	219.54	219.65	0.11	219.54	214214	252.93	160.44	24	0.9973	2.7273
014	SUCUPIRA	NM_162	220.87	221.00	0.13	220.87	214215	321.09	206.00	24	0.9973	2.7824
015	SUCUPIRA	NM_162	222.02	222.16	0.14	222.02	214217	340.54	216.62	24	0.9973	2.7406
016	SUCUPIRA	NM_162	270.05	270.16	0.11	270.05	214276	254.67	161.66	24	0.9973	2.7307
017	SUCUPIRA	NM_162	270.61	270.74	0.13	270.61	214277	304.11	194.36	24	0.9973	2.7635
018	SUCUPIRA	NM_162	272.82	272.92	0.10	272.82	214279	206.60	128.66	24	0.9973	2.6436
019	SUCUPIRA	NM_162	273.88	274.00	0.12	273.88	214281	299.48	193.66	24	0.9973	2.8224
020	SUCUPIRA	NM_162	275.65	275.76	0.11	275.65	214283	256.21	160.05	24	0.9973	2.6572
021	SUCUPIRA	NM_162	278.56	278.68	0.12	278.56	214286	293.71	184.02	24	0.9973	2.6704
022	SUCUPIRA	NM_162	280.97	281.11	0.14	280.97	214288	288.69	184.81	24	0.9973	2.7716
023	SUCUPIRA	NM_162	310.73	310.87	0.14	310.73	214323	315.98	199.21	24	0.9973	2.6987
024	SUCUPIRA	NM_162	312.71	312.83	0.12	312.71	214325	291.53	187.72	24	0.9973	2.8007
025	SUCUPIRA	NM_162	314.87	314.98	0.11	314.87	214329	252.51	158.01	24	0.9973	2.6648
026	SUCUPIRA	NM_162	315.32	315.45	0.13	315.32	214330	314.62	198.48	24	0.9973	2.7017
027	SUCUPIRA	NM_162	323.31	323.43	0.12	323.31	214338	297.20	185.87	24	0.9973	2.6623
028	SUCUPIRA	NM_162	324.53	324.63	0.10	324.53	214339	243.95	153.11	24	0.9973	2.6782
029	SUCUPIRA	NM_165	211.73	211.88	0.15	211.73	215047	373.74	240.29	23	0.9976	2.7939
030	SUCUPIRA	NM_165	214.44	214.59	0.15	214.44	215050	369.91	242.96	23	0.9976	2.9068
031	SUCUPIRA	NM_165	215.68	215.83	0.15	215.68	215051	363.72	227.46	23	0.9976	2.6629

SAMPLE SECURITY

Samples were transported from the drill rig to the core storage facilities at the Chapada exploration camp by the drilling contractor, where the geological staff logged and sampled the core. The samples were transported to the independent sample preparation facility by a locally based transport company, after which the samples were sent for preparation in ALS Chemex in Goiania, Brazil, and for analysis in Lima, Peru

The analytical laboratory stored all pulps and coarse rejects for forty-five days and then transported them back to the Chapada Exploration Project where all samples were stored in the core storage facility for the life of the Project.

LABORATORY SAMPLE PREPARATION

Sample preparation was undertaken by ALS Chemex in Goiania and involved crushing and pulverization. Upon receipt of the samples, each sample was weighed and dried at 105°C for eight hours to 12 hours. The entire sample was then crushed to 90% passing <2 mm (10 mesh), split to 0.5 kg in a riffle splitter, and pulverized to 95% passing 150 mesh. The samples were then split again to 50 g using a rotating splitter/spatula. The crusher and pulverizer were cleaned between each sample. Each fraction retained was returned to site from which they were then sent to ALS Chemex Lima, Peru for analysis.

SAMPLE ANALYSIS

All samples were analyzed by fire assay (gold) or four acid digestion (copper), both with an atomic absorption spectroscopy (AAS) finish by ALS Chemex Lima, Peru, accredited by the Standards Council of Canada ISO 17025:2005, and the secondary laboratory SGS GEOSOL, Vespasiano, Brazil accredited by ISO 9001:2008, both independent laboratories. The analysis protocols for ALS and SGS are summarized in Table 11-3.

TABLE 11-3 ANALYTICAL PROCEDURES
Lundin Mining Corporation – Chapada Mine

Laboratory	Code	Description	Instrument
ALS	Au-AA24	Fire assays, Cupellation, Atomic Absorption	Fire Assay/AAS
	Cu-AA61	Copper by Atomic Absorption	AAS
	ME-ICP41	35 Chemical Element Analysis	ICP-AES
SGS	FAA505	Fire Assay, Cupellation, Atomic Absorption	Fire Assay/AAS
	AAS40B	Copper by Atomic Absorption	AAS
	ICP14B	48 Chemical Element Analysis	ICP-OES

HISTORICAL SAMPLE ANALYSIS AND QA/QC

In 1996, Echo Bay became actively involved in the drilling and sampling program for the Project. Samples taken by Santa Elina in 1996 were subject to a rigorous QA/QC program; Geolab in Brazil was the primary assay laboratory and a large number of samples were sent to various laboratories in North America for check assays (Silva, 2011).

IMC Mining (IMC) was contracted to review the historical data. IMC's review included the following:

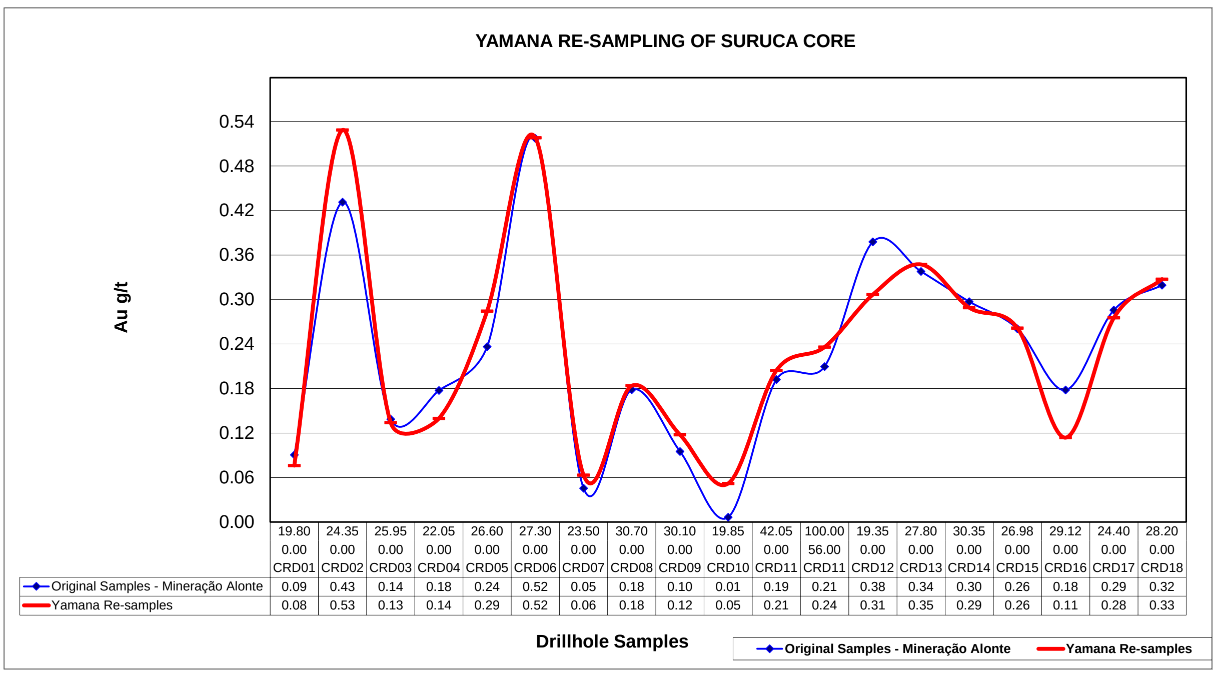
1. All historical QA/QC control files.
2. Comparison of historical data with re-assayed data from analytical laboratories in the US.

IMC concluded that the historical data was appropriate for estimation of Mineral Resources.

RE-SAMPLING OF SANTA ELINA CORE

A total of 18 Suruca diamond drill holes from Mineração Alonte (Santa Elina, 1995-1996, prefixed CDR) were re-analyzed following MMIC's procedures. The new assay results were compatible with the historical results.

FIGURE 11-1 RE-SAMPLING OF SURUCA CORE RESULTS



	19.80 0.00 CRD01	24.35 0.00 CRD02	25.95 0.00 CRD03	22.05 0.00 CRD04	26.60 0.00 CRD05	27.30 0.00 CRD06	23.50 0.00 CRD07	30.70 0.00 CRD08	30.10 0.00 CRD09	19.85 0.00 CRD10	42.05 0.00 CRD11	100.00 56.00 CRD11	19.35 0.00 CRD12	27.80 0.00 CRD13	30.35 0.00 CRD14	26.98 0.00 CRD15	29.12 0.00 CRD16	24.40 0.00 CRD17	28.20 0.00 CRD18
Original Samples - Mineração Alonte	0.09	0.43	0.14	0.18	0.24	0.52	0.05	0.18	0.10	0.01	0.19	0.21	0.38	0.34	0.30	0.26	0.18	0.29	0.32
Yamana Re-samples	0.08	0.53	0.13	0.14	0.29	0.52	0.06	0.18	0.12	0.05	0.21	0.24	0.31	0.35	0.29	0.26	0.11	0.28	0.33

QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance (QA) is necessary to demonstrate that the assay data has precision and accuracy within generally accepted limits for the sampling and analytical methods used.

Quality control (QC) consists of procedures used to ensure that an adequate level of quality is maintained in the process of sampling, preparing, and assaying the samples. In general, QA/QC programs are designed to prevent or detect contamination and allow analytical precision and accuracy to be quantified. In addition, a QA/QC program can disclose the overall sampling and assaying variability of the sampling method itself.

The assay performance of the primary laboratories used by MMIC was assessed by a review of results from the insertion of certified reference material (CRM) standards. The CRM is a sample of known value that is used to assess laboratory performance. A second type of CRM is employed to help identify any contamination issues that may occur at the preparation stage of the assay procedure. This barren CRM, or blank, is devoid of significant mineralization and is likewise inserted into the sample stream at a prescribed rate.

Assay precision is assessed by reprocessing duplicate samples from designated stages of the analytical process from the primary stage of sample splitting, through sample preparation stages of crushing/splitting, pulverizing/splitting, and assaying. Assay precision is also assessed using the CRM assay data by computing the mean and standard deviation (SD) of the assay dataset and comparing each individual assay against thresholds derived from these calculations.

An external (independent of the laboratory being assessed) industry-standard QA/QC program was conducted for the drill campaigns, which followed written protocols. The QA/QC program consisted of the insertion of blanks or sterile samples (non-certified blanks) and CRMs into the sample stream and the running of duplicate field (quarter-core) samples. Later, pulp duplicate samples were re-assayed at a secondary facility. Comments on the results are listed in the following sections.

JULY 2008 TO SEPTEMBER 2017 – SGS GEOSOL

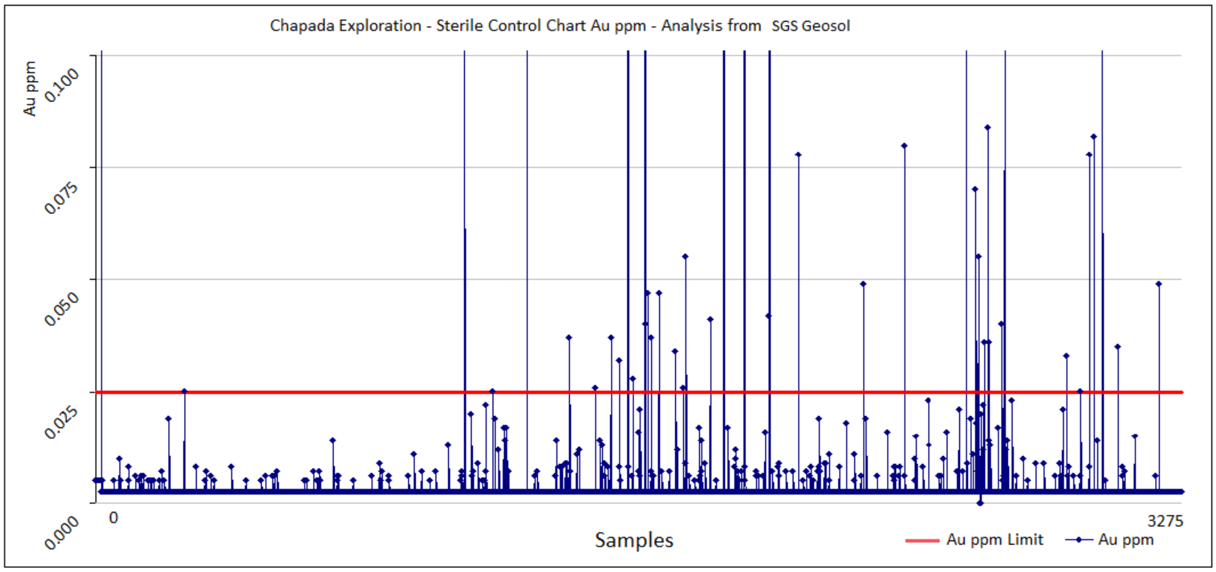
BLANKS

The protocol required the submission of one blank for every 30 samples submitted to the laboratory. A result greater than ten times the laboratory's lower detection limit (10DL) was considered to be out-of-specification (OOS) and a failure. A number of OOS results may indicate a potential cross-contamination issue between samples during the preparation phase of the assay procedure. The protocols considered a result of five times the DL (5DL) to be

OOS and if greater than five percent of the samples exceeded 5DL, the laboratory was notified. The procedures state a process investigation, re-assaying, and assay validation may be required to determine the cause of the failures.

An example of a plot used to evaluate assay performance through the insertion of blank material is illustrated in Figure 11-2.

FIGURE 11-2 GOLD BLANK CONTROL CHART



The plotted analyses were inspected and found 3,275 results by SGS Geosol with 39 results (1.2%) out of specifications for gold. For copper, there were 3,254 values reported by SGS Geosol and 23 (0.7%) were outside the acceptance limit. In RPA's opinion, the small number of failures shows acceptable levels of cross-contamination between samples.

STANDARDS

The protocol employed required the submission of three CRM standards for every 100 samples submitted to the laboratory. The CRMs from Geostats Pty Ltd. (Geostats), OREAS Ltd., and ITAK used in the 2007 to 2017 drill programs are listed in Tables 11-4 and 11-5 for gold and copper, respectively.

TABLE 11-4 2008 TO 2017 CERTIFIED REFERENCE MATERIALS FOR GOLD
Lundin Mining Corporation - Chapada Mine

Tabela Estatística Au ppm - SGS Geosol

Tipos de Padrão	Teor Certificado	Média de Resultados	Diferença Au ppm	Viés Médio	Mín zScore	Máx zScore	Total de Amostras	Falhas +/- 2SD	% Falhas +/- 2SD	Falhas +/- 3SD	% Falhas +/- 3SD
ITAK-814	0.1570	0.1360	-0.0210	-13.38%	-1.40	-1.40	1.000	0.00	0.00%	0.00	0.00%
G311-6	0.2200	0.2406	0.0206	9.37%	-1.40	39.30	24.000	0.00	0.00%	1.00	4.17%
OREAS 501b	0.2480	0.2410	-0.0070	-2.83%	-3.30	0.90	66.000	4.00	6.06%	1.00	1.52%
G303-8	0.2600	0.2468	-0.0132	-5.09%	-8.58	56.93	211.000	0.00	0.00%	3.00	1.42%
G311-3	0.2700	0.3381	0.0681	25.20%	-1.95	642.10	199.000	1.00	0.50%	7.00	3.52%
OREAS 521	0.3760	0.3593	-0.0167	-4.43%	-3.05	1.84	87.000	6.00	6.90%	1.00	1.15%
G912-5	0.3800	0.5529	0.1729	45.50%	-5.95	279.55	92.000	1.00	1.09%	6.00	6.52%
G310-4	0.4300	0.4149	-0.0151	-3.51%	-1.23	1.60	9.000	0.00	0.00%	0.00	0.00%
OREAS 502b	0.4950	0.4602	-0.0348	-7.04%	-4.60	0.93	46.000	13.00	28.26%	13.00	28.26%
G313-3	0.5100	0.2660	-0.2440	-47.84%	-8.13	-8.13	1.000	0.00	0.00%	1.00	100.00%
OREAS 522	0.5740	0.5323	-0.0417	-7.27%	-11.28	3.50	80.000	20.00	25.00%	27.00	33.75%
ITAK-819	0.7720	0.1150	-0.6570	-85.10%	-19.32	-19.32	1.000	0.00	0.00%	1.00	100.00%
G907-1	0.7900	0.8713	0.0813	10.29%	-10.76	14.42	26.000	0.00	0.00%	10.00	38.46%
G998-6	0.8000	0.8321	0.0321	4.01%	-8.95	99.92	291.000	5.00	1.72%	4.00	1.37%
G998-3	0.8100	0.8134	0.0034	0.42%	-0.74	1.72	23.000	0.00	0.00%	0.00	0.00%
G999-1	0.8200	0.8393	0.0193	2.35%	-13.42	89.58	275.000	5.00	1.82%	17.00	6.18%
OREAS 523	1.0400	0.9792	-0.0608	-5.84%	-7.15	-0.07	28.000	7.00	25.00%	7.00	25.00%
G911-10	1.3000	1.3301	0.0301	2.31%	-1.14	11.96	32.000	0.00	0.00%	1.00	3.13%
G901-2	1.7600	1.8690	0.1090	6.19%	0.78	0.78	1.000	0.00	0.00%	0.00	0.00%
G303-3	1.9300	1.6573	-0.2727	-14.13%	-18.42	1.44	9.000	0.00	0.00%	2.00	22.22%
G906-4	1.9300	1.8963	-0.0337	-1.75%	-19.20	1.50	138.000	2.00	1.45%	2.00	1.45%
G909-2	1.9400	1.9606	0.0206	1.06%	-14.44	48.81	150.000	3.00	2.00%	3.00	2.00%
G302-7	2.1400	0.0053	-2.1347	-99.75%	-23.75	-23.69	2.000	0.00	0.00%	2.00	100.00%
G397-6	3.9500	3.7136	-0.2364	-5.98%	-14.30	2.28	54.000	2.00	3.70%	8.00	14.81%
G398-10	4.0700	4.4297	0.3597	8.84%	-11.37	18.13	14.000	0.00	0.00%	4.00	28.57%
G910-5	5.2300	5.5895	0.3595	6.87%	-0.28	8.11	12.000	0.00	0.00%	1.00	8.33%
G308-4	6.7700	5.2855	-1.4845	-21.93%	-19.03	3.04	13.000	2.00	15.38%	5.00	38.46%
G907-8	6.7800	6.7806	0.0006	0.01%	-19.92	2.36	78.000	3.00	3.85%	2.00	2.56%
28				**4.02%**			**1963.00**	**74.00**	**3.77%**	**129.00**	**6.57%**

89.66% de Amostras Aprovadas

TABLE 11-5 2008 TO 2017 CERTIFIED REFERENCE MATERIALS FOR COPPER
Lundin Mining Corporation - Chapada Mine

Tabela Estatística Cu % - SGS Geosol

Tipos de Padrão	Teor Certificado	Média de Resultados	Diferença Cu %	Viés Médio	Mín zScore	Máx zScore	Total de Amostras	Falhas +/- 2SD	% Falhas +/- 2SD	Falhas +/- 3SD	% Falhas +/- 3SD
OREAS 501b	0.2600	0.2684	0.0084	3.22%	-0.97	1.83	66.000	0.00	0.00%	0.00	0.00%
GBM302-7	0.2671	0.2648	-0.0023	-0.86%	-0.47	0.19	5.000	0.00	0.00%	0.00	0.00%
GBM995-2	0.2681	0.2819	0.0138	5.15%	-18.76	59.92	414.000	0.00	0.00%	16.00	3.86%
ITAK-815	0.2860	0.2870	0.0010	0.34%	-1.92	27.29	44.000	1.00	2.27%	1.00	2.27%
GBM301-9	0.2881	0.2708	-0.0173	-5.99%	-14.46	-0.14	239.000	0.00	0.00%	2.00	0.84%
GBM312-6	0.3705	0.3670	-0.0035	-0.96%	-18.87	47.29	245.000	1.00	0.41%	4.00	1.63%
GBM995-1	0.4155	0.4125	-0.0030	-0.72%	-13.68	1.45	241.000	0.00	0.00%	1.00	0.41%
GBM314-6	0.4290	0.4403	0.0113	2.63%	-3.46	2.28	64.000	3.00	4.69%	2.00	3.13%
ITAK-814	0.4500	0.4597	0.0097	2.15%	-20.18	4.52	23.000	7.00	30.43%	8.00	34.78%
GBM914-6	0.4700	0.4612	-0.0088	-1.87%	-10.59	1.45	28.000	0.00	0.00%	3.00	10.71%
OREAS 521	0.6070	0.6073	0.0003	0.05%	-1.51	1.74	86.000	0.00	0.00%	0.00	0.00%
OREAS 502b	0.7730	0.7705	-0.0025	-0.32%	-1.30	1.05	45.000	0.00	0.00%	0.00	0.00%
OREAS 522	0.9160	0.8954	-0.0206	-2.25%	-20.96	1.20	80.000	0.00	0.00%	1.00	1.25%
GBM300-5	1.0779	1.0649	-0.0130	-1.21%	-20.24	13.75	314.000	1.00	0.32%	11.00	3.50%
ITAK-819	1.0800	1.3669	0.2869	26.57%	-63.84	33.14	19.000	0.00	0.00%	17.00	89.47%
GBM302-9	1.2700	1.2067	-0.0633	-4.98%	-19.46	0.73	91.000	0.00	0.00%	6.00	6.59%
OREAS 523	1.7200	1.6856	-0.0344	-2.00%	-1.58	-0.25	28.000	0.00	0.00%	0.00	0.00%
17				**0.05%**			**2032.00**	**13.00**	**0.64%**	**72.00**	**3.54%**

95.82% de Amostras Aprovadas

The assay results were plotted for the 1,963 submissions for gold and the 2,032 submissions for copper on scatter plots and inspected the plots to evaluate the SGS Geosol's precision performance. The best recommended value (RBV) and standard deviation (SD) for each CRM were provided by Geostats. An individual test result was considered as OOS if it exceeded three times the SD (± 3SD) of the RBV. Two consecutive results greater than twice the SD (± SD) were also considered as failures. Only one OOS value was found for copper and one for gold in that data. It was noted that some of the standard shipments did not have sufficient mass for analysis. These were classified as NSS (not enough sample) and were not taken into account in this analysis. The remaining results plotted within an acceptable range of accuracy.

The assay results from the CRM analyses were also used to assess assay precision. The mean and SD values were calculated for each CRM from the collective assay results. The individual samples were then compared to these mean and SD values for each CRM. Any individual assay outside of 2SD from the mean of the collective assays was considered to be OOS. The results showed 74 accuracy faults of +/- 2SD and 129 faults of +/- 3SD for gold and 13 values of +/- 2SD and 72 values +/- 3SD for copper. Such precision failures do not adversely affect overall confidence in the assays but may indicate potential variability inherent in assay procedures or lack of homogeneity in CRM. Examples of accuracy and precision plots are given in Figure 11-3 and 11-4 respectively.

FIGURE 11-3 ACCURACY RESULTS FOR COPPER

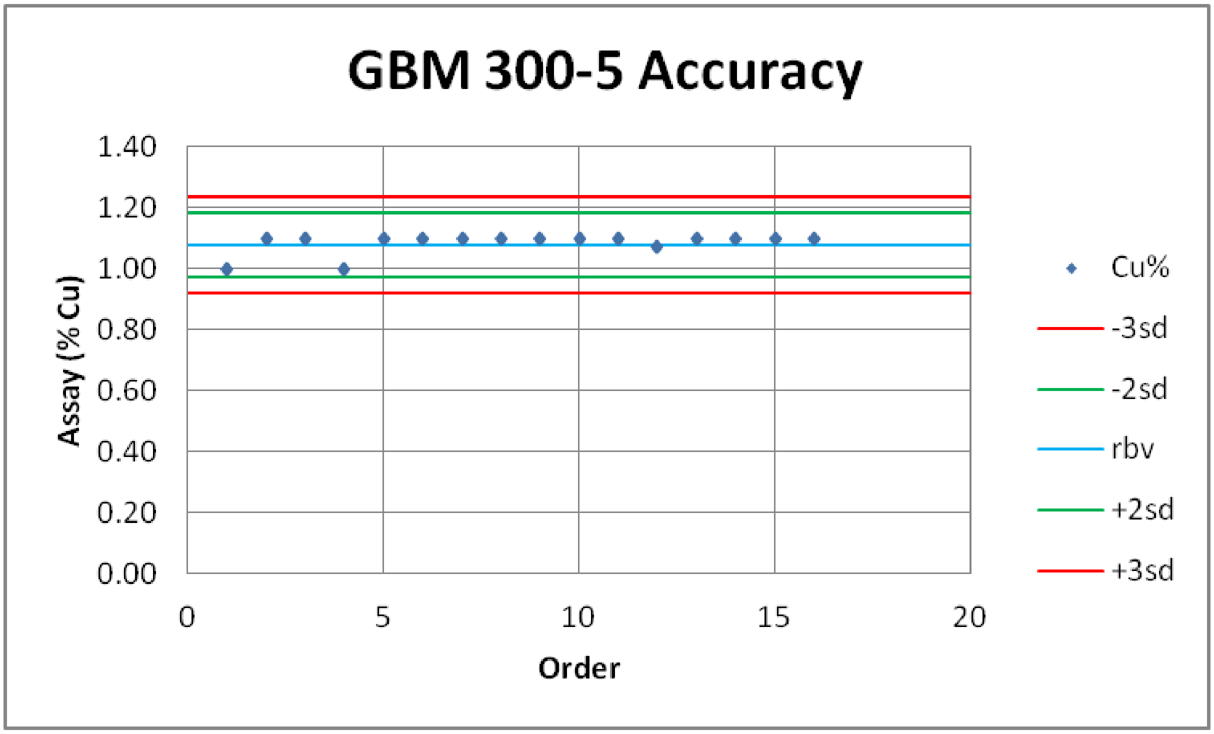
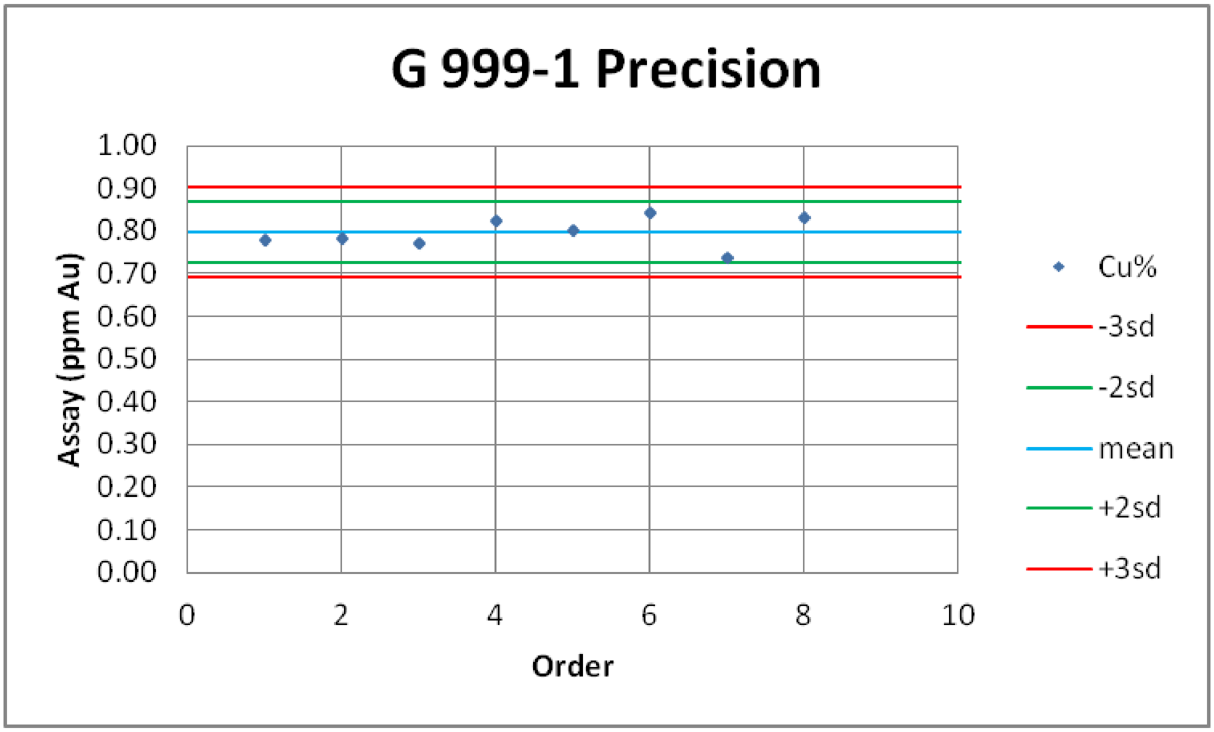


FIGURE 11-4 PRECISION RESULTS FOR GOLD



DUPLICATE ANALYSES

Routine analyses were performed on field duplicates, i.e., a second longitudinal split of the sample half-core to yield two quarter-core samples. The purpose of this is to measure the precision of the entire sampling and analysis procedure as well as providing a measure of the inherent variability and heterogeneity of the mineralized bodies (nugget effect). Field duplicates were taken once for each 20 samples (5% frequency). A total of 4,606 field duplicate analyses were completed for gold and 4,593, for copper. The statistical summaries of the original and duplicate analyses for gold and copper are shown in Tables 11-6 and 11-7 respectively.

TABLE 11-6 SUMMARY STATISTICS FOR ORIGINAL AND FIELD DUPLICATES ASSAY RESULTS FOR GOLD
Lundin Mining Corporation – Chapada Mine

	Original	Duplicate
Number of Samples	4,606	4,606
Mean (ppm Au)	0.0905	0.0899
Maximum Value (ppm Au)	3.35	3.21
Minimum Value (ppm Au)	0.0025	0.0025
Median (ppm Au)	0.0270	0.0270
Variance	0.0377	0.0358
Standard Deviation	0.1943	0.1892
Coefficient of Variation	2.15	2.10
Correlation Coefficient	0.9484	
Relative Standard Deviation	30.91%	
% Difference Between Means	-0.64%	

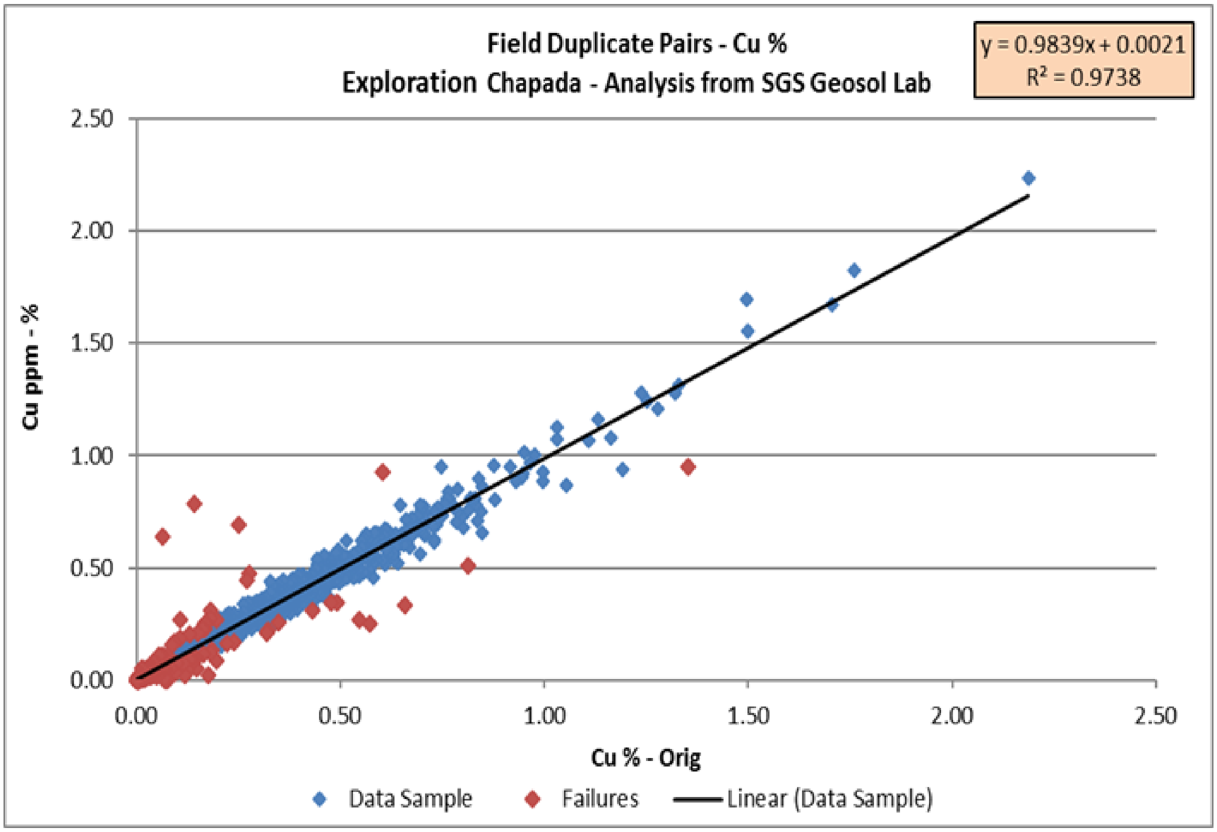
TABLE 11-7 SUMMARY STATISTICS FOR ORIGINAL AND FIELD DUPLICATES ASSAY RESULTS FOR COPPER
Lundin Mining Corporation – Chapada Mine

	Original	Duplicate
Number of Samples	4,593	4,593
Mean (%)	0.1301	0.1300
Maximum Value (%)	2.19	2.23
Minimum Value (%)	0.0004	0.004
Median (%)	0.0600	0.0596
Variance	0.0299	0.0298
Standard Deviation	0.1731	0.1725
Coefficient of Variation	1.33	1.33
Correlation Coefficient	0.9738	
Relative Standard Deviation	17.59%	
% Difference Between Means	-0.03%	

The original and field duplicate gold results were plotted on scatter diagrams and inspected for evidence of bias. The original and duplicate results showed good agreement and plotted within an acceptable range with a slight bias toward a higher grade in the original assay. The duplicate data were also plotted on a relative difference (Thompson-Howarth) plot and examined for evidence of grade bias. In RPA's opinion, there is no significant grade bias in the duplicate gold results.

The exercise was repeated for field duplicate assays analyzed for copper. Duplicates and original results showed good agreement and plotted within acceptable ranges. When plotted on Thompson-Howarth diagrams, no significant grade biases were observed. An example of a scatter plot used in the analysis are shown in Figure 11-5.

FIGURE 11-5 SCATTER PLOT - FIELD DUPLICATES ANALYZED FOR COPPER



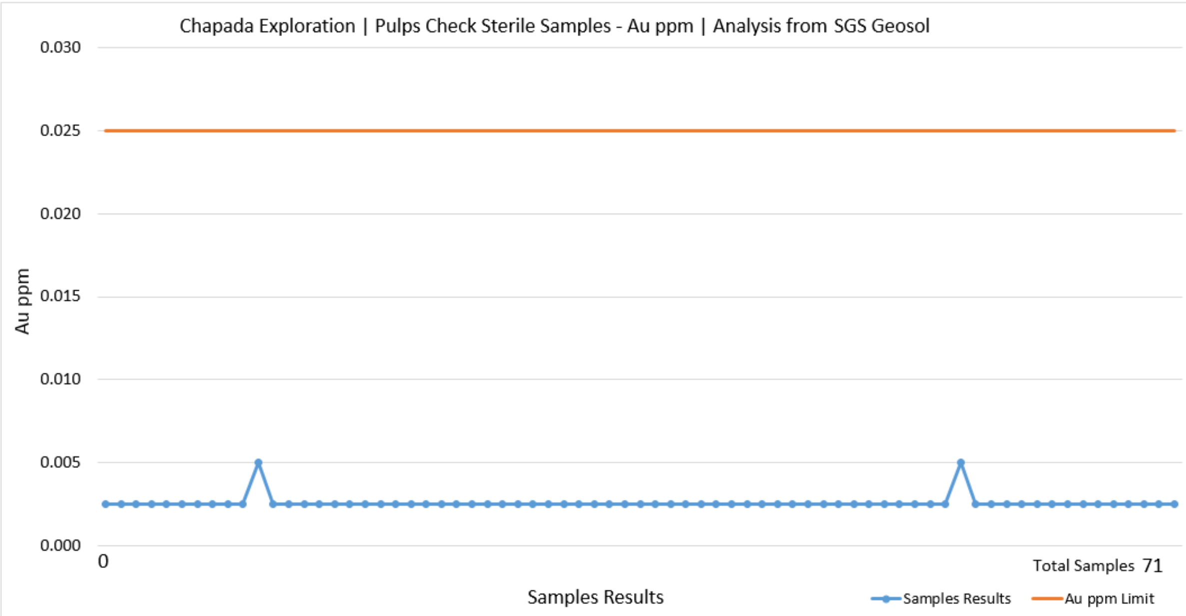
FEBRUARY TO DECEMBER 2018 – SGS GEOSOL

STERILE SAMPLES

The QA/QC protocol required the submission of one barren sterile sample for every 30 samples submitted to the laboratory. A result greater than ten times the laboratory's lower detection limit (10DL) was considered to be out-of-specification (OOS) and a failure. A number of OOS results may indicate a potential cross-contamination issue between samples during the preparation phase of the assay procedure. The protocols considered a result of five times the DL (5DL) to be OOS and if greater than five percent of the samples exceeded 5DL, the laboratory was notified. Procedures state a process investigation, re-assaying, and assay validation may be required to determine the cause of the failures.

An example of a plot used to evaluate assay performance through the insertion of sterile material is illustrated in Figure 11-6.

FIGURE 11-6 STERILE SAMPLES FOR GOLD (EXPLORATION PROGRAM)



The inspection of the plotted analyses for 2018 confirmed that out of 71 results by SGS Geosol no results out of specifications for gold could be found. For copper, there were 56 values reported by SGS Geosol and two (3.6%) were outside the acceptance limit. In RPA's opinion, the small number of failures shows acceptable levels of cross-contamination between samples.

STANDARDS

The QA/QC protocol required the submission of three CRM standards for every 100 samples submitted to the laboratory. Ore Research and Exploration Ltd (OREAS) CRMs used in the 2018 exploration drill programs are listed in Tables 11-8 and 11-9 for gold and copper, respectively.

TABLE 11-8 2018 CERTIFIED REFERENCE MATERIALS FOR GOLD
Lundin Mining Corporation - Chapada Mine

CRM	RR Value (Mean ppm)	Lab Value (Mean ppm)	Diff.	n	≥2SD//<3SD Out of Range	≥2SD//<3SD % Out of Range	≥3SD Out of Range	≥3SD % Out of Range
OREAS 501C	0.2210	0.2218	0.0008	16.00	0.00	0.00%	0.00	0.00%
OREAS 153B	0.3130	0.3081	-0.0049	7.00	0.00	0.00%	0.00	0.00%
OREAS 521	0.3760	0.3675	-0.0085	2.00	0.00	0.00%	0.00	0.00%
OREAS 502C	0.4880	0.4829	-0.0051	17.00	0.00	0.00%	0.00	0.00%
OREAS 503B	0.6950	0.6690	-0.0260	2.00	0.00	0.00%	0.00	0.00%
OREAS 503C	0.6980	0.6776	-0.0204	17.00	1.00	5.88%	0.00	0.00%
OREAS 523	1.0400	1.0860	0.0460	3.00	0.00	0.00%	0.00	0.00%
OREAS 621	1.2500	1.2243	-0.0257	3.00	0.00	0.00%	0.00	0.00%
OREAS 504B	1.6100	1.5675	-0.0425	2.00	0.00	0.00%	0.00	0.00%
			Total	69.00	1.00	1.45%	0.00	0.00%

TABLE 11-9 2018 CERTIFIED REFERENCE MATERIALS FOR COPPER
Lundin Mining Corporation - Chapada Mine

CRM	RR Value (Mean ppm)	Lab Value (Mean ppm)	Diff.	n	≥2SD//<3SD Out of Range	≥2SD//<3SD % Out of Range	≥3SD Out of Range	≥3SD % Out of Range
OREAS 501C	0.2760	0.2796	0.0036	12.00	0.00	0.00%	1.00	8.33%
OREAS 153B	0.3630	0.2996	-0.0634	1.00	0.00	0.00%	1.00	100.00%
OREAS 521	0.5310	0.5216	-0.0094	2.00	0.00	0.00%	0.00	0.00%
OREAS 502C	0.5380	0.5523	0.0143	15.00	0.00	0.00%	0.00	0.00%
OREAS 503B	0.6070	0.6087	0.0017	2.00	0.00	0.00%	0.00	0.00%
OREAS 503C	0.6780	0.6821	0.0041	5.00	1.00	20.00%	1.00	20.00%
OREAS 523	0.7830	0.7891	0.0061	12.00	0.00	0.00%	0.00	0.00%
OREAS 621	1.1100	1.0900	-0.0200	2.00	0.00	0.00%	0.00	0.00%
OREAS 504B	1.7200	1.6960	-0.0240	3.00	0.00	0.00%	0.00	0.00%
			Total	54.00	1.00	1.85%	3.00	5.56%

The assay results were plotted on scatter plots and inspected, for the 69 submissions for gold and the 54 submissions for copper, to evaluate the SGS Geosol's precision performance. The best recommended value (RBV) and standard deviation (SD) for each CRM were provided by OREAS. An individual test result was considered as OOS if it exceeds three times the SD (± 3SD) of the RBV. Two consecutive results greater than twice the SD (± SD) were also considered as failures. Only one OOS value for copper and none for gold was found in that data. The remaining results plotted within an acceptable range of accuracy.

INTERLABORATORY PULP DUPLICATE SAMPLES

A total of 3,436 exploration pulp samples were shipped from ALS Chemex and analyzed using similar assay procedures by SGS Geosol. The pulp duplicate copper and gold results were plotted on scatter diagrams (Figures 11-7 and 11-8) and inspected for evidence of bias. It was found that the duplicate results showed agreement and plotted within an acceptable range. In RPA's opinion, there is no significant grade bias in the duplicate gold results.

FIGURE 11-7 SCATTER PLOT - PULP DUPLICATES ANALYZED FOR COPPER

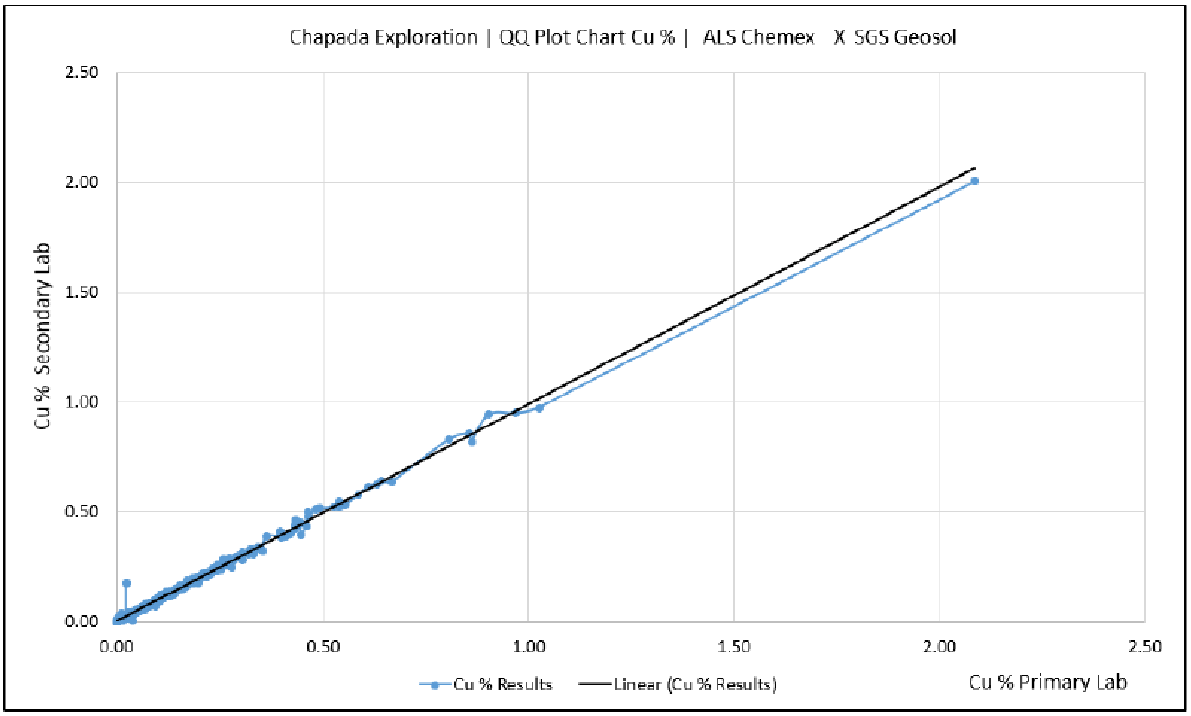
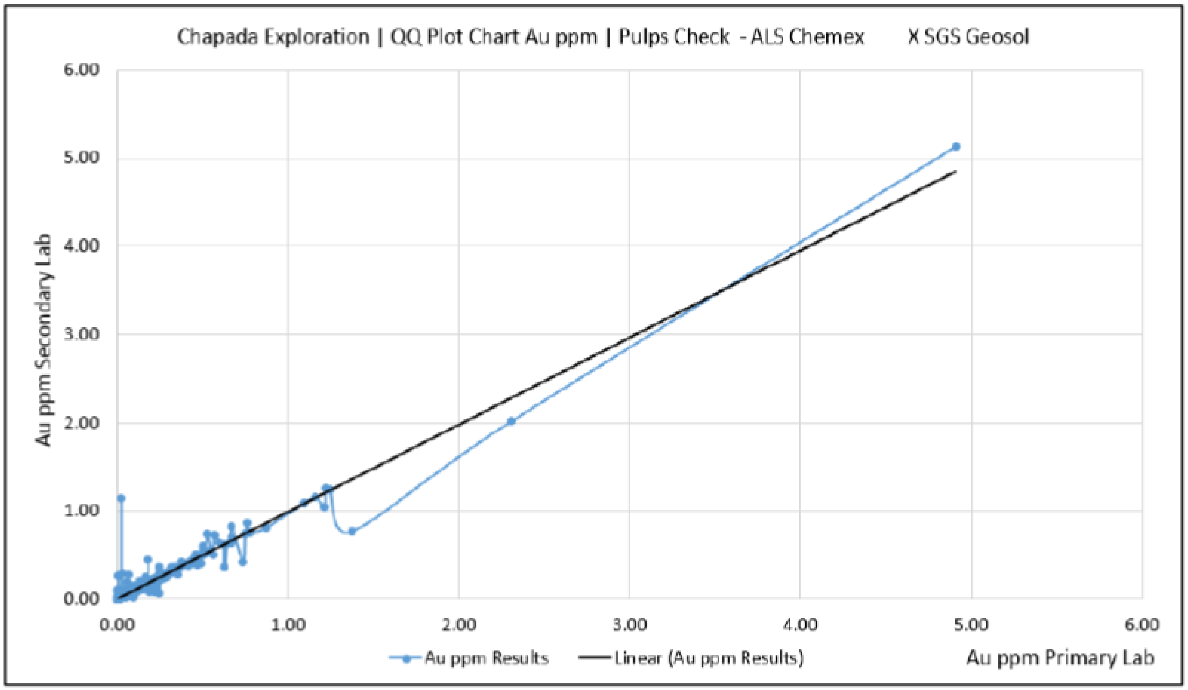


FIGURE 11-8 SCATTER PLOT - PULP DUPLICATES ANALYZED FOR GOLD



FEBRUARY 2009 TO AUGUST 2017 – ALS CHEMEX

BLANKS

Between 2009 and 2017, a total of 606 gold and 599 copper CRMs were sent to ALS Chemex (following the same protocol of three submissions per 100 samples). The inspection of the results found that nearly all samples plotted below the acceptable tolerance of 5DL for both gold and copper. A 2.6% failure rate for gold and 0.03% failure rate for copper were found.

STANDARDS

The CRMs used in the QA/QC program between 2009 and 2017 were purchased from Geostats and OREAS and are listed in Tables 11-10 and 11-11 for gold and copper, respectively. A total of 263 copper CRMs and 363 gold CRMs were submitted to Chemex ALS following the protocol of three CRMs per 100 samples.

TABLE 11-10 2009 TO 2017 CERTIFIED REFERENCE MATERIALS FOR GOLD
Lundin Mining Corporation - Chapada Mine

Tabela Estatística Au ppm - ALS Chemex

Tipos de Padrão	Teor Certificado	Média de Resultados	Diferença Au ppm	Viés Médio	Mín zScore	Máx zScore	Total de Amostras	Falhas +/- 2SD	% Falhas +/- 2SD	Falhas +/- 3SD	% Falhas +/- 3SD
OREAS 501c	0.2210	0.2213	0.0003	0.12%	-2.43	1.71	11.000	1.00	9.09%	0.00	0.00%
OREAS 501b	0.2480	0.2460	-0.0020	-0.81%	-0.20	-0.20	1.000	0.00	0.00%	0.00	0.00%
G303-8	0.2600	0.2468	-0.0132	-5.07%	-8.58	12.30	129.000	0.00	0.00%	2.00	1.55%
OREAS 521	0.3760	0.3720	-0.0040	-1.06%	-0.21	-0.21	1.000	0.00	0.00%	0.00	0.00%
OREAS 502c	0.4880	0.4708	-0.0172	-3.52%	-2.93	0.60	12.000	3.00	25.00%	0.00	0.00%
OREAS 522	0.5740	0.5625	-0.0115	-2.00%	-1.00	-0.28	2.000	0.00	0.00%	0.00	0.00%
OREAS 503b	0.6950	0.6691	-0.0259	-3.72%	-6.05	0.38	7.000	0.00	0.00%	1.00	14.29%
OREAS 503C	0.6980	0.6717	-0.0263	-3.76%	-4.47	-0.40	4.000	0.00	0.00%	1.00	25.00%
G998-6	0.8000	0.8063	0.0063	0.79%	-13.25	3.83	79.000	1.00	1.27%	2.00	2.53%
G999-1	0.8200	0.8023	-0.0177	-2.16%	-1.33	0.63	33.000	0.00	0.00%	0.00	0.00%
OREAS 523	1.0400	1.0450	0.0050	0.48%	-0.74	0.74	5.000	0.00	0.00%	0.00	0.00%
OREAS 504B	1.6100	1.5850	-0.0250	-1.55%	-2.25	0.37	4.000	1.00	25.00%	0.00	0.00%
G906-4	1.9300	1.9478	0.0178	0.92%	-0.75	1.20	16.000	0.00	0.00%	0.00	0.00%
G303-3	1.9300	1.9379	0.0079	0.41%	-2.67	1.33	39.000	1.00	2.56%	0.00	0.00%
G302-7	2.1400	0.4170	-1.7230	-80.51%	-19.16	-19.13	2.000	0.00	0.00%	2.00	100.00%
G397-6	3.9500	3.7654	-0.1846	-4.67%	-13.86	1.00	12.000	0.00	0.00%	1.00	8.33%
G907-8	6.7800	6.7550	-0.0250	-0.37%	-1.19	0.93	6.000	0.00	0.00%	0.00	0.00%
17				**-2.60%**			**363.00**	**7.00**	**1.93%**	**9.00**	**2.48%**

95.59% de Amostras Aprovadas

TABLE 11-11 2009 TO 2017 CERTIFIED REFERENCE MATERIALS FOR COPPER
Lundin Mining Corporation - Chapada Mine

Tabela Estatística Cu % - ALS Chemex

Tipos de Padrão	Teor Certificado	Média de Resultados	Diferença Cu %	Viés Médio	Mín zScore	Máx zScore	Total de Amostras	Falhas +/- 2SD	% Falhas +/- 2SD	Falhas +/- 3SD	% Falhas +/- 3SD
OREAS 501b	0.2600	0.2560	-0.0040	-1.54%	-0.36	-0.36	1.000	0.00	0.00%	0.00	0.00%
GBM302-7	0.2671	0.2690	0.0019	0.71%	-0.34	0.53	19.000	0.00	0.00%	0.00	0.00%
GBM995-2	0.2681	0.2695	0.0014	0.51%	-0.79	0.99	46.000	0.00	0.00%	0.00	0.00%
OREAS 501c	0.2760	0.2742	-0.0018	-0.66%	-1.62	1.50	11.000	0.00	0.00%	0.00	0.00%
GBM995-1	0.4155	0.4131	-0.0024	-0.58%	-1.46	1.06	94.000	0.00	0.00%	0.00	0.00%
OREAS 503b	0.5310	0.5327	0.0017	0.32%	-0.26	0.48	7.000	0.00	0.00%	0.00	0.00%
OREAS 503C	0.5380	0.5390	0.0010	0.19%	-0.80	1.07	4.000	0.00	0.00%	0.00	0.00%
OREAS 521	0.6070	0.5980	-0.0090	-1.48%	-0.60	-0.60	1.000	0.00	0.00%	0.00	0.00%
OREAS 502c	0.7830	0.7950	0.0120	1.53%	-1.45	2.05	12.000	1.00	8.33%	0.00	0.00%
OREAS 522	0.9160	0.8915	-0.0245	-2.67%	-1.42	-0.46	2.000	0.00	0.00%	0.00	0.00%
GBM300-5	1.0779	1.0822	0.0043	0.40%	-1.00	0.89	57.000	0.00	0.00%	0.00	0.00%
OREAS 504B	1.1100	1.0848	-0.0252	-2.27%	-1.21	-0.12	4.000	0.00	0.00%	0.00	0.00%
OREAS 523	1.7200	1.6836	-0.0364	-2.12%	-1.82	-0.24	5.000	0.00	0.00%	0.00	0.00%
13				**-0.03%**			**263.00**	**1.00**	**0.38%**	**0.00**	**0.00%**

99.62% de Amostras Aprovadas

The assay results were plotted for the 363 submissions for gold and the 263 submissions for copper on scatter plots which were inspected to evaluate the ALS Chemex's precision performance. The RBV and SD for each CRM were provided by ALS Chemex. It was considered that an individual test result was OOS if it exceeds three times the SD (± 3SD) of the RBV. Two consecutive results greater than twice the SD (± SD) were also considered as failures. Only one OOS value was found for copper and seven for gold in that data. It was noted that some of the standard shipments did not have sufficient mass for analysis. These were classified as NSS (not enough sample) and were not considered in this analysis. The remaining results plotted within an acceptable range of accuracy.

The assay results of the CRM analyses were used to evaluate assay precision. The mean values and SD were calculated for each CRM from the collective assay results. The individual samples were then compared to the mean values and SD for each CRM. Any individual test outside the 2SD from the average of the collective trials was considered as OOS. Seven accuracy faults of +/- 2SD and nine accuracy faults of +/- 3SD for gold and 1 accuracy fault of +/- 2SD for copper were found. Such precision failures do not adversely affect overall confidence in the assays but may indicate potential variability inherent in assay procedures or lack of homogeneity in CRM.

FIELD DUPLICATES

Routine field duplicates were resumed from 2009 to 2017 on the same frequency as the program from 2007 to 2008. During this time, a total of 1,044 duplicates were assayed for gold and 1,030 duplicates for copper. The statistical summaries are presented in Tables 11-12 and 11-13.

TABLE 11-12 SUMMARY STATISTICS FOR ORIGINAL AND FIELD DUPLICATES ASSAY RESULTS FOR GOLD
Lundin Mining Corporation – Chapada Mine

	Original	Duplicate
Number of Samples	1,044	1,044
Mean (ppm Au)	0.0626	0.0634
Maximum Value (ppm Au)	1.30	1.00
Minimum Value (ppm Au)	0.0025	0.0025
Median (ppm Au)	0.0200	0.200
Variance	0.0125	0.0126
Standard Deviation	0.1118	0.1121
Coefficient of Variation	1.79	1.77
Correlation Coefficient	0.9046	
Relative Standard Deviation	30.18%	
% Difference Between Means	1.32%	

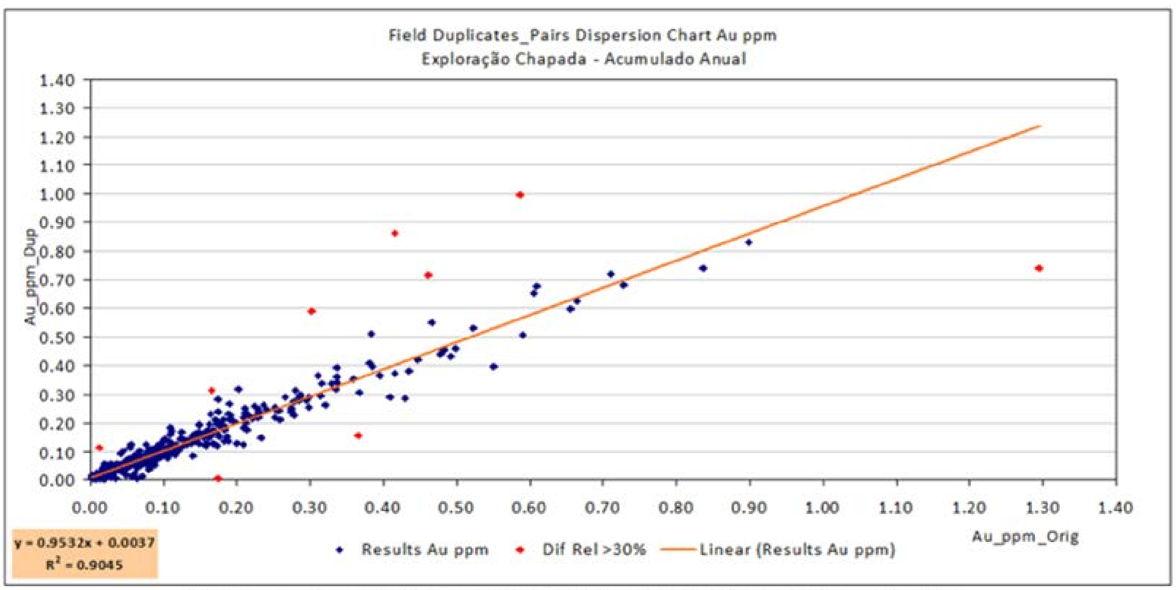
TABLE 11-13 SUMMARY STATISTICS FOR ORIGINAL AND FIELD DUPLICATES ASSAY RESULTS FOR COPPER
Lundin Mining Corporation – Chapada Mine

	Original	Duplicate
Number of Samples	1,030	1,030
Mean (%)	0.0963	0.0969
Maximum Value (%)	1.43	1.51
Minimum Value (%)	0.0005	0.0005
Median (%)	0.0300	0.0333
Variance	0.0207	0.0210
Standard Deviation	0.1438	0.1450
Coefficient of Variation	1.49	1.50
Correlation Coefficient	0.9787	
Relative Standard Deviation	19.19%	
% Difference Between Means	0.61%	

The original and field duplicate gold results were plotted on scatter diagrams and inspected for evidence of bias. The original and duplicate results showed good agreement and plotted within an acceptable range with a slight bias toward a higher grade in the original assay. The duplicate data were also plotted on a relative difference (Thompson-Howarth) plot which were examined for evidence of grade bias. In RPA's opinion, there is no significant grade bias in the duplicate gold results.

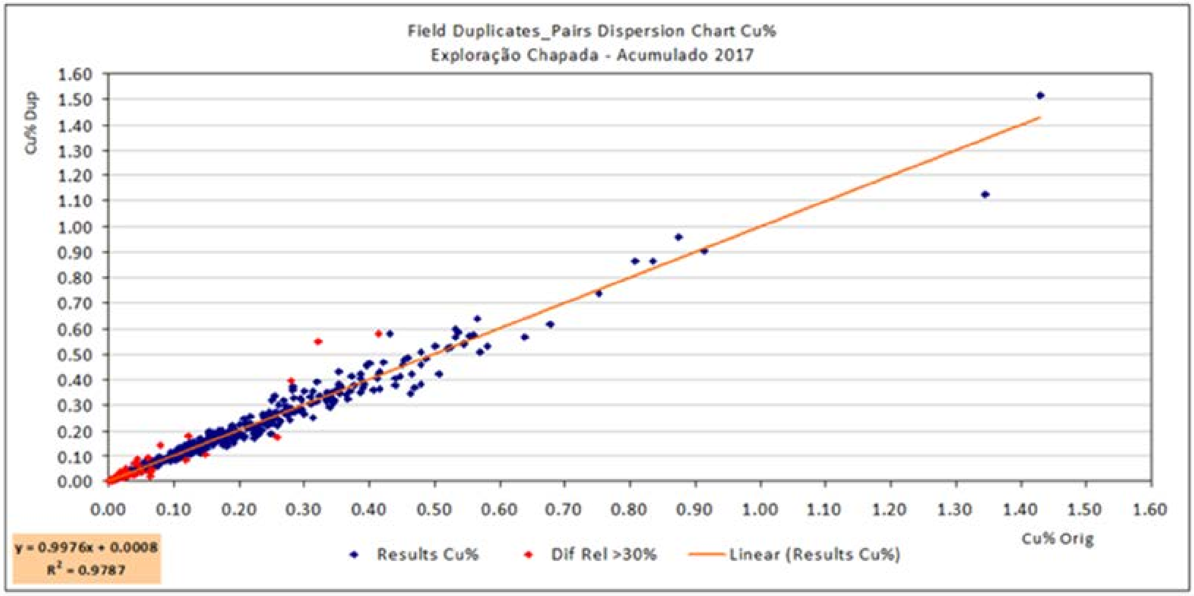
RPA repeated the exercise for the field duplicates analyzed for copper. Duplicates and original results showed good agreement and plotted within acceptable ranges. When plotted on Thompson-Howarth diagrams, the duplicate copper results showed no significant grade bias. Examples of the scatter plots used in the analysis are shown in Figures 11-9 and 11-10 respectively.

FIGURE 11-9 SCATTER PLOT - FIELD DUPLICATES ANALYZED FOR GOLD



Total_Samples	Mean Orig Samples	Mean Dup Samples	Dif Rel >30%	Dif Rel >30%	Máx Orig Au ppm	Máx Dup Au ppm	Máx Mean	Máx Abs Diff
1044.00	0.063	0.063	9.00	0.86%	1.2950	0.9950	1.0170	0.5560

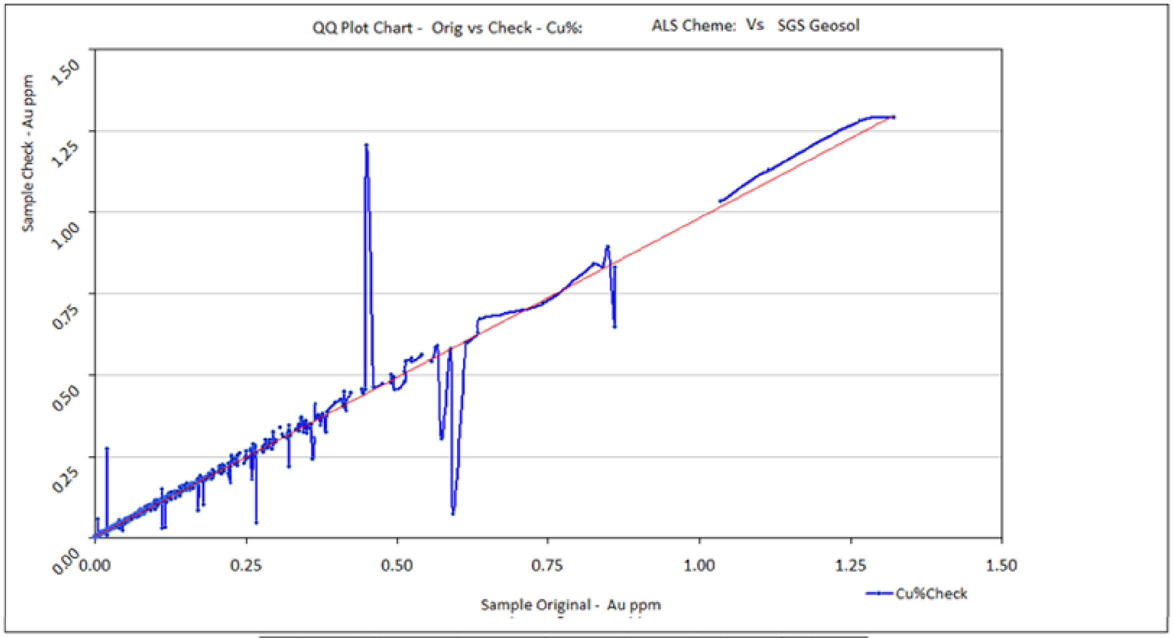
FIGURE 11-10 SCATTER PLOT - FIELD DUPLICATES ANALYZED FOR COPPER



Total_Samples	Mean Orig Samples	Mean Dup Samples	Dif Rel >30%	Dif Rel >30%	Máx Orig Cu%	Máx Dup Cu%	Máx Mean	Máx Abs Diff
1030.00	0.096	0.097	90.00	8.74%	1.4300	1.5150	1.4725	0.2260

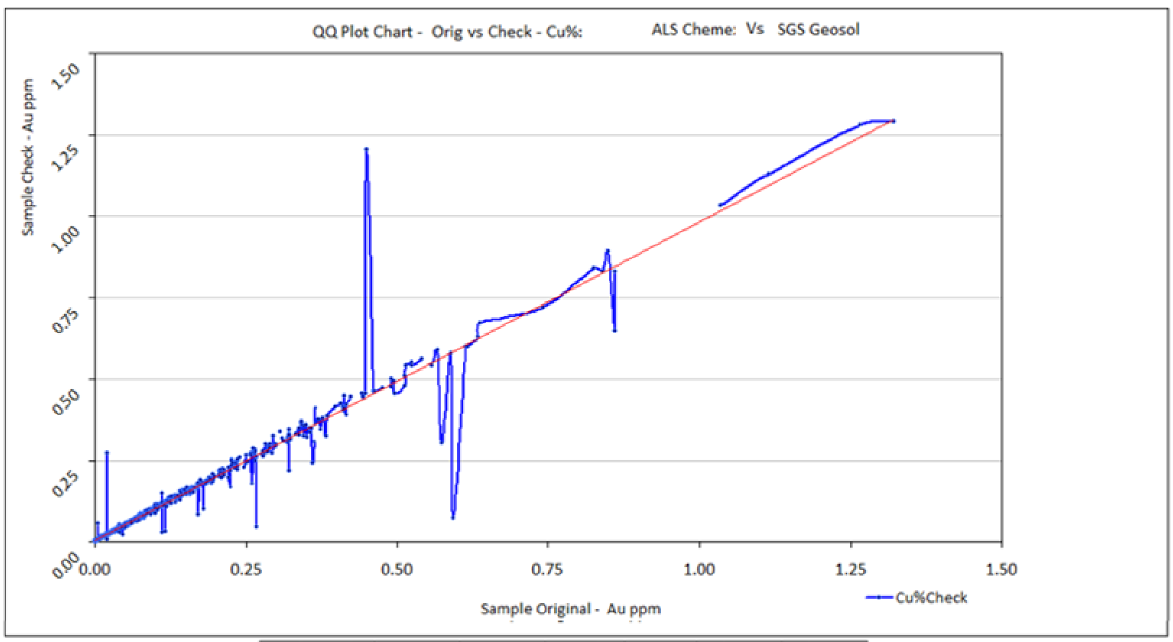
In addition to the field duplicate assays, in February 2011, an inter-laboratory program was initiated (approximately 5% of the submissions) to be shipped to a secondary laboratory for gold and copper analyses. The purpose of this program was to provide further confidence in the results and validate the assay procedures. A total of 1,005 pulp duplicates were shipped from ALS Chemex and analyzed using similar assay procedures by SGS Geosol. Scatter plots of the results are shown in Figures 11-11 and 11-12.

FIGURE 11-11 SCATTER PLOT - PULP DUPLICATES ANALYZED FOR GOLD



Total_Samples	Mean Orig Samples	Mean Dup Samples	Total Failure	% Failures	Máx Orig Cu%	Máx Dup Cu%
965.00	0.105	0.101	181.000	18.76%	1.320	1.290

FIGURE 11-12 SCATTER PLOT - PULP DUPLICATES ANALYZED FOR COPPER



Total_Samples	Mean Orig Samples	Mean Dup Samples	Total Failure	% Failures	Máx Orig Cu%	Máx Dup Cu%
965.00	0.105	0.101	181.000	18.76%	1.320	1.290

The results showed that the duplicate pairs plotted within acceptable limits with a slight bias toward higher values for gold in the original assay. The QQ plot for gold did not show significant degree of bias. The values for copper showed a good agreement between the original and pulp duplicate results in the scatter diagrams.

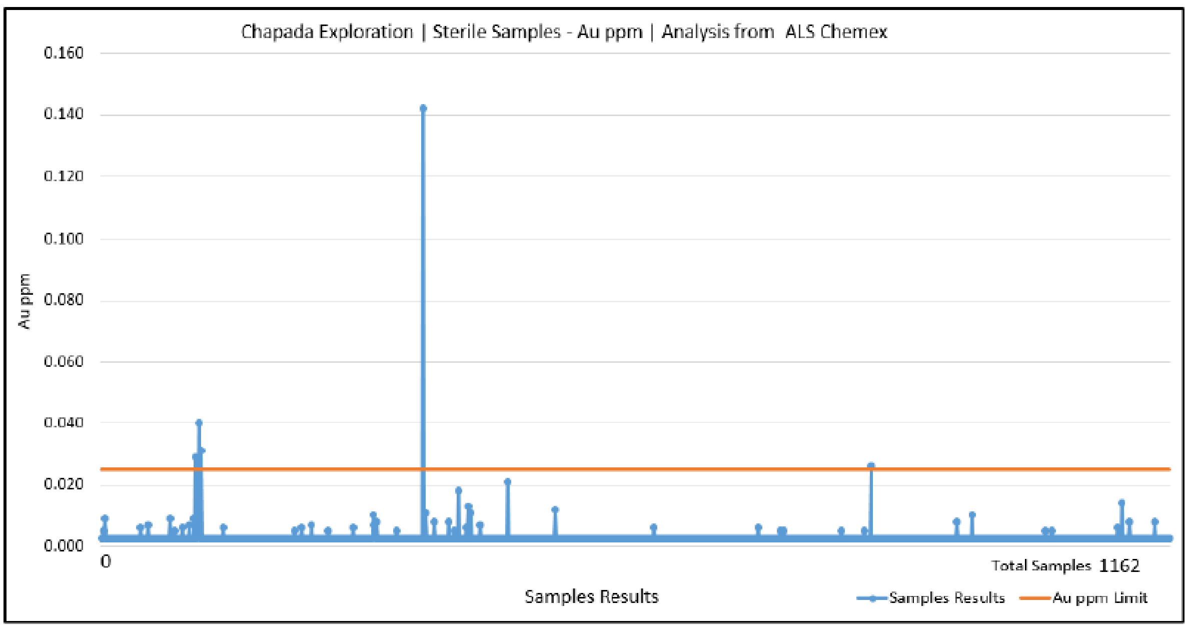
FEBRUARY TO DECEMBER 2018 – ALS CHEMEX (EXPLORATION AND INFILL PROGRAMS)

STERILE SAMPLES

Between February 2018 and December 2018, 1,360 gold and 1,123 copper sterile samples were sent to ALS Chemex. The results were inspected and showed that nearly all samples plotted below the acceptable tolerance of 5DL for both gold and copper. A 0.4% failure rate for gold and a 0.09% failure rate for copper were found.

An example of a plot used to evaluate assay performance through the insertion of sterile material in the exploration sample stream is illustrated in Figure 11-13.

FIGURE 11-13 STERILE SAMPLES FOR GOLD



STANDARDS

The CRMs used in the QA/QC program in 2018 were purchased from OREAS and are listed in Tables 11-14 and 11-15 for gold and copper, respectively, for the exploration drilling. A total of 1,113 copper CRMs and 1,350 gold CRMs were submitted to Chemex ALS (exploration and infill programs).

TABLE 11-14 2018 CERTIFIED REFERENCE MATERIALS FOR GOLD
Lundin Mining Corporation - Chapada Mine

CRM	RR Value (Mean ppm)	Lab Value (Mean ppm)	Diff.	n	≥2SD//<3SD		≥3SD	
					Out of Range	% Out of Range	Out of Range	% Out of Range
OREAS 501C	0.2210	0.2168	-0.0042	411.00	2.00	0.00%	0.00	0.00%
OREAS 501B	0.2480	0.2460	-0.0020	1.00	0.00	1.15%	0.00	0.00%
OREAS 153B	0.3130	0.2994	-0.0136	67.00	2.00	0.00%	1.00	1.49%
OREAS 521	0.3760	0.3761	0.0001	7.00	0.00	0.00%	0.00	0.00%
OREAS 502C	0.4880	0.4724	-0.0156	347.00	2.00	25.00%	0.00	0.00%
OREAS 522	0.5740	0.5430	-0.0310	1.00	0.00	4.39%	0.00	0.00%
OREAS 503B	0.6950	0.6732	-0.0218	44.00	0.00	1.55%	1.00	2.27%
OREAS 503C	0.6980	0.6732	-0.0248	210.00	2.00	5.56%	1.00	0.48%
OREAS 523	1.0400	1.0400	0.0000	43.00	0.00	1.28%	0.00	0.00%
OREAS 621	1.2500	1.2400	-0.0100	1.00	0.00	0.00%	0.00	0.00%
OREAS 504B	1.6100	1.5755	-0.0345	22.00	0.00	0.00%	0.00	0.00%
			Total	1154.00	8.00	0.69%	3.00	0.26%

TABLE 11-15 2018 CERTIFIED REFERENCE MATERIALS FOR COPPER
Lundin Mining Corporation - Chapada Mine

CRM	RR Value (Mean ppm)	Lab Value (Mean ppm)	Diff.	n	≥2SD//<3SD		≥3SD	
					Out of Range	% Out of Range	Out of Range	% Out of Range
OREAS 501B	0.260	0.256	-0.004	1.00	0.00	0.00%	0.00	0.00%
OREAS 501C	0.276	0.280	0.004	325.00	19.00	5.85%	2.00	0.62%
OREAS 621	0.363	0.355	-0.008	1.00	0.00	0.00%	0.00	0.00%
OREAS 503B	0.531	0.532	0.001	41.00	0.00	0.00%	0.00	0.00%
OREAS 503C	0.538	0.543	0.005	158.00	5.00	3.16%	0.00	0.00%
OREAS 521	0.607	0.599	-0.008	7.00	1.00	14.29%	0.00	0.00%
OREAS 153B	0.678	0.698	0.020	50.00	9.00	18.00%	2.00	4.00%
OREAS 502C	0.783	0.789	0.006	275.00	12.00	4.36%	0.00	0.00%
OREAS 522	0.916	0.914	-0.002	1.00	0.00	0.00%	0.00	0.00%
OREAS 504B	1.110	1.096	-0.014	18.00	0.00	0.00%	0.00	0.00%
OREAS 523	1.720	1.678	-0.042	41.00	6.00	14.63%	0.00	0.00%
			Total	918.00	52.00	5.66%	4.00	0.44%

The assay results for the 1,350 submissions for gold and the 1,113 submissions for copper were plotted on scatter plots and inspected to evaluate precision performance. The 1,154 CRMs for gold (exploration program) returned an approval percentage of 99.05% (Figure 11-

14). In the 11 deviations identified, eight did not exceed three standard deviations. The approval percentage was 93.90% Cu CRMs. A total of 56 deviations were observed in the 918 analyses (exploration program) performed for copper (Figure 11-15), however, 52 did not exceed ± 3SD. Since the CRMs used have low standard deviation values, the obtained approval rating is considered satisfactory. This performance was rated as satisfactory. RPA confirmed this conclusion.

OREAS 153b, OREAS 502c, OREAS 503b, and OREAS 503c CRMs show a small negative bias for gold. High dispersion is not observed in the results. The other control samples do not have systematic bias. A small positive bias for copper is observed in OREAS 501c and OREAS 153b. A minor negative bias for copper is observed in OREAS 504b and OREAS 523. The other control samples present good distribution in the results.

FIGURE 11-14 ZSCORE CHART – GOLD (G/T) – ALS CHEMEX

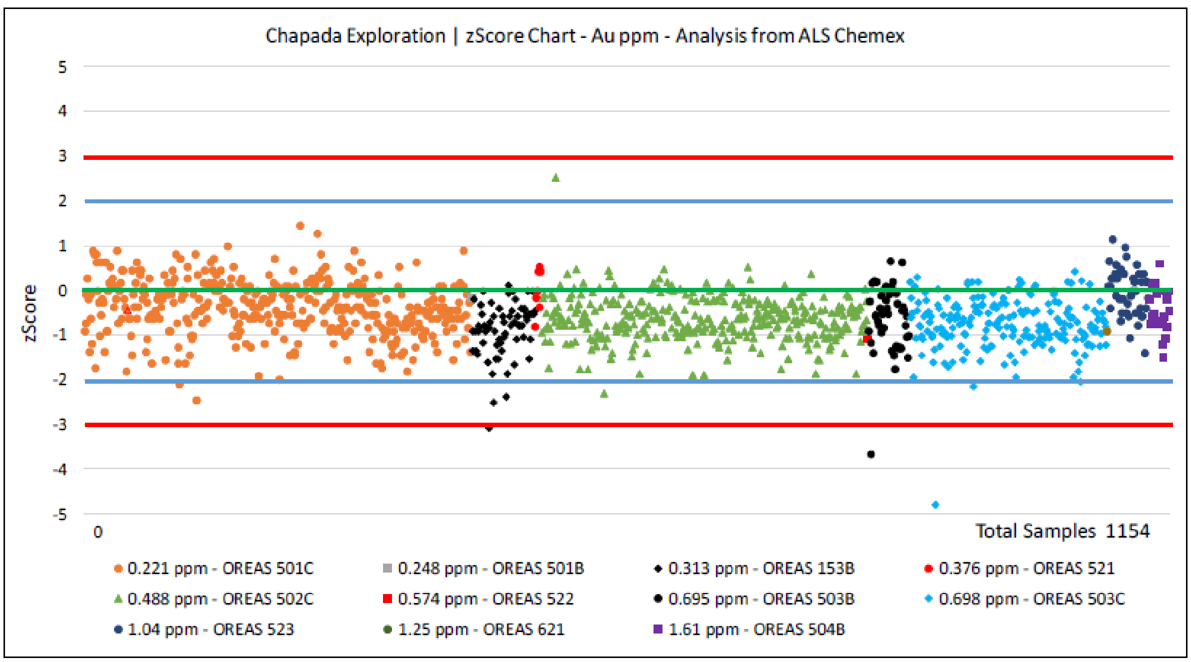
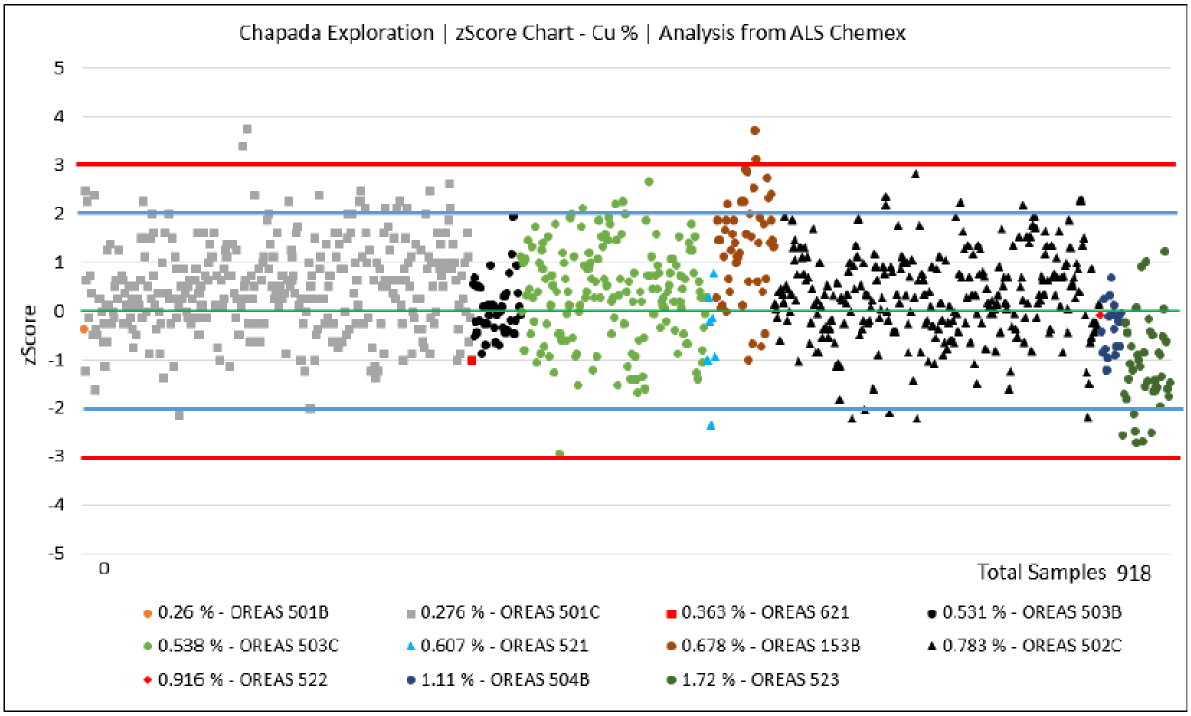


FIGURE 11-15 ZSCORE CHART – COPPER (%) – ALS CHEMEX



The original and field duplicate gold results were plotted on scatter diagrams and inspected for evidence of bias. The original and duplicate results for copper showed good agreement while gold results showed only slightly more dispersion.

Examples of the scatter plots used in the analysis are shown in Figures 11-16 (Infill Program) and 11-17 (Exploration Program) respectively.

FIGURE 11-16 SCATTER PLOT - FIELD DUPLICATES ANALYZED FOR GOLD

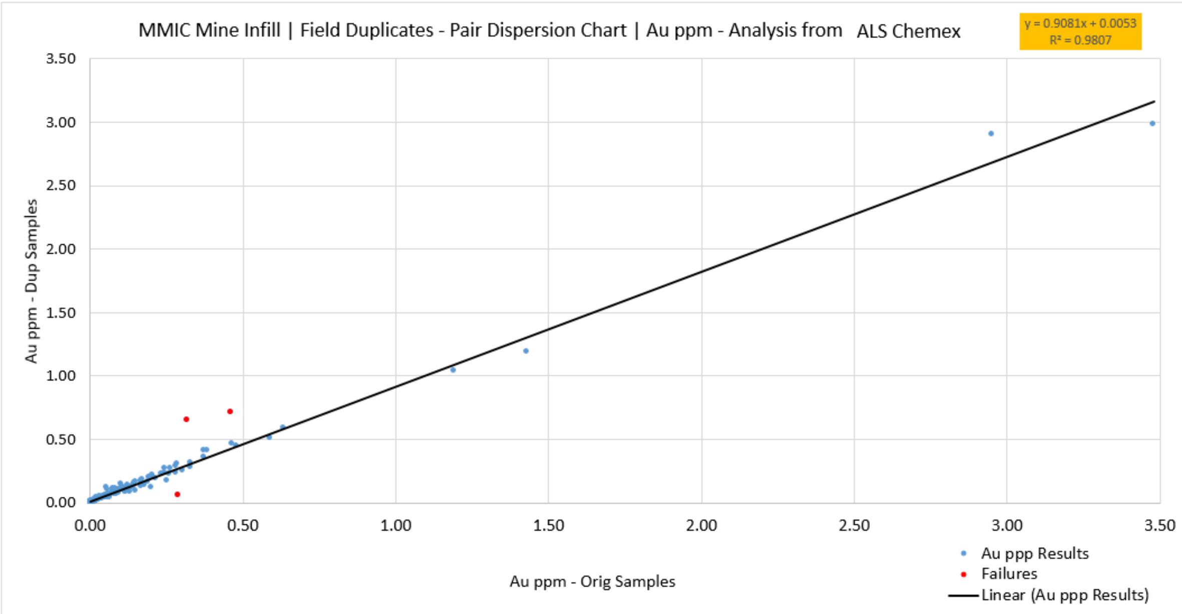
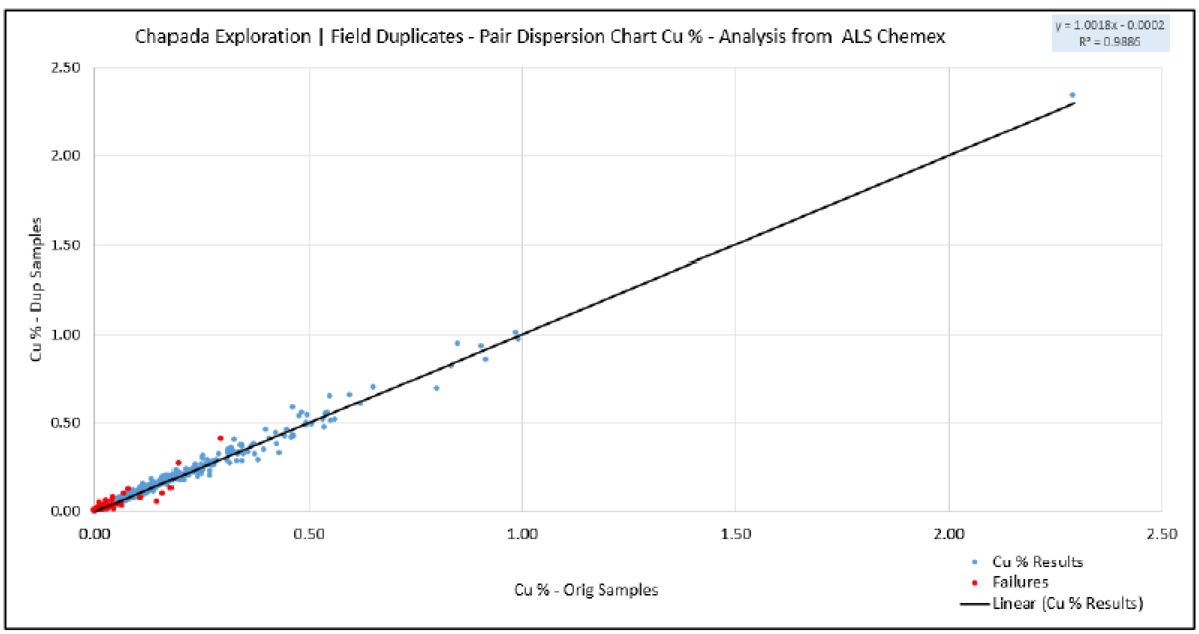


FIGURE 11-17 SCATTER PLOT - FIELD DUPLICATES ANALYZED FOR COPPER



CONCLUSIONS

The QA/QC program used meets industry standard with a generally acceptable rate of insertion for blank samples, CRMs, and pulp duplicates.

The results of the pulp duplicate assays showed reasonable reproducibility with no significant grade biases. The insertion of CRMs showed that laboratory results from SGS Geosol and ALS Chemex were acceptable with respect to precision and accuracy. The results from the insertion of blanks and sterile samples are also generally acceptable.

In RPA's opinion, the QA/QC program as designed and implemented at Chapada and Suruca is adequate and the assay results within the database are suitable for use in a Mineral Resource estimate.

12 DATA VERIFICATION

Written procedures and checks for all aspects of drilling, sampling, analyses, and data compilation are in use. For example, drill logs are verified prior to entry into the database by the Geology Department.

Compilation of assay QA/QC results was carried out on a continuous basis by a staff geologist in the Exploration Department. The data were collected and plotted on graphs to look for problem areas, and monthly and annual reports were generated. General performance was monitored, including the number of samples collected, the number and type of QA/QC samples, equipment availability, assay return times, etc. The reports also described the progress and results of special research projects, such as heterogeneity studies, that were underway at the time. Any problem areas with regard to assay verification were flagged and recommendations for appropriate action are implemented.

RPA carried out a program of validating the assay tables in the drill hole databases by means of spot checking a selection of drill holes completed that intersected the mineralized wireframe domains and were relevant to the current Mineral Resource estimate. Diamond drill core was examined by visually comparing geological entries in the drill logs and assays to the core. Assay tables of the digital database were checked against the assays presented in the original laboratory certificates for analyses completed from 2016 to 2019 including 10,463 assays from 2018. No discrepancies were found. Additional checks included a comparison of the drill hole collar locations with the digital models of the topographic surfaces and excavation models as well as a visual inspection of the downhole survey information. The standard Vulcan validation checking routines for overlapping samples and duplicate records were also carried out.

In RPA's opinion, the collection and analysis of assay QA/QC data at Chapada is quite thorough and meets standard industry practice.

RPA is of the opinion that data collection and entry, and database verification procedures for Chapada comply with industry standards and the data is adequate for the purposes of Mineral Resource estimation.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

CHAPADA

The following is a summary of the metallurgical testing programs performed on samples of the Chapada copper and gold deposits. The most recent test programs include pilot plant and in-plant testing to support optimization and process improvements in the existing grinding and flotation circuits and testing to support the potential expansion of the processing facilities from the current 65,000 tpd throughput rate to approximately 87,000 tpd. In addition, a study has been prepared by Hatch Ltd. (Hatch) for expanding the plant to 3,900 tonnes per hour (tph), or approximately 32.0 million tonnes per year (Mtpa). The study incorporates the results of the test work.

There was a significant amount of process testing completed for the development of the Chapada flowsheets. The flowsheets targeted the production of a clean, predominately chalcopyrite concentrate which contained gold. Tests and design work indicated that a concentrate grade of 28.0% Cu was achievable with acceptable recoveries of both copper and gold.

The metallurgical test work included the following major components:

- Mineralogical studies.
- Grinding and Bond Work index tests.
- Grind size versus flotation recovery studies including the evaluation of regrind after rougher flotation.
- Flotation studies to evaluate reagents, pulp density, pH, and residence time.
- Settling tests for thickener design.

Sufficient testing was completed such that Kilborn Engineering Pacific, Ltd. was able to develop a bankable feasibility design for the process plant in 1997. The Kilborn flow sheet and plant design was used to obtain an updated turnkey cost estimate for plant construction and operation.

The process testing history is summarized below:

- February 1975: INCO, “Flotation Tests on Project M” – Inco.
- April 1979: “Report RT-91228-01-R1”, INCO – Parsons-Eluma Projetos e Consultoria S/C.
- May 1980: “Report RT-91228-03-R1”, Eluma-Noranda RPT “Relatorio 13898”, Eluma-Noranda.
- December 1981: METAGO, “Metallurgical Processing”, Eluma-Noranda.
- May 1982: METAGO, “Report on Bench Scale Flotation”, Eluma-Noranda.
- September 1995: METAGO, “Estudos de Processo para a Mineracao S. Elina”.
- August 1996: MacPherson Consultants, “Proposed Grinding Circuit for Chapada Ore”, Santa Elina – Echo Bay Mines.
- February 1997: LAKEFIELD RESEARCH, “Recovery of Copper and Gold from Samples of Chapada Ore- Progress Report N.1”, Santa Elina-Echo Bay.
- October 1997: AUGMENT, “Chapada Amenability Test Report”, Santa Elina-Echo Bay.
- November 1997: Billiton Process Research, “Report PR97/90 – Bacterial Oxidation of Chapada Concentrate” Echo Bay.
- 2004: CIMM and HDA Servicos S/C Ltda. - SAG/Ball mill test work reports. The study regarding bacterial leaching of the concentration is not being applied to the Project at this time. Conventional smelting of the concentrate is anticipated.
- HDA Services S/C Ltda - 2008 – 2009, Comminution Circuit Report
- 2015 and 2016 – Optimization Project implemented by operations – Plant implements Woodgrove Inc. “Aware” (cameras and automation) technology for improved through-put, and Outotec retrofits flotation cells with forced air and Chapada implements on stream analysis with courier system to improve copper and gold recovery.
- 2018 - Yamana Gold Inc. and SNC Lavalin, 2018. Feasibility/Basic Engineering Report, Suruca Project, State of Goiás, Brazil, February 18, 2018 Rev. A.
- 2018 - Woodgrove Technologies (Woodgrove), 2018, Chapada Project, Phase 1 Pilot Testing Report, 17041-000133190PE-RPT-10000, February 2018.
- 2019 - Hatch 3,900 tph Project, Basic Project General Final Report, May 2019.

For the 2004 FS, Hatch relied on the December 1981 metallurgical processing report, the 1997 Lakefield report, and the 2004 CIMM/HDA Services S/C Ltda. report as the basis for the current flow sheets, and made the following comments:

- Testing for the Parsons-Eluma Projetos e Consultoria S/C report (1981-1982) was carried out at the Metago facility in Goiana, Brazil. The tests were performed on bulk samples from the exploration shaft and crosscuts. Locked cycle flotation tests were performed. A primary grind of 55% -150 µm was selected, although it was noted that the test results were not particularly sensitive to grind. This report is only of value as a guide, as the flow sheet at that time was radically different from what is envisaged for the FS. It included the production of separate pyrite and copper concentrates, preceded by multi-stage crushing, and rod and ball milling. Parsons-Eluma Projetos e Consultoria S/C reported that recovery was high, however, no assessment of recovery and grade is provided in the report, other than a conclusion that a 28% Cu concentrate would be achieved, with constant tails of 0.04% Cu.

The 1997 Lakefield report is a more comprehensive report, presented in a manner that allows some conclusions to be drawn. In addition, the Lakefield personnel involved in this work were still available for discussion and commentary. Lakefield based its work on an aggressive bulk rougher flotation, regrinding of the rougher concentrate and cleaning to produce a high grade concentrate. Lakefield presented the projected metallurgy for Chapada, based on the results of the testing performed (Table 13-1).

TABLE 13-1 LAKEFIELD 1997 PROJECTED METALLURGY
Lundin Mining Corporation – Chapada Mine

	% wt	Assay		Distribution (%)	
		% Cu	g/t Au	Cu	Au
Feed	100	0.338	0.328	100	100
Cu Rougher Conc.	7.29	4.78	3.6	95.3	73.8
Cu Cleaner Conc.	1.09	28	18.5	90.2	61.6
Cu Cleaner Tail.	6.2	0.3	0.71	5.1	12.2
Au Carbon					10.2
Final Tail	98.9	0.034	0.09	9.8	28.2

Gold recovery from the cleaner concentrate was 61.6%.

The Lakefield work also found a relative insensitivity to grind between P_{80} of 100 µm and 200 µm. Lakefield selected a P_{80} of 150 µm, with regrinding to finer than 50 µm to achieve the final concentrate grade. The selection of a 28% Cu concentrate at a recovery of 90.2% Cu was based on a relatively small number (four) of locked-cycle tests.

Hatch concurred with the 28% Cu concentrate grade but used the IMC Life of Mine (LOM) recoveries of 88.6% Cu and 54.6% Au based on the LOM head grades and a "fixed" tails grade. This calculation of recovery was therefore more conservative than the Lakefield conclusions. In addition, Hatch recommended further tests to investigate the relatively low gold recovery.

In January 2004, five large four metre diameter “shafts” were excavated at Chapada to obtain bulk samples for testing at the CIMM laboratory in Santiago for semi-autogenous grinding (SAG)/ball mill evaluation. The shafts were excavated through the soft soil and overburden to the mineralization to at a total depth of 30 m to 40 m. Over 100 t of samples were collected and shipped to CIMM in Santiago, and a SAG/ball mill campaign was conducted during February and March 2004.

The tests indicated a work index of 15 kWh/t to 16 kWh/t, which was somewhat higher than the values indicated in previous work (12 kWh/t to 13 kWh/t). These higher values were used, due to the quality of the samples and the reputation of CIMM, to develop the grinding circuit and size the main equipment (mill and pebble crusher size and power, and SAG mill discharge screen). The test work was managed by HDA Services S/C Ltda. of Sao Paulo, and the results provided to Hatch. Only a limited amount of sedimentation and filtration work was carried out by Hazen Research Inc. in 1996.

HDA SERVICOS S/C LTDA - 2008 – 2009 – COMMINUTION CIRCUIT REPORT

In December 2008, HDA Services S/C Ltda. prepared a Comminution Circuit Report, as summarized below. A solid ore characterization program and comprehensive survey campaigns were the basis for simulations carried out for the expansion of the Chapada grinding circuit. The former included the assessment of breakage characteristics and flotation performance of five individual ore types occurring in the Chapada deposit, while the latter comprised two detailed surveys in the existing industrial grinding circuit.

The breakage characteristics of all five main ore types were assessed by high-energy comminution (DWT – Drop Weight Test), low-energy comminution (abrasion test), and ball milling (BWI – Bond Work Index). In all cases, the ANX (Amphibole schist) ore type indicated distinctive breakage characteristics, as compared to the other four, i.e., SRT (Sericitic schist), QSRT (Sericitic Quartzite), GNS (Gneiss), and BTO (Biotite schist). Accordingly, test results showed that ANX is a much more competent ore, while BTO and SRT were considered friable ore types. Both GNS and QSRT were classified as extremely friable in terms of resistance to high-energy comminution.

Even though the ANX indicated the highest value of Bond Work Index among the five ore type results, the differences were not as severe as those obtained for the high-energy resistance. Bond Work Index was within the 12.01 kWh/t to 14.44 kWh/t range for all five ore types. Flotation testing indicated that highest copper and gold recoveries were obtained for samples ground at P_{80} within the 0.21 mm to 0.25 mm range for the SRT, QSRT, GNS, and BTO ore types. Conversely, the ANX ore type indicated that a finer grinding size corresponding to the highest copper and gold recoveries, in this case, at P_{80} equals to 0.15 mm.

The models developed based on the current Chapada operation were considered robust for simulating the entire grinding circuit, including all processing equipment such as SAG and ball mills, cone crushers, screens, and cyclones, as well as High Pressure Grinding Rolls (HPGR). In particular, the HPGR model was calibrated on the basis of a comprehensive testing program carried out at a selected manufacturer laboratory in Germany.

On the basis of individual calibrated models, a base scenario was assembled which consisted of the complete Chapada comminution circuit integrated into a simulation of the current circuit operating under nominal conditions. Nominal capacity was assumed to be 16 Mtpa which resulted in 2,058 tph plant throughput.

Both 20 Mtpa and 24 Mtpa phases of the expansion project of circuit capacity were based solely on the currently installed equipment at the Chapada grinding circuit. In both cases, the existing mills (SAG and ball mill) were adjusted to operate under increased power draw mode, which provided the extra energy required for fragmentation. The grinding circuit product was simulated for a P_{80} of 0.22 mm to 0.23 mm, well within the selected conditions by the flotation test campaign.

A second (new) grinding line was simulated, as the required capacity exceeded the maximum throughput for the existing industrial circuit. Under this scenario, the existing circuit could process QSRT, GNS, SRT, and BTO ore types, while the new line would receive only the ANX ore type. Such a scenario is based on the conclusions that QSRT, GNS, SRT, and BTO ore types were relatively more friable, while the copper and gold recoveries were found at coarser grinding sizes than the ANX ore type.

Simulations indicated that the existing grinding circuit would process 3,365 tph of QSRT, GNS, SRT, and BTO combined ore types, for a nominal P_{80} equal to 0.22 mm. In this case, the remaining throughput would have to be directed to the new grinding line, which corresponds to 750 tph, or 18% of total plant capacity planned for in the Phase III expansion. The final product was simulated for a P_{80} equal to 0.15 mm.

Among the two alternatives simulated for the new grinding line, the SAG/ball mill requires a smaller ball mill, but with slightly higher energy consumption (5%), when compared with the HPGR/ball mill option. Total installed power would also be higher for the SAG/ball mill alternative (9.75 MW), compared to 8.70 MW figure obtained for the HPGR/ball mill option. However, such a difference in installed power would be reduced in the case of a coarser grinding size (P_{80} = 0.21 mm), as indicated by the simulations. Accordingly, ball mill installed power would be 2.8 MW and 4.5 MW, respectively for the SAG/ball mill and HPGR/ball mill alternatives.

2016 – 2017 PROCESS PLANT OPTIMIZATION STUDIES

Throughout 2016 and 2017, Chapada undertook several processing optimization projects to increase mill throughput and copper and gold recoveries. The projects included the following:

- Retrofit of 10 existing flotation cells with Outotec Tankcell and FloatForce technology.
- Increase power of the SAG from 11 MW to 12.5 MW.
- Installation of an Advanced Control system for automation and stabilization of the process.
- Installation of four Staged Flotation Reactor (SFR), three conventional SFR and one type BRU (Bubble Recovery Unit) flotation cells on cleaner tailings (scavenger circuit) and two SRF cells on the regrind cyclone overflow (scalper circuit).

At the end of 2017 and beginning of 2018, bench flotation tests were conducted at Chapada using a pilot plant which indicated that copper and gold recovery increases of approximately 2.0% and 1.5% respectively are achievable through optimization of the flotation circuit. Currently, the rougher cells are routinely pulled slower than they could be, limited by the capacity of the regrind sump/pump, even though the Chapada ore is fast floating. The following two-step solution has been undertaken at Chapada in 2018 and 2019:

- Remove the column tails from the regrind circuit sending it directly to the SFR cleaner scalpers, so the rougher could be pulled harder.
- Install six new DFR (Direct Flotation Reactor) cells in the back end of the rougher/scavenger circuit (two lines of three cells per line).

WOODGROVE GRINDING OPTIMIZATION CONCEPTUAL STUDY - 2017

In 2017, Woodgrove was contracted to prepare a conceptual design and simulations to expand the Chapada processing plant from the current 24.0 Mtpa to an approximate 32.0 Mtpa. The preliminary simulations indicated that the increased throughput could be achieved with the current flotation feed size of approximately 280 µm by adding an additional ball mill, a new HPGR, a new pebble crushing circuit and a second Vertimill. An additional 15 flotation cells (seven new Rougher DFR, six new Cleaner DFR and two new Scalper SFR) would also be required to maintain the current flotation capacity.

WOODGROVE PILOT PLANT TESTING – 2018

Woodgrove completed three phases of pilot plant testing with its Staged Flotation Reactor (SFR) and Direct Flotation Reactor (DFR) technology using samples from the Chapada concentrator. Phase 1 was designed to investigate flotation circuit configurations where additional SFR units would potentially improve the overall performance of the plant. Phase 2 was performed to confirm the results of the Phase 1 testing using plant samples with blends of metallurgically challenging ores, including BT (baixa teor) and SSM (saprolite sericite material). The phase 3 program tested the newly developed DFR technology.

The objective of the Phase 1 testing was:

- To assess the performance of the SFR as a rougher scalper and a rougher scavenger.
- To determine circuit configurations using the SFR scavenging strategies.
- To compare the SFR with industrial tank cells and the laboratory batch flotation tests.
- To determine design criteria for the SFR equipment.

The objective of the Phase 2 testing was to evaluate the performance of the SFR cells with blends of BT and SSM samples and to confirm design criteria for the SFR application.

Results of the tests:

- Two configurations were identified for the SFR application including installation of the SFR units at the front end of the rougher circuit as rougher scalpers and at the end of the rougher circuit as rougher scavengers.
- Tests using blends of BT ore confirmed that the rougher scalpers can be sensitive to ore type and it is not always possible to produce final concentrate in the scalper cells.
- A test of a blend of SSM ore indicated potential recovery and upgrading issues. There was insufficient sample to test the ore in detail.
- The results of the rougher tailings tests indicated similar performance between SFR and DFR so that both units could be considered in the design. The SFR unit consists of two vessels and the DFR unit is contained in a single vessel.
- Design criteria were determined for the full scale SFR/DFR design.

The Phase 3 pilot plant test program focused on the performance of the single tank DFR units. The advantage of the DFR units is a reduction in plant footprint so the units can be installed in smaller areas. This was an advantage in the Chapada rougher tailings application. The objective of the program included confirmation that three stages of DFR would perform well in the re-scavenger circuit and the development of design criteria for the re-scavenger circuit.

Based on the results of the pilot plant testing program, the proposed changes in the Chapada concentrator included:

- Installation of a pump on the flotation column tailings to direct the flow to the SFR scalper feed tank instead of the regrind circuit.
- Installation of two rows of three DFR cells in parallel to treat the exiting scavenger tailings. The concentrate from the DFR cells will be pumped to the existing concentrate regrind circuit.
- Recalibration of the of the flotation circuit, Advanced Process Control System.

The predicted improvement in overall plant recovery was projected to be an increase of 2.5% Cu and 1.9% Au. These changes were made to the process plant with commissioning taking place during August 2019.

HATCH 3,900 TPH PROJECT, 2018 - 2019

Hatch prepared a study report regarding the 3,900 tph (32.0Mtpa) Expansion Project of the Chapada Mine. The report presented the results of the basic engineering study concerning the Mineral Reserves, mine design, processing facilities, infrastructure, execution plan and schedule and economic analysis. It should be noted that the expansion project has not been approved for execution by Lundin, at the time of this report. The main processing aspects of the report will be summarized in this report. The objective of the 3,900 tph Expansion Project is to increase the production of the Chapada processing facilities from the current 2,870 tph to 3,900 tph, (24.0 Mtpa to 31.8 Mtpa). The expansion project includes the mining and processing of the Sucupira deposit which is located adjacent to and beneath part of the current processing facilities and site infrastructure. Mining of the Sucupira deposit, even without the expansion, will require relocation of some of the process structures and equipment including the in-pit primary crushing lines, the crushed ore stockpile and pebble crushers, associated conveyors, and relocation of the electrical substation.

The comminution circuit was evaluated by MinPro International, which analyzed the following process routes:

- Opening of the SAG circuit
- Opening of the SAG circuit and raising the ball charge from 14% to 16%
- Adding a pre-crushing step (open and closed circuit)
- Adding another ball mill in parallel with the existing one
- Adding another comminution circuit in parallel with the existing one
- Opening the SAG circuit and adding an HPGR and another ball mill

It was decided at the time that the most favourable option would be to add a pre-crushing step (secondary crushing) using two cone crushers and an additional ball mill.

Woodgrove conducted pilot plant studies as previously discussed, for improvement of the flotation circuit, calculating the new plant mass balance, metallurgical recoveries of copper and gold and provided cost estimates for the new flotation equipment.

Woodgrove designed the expansion in three different steps or phases.

- Phase 1 – 2017: included the installation of two SFR cleaner scalpers and four SFR cleaner scavengers.

- Phase 2 - 2019: included the installation of six DFR (Direct Flotation Reactors) as re-scavengers, consisting of two rows of three reactors operating in parallel. This equipment was installed and was being commissioned during the RPA site visit in August 2019.

- Phase 3 – to be reviewed and approved: includes the full expansion flowsheet:
    - The addition of a third bank of roughers (7 DFR cells),
    - The addition of two more cleaner scalpers (2 SFR cells),
    - Removal of the flotation column from the flowsheet,
    - Installation of new cleaner stage flotation cells (6 DFR cells),
    - Installation of a second vertical regrind mill in parallel with the current mill.

SURUCA

There is a narrow transitional zone between the oxide and sulphide zones at Suruca, however, the mineralization can generally be characterized as either oxide or sulphide. Therefore, separate test work programs were initiated for the oxide and sulphide samples.

A draft metallurgical report was produced in September 2010 summarizing the tests conducted and available results, entitled "Relatorio de Estudos Metalurgicos – Alvos de MMIC" ('*Metallurgical Study Report on MMIC targets*').

Improvements in gold and copper recovery from the existing Chapada Mine treatment plant were investigated, while bench and pilot scale testing on the various Suruca ore types were conducted concurrently. The study was completed by U. I. Minerals (UIMIN) in July 2010 and entitled "Review of & Recommendations for the Chapada Plant – Current and Future Developments".

Three ore types were studied but only two types were relevant in the context of the Suruca deposit, gold oxide, and gold sulphide. Table 13-2 summarizes the characteristics of the ore types.

TABLE 13-2 SURUCA ORE CHARACTERISTICS
Lundin Mining Corporation – Chapada Mine

	Gold Sulphides	Gold Oxides
Gold Grade (g/t)	0.57	0.45
Copper Grade (ppm)	156	246
Total Sulphur Grade (%)	1.68	0.11

The following metallurgical test work programs were initiated:

- Characterization – USP Laboratories
- Physical Parameters Characterisation – HDA services Pty. Ltd

- Gravity and Leaching Studies – Knelson Research and Technology Centre
- Exploratory Studies for Flotation and Leaching Steps 1 and 2 – John Clark, Yamana Metallurgy Department and Funmineral Laboratories
- Evaluation Studies of Heap Leaching – Kappes, Cassiday & Associates

MMIC managed and supervised all metallurgical test work programs with most of them being completed during the previous phases of the project development. The oxide ore was the basis for these test work programs. Following the aforementioned test work, in April 2017, Kappes, Cassiday & Associates (KCA) in Reno, Nevada, USA completed an updated test work program to evaluate dynamic heap leach process by the following:

- Head Analysis;
- Agglomeration and Compaction Test Work; and
- Column Leach Test Work.

The updated KCA test work program confirmed the amenability of Suruca ore to cyanide leaching and recommended further compaction test work with much higher cement level if the heap height was to be higher than eight metres.

OXIDE CHARACTERIZATION

A summary of the oxidized ore studies are as follows:

- Free gold particles 3.7% (greater than 37 µm).
- 55% of the gold associated with oxides and hydroxides of iron.
- 31% of the gold associated with silicates.
- 10% of the gold associated with other minerals.
- The gold grains have an average size of 8 µm.
- Cyanide leaching of the whole ore sample at 100% passing 840 µm and 150 µm indicated gold recoveries of 75.9% and 89% respectively.
- Physical characterization test work indicated a bond work index (BWi) value of 16.6 kWh/t for a product grind size of 74 µm indicating that the Suruca oxide sample tested is moderately hard from the perspective of conventional ball mill grinding drop weight index (DWi) testing indicated that the sample tested was extremely friable.
- Gravity characterization test work was carried out by Knelson Research Laboratories. A conventional GRG (gravity recoverable gold) test indicated a gravity recovery of 35.4%. Leaching of the gravity concentrate with cyanide indicated a leach recovery of a 99% compared to direct leaching of the ore crushed to less than 147 µm, which gave a cyanide leach recovery of 93.6%.

- Flotation test work conducted on the oxide samples produced poor results with an overall flotation and leaching recovery of the flotation concentrates produced of approximately 30% of the feed gold content.
- Column leach tests conducted were positive. A total of 92% of the contained gold was recovered from the oxide sample submitted in a period of 52 days leaching. The sodium cyanide consumption was calculated to be 0.44 kg/t using a Portland cement addition rate of 18 kg/t. The agglomerated sample was also strongly agglomerated based on the promising "slump" tests results indicating 0% slump with no pooling or channelling noted during the testing.

SULPHIDE CHARACTERIZATION

A summary of the sulphidized ore studies are as follows:

- Free gold particles 26% (greater than 37 µm).
- 59% of the gold associated with sulphides, predominantly pyrite.
- 9% of the gold associated with silicates.
- 4% to 6% of the gold associated with tellurides.
- The gold grains have an average size of 3 µm.
- Cyanide leaching of the whole of ore sample at 100% passing 75 µm indicated a gold recovery of 88.0%. Technological characterization of the sample indicated a total gold recovery of 76.9% for a sample less than 300 µm in size.
- Physical characterization test work indicated a BWi value of 15.4 kWh/t for a product grind size of 74 µm indicating that the Suruca sulphide sample tested has a moderate to high hardness from the perspective of conventional ball mill grinding. DWi testing indicated that the sulphide ore is very competent in nature.
- Gravity characterization test work was carried out by Knelson Research Laboratories. A conventional Gravity Recoverable Gold (GRG) test indicated a gravity recovery of 35.2%. Leaching of the gravity concentrate with cyanide indicated a leach recovery of 95% compared to direct leaching of the ore crushed to less than 109 µm, which gave a cyanide leach recovery of 82.3%.
- Flotation testing was conducted in two separate stages. The stage 1 results utilizing locked cycle testing indicated gold recoveries of 82% and 85% when leaching the flotation concentrates produced. The second set of flotation tests indicated 82% recovery for flotation and 85% leach gold recovery of the concentrate produced at a grind size P_{80} of 75 µm.

14 MINERAL RESOURCE ESTIMATE

The updated Mineral Resource estimates for the Chapada (Baru, Baruzinho, Cava Central, Corpo Sul, Sucupira and SW Mina) and Suruca deposits, carried out by Chapada's personnel have been reviewed by RPA. Since the last Mineral Resource estimate, the deposit formerly known as Cava Norte has been merged into the Sucupira deposit at Chapada. The Mineral Resource estimate is based on open pit mining scenarios, and Chapada Mineral Resources are constrained by optimized pits which are based on a copper and gold net smelter return (NSR) cut-off value. RPA has reviewed the estimation methodologies, classification criteria, and Mineral Resource reporting adopted by Lundin. Mineral Resources are reported by Lundin inclusive of Mineral Reserves.

A summary of the Mineral Resources at Chapada and Suruca, dated June 30, 2019, is given in Table 14-1.

TABLE 14-1 CHAPADA MINERAL RESOURCES - JUNE 30, 2019
Lundin Mining Corporation – Chapada Mine

Deposit	Category	Tonnes (000 t)	Cu (%)	Au (g/t)	Contained Cu (000 t)	Contained Au (Moz)
Copper/Gold						
Chapada	Measured	328,948	0.25	0.16	807	1.65
	Measured – Stockpile	107,488	0.22	0.16	234	0.54
	Indicated	654,393	0.24	0.15	1549	3.06
Sub-Total	**Measured + Indicated**	**1,090,829**	**0.24**	**0.15**	**2,590**	**5.24**
	Inferred	162,769	0.22	0.08	360	0.41
Gold Only						
Suruca	Measured	12,737		0.42		0.17
	Indicated	134,780		0.54		2.32
Sub-Total	**Measured + Indicated**	**147,518**		**0.53**		**2.49**
	Inferred	12,565		0.48		0.19

Notes:
1. CIM (2014) definitions were followed for Mineral Resources.
2. Chapada and Suruca SW copper/gold Mineral Resources are estimated at an NSR cut-off value of US$4.08/t.
3. Suruca gold only Mineral Resources are estimated at a cut-off grade of 0.16 g/t Au for oxide material and 0.23 g/t Au for sulphide material.
4. Mineral Resources are estimated using a long-term gold price of US$1,600/oz and a long-term copper price of US$4.00/lb.

5. Mineral Resources at Chapada are constrained by an optimized pit and the June 2019 topographic surface.
6. Mineral Resources are inclusive of Mineral Reserves.
7. Chapada copper/gold Mineral Resources include resource estimates for Cava Central/SW, Corpo Sul, Sucupira, Baru, Santa Cruz and Suruca SW.
8. Chapada gold only Mineral Resources include resource estimates for Suruca Oxide and Suruca Sulphide.
9. Numbers may not add due to rounding.

Lundin report Mineral Resources inclusive of Mineral Reserves whereas the previous owners reported exclusive. When reported on an inclusive of Mineral Reserves basis, the June 30, 2019 Measured and Indicated copper/gold Mineral Resources at Chapada are broadly similar to those reported at December 31, 2018 with exploration discovery over the intervening 6 month period being offset by mining depletion.

RPA is not aware of any known environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other relevant factors that could materially affect the June 30, 2019 resource estimate.

DATABASE

RPA was supplied with databases for the Chapada (Cava Central, Corpo Sul, Sucupira, Baru NE, and Santa Cruz), and Suruca deposits. The drill hole database is comprised of a total of 2,530 drill holes with 377,781 m of drilling at an average length of hole of 149.0 m. Table 14-2 summarizes the databases used for resource estimation.

TABLE 14-2 DESCRIPTION OF CHAPADA AND SURUCA DATABASE
Lundin Mining Corporation – Chapada Mine

Area	Cava Central/SW	Corpo Sul	Sucupira	Baru_NE	Santa Cruz	Suruca	Total
Number of DDH	673	537	211	31	27	1,051	2,530
Total Length	110,139	118,124	51,438	5,328	5,875	86,877	377,781
Average Depth	164	220	244	172	218	83	149
Number of Surveys	18,170	38,411	13,533	1,749	1,945	26,728	100,536
Number of Litho Entries	75,150	32,092	34,867	4,917	1,852	63,671	212,549
Number of Assays	105,110	76,479	40,019	5,075	6,078	87,606	320,367

Drill hole spacing over the property ranges between sections spaced on 50 m and 200 m section lines. At Chapada (includes Cava Central/SW, Corpo Sul, Sucupira Baru NE, and Santa Cruz), drilling is spaced between 50 m and 100 m towards the centre of the deposit and

100 m to 200 m on the peripheries. At Suruca, drilling is spaced on 100 m sections in the northeast and 200 m to the southwest. Figure 14-1 shows a drill plan for the three deposits.

RPA is of the opinion that the Chapada and Suruca databases are sufficient to support June 30, 2019 Mineral Resource estimation.

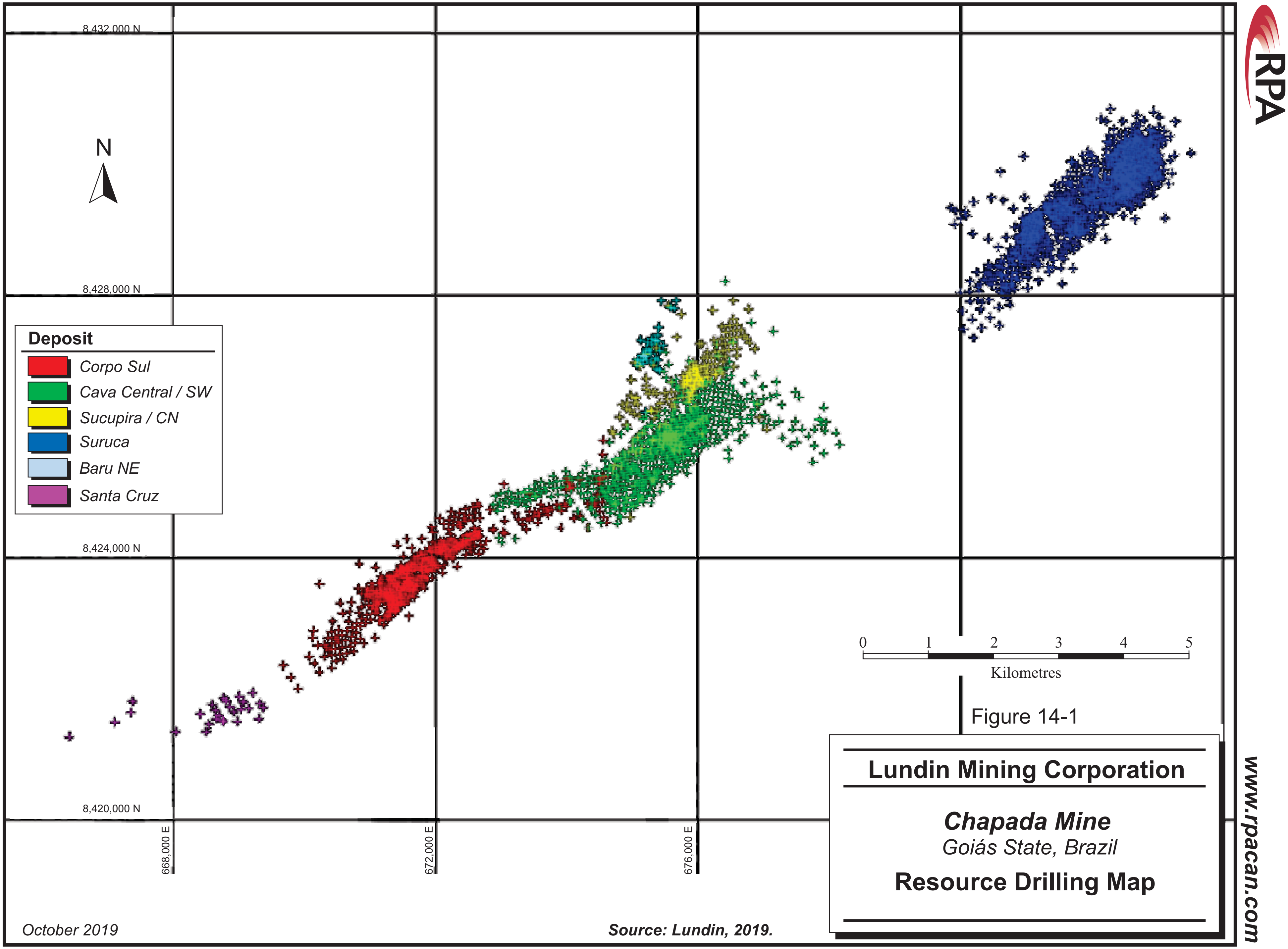


Figure 14-1

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Resource Drilling Map

October 2019

Source: Lundin, 2019.

GEOLOGICAL INTERPRETATION

Chapada's personnel developed wireframe 3D solid representations of geological features using Vulcan with refinements in Leapfrog 3D software. Solids were created for each rock type, litho-structural, and oxidation domain as illustrated in Figures 14-2 and 14-3.

For Chapada, a mineralization envelope was created to define grade continuity within the deposit. The grade shell was created on the basis of 0.1 g/t Au and 0.1% Cu minimum grade thresholds. In areas within the grade shell where the gold and copper grades were below the minimum grade threshold and presented lateral continuity between sections, internal waste solids were modelled. For consideration of any domain (grade shell or internal waste domains), at least five metres of grade continuity was taken.

A lithological model was also created in the Chapada deposit, which was separated by lithostratigraphic units. All blocks were flagged with their respective lithological codes and geological domain units in the block model to provide a geological base to the mine planning.

In Suruca, the lithological model was separated by weathering profile units in the Oxide domain and by lithostratigraphic units in the Sulphide domain; geomechanical information was also taken into consideration during Oxide domain modelling.

The Suruca gold grade shell modelling criteria is based on the Oxide domain using a 0.1 g/t Au minimum grade threshold for the low grade domain and 0.18 g/t Au as minimum grade threshold for the high grade domain (Figure 14-4). In the Sulphide domain, a 0.2 g/t Au minimum grade threshold was used. In the Suruca Sulphide SW domain, a 0.1 g/t Au minimum grade threshold was used for the low grade domain and 0.2 g/t Au minimum grade threshold was used for the high grade domain. The copper grade shell modelled for the Oxide domain uses a 0.1% Cu minimum grade threshold. In the Sulphide SW domain, a 0.1% Cu minimum grade threshold was used for the low grade domain and a 0.2% Cu minimum grade threshold was used for high grade domain.

In areas within the grade shell modelling where gold grades were below the minimum grade threshold but presented lateral continuity of a minimum of five metres, internal waste solids were modelled.

The topography surface used in the models was developed from topographic points collected in the field with a total station survey instrument and by topographic restitution. The surface was interpolated using Micromine considering all collar information from the drill holes to reproduce the primitive topography surface.

A detailed topography was collected using 3D Laser Scanning (Triangulation Irregular Network – TDN) to produce an as-mined pit surface as of June 30, 2019. The block model was reported between this surface and the resource pit shell (Figure 14-5).

RPA is of the opinion that the geological interpretations for Chapada and Suruca are suitable to support Mineral Resource estimation and meet industry standards.

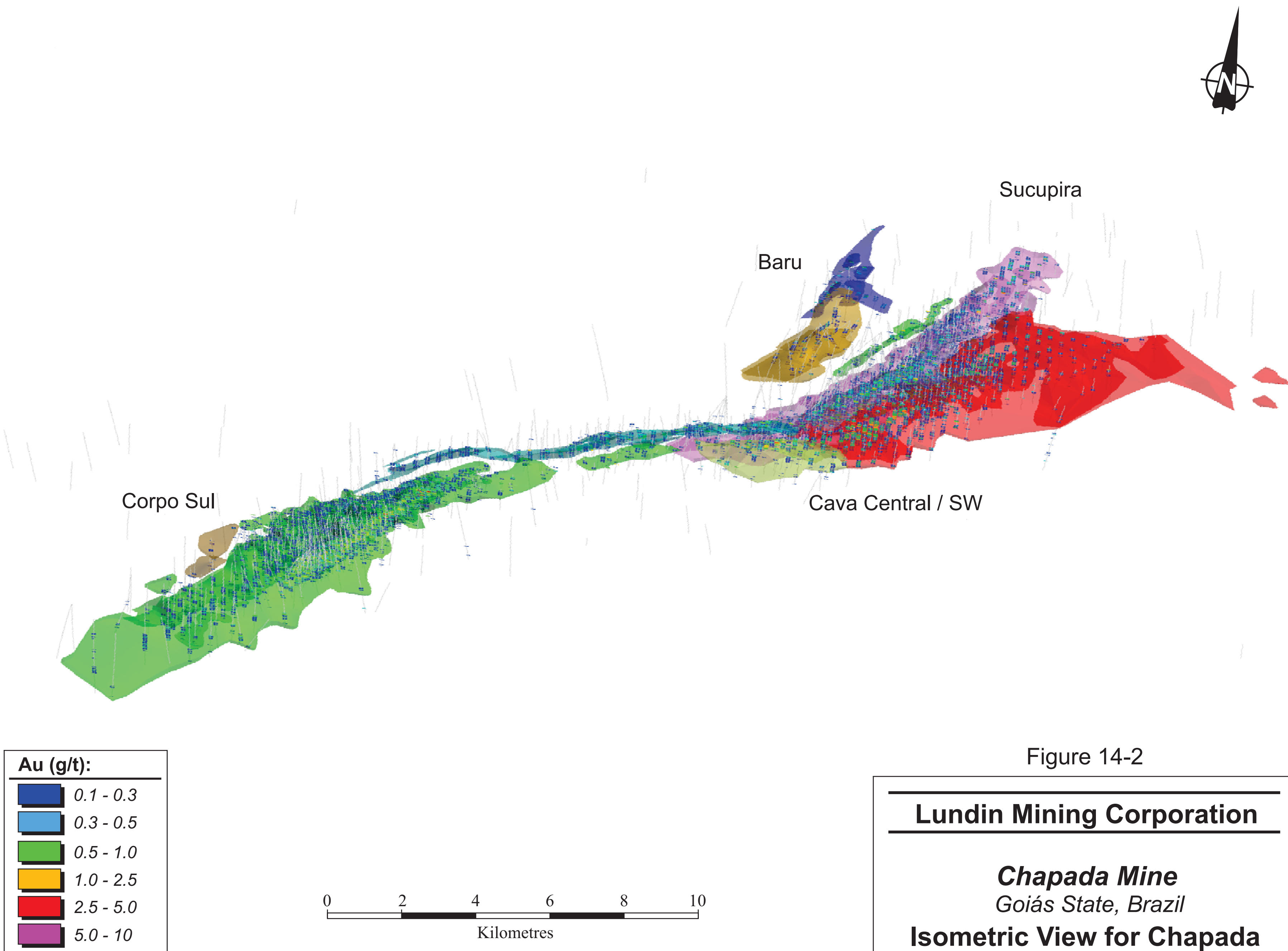


Figure 14-2

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Isometric View for Chapada

October 2019

Source: RPA, 2019.

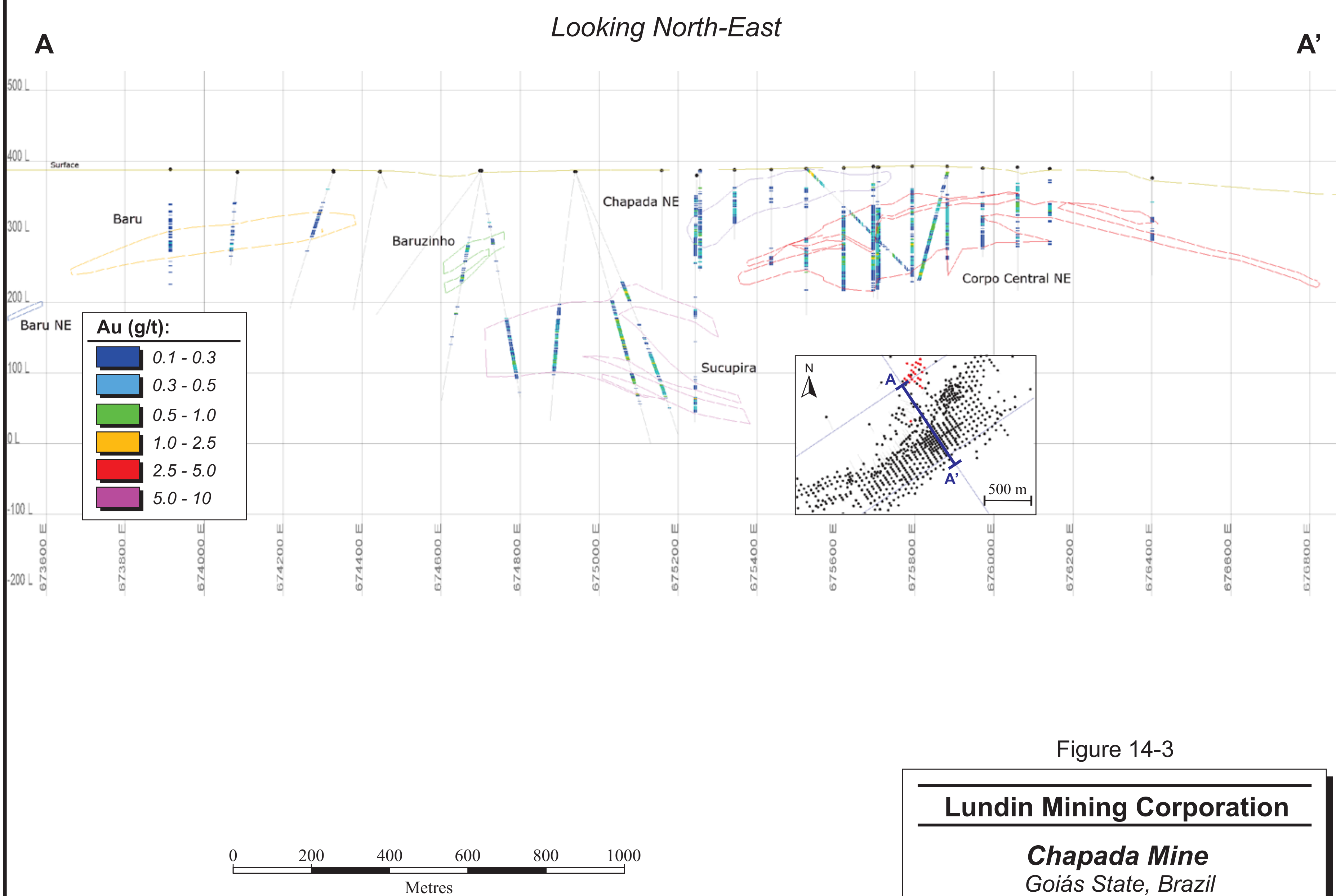


Figure 14-3

Lundin Mining Corporation

Chapada Mine

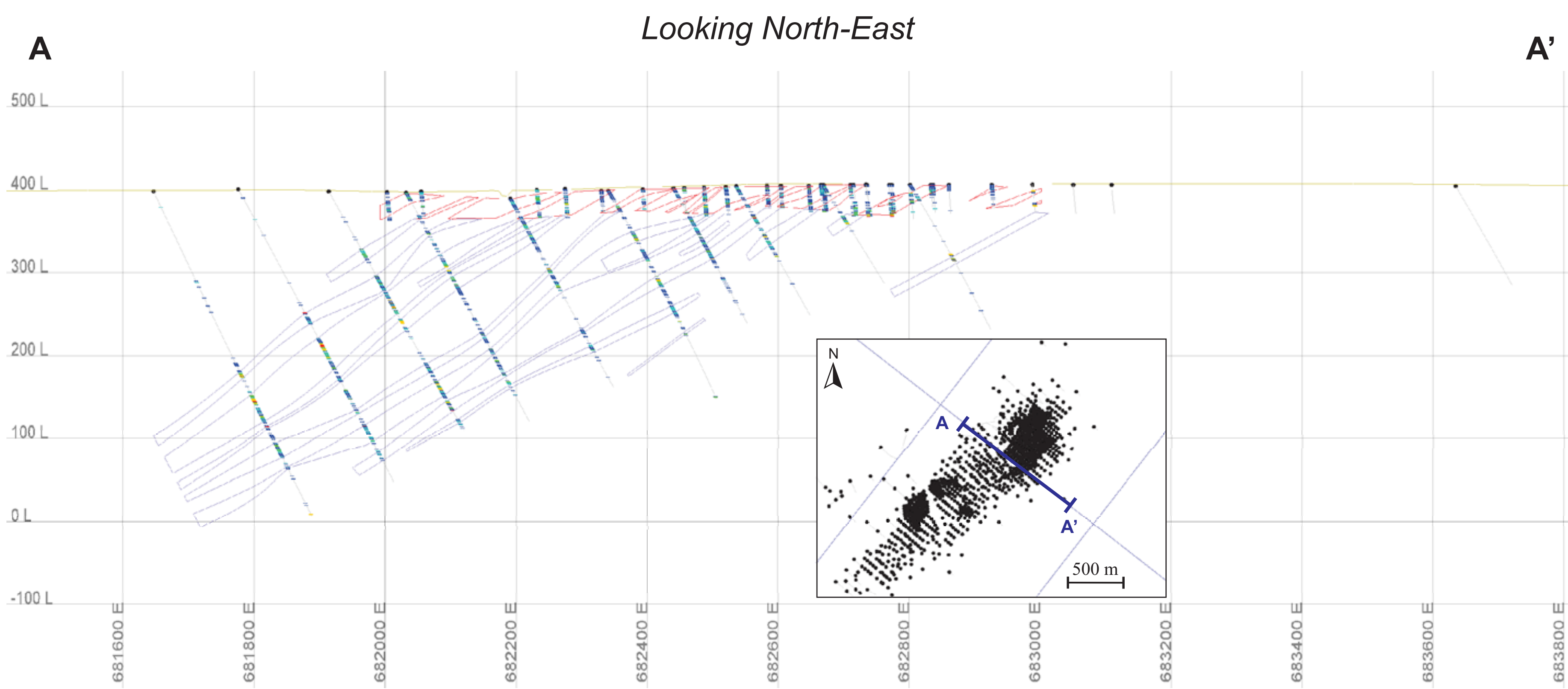
Goiás State, Brazil

Typical Vertical Section Through Chapada

October 2019

Source: RPA, 2019.

www.rpacan.com



Au (g/t):

- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.5
- 2.5 - 5.0
- 5.0 - 10

0 100 200 300 400 500
Metres

Figure 14-4

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

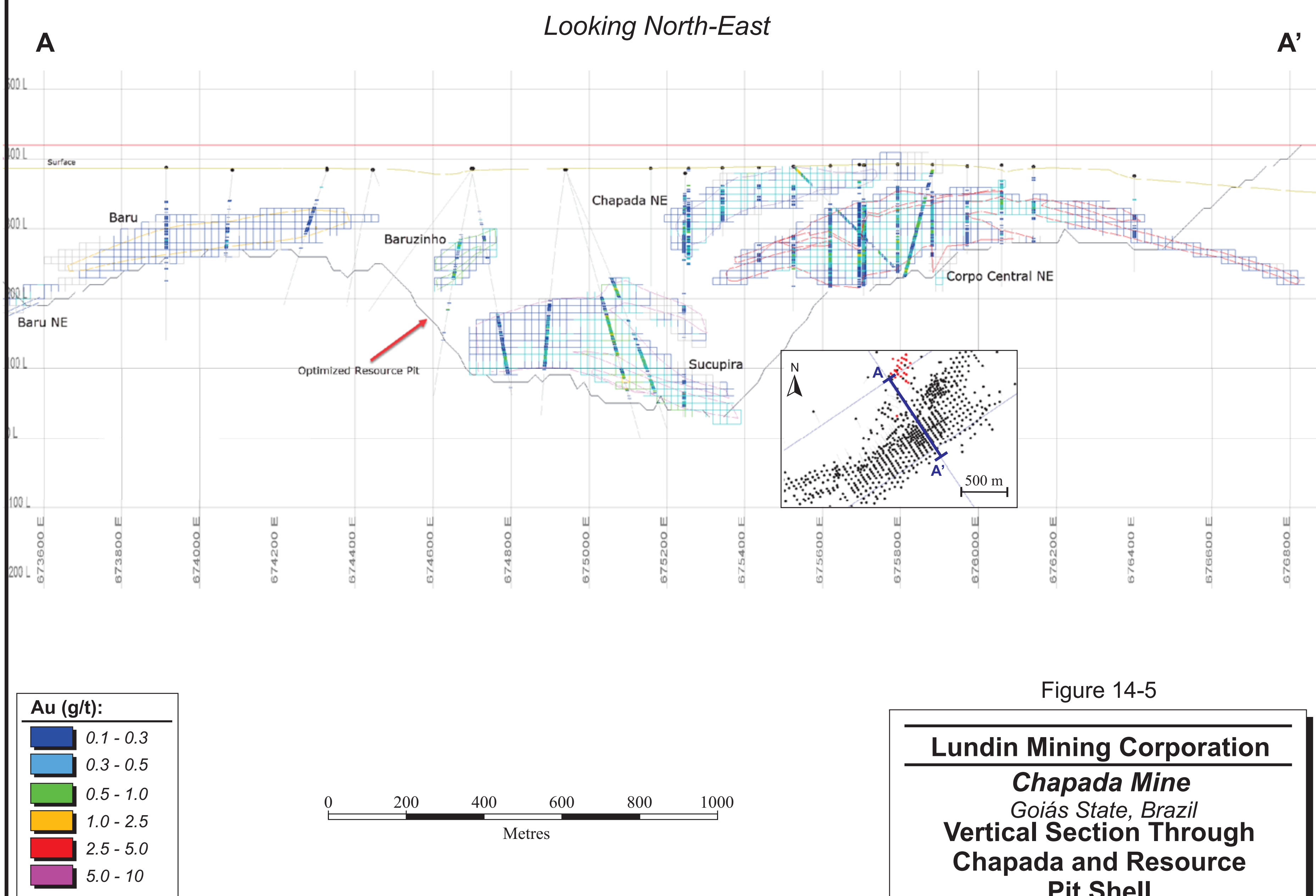
Typical Vertical Section Through Suruca

October 2019

Source: RPA, 2019.

RPA

www.rpacan.com



October 2019

Source: RPA, 2019.

Figure 14-5

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Vertical Section Through Chapada and Resource Pit Shell

RAW ASSAYS

For Chapada and Suruca, Lundin performed statistical analysis for the drill hole intercepts that occurred within the individual deposits, litho-structural wireframes, alteration (oxide vs. sulphide), and grade shells. For Suruca, statistical analysis on raw assays was performed on two domains, the Au domain, and the Cu/Au domain.

The univariate statistical analyses are summarized in Table 14-3.

TABLE 14-3 SUMMARIZED RAW STATISTICS
Lundin Mining Corporation – Chapada Mine

Gold (g/t)

Deposit	Target	Count	Min	Max	Mean	Variance	StDev	CV
Chapada	Corpo Sul	25,703	0.00	5.68	0.19	0.07	0.26	1.34
Chapada	Cana Norte / Sucupira	12,052	0.00	4.46	0.27	0.10	0.31	1.14
Chapada	Cava Central	10,862	0.00	15.38	0.30	0.11	0.33	1.10
Chapada	SW Mina - North	2,978	0.00	24.02	0.32	0.28	0.53	1.66
Chapada	SW Mina - South	2,402	0.00	1.78	0.22	0.03	0.17	0.79
Chapada	Baru NE	1,553	0.00	1.67	0.17	0.02	0.14	0.84
Chapada	Santa Cruz	420	0.01	0.74	0.15	0.01	0.09	0.64
Suruca	SW - HG	1,143	0.00	2.65	0.28	0.03	0.17	0.59
Suruca	SW - LG	4,005	0.00	24.80	0.15	0.18	0.42	2.71
Suruca	Au	7,676	0.00	82.80	0.55	2.89	1.70	3.10
Suruca	HG	9,950	0.01	296.00	0.47	10.96	3.31	7.11
Suruca	LG	8,205	0.00	2.51	0.13	0.01	0.08	0.61

Copper (%)

Deposit	Deposit	Count	Min	Max	Mean	Variance	StDev	CV
Chapada	Corpo Sul	25,703	0.00	2.54	0.26	0.03	0.18	0.68
Chapada	Cana Norte / Sucupira	23,352	0.00	2.60	0.26	0.04	0.21	0.79
Chapada	Cava Central	17,004	0.00	4.52	0.31	0.07	0.26	0.83
Chapada	SW Mina - North	9,195	0.00	4.60	0.24	0.04	0.20	0.84
Chapada	SW Mina - South	9,195	0.00	4.60	0.24	0.04	0.20	0.84
Chapada	Baru NE	4,793	0.00	2.92	0.22	0.05	0.22	1.00
Chapada	Santa Cruz	1,893	0.01	1.51	0.21	0.02	0.14	0.70
Suruca	SW - HG	1,447	0.00	0.91	0.26	0.01	0.11	0.43
Suruca	SW - LG	4,060	0.00	1.07	0.14	0.00	0.07	0.49
Suruca	Au	0	0.00	0.00	0.00	0.00	0.00	0.00
Suruca	HG	0	0.00	0.00	0.00	0.00	0.00	0.00
Suruca	LG	0	0.00	0.00	0.00	0.00	0.00	0.00

Source: Lundin 2019

Notes:
1. The statistics presented in the table have been summarized by Lundin and reviewed by RPA for reporting purposes. The average grades are weighted by the number of records in each domain sub-set and variances are the result of pooled variances for all rock types within the domain population.

COMPOSITING AND EXPLORATORY DATA ANALYSIS

A composite length of two metre was selected for Chapada Corpo Principal and Corpo Sul. For Suruca, sample composites used a half bench value of 2.5 m in the oxide domain and 2.0 m composites in the sulphide domain.

The statistics were analyzed by individualizing the samples inside each of the grade shell domains. STR is the raw data from drill holes. RLG is the 2.0 m composited samples from the drill hole database. A summary of the composite statistics is given in Table 14-4.

RPA has reviewed the compositing strategy and resulting composites and is of the opinion that the composites are adequate to support the June 30, 2019 Mineral Resource estimation.

TABLE 14-4 SUMMARIZED COMPOSITE STATISTICS
Lundin Mining Corporation – Chapada Mine

Gold (g/t)

Deposit	Target	Grade Shell	Count		Min		Max		Mean		Var		StDev		CV	
			STR	RLG	STR	RLG	STR	RLG	STR	RLG	STR	RLG	STR	RLG	STR	RLG
Chapada	Corpo Sul	Sulphide	25,703	21,952	0.00	0.00	5.68	4.97	0.19	0.20	0.07	0.07	0.26	0.26	1.34	1.29
Chapada	Cana Norte / Sucupira	Sulphide	12,052	7,228	0.00	0.00	4.46	4.40	0.27	0.27	0.10	0.08	0.31	0.28	1.14	1.05
Chapada	Cava Central	Sulphide	10,862	8,207	0.00	0.00	15.38	7.86	0.30	0.30	0.11	0.08	0.33	0.28	1.10	0.92
Chapada	SW Mina - North	Sulphide	2,978	2,050	0.00	0.00	24.02	12.55	0.32	0.32	0.28	0.18	0.53	0.43	1.66	1.32
Chapada	SW Mina - South	Sulphide	2,402	1,710	0.00	0.00	1.78	1.46	0.22	0.22	0.03	0.03	0.17	0.16	0.79	0.71
Chapada	Baru NE	Sulphide	1,553	681	0.00	0.00	1.67	0.80	0.17	0.17	0.02	0.01	0.14	0.11	0.84	0.69
Chapada	Santa Cruz	Sulphide	420	211	0.01	0.01	0.74	0.72	0.15	0.15	0.01	0.01	0.09	0.09	0.64	0.58
Suruca	Au	Sulphide	7,676	3,878	0.00	0.01	82.80	82.27	0.55	0.57	2.89	2.89	1.70	1.70	3.10	3.01
Suruca	SW - HG	Sulphide	1,143	588	0.00	0.03	2.65	1.68	0.28	0.28	0.03	0.02	0.17	0.13	0.59	0.47
Suruca	SW - LG	Sulphide	4,005	2,033	0.00	0.00	24.80	10.26	0.15	0.15	0.18	0.06	0.42	0.25	2.71	1.62
Suruca	HG	Oxide	9,950	4,131	0.01	0.01	296.00	76.55	0.47	0.46	10.96	2.53	3.31	1.59	7.11	3.47
Suruca	LG	Oxide	8,205	3,666	0.00	0.00	2.51	1.58	0.13	0.13	0.01	0.00	0.08	0.06	0.61	0.44

Copper (%)

Deposit	Target	Grade Shell	Count		Min		Max		Mean		Var		StDev		CV	
			STR	RLG	STR	RLG	STR	RLG	STR	RLG	STR	RLG	STR	RLG	STR	RLG
Chapada	Corpo Sul	Sulphide	25,703	21,952	0.00	0.00	2.54	2.47	0.26	0.26	0.03	0.03	0.18	0.17	0.68	0.64
Chapada	Cana Norte / Sucupira	Sulphide	23,352	13,829	0.00	0.00	2.60	2.10	0.26	0.27	0.04	0.04	0.21	0.19	0.79	0.72
Chapada	Cava Central	Sulphide	17,004	12,717	0.00	0.00	4.52	3.20	0.31	0.31	0.07	0.06	0.26	0.24	0.83	0.77
Chapada	SW Mina - North	Sulphide	9,195	6,361	0.00	0.00	4.60	3.45	0.24	0.24	0.04	0.04	0.20	0.19	0.84	0.79
Chapada	SW Mina - South	Sulphide	9,195	6,361	0.00	0.00	4.60	3.45	0.24	0.24	0.04	0.04	0.20	0.19	0.84	0.79
Chapada	Baru NE	Sulphide	4,793	2,123	0.00	0.00	2.92	1.90	0.22	0.22	0.05	0.04	0.22	0.20	1.00	0.90
Chapada	Santa Cruz	Sulphide	1,893	918	0.01	0.01	1.51	1.01	0.21	0.21	0.02	0.02	0.14	0.13	0.70	0.63
Suruca	SW - HG	Sulphide	1,447	741	0.00	0.01	0.91	0.66	0.26	0.26	0.01	0.01	0.11	0.09	0.43	0.34
Suruca	SW - LG	Sulphide	4,060	2,070	0.00	0.00	1.07	0.92	0.14	0.14	0.00	0.00	0.07	0.06	0.49	0.40

Source: Lundin 2019

Notes:
1. The statistics presented in the table have been summarized by LMC and reviewed RPA for reporting purposes. The average grades are weighted by the number of records in each domain sub-set and variances are the result of pooled variances for all rock types within the domain population.

RPA is of the opinion that the exhaustive statistical analysis performed at Chapada is good practice. The information gathered provides an understanding of how the statistical characteristics of domains are related to the geological controls on mineralization. Subsequent to the composite statistical analysis, variography and estimation were performed on these segregated distributions.

OUTLIER TREATMENT

Metal grade distributions are commonly positively skewed and contain a small proportion of samples which account for a disproportionate amount of the total contained metal. While these potentially outlying values are in many cases actual measurements of the contained metal within a sample, estimation of larger block volumes using these extreme values may result in block grades that are not likely achievable in any given mining scenario. One method of treating these outliers in order to reduce their influence on the average grade is to cut or cap them at a specific grade level. In the absence of production data to calibrate the cutting level, inspection of the assay distribution can be used to estimate a first pass cutting level. A second method to reduce the influence of very high grade composites is to restrict the search ellipsoid dimensions on grades greater than a designated threshold level, commonly set to 50% range of the first pass search ellipse dimensions.

Statistical analysis was performed on the data, testing for the presence of high grade outliers. After compositing the assays, a combination of histograms and probability plots were used to identify outliers and to determine capping thresholds on a per domain basis. To limit the influence of these anomalous values over the estimation, a top cut and an ellipsoid restriction were applied. The capping thresholds used are summarized in Table 14-5.

TABLE 14-5 CHAPADA AND SURUCA CAPPING
Lundin Mining Corporation – Chapada Mine

Deposit	Target	Grade Shell	Top Cut		HG Threshold		
			Au (g/t)	Cu (%)	Au (g/t)	Cu (%)	Ellipsoid Dimension
Chapada	Corpo Sul	Sulphide	2.12	1.35	0.6	0.6	50 m x 50 m x 50 m
Chapada	Corpo Sul	Mix	2.03	1.40	0.6	0.6	50 m x 50 m x 50 m
Chapada	Corpo Sul	Oxide	1.04	1.00	0.6	0.6	50 m x 50 m x 50 m
Chapada	Cava Norte / Sucupira	Sulphide	2.20	1.60	1.85	1.20	110 m x 110 m x 10 m
Chapada	Cava Norte / Sucupira	Oxide	0.70	0.50	0.70	0.50	110 m x 110 m x 10 m
Chapada	Cava Norte / Sucupira	Barren	0.20	0.20	0.20	0.20	110 m x 110 m x 10 m
Chapada	Cava Central	Sulphide	1.75	1.50	1.75	1.5	60 m x 55 m x 10 m
Chapada	SW Mina - North	Sulphide	1.80	1.40	1.75	1.4	60 m x 55 m x 10 m
Chapada	SW Mina - South	Sulphide	1.00	1.40	1	1.4	60 m x 55 m x 10 m
Chapada	Baru NE	Sulphide	0.80	1.90	0.8	1.9	110 m x 110 m x 10 m
Chapada	Baru NE	Oxide	0.50	1.10	0.5	1.1	110 m x 110 m x 10 m
Chapada	Baru NE	Barren	0.40	0.30	0.4	0.3	110 m x 110 m x 10 m
Chapada	Santa Cruz	Santa Cruz	0.45	0.85	-	-	-
Suruca	Au	Sulphide - Au	5.00	-	5.00	-	110 m x 60 m x 10 m
Suruca	SW - HG	Sulphide - SW - HG	0.75	0.55	0.75	0.55	110 m x 60 m x 10 m
Suruca	SW - LG	Sulphide - SW - LG	0.50	0.35	0.50	0.35	110 m x 60 m x 10 m
Suruca	Barren	Sulphide - Barren	0.25	0.15	-	-	-
Suruca	SW - HG	Oxide - HG	3.90	0.50	3.90	0.50	50 m x 40 m x 5 m
Suruca	SW - LG	Oxide - LG	0.45	0.50	0.45	0.50	50 m x 40 m x 5 m
Suruca	Barren	Oxide - Barren	0.25	0.12	-	-	-

Source: Lundin 2019

RPA has reviewed the capping grades used during estimation and is of the opinion that they are appropriate for resource estimation. RPA also recommends that assays be capped prior to compositing as opposed to capping composites.

DENSITY

Bulk density measurements were conducted at the Project site on drill core samples. Details of the bulk density study is given in Section 11 of this report. The bulk densities used during tonnage estimation are averages for fine saprolite (oxide), coarse saprolite (mix), and hard rock. The following specific gravities (Table 14-6) were applied to block volumes for tonnage estimations:

TABLE 14-6 BULK DENSITY
Lundin Mining Corporation – Chapada Mine

Chapada: Oxidation Zone	Cava Central / SW	Corpo Sul	Sucupira	Baru NE	Santa Cruz
Oxide	1.85	1.64	1.64	1.64	1.69
Mix	2.35	2.35	2.35	2.35	1.98
Hard Rock	2.74	2.75	2.76	2.76	2.68

Suruca:	Oxide Domain					Sulphide Domain		
	Soil	Mottled Zone	Fine Saprolite	Coarse Saporlite	Alterated Rock	Sulphide	MTS	ANF
Density	1.472	1.397	1.581	2.066	2.273	2.824	2.838	2.915
CV	0.12	0.11	0.20	0.18	0.14	0.05	0.06	0.03
Estimated	YES	YES	YES	YES	YES	NO	NO	NO

Source: Lundin 2019

VARIOGRAPHY

Experimental variograms were calculated on composites divided up by litho-structural domains (Cava Central, Cava Norte, Sucupira, Corpo Sul, and Suruca), grade shell (Cava Central, Cava Norte, Sucupira, Corpo Sul, and Suruca) and oxidation domain (Suruca) for copper and gold separately. Variograms were calculated using non-standardized traditional variogram formulations. The nugget effect was fit to downhole variograms and anisotropy was determined from directional variograms. The results of the variography were interpreted as directions of geological continuity. In the absence of meaningful semi-major experimental variograms, omni-directional variograms were calculated to model the major and semi-major directions. The variogram models generated were used to guide search ranges and rotations (Table 14-7).

TABLE 14-7 VARIOGRAM PARAMETERS CHAPADA - COPPER AND GOLD
Lundin Mining Corporation – Chapada Mine

Copper

Domain	Az (°)	Plunge (°)	Dip (°)	Nugget	Structure 1 Type	Sill	Az Axis (m)	Dip Axis (m)	Thickness Axis (m)	Structure 2 Type	Sill	Az Axis (m)	Dip Axis (m)	Thickness Axis (m)	Structure 3 Type	Sill	Az Axis (m)	Dip Axis (m)	Thickness Axis (m)
Cava Central	55	0	0	0.26	Spherical	0.09	44	26	25	Spherical	0.65	214	120	62	-	-	-	-	-
SW Mina - North	55	0	0	0.33	Spherical	0.44	32	40	18	Spherical	0.23	170	150	50	-	-	-	-	-
SW Mina - South	75	0	30	0.26	Spherical	0.74	182	76	58	-	-	-	-	-	-	-	-	-	-
Corpo Sul - Oxide	55	0	0	0.06	Spherical	0.47	210	140	20	Spherical	0.58	1000	350	20	-	-	-	-	-
Corpo Sul - Mix	55	0	-10	0.006	Spherical	0.02	90	60	46	Spherical	0.0025	450	130	46	Spherical	0	450	250	46
Corpo Sul - Sulphide	55	10	-10	0.005	Spherical	0.01	40	30	25	Spherical	0.0115	125	70	55	Spherical	0	500	130	55
Sucupira - Sulphide	235	0	-10	0.009	Spherical	0.03	70	40	37	Spherical	0.006	170	60	37	-	-	-	-	-
Baru NE	20	0	-10	0.33	Spherical	0.48	135	80	25	Spherical	0.19	350	120	40	-	-	-	-	-
Santa Cruz	40	0	39	0.15	Spherical	0.5	170	100	8	Spherical	0.4	220	150	58	-	-	-	-	-
Suruca Sulphide SW HG	40	0	30	0.25	Spherical	0.4	82	75	3.5	Spherical	0.35	120	100	9.5					
Suruca Sulphide SW LG	40	0	30	0.3	Spherical	0.43	78	48	4	Spherical	0.27	120	98	10					

Gold

Domain	Az (°)	Plunge (°)	Dip (°)	Nugget	Structure 1 Type	Sill	Az Axis (m)	Dip Axis (m)	Thickness Axis (m)	Structure 2 Type	Sill	Az Axis (m)	Dip Axis (m)	Thickness Axis (m)	Structure 3 Type	Sill	Az Axis (m)	Dip Axis (m)	Thickness Axis (m)
Suruca Oxide HG - Au	130	23	0	0.15	Spherical	0.25	30	20	2.5	Spherical	0.6	70	31	6.4	-	-	-	-	-
Suruca Oxide LG - Au	40	0	23	0.35	Spherical	0.2	72	30	2.8	Spherical	0.45	118	65	6	-	-	-	-	-
Suruca Sulphide Au	310	-30	0	0.1	Spherical	0.4	60	45	1.5	Spherical	0.5	92	72	5.8	-	-	-	-	-
Suruca Sulphide SW HG - Au	40	0	30	0.1	Spherical	0.29	100	23.5	2.8	Spherical	0.61	130	44	13.6	-	-	-	-	-
Suruca Sulphide SW LG - Au	40	0	30	0.4	Spherical	0.39	120	60	2.8	Spherical	0.21	140	95	14	-	-	-	-	-
Suruca Sulphide SW HG - Cu	40	0	30	0.25	Spherical	0.4	82	75	3.5	Spherical	0.35	120	100	9.5					
Suruca Sulphide SW LG - Cu	40	0	30	0.3	Spherical	0.43	78	48	4	Spherical	0.27	120	98	10					

Source: Lundin 2019

BLOCK MODEL

Block models measuring ten metres in each direction were generated in Minesight for Chapada (Cava Central, Cava Norte, Corpo Sul, and Sucupira) and five metres in each direction were generated for Suruca deposits. Blocks were flagged by litho-structural domain, grade shell and oxidation domain and were clipped to the original and surveyed as-mined topographic surfaces. A summary of the two block models is provided in Table 14-8.

TABLE 14-8 CHAPADA AND SURUCA BLOCK MODEL DEFINITIONS
Lundin Mining Corporation – Chapada Mine

Parameter	Chapada	Suruca	Santa Cruz
X Size (m)	10	5	5
Y Size (m)	10	5	5
Z Size (m)	10	5	5
X Origin	670,500	680,800	666,000
Y Origin	8,420,000	8,426,900	8,421,100
Z Origin	-280	-200	0
X Offset	105,000	4,500	3,600
Y Offset	4,000	2,200	1,000
Z Offset	750	950	400
Azimuth Rotation	56	40	90

Source: Lundin 2019

GRADE INTERPOLATION

Block grades were estimated using Ordinary Kriging (OK) in areas where sufficient composites were available to produce reliable variograms. In the absence of reliable variograms, block estimates were performed using Inverse Distance to the third power (ID^3).

For Chapada and Suruca, the general estimation strategy is as follows:

1. Search rotations are the same as variogram rotations.
2. Search ranges for the first pass correspond to variogram range of the total sill.
3. Second search pass is twice the variogram range and third is two to four times the variogram range.
4. Minimum of three samples per estimate for all passes.
5. Maximum of 16 to 20 samples per estimate.
6. Maximum of four samples per hole.

7. Equal discretization in each direction, with five points.

For Suruca, hard boundaries between modelled mineralization (grade shells) and waste, both internal and external, were used during interpolation. The Suruca interpolation parameters are summarized in Table 14-9.

TABLE 14-9 SURUCA INTERPOLATION PARAMETERS
Lundin Mining Corporation – Chapada Mine

Copper:

Variable	Zone	Estimation Pass	Search Direction			Search Distance			Samples		
			Bearing	Plunge	DIP	Major	Semi	Minor	Minimum	Maximum	Maximum per Octant
Sulphide	Corpo Sul - Au and Cu	1	Dynamic Search			55	55	5	8	32	4
		2	Dynamic Search			110	55	10	8	32	4
		3	Dynamic Search			110	110	10	8	32	4
		4	Dynamic Search			240	220	50	4	8	-
		5	Dynamic Search			500	400	80	4	8	-
	CN Sucupira - Au and Cu	1	Dynamic Search			55	55	5	8	32	4
		2	Dynamic Search			110	55	10	8	32	4
		3	Dynamic Search			110	110	10	8	32	4
		4	Dynamic Search			240	220	50	4	8	-
		5	Dynamic Search			500	400	80	4	8	-
	Cava Central - Au and Cu	1	Dynamic Search			60	55	10	8	16	4
		2	Dynamic Search			110	105	20	8	16	4
		3	Dynamic Search			110	105	30	4	15	3
		4	Dynamic Search			220	210	50	2	8	-
	SW Mina North - Au and Cu	1	Dynamic Search			60	55	10	8	16	4
		2	Dynamic Search			110	105	20	8	16	4
		3	Dynamic Search			110	105	30	4	15	3
		4	Dynamic Search			220	210	50	2	8	-
	SW Mina South - Au and Cu	1	Dynamic Search			110	100	10	6	16	4
		2	Dynamic Search			110	100	15	6	16	4
		3	Dynamic Search			220	210	30	4	15	3
		4	Dynamic Search			250	220	50	2	8	-
	Baru NE - Au and Cu	1	Dynamic Search			55	55	5	5	32	4
		2	Dynamic Search			110	55	10	8	32	4
		3	Dynamic Search			110	110	10	8	32	4
		4	Dynamic Search			240	220	50	4	12	3
		5	Dynamic Search			500	400	80	4	8	-
	Santa Cruz - Au	1	50	0	0	250	150	20	3	20	3
		2	50	0	0	300	200	30	3	20	3
		3	50	0	0	350	250	40	2	20	-
		4	50	0	0	500	300	50	2	15	-
	Santa Cruz - Cu	1	50	0	0	200	100	20	3	20	3
		2	50	0	0	400	200	40	3	20	3
		3	50	0	0	1000	600	100	2	20	-
		4	50	0	0	2500	200	300	1	15	-

Gold:

Variable	Zone	Estimation Pass	Search Direction			Search Distance			Samples		
			Bearing	Plunge	DIP	Major	Semi	Minor	Minimum	Maximum	Maximum per Octant
Au	Suruca Oxide – Grade Shell Au	1	130	23	0	50	40	5	6	16	4
		2	130	23	0	60	50	10	6	16	4
		3	130	23	0	80	60	15	5	15	3
		4	130	23	0	150	120	30	2	9	3
	Suruca Sulphide - Grade Shell Au	1	Dynamic Search			110	60	10	6	16	4
		2	Dynamic Search			150	80	15	6	16	4
		3	Dynamic Search			180	100	20	5	15	3
		4	Dynamic Search			200	110	30	2	9	3
	Suruca Sulphide SW - Grade Shell Au	1	Dynamic Search			110	60	10	6	16	4
		2	Dynamic Search			150	80	15	6	16	4
		3	Dynamic Search			180	100	20	5	15	3
		4	Dynamic Search			200	110	30	2	9	3
	Suruca Oxide - Waste Domain Au	3	130	23	0	80	60	15	5	15	3
		4	130	23	0	300	240	50	2	9	3
	Suruca Sulphide - Waste Domain Au	3	40	0	30	180	100	20	5	15	3
		4	40	0	30	400	220	50	2	9	3
Cu	Suruca Oxide - Grade Shell Cu	1	130	25	0	50	40	5	6	16	4
		2	130	25	0	60	50	10	6	16	4
		3	130	25	0	80	60	15	5	15	3
		4	130	25	0	150	120	30	2	9	3
	Suruca Oxide - Waste Domain Cu	3	130	25	0	80	60	15	5	15	3
		4	130	25	0	300	240	50	2	9	3
	Suruca Sulphide SW - Grade Shell Cu	1	Dynamic Search			110	60	10	6	16	4
		2	Dynamic Search			150	80	15	6	16	4
		3	Dynamic Search			180	100	20	5	15	3
		4	Dynamic Search			200	110	30	2	9	3
	Suruca Sulphide - Waste Domain Cu	3	40	0	30	180	100	20	5	15	3
		4	40	0	30	400	220	50	2	9	3

Source: Lundin 2019

RPA reviewed the interpolation strategy adopted for Chapada and Suruca and is of the opinion that it is adequate to support Mineral Resource estimation.

BLOCK MODEL VALIDATION

The following methods were used to validate the block models:

- Visual inspection of block grades versus composites
- Swath plots of the Ordinary Kriged estimates versus Nearest Neighbour estimates (Figures 14-7 to 14-10)
- Comparisons between composite and global block statistics.

RPA has reviewed the validation procedures adopted and is of the opinion that the methodology has followed industry standard procedures, performing rigorous validation of the block models generated. Swath plots and visual comparisons of blocks to samples show good reproduction of the local mean. The cross-validation plots are demonstrating that the estimation parameters are successfully minimizing the error variance and that there is no significant conditional bias being introduced.

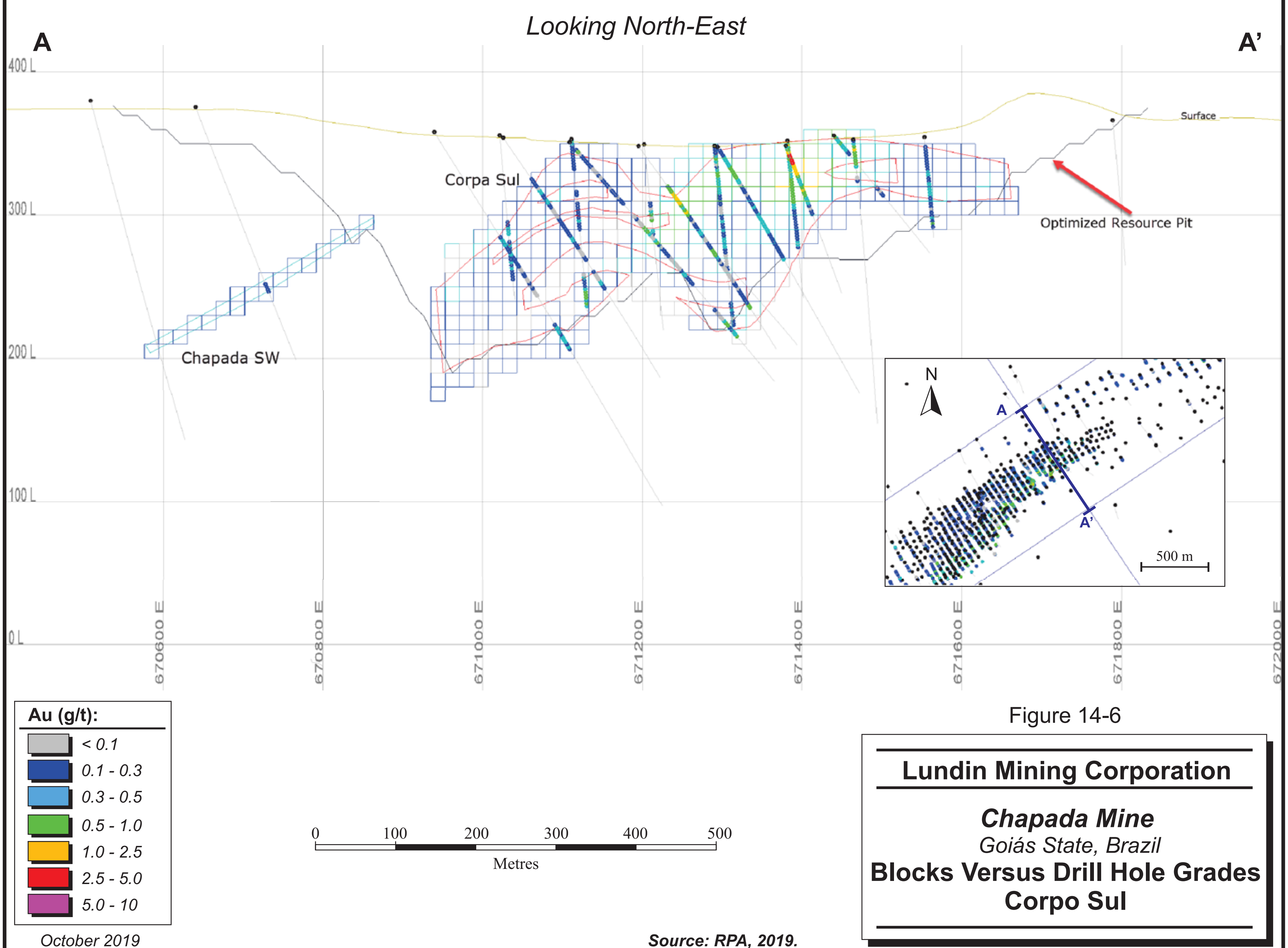


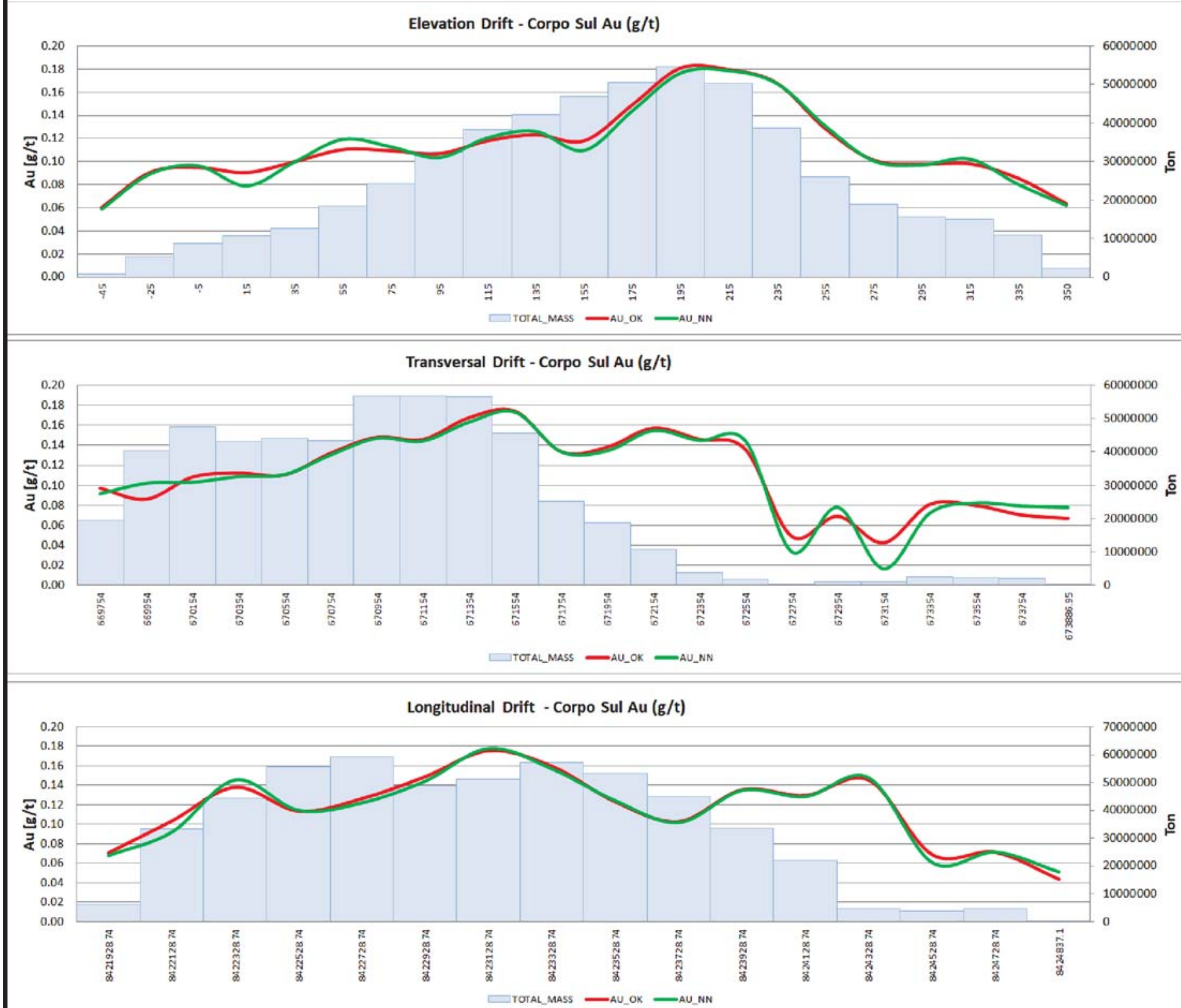
Figure 14-6

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Blocks Versus Drill Hole Grades
Corpo Sul



Au_Mean_X	NN_Mean_X	Difference (%)
0.112	0.110	1.291

Au_Mean_Y	NN_Mean_Y	Difference (%)
0.116	0.115	0.911

Au_Mean_Z	NN_Mean_Z	Difference (%)
0.113	0.112	0.679

Figure 14-7

Lundin Mining Corporation

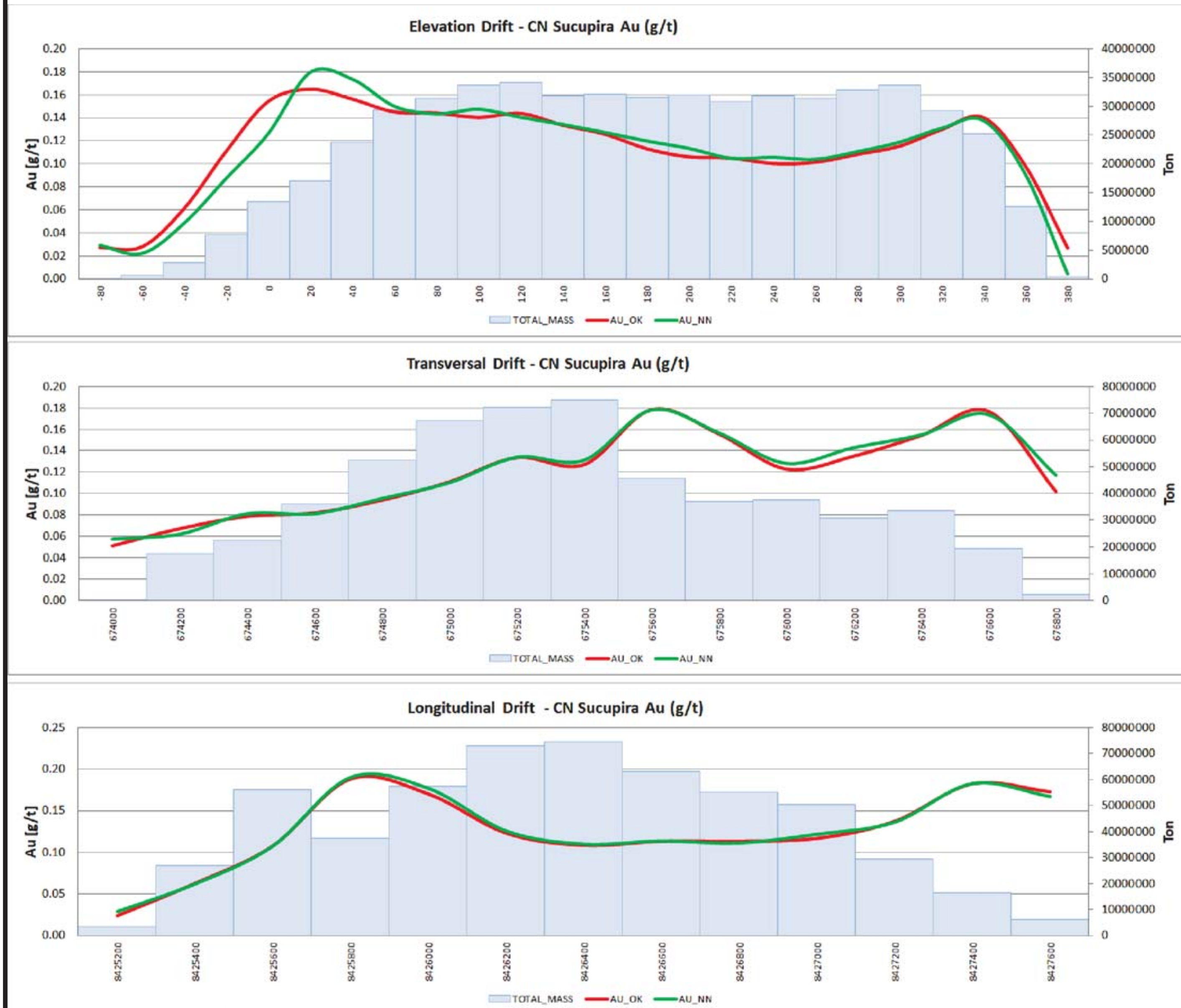
Chapada Mine

Goiás State, Brazil

Swath Plot of OK Versus NN Block Values - Au - Corpo Sul

October 2019

Source: Lundin, 2019.



Au_Mean_X	NN_Mean_X	Difference (%)
0.118	0.121	-2.042

Au_Mean_Y	NN_Mean_Y	Difference (%)
0.125	0.126	-0.848

Au_Mean_Z	NN_Mean_Z	Difference (%)
0.112	0.110	1.555

Figure 14-8

Lundin Mining Corporation

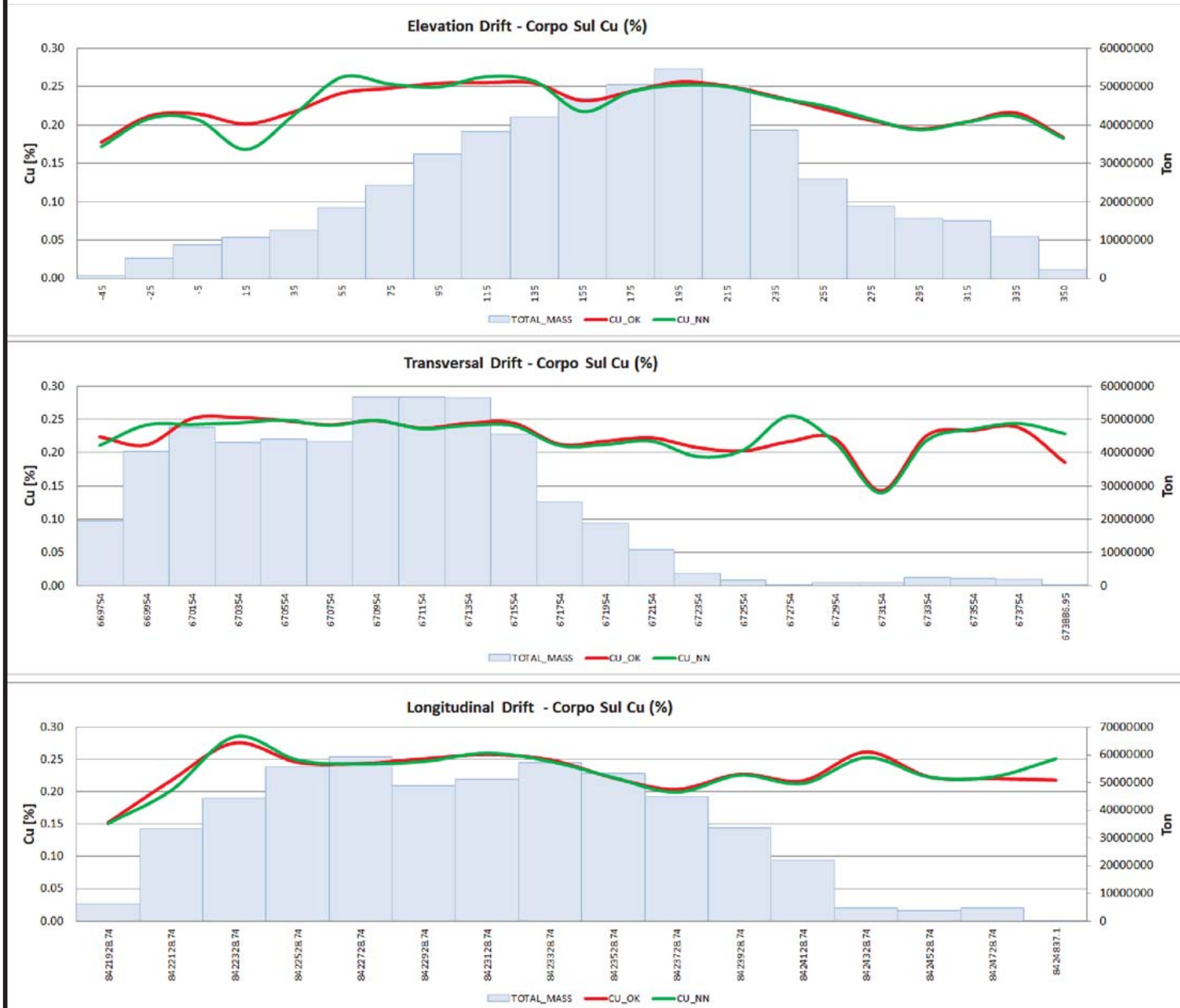
Chapada Mine

Goiás State, Brazil

Swath Plot of OK Versus NN Block Values - Au - Sucupira

October 2019

Source: Lundin, 2019.



Cu_Mean_X	NN_Mean_X	Difference (%)
0.224	0.226	-0.693

Cu_Mean_Y	NN_Mean_Y	Difference (%)
0.230	0.231	-0.106

Cu_Mean_Z	NN_Mean_Z	Difference (%)
0.225	0.223	1.017

Figure 14-9

Lundin Mining Corporation

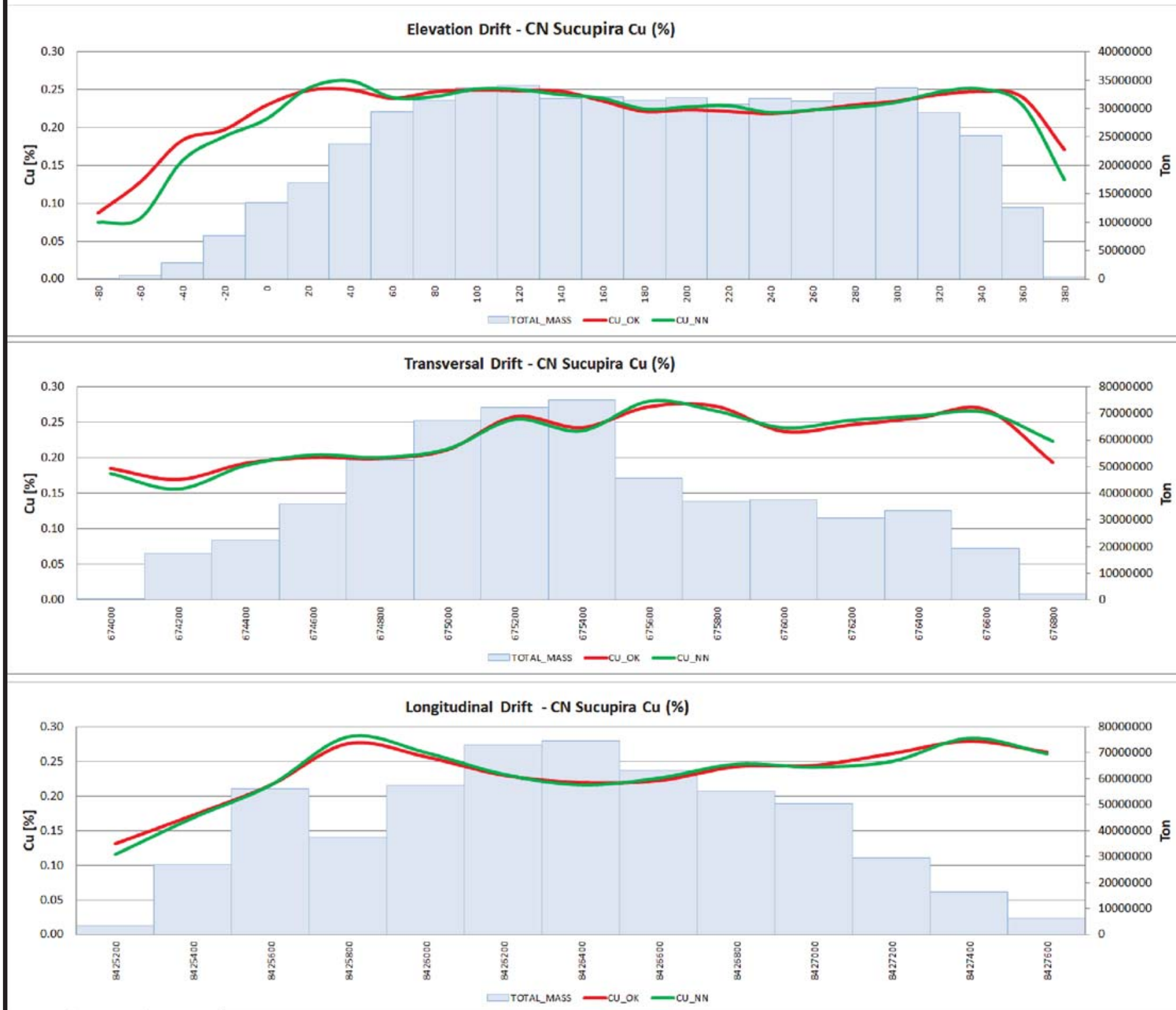
Chapada Mine

Goiás State, Brazil

Swath Plot of OK Versus NN Block Values - Cu - Corpo Sul

October 2019

Source: Lundin, 2019.



Cu_Mean_X	NN_Mean_X	Difference (%)
0.227	0.228	-0.781

Cu_Mean_Y	NN_Mean_Y	Difference (%)
0.232	0.231	0.414

Cu_Mean_Z	NN_Mean_Z	Difference (%)
0.219	0.214	2.527

Figure 14-10

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Swath Plot of OK Versus NN Block Values - Cu - Sucupira

October 2019

Source: Lundin, 2019.

CUT-OFF GRADE AND OPTIMIZED PIT SHELL

For Chapada, the June 30, 2019 Mineral Resources were constrained by an optimized pit shell based on metal prices of $1,600/oz Au and $4.00/lb Cu. Sulphide Mineral Resources were reported using a variable NSR marginal cut-off value averaging approximately $4.08/t (Table 14-10). For Suruca, Mineral Resources are estimated at a cut-off grade of 0.16 g/t Au for Oxide and 0.23 g/t for Sulphide (Table 14-11).

TABLE 14-10 NSR PARAMETERS - CHAPADA
Lundin Mining Corporation – Chapada Mine

Description	Unit	Cost/Price
Copper Price	$/lb	4.00
Gold Price	$/oz	1,600
Exchange Rate	R$/US$	3.95
Average Mining Cost	$/t	1.82
Mining Cost Soil Material	$/t	1.4
Mining Cost Blasted Material	$/t	1.84
Incremental Mining Cost	$/t 10m Bench	0.026
Rehandling Cost	$/t	0.92
Processing + G&A + Sustaining Capex	$/t	4.08
Processing Cost	$/t	3.17
G&A Cost	$/t	0.49
Sustaining Capex	$/t	0.41
Smelter Payable Copper	%	95.7%
Smelter Payable Gold	%	93.3%
Copper Smelter, Refining, Freight	$/lb	0.63
Gold Refining	$/oz	4.47
Copper CFEM	% of Gross	2.00
Gold CEFEM	% of Gross	2.00
Streaming Deal	Inf	No
NSR Discounted Cut-off	**$/t**	**4.08**

Notes:
1. Numbers may not add due to rounding.

Lundin recently purchased the Chapada operations and RPA recommends that the copper and gold prices used for Mineral Resources estimate be reviewed to apply similar prices as other Lundin operations.

TABLE 14-11 NSR PARAMETERS - SURUCA
Lundin Mining Corporation – Chapada Mine

Description	Unit	Cost/Price
Gold Price	$/oz	1,600
Gold Payable	%	99.0%
Oxide Ore Mining Cost	$/t	1.55
Sulphide Ore Mining Cost	$/t	2.10
Soil Waste Mining Cost	$/t	1.55
Rock Waste Mining Cost	$/t	2.10
Incremental Mining Cost	$/t	N/A
Heap Leach Processing Cost	$/t	5.01
CIL Processing Cost	$/t	8.79
G&A Cost	$/t	0.56
Oxide Metallurgical Recovery	%	85%
Sulphide Metallurgical Recovery	%	88%
Cut-off Oxide Ore - Resources	**g/t**	**0.16**
Cut-off Sulphide Ore - Resources	**g/t**	**0.23**

Notes:
1. Numbers may not add due to rounding.
2. Exchange Rate: 3.95 R$/US$
3. Carbon in leach (CIL)

RPA is of the opinion that the cut-off grades and NSR cut-off values are reasonable.

CLASSIFICATION

Chapada classification criteria was based on the Relative Standard Error (RSE) determined by scaling the kriging error in OK production panels to the coefficient of variation of the underlying composite distribution. The method makes use of theoretical sample grids at different spacing to determine a number of RSE values which are scaled to quarterly or annual production volumes. The acceptance criteria are as follows:

- Measured Resources should have grades estimated with ±15% relative accuracy on a quarterly production panel at 90% confidence.
- Indicated Resources should have grades estimated with ±15% relative accuracy on an annual production panel at 90% confidence.

The following classification criteria were followed for Chapada and Suruca:

- Measured Resources:
  - For Chapada, Suruca Sulphide, and Suruca SW - Drill spacing 50 m X 50 m with an average distance between samples and block of less than 50 m and a minimum of two drill holes used in block estimate.

  - For Suruca Oxide - Drill spacing of 35 m x 35 m with an average distance between samples and block of less than 50 m and a minimum of three drill holes used in block estimate

- Indicated Resources:
  - For Chapada, Suruca Sulphide, and Suruca SW - Drill spacing 100 m X100 m with an average distance between samples and block of less than 100 m and a minimum of two drill holes used in block estimate.
  - For Suruca Oxide - Drill spacing of 100 m x 50 m with an average distance between samples and block of less than 100 m and a minimum of two drill holes used in block estimate

- Inferred Resources:
  - For Chapada, Suruca Sulphide, and Suruca SW - Drill spacing 200 m X 200 m with an average distance between samples and block of less than 200 m and a minimum of two drill holes used in block estimate.
  - For Suruca Oxide - Drill spacing of 200 m x 200 m with an average distance between samples and block of less than 200 m and a minimum of two drill holes used in block estimate

Figure 14-11 shows the classification for Suruca for both sulphide and oxide domains.

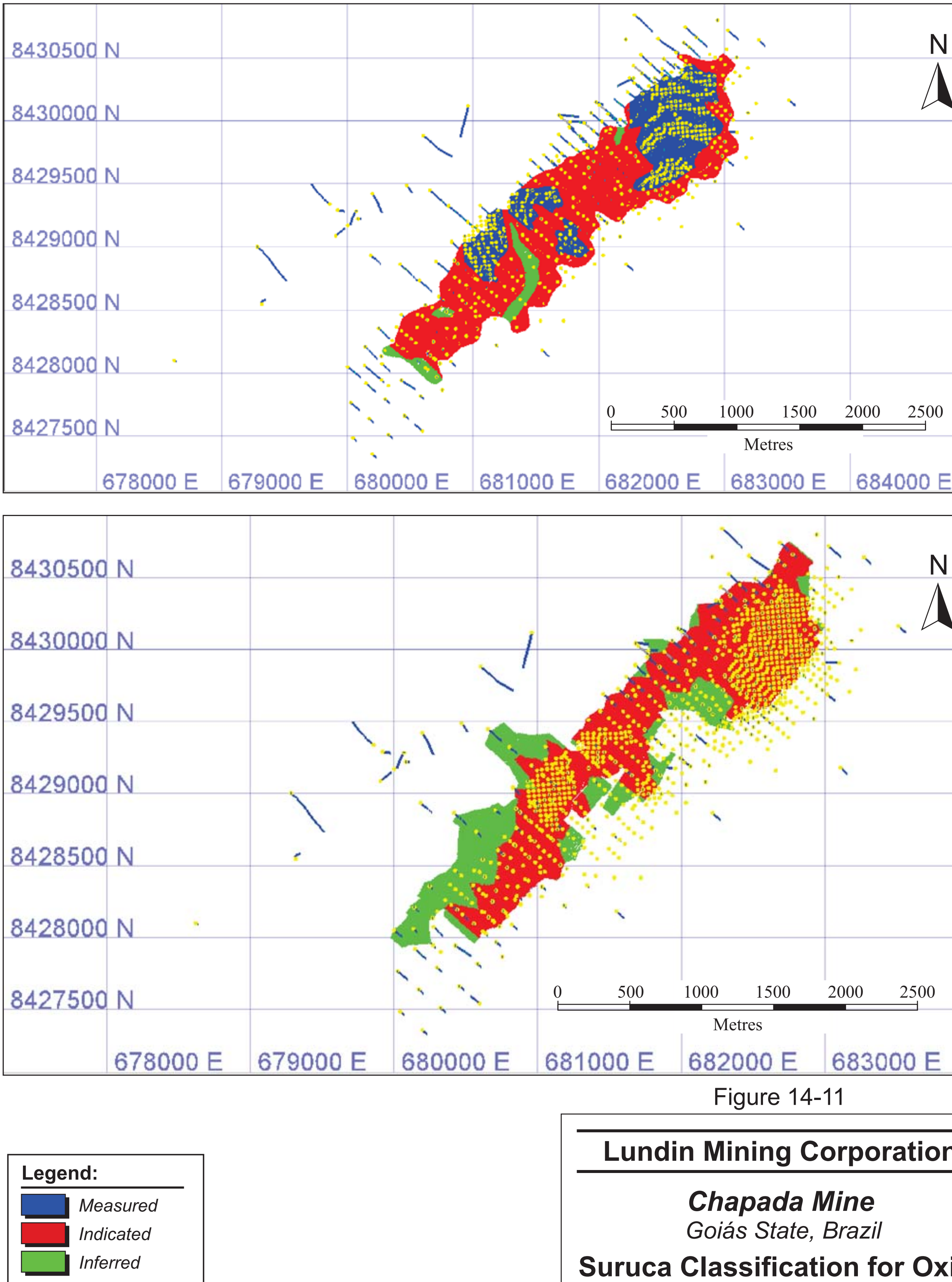


Figure 14-11

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Suruca Classification for Oxide and Sulphide Domains

October 2019

Source: RPA, 2018.

Classification for Chapada, Suruca Sulphide, and Suruca SW was based on a 50 m by 50 m drill pattern for the Measured Mineral Resources, 100 m by 100 m drill pattern for Indicated, and 200 m by 200 m drill pattern for Inferred. For Suruca Oxide, classification was based on a 35 m by 35 m drill pattern for Measured Mineral Resources, 100 m by 50 m for Indicated, and 200 m by 200 m drill pattern for Inferred.

The drill spacing and classification criteria were applied to Chapada and Corpo Sul deposits by designating areas as Measured, Indicated, and Inferred using wireframes to ensure the classification did not contain nonsensical isolated categorized blocks amongst different categories.

RPA has reviewed the criteria for classification and the classification designations and is of the opinion that the block classification designations appear reasonable. It is not plausible for there to be a lower estimation accuracy at a higher drilling density.

RPA is of the opinion that the Chapada and Suruca Mineral Resource classification criteria and designation are reasonable.

MINERAL RESOURCES

The June 30, 2019 Mineral Resources for Chapada and Suruca Mine are reported as per the Mineral Resource estimation methodologies and classification criteria detailed herein. Table 14-12 summarizes the Mineral Resources inclusive of Mineral Reserves by deposit.

TABLE 14-12 MINERAL RESOURCES - JUNE 30, 2019
Lundin Mining Corporation – Chapada Mine

Category	Deposit	Tonnes (000 t)	Cu (%)	Au (g/t)	Contained Cu (000 t)	Contained Au (Moz)
Copper/Gold						
Measured						
	Baru	0	0.00	0.00	0	0.00
	Baruzinho	461	0.21	0.16	1	0.00
	Cava Central	63,248	0.22	0.14	139	0.28
	Corpo Sul	161,109	0.24	0.14	385	0.75
	Outros	1,145	0.28	0.22	3	0.01
	Sucupira	91,850	0.28	0.18	255	0.52
	SW	11,134	0.22	0.23	25	0.08

Category	Deposit	Tonnes (000 t)	Cu (%)	Au (g/t)	Contained Cu (000 t)	Contained Au (Moz)
	Santa Cruz	0	0.00	0.00	0	0.00
	Suruca	0	0.00	0.00	0	0.00
Sub-Total	**Measured**	**328,948**	**0.25**	**0.16**	**807**	**1.60**
	Measured-Stockpiles	**107,488**	**0.22**	**0.16**	**234**	**0.50**
Indicated	Baru	70,141	0.22	0.08	157	0.18
	Baruzinho	9,284	0.18	0.15	17	0.04
	Cava Central	67,895	0.22	0.11	148	0.25
	Corpo Sul	182,377	0.25	0.13	459	0.77
	Outros	73	0.27	0.13	0	0.00
	Sucupira	158,775	0.27	0.16	421	0.82
	SW	93,959	0.25	0.16	238	0.49
	Santa Cruz	0	0.00	0.00	0	0.00
	Suruca	71,889	0.15	0.22	108	0.51
Sub-Total	**Indicated**	**654,393**	**0.24**	**0.15**	**1,549**	**3.10**
Total	**Measured + Indicated**	**1,090,829**	**0.24**	**0.15**	**2,590**	**5.20**
Inferred	Baru	35,911	0.22	0.06	81	0.1
	Baruzinho	4,654	0.13	0.05	6	0.0
	Cava Central	15,383	0.21	0.11	32	0.1
	Corpo Sul	38,869	0.26	0.11	99	0.1
	Outros	8	0.14	0.04	0	0.0
	Sucupira	1,929	0.21	0.11	4	0.0
	SW	524	0.20	0.09	1	0.0
	Santa Cruz	65,037	0.21	0.06	136	0.1
	Suruca	453	0.09	0.27	0	0.0
Sub-Total	**Inferred**	**162,769**	**0.22**	**0.08**	**360**	**0.4**
Gold Only						
Measured	Suruca	12,737	0.00	0.42	0	0.20
Indicated	Suruca	134,780	0.00	0.54	0	2.30
Total	**Measured + Indicated**	**147,518**	**0.00**	**0.53**	**0**	**2.50**
Inferred	**Suruca**	**12,565**	**0.00**	**0.48**	**0**	**0.2**

Notes:

1. CIM (2014) definitions were followed for Mineral Resources.
2. Chapada and Suruca SW copper/gold Mineral Resources are estimated at an NSR cut-off value of US$4.08/t.
3. Suruca, Mineral Resources are estimated at a cut-off grade of 0.16 g/t Au for oxide material and 0.23 g/t for sulphide material.
4. Mineral Resources are estimated using a long-term gold price of US$1,600/oz and a long-term copper price of US$4.00/lb.
5. Mineral Resources at Chapada are constrained by an optimized pit and the June 2019 topographic surface.
6. Mineral Resources are inclusive of Mineral Reserves.
7. Chapada copper/gold includes resources estimates from Cava Central/SW, Corpo Sul, Sucupira, Baru NE, Santa Cruz and Suruca SW.

8. Chapada Suruca gold only includes resource estimates from Suruca Oxide and Suruca Sulphide.
9. Numbers may not add due to rounding.

RPA has reviewed the following items and finds the estimation methods and classification criteria adopted by Lundin are reasonable and sufficient to support the Mineral Resources reported:

- The resource database
- The geological interpretations
- Exploratory data analysis
- Composites and compositing strategy
- Capping grades applied
- Bulk density
- Variography
- Block model parameters
- Interpolation strategy
- Classification criteria determination and designation

15 MINERAL RESERVE ESTIMATE

The Mineral Resource estimates discussed in Section 14 were prepared using industry standard methods and provide an acceptable representation of the deposit. RPA reviewed the reported Mineral Resources, production schedules, and factors for conversion from Mineral Resources to Mineral Reserves. Based on this review, RPA is of the opinion that the Measured and Indicated Mineral Resources within the final pit designs at Chapada can be classified as Proven and Probable Mineral Reserves.

The Mineral Reserves for the Project, as of June 30, 2019, are summarized in Table 15-1.

TABLE 15-1 CHAPADA MINERAL RESERVES - JUNE 30, 2019
Lundin Mining Corporation - Chapada Mine

Deposit	Category	Tonnes (000 t)	Cu (%)	Au (g/t)	Contained Cu (000 t)	Contained Au (Moz)
Copper/Gold						
Chapada	Proven	292,446	0.24	0.16	706	1.46
	Proven – Stockpile	107,448	0.22	0.16	234	0.50
	Probable	338,855	0.24	0.14	817	1.52
Sub-Total	**Proven & Probable**	**738,789**	**0.24**	**0.15**	**1,757**	**3.52**
Gold Only						
Suruca	Proven	11,454		0.42		0.15
	Probable	53,741		0.53		0.92
Sub-Total	**Proven & Probable**	**65,195**		**0.51**		**1.07**

Notes:

1. CIM (2014) definitions were followed for Mineral Reserves.
2. Chapada copper/gold Mineral Reserves are estimated at an NSR cut-off value of $4.08/t.
3. Chapada copper/gold Mineral Reserves are estimated using an average long-term gold price of US$1,250/oz and a long-term copper price of $3.00/lb.
4. Suruca gold only Mineral Reserves are estimated at a cut-off grade of 0.19 g/t Au for oxide material and 0.30 g/t Au for sulphide material.
5. Suruca oxide and Suruca sulphide Mineral Reserves are estimated using an average long-term gold price of US$1,250/oz.
6. Numbers may not add due to rounding.

Table 15-2 presents the Suruca oxide and sulphide reserves.

TABLE 15-2 SURUCA MINERAL RESERVES - JUNE 30, 2019
Lundin Mining Corporation - Chapada Mine

Deposit	Category	Tonnes (000 t)	Cu (%)	Au (g/t)	Contained Cu (000 t)	Contained Au (Moz)
Gold Only						
Suruca Oxide	Proven	10,761		0.41		0.14
	Probable	11,765		0.41		0.16
Sub-Total Oxide	**Proven & Probable**	**22,526**		**0.41**		**0.30**
Suruca Sulphide	Proven	692		0.49		0.01
	Probable	41,976		0.56		0.75
Sub-Total Sulphide	**Proven & Probable**	**42,669**		**0.56**		**0.76**
Total Suruca	**Proven & Probable**	**65,195**		**0.51**		**1.07**

Notes:

1. CIM (2014) definitions were followed for Mineral Reserves.
2. Suruca gold only Mineral Reserves are estimated at a cut-off grade of 0.19 g/t Au for oxide material and 0.30 g/t Au for sulphide material.
3. Suruca oxide and Suruca sulphide Mineral Reserves are estimated using an average long-term gold price of US$1,250/oz.
4. Numbers may not add due to rounding.

The June 30, 2019 copper/gold Mineral Reserves at Chapada have increased slightly over those reported at December 31, 2018 primarily as a result of new open pit optimizations completed on the Baru NE and Sucupira SW orebodies offset by mining depletion over the intervening six months.

DILUTION AND ORE LOSS

Chapada Mineral Resources are converted to Mineral Reserves using modifying factors to account for mining dilution and ore recovery. A dilution factor of 5% is applied to each block and an extraction factor based on historical reconciliation data.

For Suruca Oxide Mineral Reserves, dilution and mining recovery were included by regularizing the block model to a selective mining unit (SMU) of 10 m by 10 m. Suruca Sulphide Mineral Resources are factored by 5% mining dilution at zero grade and a mining extraction factor of 95% is applied for conversion to Mineral Reserves.

CUT-OFF GRADE

The cut-off for Chapada copper-gold Mineral Reserves is applied to the NSR value of each block. The parameters used for calculating the NSR cut-off value are listed in Table 15-3.

TABLE 15-3 NSR PARAMETERS
Lundin Mining Corporation – Chapada Mine

Description	Unit	Cost/Price
Copper Price	$/lb	3.00
Gold Price	$/oz	1,250
Average Mining Cost – Soft Rock	$/t	1.40
Average Mining Cost – Hard Rock	$/t	1.84
Mining – Incremental Cost	$/t/10m	0.026
Processing	**$/t**	**4.08**
Processing	$/t	3.17
G&A	$/t	0.49
Sustaining Capex	$/t	0.41
Average Plant Copper Recovery	%	83.03%
Average Plant Gold Recovery	%	56.96%
Smelter Payable Copper	%	95.74%
Smelter Payable Gold	%	93.27%
Copper Smelter, Refining, Freight	$/lb	0.63
Gold Refining	$/oz	4.47
Copper Royalty, Sales Taxes	% of Gross	2.0%
Gold Royalty	% of Gross	2.0%

Notes:
1. Numbers may not add due to rounding.
2. Exchange Rate: 3.95 R$/US$

The NSR formula is as follows:

$$NSR\ (\$/t) = \frac{(Copper\ Revenue\ (\$) + Gold\ Revenue(\$)) - Offsite\ Costs\ (\$)}{Block\ Tonnes}$$

The cut-off value of $4.08 is calculated using the following formula:

$$Cut\text{-}off\ Value\ (\$/t) = Processing\ Cost(\$/t) + G\&A\ Cost\ (\$/t)$$

For the Suruca open pit, the cut-off grade is 0.19 g/t Au for oxide material and 0.30 g/t Au for sulphide material.

RECONCILIATION

Mill feed production is compared to the Mineral Reserve model for the volume mined from January to June 2019 (Table 15-4).

TABLE 15-4 JANUARY - JUNE 2019 MINE TO PLANT RECONCILIATION
Lundin Mining Corporation - Chapada Mine

	Tonnes (000 t)	Grade		Metal	
		Au (g/t)	Cu (%)	Au (oz)	Cu (t)
Mineral Reserve Model	11,605	0.221	0.290	82,488	33,698
Adjusted Production	11,223	0.234	0.293	84,437	32,910
Difference (%)	-3.29%	+5.85%	+0.99%	+2.36%	-2.34%

Overall, the Mineral Reserve model predicted more tonnes and slightly lower grades than was mined between January and June 2019, however, the predicted and produced amounts of gold and copper metal are very similar, which substantiates the Mineral Reserve estimate at Chapada.

16 MINING METHODS

The LOM plan includes two main open pit mining areas to be developed on the property, Chapada and Suruca. Production is entirely from Chapada, including the Corpo Principal, Cava Norte, and Corpo Sul pits. These pits are planned to eventually join into a single pit and Sucupira pit is planned as an additional series of pushbacks. The Suruca mining area includes Suruca Oxide and Suruca Sulphide gold Mineral Reserves.

The Project is located in gently undulating terrain at elevations between 340 MASL and 400 MASL. The Chapada open pit has ultimate design dimensions of approximately eight kilometres along strike, up to 1.5 km wide, and 380 m deep. The Suruca open pit will be located approximately seven kilometres northeast of the Chapada open pit, and about two kilometres east of the town of Alto Horizonte. Final pit dimensions for Suruca will be approximately two kilometres along strike and about one kilometre wide.

The processing plant is located at the northwest end of the Chapada pit rim. The TSF is located to the northwest of the Chapada open pit, with the pond as close as 0.5 km to the pit rim and the tailings dam being up to five kilometres to the northwest.

The LOM production schedule is based on the Mineral Reserve statement in Section 15 of this report. There is potential to upgrade some areas of the Inferred Mineral Resources to Indicated or Measured Mineral Resources and then convert these Mineral Resources to Mineral Reserves. In addition, significant local exploration potential exists for the discovery of further Mineral Resources.

GROUND CONDITIONS/SLOPE STABILITY

Yamana has had independent consultants conduct a geotechnical characterization study of Chapada rock slopes where the main items addressed are:

- The geotechnical mapping of the pit;
- The geotechnical description of the drill core samples;
- The geotechnical classification of the rock mass;
- The relevant structural features;

- Analysis and selection of the geotechnical parameters that are to be adopted.

The characterization study was used to classify the rock masses and determine the geotechnical parameters for pit slopes. The slope design recommendations for the Cava Norte, Corpo Principal, Cava SW, and Corpo Sul pits are listed in Tables 16-1, 16-2, 16-3, and 16-4 respectively. The geotechnical sectors corresponding to these recommendations are illustrated in Figures 16-1, 16-2, 16-3, and 16-4. A complete geotechnical analysis for Sucupira was completed in 2018.

The slope design recommendations are divided into the following geotechnical classifications:

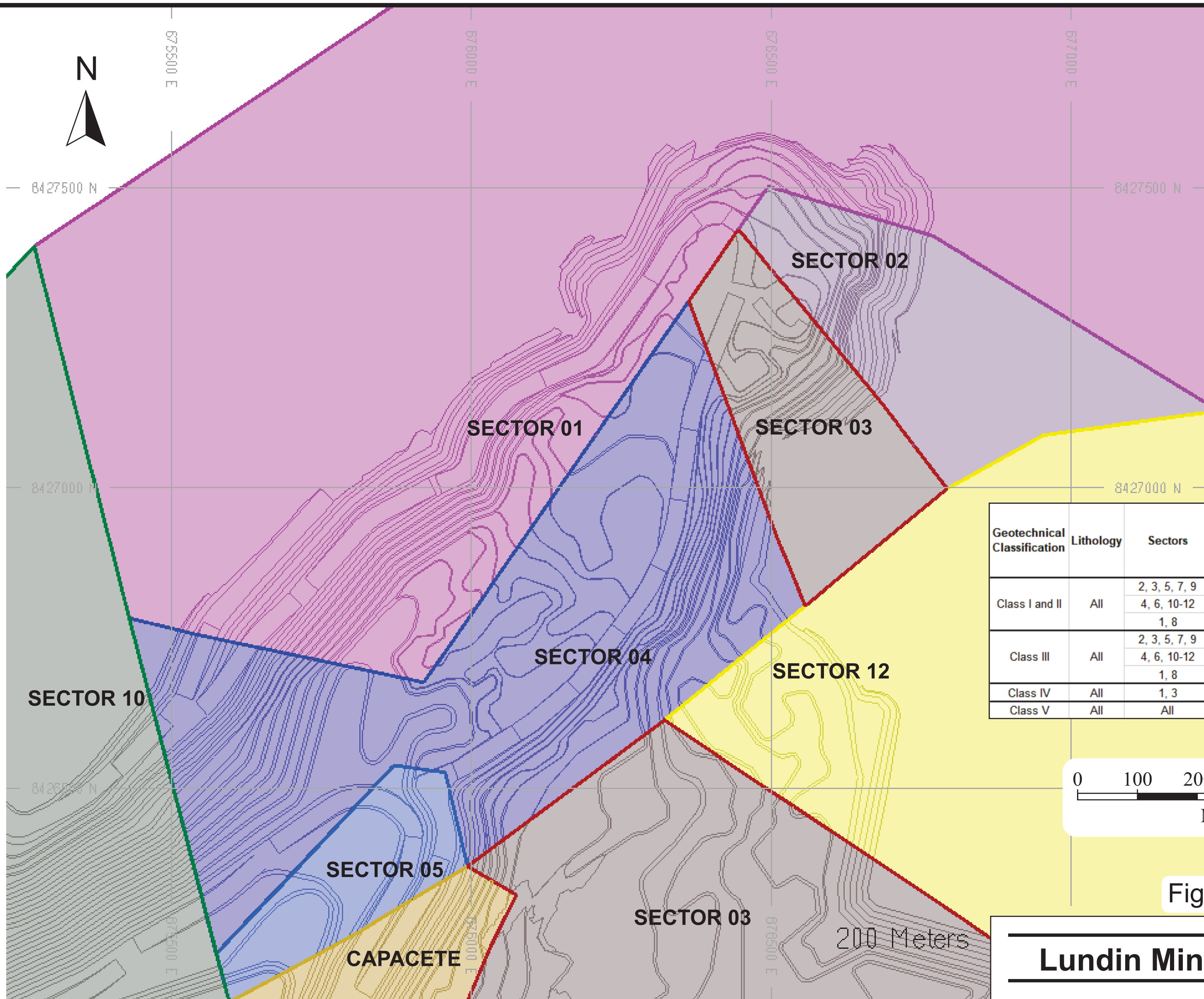
- I-II Slightly fractured rock (very good and good rock quality)
- III Slightly altered and moderately fractured (regular rock quality)
- IV Highly altered and fractured (poor rock quality)
- V Soil and completely altered and fractured (very poor rock quality)

TABLE 16-1 CAVA NORTE SLOPE DESIGN RECOMMENDATIONS
Lundin Mining Corporation - Chapada Mine

Geotechnical Classification	Lithology	Sectors	Benches Bench Height (m)	Benches Berm Width (m)	Max. Face Angle (°)	Inter-ramp Max. Height (m)	Inter-ramp Max. Angle (°)	Safety Berm (m)
Class I and II	All	1, 3, 5	20	8.5	80	100	59	15
		2, 4	20	8.5	85	100	63	
Class III	All	1, 3, 5	20	8.5	80	100	59	
		2, 4	20	8.5	85	100	63	
Class IV	All	1, 3	10	7.0	75	100	55	
		2, 4, 5	20	7.0	75	100	55	
Class V	All	All	10	7.0	40	50	28	

TABLE 16-2 CORPO PRINCIPAL SLOPE DESIGN RECOMMENDATIONS
Lundin Mining Corporation - Chapada Mine

Geotechnical Classification	Lithology	Sectors	Benches Bench Height (m)	Benches Berm Width (m)	Max. Face Angle (°)	Inter-ramp Max. Angle (°)
Class I and II	All	2, 3, 5, 7, 9	20	10.0	75	52
		4, 6, 10-12	20	8.0	70	53
		1, 8	10	7.0	75	46
Class III	All	2, 3, 5, 7, 9	20	10.0	75	52
		4, 6, 10-12	20	8.0	70	53
		1, 8	10	7.0	75	46
Class IV	All	1, 3	10	7.0	65	41
Class V	All	All	10	7.0	45	30



Geotechnical Classification	Lithology	Sectors	Benches			Inter-ramp	GEOTC
			Bench Height (m)	Berm Width (m)	Max. Face Angle (°)	Max. Angle (°)	
Class I and II	All	2, 3, 5, 7, 9	20	10	75	52	52
		4, 6, 10-12	20	8	70	53	52
		1, 8	10	7	75	46	45
Class III	All	2, 3, 5, 7, 9	20	10	75	52	52
		4, 6, 10-12	20	8	70	53	52
		1, 8	10	7	75	46	45
Class IV	All	1, 3	10	7	65	41	40
Class V	All	All	10	7	45	30	30

Figure 16-1

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Cava Norte Pit

Geotechnical Zones

October 2019

Source: Lundin, 2019.

RPA

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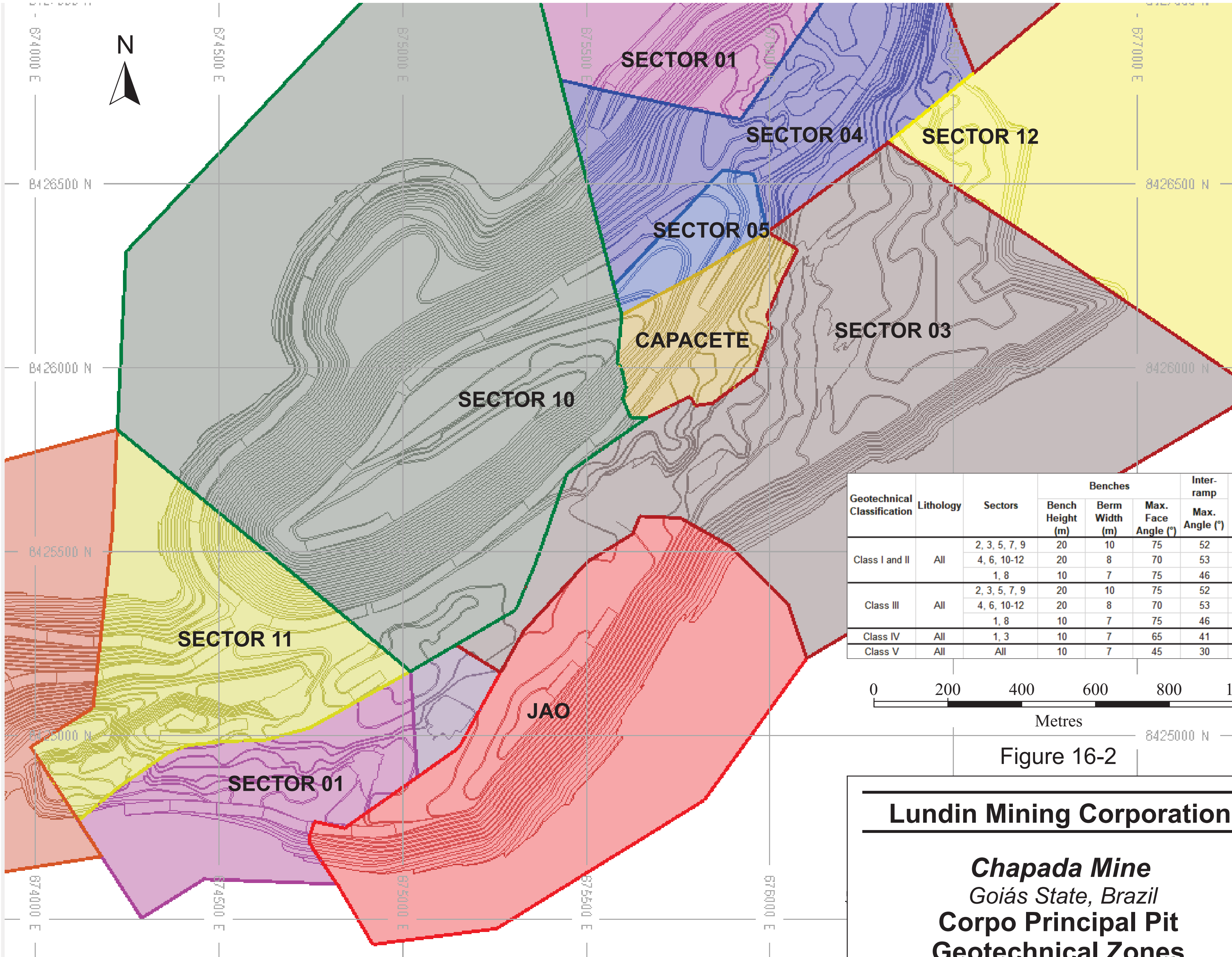

Geotechnical Classification	Lithology	Sectors	Benches			Inter-ramp	GEOTC
			Bench Height (m)	Berm Width (m)	Max. Face Angle (°)	Max. Angle (°)	
Class I and II	All	2, 3, 5, 7, 9	20	10	75	52	52
		4, 6, 10-12	20	8	70	53	52
		1, 8	10	7	75	46	45
Class III	All	2, 3, 5, 7, 9	20	10	75	52	52
		4, 6, 10-12	20	8	70	53	52
		1, 8	10	7	75	46	45
Class IV	All	1, 3	10	7	65	41	40
Class V	All	All	10	7	45	30	30

Figure 16-2

Lundin Mining Corporation

Chapada Mine
Goiás State, Brazil
Corpo Principal Pit
Geotechnical Zones

October 2019

Source: RPA, 2019.

RPA

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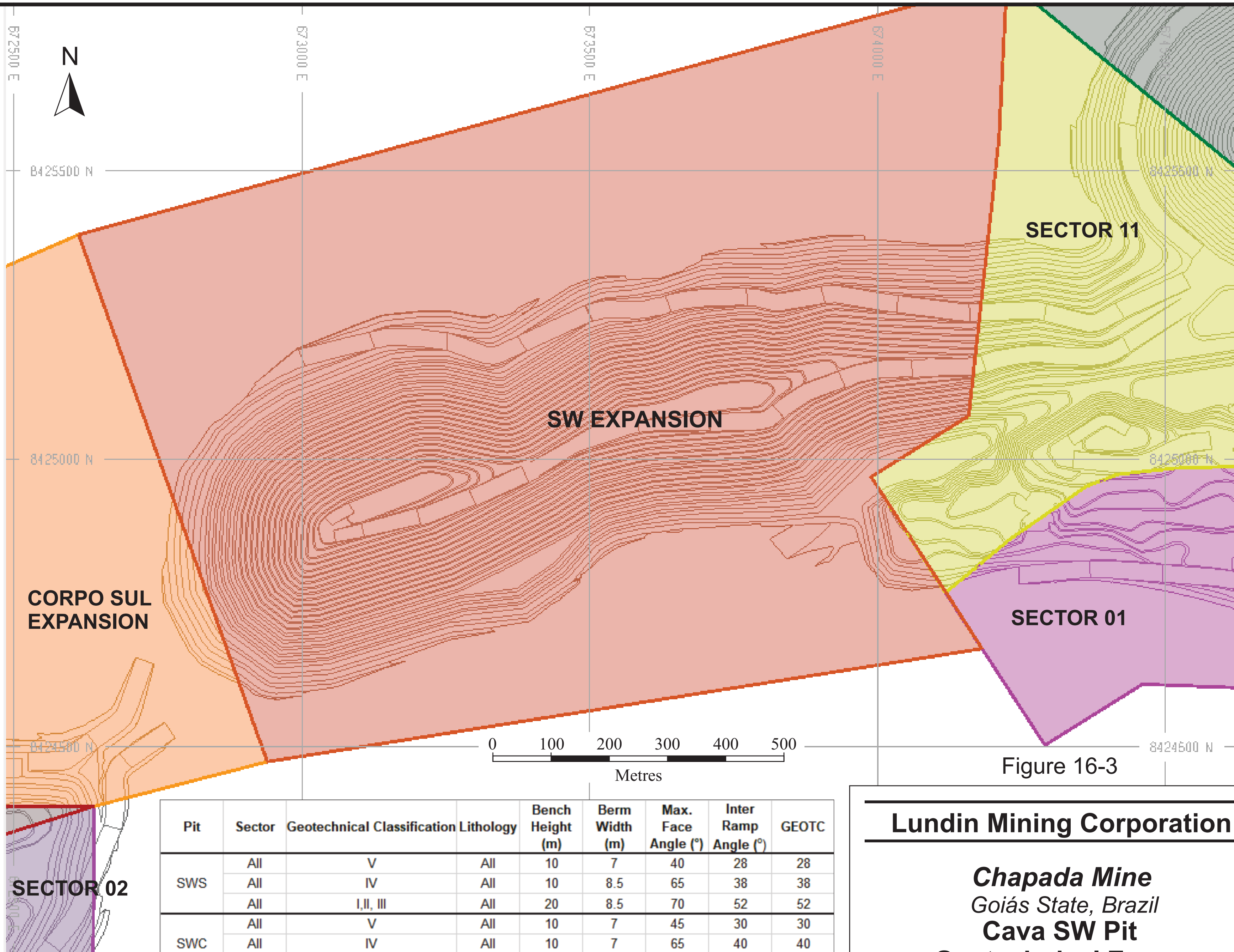


Figure 16-3

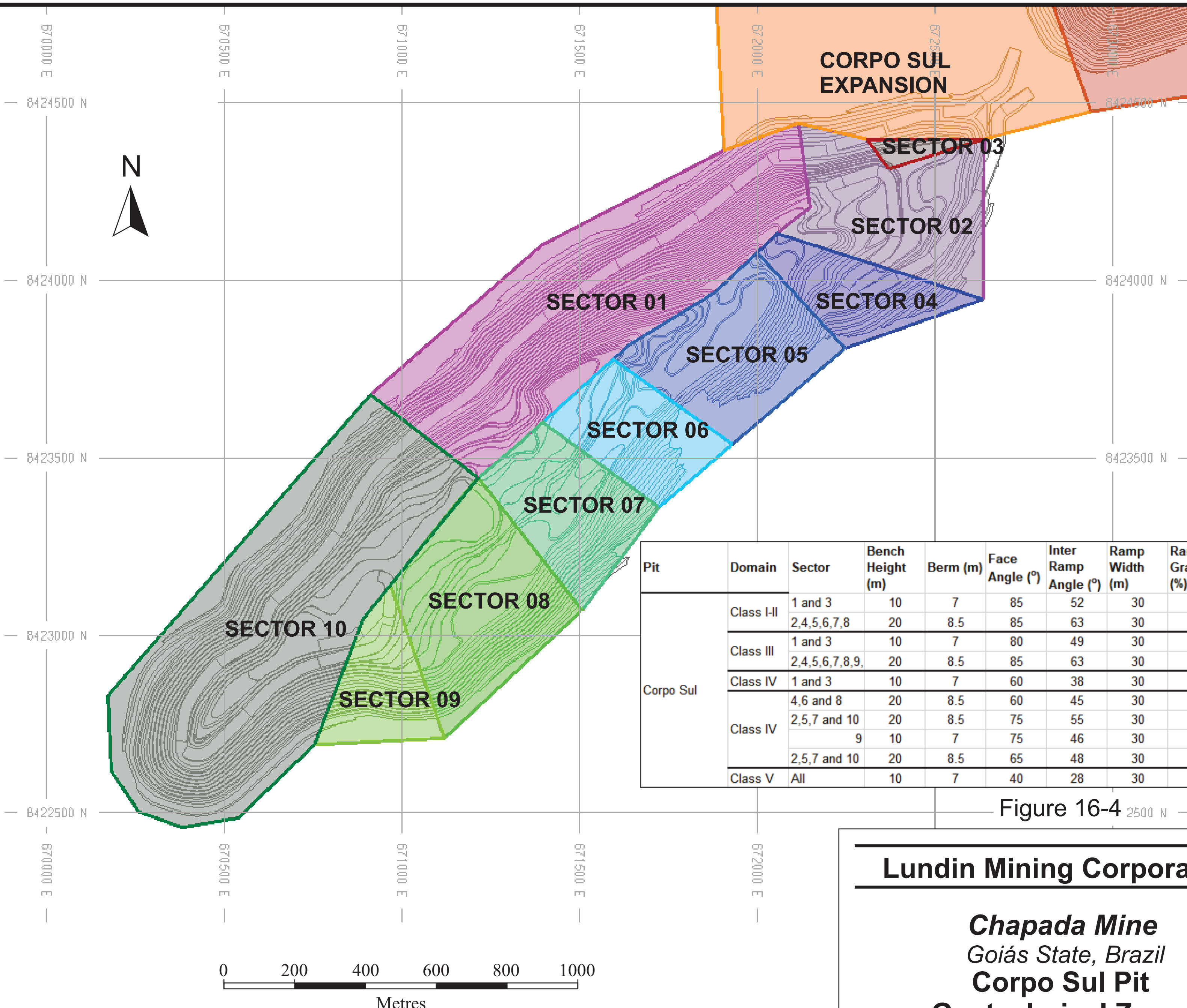
Lundin Mining Corporation

Chapada Mine
Goiás State, Brazil
Cava SW Pit
Geotechnical Zones

Pit	Sector	Geotechnical Classification	Lithology	Bench Height (m)	Berm Width (m)	Max. Face Angle (°)	Inter Ramp Angle (°)	GEOTC
SWS	All	V	All	10	7	40	28	28
	All	IV	All	10	8.5	65	38	38
	All	I,II, III	All	20	8.5	70	52	52
SWC	All	V	All	10	7	45	30	30
	All	IV	All	10	7	65	40	40
	All	I,II, III	All	20	8.5	75	45	45

October 2019

Source: RPA, 2019.



Pit	Domain	Sector	Bench Height (m)	Berm (m)	Face Angle (°)	Inter Ramp Angle (°)	Ramp Width (m)	Ramp Grade (%)	GEOTC
Corpo Sul	Class I-II	1 and 3	10	7	85	52	30	8	52
		2,4,5,6,7,8	20	8.5	85	63	30	8	62
	Class III	1 and 3	10	7	80	49	30	8	48
		2,4,5,6,7,8,9,	20	8.5	85	63	30	8	62
	Class IV	1 and 3	10	7	60	38	30	8	38
	Class IV	4,6 and 8	20	8.5	60	45	30	8	45
		2,5,7 and 10	20	8.5	75	55	30	8	55
		9	10	7	75	46	30	8	45
		2,5,7 and 10	20	8.5	65	48	30	8	48
	Class V	All	10	7	40	28	30	8	28

Figure 16-4

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Corpo Sul Pit
Geotechnical Zones

October 2019

Source: RPA, 2019.

RPA

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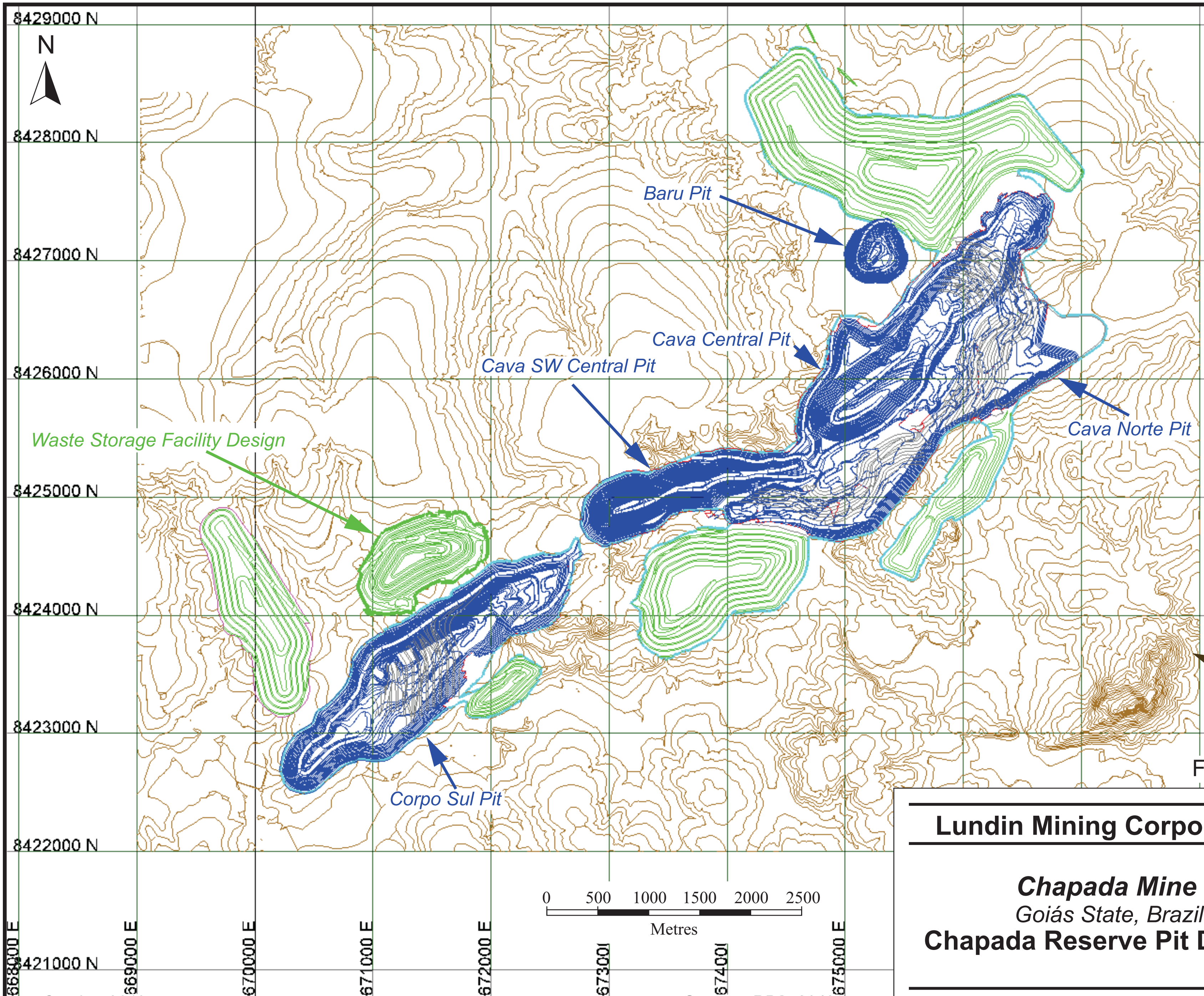
TABLE 16-3 CAVA SW SLOPE DESIGN RECOMMENDATIONS
Lundin Mining Corporation - Chapada Mine

Pit	Sector	Geotechnical Classification	Lithology	Bench Height (m)	Berm Width (m)	Max. Face Angle (°)	Inter Ramp Angle (º)
SWS	All	V	All	10.0	7.0	40	28
	All	IV	All	10.0	8.5	65	38
	All	I-II, III	All	20.0	8.5	70	52
SWC	All	V	All	10.0	7.0	45	30
	All	IV	All	10.0	7.0	65	40
	All	I-II, III	All	20.0	8.5	75	45

TABLE 16-4 CORPO SUL SLOPE DESIGN RECOMMENDATIONS
Lundin Mining Corporation - Chapada Mine

Geotechnical Classification	Sectors	Bench Height (m)	Benches Berm Width (m)	Max. Face Angle (°)	Inter-ramp Angle (°)	Ramp Width (m)	Ramp Grade (%)
Class I and II	1, 3	10	7.0	85	52	30.0	8.0
	2, 4-8	20	8.5	85	63	30.0	8.0
Class III	1, 3	10	7.0	80	49	30.0	8.0
	2, 4-10	20	8.5	85	63	30.0	8.0
Class IV	1, 3	10	7.0	60	38	30.0	8.0
	4, 6, 8	20	8.5	60	45	30.0	8.0
	2, 5, 7,10	20	8.5	75	55	30.0	8.0
	9	10	7.0	75	46	30.0	8.0
	2, 5, 7,10	20	8.5	65	48	30.0	8.0
Class V	All	10	7.0	40	28	30.0	8.0

In the Suruca pit, inter-ramp slope angles of 24.7° to 36.0° are applied in the saprolite and oxide material types. The Suruca oxide pit will be mined in 5 m high benches with a maximum depth of approximately 30 m. Inter-ramp angles of up to 53° are applied in the sulphide material.



October 2019

Source: RPA, 2019.

Figure 16-5

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Chapada Reserve Pit Design

RPA

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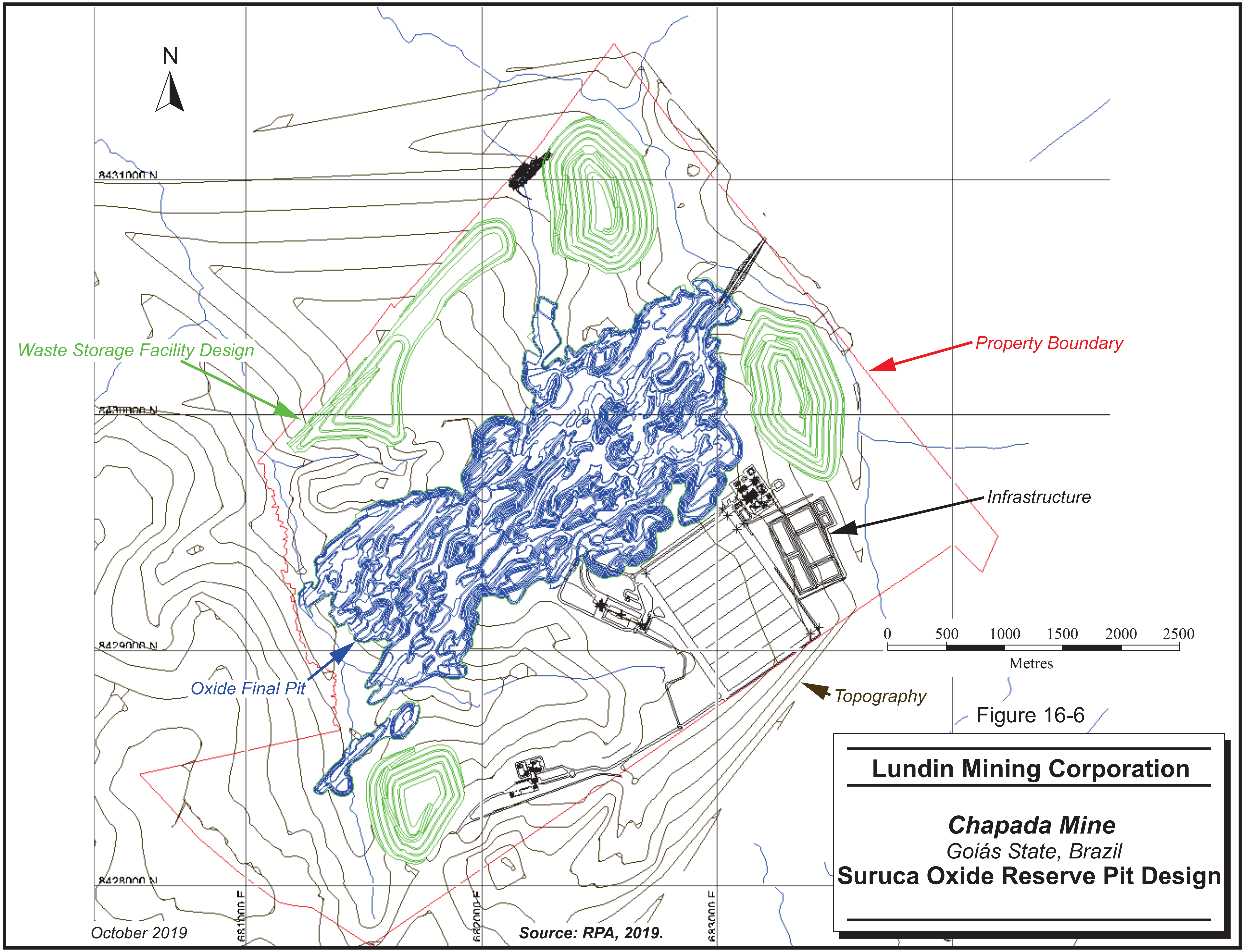


Figure 16-6

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Suruca Oxide Reserve Pit Design

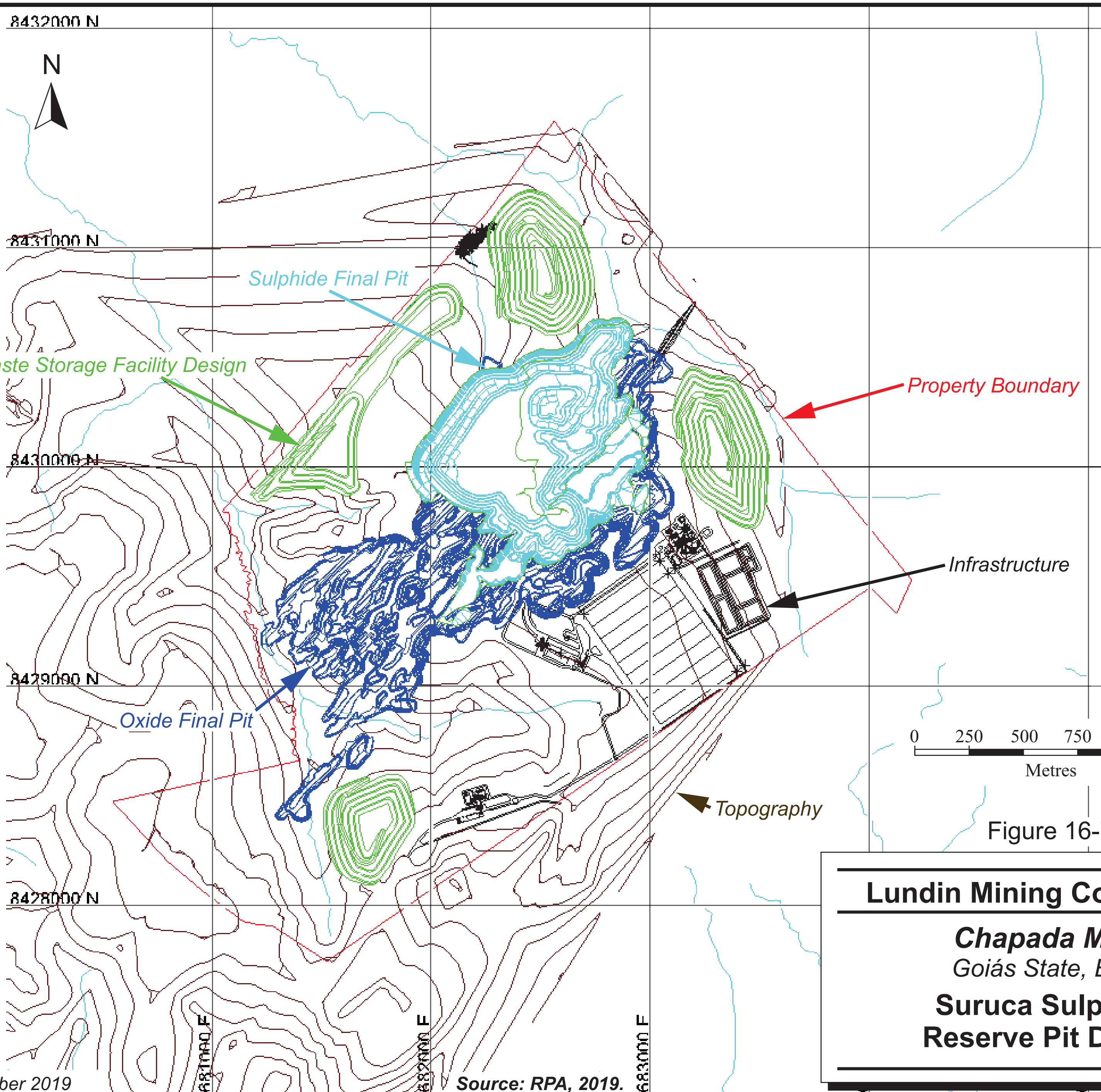


Figure 16-7

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Suruca Sulphide Reserve Pit Design

October 2019

Source: RPA, 2019.

MINE DESIGN

Mine operations are exclusively by open pit method, with a fleet of rigid frame haul trucks combined with a variety of diesel powered hydraulic excavators and front end loaders as the primary loading equipment. A fleet of large diesel powered blast hole rigs are employed for production drilling. Blasting is required for all rock types except for unconsolidated material at surface.

Chapada copper-gold open pit optimizations are run on the Mineral Resource model taking into consideration reserve metal prices, copper at $3.00/lb and gold price at $1,250/oz, mining factors, and the pit slope recommendations. The NSR and operating costs parameters used in the pit optimization are as outlined in Table 15-2. Sensitivity to metal price is run in order to identify pit phases for scheduling to improve project net present value and maintain a practical mine sequence and production schedule.

Results from the open pit optimizations are used to design final pit limits. Chapada pit design parameters are presented in Table 16-5. Final pit walls are double benched (total bench height of 20 m) and pre-split wall control blasting is employed.

TABLE 16-5 PIT DESIGN PARAMETERS
Lundin Mining Corporation – Chapada Mine

Pit	Domain	Sector	Bench Height (m)	Berm (m)	Face Angle (º)	Inter Ramp Angle (º)	Ramp Width (m)	Ramp Grade (%)
Cava Norte	Class I-II	1,5	20	8.5	80	59	30	8
		2,3,4	20	8.5	85	63	30	8
	Class III	1,5	20	8.5	80	59	30	8
		2,3,4	20	8.5	85	63	30	8
	Class IV	1,3	10	7.0	75	55	30	8
		2,4,5	20	7.0	75	55	30	8
	Class V	All	10	7.0.	40	28	30	8
Corpo Principal	Class I-II	2,3,5,7,9	20	10.0	75	52	30	8
		4,6,10-12	20	8.0	70	53	30	8
		1,8	10	7	75	46	30	8
	Class III	2,3,5,7,9	20	10	75	52	30	8
		4,6,10-12	20	8	70	53	30	8
		1,8	10	7	75	46	30	8
	Class IV	1,3	10	7	65	41	30	8
	Class V	All	10	7	45	30	30	8
Corpo Sul	Class I-II	1,3	10	7	85	52	30	8
		2,4,5,6,7, 8	20	8.5	85	63	30	8
	Class III	1,3	10	7	80	49	30	8
		2,4,5,6,7,8,9,10	20	8.5	85	63	30	8
	Class IV	1,3	10	7	60	38	30	8
	Class IV	4,6,8	20	8.5	60	45	30	8
		2,5,7,10	20	8.5	75	55	30	8
		9	10	7	75	46	30	8
		2,5,7,10	20	8.5	65	48	30	8
	Class V	All	10	7	40	28	30	8

Source: Lundin 2019.

The Suruca Oxide and Suruca Sulphide pit optimization are based on the parameters listed in Tables 16-6 and 16-7 respectively.

TABLE 16-6 SURUCA OXIDE PIT OPTIMIZATION PARAMETERS
Lundin Mining Corporation – Chapada Mine

Description	Unit	Cost/Price
Gold Price	$/oz	1,300
Average Mining Cost	$/t	1.45
Processing Cost	$/t	4.72
G&A Cost	$/t	0.47
Total Offsite Cost	$/oz	44.00
Payable Gold	%	99.95
Processing Recovery	%	85%

TABLE 16-7 SURUCA SULPHIDE PIT OPTIMIZATION PARAMETERS
Lundin Mining Corporation – Chapada Mine

Description	Unit	Cost/Price
Gold Price	$/oz	900
Average Mining Cost	$/t	2.01
Processing Cost	$/t	8.92
G&A Cost	$/t	0.49
Total Offsite Cost	$/oz	52.0
Processing Recovery	%	88%

At Suruca, pit design parameters are as follows:

For saprolite and oxide material types:

- 5 m bench height,
- 60° bench face angle,
- 4 m to 8 m safety berm,
- 15 m ramp width at maximum 10% gradient.

For sulphide material type:

- 30 m bench height,
- 70° bench face angle,
- 12 m safety berm,
- 25 m ramp width at maximum 10% gradient.

LIFE OF MINE PLAN

The LOM plan is based on Mineral Reserves, as of June 30, 2019. The LOM plan is based on a processing rate of 24.0 Mtpa. The ore stockpile will be processed intermittently throughout the mine life. The mine life is 24 years plus an additional eight years at the end of the mine life for processing the remainder of the ore stockpile. Table 16-8 presents the open pit LOM schedule by year.

As of the effective date of this report mine and plant expansion opportunities to increase the processing rate to a range from 28.0 Mtpa to 32.0 Mtpa, potentially in stages, are being reviewed by Lundin.

TABLE 16-8 LIFE OF MINE PLAN
Lundin Mining Corporation - Chapada Mine

Mine Production Plan	Units	2H2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
Chapada Main Open Pit																																		
Ore fed to mill	Tonnes (Mt)	3.86	9.59	14.08	10.19	8.99	6.66	17.68	3.78	13.45	0.35	22.87	21.79	6.58	0.74	1.64	-	-	-	-	-	1.75	8.14	3.84	7.86	-	-	-	-	-	-	-	-	**163.82**
	Cu (%)	0.31	0.27	0.28	0.30	0.28	0.30	0.27	0.24	0.28	0.22	0.21	0.23	0.24	0.22	0.21	-	-	-	-	-	0.21	0.21	0.21	0.28	-	-	-	-	-	-	-	-	0.26
	Au (g/t)	0.20	0.17	0.16	0.18	0.20	0.21	0.20	0.19	0.18	0.11	0.14	0.12	0.14	0.08	0.15	-	-	-	-	-	0.16	0.08	0.10	0.16	-	-	-	-	-	-	-	-	0.16
Ore to Stock	Tonnes (Mt)	3.77	4.89	6.04	7.41	-	-	2.29	0.83	1.58	0.38	6.80	2.52	-	0.17	0.32	-	3.35	0.09	0.22	-	0.37	1.84	-	-	-	-	-	-	-	-	-	-	**42.84**
	Cu (%)	0.18	0.15	0.14	0.22	-	-	0.16	0.13	0.13	0.16	0.14	0.14	-	0.14	0.12	-	0.12	0.13	0.12	-	0.17	0.13	-	-	-	-	-	-	-	-	-	-	0.16
	Au (g/t)	0.08	0.08	0.08	0.16	-	-	0.10	0.07	0.06	0.09	0.07	0.04	-	0.04	0.08	-	0.03	0.03	0.03	-	0.13	0.04	-	-	-	-	-	-	-	-	-	-	0.08
Corpo Sul																																		
Ore fed to mill	Tonnes (Mt)	8.29	8.85	2.97	5.40	6.85	14.42	3.33	17.23	7.56	23.65	0.07	-	-	-	11.09	1.95	19.68	15.04	-	-	13.95	8.40	8.63	6.39	-	-	-	-	-	-	-	-	**183.75**
	Cu (%)	0.30	0.29	0.28	0.27	0.24	0.24	0.27	0.26	0.23	0.25	0.20	-	-	-	0.22	0.23	0.25	0.27	-	-	0.24	0.22	0.24	0.25	-	-	-	-	-	-	-	-	0.25
	Au (g/t)	0.24	0.24	0.20	0.19	0.14	0.14	0.15	0.14	0.18	0.16	0.10	-	-	-	0.11	0.10	0.11	0.12	-	-	0.11	0.09	0.12	0.14	-	-	-	-	-	-	-	-	0.14
Ore to Stock	Tonnes (kt)	4.89	7.11	5.89	8.90	3.78	6.68	0.38	1.77	1.77	4.49	0.03	-	-	-	2.28	0.66	2.45	1.64	-	-	3.21	2.30	0.78	-	-	-	-	-	-	-	-	-	**59.00**
	Cu (%)	0.24	0.14	0.12	0.17	0.14	0.17	0.14	0.14	0.13	0.13	0.13	-	-	-	0.13	0.13	0.13	0.13	-	-	0.13	0.13	0.13	-	-	-	-	-	-	-	-	-	0.15
	Au (g/t)	0.18	0.07	0.06	0.10	0.07	0.09	0.07	0.07	0.07	0.06	0.06	-	-	-	0.05	0.05	0.05	0.05	-	-	0.05	0.04	0.05	-	-	-	-	-	-	-	-	-	0.08
Sucupira																																		
Ore fed to mill	Tonnes (Mt)	-	-	-	-	-	-	-	-	-	-	1.06	2.21	16.89	20.26	8.27	19.05	1.32	5.96	21.01	21.00	5.30	4.46	11.52	8.38	-	-	-	-	-	-	-	-	**146.70**
	Cu (%)	-	-	-	-	-	-	-	-	-	-	0.24	0.24	0.27	0.29	0.35	0.31	0.23	0.24	0.31	0.31	0.30	0.25	0.28	0.28	-	-	-	-	-	-	-	-	0.29
	Au (g/t)	-	-	-	-	-	-	-	-	-	-	0.26	0.27	0.15	0.21	0.23	0.22	0.26	0.14	0.21	0.24	0.26	0.16	0.19	0.16	-	-	-	-	-	-	-	-	0.21
Ore to Stock	Tonnes (Mt)	-	-	-	-	-	-	-	-	-	-	0.04	0.36	4.12	4.33	1.06	4.98	0.40	2.68	3.33	3.67	1.29	0.79	1.41	-	-	-	-	-	-	-	-	-	**28.46**
	Cu (%)	-	-	-	-	-	-	-	-	-	-	0.13	0.12	0.13	0.13	0.13	0.13	0.12	0.13	0.13	0.13	0.12	0.13	0.13	-	-	-	-	-	-	-	-	-	0.13
	Au (g/t)	-	-	-	-	-	-	-	-	-	-	0.04	0.04	0.05	0.04	0.04	0.05	0.04	0.04	0.04	0.05	0.06	0.04	0.04	-	-	-	-	-	-	-	-	-	0.05
Baru NE																																		
Ore fed to mill	Tonnes (Mt)	-	-	-	-	5.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5.26**
	Cu (%)	-	-	-	-	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.33
	Au (g/t)	-	-	-	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.12
Ore to Stock	Tonnes (Mt)	-	-	-	-	1.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1.47**
	Cu (%)	-	-	-	-	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.13
	Au (g/t)	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05
Ore from HG Stock to Mill	Tonnes (Mt)	0.10	3.60	3.60	3.60	2.91	2.92	3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.80	24.00	24.00	24.00	24.00	24.00	7.04	**167.57**
	Cu (%)	0.36	0.29	0.28	0.27	0.18	0.18	0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.18	0.18	0.16	0.12	0.12	0.12	0.12	0.16
	Au (g/t)	0.25	0.24	0.20	0.19	0.12	0.12	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.11	0.11	0.09	0.05	0.05	0.05	0.05	0.08
Ore from LG Stock to Mill	Tonnes (Mt)	-	1.46	3.35	4.81	-	-	-	3.00	3.00	-	-	-	0.53	2.99	3.00	3.00	3.00	3.00	2.99	3.00	3.00	3.00	-	1.36	24.00	3.20	-	-	-	-	-	-	**71.68**
	Cu (%)	-	0.23	0.23	0.23	-	-	-	0.24	0.24	-	-	-	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	-	0.24	0.24	0.24	-	-	-	-	-	-	0.23
	Au (g/t)	-	0.17	0.17	0.17	-	-	-	0.17	0.17	-	-	-	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	-	0.17	0.17	0.17	-	-	-	-	-	-	0.17
Total Ore to Plant	**Tonnes (Mt)**	**12.25**	**23.50**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**24.00**	**7.04**	**738.79**
	Cu (%)	**0.30**	**0.28**	**0.27**	**0.27**	**0.27**	**0.25**	**0.26**	**0.25**	**0.26**	**0.25**	**0.21**	**0.23**	**0.26**	**0.28**	**0.27**	**0.29**	**0.24**	**0.26**	**0.30**	**0.30**	**0.25**	**0.23**	**0.25**	**0.27**	**0.24**	**0.19**	**0.18**	**0.16**	**0.12**	**0.12**	**0.12**	**0.12**	**0.24**
	Au (gpt)	**0.23**	**0.20**	**0.17**	**0.18**	**0.15**	**0.16**	**0.18**	**0.15**	**0.18**	**0.16**	**0.14**	**0.13**	**0.15**	**0.20**	**0.16**	**0.21**	**0.13**	**0.13**	**0.21**	**0.23**	**0.15**	**0.11**	**0.15**	**0.16**	**0.17**	**0.12**	**0.11**	**0.09**	**0.05**	**0.05**	**0.05**	**0.05**	**0.15**
Main Open Pit Waste Mined	Tonnes (Mt)	4.48	16.09	13.36	5.00	0.36	0.87	41.93	32.47	27.62	1.94	16.76	7.51	1.53	0.15	4.89	0.00	9.47	0.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	185.11
Strip Ratio Main Open Pit		0.59	1.11	0.66	0.28	0.04	0.13	2.10	7.06	1.84	2.67	0.57	0.31	0.23	0.16	2.50	0.00	2.83	7.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.90
Corpo Sul Waste Mined	Tonnes (Mt)	11.77	17.84	20.77	24.16	19.15	40.72	1.40	9.44	13.94	39.18	0.16	-	-	-	2.59	1.07	2.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	205.00
Strip Ratio Corpo Sul		0.89	1.12	2.34	1.69	1.80	1.93	0.38	0.50	1.49	1.39	1.67	-	-	-	0.19	0.41	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.84
Sucupira Waste Mined	Tonnes (Mt)	-	-	-	-	-	-	-	1.48	1.09	-	22.12	33.51	38.88	41.35	34.87	39.30	24.68	35.85	41.06	42.33	38.95	6.62	-	-	-	-	-	-	-	-	-	-	402.08
Strip Ratio Sucupira		-	-	-	-	-	-	-	-	-	-	19.95	13.03	1.85	1.68	3.74	1.64	14.29	4.15	1.69	1.72	5.91	1.26	-	-	-	-	-	-	-	-	-	-	2.30
Baru Waste Mined	Tonnes (Mt)	-	-	-	-	22.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.26
Strip Ratio Baru		-	-	-	-	3.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.31
Plant Production Plan	**Units**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**Total**
Plant Recoveries	Cu Rec%	82.7%	85.1%	83.4%	82.2%	85.7%	84.8%	85.0%	82.8%	83.4%	84.6%	82.8%	83.8%	84.7%	84.6%	84.0%	85.0%	82.4%	83.1%	85.3%	85.6%	82.7%	81.3%	84.9%	85.0%	67.5%	77.9%	80.1%	79.1%	76.3%	76.3%	76.3%	76.3%	-
	Au Rec%	63.0%	61.0%	57.4%	57.4%	58.4%	58.6%	60.5%	56.3%	58.2%	58.2%	57.4%	56.9%	57.1%	60.1%	58.0%	60.8%	54.0%	54.2%	60.4%	62.2%	57.2%	52.4%	58.5%	57.6%	46.9%	51.9%	53.2%	51.1%	45.1%	45.1%	45.1%	45.1%	-
Concentrate Production	Tonnes (000 t)	130.46	238.88	233.48	229.42	236.25	217.82	221.42	211.22	222.35	214.78	180.68	199.49	222.19	244.88	229.45	254.06	205.73	217.12	260.47	266.16	208.69	187.22	218.74	237.51	162.00	147.75	145.56	131.86	94.11	94.11	94.11	27.61	6,185.55
	Cu (%)	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
	Au (g/t)	13.45	12.30	10.26	11.08	9.18	10.18	12.07	9.86	11.12	10.16	11.05	9.12	9.10	11.76	9.98	11.91	7.99	7.95	11.44	13.03	9.97	7.30	9.74	9.03	12.11	9.86	9.47	8.38	5.46	5.46	5.46	5.46	10.12
Contained Metal	Cu (000 t)	30.66	56.14	54.87	53.91	55.52	51.19	52.03	49.64	52.25	50.47	42.46	46.88	52.21	57.55	53.92	59.70	48.35	51.02	61.21	62.55	49.04	44.00	51.40	55.82	38.07	34.72	34.21	30.99	22.11	22.11	22.11	6.49	1,453.60
	Au (000 oz)	56.42	94.50	77.02	81.74	69.70	71.29	85.92	66.99	79.50	70.17	64.17	58.51	65.02	92.62	73.60	97.27	52.86	55.53	95.83	111.53	66.92	43.92	68.49	68.94	63.10	46.81	44.31	35.51	16.52	16.52	16.52	4.85	2,012.61

The Suruca oxide yearly production schedule is presented in Table 16-9. A pre-production period of five months is expected during the first year of the Suruca oxide LOM and a short term stockpile is also planned to be used during the rainy seasons due to the reduced mine fleet utilization. As of the date of this report, the start date of the Suruca oxide mine was under consideration by Lundin. Studies were ongoing to assess the Suruca oxide and sulphide pits as an integrated complex.

TABLE 16-9 SURUCA OXIDE LIFE OF MINE PLAN
Lundin Mining Corporation – Chapada Mine

	Units	LOM	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Ore Mined	000 t	23,326	4,685	4,399	4,461	4,401	4,400	981
Waste Mined	000 t	23,004	2,584	3,099	4,852	5,375	5,631	1,464
Ore Processed	000 t	22,526	3,945	4,399	4,401	4,401	4,400	981
Gold Grade	g/t	0.41	0.46	0.43	0.44	0.40	0.36	0.36

Notes:
1. Cut-off grade 0.19 g/t Au

As of the date of this report, Suruca Sulphide reserves are planned to be mined at the end of the Chapada mine life and ore from Suruca Sulphide will be fed into a modified Chapada processing plant at a rate of 8.0 Mtpa. Alternative scenarios, however, were being studied to process Suruca Sulphide with a standalone carbon in leach (CIL) or carbon in pulp (CIP) plant.

Table 16-10 presents the Suruca Sulphide LOM schedule by year.

TABLE 16-10 SURUCA SULPHIDE LIFE OF MINE PLAN
Lundin Mining Corporation – Chapada Mine

		LOM	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Ore Mined	000 t	50,654	75	9,051	14,125	8,000	8,736	8,000	2,669
Waste Mined	000 t	99,073	3,422	17,498	25,153	22,000	21,264	9,734	0
Ore Processed	000 t	42,669	0	8,000	8,000	8,000	8,000	8,000	2,669
Gold Grade	g/t	0.68	0.00	0.65	0.70	0.64	0.54	0.36	0.25

Notes:
1. Cut-off grade 0.30 g/t Au

WASTE ROCK

Waste rock dumps are located adjacent to the Chapada open pit. Limits of the waste rock dumps start just past the ultimate pit rim in order to minimize waste haulage distances. Suitable terrain is available adjacent to the existing waste dumps to expand the footprint as required by the production schedule, assuming permitting approvals and surface rights are in place. In addition, pit backfilling opportunities will be available later in the mine life.

MINE EQUIPMENT

Chapada mining is by conventional truck and shovel open-pit operations. Both Owner mining and contractor mining operations take place in order to meet the production targets. Table 16-11 presents the major equipment fleets for Chapada and its primary mining contractors.

TABLE 16-11 CHAPADA MINE EQUIPMENT FLEET
Lundin Mining Corporation – Chapada Mine

Equipment	Number
Chapada:	
Sandvik D45 Drill	2
Atlas Copco ROC L8 RC Drill (Sampling)	1
Liebherr R 9250 - Excavators	3
Caterpillar 993 Wheel Loader	2
Caterpillar 785C Truck	13
Caterpillar 777GTruck	6
Liebherr 964 - Excavators	1
Caterpillar 944 - Loader	2
Caterpillar 16 M Motor Grader	3
Caterpillar D9 Track Dozers	3
Caterpillar 834 Wheel Dozer	1
Caterpillar 320D Excavator	1
Caterpillar D6M Track Dozers	2
MERCEDES BENZ 2638 Board Truck	1
MERCEDES BENZ 2423 Munck Truck	1
HYSTER fork-lift	1
TEREX 250 T AC-250-1 Crane	1
MERCEDES MADAL 30 T MD-300 2831 Crane	1
SANY 80 T STC-800 Crane	1

Equipment	Number
MTSUL Contractor Equipment:	
Volvo A-60 Truck	4
Caterpillar 740 Truck	15
MERCEDES BENZ 1725/42 ATEGO Fuel Truck	2
MERCEDES BENZ AXOR 3344 K Water Truck	2
VOLVO 950 Excavator	2
Caterpillar 374 Excavator	1
JOHN DEERE Motor Grader	1
Caterpillar D6T Track Dozer	2
Caterpillar 950 Loader	1
Enaex Contractor Equipment:	
MERCEDES BENZ / 2726 K 6X4 - Truck	2
MERCEDES BENZ / ATRON 2729 K 6X4	1
SCANIA P420 B6X4	1
VOLVO / FM 500 8X4R	1
MINI CARREGADEIRA CASE SV 300	1
U & M Contractor Equipment:	
Hitachi EX 5500 - Excavators	3
Hitachi EX 2500 - Excavators	2
Komatsu 930 Truck	12
Komatsu 730 Truck	5
Caterpillar 16 H Grader	3
Caterpillar D9T Track Dozers	3
Caterpillar D10 Track Dozers	3
Atlas Copco D65 Drill	1
Caterpillar 777 Water Truck	1
Volks Water Truck	4
MECBRUN Contractor Equipment:	
Caterpillar 950 Loader	1
Hyundai 220 Excavator	2
Dynapac CA-250 Road roller	1
Volkswagen 3133 Truck	1
Mercedes AXOR 2729 Truck	3
Mercedes AXOR 3131 Water Truck	2
Mercedes AXOR 2729 Water Truck	3
Volkswagen 3128 Truck	2
Volvo 220 Excavator	1

Mineração e Construção S/A, (U&M) complement mine operations for waste removal and disposal, mine development. Other contractors primarily operate in the soft material within the upper benches of the mine and provide ancillary equipment comprising a water truck, and truck and wheel loaders to help plant operations and other small requested operations.

Eneax is the explosives supplier and carries out blasting operations.

As of the effective date of this report, the major equipment fleet was sufficient to meet the LOM production schedule.

Replacement of existing units in the major equipment fleet is required to meet the LOM production schedule. Table 16-12 summarizes the major equipment replacement schedule. No additional equipment replacements are scheduled beyond 2041.

RPA has reviewed the fleet and is of the opinion that the equipment productivities are reasonable and that the fleet is sufficient to meet the LOM production schedule when consideration for contract mining capacity is included.

At Suruca, the open pit mining activities will be primarily undertaken by a contractor-operated fleet as the base scenario for the FS.

The proposed plant processing rate and overall strip ratio allowed a total material movement under 10 Mtpa – perfectly suitable for small equipment such as on-highway trucks under 35 t of payload. The mine equipment fleet estimated for the Suruca Project is shown on Table 16-13.

TABLE 16-12 CHAPADA MINE EQUIPMENT FLEET REPLACEMENT SCHEDULE
Lundin Mining Corporation – Chapada Mine

Equipment Replacement	2021	2022	2023	2024	2025	2026	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Caterpillar 785C Haul Truck	-	-	-	-	1	-	4	5	4	-	-	-	-	-	-	-	-	-	-	-
Caterpillar 777G Haul Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liebherr R 9250 Excavators	1	1	1	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
Caterpillar 993 Wheel Loader	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Caterpillar D9 Track Dozer	-	1	-	2	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-
Caterpillar 834H Wheel Dozer	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-
Caterpillar 16M Motor Grader	-	1	1	1	-	-	-	1	1	1	-	-	-	1	1	-	-	-	-	-
Sandvik-D45 KS Drill	-	-	2	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Atlas Copco ROC L8 Drill	-	-	1	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-
Liebherr 944 Excavators	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Liebherr 964 Backhoe (Mill)	-	-	1	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-	-	1

TABLE 16-13 SURUCA OXIDE MINE EQUIPMENT FLEET
Lundin Mining Corporation – Chapada Mine

Equipment Type	Class	Number of Units
Hydraulic Excavator	4.5 m^3	3
Wheel Loader	4.8 m^3	1
On-Highway Truck	35 t 8x4	14
Motor Grader	14 ft. class	2
Track Dozer	D6-class	1
Track Dozer	D8-class	1
Grade Control	RC drill	1
Water Truck	20,000-litre class	3

MANPOWER

Chapada operates on a 24 hour per day, 365 days per year schedule. For most operating positions, there are four work crews with three on site at any time working three 8 hour shifts per day.

Mining operating manpower is based on approximately four operators for each operating position. Mining manpower for operations, maintenance, and technical services in 2019 is approximately 979 staff, employees, and contractors.

MINE INFRASTRUCTURE

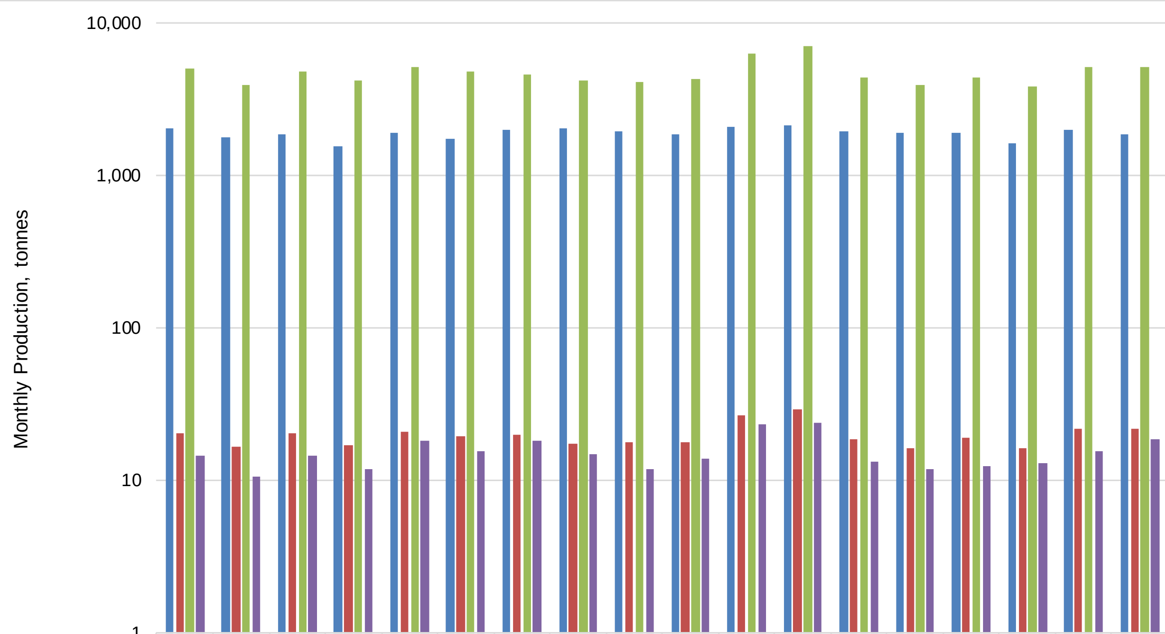
Chapada has all necessary infrastructure for a large open pit mine operation. Mining related infrastructure includes a truck shop, truck wash facility, warehouse, fuel storage and distribution facility, explosives' storage and magazine sites, and electrical power distribution and substations to support construction projects and mine operations.

17 RECOVERY METHODS

CHAPADA CONCENTRATOR PERFORMANCE – 2018 AND 2019

The Chapada concentrator is designed to treat copper sulphide ore at a nominal rate of 65,000 tpd for a total of 24.0 Mtpa. In 2018, the mill processed 22.93 Mt (62,820 tpd) of ore with average recoveries for copper and gold of 82.4% and 63.3%, respectively. In the months of January through June 2019 the mill processed 11,2 Mt (62,003 tpd) of ore with average recoveries for copper and gold of 81.6% and 59.7% respectively. Average concentrate grades for 2018 were 24.1% Cu and 15.5 g/t Au and for January through June 2019 were 23.7% Cu and 13.8 g/t Au. The plant is operating consistently. Figure 17-1 presents the monthly mill production including tonnes of ore processed, concentrate production, copper production, and gold production for 2018 and the months of January through June 2019. The following figures show a consistently operating process facility with good process controls.

FIGURE 17-1 MONTHLY MILL PRODUCTION FOR 2018 AND 2019



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Mill, t/1000	2,046	1,786	1,856	1,562	1,910	1,753	1,972	2,021	1,958	1,863	2,086	2,116	1,947	1,901	1,902	1,608	1,986	1,879
Cu Con,t/1000	20.4	16.6	20.2	16.9	20.8	19.4	19.8	17.2	18.0	17.7	26.9	29.3	18.6	16.4	18.9	16.1	22.0	21.6
Copper, t	5,053	3,892	4,843	4,174	5,134	4,811	4,617	4,235	4,122	4,257	6,365	7,079	4,393	3,928	4,430	3,849	5,199	5,117
Gold, oz/1000	14.5	10.7	14.6	11.9	18.3	15.5	18.1	14.8	11.8	13.9	23.6	23.6	13.2	12.0	12.3	13.0	15.4	18.5

Figure 17–2 presents the monthly average copper and gold recoveries for 2018 and the months of January through June 2019.

FIGURE 17-2 MONTHLY COPPER AND GOLD RECOVERIES FOR 2018 AND 2019

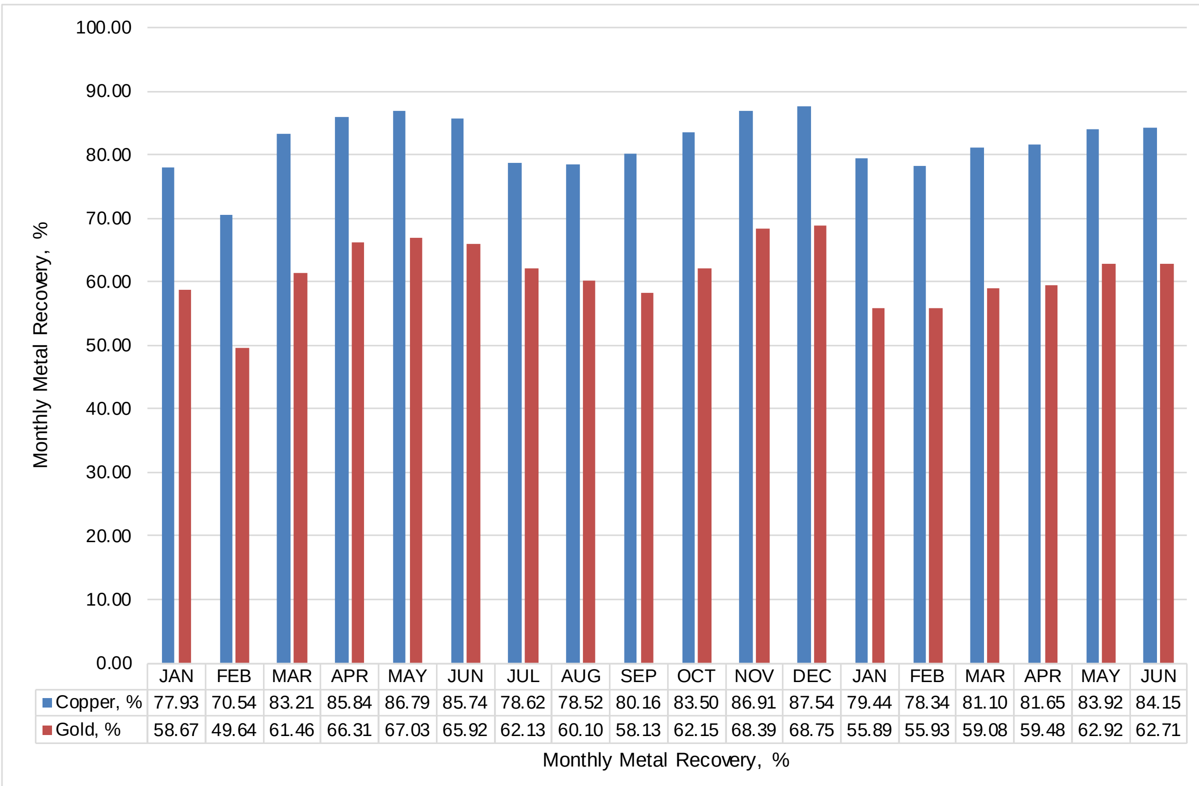


Figure 17-3 presents the copper and gold recoveries versus copper concentrate grade for 2018 and 2019.

FIGURE 17-3 COPPER AND GOLD RECOVERY VS COPPER CONCENTRATE GRADE

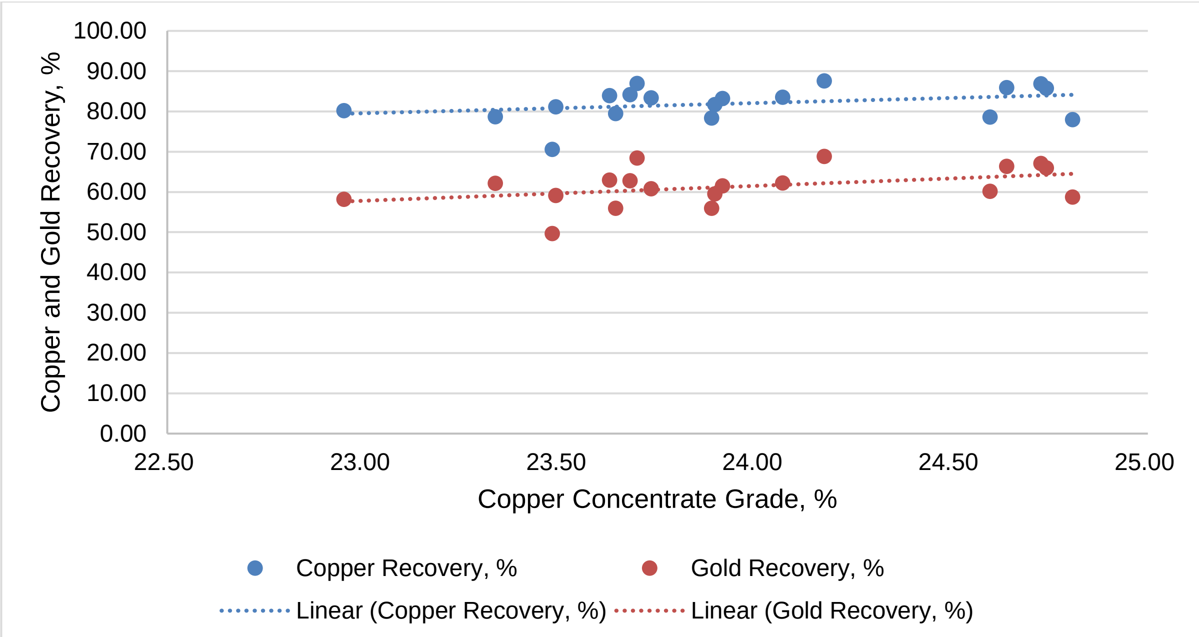
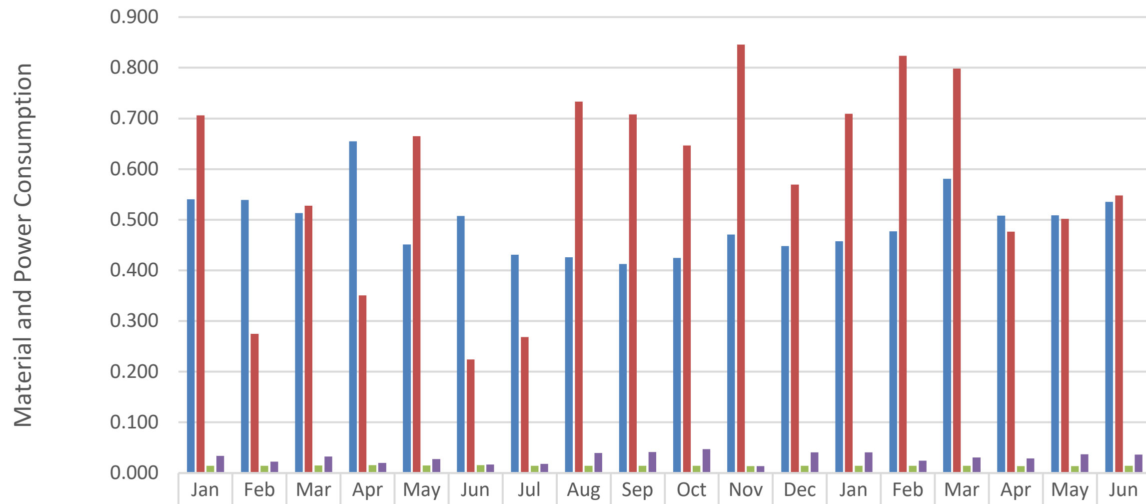


Figure 17-4 presents the key monthly material and power consumptions for 2018 and the months of January through June 2019.

FIGURE 17-4 MATERIAL AND POWER CONSUMPTIONS FOR 2018 AND 2019

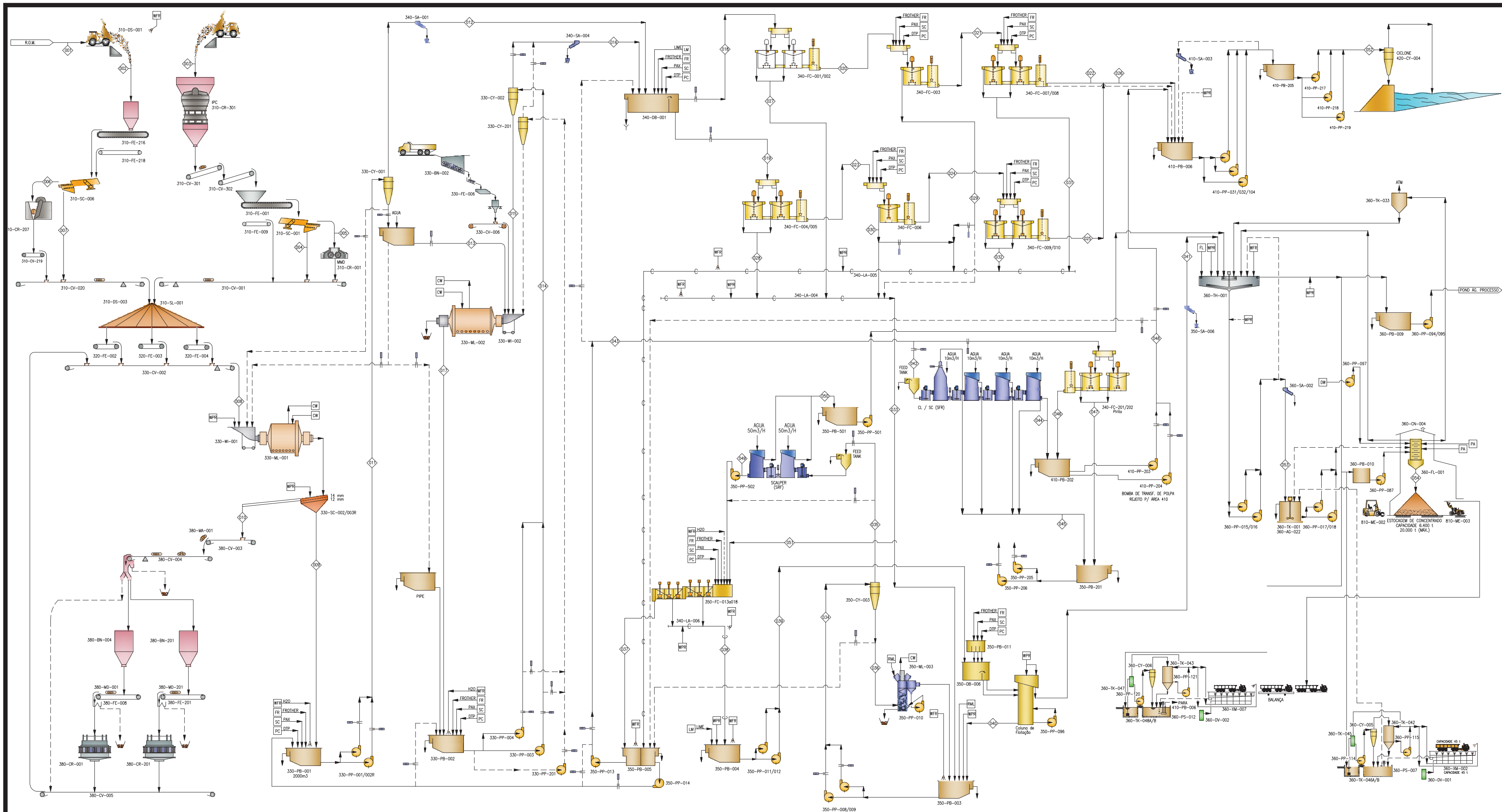


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Media, kg/t	0.541	0.539	0.513	0.655	0.451	0.507	0.431	0.426	0.413	0.424	0.471	0.448	0.458	0.477	0.581	0.508	0.509	0.535
Lime. Kg/t	0.706	0.275	0.528	0.351	0.665	0.224	0.268	0.733	0.708	0.647	0.846	0.570	0.709	0.824	0.798	0.476	0.502	0.548
Power, MWh/t	0.014	0.015	0.015	0.016	0.015	0.016	0.015	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
Collector, kg/t	0.034	0.023	0.032	0.020	0.028	0.017	0.018	0.040	0.042	0.047	0.013	0.041	0.041	0.024	0.031	0.029	0.037	0.036

2018 and 2019 Monthly Material and Power Consumption

CURRENT PROCESS DESCRIPTION

Figure 17-5 is the current process flow diagram for the Chapada concentrator.



LEGENDA

- FLUXO PRINCIPAL
- FLUXO ALTERNATIVO
- CALHA
- FLUXO SECUNDÁRIO
- WFR – ÁGUA NOVA
- DW – ÁGUA POTÁVEL
- WPR – ÁGUA DE PROCESSO
- CW – ÁGUA DE RESFRIAMENTO
- BA – AR DO SOPRADOR
- PA – AR DE PROCESSO
- SC – COLETORES PRIMÁRIO / SECUNDÁRIO
- PC – DTP
- FR – ESPUMANTE
- LM – LEITE DE CAL
- SR – REAGENTE RESERVA

Figure 17-5

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Chapada Concentrator Process Flow Sheet

October 2019

Source: Yamana Gold, 2018.

PRIMARY CRUSHING

Ore is delivered from the mine by haul truck to one of two parallel lines of primary crushers. The first line consists of a primary gyratory crusher located adjacent to the pit. Ore is dumped directly into the crusher feed bin. Oversized material is broken using a hydraulic rock breaker. The discharge of the gyratory crusher is then conveyed to the feed bin of an MMD 1000 Sizer (Sizer) for secondary crushing. The ore is transferred from the bin with an apron feeder and passed over a vibrating grizzly feeder which feeds the Sizer. Grizzly undersize bypasses to the Sizer product conveyor and, along with the Sizer product, is conveyed to the crushed ore stockpile. The Sizer limits the production rate as it has a lower capacity than the gyratory crusher. Consideration has been given to bypassing the Sizer to increase production.

The second system consists of a Metso C160 jaw crusher. Ore is dumped directly into the crusher feed bin. The ore is drawn from the bin with an apron feeder to a vibrating grizzly feeder which feeds the jaw crusher. Crusher product and grizzly undersized material are combined on the jaw crusher discharge conveyor and transferred the crushed ore stockpile.

CRUSHED ORE STOCKPILE AND RECLAIM

The crushed ore stockpile is a conical stockpile with three draw points using apron feeders. Ore is drawn from the stockpile by three apron feeders onto the SAG mill feed conveyor, which delivers the ore directly into the SAG mill feed chute.

PRIMARY AND SECONDARY GRINDING

The grinding circuit consists of a primary 10.4 m x 5.8 m long EGL SAG mill with a dual pinion 12,500 kW drive (2 x 6,250 kW) for primary grinding. The SAG mill discharges onto a horizontal double deck vibrating screen. The top deck has 12 mm openings and the bottom has six millimetres openings. The screen oversize pebble is conveyed to two HP800 pebble crushers with 600 kW drives. The pebble is reduced from the typical critical size of 38 mm x 75 mm, to approximately 12 mm and then returned by conveyor to the SAG mill feed conveyor. The screen undersize slurry reports to the primary cyclone feed pumpbox. The slurry is then pumped to a cyclopac consisting of six 813 mm diameter hydrocyclones (five operating). The cyclone underflow slurry flows by gravity to the 7.3 m x 12.2 m long EGL ball mill with a dual pinion 12,500 kW drive (2 x 6,250 kW) drive, while the cyclone overflow flows to the rougher flotation feed distribution tank. The primary cyclone underflow can be routed to either the ball mill or SAG mill, allowing the SAG mill to be operated in either open or closed circuit as required. The ball mill discharges into the secondary cyclone feed pumpbox from which it is pumped to the ball mill cyclopac consisting of nine 813 mm diameter cyclones (seven operating). The cyclone underflow reports to the ball mill feed chute and the cyclone overflow flows by gravity to the rougher flotation feed distribution tank.

ROUGHER FLOTATION

The rougher flotation circuit consists of two lines of rougher-scavenger flotation cells. Each line has a bank of five 160 m^3 Dorr-Oliver Eimco tank flotation cells that have been retrofitted with Outotec mechanisms (Outotec TankCell and FloatForce), consisting of two rougher cells, one middling cell and two scavenger cells in series.

- The concentrate from the rougher cells flows to the concentrate regrind feed pumpbox.
- The cyclone underflow feeds the vertical regrind ball mill.
- The concentrate from the middling cell can either report the concentrate regrind or to the primary cyclone feed pumpbox in the grinding circuit.
- The concentrate from the scavenger cells is pumped back to the primary cyclone feed sump in the grinding circuit.
- The scavenger tailings are pumped to the TSF.

CONCENTRATE REGRINDING

The concentrate regrind circuit consists of a Metso Vertimill, VTM-1000-WB, with a 748 kW drive in closed circuit with a bank of four 20 in. hydrocyclones (two operating).

CLEANER FLOTATION

- The cyclone overflow from the concentrate regrind circuit flows to the new SFR cleaner scalper cells.
- The concentrate from the SFR scalper cells is final concentrate grade and is pumped to the concentrate thickener.
- The cleaner scalper tailings are pumped to a bank of six 21.5 m^3 conventional cleaner flotation cells.
- The cleaner tailings are pumped to a new bank of four Staged Flotation Reactor (SFR) cleaner scavenger flotation cells.

- There is an existing bank of two 160 m^3 Wemco tank cells that currently operate as cleaner scavenger cells or pyrite cells in parallel with the new SFR cleaner scavengers.

- The concentrate from the cells is pumped to the feed of the cleaner flotation cells. The tailings from both banks of cells are pumped the final tailings pumpbox and then to the TSF.

- The cleaner concentrate is pumped to a final cleaner column flotation cell. The tailings from the column cell are pumped to the concentrate regrind circuit and the concentrate is pumped to the final concentrate thickener.

CONCENTRATE THICKENING, FILTRATION, AND STORAGE

The final concentrate is thickened to approximately 60% solids in a 13 m diameter x 3 m high Dorr Oliver Eimco thickener. The thickened concentrate is then pumped from the thickener underflow to an 11 m diameter x 11 m high concentrate storage tank. The concentrate is then pumped to a Larox PF60/72 M145 filter press, with a capacity of approximately 45 tph, located in the concentrate storage building above the concentrate stockpile. The pressure filter reduces the concentrate moisture to approximately 8% before discharging it onto the stockpile below. The concentrate is then loaded onto trucks and transported to the Port of Vitoria for shipping.

TAILINGS STORAGE FACILITY

The flotation tailings are pumped to the TSF using a two stage pumping system consisting of three pumps per stage and a security system which monitors the pumping system in case of problems. The tailings are pumped to a cyclopac at the TSF consisting of fifty 508 mm diameter hydrocyclones (6 to 12 operating). The finer tailings from the cyclone overflow are deposited in the tailings basin and the coarse sand cyclone underflow material is used for dam construction. Cycloned overflow tailings with a density of approximately 20% solids are deposited into the tailings basin. Water from the basin is recirculated back to the plant. Water percolating through the dam is pumped into the reservoir by a seepage pump circuit.

PROCESS WATER RECLAIM

Process water is pumped from the water reservoir in the TSF area to the process water reservoir at the process plant, from a water pumping station located in the tailings water reservoir adjacent to Dike II. A reclaim booster pump station is located outside of the TSF in the reclaim water pipeline. Each station is equipped with a set of three centrifugal pumps operating in parallel for a combined capacity of 7,600 m^3/h.

Water is supplied to the plant from the process water reservoir using four centrifugal pumps operating in parallel for a total capacity of 7,600 m^3/h.

FRESH/MAKE-UP WATER SUPPLY

Fresh/make-up water is supplied from two sources, the Rio dos Bois pump station, and the Cava Central mine. The Rio dos Bois pump station consists of two parallel pipelines fed by six submersible pumps connected to the water lines by a valved header which allows each pump to supply either pipeline. A submersible pump is connected to each of the headers by a flexible hose.

The Cava mine pits are the primary source of fresh/process water and have been used exclusively for the past several years. Surface and ground water drains into and collects in the bottom of the pit. Water is pumped from the pit using submersible pumps and a booster pump station to transfer the water to the water reservoir in the tailings dam. From there it is pumped to the process water reservoir at the process plant.

The water storage capacity in the bottom of the mine pits is used to maintain the overall site water balance. Water can be pumped from one pit to the other and to the TSF and process plant, providing flexibility in controlling the site water balance.

REAGENT STORAGE AND DISTRIBUITON

The reagents used in the Chapada concentrator include:

- Slaked Lime – Calcined lime is supplied to the plant and slaked using a ball mill type slakeing system. The slaked lime slurry is then delivered to the plant by circulation pumps.

- Potassium Amyl Xanthate Collector (PAX) and M92 collectors will be stored in two of three 62 m^3 tanks and distributed to the plant using metering pumps.

Frother, including MIBC and DF-400 will be stored in three 46 m^3 storage tanks.

STUDY FOR THE EXPANSION OF THE MINE AND MILL

In 2018, a study and basic engineering report was commissioned which combined the information gained in the series of studies that were performed with respect to process plant upgrading, optimization, and ultimately the expansion of the mine and processing facilities from the current 24.0 Mtpa to approximately 32.0 Mtpa.

The expansion studies included the relocations necessary to mine the Sucupira deposit, a portion of which is located beneath the some of the processing facilities and site infrastructure. The plant expansion has not been approved at this time, however, the mining plan includes development of the Sucupira pit, which, even without the expansion, will require the relocation of some of the process and ancillary facilities. The 3,900 tph basic engineering study will guide the relocation of the equipment.

Woodgrove conducted pilot plant studies as discussed In Section 13. The results of the studies were positive and the installation of the new flotation equipment and systems to optimize the plant has been completed, except for the equipment specific to the expansion. The equipment associated with the plant expansion will be installed if, and when, the expansion is approved.

The execution plan for the Woodgrove equipment was divided into three phases.

- Phase 1 – 2017: included the installation of 2 SFR cleaner scalpers and 4 SFR cleaner scavengers.

- Phase 2 - 2019: included the installation of six DFR (Direct Flotation Reactors) as re-scavengers, consisting of 2 rows of three reactors operating in parallel. This equipment was installed and was being commissioned during the RPA site visit in August 2019.

- Phase 3 - includes the full expansion flowsheet:
    - The addition of a third bank of roughers (7 DFR cells),
    - The addition of two more cleaner scalpers (2 SFR cells),
    - Removal of the flotation column from the flowsheet,
    - Installation of new cleaner stage flotation cells (6 DFR cells),
    - Installation of a second vertical regrind mill in parallel with the current mill.

SUCUPIRA DEPOSIT DEVELOPMENT

The current mine plan includes the development and mining of the Sucupira deposit. The Sucupira mineralization extends beneath parts of the Chapada processing facilities. Figure 17-6 shows the location of the process facilities in relation to the Sucupira pit and the affected process systems and the proposed new locations for the facilities. The following facilities will be relocated:

- Primary gyratory crusher and conveying system
- Primary jaw crusher and conveying system
- Pebble crushing system
- Truck shop and fuel station
- Chemical and process laboratories
- Warehouse facilities.
- 230 kV transmission line will be relocated outside of the tailings dam area.
- Main power substation will have to be relocated
- Power for the plant will be supplied by the new substation

The new primary crushing and conveying systems will be installed on rock fill pads built adjacent to the southern end of the tailings impoundment, between the tailings dam and the Sucupira pit. The secondary crusher installation required for the expansion will be located along the conveyor alignment. The conveyors will follow the southern boundary of the tailings impoundment to the open area to the northwest of the process plant. This area will contain the relocated crushed ore stockpile and reclaim systems. The pebble crushing circuits will be relocated to the west of the mill building at right angles to the SAG mill. The new main substation will be located on the eastern side of the plant.

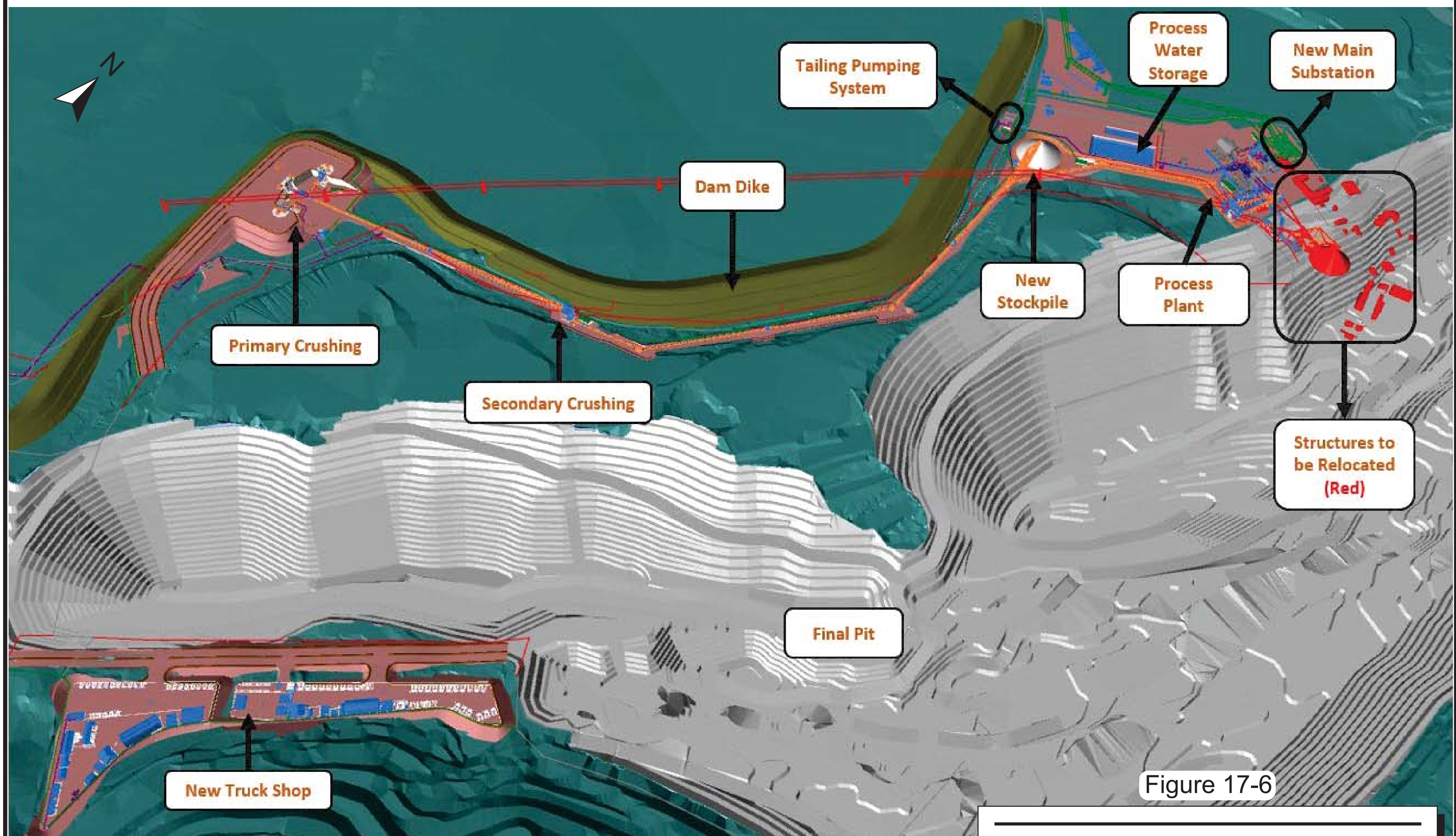


Figure 17-6

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Relocation of Equipment and Facilities for Mining the Sucupira Pit

October 2019

Source: Lundin, 2019.

RPA

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SURUCA DEPOSIT OXIDE AND SULPHIDE ORES

Run of mine (ROM) material from the Suruca deposit, which consists of oxide and sulphide mineralization, will be processed separately. The oxide ore will be processed using conventional heap leaching technology, and the sulphide ore will be processed in the existing concentrator after some modifications.

SURUCA SULPHIDE ORE

Suruca sulphide ore is currently being planned to be processed through the existing Chapada plant, with some modifications, at the end of the Chapada mine life. There is also an option to construct a standalone CIL or CIP plant for processing the sulphide ore. Conceptual studies are ongoing.

SURUCA OXIDE ORE

Processing oxide from the Suruca deposit is planned according to the Suruca FS, prepared by Yamana and SNC Lavalin in February 2018 (Yamana and SNC Lavalin, 2018). Lundin is currently assessing the Project within the context of the Chapada complex. Figure 17-7 shows the Suruca oxide process flow sheet.

The Suruca FS has finalized the design for the oxide gold mineralization. The material will be open pit mined, crushed, and agglomerated and then conveyed to on-off multiple use heap leach pad for metal extraction and further processing in on-site facilities. The leach solution processing facilities will consist of a carbon adsorption column circuit. Carbon elution will include acid washing, carbon elution using caustic, cyanide, and pressure. The metal will be recovered from the pregnant eluate by electro-winning and the electrowinning cell sludge will be filtered, dried, and cast into gold and silver doré bars or ingots for sale. The overall gold recovery is expected to be 85%. Spent ore form heap leach pad, or tailings, will be reclaimed by truck and shovel and disposed of via dry stacking on surface in a dedicated storage area.

USE OF EXISTING EQUIPMENT

Second-hand and previously purchased equipment has been specified and obtained by Yamana for the crushing, agglomeration, adsorption, reagents and select other processes, and thus utilization of existing purchased equipment is required as much as possible.

CRUSHING AND AGGLOMERATION

The ore processing route begins with the crushing of the raw ore from the mine, consisting of two in series stages of roller crushers; the first with a single crusher and the second with two crushers in parallel. Cement is added to crushed ore and routed to the agglomeration drum where moisture (sodium cyanide solution) is added to the solids. After the drum, the ore is stacked on a dynamic leach pad.

HEAP LEACHING

Single-lift, multiple-use heap leach pads will be used for the heap leaching process for 4.4 Mtpa. Through a trade-off study, the dynamic approach has shown to deliver a lowest life cycle cost and lower stability risks than a single use pile. The stacked ore is leached with cyanide solution for the recovery of gold for 80 days. The rich solution from these heaps is drained through a piping network and routed to a collection pond; from where it is taken and fed to the adsorption circuit of columns with activated carbon.

SOLUTION PONDS

The solution management system comprises HDPE-lined ponds for pregnant solution, barren solution, emergency containment, and neutralization (two stages).

ADSORPTION

Pregnant solution, with relatively low concentrations of gold, are suitable for treatment by conventional counter-current carbon-in-column (CIC) adsorption. There will be two CIC circuits, each with five columns, working in parallel for recovery of gold and other metals onto carbon.

ACID WASH, ELUTION AND CARBON REGENERATION

The elution process will be Pressure Zadra process, which will be coupled with the downstream electro-winning circuits. The loaded carbon from the adsorption columns is transported to the acid wash circuit to remove inorganic impurities. Recovered barren solution is recycled back to feed the heap leach irrigation. After acid wash, the loaded carbon goes through the elution circuit to desorb the gold off of the carbon; the spent carbon is cycled through a regeneration process and returned to the adsorption circuit.

ELECTRO-WINNING

Dried electro-winning concentrate as final product was identified to provide the best overall value and lowest risk profile to the Suruca Project. The elution solution is then sent through electrowinning to recover the gold onto cathodes. The solids on cathodes are washed off, filtered, and dried to produce a concentrate cake as a final product.

REAGENTS

Reagents are stored and distributed on-site to facilitate the process operation. The key reagents are the cement used in agglomeration and sodium cyanide used mainly in leaching.

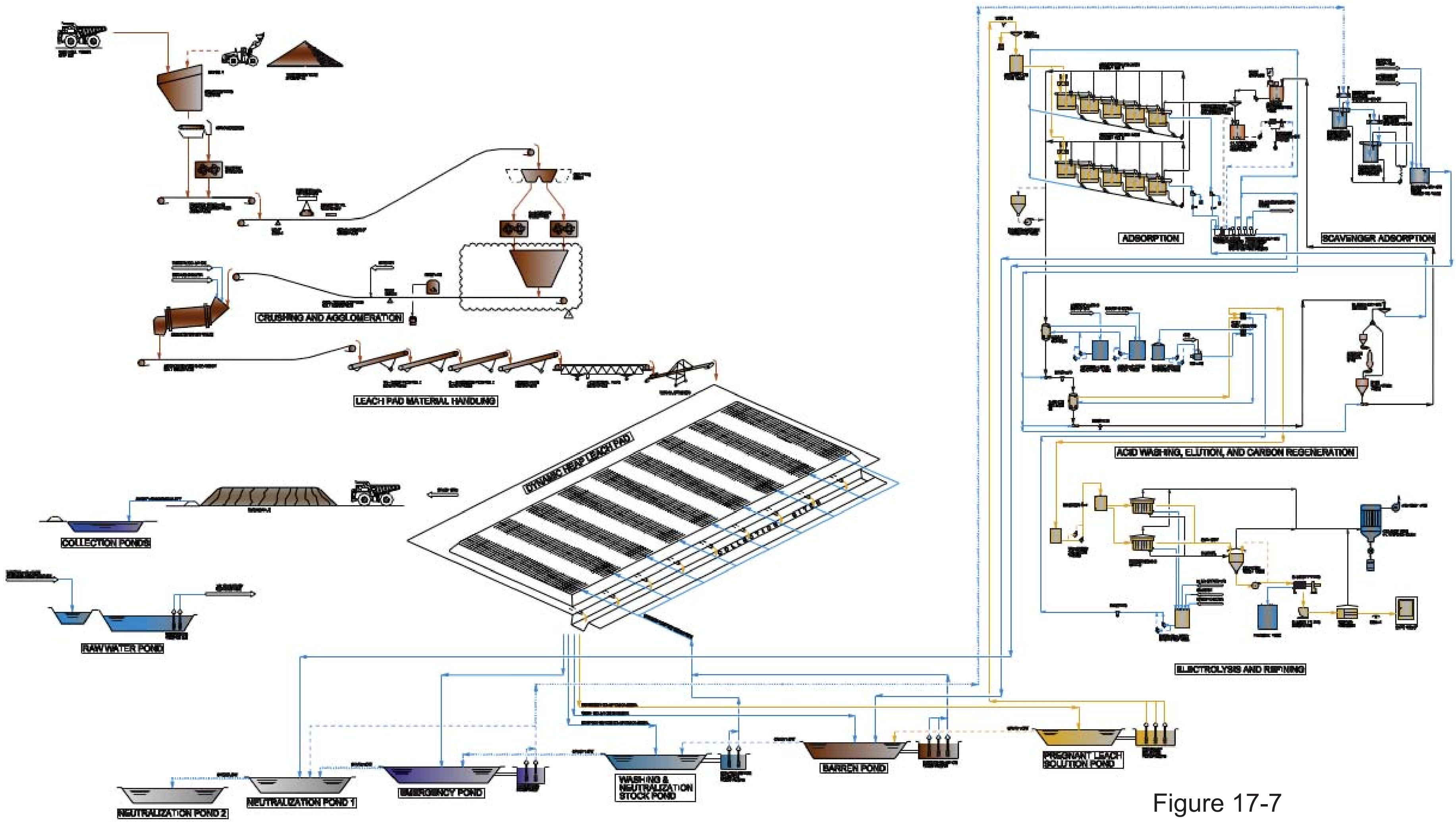


Figure 17-7

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

Suruca Oxide Process Flow Sheet

October 2019

Source: Yamana Gold, 2018.

18 PROJECT INFRASTRUCTURE

Chapada operates an open pit mine and process plant and has all the required infrastructure necessary for a mining complex including:

- Open pit mine and mine infrastructure including truck shop, truck wash facility, warehouse, fuel storage and distribution facility, explosive's storage and magazine sites, and electrical power distribution and substations to support construction projects and mine operations.
- A conventional grind/flotation mill for processing sulphide ore and mill infrastructure including assay laboratory, maintenance shops, and offices.
- Mine and mill infrastructure including office buildings, shops, and equipment.
- A TSF comprising a centreline raised dam constructed with cyclone tailings with current permitted capacity for 2.5 years and plans for further expansion.
- Local water supplies as required.
- Electric power from the national grid.
- Haulage roads from the mines to the plant.
- Stockpile areas for high grade and low grade ore and waste dumps.
- Maintenance facilities.
- Administrative office facilities.
- Core storage and exploration offices.
- Access road network connecting the mine infrastructure to the town site and to public roads.

POWER SUPPLY AND DISTRIBUTION

The Project is connected to the National Electric Grid through a 230 kV Transmission Line connected to the CELG electric substation at the city of Itapaci, GO. The Chapada power line is an 84 km private line that connects to the mine's 230 kV/13.8 kV main power substation with three 42 MVA transformers. The current power demand at the Project is 46.5 MW. The capacity limit for the power line is 100 MVA. In 2017, a 230 kV power line was completed from

Serra de Mesa to Itapaci via Barro Alto, duplicating the original line and increasing the regional capacity.

The alignment of the power line through the Project site includes a section that passes through the TSF. Current engineering studies plan for this section of the line to be rerouted outside the TSF boundary as part the plant equipment and infrastructure relocation to accommodate the mining of the Sucupira deposit. The main substation is planned to be relocated to the northeast of the plant. Figure 18-1 shows the new alignment of the power line and the location of the new substation.

After transformation from 230kV to 13.8 kV, power is be distributed to secondary substations (4,160 V and 460 V), e-houses in distribution lines. Secondary substations are located at main power consuming areas of the plant including, primary crushing, secondary crushing, grinding and concentrator, tailings pumping, water pond and existing stockpile.

WATER SUPPLY

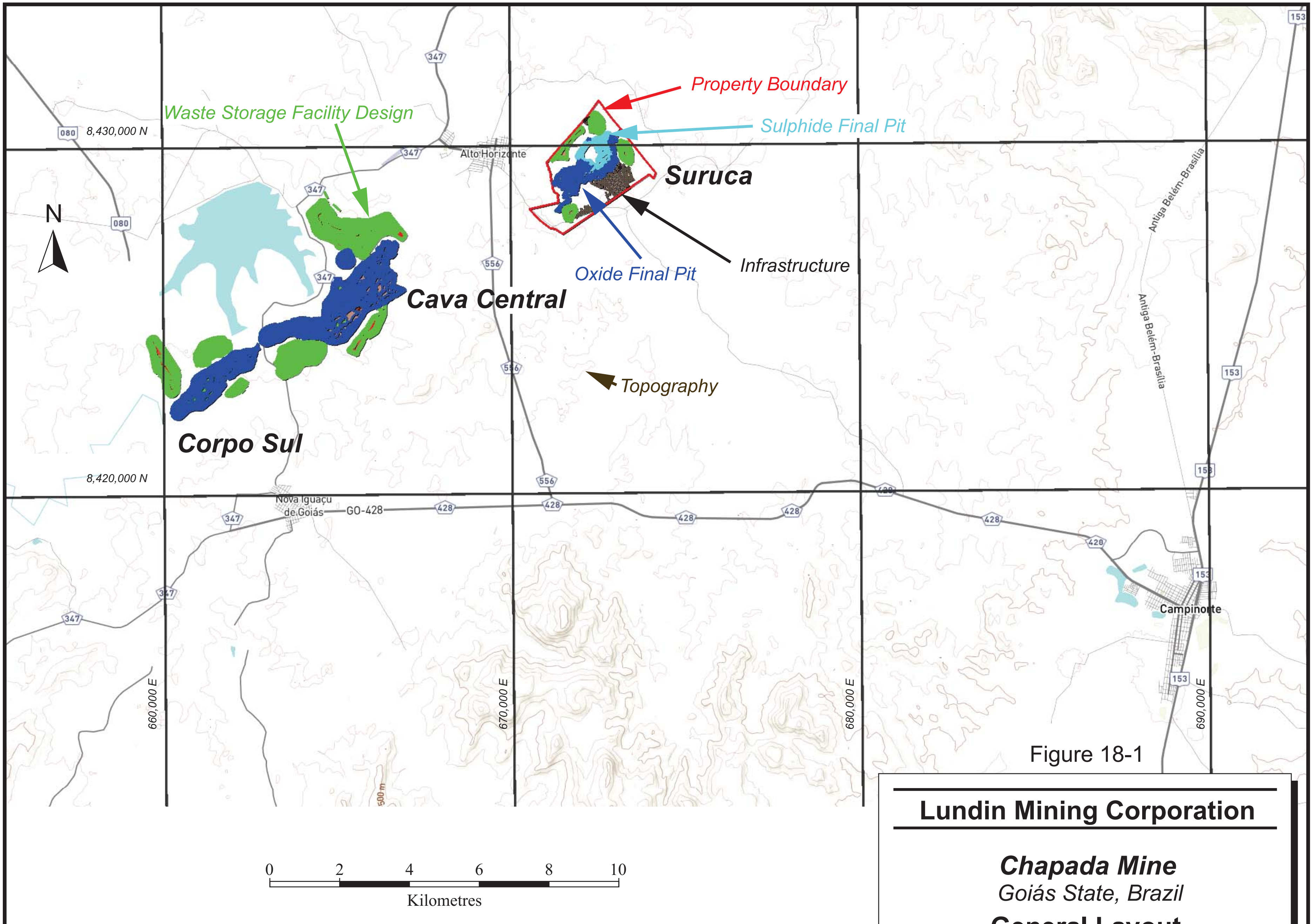
WATER CATCHMENT SYSTEM – TAILINGS FACILITY

Process water is pumped from a water pumping station located in the water reservoir adjacent to Dike II in the TSF area to the process water reservoir at the process plant. A booster pump station is located outside of the TSF in the reclaim water pipeline. Each station is equipped with a set of three submersible centrifugal pumps operating in parallel for a combined capacity of 7,600 m^3/h.

CONCENTRATE STORAGE AND SHIPPING

Concentrate is filtered and stored in the Chapada concentrate warehouse which has approximately 6,000 t of storage capacity. The concentrate is loaded into end dump transport trucks in the Chapada warehouse using a frontend loader. The trucks are weighed before loading and samples are taken from each loader bucket during loading. The samples are analyzed for moisture and metal content. The loaded trucks are weighed, tarped, and sealed and then travel from Chapada, approximately 1,630 km to the Multilift Logistics warehouse in the Port of Vitoria in the State of Espirito Santo. The travel time is approximately 4 days. The trucks are weighed by Multilift and the concentrate is unloaded onto conveyors that transport the concentrate to a stockpile in the Multilift warehouse to await the next vessel. The concentrate is then loaded into clamshell type containers (Multilift Articulated Bucket System) which are transported to the ship on flat bed trucks. The buckets are then lifted by the ship's overhead crane and the concentrate is dumped into the hold of the ship. Samples are taken during loading and a moisture certificate generated. An electronic invoice is issued NF-e. Receive the NF-e to close the exportation with Brazilian Customs.

The Project is spread out over approximately 7.5 km strike length, as illustrated in Figure 18-1.



October 2019

Source: RPA, 2019.

Figure 18-1

Lundin Mining Corporation

Chapada Mine

Goiás State, Brazil

General Layout

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19 MARKET STUDIES AND CONTRACTS

Information for this section was supplied by Lundin.

The product from the Chapada concentrator is copper concentrate containing gold and silver, which is readily marketable on world markets. The concentrates are clean and have a very low content of critical elements such as lead, zinc, arsenic, antimony, bismuth, and mercury.

Chapada concentrate is currently sold through a long-term contract and under a series of short to medium term contracts into the spot sales market. A copper sales strategy is being developed and will include additional sales under longer term direct-to-smelter conditions. All long-term contracts will be referenced against annual copper smelter treatment terms while the shorter-term contracts will be market based at the time of sale. The concentrate is currently shipped from a public port facility in Vitoria, Brazil to destinations in Europe and the Far East.

20 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

ENVIRONMENTAL STUDIES

The following environmental management programs have been developed for the Project:

- Monitoring of surface water quality (receiving environment)
- Monitoring of Rainfall and Effluent Water Quality Control
- Monitoring of erosion processes
- Study of geochemical characteristics of waste material and groundwater contamination
- Air quality monitoring
- Monitoring of flora
- Monitoring of terrestrial fauna
- Monitoring of ichthyofauna
- Monitoring of environmental compensation areas
- Remediation of disturbed areas
- Disposal of waste rock and low-grade ore

Chapada develops environmental control reports, most recently on an annual basis, which are submitted for regulatory review. Four reports dated August 2014, December 2016, February 2018, and March 2019 were available for review. The 2019 report presents results and conclusions of the monitoring programs for water quality, air quality and noise. Results for flora, terrestrial fauna and ichthyofauna (fish in the region) were not included.

Air quality monitoring is conducted weekly at three locations. Noise monitoring is conducted monthly at five locations. Results presented in the 2019 Environmental Control Report indicate compliance with applicable limits. Air quality compliance is checked against applicable Brazilian legislation, i.e., Decree No. 1745 and the Brazilian National Environment Council (CONAMA) Resolution No. 491/2018. Noise compliance is checked against maximum noise limits from CONAMA 01/90, ABNT NBR 10151:2000 and Decree No. 5871/03. Road irrigation is carried out regularly at the site and access roads for dust suppression. Water quality monitoring is described under the Water Management section below.

Based on the documentation available for review, including observations and recommendations made by SLR Consulting following a site reconnaissance visit in 2014, a portion of the waste rock is Potentially Acid Generating (PAG). Accordingly, the mine operation involves segregation of Non-Acid Generating (NAG) waste from PAG waste and strategic placement of the PAG waste. Static testing results are incorporated in the geologic block model to aid in waste management planning. Based on discussions with operations staff during the site visit, seepage from the tailings dams and waste rock dumps is sampled regularly. Seepage from the TSF is neutral whereas seepage from some waste rock dumps was found to be acidic in some locations.

Water balance analysis developed by SLR Consulting for the waste dumps indicated that several years (six to nine years) are required before the waste becomes saturated enough to generate significant leachate/seepage. Nonetheless, acid drainage has been occurring. The pits have neutral to acidic water, and there are locations around the mine where ARD is evident. Chapada has indicated that changes occurring to water quality are not yet significant. SLR Consulting observed in 2014 that Chapada personnel were utilizing the data and observations from the water quality monitoring program to make inferences as to why conditions may be changing at some locations and adjusting plans and procedures accordingly. This practice should be maintained.

PERMITTING

MMIC holds the mining rights related to the Project, having succeeded and incorporated Mineração Alonte Ltda. on May 14, 1998. Mineração Alonte had succeeded Mineração Serras do Leste Ltda., in 1994.

Mining rights are regulated by Mining Directive No. 2394/79, pursuant to Departamento Nacional de Produção Mineral (National Department of Mineral Production DNPM) case No. 808.923/74, and Mining Directive No. 350, pursuant to DNPM case No. 860.931/1994. There is also case No. 860.273/03 where the Corpo Sul is located. Property rights in the area correspond to the surface rights owner, Fazenda Genipapo, on which the Project is situated on, and under which the respective deposit is located.

The Environmental Impact Study and corresponding Environmental Impact Report were submitted in December 1996 to the former FEMAGO, currently the State Secretariat of the Environment – SEMARH – in accordance with the National Environmental Council (CONAMA) Resolution 001/86, Goiás State Environmental Agency (FEMAGO) Directives and the State Council for the Environment, along with preliminary and installation license applications. Preliminary licence No. 013/99 was issued to MMIC, along with requisite installation licenses issued under No. 171/2001. The Preliminary license was renewed in June 2000 and its registration number was updated to 009/2000. The installation license was renewed in July 2006 and its registration number was updated to 287/2006.

The operating licence, also known as the Licence to Function, was obtained on November 20, 2006. It was renewed on September 29, 2008, with renewal intervals as per the terms of the regulating body. The most recent renewal was obtained in August 2012 carrying a valid term to 2022 as per process 20027/2009. This license is currently being updated, to consolidate several expansion/construction permits obtained during the operation.

Operation at Chapada began in the South Pit, following obtained licenses for the construction and installation Pit, IPC – In Pit Crusher and South Waste Rock Piles. The following licenses are either in place or are in the process of being obtained:

- Waste Rock Pile 2A construction and installation licence number 1450/2015, process 16564/2014, obtained on July 8, 2015. Valid until 2021. Construction and installation are complete, and the facility is in operation. Expansion of Waste Rock Pile 2A was constructed under license number 253/2015 and is complete;

- Waste Rock Stack 3 construction and installation license number 635/2019 obtained on August 13, 2019. Valid until 2024

- Ninth Tailings Dam elevation license number 525/2018 (crest elevation 378 m) obtained on June 28, 2018 (an extension of the prior licenses). Valid until 2024, construction is ongoing);

- Southwest Phase II Stack (Expansion License) valid until March 4, 2021;

- Cava Sul construction license number 20027/2009 valid until December 19, 2020;

- U&M Truck Shop Relocation license number 260/2019 which is awaiting review;

- Paraguay Farm Legal Reserve Relocation license number 4354/2018 which is awaiting review;

- LI Plant Suruca license number 29/2018 valid until January 16, 2024;

- Gas Station license number 040/2017 valid until October 16, 2019;
- Suruca Cava license number 1430/2017 valid until December 20, 2023;
- Suruca Stack 2A license number 1439/2017 valid until December 21, 2023; and
- Suruca Stack 2B license number 1417/2017 valid until December 14, 2023.

Chapada has obtained water permits which allow for the capturing and pumping of water from Rios Dos Bois as well as mine facilities such as the open pits and seepage collection ponds:

- Rios dos Bois Funding permit number 50/2013 which is in the process of renewal.
- Grant Pumping Dam permit number 155/2018 which is valid until 2030;
- North Pit Pumping Grant permit number 87/2019 which is valid until 2031;
- Central Pit Pumping Grant permit number 1408/2018 which is valid until 2030;
- DDHS Lower South Body PB 01 permit number 159/2018 which is valid until November 2019;
- DDHS Lower South Body PB 06 permit number 158/2018 which is valid until November 2019;
- DDHS Lower South Body PB 03 permit number 157/2018 which is valid until November 2019;
- DDHS Lower South Body PB 05 permit number 156/2018 which is valid until November 2019;
- Pumping South Pit permit number 3886/2014 which is awaiting review;
- Lower South Body – Well 02 in process;
- Lower South Body – Well 04 in process;
- ETA Building ADM Grant permit number 86/2006 which is in the process of renewal;
- ETA Laboratory Award permit number 718/2006 which is in the process of renewal; and
- South Pit Grant permit number 91/2014 which is in the process of renewal.

The acquisition of the following licences is planned and required for the continuation of mining operations for the projected remaining mine life:

- Relocation of Santana dos Araujos Farm Legal Reserve, which is currently in progress,
- Pit Baru Northeast Installation license, which is currently in preparation of study,

- Power Transmission Line Deviation license, which is currently in preparation,
- Waste Rock Dump N1 expansion, which is currently in progress,
- TSF dam operating license which is in preparation to increase the TSF dam crest above 378 m and
- Low Grade and Waste Dumps Operation Permits.

SOCIAL OR COMMUNITY REQUIREMENTS

SOCIAL AND ENVIRONMENTAL ASSESSMENT MANAGEMENT SYSTEMS

Chapada demonstrates strong integration with the local community through direct investment. The primary sources of investment are through taxation, local jobs, procurement, and social investments.

GRIEVANCES

Although accepting of the Project, local community members have raised concerns regarding unintended impacts of noise, dust, and vibration. Lundin provides a toll-free line and WhatsApp channel to allow community members to voice concerns and grievances, which are recorded and investigated. The commitments are tracked and monitored in order to report back to communities on progress and continued engagement for improvement.

LABOUR AND WORKING CONDITIONS

Chapada currently has 752 employees and approximately 1,340 contractors. Around 10 % of the workforce is female. The majority of the workforce is between 26 to 35 years old (42%) and 36 to 45 years old (32%).

Chapada's current OHS management system is ISO14001 and OHS18001 certified by a third party. A formal Lundin Responsible Mining Management System (RMMS) gap assessment will be conducted by a third party in H1 2020 to identify any OHS management system alignment and improvement opportunities. The RMMS includes health and safety training programs, along with an Occupational Hygiene Program.

COMMUNITY WELFARE

Taxation generated from Chapada, along with direct benefit programs, have continued to improve the welfare of the local community. It was observed that Alto Horizonte has benefitted directly, using the funds for schools, churches, and other facilities to service the community. The Alto Horizonte community is considered very safe with low reported security concerns.

In 2018 the Project voluntarily partnered with the Commonwealth Scientific Industrial Research Organization based out of Australia to incorporate a Social License to Operate (SLO) index. The SLO is intended to benchmark efforts made by the Project to integrate social performance and continued engagement with the local community. Follow up reporting indicates the Project continues to be accepted by the local community and is responding to feedback on improvements. Members of the Project's leadership team live in the local community and have established systems for sharing information, engaging the local community, and creating social networks for cooperation.

LAND ACQUISITION & RESETTLEMENT

The predominant use for land surrounding the Project is cattle ranching. Nearly 80 farms make up 50%, or approx. 200 ha, of land surrounding the Project which is not conducive to agricultural use due to the low availability of water. It is understood that relations with landowners are positive and constructive. Any expansions to Chapada will likely require the relocation of affected landowners.

According to Lundin, the site has established a Land Management Committee, led by the Managing Director, to define and coordinate the strategy moving forward based on the International Finance Corporation (IFC) standards (*Good Practice Handbook: Land Acquisition and Resettlement* (IFC 2019)).

INDIGENOUS PEOPLES

Based on available information provided by Brazil's Indigenous Agency, FUNAI, there appears to be no evidence of Indigenous populations living in the area. Also, there are no "Quilombola" communities present near the site, based on a database provided by Fundação Palmares, the government entity responsible for promoting the rights of Afro-Brazilians.

CULTURAL HERITAGE

The Chapada project obtained permits and carried out a cultural heritage and archeological program as part of the initial permitting process. Surveys and non-destructive analysis were executed, the archeological artefacts were recovered for all the directly affected areas of the operation. Artefacts were taken to a local museum at Porangatu City. A Cultural Heritage Education plan was developed and provided to local communities.

WATER MANAGEMENT

According to the 2019 Environmental Control Report, a Drainage Master Plan has been developed for the management of surface runoff from mine facilities (open pit and waste piles). The contact water collected on site is either recirculated to mine operation users (ore processing, dust control, etc.) or lost to evaporation/infiltration. Surface water from the waste piles is released directly to the environment. These releases are monitored at control points; the water quality standards are reportedly being met at these locations. Potential acid drainage that may occur in the future, should be captured, and conveyed for treatment to prevent the potential direct release to the environment.

Water from open pit dewatering is pumped to the TSF. Water collected in the TSF is recirculated to the ore processing plant. Surface runoff from the ore processing plant is directed to a water management pond located in the process plant area, with periodic maintenance and inspections carried out. Water levels in the tailings pond are carefully tracked to maintain targeted operating water levels and dam freeboard requirements. Water is also stored in the open pit sumps when necessary. Fresh water supplies for ore processing can be taken from the Rio dos Bois, when required, to meet the industrial plant water demand. Mine staff informed RPA during the site visit, that no water from the river has been taken in the past two years. It is further noted that the Rio dos Bois is ephemeral in nature and sections of the river, near the mine site, go dry at various times of the year.

An integrated site-wide water balance has been developed as part of the 2019 expansion study to account for inflows and outflows associated with the water management system at the mine site. It is unclear if the water balance is continuously tracked during operation to support decision making associated with water management. A water balance for ongoing operations to be updated regularly by mine operations personnel (or a designated consultant) is an important tool to ensure that sufficient water is available for ore processing and that pond water levels are adequate for safe operation of the TSF. The water balance makes it possible to track trends and conduct short term predictions through the simulation of variable operating and/or climatic scenarios to support decision making associated with tailings pond operation (e.g., maintaining adequate dam freeboard at all times). The Tailings Storage Facility is covered by a specific water management plan developed by a specialized external consultant – Pimenta de Ávila. The water balance will be integrated with the site-wide balance.

Chapada's current water collection license from the Rio dos Bois is for 2,100 m^3/hr, up to a maximum of 10.3 million m^3/year, and the maximum permitted volume of water storage in the tailings dam is dam is 229 million m^3, according to Permit 525/2018 valid through to June 2024. The annual consumption amount is approximately 3.38 million m^3/year and with the expansion will increase to 6.94 million m^3/year, which is within the permitted level. The expansion study indicated that there is no shortage of water in the region and that no difficulty is foreseen should the need arise to increase the permitted limit. The expected lead time for such approval is 6 to 12 months.

MONITORING

RAINFALL

Rainfall monitoring is conducted by mine staff using a combination of manual and automatic rainfall gauges for a total of 11 gauges. Based on available records the annual rainfall is approximately 1,500 mm.

GROUNDWATER LEVEL MONITORING

In total, there are 66 piezometers that have data records between April 2007 and October 2016. The first piezometers were installed in the mine area in 2005, and new piezometers were added as the mine operation advanced. As of 2018, there were 40 active instruments. Monitoring is conducted quarterly. Water quality indicative parameters are measured in the field. These parameters are temperature, pH, conductivity, dissolved oxygen, and oxygen reduction potential.

The analytical results from water quality sampling are compared to standards of CONAMA Resolution No. 396/08, to verify compliance with the Brazilian legislation, or against background concentrations, and these results are reported annually to regulators. According to the 2019 Environmental Control Report, the monitoring results show compliance relative to the standards and/or background concentrations.

SURFACE WATER QUALITY MONITORING IN THE RECEIVING ENVIRONMENT

Twenty eight (28) surface water quality monitoring locations at the following water courses:

- Rio dos Bois
- Formiga river
- Caraíba stream and tributaries
- Bacu-Pari stream and tributaries
- Tum-Tum stream
- Aparecida stream

The monitoring at locations near the TSF (stations SUP07, SUP13, SUP18, SUP21 and SUP30) is conducted monthly whereas the rest of the locations are monitored quarterly (i.e. four annual campaigns). The results are documented in quarterly reports.

The analytical results are compared to standards of CONAMA Resolution No. 357/05 (class 2 water bodies) to verify compliance with the Brazilian legislation, or against background concentrations obtained during the monitoring sampling carried out between 2004 and 2006 and reported to regulators. According to the 2019 Environmental Control Report, the monitoring results show compliance with the standards.

RAINFALL AND EFFLUENT WATER QUALITY CONTROL

Monitoring of stormwater and effluent quality through periodic evaluation of the physicochemical and chemical characteristics against the conditions and quality standards established by CONAMA Resolution No. 357/05 for Class 2 water bodies (local water discharge), and CONAMA Resolution No. 430/11 for effluent release.

Analytical testing is performed by a National Institute of Metrology, Standardization, and Industrial Quality in Brazil (INMETRO) accredited laboratory that meets Quality Management System standards NBR ISO / IEC 17025 for laboratory testing. The procedures for chemical analysis follow directives established in the latest version of the Standard Methods for Examination of Water and Wastewater, and the ABNT NBR 9898/87 standard for preservation and sampling techniques.

The monitoring program include 26 locations for rainfall runoff drainage influenced by low-grade ore stockpiles in the mine's operating area (quarterly), six effluent locations associated with the sewage treatment plant and the oil separator box (monthly), seven locations in the TSF (quarterly), ten locations at points of release and mixing zones (when releases take place), and 1 location at Ducks Lake (monthly). Monitoring reports are submitted annually for regulatory review. 2019 results were not yet available.

EROSION CONTROL

Monthly monitoring involving systematic field inspections are conducted to identify the progress of erosive processes and the effectiveness of control measures implemented.

MINE WASTE AND TAILINGS

TAILINGS MANAGEMENT

The TSF Main Dam is currently at elevation 376 m (masl); increasing the dam elevation to its currently permitted height of 378 m provides approximately 2.5 years of tailings storage capacity at the current production rate of 24.0 Mtpa. Design and permitting is currently underway to raise the dam crest elevation to 382 m.

The increased Mineral Reserves require the TSF dam crest elevations be raised to approximately 398 m to provide storage capacity for tailings from an additional 510 Mt of ore and conceptual designs are in place.

It should be noted that the current Mineral Reserve pit potentially encroaches within the 100 m buffer to the Dike II toe as set out in the 2019 expansion study. Safe blasting procedures and a dam instrumentation and monitoring plan will need to be developed to ensure dam stability when the open pit expands towards the toe of the TSF.

Some of the Chapada tailings are considered non acid-generating while those from Corpo Sul are potentially acid-generating. Further geochemical testing and modelling is recommended, however water data provided to date suggest acid generating conditions may prevail for the life of the mine.

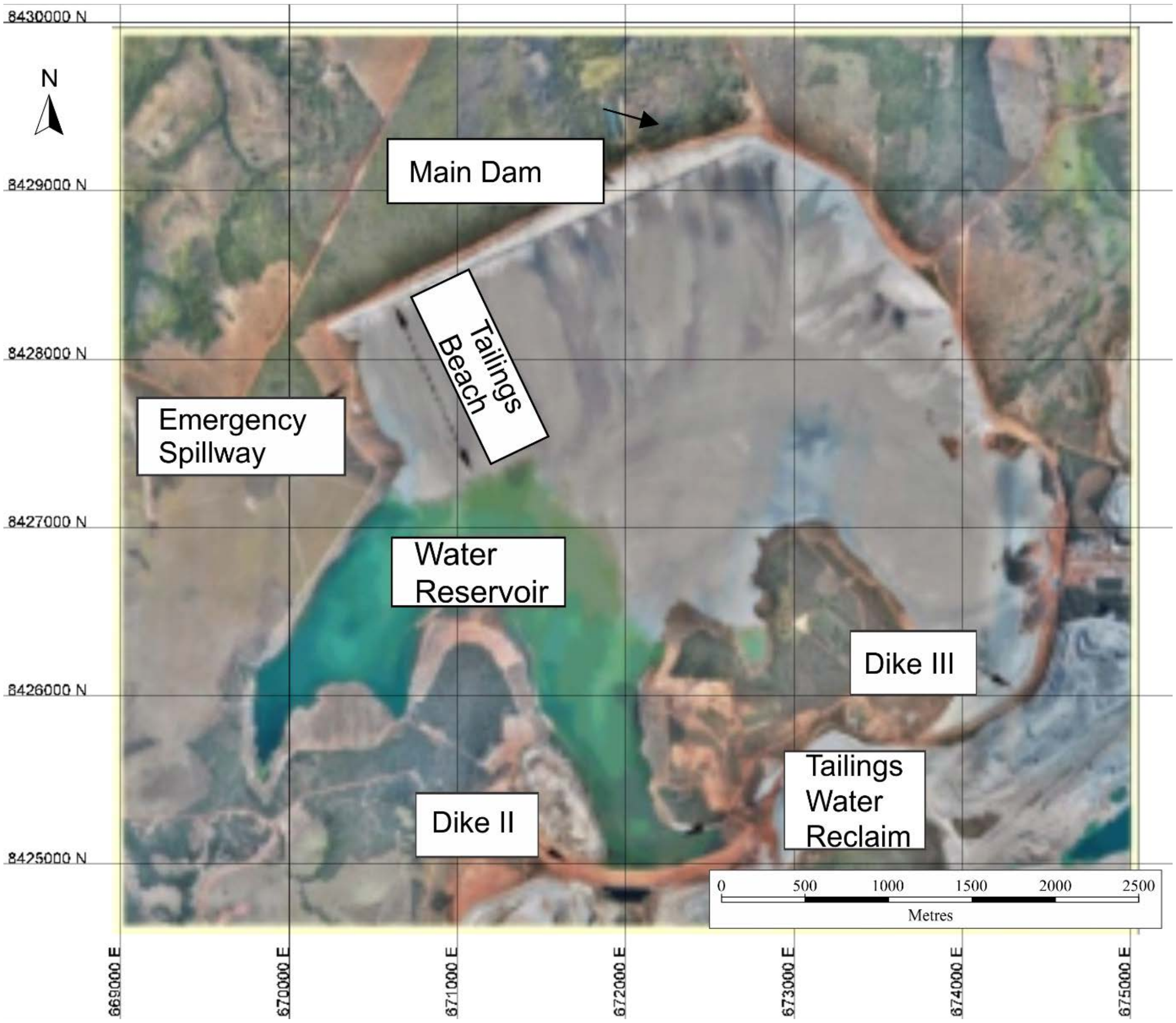
TAILINGS STORAGE FACILITY

The TSF consists of three dams: the Main Dam, Dike II, and Dike III illustrated below in Figure 20-1. The Main Dam starter dam was constructed from compacted local borrow material (clay to clayey silt soil) and has been subsequently raised by the centerline construction method using cycloned tailings to raise the downstream portion of the dam. In 2019, the Main Dam had a crest elevation at 376 m. The crest has an average width of ten metres and is about five kilometres in length. All structures were constructed with foundation drains and Dike II is also equipped with a vertical chimney drain.

The original TSF design was for an ultimate crest elevation up to 382 m, with the tallest segment of the dam being 54 m with a base elevation of 328 m at the downstream toe. To contain tailings for the proposed open pit expansion and the extended LOM, however, the existing tailings facility is planned to be raised up to an elevation of 398 m, with a maximum proposed dam height of 70 m. The proposed TSF expansion will be constructed with the same cyclone sand dam and centreline methodology (Main Dike and Dike III). Since tailings are not being deposited from Dike II and it is a water retention dam, it will be raised using local borrow material also by the centreline method.

It is worth noting that the mine expansion study recommends that for the proposed TSF dams, the minimum required tailings beach length should be increased from 100 m to 600 m. Currently the tailings beach is more than 1000 m long. Beach development should be prioritized next to the tallest dam segments.

FIGURE 20-1 TAILINGS STORAGE FACILITY LAYOUT



The TSF decant water pond is formed near Dike II. Dike III was built with compacted soil initially and then cycloned tailings sand while Dike II was built entirely with local borrow material. At the time of last reporting (2019), Dike III had a crest elevation of 375 m, and Dike II had a crest elevation of 374 m. The water level is at an elevation of approximately 367 m, and the emergency spillway invert is at 371 m.

The TSF has a "Class B" consequence classification rating according to the Brazilian system outlined in Departamento Nacional de Produção Mineral (DNPM) Portaria No 70.389 (May 17, 2017). The TSF is designed to store the 1:1,000 year flood event and maintain one meter of freeboard. The emergency spillway is designed to pass the flow associated with the 1:10,000 year flood event. The TSF is designed for a 1:475 year earthquake event which may not be in alignment with Canadian Dam Association guidelines (these guidelines are recognized as international best practice for dam design). Classification of the dam hazard potential according to CDA guidelines is recommended along with continuation of the independent reviews of the design and operation of the dams.

The Main Dam is instrumented with 32 water level indicators, five standpipe piezometers, six vibrating wire piezometers, two inclinometers, and 14 survey markers. Dikes II and III are instrumented with nine water level indicators and three standpipe piezometers. Recent dam safety inspections have reported that the tailings dams are being built and operated within the design parameters and are safe (Geoconsultoria, 2018, Baco Parí Stream Tailings Dam Regular Safety Inspection Report).

No information regarding the TSF foundation investigations was provided and therefore can not be commented on in this report.

WASTE ROCK DUMPS

Waste rock dumps are located adjacent to the open pits. The majority of the waste rock at the mine has been classified as potentially acid generating, with little neutralizing potential. Further characterization of waste rock storage facilities is required for improved water management during operation and for mine closure.

CLOSURE

The mine life for the Chapada open pits (Corpo Principal, Cava Norte, Corpo Sul, and Sucupira) is currently 24 years to 2042, while, the processing operations phase is planned to continue until 2050 with stockpiled low grade ore. The closure plan consists of three major types of activity: decommissioning, closure and rehabilitation, and post-closure monitoring and reporting. Decommissioning involves permanently ending the mining and mineral processing operations and removing all equipment and facilities not designated for future use. Reclamation includes reclaiming the mine site when possible to other sustainable uses as defined in closure management plans which primarily consists of regrading slopes, the placement of cover material, the construction of stormwater controls, and revegetation. Post-closure monitoring and reporting is conducted following closure activities to verify the measures taken at closure meet closure objectives. The first version of the plan for mine closure including rehabilitation of the TSF, mine sites, waste piles was submitted in 2008 and has been updated throughout the years. The latest closure plan was completed on August 21, 2015.

Each year, Chapada updates the forecasted closure cost. As part of the process, Chapada considers the layout and disturbance of the key features and infrastructure, including:

- Open pits
- Waste rock piles and low-grade deposits
- Tailings storage facility
- Industrial plant and support areas
- Post-closure monitoring

At closure, the open pit work will consist of constructing stormwater controls and the mitigation of the erosive processes. The open pits will be closed as pit lakes.

Closure of the waste rock piles will consist of providing a physically and chemically stable, reliable, and sustainably engineered interface between the environment and the mine waste. This includes regrading of slopes, the construction of stormwater controls, and revegetation activities and supports the agreed-upon land uses while minimizing degradation of the surrounding environment following closure. Further investigations and analysis are recommended to evaluate the objectives of waste rock covers for the Project and to compare and test alternatives. Rehabilitation was planned to commence in 2018 prior to the proposed mine expansion. No information on updated closure planning for the expanded project was available for review. The 2015 mine closure plan is being updated pursuant to LMC's mine closure standard. The updated mine closure plan will be issued in late 2020.

Current mine closure planning assumes that TSF closure will consist of draining and treating the water stored in the TSF, the construction of storm water controls to reduce the possibility of water accumulation in the TSF and covering the tailings with compacted soil and revegetating.

The closure of the processing plant and support areas consists of decommissioning and removing all the equipment and facilities that will no longer be in use post closure.

Post-closure monitoring consists of monitoring the closed facilities to verify the measures taken at closure meet planned future use goals. Monitoring will include surface water, groundwater, vegetation, and the engineered closed facilities such as stormwater controls and cover material.

In 2015 the forecast closure cost estimate for the Project was estimated at 475.1 million BRL or approximately US$126.7 million (VOGBR, 2015, Maracá Mining: Conceptual Closure Plan – Technical Report) and is updated annually.

21 CAPITAL AND OPERATING COSTS

CAPITAL COSTS

Estimated capital costs for Chapada for the next five years are tabulated below in 2019 US dollars using an exchange rate of 3.75 R$/US$. It is noted that over 80% of the capital costs are forecast to be locally denominated in R$. The Project capital includes primarily mobile equipment rebuilds and replacements, while the TSF capital costs includes routine dam raises and distribution pipeline raises and relocations. The infrastructure and plant relocations necessary for the mining of the Sucupira deposit are currently scheduled to commence in 2021 and total an estimated $161.9 million at the time of anticipated completion in 2027.

Lundin capitalizes waste stripping costs when experienced strip ratios are above the average planned strip ratio for each open pit phase under development. During the production phase of the Chapada open pit, waste stripping costs, which provide probable future economic benefits and improved access to the orebody are capitalized to mineral properties. Capitalized waste stripping from the open pit is forecasted to be US$171.2 million for the period 2020 to 2024.

Exclusions from the capital and sustaining cost estimate include, but are not limited to, the following:

- Potential future mine and plant expansion plans currently under review by Lundin
- The Suruca project (shown separately below),
- Potential project financing and interest charges,
- Working capital.

TABLE 21-1 TOTAL CAPITAL COST
Lundin Mining Corporation – Chapada Mine

Capital Cost ($ million)	2020-24	2020	2021	2022	2023	2024
Sustaining						
Mine	66.9	8.7	18.5	12.5	19.7	7.5
Mill	18.9	13.5	0.8	0.8	2.7	1.1
Tailings	22.7	5.4	4.4	4.0	4.2	4.7
G&A	11.0	1.4	3.8	1.5	3.4	0.9
Sub-Total Sustaining	**119.5**	**29.0**	**27.5**	**18.8**	**30.0**	**14.2**
Relocate Infrastructure	122.7	-	2.0	35.9	69.9	15.0
Capitalized Stripping	**171.2**	**16.9**	**31.1**	**32.7**	**25.6**	**64.9**

Over the current LOM, Sustaining Capital average US$12.9 million per year for the next 31 years. Reclamation and closure costs are estimated to be US$126.7 million.

Lundin is continuing to optimize the production schedules at the current 24.0 Mtpa throughput rate and will actively review the options for mine and plant expansion, potentially to 32.0 Mtpa, in parallel with a more aggressive exploration program. RPA has reviewed a LOM economic analysis of Chapada including estimated capital costs provided by Lundin and confirm that the outcome results in a positive cash flow that supports the statement of this Mineral Reserves.

The Suruca oxide pit and heap leach initial pre-production capital cost is estimated to be $57.3 million, sustaining capital $5.3 million, and closure cost $4.1 million. The LOM capital cost is $66.7 million and includes initial, sustaining, and closure costs. Both pre-production and LOM capital cost estimates for Suruca assume an exchange rate of 3.5 R$/US$.

OPERATING COSTS

Chapada has been in continuous production since 2007 and operating costs are tracked and well understood. Forecast unit operating costs for the next five years are summarized in Table 21-2 below. The forecast operating costs are estimated using an exchange rate of 3.75 R$/US$ and it is noted that over 80% of the operating costs are locally denominated in R$. Total average forecast unit costs for the mine on a cash basis are $9.12/t milled for the next five years, inclusive of ore stockpile movements and exclusive of mine development costs to be capitalized. The average operating costs over the full LOM is expected to trend lower particularly when treating stockpiled ores

TABLE 21-2 TOTAL OPERATING COST
Lundin Mining Corporation – Chapada Mine

Cost	Unit	Average 2020-24	2020	2021	2022	2023	2024
Mining	$/t material moved	2.06	2.04	2.01	2.06	2.04	2.18
Mining	$/t milled (excludes capitalized stripping)	4.79	5.38	4.73	4.81	5.01	4.04
Processing	$/t milled	3.31	3.28	3.32	3.33	3.30	3.30
G&A	$/t milled	1.02	1.18	1.05	1.00	0.94	0.94
Total	**$/t milled**	**9.12**	**9.84**	**9.10**	**9.14**	**9.25**	**8.28**

Notes:
1. Numbers may not add due to rounding.

The Suruca oxide operating cost will vary from year over year, due to the variation in plant ore feed and more significantly the difference in tailings handling requirement. Over the LOM, the overall operating cost is estimated at approximately 25.17 BRL or $7.19/t ore feed, as shown in Table 21-3.

TABLE 21-3 TOTAL OPERATING COST – SURUCA OXIDE
Lundin Mining Corporation – Chapada Mine

Cost	Units	Value
Mining	$/t mined	1.27
	$/t placed	2.61
Processing	$/t processed	4.16
G&A	$/t processed	0.42
Total (Processed+G&A)	$/t processed	**7.19**

Notes:
1. Exchange Rate: 3.5 R$/US$

The forecast average C1 cash cost for Chapada over the next five years is $1.38/lb Cu, net of the precious metal by-product credits, assuming $1,300/oz Au and $16.0/oz Ag pricing and an exchange rate of 3.75 R$/US$. The forecast C1 cash cost for the following five years are shown below in Table 21-4.

TABLE 21-4 C1 CASH COST
Lundin Mining Corporation – Chapada Mine

Cost	Unit	Av 2020-24	2020	2021	2022	2023	2024
C1 Cash Cost	$/lb Cu	1.38	1.21	1.34	1.17	1.69	1.49

Coincident with Lundin's acquisition of Chapada, certain subsidiaries of Yamana related to Chapada assumed previously entered into metals purchase agreements. Chapada C1 cash costs are calculated on a by-product basis and do not include the effects of copper stream agreements. Effects of copper stream agreements will be a component of the copper revenue and will impact realized revenue per pound.

Sandstorm Gold Ltd. ("Sandstorm") is entitled to purchase 4.2% of the payable copper produced from Chapada up to a maximum of 3.9 Mlb annually at 30% of the market price. The percentage of payable copper is subject to two reduction thresholds. Once an aggregate of 39 Mlb has been delivered the percentage of payable copper reduces to 3.0%. Upon delivery of 50 Mlb Cu the percentage of payable copper reduces to 1.5% for the remaining life of mine. The prior owner, however, provided a MMIC guarantee of a silver stream at its Cerro Moro property, a modified version of which is still in place. The modified guarantee provides that the reduction thresholds will be suspended in the event that Yamana and certain of its subsidiaries do not perform certain obligations under the Cerro Moro silver purchase agreement with Sandstorm. Lundin is fully indemnified by Yamana for any losses attributed with MMIC's performance under this continuing guarantee. It should be noted that the agreement with Sandstorm is with a separate wholly owned subsidiary of Lundin and it is not an encumbrance or obligation on Chapada.

Altius Minerals Corporation (Altius) is entitled to purchase 3.7% of the payable copper produced from Chapada at 30% of the market price. The percentage of payable copper is subject to two reduction thresholds. In the event of a specified expansion at Chapada, which is deemed effective at such time as throughput increases to an annualized run rate of more than 26 Mt for a period of 150 days with a corresponding increase in copper production from a base rate for copper production of not less than 33%, the percentage of payable copper reduces to 2.65%. Also, upon delivery of 75 Mlb Cu in aggregate the percentage of payable copper reduces to 1.5% for remaining life of mine. It should be noted that the agreement with

Altius is with a separate wholly owned subsidiary of Lundin and it is not an encumbrance or obligation on Chapada.

MANPOWER

Mine site manpower is currently 2,092 people. Direct mine site employees are 752 with 1,340 contractors and consultants. The breakdown of manpower by area is provided in Table 21-5.

TABLE 21-5 MANPOWER
Lundin Mining Corporation – Chapada Mine

Area	Company	Contract	Total
Mine Operating	153	533	686
Mine Maintenance	42	143	185
Geology/Planning	50	58	108
Plant Operating	69	29	98
Plant Maintenance	165	49	214
Administration	113	132	245
Laboratory	26	-	26
HSE & Community Relations	24	9	33
Infrastructure and Tailings Dam	74	257	331
Technical Services	13	92	105
Exploration	23	38	61
Total	**752**	**1,340**	**2,092**

22 ECONOMIC ANALYSIS

Under NI 43-101 rules, producing issuers may exclude the information required in Section 22, Economic Analysis on properties currently in production, unless the Technical Report includes a material expansion of current production. RPA notes that, as of the effective date of the report, Lundin is a producing issuer, the Chapada Mine is in production, and a material expansion is not being planned. RPA has performed an economic analysis of the Chapada Mine using the estimates presented in this report and confirms that the outcome is a positive cash flow that supports the statement of Mineral Reserves.

23 ADJACENT PROPERTIES

There are no material adjacent properties to the Chapada Mine as defined by NI 43-101.

24 OTHER RELEVANT DATA AND INFORMATION

No additional information or explanation is necessary to make this Technical Report understandable and not misleading.

25 INTERPRETATION AND CONCLUSIONS

Based on review of the available documentation, RPA offers the following conclusions:

GEOLOGY AND MINERAL RESOURCES

- The mineralization at Chapada is interpreted as a porphyry and epithermal system.

- The procedures for drilling, sampling, sample preparation, and analysis are appropriate for estimation of Mineral Resources.

- Mineral Resources conform to CIM (2014) definitions.

- RPA reviewed the following items and finds the estimation methods and classification criteria adopted by Lundin to be reasonable and sufficient to support Mineral Resource disclosure:
    - The Mineral Resource database
    - The geological interpretations
    - Exploratory data analysis
    - Composites and compositing strategy
    - Capping grades applied
    - Bulk density
    - Variography
    - Block model parameters
    - Interpolation strategy
    - Classification criteria determination and designation

- Measured and Indicated Mineral Resources of copper/gold inclusive of Mineral Reserves are estimated at 1,091 Mt grading 0.24% Cu and 0.15 g/t Au and containing approximately 2.6 Mt Cu and 5.2 million ounces (Moz) Au. Measured and Indicated Mineral Resources of gold only are estimated at 147.5 Mt grading 0.53 g/t Au containing approximately 2.5 Moz Au.

- Inferred Mineral Resources of copper/gold are estimated at 163 Mt grading 0.22% Cu and 0.08 g/t Au and containing approximately 360,000 t Cu and 400,000 oz Au. Inferred Mineral Resources of gold only are estimated at 12.6 Mt grading 0.5 g/t Au containing approximately 200,000 oz Au.

MINING AND MINERAL RESERVES

- The Mineral Reserve estimates have been prepared utilizing acceptable estimation methodologies and the classification of Proven and Probable Mineral Reserves conform to CIM (2014) definitions.

- Proven and Probable Mineral Reserves of copper/gold, including existing stockpiles scheduled for processing, are estimated to be 738.8 Mt grading 0.24% Cu and 0.15 g/t

Au, containing approximately 1.8 Mt of copper and 3.5 Moz Au. Proven and Probable Mineral Reserves of gold only, are estimated to be 65.2 Mt grading 0.51 g/t Au, containing approximately 1.1 Moz Au.

- Economic analysis of the LOM plan generates a positive cash flow and, in RPA's opinion, meets the requirements for the statement of Mineral Reserves. In addition to the Mineral Reserves in the LOM plan, there are Mineral Resources and exploration potential that represent opportunities for the future.

- Reconciliation of the ore mined from January to June 2019 comparing the Mineral Reserve block model to the plant feed substantiates the Mineral Reserve estimate at Chapada.

MINERAL PROCESSING

- From 2015 through 2017, the process plant went through an optimization program that included throughput improvements through further automation of the grinding circuit, improved recoveries by flotation cell retrofits, and on-line analysis of sample streams.

- The most recent test programs include pilot plant and in-plant testing to support optimization and process improvements in the existing grinding and flotation circuits and testing to support the potential expansion of the processing facilities from the current 65,000 tpd or 24.0 Mtpa to approximately 87,000 tpd or 32.0 Mtpa, potentially in stages.

- Woodgrove Technologies completed three phases of pilot plant testing with its SFR and DFR technology using samples from the Chapada concentrator.

- Based on the results of the pilot plant testing program, the following changes in the Chapada concentrator were made including with commissioning underway at the time of report writing:
  - Installation of two SFR cleaner scalpers and four SFR cleaner scavengers.
  - Installation of a pump on the flotation column tailings to direct the flow to the SFR scalper feed tank instead of the regrind circuit.
  - Installation of two rows of three DFR cells in parallel to treat the existing scavenger tailings. The concentrate from the DFR cells will be pumped to the existing concentrate regrind circuit.
  - Recalibration of the flotation circuit, Advanced Process Control System.
  - The predicted improvement in overall plant recovery was projected to be an increase of 2.5% Cu and 1.9% Au.

ENVIRONMENTAL, PERMITTING AND SOCIAL CONSIDERATIONS

- There are environmental monitoring programs and water management practices in place. Currently, water sampling at control points downstream of the mine indicate water quality standards are being met. Seepage from some waste rock dumps could be acidic and, in the future, plans for more robust a water management controls at these locations will be implemented. Collection of acid seepage may increase the volume of contact water requiring management within the mine site. Depending on the additional amount of contact water, it may not be possible to continue relying solely on the tailings pond to store contact water. New water management ponds may be required. Furthermore, the current negative water balance could turn into a positive water balance where excess water must be treated and discharged to the environment.

- Chapada has assessed potential displaced landowners resulting from the mine expansion. The site has established a Land Management Committee based on the IFC standards.

- Chapada has obtained the necessary permits and licenses for operation and requires multiple license extensions and new licenses for planned operations, some of which are currently in progress and based on the data provided and responses to requests, these are not at risk of being delayed or rejected. No license or permit violations have been provided or discovered and as a result the Project and operations are believed to be in good standing. A discharge permit is not required for the site at this time.

- The historic TSF design criteria have been set according to Brazilian regulations and practice and not necessarily using the CDA (2014) hazard potential classification and corresponding earthquake and flood criteria. All future TSF raises will be designed according to CDA, guidelines, which are recognized as international best practice.

- The TSF is currently permitted to a dam crest elevation of 378 m which is sufficient for approximately 2.5 years of tailings deposition at the current production rate. Design and permitting is currently underway to raise the dam crest elevation to 382 m. Conceptual designs have been developed to raise the dam crest to 398 m elevation to meet expansion requirements.

- Mine closure planning is an on-going activity at Chapada. A mine closure plan was filed in 2008 specifically for the TSF, mine sites, waste pile; this plan was most recently updated in 2015. In 2015, the forecasted mine closure cost for the Project was estimated at $126.7 million; at this time, these estimates do not appear to include potential future mine expansions.

26 RECOMMENDATIONS

Based on the site visit and subsequent review of the available documentation, the following recommendations are offered:

GEOLOGY AND MINERAL RESOURCES

- Cap individual assays as opposed to composites.
- Execute the significantly increased exploration program over the next three years, largely focused on near mine targets.
- Review the copper price used in the reported Mineral Resources applying a similar price as other Lundin operations.

MINING AND MINERAL RESERVES

- Previous owner developed pit optimization to maximize metal content for pit design, Lundin should explore pit optimization to maximize net present value (NPV) of the operation possibly resulting in smaller pits and reduced TSF requirement.
- Suruca gold only Mineral Reserves should be revised with updated parameters in order to maximize the NPV of the Project.

MINERAL PROCESSING

- Commissioning and optimization work should continue to obtain the best performance of the new processing and flotation equipment and to determine the effects of the equipment on the overall system, such as the effect of the new recycle streams in the flotation circuit.
- Continue to verify the plant production and recoveries through mine, mill, and final concentrate reconciliation as the operation continues on an on-going basis. The reconciliations will provide feedback for value assurance from the optimization program and continuous improvement initiatives.
- The mining and processing of the Sucupira mineralization will require relocation of some of the process systems and site infrastructure. The relocation will require advancement of the engineering and procurement work performed in the expansion/basic engineering study. Detailed planning will be required to do the relocations without loss of production.

ENVIRONMENTAL, PERMITTING AND SOCIAL CONSIDERATIONS

- Consider inclusion of results of monitoring of flora, terrestrial fauna, and fish in the annual environmental control reports.

- Continue additional static and kinetic geochemical testing on tailings and waste rock samples to enhance the geochemical characterization of the waste materials to verify or improve the waste disposal management practices.

- Additional water balance modelling work should be carried out considering a range of climate scenarios (i.e. wet and dry years) to identify water storage requirements based on estimates of acid seepage rates that may have to be collected from the waste dumps in the future. The capacity of the TSF to store water will vary as the mine operation progresses. Simulation of water balance scenarios for future years of operations will indicate if the TSF would have capacity to store additional contact water and if additional water management ponds will be required.

- According to the March 2019 environmental control report, the monitoring results on water quality, air quality, and noise are compliant with applicable standards and regulations. Water quality results should continue to be tracked with particular attention to geochemical testing and characterization, along with seepage from waste dumps.

- Implement a water balance for ongoing operations to be updated by mine operations personnel using meteorological and water monitored data on a regular basis (currently being developed on site). The water balance is an important tool to track trends and conduct short term predictions through simulation of variable operating and/or climatic scenarios to support decision making associated with tailings pond operation (e.g., maintaining adequate freeboard at all times).

- The operation should confirm the designed 100 m stand off distance between the open pit and the TSF is adequate. The site should also investigate future alternative tailings deposition options, including the potential for in-pit tailings deposition or co-disposal.

- Further work is required on the acid generating potential of the current and proposed LOM tailings and waste rock including practical data interpretation by qualified professionals, which may result in additional recommendations for additional waste characterization estimate initiatives.

- A blast control monitoring program should be designed to mitigate concerns over TSF dam stability and expansion pit proximity.

- Evaluate closure cover alternatives, and associated costs, for the waste rock dumps and TSF.

- The TSF seismic design event and emergency spillway capacity should be re-evaluated for compliance with the CDA guidelines, which are recognized as international best practice.

- Tailings beach development should be monitored as a critical control during operations.

- The Project should update the forecasted closure costs estimate should a mine expansion project be approved.

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28 DATE AND SIGNATURE PAGE

This report titled "Technical Report on the Chapada Mine, Goiás State, Brazil" dated October 10, 2019 with an effective date of June 30, 2019, was prepared and signed by the following authors:

(Signed & Sealed) ***Chester M. Moore***

Dated at Toronto, ON
October 10, 2019

Chester M. Moore, P.Eng.
Principal Geologist

(Signed & Sealed) ***Hugo M. Miranda***

Dated at Lakewood, CO
October 10, 2019

Hugo M. Miranda, ChMC(RM)
Principal Mining Engineer

(Signed & Sealed) ***Andrew P. Hampton***

Dated at Lakewood, CO
October 10, 2019

Andrew P. Hampton, M.Sc., P.Eng.
Principal Metallurgist

(Signed & Sealed) ***David G. Ritchie***

Dated at Toronto, ON
October 10, 2019

David G. Ritchie, M.Eng., P.Eng.
Managing Principal, Mine Waste Engineering Manager/Engineering Service Line Lead
SLR Consulting (Canada) Ltd.

29 CERTIFICATE OF QUALIFIED PERSON

CHESTER M. MOORE

I, Chester M. Moore, P.Eng., as an author of this report titled “Technical Report on the Chapada Mine, Goiás State, Brazil”, prepared for Lundin Mining Corporation with an effective date of June 30, 2019, and dated October 10, 2019, do hereby certify that:

1. I am Principal Geologist with Roscoe Postle Associates Inc. of Suite 501, 55 University Ave Toronto, ON, M5J 2H7.

2. I am a graduate of the University of Toronto, Toronto, Ontario, Canada in 1972 with a Bachelor of Applied Science degree in Geological Engineering.

3. I am registered as a Professional Engineer in the Province of Ontario (Reg. #32455016). I have worked as a geologist for more than 40 years since my graduation. My relevant experience for the purpose of the Technical Report is:
   - Mineral Resource and Reserve estimation, feasibility studies, due diligence, corporate review and audit on exploration projects and mining operations worldwide
   - Various advanced exploration and mine geology positions at base metal and gold mining operations in Ontario, Manitoba, and Saskatchewan
   - Director, Mineral Reserve Estimation and Reporting at the corporate offices of a major Canadian base metal producer

4. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

5. I visited the Chapada operations on August 20 and 21, 2019.

6. I am responsible for Sections 2 to 12, 14, and 23 and related disclosure in Sections 1, 25, 26, and 27 of the Technical Report.

7. I am independent of the Issuer applying the test set out in Section 1.5 of NI 43-101.

8. I have prepared a previous NI 43-101 Technical Report dated March 21, 2018 on the Chapada Mine.

9. I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.

10. At 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.

Dated this 10th day of October 2019.

(Signed & Sealed) *Chester M. Moore*

Chester M. Moore, P.Eng.

HUGO M. MIRANDA

I, Hugo M. Miranda, ChMC(RM), as an author of this report titled “Technical Report on the Chapada Mine, Goiás State, Brazil”, prepared for Lundin Mining Corporation with an effective date of June 30, 2019, and dated October 10, 2019, do hereby certify that:

1. I am Principal Mining Engineer with RPA (USA) Ltd. of 143 Union Boulevard, Suite 505, Lakewood, Colorado, USA 80228.

2. I am a graduate of the Santiago University of Chile, with a B.Sc. degree in Mining Engineering in 1993, and Santiago University, with a Masters of Business Administration degree in 2004 and Colorado School of Mines with a Master of Engineering (Engineer of Mines) in 2015.

3. I am registered as a Competent Person of the Chilean Mining Commission (Registered Member #0031). I have worked as a mining engineer for a total of 23 years since my graduation. My relevant experience for the purpose of the Technical Report is:
   - Principal Mining Engineer - RPA in Colorado. Review and report as a consultant on mining operations and mining projects. Mine engineering including mine plan and pit optimization, pit design and economic evaluation.
   - Principal Mining Consultant – Pincock, Allen and Holt in Colorado, USA. Review and report as a consultant on numerous development and production mining projects.
   - Mine Planning Chief, El Tesoro Open Pit Mine - Antofagasta Minerals in Chile.
   - Open Pit Planning Engineer, Radomiro Tomic Mine, CODELCO – Chile.
   - Open Pit Planning Engineer, Andina Mine, CODELCO - Chile.

4. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

5. I visited the Chapada operations on August 20 and 21, 2019.

6. I am responsible for Sections 15, 16, 18, 19, 21, 22, and 24 and related disclosure in Sections 1, 25, 26, and 27 of the Technical Report.

7. I am independent of the Issuer applying the test set out in Section 1.5 of NI 43-101.

8. I have prepared a previous NI 43-101 Technical Report dated March 21, 2018 on the Chapada Mine.

9. I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.

10. At 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.

Dated this 10th day of October 2019.

(Signed & Sealed) *Hugo M. Miranda*

Hugo M. Miranda, ChMC(RM)

ANDREW P. HAMPTON

I, Andrew P Hampton, M.Sc., P.Eng., as an author of this report titled "Technical Report on the Chapada Mine, Goiás State, Brazil", prepared for Lundin Mining Corporation with an effective date of June 30, 2019, and dated October 10, 2019, do hereby certify that:

1. I am Principal Metallurgist with RPA (USA) Ltd. of 143 Union Boulevard, Suite 505, Lakewood, Colorado, USA 80228.

2. I am a graduate of Southern Illinois University in 1979 with a B.S. Degree in Geology, and a graduate of the University of Idaho in 1985, with an M.S. Degree in Metallurgical Engineering.

3. I am registered as a Professional Engineer in the Province of British Columbia, Licence No. 22046. I have worked as an extractive metallurgical engineer for a total of 35 years since my graduation. My relevant experience for the purpose of the Technical Report is:
   - Process plant engineering, operating and maintenance experience at mining and chemical operations, including the Sunshine Mine, Kellogg, Idaho, Beker Industries Corp, phosphate and DAP plants in Florida and Louisiana respectively, and the Delamar Mine in Jordan Valley Oregon.
   - Engineering and construction company experience on a wide range of related, precious metal projects and studies, requiring metallurgical testing, preliminary and detailed design, project management, and commissioning and start-up of process facilities and infrastructure. EPCM companies included Kilborn Engineering Pacific Ltd., SNC Lavalin Engineers and Constructors, Washington Group International Inc. and Outotec USA, Inc.

4. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a "qualified person" for the purposes of NI 43-101.

5. I visited the Chapada operations on August 20 and 21, 2019.

6. I am responsible for Sections 13 and 17 and parts of 20 (other than mine waste and tailings aspects) and related disclosure in Sections 1, 25, 26, and 27 of the Technical Report.

7. I am independent of the Issuer applying the test set out in Section 1.5 of NI 43-101.

8. I have previously prepared Technical Reports on the property that is the subject of this Technical Report.

9. I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.

10. At 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.

Dated this 10th day of October 2019.

(Signed & Sealed) *Andrew P. Hampton*

Andrew P. Hampton, M.Sc., P.Eng.

DAVID G. RITCHIE

I, David G. Ritchie, M.Eng., P.Eng., as an author of this report titled "Technical Report on the Chapada Mine, Goiás State, Brazil", prepared for Lundin Mining Corporation with an effective date of June 30, 2019, and dated October 10, 2019, do hereby certify that:

1. I am Managing Principal, Mine Waste Engineering Manager/Engineering Service Line Lead with SLR Consulting (Canada) Ltd. at 36 King Street East, 4th floor, Toronto, M5C1E5.

2. I am a graduate of Ryerson Polytechnic University in Toronto in 1995 with a B.Eng. in Civil Engineering and of the University of Western Ontario in London, Ontario in 2000 with a M.Eng. in Geotechnical Engineering.

3. I am registered as a Professional Engineer in the Province of Ontario, Licence No.90488198, and the Province of British Columbia. I have worked as geotechnical engineer for a total of 24 years since my graduation. My relevant experience for the purpose of the Technical Report is:
   - Lead designer for various tailings management facilities located around the world;
   - Experiences with design of tailings and water retention dams including site investigations, geotechnical engineering and tailings deposition plans; and
   - Experience with dam safety inspections, performance monitoring experience, and lead for several dam safety review portfolios.

4. I have read the definition of "qualified person" set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

5. I have not visited the Chapada Mine.

6. I am responsible for the preparation of parts of Section 20 (mine waste and tailings aspects) and related disclosure in Sections 1, 25, 26, and 27 of the Technical Report.

7. I am independent of the Issuer applying the test set out in Section 1.5 of NI 43-101.

8. I have had no prior involvement with the property that is the subject of the Technical Report.

9. I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.

10. At 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.

Dated this 10th day of October 2019.

(Signed & Sealed) *David G. Ritchie*

David G. Ritchie, M.Eng., P.Eng.