NI 43-101 TECHNICAL REPORT – PRELIMINARY ECONOMIC ASSESSMENT

SAMAPLEU PROJECT

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This Technical Report contains estimates, projections and conclusions that are forward-looking information within the meaning of applicable laws. Forward-looking statements are based upon the responsible Qualified Person's ("QP") opinion at the time they are made but, in most cases, involve significant risks and uncertainty. Although each of the responsible QPs has attempted to identify factors that could cause actual events or results to differ materially from those described in this Report, there may be other factors that could cause events or results not be as anticipated, estimated or projected. There can be no assurance that forward-looking information in this Report will prove to be accurate, as actual results and future events could differ materially from those anticipated in such statements or information, Accordingly, readers should not place undue reliance on forward-looking information. Forward-looking information is made as of the effective date of this Technical Report, and none of the QPs assume any obligation to update or revise it to reflect new events or circumstances, unless otherwise required by applicable laws.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 SUMMARY

Sama Resources Inc ("The Company/Sama") is a listed company trading on the Toronto Stock Exchange under the symbol SME. The Samapleu Project operates under a Joint Venture (JV) agreement between Sama Nickel Corporation (66⅔% share; operator) and SODEMI (33⅓ %). The Project is located in the Ivory Coast in West Africa.

Sama has mandated DRA/Met Chem, a division of DRA Americas Inc. ("DRA/Met-Chem") to complete this Technical Report on the Preliminary Economic Assessment ("PEA"), following National Instruments 43 101 ("NI 43 101") rules and guidelines, regarding the Samapleu Project in order to advance the Project.

1.1 Property Description and Location

The Samapleu East Exploration Permit 838 ("*Permis de recherche minière*"; PR838) is located approximately 650 road km northwest of Abidjan, Ivory Coast, West Africa. PR838 is close to the village of Yorodougou, about 50 km west of Biankouma and 25 km east of the border with Guinea.

PR838 has an irregular shape with a maximum N-S extent of 24 km and 16 km along the E-W direction, for a total area of 258 km². PR838 was renewed several times under the name of PR123. In June 18, 2019, the original PR123 was replaced by two (2) new Exploration Permits named: Samapleu East (PR838) and Samapleu West (PR839) (Figure 1.1).

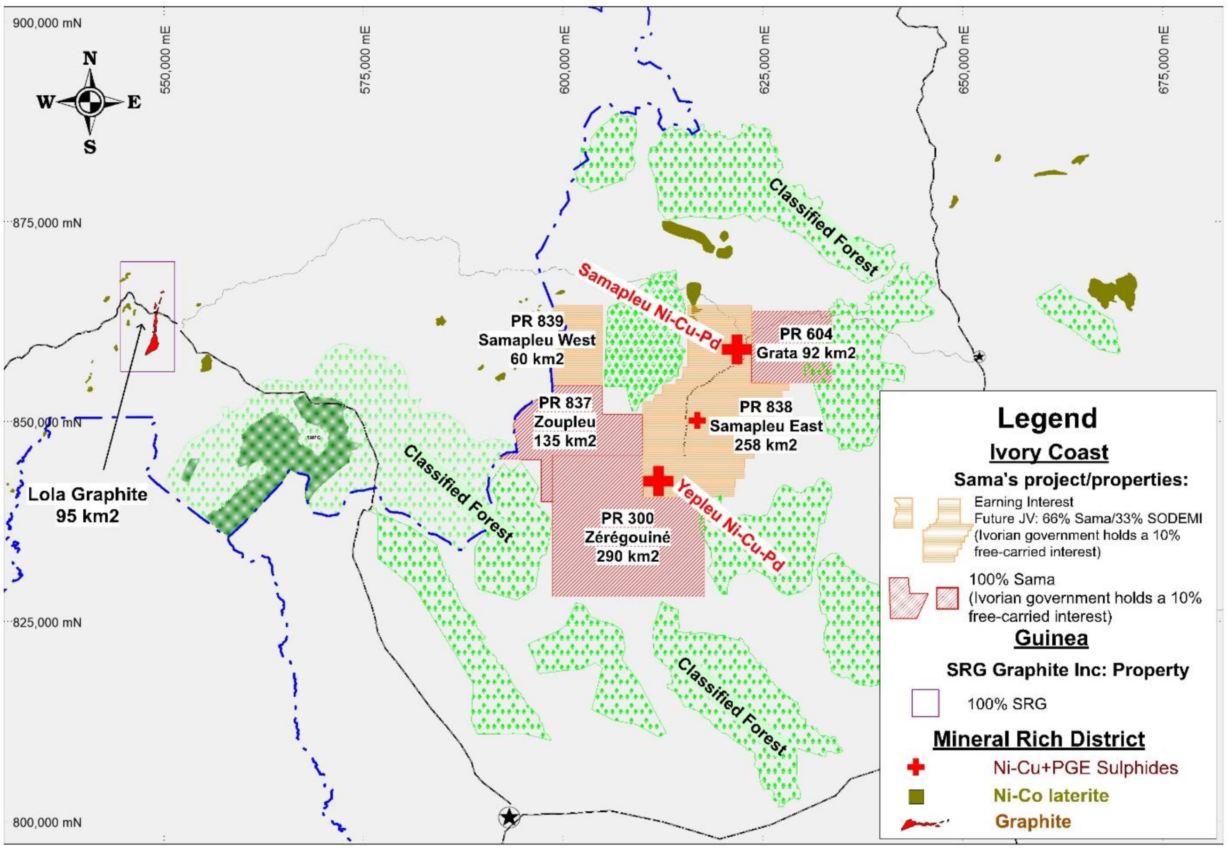
The Project operates under a Joint Venture (JV) agreement between Sama Nickel Corporation (66⅔% share; operator) and SODEMI (33⅓ %). Sama is under the obligation of financing various exploration program until a technical study for the Samapleu Project is finalised. Upon filing the technical study, if the Committee decides to follow up with the Project, SODEMI will be reimbursed for the historical exploration work expenditures and will reimburse Sama for the costs related to the exploration activities completed between January 15, 2009 and the approval date of the Bankable Feasibility Study. The financial participation of the future JV would be as follows: Sama Nickel (60%), SODEMI (30%) and the Ivorian Government (10%). In case it is decided to not follow up on the Project, SODEMI has the option to terminate the JV and SODEMI will own all the exploration data and studies without financial compensation.

Sama Nickel Corporation, through its two (2) subsidiaries, Sama Nickel Côte d'Ivoire SARL and Société Minière du Tonkpi SARL, own exploration rights on three (3) additional Exploration Permits (PR300, PR604 and PR837) adjacent to PR838 and PR839 (Figure 1.1) for a combined 839 km². These three (3) PR are 100% owned by Sama Nickel Corporation.

In 2018, Sama closed a private placement with HPX Ivory Coast Holdings Inc., a subsidiary of High Power Exploration Inc. Upon the execution of the earn-in and joint venture agreement, HPX will have the ability to acquire an interest of up to 60% in Sama's Côte d'Ivoire project, including the Samapleu

Project, by fulfilling specific obligations, namely funding exploration work, purchasing common shares and warrants.

Figure 1.1 – Sama's Exploration Licenses



1.2 Accessibility, Climate, Local Resources, Infrastructure, and Physiography

Access to the Property from Abidjan is via 225 km of paved road toward the NW to Yamoussoukro, followed by paved roads to Daloa and Duékoué to the west and north to Man and Biankouma (Figure 1.2). From Biankouma, the village of Yorodougou, where the Samapleu exploration camp is located, is accessed by a dirt road approximately 35 km toward the W-NW. The road continues through the town of Sipilou (further 25 km to the W) and to a border post between the Ivory Coast and Guinea. Access from Yorodougou to the Samapleu Deposits is via bush tracks servicing small villages and roads constructed by Sama.

Since 2017, the area is also accessible by plane with a three (3) flight per week between the town of Man and Abidjan. It is a two-hour drive from Man's airport to Sama's base camp in Yorodougou.

The Project area falls within the Guineo-Soudanian climatic zone, which is a transition zone between equatorial and tropical climates and has distinct rainy and dry seasons. The dry season extends from

November to March. The annual rainfall in the Project area averages 1,600 to 1,800 mm and temperatures range from 10°C to 35°C with an average of 23°C.

PR838 benefits from road access and basic services available in the towns of Man and Biankouma. Man is serviced by a domestic airport with scheduled flights. Biankouma and Sipilou are the largest local urban centre in the PR838 area. The Project is about 650 km to the port of Abidjan, while it is less than 550 km to the port of San Pedro.

A variety of mining activities has occurred in western Ivory Coast over the years. Consequently, some services and expertise related to the mining industry are available in the region. Indeed, since the 1970s, world-class deposits were discovered in the Man region, most notably the Mount Klahoyo and Gao iron deposits and the Biankouma-Touba-Sipilou nickel laterite deposits. Production at the Foungouesso nickel mine started in 2017 with direct shipping of nickel rich saprolite, and production at the Ity gold mine has resumed in 2019.

Power will be supplied to the Project site via a 90-kV overhead transmission line from Man to Danané over a distance of 80 km.

There is no water utility in the region, but several continuous waterways exist in the project area. The Méné River is considered as the largest potential source of water.

The PR838 area is characterised by rolling hills dominating low grasslands and valleys. The elevations range from 400 m above sea level to slightly above 1,200 m.

1.3 History

In 1997, SODEMI was awarded the PR123 permit (now known as PR838 and PR839). In 2009, SODEMI and Sama Nickel Corporation signed a joint venture agreement to explore PR123.

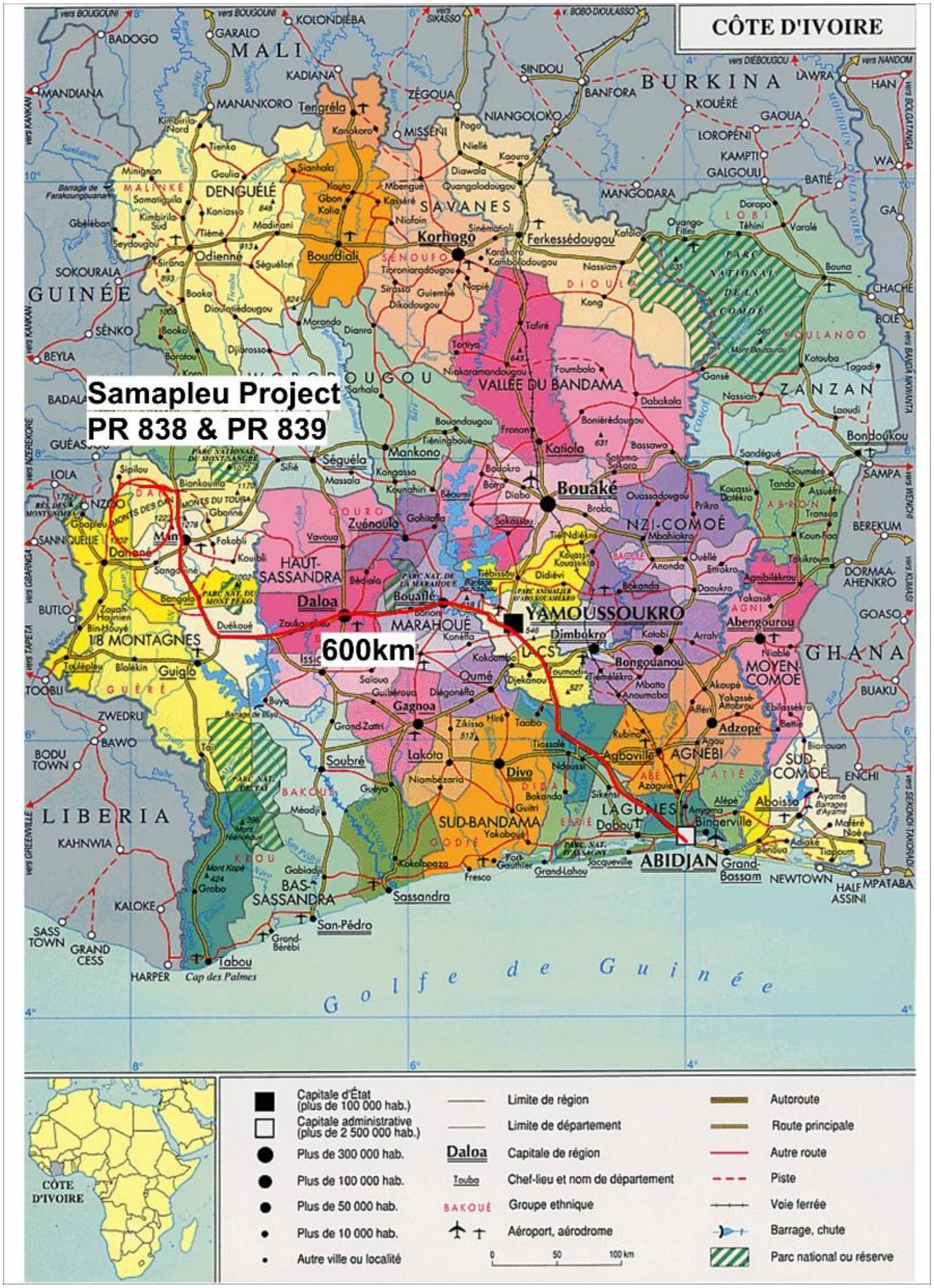
Landen Capital Corp. acquired Sama Nickel Corporation in 2010 and issued common shares to the Sama shareholders, who will retain a 1% net smelter royalty on Sama's portion of the Project.

In 2010, PR123 was renewed, and the surface area was reduced from the initial 750 km2 to 298 km2, to which a block of 151 km2 was added, bringing the total to 449 km2. Subsequent renewals kept the permit in good standing until June 2017.

On June 18, 2019, two (2) new exploration permits, Samapleu East (PR838 - Decree No 2019-526) and Samapleu West (PR839 – Decree No 2019-527) covering 318 km² were granted. Both PRs expire on June 19, 2023, with possible renewal periods totalling up to 12 years.

The Samapleu mineralization was discovered by SODEMI in 1976 through a regional stream sediment sampling program in association with SODEMI, and later by Falconbridge Ltd., in association with SODEMI.

Figure 1.2 – Map of Ivory Coast Showing the Location of PR838 and PR839



As a result, most of the major Ni-Co rich laterite deposits known today were outlined, including the Sipilou, Foungouesso, Moyango, Touoba and the Sipilou South deposits.

Following on the encouraging results, SODEMI narrowed down the search area to the vicinity of Samapleu village and performed a detailed soil sampling program. Exploration at Samapleu was followed by a dormant period between 1998 and 2009 when SODEMI and Sama resumed exploration on the Project.

From 2010 to 2019, subsequent exploration included geochemical sampling, geophysical surveying and several phases of core drilling. Several research projects on the Yacouba intrusive complex, the Ni-Cu-PGE and chromite mineralization have been sponsored by Sama.

A historical resource was estimated by WSP in July 2012 and was updated in December 2012 and further updated in May 2015.

1.4 Geological Setting and Mineralization

The project area is located in the eastern portion of the Archean West-African Craton (WAC) that is represented by two shields: Reguibat to the north and Man to the south. The Man shield is subdivided into a western domain, predominantly of Archean age (Kénéma-Man), and an east-central domain (Baoulé-Mossi) composed of Paleoproterozoic rocks.

The Project lies within the Kénéma-Man domain, which consists chiefly of Archean granulitic and migmatitic gneiss and relic supracrustal belts with mafic to ultramafic rocks and iron formation. In turn, the Kénéma-Man domain is separated in two, and the project is located in the granulitic and migmatitic rocks of the southern domain.

The Yacouba mafic and ultramafic Layered Complex of Eburnean age has intruded the older gneissic assemblage of the WAC. The Complex that was recently discovered by Sama can be traced discontinuously over 60 km along a NE-SW corridor. The Yacouba Complex is characterised by magmatic intrusions, prompting assimilation of the country rock creating a large complex predominantly composed of the resultant migmatite material with well-preserved pyroxenite, gabbro and anorthosite members (Figure 7.1). At the Samapleu deposit, the intrusive members appear as possible feeder dyke that vertically crosscuts the Archaean gneiss and granulite sequence.

The Yacouba complex was recognised by drill holes at the Samapleu Main, Samapleu Extension and Yorodougou locations. The Samapleu intrusion is interpreted to represent a magmatic conduit of the Yacouba complex.

The layered successions are the host of Ni-Cu sulphides (mainly pyrrhotite-pentlandite and chalcopyrite), disseminated Pt and Pd minerals and massive chromite layers. The mineralization is preferably hosted in pyroxenite, although local zones rich in sulphides were identified within the peridotite units. In addition, strong sulphide mineralization also occurs at the gabbro-norite contact of the main zone of Samapleu.

The Samapleu Main Deposit is composed of an Upper and a Lower mafic-ultramafic block separated by a shallowly-dipping fault. Despite having intruded the Archean craton 2.1 Ga ago, the intrusive sequence remained remarkably well preserved with original textures intact. There is no evidence of shearing or foliation or any trace of subsequent hydration (no late serpentinization).

1.5 Deposit Types

According to classical classifications of magmatic nickel-copper-PGE sulphide deposits, the Samapleu deposits are interpreted to occur as sulphides concentration within a differentiated, ultramafic and mafic feeder dykes system of the layered Yacouba complex. These rare intrusion types are host to the largest Ni-Cu deposits in the world, such as Jinchuan or Kalatongke (China), Voisey's Bay or Eagles Nest (Canada), Kabanga (Tanzania), Eagle (USA) and N'komati (South Africa).

The Samapleu mineralization is part of an ultramafic sequence part of the Yacouba complex, rather than of the type associated with a gabbro assemblage.

1.6 Exploration

Exploration by Sama over the PR123 commenced in earnest in 2009, with 60 line-km of IP survey that outlined several features with strong conductivities.

In 2010, 48 line-km of ground magnetic survey was completed to better define the contacts between the ultramafic units. The Samapleu Extension 1 Deposit was discovered by Sama in 2010 after drilling an IP anomaly.

A stream sediment sampling program was completed in 2010 in the northwestern corner of PR123.

Numerous chromite occurrences and mineralised blocks scattered over 10 km along the Bounta-Gangbapleu Ridge were discovered by mapping in 2011.

In 2012, a survey of 13,556 line-km of airborne magnetometer and radiometric covered the entire PR123 as well as part of Sama's Lola graphite property in Guinea and generated several exploration targets.

From December 2012 to January 2013, a total of 3,300-line km of Helicopter Time Domain Electromagnetic ("HTEM") and Magnetic survey covered the most promising areas of the permit. In 2014, *Abitibi Géophysique Inc*. ("*Abitibi*") completed 30 line-km of ground InfiniTEM survey over the Samapleu Main and Extension 1 areas. Later in 2014, 24 line-km of InfiniTEM survey were added over the newly discovered Yepleu mineralization located 18 km to the SW of the Samapleu deposits.

A total of 59 holes were completed in 2012 in different areas of PR123 with a portable Pionjar drill. These holes were used as a reconnaissance exploration tool to recover 15 cm long samples, the content of which was determined by a Niton portable XRF analyser.

Sama opened more than 350 km of roads to provide access to various locations within the project area that is in a fairly remote mountainous sector with poor infrastructure.

1.7 Drilling

Sama's 2010-12 drill programs were contracted to Orex Africa SARL of Abidjan, using a track-mounted YDX-3L wire line drill rig. In January 2013, Sama purchased a Coreteck track mounted CSD1300G wire line drill rig and another one in 2014. Since then, most of the drilling activities were performed internally. In November 2018, Sama contracted Capital Drilling for performing deep holes (+ 700 m long) at the Yepleu prospect.

A summary of the different drill programs performed by Sama within the entire land package is presented in Table 1.1.

Table 1.1 – Drilling Programs - 2010 to May 2019

Area	Contractor Drilling		Sama Drilling		Total Lengths
	Borehole	(m)	Borehole	(m)	(m)
Main Deposit	90	12,677	12	3,458	16,135
Samapleu Extension 1	57	7,643	19	4,349	11,992
Yepleu	5	4,401	25	4,891	9,292
Sipilou South Laterite	80	2,682			2,682
Yorodougou	4	734	2	291	1,025
Bounta			1	376	376
Bounta North chromite	6	684			684
Santa			5	952	952
Grata			2	771	771
Regional	12	2,255			2,255
Total 2010-2019	**254**	**31,076**	**66**	**15,088**	**46,164**

1.8 Sample Preparation, Analysis and Security

After core photography, logging included recording of core recovery, RQD, basic geotechnical information, geological and structural elements. Three magnetic susceptibility readings were taken at 1-m intervals and the samples for density determination were selected.

Nominal sample intervals were 1.0 m and 1.5 m but were adjusted to respect lithological contacts or abrupt changes in mineralization. The geologists marked a reference line on the core to ensure that the samples were cut perpendicularly to the fabrics. The soft core was cut in two with a spatula and the hard core was split using a diamond blade saw.

Sample books with pre-recorded, unique sequential number and tags reserved for QC samples at pre-determined locations were used by Sama.

Density determination and moisture percent were performed by Sama's geologists using the immersion method, which is the appropriate method to determine the in-situ density of rocks. Full core stubs of 10 to 15 cm were used for the determinations. Frequent calibration of the scale and measurements of a standard are part of Sama's protocol.

Sample preparation was performed at the *Société de Développement de Gouessesso* in the Ivory Coast. The samples from the different drill programs were analyzed by independent and certified laboratories in Australia, South Africa and Canada. SGS South Africa Pty, Ultra Trace Pty, Perth, Australia, Bureau Veritas Mineral Laboratories, Rustenburg, South Africa and Actlabs, Lancaster, Ontario, Canada.

All the laboratories used the technique involving sodium peroxide fusion of the samples, dissolving the melt in hydrochloric acid and analyzing the resulting solution by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) for the major elements (Ni, Co, Cu, etc..). The precious metals (Au, Pt and Pd) were determined by Fire Assay with an OES analytical finish.

Core handling was under Sama's control from the drill site, under the geologists' supervision to the Yorodougou base camp where the core boxes were transported and on to the sample preparation facility in Abidjan, Ivory Coast. Pulps samples were then sent for assaying at Activation Laboratories in Ontario, Canada.

The boxes are safely stored in a secured warehouse at Yorodougou, with the coarse rejects and pulps returned from the laboratories.

1.9 Data Verification

1.9.1 Site Visit

A Personal Inspection of the Samapleu property was completed by Yves A. Buro, P.Eng., DRA/Met-Chem’s independent QP, between April 4 and April 8, 2018.

The most significant outcrops including several occurrences of Ni-Cu or massive chromite mineralization were examined.

The collar location of 15 former drill holes was recorded using a hand-held GPS and the readings in the field corresponded to the database entries.

No density determinations were performed by Sama at the time of the visit, but the dedicated room where the equipment is protected from disturbances was inspected.

1.9.2 Procedures - Technical

Written procedures on the following operations are available for the geologists: list of basic geotechnical parameters to record, general drilling, and core logging procedures and in-situ density determination methodology.

1.9.3 Core Review

Two (2) holes from the Main and Extension 1 deposits were inspected in detail. No discrepancies were found between the observed core and the logs and good agreement was observed between the visual estimation of the mineralization and the analytical result for nickel.

Each core box is clearly identified and stored in a secured warehouse near Yorodougou with the coarse rejects and pulps returned from the laboratories.

1.9.4 QP Check Samples

Sixteen (16) coarse rejects or half core from eight (8) holes drilled in 2017-2018 were selected for independent QP check analysis. The samples were selected in an attempt to represent both a fair distribution in the three dimensions of the Main and Extension 1 deposits and to cover a full range of nickel grades.

The OREAS 72b Certified Reference Material (CRM) was inserted at three locations into the batch of QP check samples.

The samples were prepared at *Société de Développement de Gouessesso* and shipped to Actlabs, Lancaster, Canada for analysis. The same preparation and analytical procedures (ICP-OES and Fire Assay) used on Sama's original samples were applied to the QP check samples.

Actlabs is independent of Sama, is fully certified and accredited to international standard ISO/IEC 17025 and operates under a quality management system that complies with the requirements of ISO 9001: 2008.

The Ni% results show a good degree of correlation, but a systematic positive bias toward the duplicate analyses. The same positive bias is observable in the results from the three (3) CRMs, although the differences for the nickel values remain close to the acceptable threshold (9.3% and 10.6%).

It is probable that part of the variability between the original and duplicate analyses on the QP samples originates from the facts that the QP samples were from both the oxide and the sulphide zones and consisted of a mix of coarse rejects and of the second halves of the original core. Consequently, even though the repeatability shown by the QP check samples is not outstanding, Y. A. Buro believes that the original results from Actlabs can be used in a resource estimate.

1.9.5 Short Distance Variability

No twin holes were drilled by Sama to assess the short-range variability of the mineralization. However, comparisons of the results from four holes drilled from the same set-up (quasi-twins) show excellent general correlation between all of them.

1.9.6 Conclusion

The QP considers that sufficient pertinent information of appropriate quality has been gathered by Sama to be used in a resource estimation. No factors that could compromise the reliability of the resources estimate or completion of the required work was observed during the site visit.

1.10 Mineral Processing and Metallurgical Testing

To date four (4) test work campaigns have been conducted on samples from the Samapleu deposit. The first campaigns (SGS, CTMP) examined the use of flotation and pre-concentration techniques (heavy-liquid separation, size-separation) were trialed to develop a flowsheet for the process. The most recent campaign was conducted by SGS (2019) focused on samples graded 0.3%Ni, 0.1%Ni, 0.6% Ni, and 1.9% Ni to understand ore variability and develop a flowsheet centered around a flotation process.

The major findings of the test work were the following:

- Mineralogical analysis showed that nickel and copper in the deposit are present predominantly as pentlandite, and the principal gangue minerals are pyrrhotite, and magnesium bearing minerals (orthopyroxene and clinopyroxene, amphibole, and chlorite);
- The mineralization of nickel changes with head grade and is finely disseminated;
- The Bond Work Index of a composite sample was measured at 19 kWh/t;
- The mineralised material has shown to amenable to concentration by flotation;
- The bulk rougher flotation tests were able to produce a bulk concentrate of 6.60% Cu and 2.72% Ni at recoveries of 90.1% copper recovery and 42.8% Nickel recovery; the nickel scavenger was 3.13% Ni at 31.4%;
- The first lock cycle test was able to achieve a bulk Cu/Ni concentrate grading 11.6% Cu, 6.39% Ni, with a copper recovery of 89.1% and a nickel recovery of 68.1%;
- Copper/nickel separation was difficult in the laboratory, possibly due to the small quantity of material remaining after the lock cycle test. Separation efficiency would be expected to increase.

1.11 Mineral Resources Estimate

Under CIM definition standards, Mineral Resources should have a reasonable prospect of eventual economic extraction. In order to determine the mineralization zones that can be potentially mined economically an optimised pit shell was developed using the Lerchs-Grossmann (LG) algorithm implemented in HxGN MinePlan 3D.

The Mineral Resources Estimate for the Samapleu Nickel and Copper deposits contains, at a Nickel Equivalent (NiEq = Ni + 0.167*Cu) Cut-Off Grade (COG) of 0.1%, 33.18 Mt of Indicated Mineral Resources at an average of 0.27% NiEq and 0.24% Ni and 17.78 Mt of Inferred Mineral Resources at an average of 0.25% NiEq and 0.22% Ni. The effective date of the Mineral Resources is October 26, 2018 which corresponds to the date of reception of the drill hole database from Sama Resources.

Table 1.2 presents a summary of the Mineral Resources.

Table 1.2 – Summary of the Mineral Resources (COG of 0.1% NiEq)

Category	**Resources** (Mt)	**NiEq** (%)	**Ni** (%)
Measured [1,2,3]	-	-	-
Indicated [1,2,3]	33.18	0.269	0.238
Meas. + Ind.	**33.18**	**0.269**	**0.238**
Inferred [1,2,3,4]	17.78	0.248	0.224

1. Mineral Resources are exclusive of Mineral Reserves.
2. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. There is no certainty that all or any part of the Mineral Resources estimated will be converted into Mineral Reserves. The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues
3. The CIM definitions were followed for the classification of Indicated and Inferred Mineral Resources.
4. The quantity and grade of reported Inferred Resources in this estimation are uncertain in nature and there has been insufficient exploration to define these Inferred Resources as an Indicated or Measured Mineral Resource. It is reasonably expected that a portion of Inferred Mineral Resources could be upgraded with continued exploration.
5. Pit shell defined using 52-degree pit slope, copper concentrate price of $2.1/lb and nickel powder price of $13.5/lb, $3/t mining costs, $15/t of processing and G&A costs, and a resulting cut-off grade of 0.1% NiEq.

1.12 Mining Method

The mining method selected for the Project is a conventional open pit operation with off-highway haul trucks, hydraulic excavators, and wheel loaders. The Project consists of three (3) separate pits (Pit A, Pit B, and Pit C) with one (1) waste dump designed close by to reduce haulage distance.

Since this study is at a PEA level, Measured, Indicated, and Inferred material have been considered in the optimisation and mine plan. The mineralised material and waste rock will be loaded into off-highway haul trucks with excavators and/or wheel loader.

Samapleu mineralised material, contained into three (3) pits, are intended to be mined by surface operations. It is estimated that approximately 44.42 Mt of mineralised material is extractable over a 20-year mine life.

The mine will operate year-round, seven (7) days per week, twenty-four (24) hours per day (2 shifts, 12 hours each). Since the mill will operate seven (7) days per week, a run of mine stockpile will be maintained to provide a constant supply of feed to the crusher with a minimum of one (1) month of production capacity. During the days when the mine is not operating (for technical or weather reasons), the crusher will be fed by the front-end loader from the stockpile or with a production truck. The mine fleet requirements and manpower are based on this work schedule.

A production schedule (mine plan) was developed for the Project to produce 39,960 tonnes of nickel concentrate per year. Using a variable mill recovery from 70.00% a targeted concentrate grade of 10.00% results in an average run of mine feed of 2.3 Mt per year (6,508 t/d) at an average diluted grade of 0.244% Ni.

A year of pre-production phase has been planned to achieve the following objectives:

- Clear vegetation and topsoil;
- Supply road construction material;
- Supply construction material for the tailings dyke;
- Strip overburden and waste rock to expose the mineralisation.

The schedule produces 27,972 tonnes of concentrate in the first year of production which accounts for a plant ramp-up.

The mine plan has been developed by advancing several benches concurrently. An average of 13,743 tonnes of material will be mined each day during the 20-year mine life.

1.13 Recovery Method

The mineral process is designed to produce 120 dry metric tonnes per day of nickel concentrate at 10.34% Ni grade, from ore containing 0.24% Ni. Nickel recovery to the nickel concentrate is predicted to be 70.00%. Copper concentrate will also be produced as a saleable product (23.00% Cu and 80.00% copper recovery to the copper concentrate). The mineral process flowsheet includes crushing, grinding, rougher flotation, and cleaner flotation. The back end of the concentrator includes tailings and concentrate thickening, concentrate filtration, and material handling. The potential acid generating tailings from the concentrator will be filtered by a filter press and stacked outside the concentrator area.

The nickel concentrate will be fed to carbonyl refining plant for extraction of nickel and iron. The nickel concentrate will be roasted to covert the sulfide minerals to oxides in a fluid bed roaster. Calcined concentrate will then be reduced in rotary kiln with hydrogen to convert the nickel and iron oxides to metallic nickel and iron respectively. Nickel and iron will be extracted from reduced concentrate in the form of volatile metal carbonyls through CVMR®'s carbonyl process, separated and decomposed to metal nickel and iron products.

1.14 Project Infrastructure

The Project infrastructure includes the 90-kV overhead transmission line from Man to Danané, the main access road and site roads, general site works, site electrical distribution and communication, site fire protection, fresh water, potable water and sewage treatment, auxiliary buildings, water treatment and tailings and water management facilities, and a construction camp for 400 workers.

A PEA level assessment of tailings disposal requirements was performed. The assessment aimed to estimate the quantities of materials required for the construction of confinement dykes for the proposed tailings impoundment facility.

The TSF consists of Non-Acid Generating (NAG)and Potential Acid Generating (PAG) tailings from the concentrator. The PAG tailings are collected in a thickener and then filtered to 12% moisture and transported to the PAG tailings impoundment by truck. The impoundment is protected by a membrane to ensure that the sulphur is properly contained within the tailings area.

The NAG tailings of 65 wt% solid content are collected in a tailings thickener and then pumped over 3 km to a tailings impoundment. Water is reclaimed from the tailings storage and returned to the process water tanks for reuse in the process.

At Year 11, the NAG tailings will be pumped to Pit A and in Year 17, the NAG will be pumped to Pit B.

1.15 Market Studies and Contracts

Carbonyl nickel powder is mainly used in electrodes, electronic products, controllable expansion alloys of batteries and fuel cells. With the increasing demand for special chemicals, new materials have been invented for personal applications. Carbonyl nickel powder has many advantages in electronic applications. It is used to improve the mechanical and fatigue properties of alloy steel. It enhances the conductivity and magnetism of electronic materials. Carbonyl nickel powders are also used as adhesives for fixed granular materials and can be used in filter assemblies in the form of high porosity products.

Carbonyl iron powder has the characteristics of high activity, fine particle size, good formability and sintering property. Adding a small amount of carbonyl iron powder to iron-based powder metallurgical structural parts can reduce sintering temperature, improve the structure and mechanical properties of products, and is the raw material for producing high-quality powder metallurgical products. It can also be used as a noise suppressor in a filter choke. Carbonyl iron powder grades have many advantages over cobalt binders.

The product prices were based on Maia Research Analysis report on nickel powder and iron powder, October 2019, as well as referencing current markets, forecasts and reports in the public domain.

Nickel (99.8% Ni) and iron (98.5% Fe) powders will be sold directly onto markets as final products. Between 2015 to 2018, the nickel powders were sold with a premium of between $7.42 US/kg to $10.71 US/kg shown in Table 19.1 as well as the London Metal Exchange (LME) value.

It is assumed the average premium price of nickel powder is $8.95 US/kg with 2019 LME price of $16.53 US/kg, which amounts to $25.48 US/kg.

Based on Maia Research Analysis, the iron powder is expected to be sold at $6.90 US/kg.

Maia Research Analysis has estimated that the global nickel powder market will grow by 31% from 2018 to reach 34.14 kilotonnes (kt) in 2024 while the iron powder market is estimated to increase by approximately 29% from 2018 to 28.98 kt in 2024.

Based on the projections, Roskill believes that world total copper consumption might exceed 43Mt by 2035, implying per capita consumption of 5 kg by that date. Driven by population and GDP growth, urbanisation and electricity demand, applications utilising copper's excellent electrical and heat transfer properties will account for the overwhelming proportion of world volume growth. Electric vehicles and associated network infrastructure are just one facet of this and may contribute between 3.1–4.0 Mt of net growth by 2035. Direct use scrap use will fulfil a greater proportion of the total, but the expansion in the requirements for refined copper will remain substantial; fuelling the need for the next generation of brownfield expansions and greenfield mine projects.

Copper concentrates will be produced as one (1) of the three (3) products at Samapleu. The concentrate produced will have an estimated grade of 23% Cu. The Cu concentrate will require downstream smelting and refining to produce marketable copper. The equivalent metal price for copper concentrate (23%) for base case is estimated as 70% of copper metal LME price of $6,000 US/t to take into consideration of treatment charges, refining charges, and other costs, i.e. $0.966 US/kg.

1.16 Environmental Studies, Permitting and Social or Community Impact

The Project will be subject to the laws of the Republic of Côte d'Ivoire. In 2016 until now, additional and complemental studies were performed to enhance the environmental database by including biological, hydrology, pedology, noise and socio-economic aspects through the Abidjan based SIMPA-CI. More information will be available at the next stage of engineering.

In accordance with the Ivorian legislation, an environmental and social impact assessment is required for any request for an exploitation lease. For this purpose, the Company requested the "*Agence Nationale de l'Environnement*" (National Environmental Agency) (ANDE) to supply the study's Terms of Reference (TOR).

Several environmental baseline studies have been completed since 2013 to set environmental reference values and to identify any major environmental issues. In parallel, several stakeholder and public engagement activities were set forth since 2013 to obtain an overview of potential socioeconomic issues and to propose adequate measures to foster the social acceptability of the Project and its harmonious insertion at the local level.

Fieldwork to describe the receiving environment was done in 2013 on the following components: soil characterisation; sediment characterisation; geochemistry, hydrogeology; surface water quality; groundwater quality; noise environment; vegetation, wetlands and special status plant species; aquatic fauna and fish fauna; small mammals; amphibians and reptiles; and birds.

Sama has been active in the region and has adopted a proactive approach to communications, local employment, education and health. Various social actions are taken to improve the daily life of local communities.

Sama has implemented a community consultation program to reinforce their community relations by explaining the exploration work and future project.

Several community meetings were held in the project area until now. These meetings were either under supervision of Sama itself or as part of the ongoing Environmental and Social studies.

1.17 Capital and Operating Costs

1.17.1 Capital Cost Estimate (Capex)

The Project scope covered in this Report is based on the construction of a green field mining and processing facility with an average mill feed capacity of 2.3 Mtpy of material and producing an average of 4 ktpy of carbonyl nickel powder, 8 ktpy of carbonyl iron powder and 14 ktpy of copper concentrate.

The capital and operating cost estimates related to the mine, the concentrator, and all required facilities and infrastructure have been developed by DRA/Met-Chem or consolidated from external sources.

The capital and the operating costs are reported in United States Dollars ("$").

Table 1.3 presents a summary of the pre-production initial capital. Sustaining capital costs is estimated at $180 M and is distributed over the life of the mine, but not included in the initial Capex.

Table 1.3 – Initial Capex Summary

Area	Area Description	Total Costs ('000 USD)
	Direct Costs	
1000	Mining	19,497
2000	Crushing	4,983
3000	Concentrator	48,285
4000	Tailings Management System	29,241
5000	General Site Infrastructure	22.196
6000	Power	22,968

C1000	CVMR Facilities	38,738
	Sub-total – Direct Costs	**185,908**
	Indirect Costs	
9000	Indirect Costs	59,341
9000	Contingency	36,788
	Sub-total –Indirect Costs	**96,129**
	TOTAL:	**282,037**

Numbers may not add due to rounding.

1.17.1.1 Sustaining Capital

Sustaining Capital comprises replacement of mining equipment amounting to $19.3 M over the LOM, and costs to increase the waste piles and the tailings impoundments. The initial Capex covers an allowance for two (2) years of operations for the tailings systems with an allowance to increase the dam structure on a yearly basis to accept the quantity of tailings added each year. The cost of the tailings impoundment structures over the LOM excluding the initial Capex value is $160 M.

1.17.1.2 Closure and Rehabilitation Costs

Based on site layouts, a provision of $15 M was estimated for the closure and rehabilitation of the mine site. Requirements were established and cost estimation was based on recent projects.

The expenses were accounted for in the economic analysis and incurred during the final years of the LOM.

No provision is required for the dismantling and disposal of the industrial facilities as it is assumed that the costs will be compensated by the salvage value.

1.17.2 Operating Cost Estimate (Opex)

The estimated operating costs of the Project cover the mining, processing, general administration and site services. Table 1.4 presents the operating costs summary.

The sources of information used to develop the operating costs include in-house databases and outside sources, particularly for materials, services and consumables.

Table 1.4 – Operating Costs Summary

Description	**LOM Average Annual Cost** ($) [2]	**Cost / t milled** ($/t)	**Total** (%)
Mining	9,236,111	4.01	16.8
Concentrator Processing	27,554,708	12.11	50.3

CVMR Processing	11,641,447	5.12	21.2
Water and Tailings Management [3]	50,000	0.02	0.1
Products Transportation	2,927,990	1.26	5.3
General and Administration [3]	3,406,58	1.45	6.2
Total Opex [1]	54,816,514	23.96	**100.0**

1 The totals may not add-up due to rounding errors.
2 Excludes first and last year.
3 Based on process plant throughput of 2,418,886 mt of mineralised material per year

1.18 Economic Analysis

The economic assessment of the Samapleu Project has been generated in US dollars and based on 100% equity. In addition, current Ivory Coast tax regulations were applied to assess corporate tax liabilities. Table 1.5 summarises the base case economic/financial results of the Project. It should be noted that the economic analysis contained in this Report is based entirely on mineral resources that are not mineral reserves.

Total operating costs over the life of the project were estimated at $1,051 M, or an average $2,062/t of products.

The financial results indicate a pre-tax Net Present Value ("NPV") of $614.9 M at a discount rate of 8%. The pre-tax Internal Rate of Return ("IRR") is 32.5 % and the payback period is 2.5 years.

After-tax NPV is $390.7 M at a discount rate of 8%. The after-tax IRR is 27.2% and the payback period is 2.6 years.

Table 1.5 – Base Case Financial Results

Financial Results	Unit	Pre-tax	After-tax
NPV @ 8%	M USD	614.9	390.7
IRR	%	32.5	27.2
Payback Period	Year	2.5	2.6

The financial indicators associated with the economic analysis are summarised in Table 1.6.

Table 1.6 – Project Evaluation Summary – Base Case

Description	Unit	Value
Throughput[1]	t/y	2,329,034
Total Products[1]	t/y	26,458
Net Sales Revenue	'000 USD	3,293,100

Total Capex	'000 USD	282,037
Total Sustaining Capex	'000 USD	179,300
Closure Costs	'000 USD	15,000
Total Opex	'000 USD	1,050,863
Opex[2]	USD/t products	2,062
Pre-Tax		
NPV (discount rate=8%)	'000 USD	614,881
IRR	%	32.5%
Payback Period	Years	2.5
After-Tax		
NPV (discount rate=8%)	'000 USD	390,686
IRR	%	27.2%
Payback Period	Years	2.6

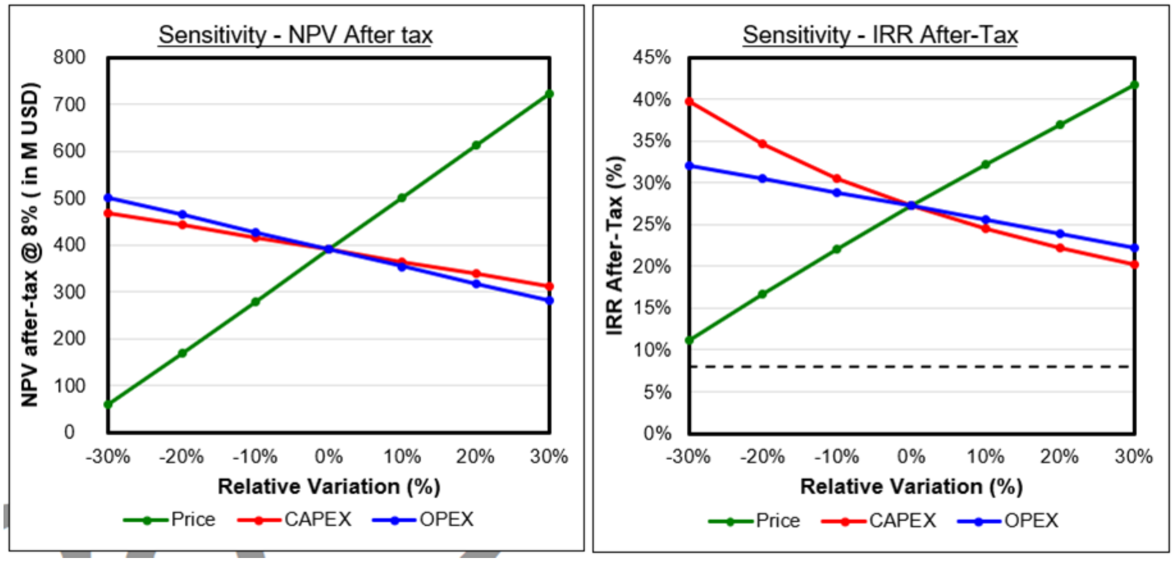
Note:
[1] Excluding Years 1 &20
[2] Based on LOM results

A sensitivity analysis was carried out to assess the impact of changes in total pre-production capital expenditure ("Capex"), operating costs ("Opex") and concentrate price ("Price") on the project's NPV at 8% (i.e. base case) and IRR. Each variable was examined one-at-a-time. An interval of ±30% with increments of 10% was applied to the Capex, Opex and Price variables.

The after-tax sensitivity analysis is shown in Figure 1.3. The Project's after-tax viability is not significantly vulnerable to the underestimation of capital or operating costs. If Opex increases by 30%, after-tax NPV decreases to $80 M and after-tax IRR decreases to 22%. An increase of 30% in Capex, results in after-tax NPV of $312 M and after-tax IRR of 20%.

This Report was compiled according to widely accepted industry standards. However, there is no certainty that the conclusions reached in this Report will be realised.

Figure 1.3 – After-Tax NPV and IRR Sensitivity to Changes in: Capex, Opex, and Average Price



1.19 Interpretation and Conclusions

This Report was prepared and compiled by DRA/Met-Chem, by or under the supervision of the QPs, at the request of Sama. This Report has been prepared in accordance with the provisions of National Instrument 43-101 Standards of Disclosure for Mineral Projects.

1.19.1 Conclusions

1.19.1.1 Mineral Processing and Metallurgical Testing

Mineral Processing Test Work

- The mineralised material from the Samapleu deposit has shown itself to be amenable to concentration by flotation. Given the relatively low grade of the deposit, different methods have been trialled to pre-concentrate the material to increase head grade prior to flotation.
- The use of heavy liquid separation was able to achieve a degree of pre-concentration at some SG values; however, the losses of nickel and copper were considerable. The same applies for pre-concentration via magnetic separation and size separation. The nature of the mineralised material deposit (finely disseminated) does not seem to lend itself well to pre-concentration.
- The results from CTMP were unable to achieve the results of the SGS 2011 campaign. The head grades from the 2011 test work campaign were significantly higher; however, the dosage of xanthate was kept relatively constant. Examination of the kinetic curves shows rapid, non-selective flotation; which could potentially be a symptom of an overdose of xanthate in the circuit.
- The poor copper/nickel separation results can be explained by the small quantity of material remaining after the lock cycle test and the fact that this portion of the flow sheet was tested in

open circuit. Testing a larger sample would allow the copper/nickel separation step to be included in the lock cycle test work.

Carbonyl Powder Production Test Work

- Overall recovery of nickel was observed as 96.7% - 97.9%. These results correspond with extraction rates achieved during TGA tests.
- Overall recovery of iron can max 95.0%, and can be suppressed with sulphidation down to 80.6%.
- Sulphur has been roasted away from 30% to 0.2% at 1050°C. The reaction of desulphurisation is rapid.
- The metallic oxides were reduced with hydrogen at 650°C, during 2 hours residence time.
- Carbonylation was carried out at 40 bar CO pressure and at 130°C.
- Overall extraction time was 24 hrs with the average rate of extraction close to 3-4% per hour.
- Carbonylation residue was not pyrophoric and did not have any metal carbonyl contamination. Bulk density of residue was 0.60 – 0.70 g/cc.
- No cobalt was found in the ferronickel powder product.
- Based on the analytical result from the SGS Canada Inc. the copper upgrade in the carbonylation residue from the feed concentrate was observed 290% and the cobalt upgraded 230%.

1.19.1.2 Recovery Methods

Mineral Processing Plant

- The processing plant nominally processes 2.4 Mt/y of run-of-mine mineralised material to produce 39,000 t/y of nickel concentrate at 10.34% Ni grade and 15,000 t/y of copper concentrate at 23.00% Cu grade. Global nickel and copper recovery are 73.04% and 92.31%, respectively. A suitable process flow sheet has been developed which includes crushing, primary grinding, secondary grinding, bulk flotation, copper cleaning, nickel cleaning, desulphurisation, thickening, filtering, and material handling.
- The processing plant design detailed above provides sufficient basis for the development of the capital and operating cost estimates for the processing plant shown in Section 21.
- The design of the flotation test work stems largely from the test work campaign conducted by SGS in 2019 (summarised in Section 13). Where the test work is incomplete, design values have been based on experience in the industry.

Carbonyl Refining Plant

CVMR's metallurgical test and process design works allowed to develop a concept level flowsheet that supports annual production of 4000 t of premium Carbonyl nickel powders, and 8400 t of premium carbonyl iron powder along with the potentially marketable byproducts such as carbonyl residue and sulphuric acid.

An equipment selection work identified:

1. the required process circuits;
2. equipment units required for the economical operations.

Based on CVMR's previous design experience the basis for the key parameters, and operating protocols were established

1.19.2 Risk Evaluation

Risk and opportunity management is an important element of the project's operational strategy and implementation. It is used to avoid losses, anticipate problems and realize gains or benefits.

External risks are elements such as the political situation in the project area, the price of minerals, the exchange rate and government legislation. These external risks are generally applicable to all projects. A negative variation of these elements compared to the assumptions made in the economic model would affect the profitability of the project and the estimate of mineral resources.

These external risks are to some extent independent of the project and are much more difficult to predict and mitigate.

As with all mining projects, there are technical risks that could affect the feasibility and economic results of the project. There are a number of risks and uncertainties identifiable with all projects and generally cover the aspects of mineralization, process, financial, environmental and authorization. These risks are common to most mining projects, many of which can be mitigated by adequate engineering studies, design, planning and management. Some of these risks can be reduced and / or mitigated by the following studies identified in Section 25.2.

1.20 Recommendations

1.20.1 MINING AND GEOLOGY

For mining method, DRA/Met-Chem recommends certain work for the next stage of the Project:

- Definition drilling program aimed at identifying additional resources and upgrade resources
- Geotechnical or hydrogeological investigations for surface infrastructure to be carried out.
- Overburden will need to be estimated and modelled.
- A complete pit slope analysis by a geotechnical engineer.
- A hydrogeological study be carried out. This study will provide an estimate of the quantity of water that is expected to be encountered during the mining operation.

1.20.2 GEOTECHNICAL INVESTIGATION

To carry out geotechnical studies (stability analysis, bearing capacity, etc.) for the final locations of the various structures of the water transformation and treatment plants, roads, overburden, waste rock deposits, for NGA and PGA tailings, CVMR residue etc.

1.20.3 MINERAL PROCESSING AND METALLURGICAL TESTING

1.20.3.1 Mineral Processing Plant

DRA/Met-Chem recommends certain work for the next stage of the Project:

- Given the drastic change in nickel deportment between the 0.1%Ni and 0.3%Ni samples in the 2019 SGS test work, the overall recovery of nickel will likely be sensitive to head grade. It is highly recommended to conduct further mineralogical studies on material between 0.1% and 0.3% head grade to understand maximum nickel recovery;
- The change in deportment needs to be understood as the nickel recovery may be severely limited by the nickel available as pentlandite;
- Further test work should be conducted to understand variability within the ore deposit. These variability samples should be chosen in conjunction with the mining plan. These variability tests should include comminution as well as flotation;
- SGS and CTMP have measured different hardness values on similarly graded samples more comminution test work should be conducted to characterise hardness and adequately size milling equipment;
- Test work should be conducted on thickening and filtration to adequately size thickener and filtration equipment (on all final streams);
- Final streams should be submitted for environmental characterisation;

- Given the relatively low head grade of the deposit, further test work should examine coarse particle flotation. The use of coarse particle flotation, if applicable to this deposit, may significantly impact grinding costs.

1.20.3.2 Carbonyl Powder Production

The following recommendations can be made for further test work:

- Pilot plant work with the larger samples of the concentrate;
- Study of the concentrate feed variability;
- Evaluation of the potential upgrade of Cu and Co value in the carbonylation residue by gravity and magnetic separation;
- Some trade off studies on the sulphur abatement from the roasting off gas – alternatives to the acid production.

1.20.4 RECOVERY METHODS

Certain work is recommended for the next stages of the project development:

<u>Concentrator</u>

- Revision of the design and costing with further test work. In particular, further grindability test work should be completed to ensure that the milling circuits are adequately sized; thickening and filtration test work should be completed to adequately size the flocculant systems, thickeners and filter presses;
- Further flotation test work should be conducted on the flow sheet;
- For the Potential Acid Generating tailings, there is also the possibility of generating a sulphuric acid product as suggested by SGS in 2012. This possibility could be discussed on a high level to see if it improves the project economics and facilitates the storage of Potential Acid Generating tailings;
- The primary grind size of 0.065 mm is fine and energy intensive. In conjunction with test work, it would be worth studying whether coarse particle flotation can be used to reject some material, reducing the amount of material to be milled (thereby reducing mill sizes and power draw).

<u>Carbonyl Refining Plant</u>

- Continue process definition work to PFS level;
- Conduct trade-off studies targeting on reduction of operating costs, and determining the additional value streams;
- Work with equipment vendors to evaluate the market and firm up an equipment list for the carbonyl plant;

1.20.5 ENVIRONMENT AND COMMUNITY

It is recommended to perform the following work in connection with environmental and community activities:

- Extend soil and surface water surveys to select the best location for the tailing ponds, waste rock, and overburden piles;
- Study options for water management strategy to take into consideration the future plant process water requirement and site water management;
- Carry out a hydrogeological study to collect field data in order to estimate from groundwater flow modelling dewatering rates and impacts;
- Continue ongoing consulting and environmental studies required to support permitting requirements and to optimise the site layout.

1.20.5.1 Hydrogeology

Surface and groundwater management plans are necessary to ensure a safe working environment and minimize disruption to operations. Precipitation and high levels of water saturation can negatively impact mining operations and slope stability. Additional hydrogeological research must be carried out for a better understanding on water management. These studies aim to obtain the fundamental hydrogeological characteristics and conditions for draining the pits as well as for the stability of their walls. Studies will need to be undertaken to establish an erosion control plan.

1.20.5.2 Geochemical Tests

Geochemical tests are necessary to characterize the ore, the host rock (sterile) of the property as well as the NGA and PGA tailings, and CVMR residue. These tests will identify any potential impact of metal leaching from operations.

1.20.5.3 Resettlement Action Plan

It's recommended to develop the resettlement action plan which will include provisions for the phased approach to the livelihood resettlement and restoration process, based on the current schedule established for the life of the mine, as well as a full procedure for compensation.

1.20.6 PROPOSED WORK PROGRAM

To ensure the potential viability of the mineral resources, proposed activities to be undertaken in the next phase have been identified. These activities along with estimated costs, are shown in Table 1.7.

Table 1.7 – Estimated Budget for Next Phase

Activities	Estimated Budget $ (USD)
Definition Drilling Campaign	400,000
Geotechnical and Hydrogeology Studies	500,000
Metallurgical Test Work Program (Concentrator and CVMR)	600,000
Environmental Studies	1,000,000
Feasibility Study (Concentrator and CVMR)	3,000,000
Sub-Total	5,500,000
Contingency (20 %)	1,100,000
Total	**6,600,000**

2 INTRODUCTION

Sama Resources Inc ("The Company/Sama") is a listed company trading on the Toronto Stock Exchange under the symbol SME. The Samapleu Project operates under a Joint Venture (JV) agreement between Sama Nickel Corporation (66⅔% share; operator) and SODEMI (33⅓ %). The Project is located in the Ivory Coast in West Africa.

Sama has mandated DRA/Met Chem, a division of DRA Americas Inc. ("DRA/Met-Chem") to complete this Technical Report on the Preliminary Economic Assessment ("PEA"), following National Instruments 43 101 ("NI 43 101") rules and guidelines, regarding the Samapleu Project in order to advance the Project.

2.1 Terms of Reference Scope of Study

The following Technical Report (herein after "**the Report**") is a review and compilation of the exploration and metallurgical works performed by Sama Resources Inc. ("**Sama**") on the Samapleu Property.

Met-Chem, a division of DRA Americas Inc. ("**DRA/Met-Chem**") has provided engineering and integration services for all aspects of the NI 43-101 Technical Report Preliminary Economic Assessment ("**PEA**") on the Samapleu Project with the participation of other consulting companies.

2.2 Qualified Persons

At the request of Sama, DRA/Met-Chem has been mandated to prepare a NI 43-101 Report for the Samapleu Project with the participation of specialised consultants. Table 2.1 provides a detailed list of qualified persons as defined in Section 1.5 of NI 43-101 and their respective sections of responsibility.

Table 2.1 – Qualified Persons and their Respective Sections of Responsibilities

Section	Title of Section	Qualified Persons
1	Summary	Daniel M. Gagnon and related QPs
2	Introduction	Daniel M. Gagnon
3	Reliance on Other Experts	Daniel M. Gagnon
4	Property Description and Location	Schadrac Ibrango
5	Accessibility, Climate, Local Resources, Infrastructure and Physiography	Schadrac Ibrango
6	History	Schadrac Ibrango
7	Geological Setting and Mineralization	Schadrac Ibrango
8	Deposit Types	Schadrac Ibrango
9	Exploration	Schadrac Ibrango
10	Drilling	Schadrac Ibrango
11	Sample Preparation, Analysis and Security	Schadrac Ibrango
12	Data Verification	Schadrac Ibrango
13	Mineral Processing and Metallurgical Testing	
13.1	Mineral Processing Test Work	Nalini Singh
13.2	Carbonyl Powder Production Test Work	Volodymyr Liskovych
14	Mineral Resources Estimates	Schadrac Ibrango
15	Mineral Reserve Estimates	N/A
16	Mining Methods	Daniel M. Gagnon
17	Recovery Methods	
17.1	Processing Plant	Ryan Cunningham
17.2	CVMR Process Description	Volodymyr Liskovych
18	Project Infrastructure	Daniel M. Gagnon
19	Market Studies and Contracts	Daniel M. Gagnon
20	Environmental Studies, Permitting and Social or Community Impact	Marie-Claude Dion St-Pierre (GCM)
21	Capital and Operating Costs	Daniel M. Gagnon and related QPs
22	Economic Analysis	Daniel M. Gagnon
23	Adjacent Properties	Schadrac Ibrango
24	Other Relevant Data and Information	Daniel M. Gagnon
25	Interpretation and Conclusions	Daniel M. Gagnon and related QPs
26	Recommendations	Daniel M. Gagnon and related QPs
27	References	Daniel M. Gagnon and related QPs

2.3 Effective Date and Declaration

This Report is considered effective as of May 22, 2019 and the Mineral Resources effective date is October 26, 2016. It is in support of Sama's press release, dated May 27, 2020, entitled "*Sama Resources Announces Positive Preliminary Economic Assessment for Samapleu Project*".

The current Report provides an independent Technical Report for the estimate to complete for the Samapleu Project, in conformance with the standards required by NI 43-101 and Form 43-101F1.

2.4 Site Visit

This Section provides details of the personal inspection on the Property by some of the Qualified Persons.

Mr. Yves A. Buro, P. Eng., a qualified person under the terms of NI 43-101, conducted a site visit to the Samapleu Property on April 4-8, 2018. Mr. Buro changed his status from Engineer to Retired Engineer on April 1, 2020 and is currently registered on the OIQ's roll as a Retired Engineer and, as such, is no longer entitled to perform the activities reserved to the engineering profession.

The purpose of the visit included general discussions with Sama's technical team, examination of the data collection, and interpretation, core logging and sampling, database construction, QA/QC system and general procedures. Mr. Buro examined some core and selected independent check samples. Several outcrops and drill sites were visited.

Dr. Schadrac Ibrango, P.Geo., PhD, MBA., a qualified person under the terms of NI 43-101, conducted a site visit to the Samapleu Property on October 25 to 27, 2018.

Dr. Ibrango, senior geologist, is responsible for the mineral resource modelling on the Samapleu nickel and copper project in Ivory Coast. The objective of this site visit was to collect the Project database which will be used for the Mineral Resource Estimates, perform a visit of both Samapleu's deposits and visit core from selected holes.

Mr. Daniel M. Gagnon, P. Eng., a qualified person under the terms of NI 43-101, conducted a site visit to the Sampleu Property on October 14-17, 2019.

Mr. Gagnon met with Dr. Audet who led the visits. The purpose of the site visit included discussions with Sama's technical team, tour the selected locations as well as discussions with local companies.

2.5 Units and Currency

In this Report, all currency amounts are US Dollars ("**USD**" or "**$**") unless otherwise stated. Quantities are generally stated in *Système international d'unités* ("**SI**") metrics units, the standard Canadian and international practices, including metric tonne ("**tonne**", "**t**") for weight, and kilometre ("**km**") or metre ("**m**") for distances. Abbreviations used in this Report are listed in Section 28.

3 RELIANCE ON OTHER EXPERTS

The QPs prepared this Report using reports and documents as outlined in the “References”, Section 27 of this Report. The Authors wish to make clear that they are qualified persons only in respect to the areas in this Report identified in their “Certificates of Qualified Persons”, submitted with this Report to the Canadian Securities Administrators.

A draft copy of the Report has been reviewed for factual errors by Sama. Any changes made as a result of these reviews did not involve any alteration to the conclusions made. Hence, the statement and opinions expressed in this Document are given in good faith and in the belief that such statements and opinions are neither false nor misleading at the date of this Report.

The Qualified Persons (QP) who prepared this Report relied on information provided by experts who are not QPs. The QPs who authored the sections in this Report believe that it is reasonable to rely on these experts, based on the assumption that the experts have the necessary education, professional designations, and relevant experience on matters relevant to the Technical Report.

The QPs used their experience to determine if the information from previous reports was suitable for inclusion in this Technical Report and adjusted information that required amending. This Report includes technical information, which required subsequent calculations to derive subtotals, totals and weighted averages. Such calculations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, the QPs do not consider them to be material.

DRA/Met-Chem has relied on reports and opinions provided by CVMR Corporation (CVMR) regarding carbonyl powder production test work and design. CVMR is a privately held corporation based in Toronto with 36 years of vapour metal refining experience. CVMR is a technology developer in field of the carbonyl powder production conducted a test work and a pilot plant work campaign on the Samapleu concentrate. DRA/Met-Chem has reviewed the content and believes that it provides current and reliable information.

DRA/Met-Chem has relied upon market studies provided by Sama. Section 19 summarises the key information regarding Carbonyl Nickel Powder, Carbonyl Iron Powder as well as Copper market overview and outlook. DRA/Met-Chem has reviewed the content of the market study presentation and believes that it provides a reasonable overview of the past and current market as well as projections according to various recognised sources.

DRA/Met-Chem has relied on reports and opinions provided by Sama and their Consultants (SIMPA) The Environment Studies, Permitting and Social or Community Impact (Section 20) was prepared by GCM Consultants Inc. (GCM). GCM has reviewed the content of this Section and believes that it provides current and reliable information on environmental, permitting and social or community factors related to the Project.

4 PROPERTY DESCRIPTION AND LOCATION

4.1 Description and Location

The Samapleu East Exploration Permit 838 ("*Permis de recherche minière*"; PR838) is located approximately 650 road km northwest of Abidjan, the economic capital of Ivory Coast (*Côte d'Ivoire*), West Africa (Figure 4.1). PR838 is close to the village of Yorodougou, in west-central Ivory Coast, Montagnes District, Tonkpi Region. The Project is about 50 km west of Biankouma and 25 km east of the border with Guinea.

PR838 has an irregular shape with a maximum N-S extent of 24 km and 16 km along the E-W direction, for a total area of 258 km² (Figure 4.1). The permit is approximately centred on latitude 7° 43' 00" N and longitude 7° 55' 00" W (UTM 619,800E; 854,000N).

The Property boundaries are not surveyed in the field, but they are expressed officially by straight lines connecting the apices defined by their latitude-longitude or UTM coordinates (Figure 4.2).

Figure 4.1 – Sama's Exploration Licenses

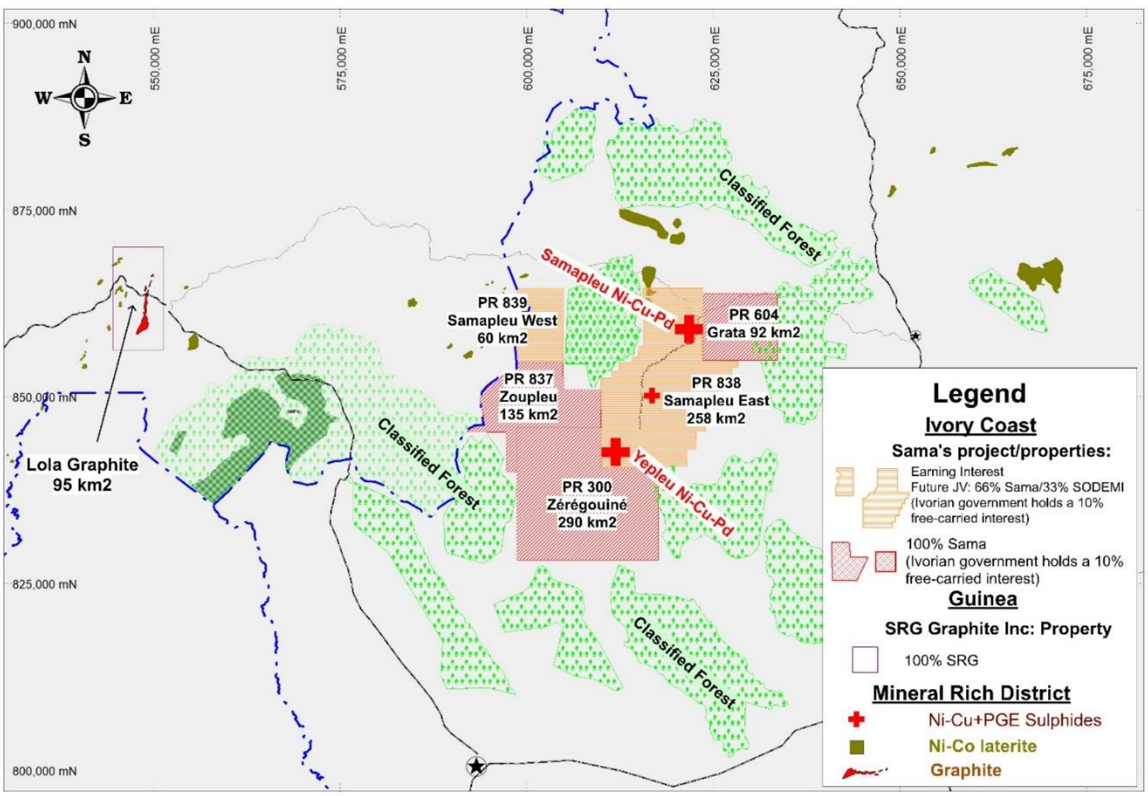
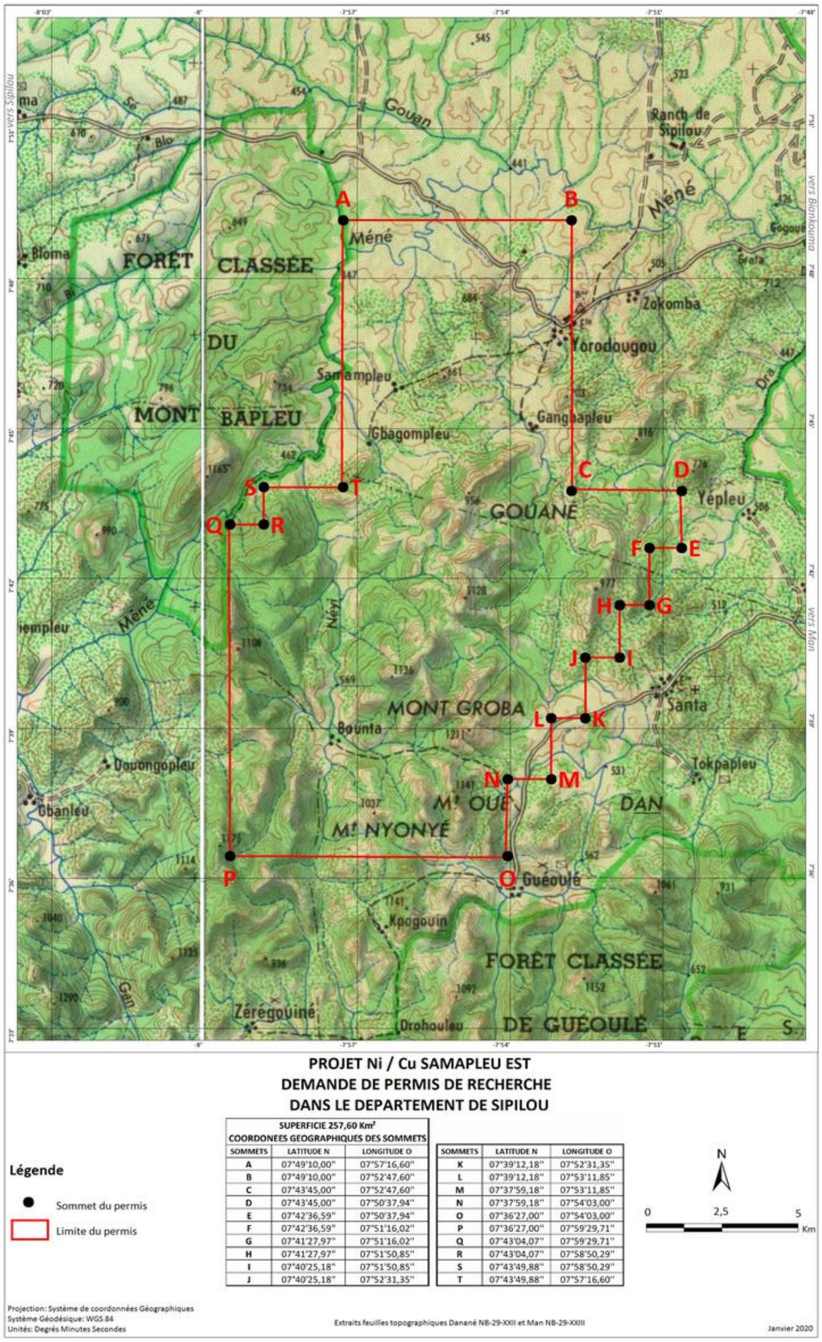


Figure 4.2 – Samapleu (PR838) Claim Vertices (UTM Coordinates; WGS84, Zone 29 North)



SOMMETS	LATITUDE N	LONGITUDE O	SOMMETS	LATITUDE N	LONGITUDE O
A	07°49'10,00"	07°57'16,60"	K	07°39'12,18"	07°52'31,35"
B	07°49'10,00"	07°52'47,60"	L	07°39'12,18"	07°53'11,85"
C	07°43'45,00"	07°52'47,60"	M	07°37'59,18"	07°53'11,85"
D	07°43'45,00"	07°50'37,94"	N	07°37'59,18"	07°54'03,00"
E	07°42'36,59"	07°50'37,94"	O	07°36'27,00"	07°54'03,00"
F	07°42'36,59"	07°51'16,02"	P	07°36'27,00"	07°59'29,71"
G	07°41'27,97"	07°51'16,02"	Q	07°43'04,07"	07°59'29,71"
H	07°41'27,97"	07°51'50,85"	R	07°43'04,07"	07°58'50,29"
I	07°40'25,18"	07°51'50,85"	S	07°43'49,88"	07°58'50,29"
J	07°40'25,18"	07°52'31,35"	T	07°43'49,88"	07°57'16,60"

4.2 Tenement and Encumbrances

Exploration permits in the Ivory Coast are granted by the Department of Mines and Energy and are based on the work program proposed by the applicants. As of the new mining code of 2015, an exploration permit is first issued for a four-year period, with two (2) possible renewal periods of three years each, followed by an additional two-year period, based on results and merits. At each renewal, a work program with a budget commitment is submitted by the Department of Mines and Energy and the Applicant. The title holder is required to submit monthly activity reports as well as an annual activity report to the Department of Mines and Energy.

The original PR123 was granted to SODEMI by decree № 97-375 of July 2, 1997 and was renewed several times to June 2017. The PR 123 was replaced by two (2) new exploration Permits, the Samapleu East (PR838) and the Samapleu West (PR839). The Samapleu East PR 838 gives Sama the right to explore for Cu, Ni and Pt.

Traditional land tenure systems are generally based on communal ownership of land. At the same time, individual families are granted rights to cultivate plots of land to insure their household's subsistence. These rights include some form of inheritance within the family. However, unclaimed or unused lands revert to the community. In 1902 the French introduced the concept that individuals or corporations could hold legal title to land with exclusive rights, but it appears that most of the rural lands are still managed communally on a village-by-village basis.

Within PR838, the surface rights belong either to individuals, as lots defined in villages, or to tribal groups through family clans, outside of villages.

However, the permit holder has the access right to conduct exploration or mining, but fair compensation must be paid to the surface right owner(s) if damages or nuisances are caused by exploration works. The Mining Code provides for a system of arbitration (Item 68) if no agreement can be reached by the two parties.

4.3 Joint Venture Agreement

A Memorandum of Agreement (the "Joint Venture"; "JV") between SODEMI and Sama Nickel Corporation was signed on January 15, 2009. Under the terms of the agreement, Sama Nickel Corporation is the operator of the JV through Sama Nickel Côte d'Ivoire SARL. The JV is controlled by Sama Nickel Corporation (66⅔ % share) and by SODEMI (remaining 33⅓ %). The JV and the PR123 project are managed by a joint Management Committee made up of SODEMI and Sama's representatives. Several Management Committee meetings have taken place since 2009 and all the proposed work programs and budgets have been approved since.

On October 25, 2015, Sama Nickel and SODEMI extended certain terms of PR123 resulting in an exploration license extension to June 25, 2017.

In March 2018, SODEMI applied for two (2) new exploration permits covering a total area of 318 km^2 (Samapleu East and Samapleu West) to replace the former PR123 (Figure 4.1). According to a new regulation in Ivory Coast, classified forests must be removed from any new application. Therefore, the total surface area covered by the two (2) new exploration permits is smaller than the initial area covered by the former PR123.

On June 19, 2019, the two (2) new exploration permits, Samapleu East (PR838 - Decree No 2019-526) and Samapleu West (PR839 – Decree No 2019-527) covering 318 km² were granted. Both PRs expire on June 19, 2023, with possible renewal periods totalling up to 12 years. In accordance with both explorations permits, Sama Nickel agreed to complete an exploration program evaluated at F CFA 2,315,000,000 for PR838 (approximately $5,257,421 CAD as at June 30, 2019) and F CFA 760,000,000 for PR839 (approximately $1,725,978 CAD as at June 30, 2019) before the term of the exploration permits.

Upon completion of the BFS, the Advisory Committee ("AC"), which consists of two (2) Sama Nickel representatives and two (2) SODEMI representatives, will conclude on the feasibility of the project. If the AC decides to proceed with the project, an Exploitation Entity ("EE") will be established whereby future funding will be split between Sama Nickel and SODEMI at 66.7% and 33.3%, respectively. The EE will reimburse SODEMI for all costs associated with previous exploration work conducted until January 15, 2009 up to a maximum of F CFA 834,999,457 (approximately $1,896,304 CAD as at June 30, 2019) and will reimburse Sama Nickel for costs associated with exploration work conducted between the Effective Date and the approval of the BFS subject to the approval of the AC which represents a total amount of $20,480,735 as at June 30, 2019.

On September 20, 2019, SODEMI and Sama signed the continuation of the JV on the new PR838 and PR839 (replacing the PR123) with the consideration that due to the significant investments invested by Sama Nickel in the context of research work on the territory covering the previous PR123 since the date signing of the JV dated 15 January 2009, confirm Sama Nickel's absolute, unequivocal and direct interest in the PR838 and PR839 of 66.67% and SODEMI at 33.33% and this notwithstanding any possible application for an Operating Permit.

Financing the various exploration program for the JV is Sama Nickel's obligation until a technical study for the Samapleu Project is finalised. SODEMI will not contribute financially to the exploration work. Upon filing the technical study, an AC made up of two (2) representatives of Sama Nickel and two (2) from SODEMI will decide on the next course of action.

If the AC decides to follow up with the project, an Operating Group ("*Entité d'Exploitation*", "*EE*") will be set up with JV partners Sama Nickel and SODEMI holding a shared management of 66⅔% and 33⅓%, respectively. The EE will reimburse SODEMI for the expenditures in connection with the historical exploration work up to a maximum of 934,999,457 CGA F (about $1,880,419 CAD) and will reimburse Sama Nickel for the costs related to the exploration work completed between January 15, 2009 and the approval date of the Bankable Feasibility Study (BFS), contingent upon the approval from the AC. The financial participation of the future EE will be as follows:

Sama Nickel:	60%
SODEMI:	30%
Ivorian Government:	10%
TOTAL	**100%**

If the AC decides to not follow up on the project, SODEMI has the option, at its own discretion, to terminate the JV and SODEMI will own all the results from the exploration work and all the studies related to the infrastructures, without financial compensation.

In 2018, Sama closed a private placement with HPX Ivory Coast Holdings Inc. ("HPX") a subsidiary of High Power Exploration Inc., a private mineral exploration company deploying proprietary in-house geophysical technologies to evaluate buried targets. Upon the execution of the earn-in and joint venture agreement, HPX will have the ability to acquire an interest of up to 60% in Sama's Côte d'Ivoire project, including the Samapleu Project, by funding exploration expenses through total investments of $30,000,000 CAD.

Under the terms of the strategic investment, HPX agreed to purchase 25,000,000 Units (one common share and one "Warrant") of Sama, resulting in total proceeds of $5,250,000 CAD. The Units have a term of two (2) years from the closing date at an exercise price of $0.28 CAD per share. Assuming full exercise of the Warrants, the gross proceeds of the Private Placement will total $12,250,000 CAD (Source: *Sama Resources Inc. Press Release, April 13, 2018*).

Sama reports that 7,142,857 share purchase warrants of the Company held by HPX ("HPX Warrants") have been exercised prior to the scheduled expiry date of April 13, 2020. The HPX Warrants were exercised at a price of $0.28 per warrant share for total proceeds of approximately $2M CAD. (Source: *Sama Resources Inc. press release, June 12, 2019)*

Details on the agreement to complement the above general information are provided in Sama's website and filed documents.

4.4 Royalties, Back-in Rights

In consideration for the acquisition of Sama Nickel Corporation by Landen, the Sama Nickel Corporation's shareholders will retain a 1% net smelter royalty on Sama's portion of the Project and an area of mutual interest (*Landen Press Release; March 29, 2010*).

4.5 Required Permits

No other permits are needed for either SODEMI or Sama to perform exploration work within the PR838 area. Significant exploration and drilling activities have already been permitted and performed by Sama on the property.

4.6 Liabilities, Risks

DRA/Met-Chem is not aware of environmental liabilities related to the Project area. In addition, DRA/Met-Chem is unaware of significant factors or risks that may affect access, title or right or ability to perform work on the property.

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

5.1 Accessibility

The Ivory Coast is located in West Africa and borders Guinea and Liberia to the west, Burkina Faso and Mali to the north, Ghana to the east, and the Gulf of Guinea (Atlantic Ocean) to the south.

Access to the Property from Abidjan is via 225 km of a paved four-lane highway toward the NW to Yamoussoukro, followed by paved roads to Daloa and Duékoué to the west and north to Man and Biankouma. From Biankouma, the village of Yorodougou, where the Samapleu exploration camp is located, is accessed by a dirt road over approximately 35 km toward the W-NW. This road continues through the town of Sipilou approximately 25 km to the west of Yorodougou, and over a further 3 km to a border post between the Ivory Coast and Guinea. This road provides access to a highway leading to Lola in Guinea, 50 km west of the border. Access from Yorodougou to the Samapleu Deposits is via bush tracks servicing small villages and roads constructed by Sama.

5.2 Climate and Vegetation

The Project area falls within the Guineo-Soudanian climatic zone, which is a transition zone between equatorial and tropical climates, and has distinct rainy and dry seasons. The dry season extends from November to March, while the dry season covers the period from March to October. The rainfall in the Project area averages 1,600 to 1,800 mm of rain per annum. Temperatures range from about 10°C to 35°C (Table 5.1). The Lola weather station in Guinea is the station closest to the Project with complete record over extended periods.

Although some specific exploration work might be affected during the rainy season, companies operate mines year-round in similar climate conditions in West Africa, as is the case for the iron mines in Liberia.

The PR838 area is located in the transition zone between the tropical forest area and the northern savannah, where grassy woodland and occasional dry scrub are predominant. The tropical forest covers nearly one-third of Ivory Coast, from the coastline to the town of Man in the north and to the west between the Sassandra River and the mouth of the Cavally River. The northern savannah is underlain by lateritic or sandy soils with a gradual decrease of vegetation cover from the south northward. The vegetation communities observed in the PR838 area can be divided into three (3) main habitat types which reflect a combination of terrain, drainage and vegetation cover. These vegetation communities are:

- Tropical forest with dense closed canopy;
- Grasslands with scattered trees and shrubs with moderate to open canopy;
- Degraded tropical savannah and forest due to plantation and agriculture (cleared and/or burnt forest).

Table 5.1 – Historical Climate Conditions at the Lola Weather Station, Guinea

Month	Temperature (°C)			Precipitations (mm)			Wind Speed
	Average	Min.	Max.	Average	Min.	Max.	(km/h)
January	23.3	10.8	33.7	17.6	0.0	86.6	4.3
February	24.7	13.2	34.7	55.8	0.0	189.3	4.7
March	25.6	16.5	34.4	121.7	47.9	223.4	5.0
April	25.8	18.4	33.1	167.0	85.6	273.5	5.0
May	25.4	18.4	32.1	179.5	80.5	295.0	5.0
June	24.4	18.1	31.1	199.9	92.1	374.1	6.5
July	23.5	18.0	29.5	234.3	112.0	476.9	6.8
August	23.5	18.6	29.4	294.6	183.5	400.4	6.5
September	24.1	18.3	30.0	271.7	155.2	417.3	5.4
October	24.5	17.8	30.9	164.2	74.5	348.7	4.7
November	24.5	16.0	31.3	61.0	11.8	166.3	5.0
December	23.3	12.4	31.5	13.6	0.0	75.1	4.0

(Sources: Temperatures: WMO; data for the period 1961-1990; Precipitations Etude Climatologique des Sites de Lola et de N'zerekore 2017; Mamadou Tounkara; Direction Nationale de la Météorologie; Décembre 2017, data collected in 1979-2009; Wind speed: www.weatherbase.com; Years on Record: 112)

5.3 Local Resources

In January 2019, Ivory Coast has an estimated population of 25,280,000 and a population density of 64 people per km^2 (*http://worldpopulationreview.com/countries/ivory-coast-population/*). However, the population density is estimated at less than 3 persons per km^2 in the PR838 area.

The largest city is Abidjan, a port city with a population estimated at 4.5 million and a metro population exceeding 5.1 million (*http://worldpopulationreview.com/countries/ivory-coast-population/*). The capital of Ivory Coast is Yamoussoukro, which has a population of 355,600 (*http://hikersbay.com/climate/cotedivoire/yamoussoukro?lang=en*).

The population of Ivory Coast is composed of different ethnic groups, the main ones being Akan (primarily Baoulé and Agni), Krou (Bété, Wê), Mandé (Malinké), Dan (Yacouba, Gouro) and Gour (Senoufo). The Akan ethnic group represents about 35% of the total population of the country.

The predominant ethnic groups in the PR838 area are the Yacouba, Wê, Toura and Malinké. Religious communities from these groups consist of a combination of Moslem, Christian or animist creeds.

French is the official language, but the main native languages in the PR838 area are Lobi, Senoufo, Baoulé, Yacouba and Dioula (a vernacular language). Yacouba is the principal language in the immediate PR838 area.

Biankouma and Sipilou are the largest local urban centre in the PR838 area. They are serviced by the larger town of Man (population of approximately 200,000) located about 45 km to the south of Biankouma and has a domestic airport. These three (3) towns, in addition to the village of Yorodougou, are home of the State Authority represented by a Regional Prefect ("*Préfet de Région*") in Man, two (2) Department Prefects ("*Préfets de Département*") in Biankouma and Sipilou and one (1) Sub-Prefect ("*Sous-préfet*") at Yorodougou.

Other communities outside of these centres and of the Yorodougou sub-prefecture consist of villages, often with less than 100 inhabitants, or hamlets.

The economy of the PR838 area is primarily agricultural and much of it is on a subsistence basis. Coffee and cocoa crops represent the main source of the cash economy related to agriculture. Logging is another pillar of the local economy.

A variety of mining activities has occurred in western Ivory Coast over the years. Consequently, some services and expertise related to the mining industry are available in the region.

Indeed, since the 1970s, world-class deposits were discovered in the Man region, such as the Mount Klahoyo (35 km to the SE of Man; 700 Mt at 33% Fe) and Mont Gao (80 km SW of Man; 510 Mt at 40% Fe) iron deposits *(Source: Rôle de la Sodemi dans le développement du secteur minier; Yao Kouané Raoul; Présentation, 8 juin 2010*) and the Biankouma-Touba-Sipilou nickel laterite deposits estimated to contain 169 Mt @ 1.77% Ni and 0.08% Co. The Foungouesso, Moyango and Viala projects were acquired by *Compagnie minière du Bafing SA* (*CMB*). Production at the Foungouesso nickel mine started in April 2017, with about 380,000 tonnes extracted in 2017 (*Source: Rapport Annuel DGPE 2017-2018 – Direction Générale du Portefeuille de l'État, Abidjan*). Foungouesso contains a reported estimated resource of 60 Mt at 1.84% Ni.

In the 1970s, low-grade iron deposits were identified at Bangolo (South of Man), while the Bobi diamond mine near Seguela (NW of Man) produced 270,000 carats per year until 1979, followed by artisanal mining of primary and placer diamonds around Dualla-Bobi-Diarabam.

In 1991, a gold mine was developed at Ity, near Danané (approximately 100 km SW of Biankouma). Ity has produced more than 1.2 million ounces of gold in its 20-plus years of operation (*Source: Endeavour Mining website*), and Endeavour expects to resume production in early Q2-2019 (*Source: February 20, 2019 Endeavour Press Release*). Endeavour Mining announced the successful completion of the 25% volumetric upgrade of the carbon-in-leach (“CIL”) plant, from 4 Mtpa to 5 Mtpa, at its Ity mine in Côte d’Ivoire in November 2019 (*Source: November 21, 2019 Endeavour Press Release*).

5.4 Infrastructure

PR838 benefits from a road network leading to the Project and basic services are available in the towns of Man and Biankouma.

There are two (2) deep-sea ports in the Ivory Coast: one in Abidjan and one in San Pedro (Figure 1.2). The distance to Abidjan is about 650 km while San Pedro is less than 550 km away.

The port of San Pedro has a packaged goods terminal with a 4,000 m^2 warehouse opening directly onto the dock. The port can accommodate vessels up to approximately 20,000 DWT with a certified draft depth of 9 m. A future bulk terminal will accommodate vessels up to 35,000 DWT, although this will require a water draft of 14 m.

5.4.1 Power Supply

Power will be supplied to the Project site via a 90-kV overhead transmission line from Man to Danané over a distance of 80 km.

5.4.2 Water Supply

There is no water utility in the region. Several continuous waterways exist in the project area, four (4) of which have been monitored for rate of flow and elevation over the past few years. The Méné River is considered as the largest potential source of water.

5.5 Physiography

The terrain in the Ivory Coast can be described as a large plateau rising gradually from sea level in the south to almost 500 m elevation in the north, with the highest point at Mount Nimba (1,752 m) on the Guinean border to the west.

The PR838 area is characterised by rolling hills covered with tropical forest, low grasslands and valleys. Steep scarps are present locally. The elevations range from 400 m above sea level in the low grasslands to slightly above 1,200 m on the mountain ridges. A gradual transition from the sector of forested hills to a savannah plain is observed near the northern edge of PR838.

6 HISTORY

The information in this section is largely drawn or summarised from the Report available on SEDAR entitled: "Technical Report on the Samapleu Nickel and Copper Deposits Côte D'ivoire, West Africa", prepared by WSP Canada Inc. and dated December 2015.

6.1 Ownership History

Land in Ivory Coast is federally owned and an application through the Department of Mines and Energy is required to obtain an exploration permit.

Pursuant to a request by SODEMI (*Société pour le développement minier en Côte d'Ivoire*), the *République de la Côte d'Ivoire* awarded SODEMI the PR123 permit by decree No 97-375 dated July 2, 1997. This permit was renewed pursuant to decree No 014/MME/DM dated May 13, 2008. Thereafter, a joint venture agreement was signed on January 15, 2009 between SODEMI and Sama Nickel Corporation, a private Canadian company, in order to explore PR123.

Landen Capital Corp. ("Landen") acquired 100% of Sama Nickel Corporation on March 29, 2010, in a reverse merger transaction. Landen assumed all of Sama Nickel Corporation's obligations through a wholly owned subsidiary, Sama Nickel Côte d'Ivoire SARL. In consideration for the Sama shares, Landen issued an aggregate of 12,500,000 common shares to Sama shareholders, who will retain a 1% net smelter royalty on Sama's portion of the Project (Source: *Press Release, Landen; March 29, 2010*). In mid-2010, Landen changed its name to Sama Resources Inc.

On October 25, 2010, PR123 was renewed for two years by decree No 008/MME/DGMG/DDM. In order to comply with the mining rules and regulations, the surface area was reduced from the initial 750 km² to 298 km², to which a block of 151 km² was added to the renewed PR123 on the northwest (decree No 2013-856), bringing the total to 449 km² (Figure 4.2). The request for the PR123 renewal, for an additional three years was granted on October 31, 2012 under Arrêté MMPE/DGMG/DDM No 091. PR123 was renewed to June 2017 by Arrêté No 2015-124/MIM/DGMG dated November 26, 2015.

In 2018, Sama closed a private placement with HPX Ivory Coast Holdings Inc. ("HPX") a subsidiary of High Power Exploration Inc., a private mineral exploration company. Upon the execution of the earn-in and joint venture agreement, HPX will have the ability to acquire an interest of up to 60% in Sama's Côte d'Ivoire Project, including the Samapleu Project.

On June 18, 2019, the two (2) new exploration permits, Samapleu East (PR838 - Decree No 2019-526) and Samapleu West (PR839 – Decree No 2019-527) covering 318 km² were granted. Both PRs expire on June 19, 2023, with possible renewal periods totaling up to 12 years.

6.2 Exploration History

The Samapleu mineralization was discovered by SODEMI in 1976 through a regional stream sediment sampling program that was part of a Geomine's Iron-Titanium-Vanadium exploration program. Geomine Ltd. is a defunct exploration company that explored western Ivory Coast in the 1970s in association with SODEMI. Falconbridge Ltd., in association with SODEMI, also explored for Ni-Co laterite deposits in the area adjacent to the former PR123.

The results from the regional stream sediment sampling program outlined most of the major Ni-Co laterite deposits known today, including Sipilou, Foungouesso, Moyango, Touoba and Sipilou South, and identified the potential of the Samapleu Ni-Cu mineralization.

Following on Geomine's encouraging results, SODEMI narrowed down the search area in the vicinity of Samapleu village and performed line-cutting and a detailed soil sampling program. A total of 2,731 samples were collected and analyzed for Ni, Cu and Au at SODEMI's laboratory in Abidjan. Exploration at Samapleu continued until 1998; but was followed by a dormant period until 2009 when SODEMI and Sama Nickel resumed exploration on the project. This hiatus was caused by the difficulty to unravel the geometry of the deposits, although encouraging results had been obtained.

Subsequent exploration included geochemical sampling, geophysical surveying and several phases of core drilling, as summarised in Table 6.1. Little information is available on the specifications for the various "in-house" drill campaigns performed by SODEMI with their own rigs, except that all core was of BQ diameter (36.5 mm). The drill holes intersected disseminated, semi-massive and massive sulphide mineralization containing up to 8.0% Cu, 4.0% Ni and elevated PGE values.

In March 2010, Sama started several drilling programs aimed at targets within PR123 and in the region. Several research projects, namely on the Yacouba complex or on the Ni-Cu-PGE and chromite mineralization have been sponsored by Sama and performed by Prof. C. Picard, F. Gouedji, N. Ouattara, B. Bakayoko. M.A. Audet, and others.

Table 6.1 – Summary of Exploration and Development Work Within the Vicinity of PR123

Company	Year	Activity	Results
Geomine Ltd.	1970s	Stream sediment sampling; 6,373 samples	Discovery of Ni-Co deposits, including Sipilou South
SODEMI	1970s	Line-cutting; Soil sampling; 2,731 samples, 674 rock samples.	
	1978	Drilling (Sipilou South) 3 holes for 75 m; IP survey, 32 line/km (over Ni in soil anomalies near Samapleu village).	Mineralization confirmed
	1982	Drilling 14 holes for 2,812 m	
	1986-87	Drilling 23 holes for 2,824 m	
Trillion Res.	1991	Geological review	

Company	Year	Activity	Results
SODEMI	1993	IP survey 13 line/km; Max-Min (100 line km); Ground MAG survey	Mineralization confirmed; drill targets generated
	1996-97	Drilling 5 holes for 780 m	Drill testing IP anomalies
	1998	Stream sediment sampling; 2,067 samples (Regional and south of PR 123)	Targets: Ni, Cu and Ag
SODEMI – Sama Nickel	2009	Joint venture agreement signed in January	
Sama Resources	2010-13	Drilling 252 holes for a total of 30,025 m over PR123 & regional exploration. 2012: Mag + Radiometric airborn survey 2013: EM airvborn survey	2010: Discovery of Samapleu, Samapleu Extension 1 Ni-Cu-PGE deposits 2013: discovery of Yepleu Ni-Cu-PGE deposit
	2012	First mineral resource estimate by WSP; NI 43-101 report.	
	2014-15	Drilling 24 holes for 6,402 m Updated mineral resource estimate by WSP; NI 43-101 report.	
	2017-19	Drilling 44 holes for 9,737 Geotechnical study for Samapleu, by Mine Design Engineering; Kingston, Canada. 2018: additional EM airborne survey 2018: HPX's Typhoon ground surveys 2019: Drilling at Samapleu and Yepleu 2018-19: PEA study	

6.3 Historical Resource Estimate

The first mineral resource estimate for the Samapleu Deposits is presented in NI 43-101 Technical Report dated July 20, 2012 (Rivard et al. 2012). The estimate was based on 102 boreholes for a total of 15,849 m, using a cut-off grade (COG) of 0.10% Ni. The results are presented as in-situ resources (Table 6.2).

Table 6.2 – Samapleu Deposits Mineral Resources at 0.10% Nickel COG (July 2012)

Category	Tonnes (x1,000)	Ni (%)	Cu (%)	Co (%)	Pt (ppm)	Pd (ppm)
Indicated	12,467	0.24	0.22	0.02	0.11	0.30
Inferred	7,986	0.23	0.17	0.02	0.08	0.31

The original resource estimate was updated in December 2012 and included the results from previously unsampled intervals and eight (8) holes that were drilled after the initial mineral resource estimation of July 2012. These holes raised the total length of core to 17,273 m. The results from this estimate are presented in a technical report by WSP re-issued on December 22, 2015. The estimated tonnes and grades are reported as in -situ resources, without pit constraints, using a cut-off grade of 0.10% Ni (Table 6.3).

Table 6.3 – Samapleu Deposits Mineral Resources at 0.10% Nickel COG (December 2012)

Category	Tonnes (x1,000)	Ni (%)	Cu (%)	Co (%)	Pt (ppm)	Pd (ppm)
Indicated	14,159	0.24	0.20	0.02	0.11	0.29
Inferred	26,480	0.24	0.18	0.01	0.09	0.31

The reader is cautioned that both the original and updated historical estimates of July and December 2012 are not relevant to the current estimate that is based on a larger amount of drilling and geoscientific information gathered since the issue of the 2012 resource estimates. These historical estimates are only presented here for the sake of completeness of the current Report and should not be relied upon. The estimate presented in this Report supersedes the 2012 estimates that the issuer and DRA/Met-Chem are considering as no longer current and complete. A qualified person has not done sufficient work to classify the historical estimates as current mineral resource.

Mineral resources are not mineral reserves and do not have a demonstrated economic viability. There is no certainty that all or any part of the mineral resources will be converted into mineral reserves.

7 GEOLOGICAL SETTING AND MINERALIZATION

The information in this section is largely drawn or summarised from the Report available on SEDAR entitled: "Technical Report on the Samapleu Nickel and Copper Deposits Côte D'ivoire, West Africa", prepared by WSP Canada Inc. and dated December 2015), an internal Report by Sama to support an application for a mining permit (2017), a publication by Gouedji et al. (Bull. Soc. géol. Fr., 2014) and is complemented by an Internet search. More details on the regional and property geology can be found in the above-mentioned documents.

7.1 Regional Geology

The project area is located in western Ivory Coast, which constitutes the eastern limit of the West-African Archean craton (WAC).

The WAC is represented by two Precambrian shields: Reguibat to the north and Man to the south. The Man shield is considered to be a remnant of a much larger craton that includes the Guyana craton of South America that split by continental breakup in the Jurassic period.

The Man shield is subdivided into a western domain, predominantly of Archean age (Kénéma-Man), and an east-central domain (Baoulé-Mossi) composed of Paleoproterozoic rocks. The two domains are separated by the major, sub-meridian, strike-slip Sassandra fault. The Archean formations outcrop continuously in the western part of the WAC, from Sierra Leone to western Ivory Coast.

The Achean rocks were shaped by two major tectono-thermal events whose respective chronology is uncertain: the earlier Leonian orogeny (3.5-2.9 Ga) and the Liberian orogeny (2.9-2.5 Ga). This was followed by the polycyclic Eburnean orogeny comprised of a series of events: collision at the margin of the craton and two phases of transcurrent tectonism (2.5-1.8 Ga).

Work from Nahon et al. (1982), Camil (1984) and Kouamelan et al. (1997) indicates that Paleoproterozoic reworking has been found in the Man area during the Birimian event (2.1 Ga), and has produced an important amount of juvenile magmatism. The effects of Eburnean ductile deformation along NE-SW, NW-SE and N-S trends can be observed in the region.

The Project lies within the Kénéma-Man domain, which consists chiefly of Archean granulitic and migmatitic gneiss with subordinate granitoids, and relic supracrustal belts with mafic to ultramafic rocks and iron formation. The formations are metamorphosed to granulitic facies.

The Kénéma-Man domain is separated in two by the E-NE Man-Danané fault, on the basis of tectono-metamorphic criteria:

- The northern domain (Province of Man), representing the base of the Archean shield where the predominant facies are of high metamorphic grade and of granulitic type;
- The southern domain of granulitic and migmatitic rocks, composed of charnokitic gneiss, biotite migmatitic gneiss, leptynite and granite.

The southern domain has a stronger tectono-metamorphic overprint caused by the Birimian event than the northern domain where the Archean features are less reworked.

The Project is located 50 km north of the Man-Danané fault and 100 km west of the Sassandra fault.

A mafic and ultramafic Layered Complex (Ouattara, 1998) of Eburnean age (2.09 Ga), the Yacouba Complex, has intruded the older gneissic assemblage of the WAC (Chisholm, 1991; Ouattara, 1998). The Yacouba Complex can be traced discontinuously along a NE-SW corridor of at least 30 km long by 10 km wide between Zeregouiné in the SW, Yorogoudou in the NE and Santa to the East. The Yacouba Complex hosts the Samapleu mineralization and has been recently discovered and identified through exploration work performed by Sama since 2009.

The Yacouba Complex is characterised by a feeder system of magmatic material assimilating the Archean country rock thus creating magmatic migmatite complex with locally well-preserved peridotite, pyroxenite, chromitite and minor gabbro or gabbro-norite units. The Yacouba Complex is often seen vertically crosscutting the Archaean gneiss and granulite, especially in the Samapleu area (SODEMI, 1976; Ouattara, 1998; Gouedji, 2014, Gouedji et al.; 2014). At the Yepleu sector, 25 km SW of the Samapleu deposit, the intrusive complex displays magmatic migmatite with distinct sub-horizontal layering or magmatic bedding. There also, the migmatite is seen together with a succession of noritic to anorthositic assemblages.

The Yacouba complex layered successions are the host of Ni-Cu sulphides (mainly pyrrhotite-pentlandite and chalcopyrite), disseminated Pt and Pd minerals and massive chromite layers.

Figure 7.1 shows a 3D representation of the Yacouba intrusive complex together with target mineralization as accumulations of massive sulfides in traps and embayment (Northeast is toward the upper right corner).

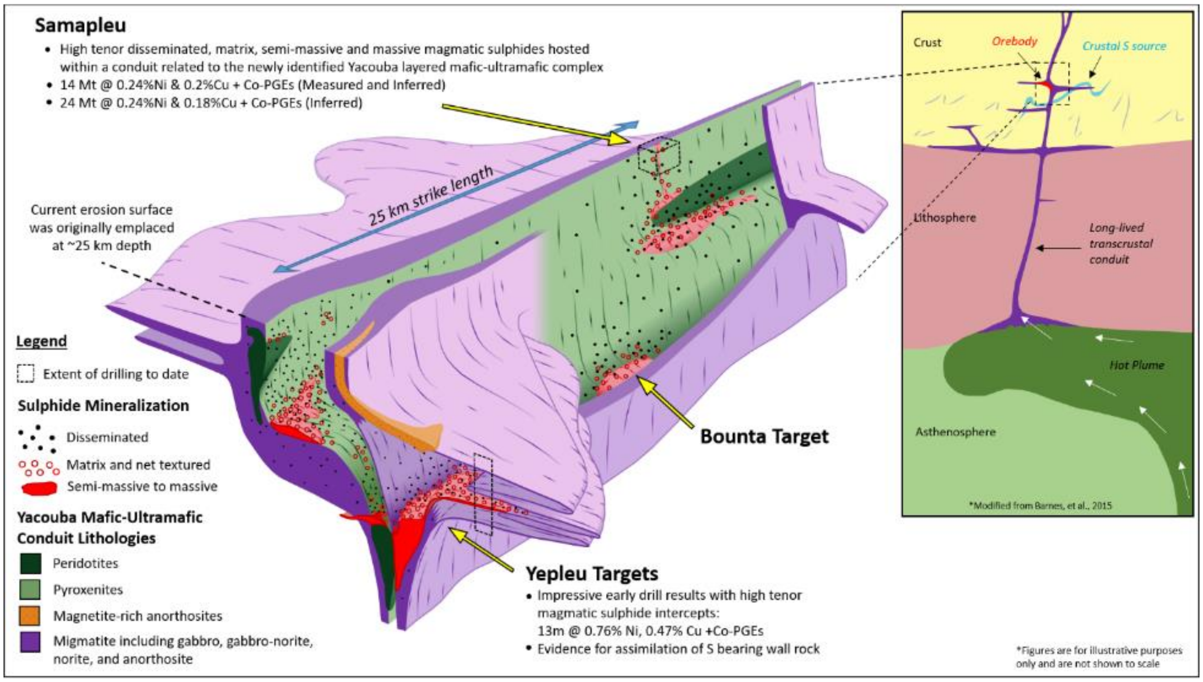
7.2 Property Geology

The laterite profile at Samapleu Main is very thin over the summits overlying the gabbro layer and becomes thicker down slope over the pyroxenite units, reaching approximately 35 m. At the Samapleu Extension 1 Deposit, the thickness of the laterite profile is typically between 30 and 40 m. As a consequence of this highly developed lateritization profile, the surface geological data remain scarce and most of the geological information is derived from drilling and geophysical data.

The PR838 is underlain by gneissic granulite, mafic granulite, charnockite, aluminous garnet and magnetite gneiss, garnet jotunite/enderbite, biotitite and grenatite (Figure 7.2). All have been affected by high-grade facies of metamorphism under granulitic P and T conditions.

The Yacouba mafic and ultramafic intrusive complex was recognised by drill holes at the Samapleu Main, Samapleu Extension, Yorodougou, Bounta, Santa and at the Yepleu locations. The Samapleu intrusion is interpreted to represent a magmatic conduit as one of the Yacouba complex feeders system.

Figure 7.1 – 3D Representation of the Yacouba Intrusive Complex



The lithological assemblage at the Main Deposit includes the following facies succession from the surface down: laterite; pyroxenite interlayered with peridotite units; gabbro. The ultramafic series is composed of an irregular sequence ranging from 2 to 60 m in thickness, with a succession of facies from stratigraphic bottom to top made up of chromitite, olivine cumulate and pyroxene cumulate. The ultramafic and mafic sequences display plagioclase cumulate at the top (Ouattara, 1998). Contacts between various geological units are generally sharp and well-defined. The sequence contains massive chromite and nickel-copper suphide-rich layers exposed at surface at several locations.

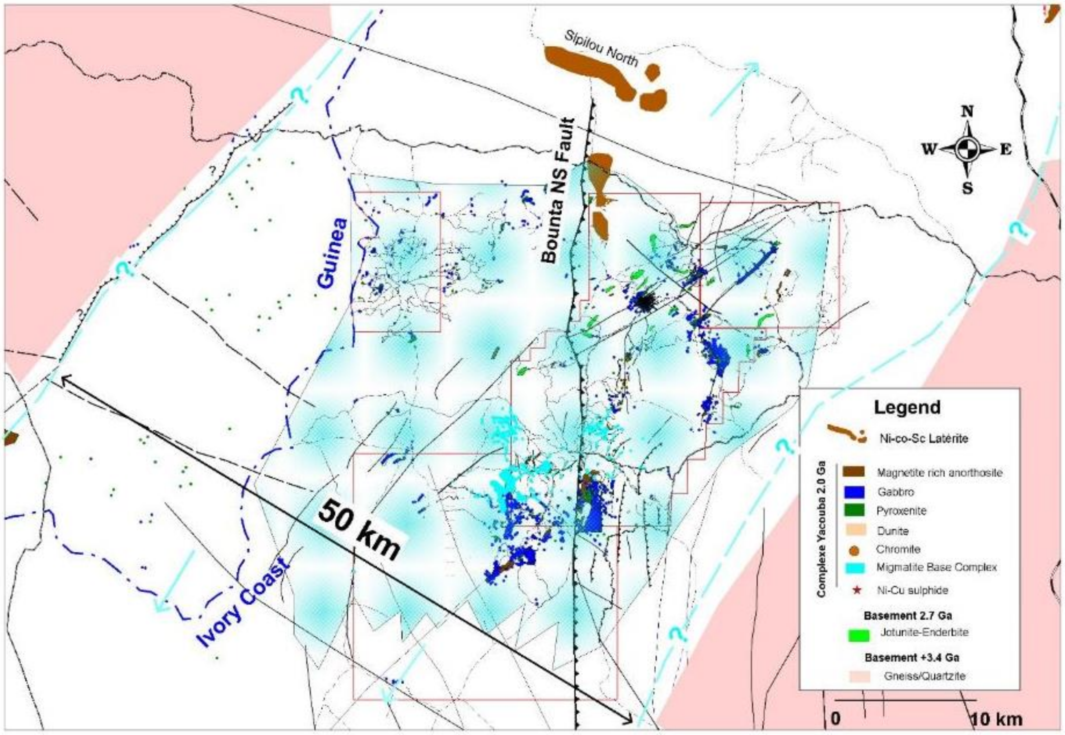
The geological succession at the Samapleu Extension 1 Deposit is fairly similar to the Samapleu Main Deposit succession with, from top to bottom: surface laterite; peridotite (dunite, lherzolite); pyroxenite (websterite); plagioclase rich websterite/gabbro.

7.3 Structural Geology

The magnetic data highlight a general NE-SW fabric of the formations that could be attributed to ductile deformation zones. Large-scale sigmoidal- or rhomboidal-shaped dilational jog may form at the loci of curvature along the shears that would favour the emplacement of the mafic and ultramafic intrusions such as those at Samapleu or Yepleu.

The area appears to have been affected by at least two phases of deformation that may have formed dome and basin type of folds, although this has not been demonstrated within the PR 838 area.

Figure 7.2 – Surface Geology in the Vicinity of Sama's Land Package



7.4 Petrology

Detailed petrological and mineralogical determinations of the various lithological units observed at the Samapleu deposits were performed by Mr. Gouedji in 2011 as part of a Ph.D. research program and are summarised as follows:

- Peridotite: mainly dunite and serpentinized lherzolite. The dunite is composed of olivine, magnetite (derived from olivine during serpentinization) and minor amounts of orthopyroxene. The lherzolite consists of partially serpentinized olivine (>70%), ortho-, clinopyroxene and rare amphiboles. Minor amounts of sulphides and massive chromite are also present;
- Pyroxenite: includes websterite, spinel-rich and olivine-rich websterite. The websterite is composed of orthopyroxene (60%) and clinopyroxene (<20%) and amphiboles. The pyroxenite facies can carry disseminated semi-massive and massive sulphide mineralization. Green spinels (hercynite) are also present;
- Massive chromite: found as thin layers within the pyroxenite assemblage. Massive chromite exhibits an interstitial habit and typical net texture surrounding pyroxene minerals. Biotite, muscovite, rare amphibole and sulphides are also present and account for less than 5%.
- Plagioclase-rich websterite: progressive enrichment in plagioclase toward the footwall gabbro (stratigraphic top). The sulphide phases are somewhat less abundant;

- Gabbro: includes gabbro, anorthosite, gabbronorite and sapphirine-rich mafic rocks. It represents mafic cumulates of the upper part of the intrusion.

7.5 Mineralization

Mineralization in the Main and the Extension 1 deposits consists predominantly of pyrrhotite, pentlandite and chalcopyrite, with subordinate amounts of pyrite, PGE and chromite. According to Ouattara and Gouedji (2014), and based on drill data, mineralization is preferably hosted in pyroxenite, although local zones rich in sulphides were identified within the peridotite units. In addtion, strong sulphide mineralization also occurs at the gabbro-norite contact of the main zone of Samapleu.

The most common occurrence for the sulphides is the net-texture (matrix) type, which is indicative of a disseminated type of mineralization. Globular ("blebby"), breccia, massive and semi-massive types of sulphide mineralization have also been observed.

The presence of these types of sulphide occurrences suggests that the mineralization was governed by sulphur saturation of the magma. This created an immiscible liquid and separation and precipitation of the sulphides from the silicate liquid of the parent magma, followed by accumulation during a tardi-magmatic process.

Information obtained from Sama's geological mapping, geophysical survey data and detailed borehole observations suggests that the Samapleu Main Deposit is composed of an Upper and Lower mafic-ultramafic blocks. The Upper block extends from surface to a maximum depth of 150 m. The Lower block is separated from the Upper block by a SW, shallowly-dipping fault causing a displacement of approximately 75 m.

Sama's surface exploration has identified a new mafic to ultramafic complex located 3.5 km south of the Main Samapleu deposit. This new Gangbapleu sector extends for several km to the southwest. A mineralized pyroxenite sample collected at surface has returned 0.15% Cu and 0.07% Ni. Although low, these unexpected values are indicative of the potential for a whole new complex. The Gangbapleu mafic-ultramafic complex appears to extend sporadically southward for a further 10 km.

8 DEPOSIT TYPES

This Section is drawn from the internal report entitled: "Demande de Permis d'Exploitation, Sama; Étude de Faisabilité, Juin 2017". Additional information on the deposit types can be found in the Report available on SEDAR entitled: "Technical Report on the Samapleu Nickel and Copper Deposits Côte D'ivoire, West Africa", prepared by WSP Canada Inc. and dated December 2015.

The magmatic nickel-copper-PGE deposits occur as sulphide concentrations in a variety of magmatic mafic and ultramafic rocks.

Sulphide droplets often form within the ultramafic intrusion through contamination of the parental, mantle-derived magma with sulphur from adjacent rock units or by assimilation from the crust. As these sulphide droplets circulate through the magma by convection, they scavenge nickel, copper and the platinum group elements from the magma, as these elements have a strong chemical affinity for sulphur. As the sulphides are heavier than the magma, they sink through the magma and accumulate at the base of the intrusion as pockets or layers of sulphides that crystallise during cooling of the magma to form mineral deposits.

According to classical classifications of nickel sulphide deposits, the Samapleu and Yepleu deposits are interpreted to be part of a differentiated, ultramafic and mafic feeder dykes system of the recently discovered layered Yacouba complex (Gouedji et al., 2014). These rare intrusion types are host to the largest nickel and copper deposits in the world, such as the Jinchuan (China), 515 Mt at 1.06% Ni; Voisey's Bay (Canada), 137 Mt at 1.68% Ni; Kabanga(Tanzania), 52 Mt at 2.65% Ni; Eagle (USA), 4.5 Mt at 3.33% Ni; Eagles Nest (Canada), 20 Mt at 1.68% Ni; Kalatongke (China), 24 Mt at 0.68% Ni and N'komati (South Africa) 2.8 Mt at 2.08 % Ni.

The Samapleu license is located adjacent to the large world class nickel-cobalt laterite deposits of Sipilou, Foungouesso, Moyango and Viala.

As is common in numerous documented intrusions, the emplacement of the Samapleu sequences is related to intense tectonic activity. However, the specific character of the Samapleu sequences is the fact that the magmatic intrusion originated from the lower continental crust at a depth of about 25 km.

The magmatic Ni, Cu and PGE deposits are subdivided into two main groups: the deposits in association with ultramafic and with gabbroic sequences (O.R. Ekstrand, 1984).

The Samapleu mineralization is part of a typical ultramafic sequence. When compared, all the world class Ni-Cu sulphides share some characteristics (Naldrett, 1999):

- An ultramafic to picritic parent magma:
  - Proximity to a major tectonic structure;
  - Presence of rocks enriched in sulphides;

- Depletion in chalcophile elements in the intrusive rocks;
- Geochemical evidences of interaction between the magma and the host rocks and presence of, or proximity to, a dynamic magmatic conduit (feeder dykes).

It seems that most of the above criteria are present in the Samapleu deposits. In addition, the massive sulphide lenses in the Samapleu deposits have been recognised as sharing several additional characteristics that suggest that they belong to a major mineralization system:

- Extreme variations of the Ni:Cu ratio, indicative of sulphide fractionation;
- Local occurrence of large quantities of sulphides, which suggest that fractionation took place before their emplacement;
- Highly various textures in the sulphides and the presence of breccia zones;
- Presence of a rare texture, the “loop texture”: large pyrrhotite crystals fringed by chalcopyrite and pentlandite forming a loop around pyrrhotite. These textures are particularly conspicuous in the Norilsk and Voisey's Bay deposits;

Abundant inclusions of sulphides under the form of blebs-droplets in the pyroxene crystals, which indicates sulphur saturation of the magma prior to crystallisation.

The model of mineralization associated with a layered mafic-ultramafic intrusion has been appropriately used by Sama to guide their exploration and development work on the Ni-Cu-PGE deposits in the Samapleu region.

9 EXPLORATION

The information in this Section is a summary and updated from the Report available on SEDAR entitled: "Technical Report on the Samapleu Nickel and Copper Deposits Côte D'ivoire, West Africa", prepared by WSP Canada Inc. and dated December 2015. Geophysical and compilation maps presented in the WSP's report are not reproduced here.

Exploration by Sama over the previous PR123 and now PR838 commenced in earnest in March 2009, when a line grid was established over the main Samapleu deposit and along its possible extension. The grid also covered Ni-and-Cu-in-soil anomalies in the vicinity of Yorodougou village and in the northwest corner of the property, over the Sipilou South Ni-Co laterite deposit.

In September and October 2009, 60 line-km of IP survey was completed over the three grids by *Société Nouvelle de Géophysique* ("SNG") of Abidjan, Ivory Coast. Readings were taken at 50-m intervals on 100 m to 150 m spaced lines. SNG collected the data and performed the interpretation. The survey outlined six features with strong conductivities at both the Samapleu and the Yorodougou grids. Thereafter, *Abitibi Géophysique* ("Abitibi"), Val d'Or, Quebec, Canada audited SNG's results and interpretation and confirmed the size and location of SNG's interpreted IP anomalies. The Samapleu Extension 1 deposit was discovered by Sama in June 2010 after drilling an IP anomaly.

In January 2010, SNG performed a total of 48 line-km of ground magnetic survey over the Samapleu and the Yorodougou grids. The readings were taken at 12.5-m intervals on the lines. The aim of the ground magnetic survey was to define the contacts between the ultramafic units with higher accuracy.

A stream sediment sampling program was completed in 2010 in the northwestern corner of the original PR123 (now Samapleu West (PR839)).

Numerous chromite occurrences and mineralized blocks scattered over 10 km along the Bounta-Gangbapleu Ridge were discovered by mapping in November 2011.

In April 2012, Xcalibur Airborne Geophysics, South Africa, performed 13,556 line-km of airborne magnetometer and radiometric survey. The survey covered the entire previous PR123 as well as part of Sama's Lola graphite property in neighbouring Guinea. In addition to delineating thrust fronts and faults, the survey generated several areas of exploration interest (Figures 9.1 to 9.3). Geological reconnaissance over these targets took place from December 2012 to January 2013.

From December 2012 to January 2013, Fugro Airborne Surveys, a geophysical survey company based in South Africa, performed an electromagnetic and magnetic helicopter survey covering a total of 3,300 line km ("HTEM"), on a combination of flight lines at 100 m and 200 m spacing, covering the most promising areas of the PR123 license (Figure 9.4).

Figure 9.1 – Xcalibur, High Resolution Airborne Magnetic Survey - Magnetic Signal

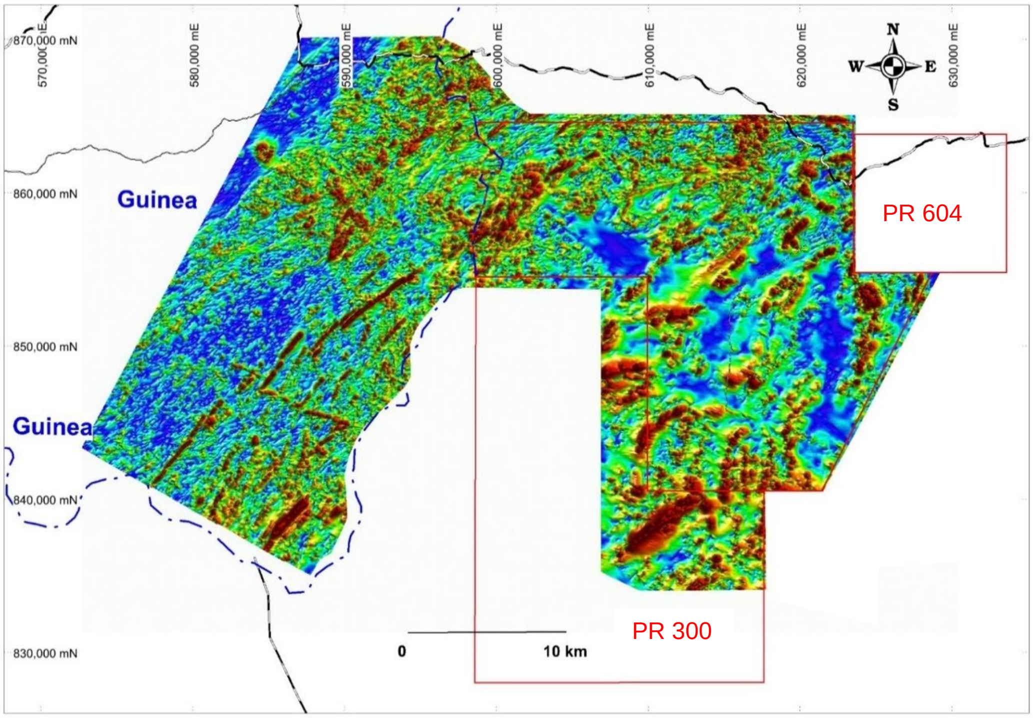


Figure 9.2 – Xcalibur, High Resolution Airborne Geophysical Survey, Radiometrics, Potassium (K) Signal

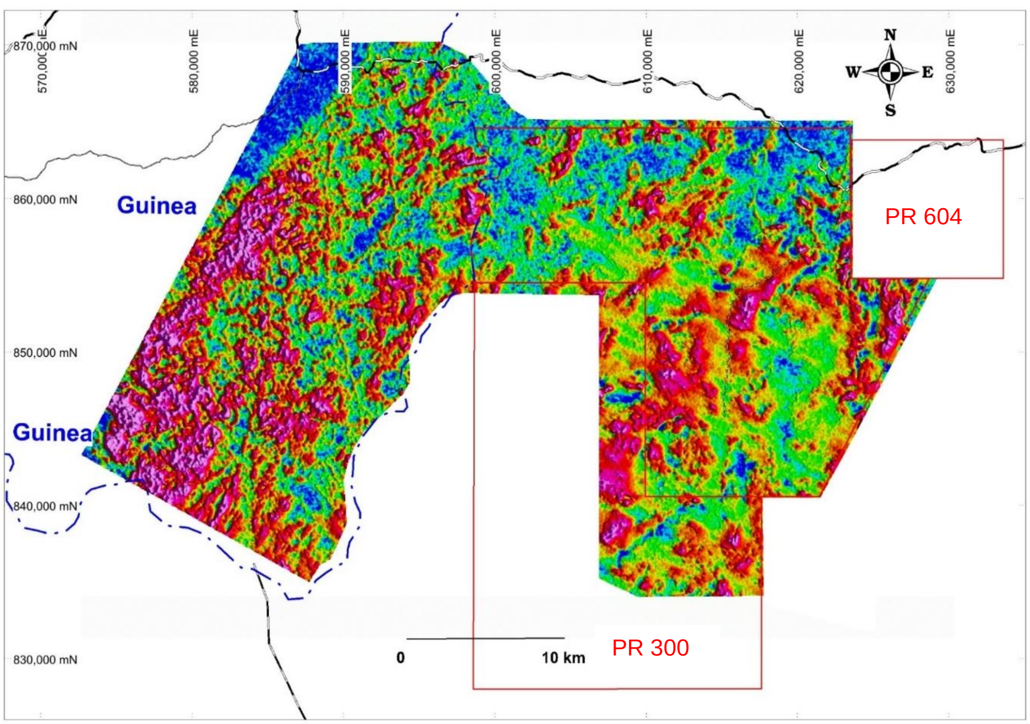


Figure 9.3 – Xcalibur, High Resolution Airborne Geophysical Survey, Radiometrics, Thorium (Th) Signal

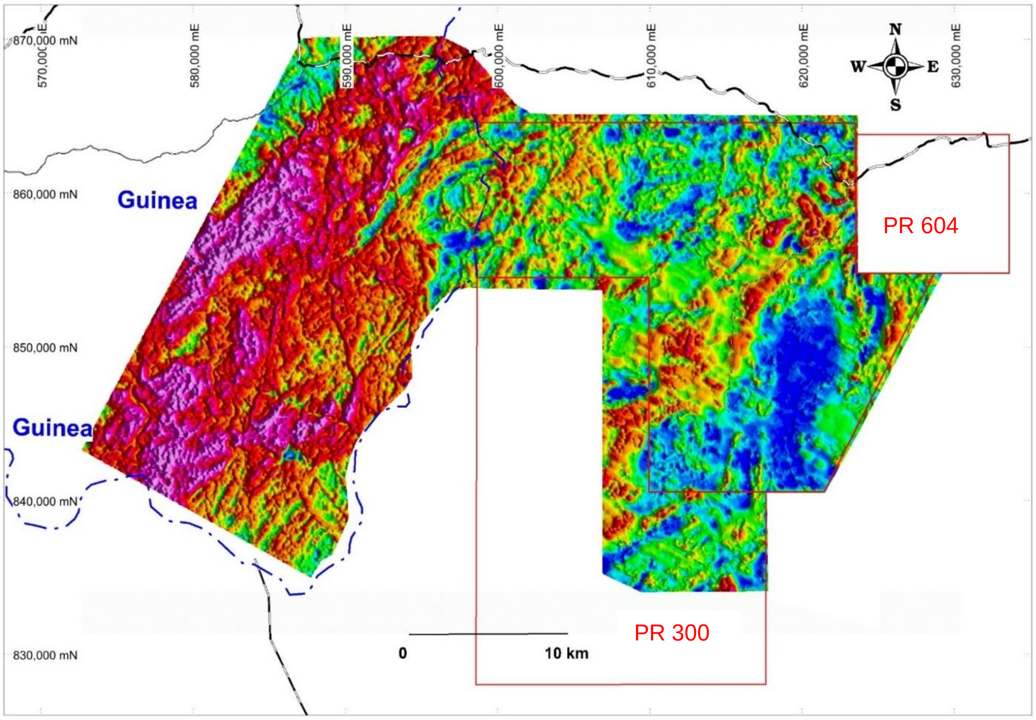
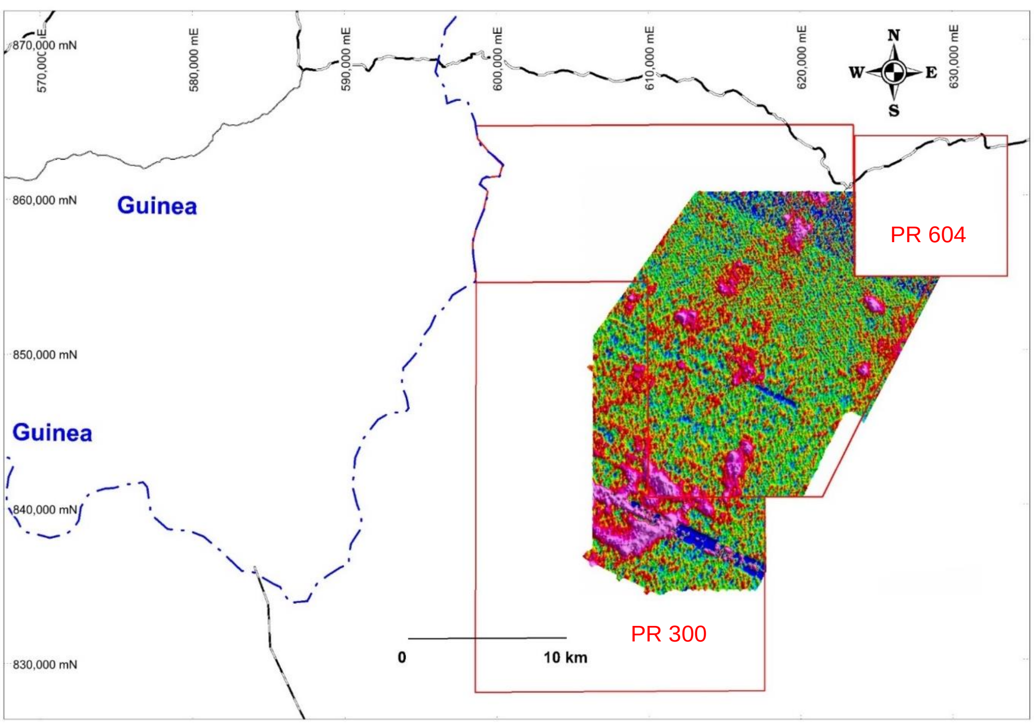


Figure 9.4 – Fugro, High Resolution Heliborne HTEM Survey, Raw Data



A total of 59 holes were completed in 2012 in different areas of PR123 with a portable Pionjar drill. The technique was used as a reconnaissance exploration tool to recover samples over a few tens of meters below surface, the content of which was determined by a Niton portable XRF analyzer. Drilling is completed with a sampling tube about 15 cm long and 2.5 cm in diameter attached to the drill stem. The tube has a side opening through which the material flows as the tool is pushed downward. The last material that enters the sampler is retrieved whenever the rods are pulled out.

Geological mapping performed by Sama's team has identified additional mafic and ultramafic complexes throughout the Permit, from which two (2) new sectors were outlined as highly prospective for additional mineralization:

- Within the southwest member of the 2.2 km long host of Extension 1;
- A 1.5 km long structure, the Yorodougou Dyke.

Sama spent a total of approximately $20.8 M in exploration work on the Samapleu property (PR123 now PR838), between the first exploration activities in 2009 until Sept. 30, 2019. Table 9.1 presents the annual exploration expenditures in Ivory Coast at the PR123 (now PR838 & 839) as well as for all Exploration Permits in Ivory Coast since 2009.

Table 9.1 – Consolidated Exploration Expenditures over PR123 (new PR838) and for Combined all PRs in Ivory Coast between 2009 and 2019

Year	PR123 (PR 838 & 839)		All PRs	
	$M CAD	Cum. $M CAD	$M CAD	Cum. $M CAD
2010 (Sept. 30) *1	6.5	6.5	6.7	6.7
2011 (Sept. 30)	3.3	9.8	3.4	10.1
2012 (Sept. 30)	2.8	12.6	2.8	12.9
2013 (Sept. 30)	2.9	15.5	3.1	16.0
2014 (Sept. 30)	1.4	16.9	1.8	17.8
2015 (Dec. 31)	0.8	17.6	1.1	18.9
2016 (Dec. 31)	0.3	17.9	0.6	19.5
2017 (Dec. 31)	1.7	19.7	1.9	21.4
2018 (Dec. 31)	0.7	20.4	3.7	25.1
2019 (Sept. 30)	0.4	20.8	3.5	28.6
Total		**20.8**		**28.6**

*Note 1: 2009 and 2010 expenditures are combined
The totals may not add-up due to rounding errors.

A total of 282 km of line cutting was performed by Sama in support of various exploration activities, including geological mapping and geophysical surveying. Since the project area is in a fairly remote and mountainous sector with poor infrastructure, Sama opened more than 350 km of roads in order to provide access to field crews and to drilling equipment to various areas of Sama's land package.

The understanding of geology in the project area has considerably advanced since Sama started exploration work in 2009.

The detailed interpretation of the HTEM survey identified more than 20 priority targets for nickel, copper, palladium exploration (Figures 9.5 to 9.7). HTEM targets have been identified at Samapleu Main and what will become Samapleu Extension 1, as well as along a corridor of more than 30 km, oriented northeast to southwest. Mapping has shown that the Samapleu project contains differentiated mineralised intrusions in nickel, copper, cobalt, platinum, palladium and rhodium. This mineralization is analogous to the large known world-class deposits; Noril'sk, Kabanga, N'Komatie, etc.

In August 2014, Abitibi conducted a total of 30 line km of ground InfiniTEM geophysical survey overlaying Samapleu Main and Extension 1.

In September 2014, Abitibi completed an InfiniTEM survey of 24 line km in the newly discovered Yepleu area, located 18 km southwest of the Samapleu deposits (Figures 9.8 and 9.9).

These surveys delineated numerous areas with high potential for finding accumulations of disseminated to massive polymetalic rich sulphides. Sama carried out several regional mapping and sampling campaigns as follow-up on a few of these identified areas.

A soil sampling program over the Yepleu occurrence and the Mossikro prospect was completed in 2013. A total of 821 samples were collected and analyzed with a Niton portable XRF instrument. The results for Ni are presented in Figure 9.10, overlaid upon the HTEM signal.

Figure 9.5 – Fugro, High Resolution Heliborne HTEM Survey, Plot of Conductivity

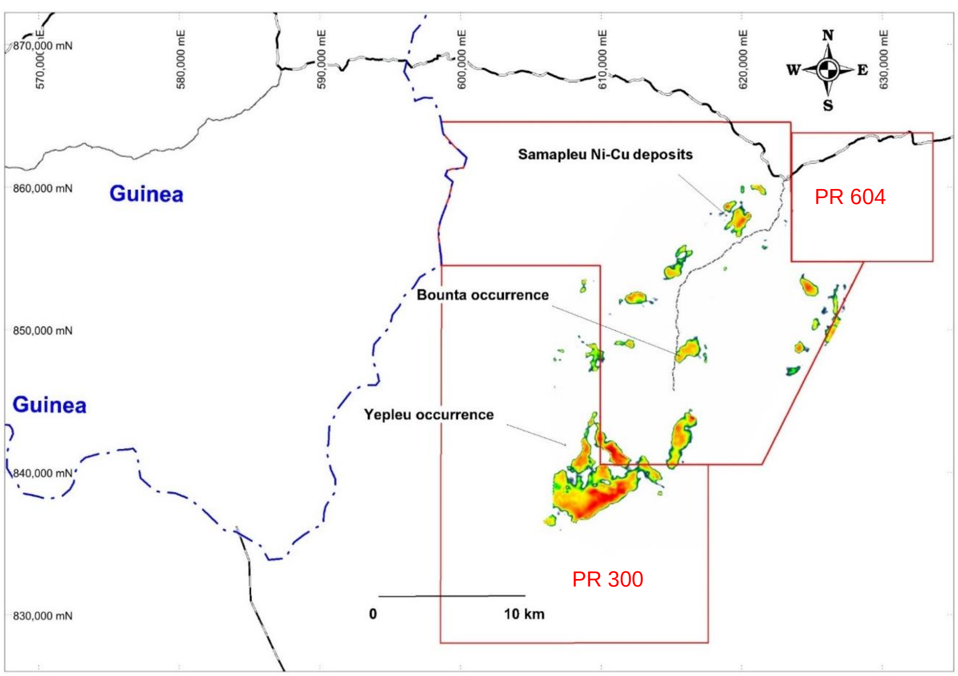


Figure 9.6 – Fugro, High Resolution Heliborne HTEM Survey, Plot of Conductivity over the Samapleu Deposits and Location of Completed Drillholes

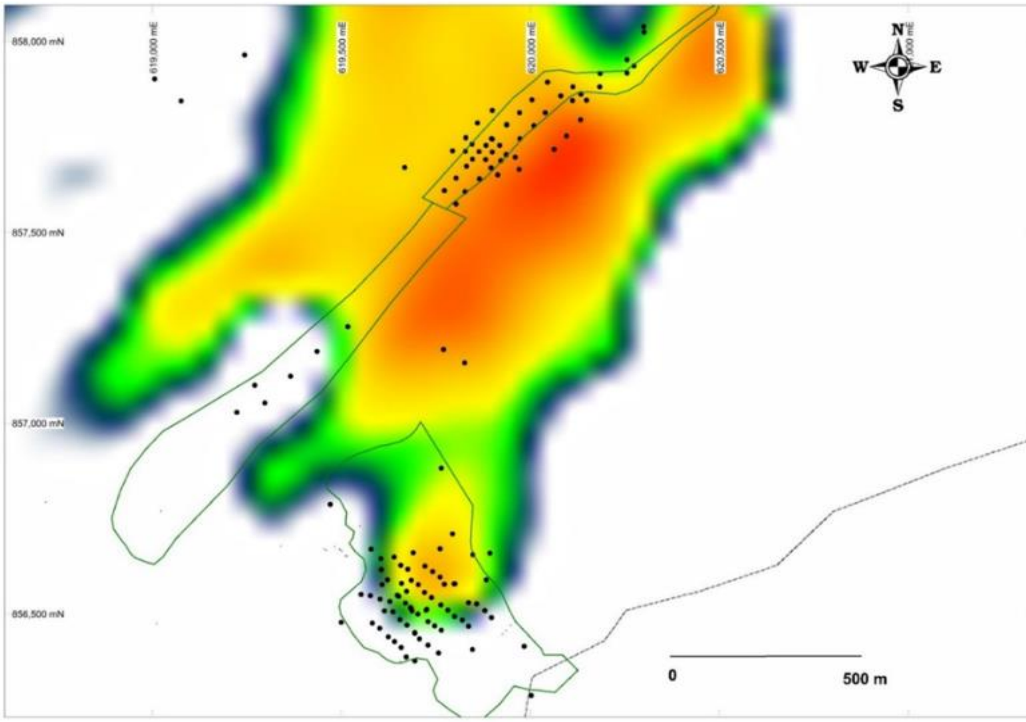


Figure 9.7 – Fugro, High Resolution Heliborne HTEM Survey, Plot of Conductivity over Yepleu

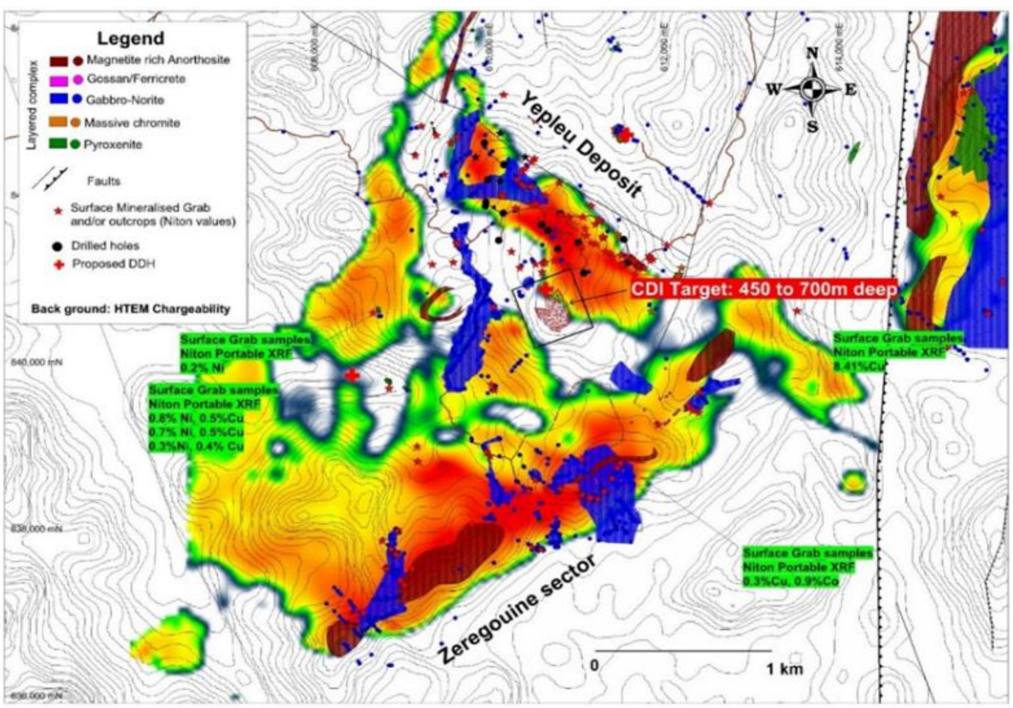


Figure 9.8 – Abitibi Geophysics, InfiniTEM Survey at Yepleu in 2013 (PR 123 (PR 838) & PR 300)

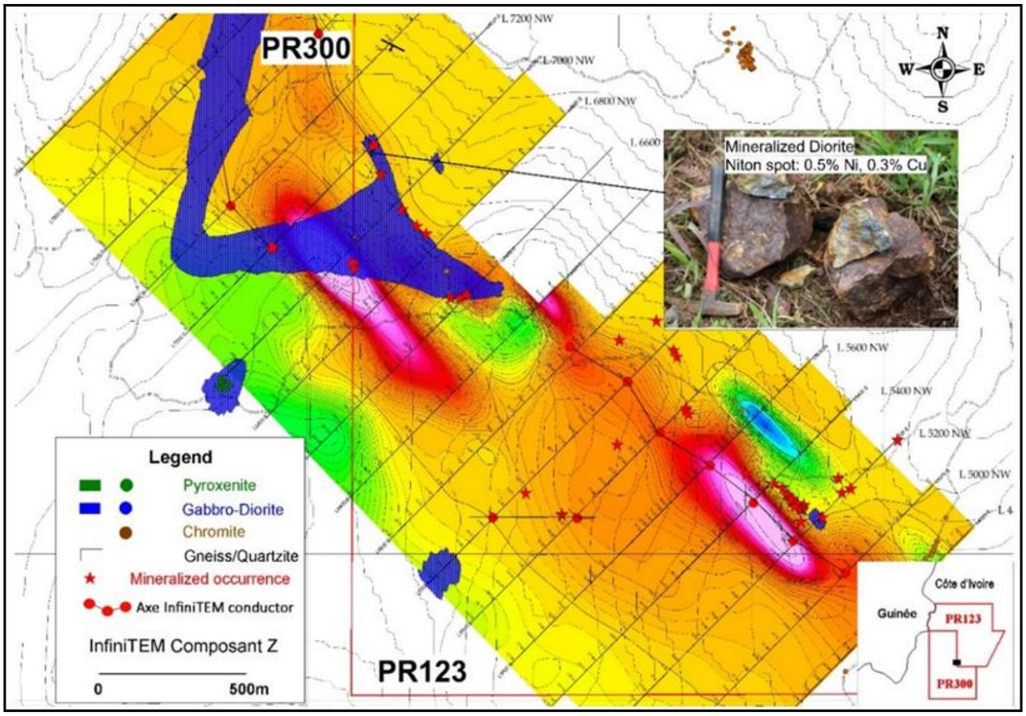


Figure 9.9 – Abitibi Geophysics, InfiniTEM Survey at Samapleu in 2013 (PR 123 (PR 838))

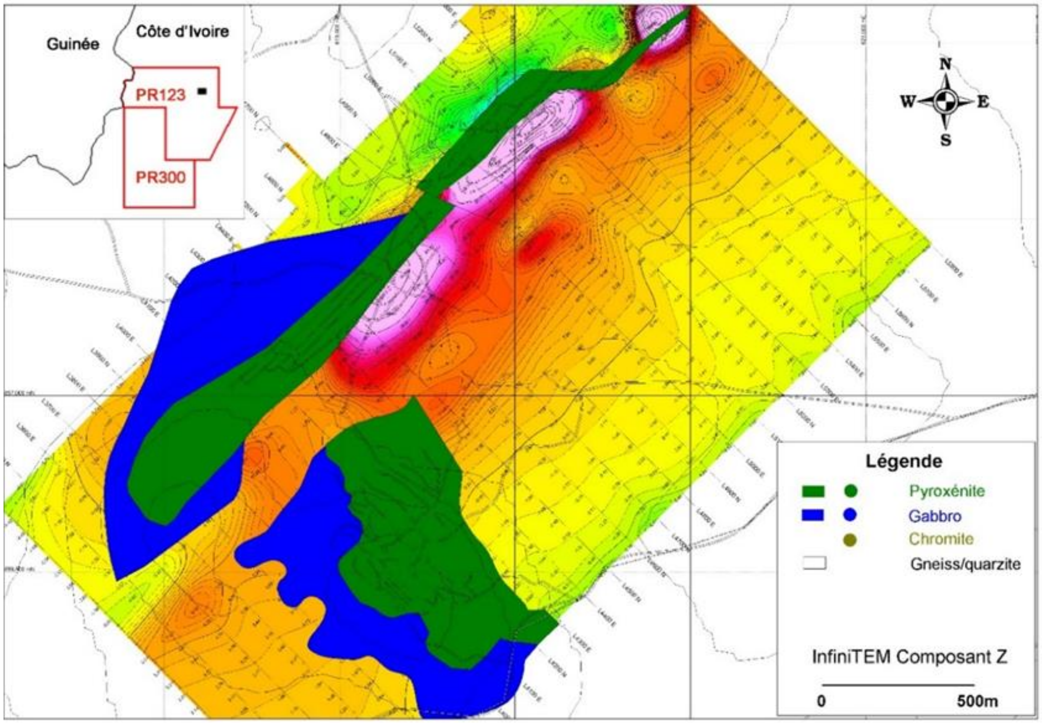
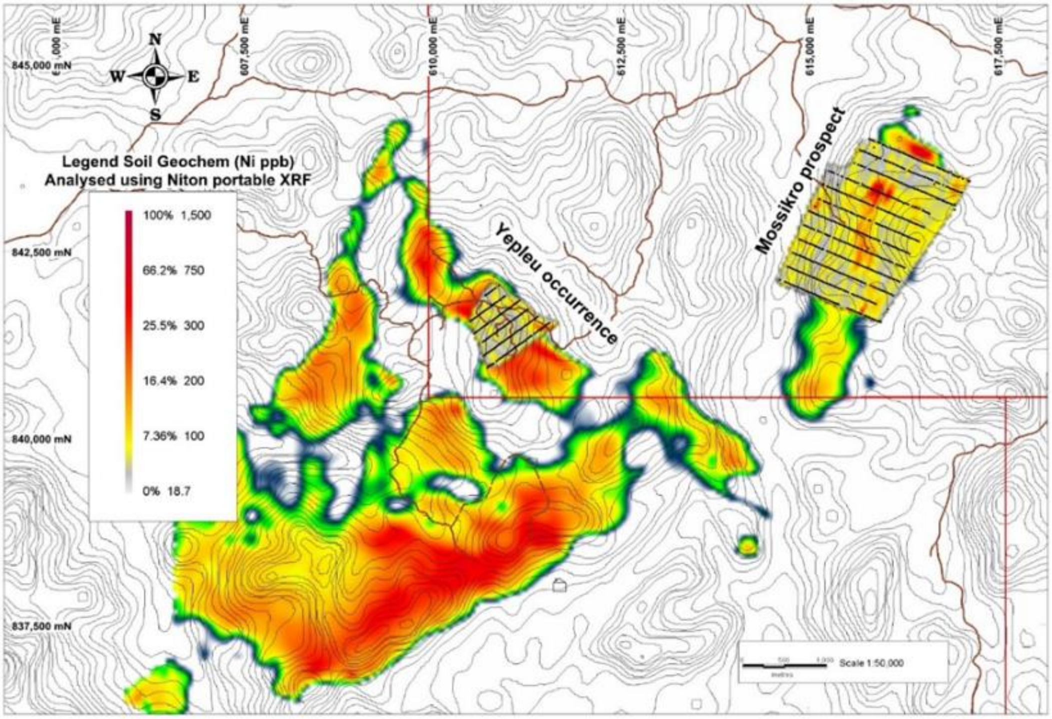


Figure 9.10 – Soil Sampling Program at Mossikro and Yepleu in 2013, Ni ppm Isolines Overlain upon the Interpreted HTEM Conductivity Signal



Exploration activities by Sama since March 2010 are presented in Table 9.2.

Table 9.2 – Summary of Exploration Work to Date - All PRs

Activity	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Cum.
Geophysics MAG & Radiometric	km	-	-	-	13,556	-	-		-	-	-	**13,556**
Geophysics HTEM	line/km	-	-	-	3,300	-	-		-	-	-	**3,300**
Geophysics VTEM	line/km									2,889		**2,889**
Line cutting	km	183	21	49	71	14	12			166	321	**835**
Geophysics InfiniTEM	line/km	-	-	-	54	-	-					**54**
Geophysics IP / Ground Survey	km	85	39	23	-	-	-					**146**
Geophysics Mag/ Ground Survey	km	76	52	23	-	-	-					**150**
Geophysics MAX-MIN	km	-	-	-	-	6	8					**13**
Geophysics: Down-Hole EM	#					3		2			3	**8**
Field Mapping	km	56	21	49	77	57	43					**303**
Soil Geochemistry	#	-	-	-	821	-	-					**821**
Access roads	km	55	16	36	41	1	31		50	20	124	**374**
Pits (m)	#	12	1	-	-	-	-					**13 (104 m)**
Trenches (m)	#	-	-	8	-	-	-					**8 (550 m)**
Geophysics Typhoon	line/km									1,130	2,695	**3,825**

The totals may not add-up due to rounding errors

10 DRILLING

Sama's 2010-2012 drill programs were contracted to Orex Africa SARL of Abidjan, using a track-mounted YDX-3L wire line drill rig. In January 2013, Sama purchased a Coreteck track mounted CSD1300G wire line drill rig and another one in 2014. Since then, most of the drilling activities were performed internally. In November 2018, Sama contracted Capital Drilling for performing deep holes (+ 700 m long) at the Yepleu prospect. In August 2019, the Company purchased a new Coreteck SCD3000 drill rig, allowing drilling down to 1,500 m from surface.

10.1 2010-2012 Drilling Program

Sama's 2010-2012 drilling programs were contracted to Orex Africa SARL of Abidjan, Côte d'Ivoire (currently known as Global Exploration Services SARL; "GES"). A track-mounted YDX-3L wire line drill rig was used.

Three (3) drilling programs were carried out between March 2010 and the end of July 2010; November 2010 and November 2011; and May 2012 and December 2012.

Table 10.1 provides details on these drilling programs.

Table 10.1 – Drilling Programs - 2010 to 2012

Area	Target	Drill Holes	Total Lengths (m)
PR123	Samapleu Main	71	10,635
	Samapleu Extension 1	43	7,018
	Sipilou South	80	2,682
Exploration	Various	17	2,649
	Grand Total	**211**	**22,984**

Sama performed a total of 211 boreholes for a total of 22,984 m from March 2010 to December 2012.

Seventy-one (71) holes for 10,635 m were drilled at the Samapleu Main Deposit. Forty-three (43) holes for 7,018 m were drilled at the Samapleu Extension 1 Deposit and 80 boreholes for 2,682 m were done at the Sipilou South laterite deposit located 4.5 km NW of Samapleu deposit.

10.2 2013 Drilling Program

In January 2013, Sama purchased their first Coreteck track-mounted CSD1300G wireline drill rig and another one in 2014. Since then, all the drilling was performed internally.

A total of 14 holes were drilled for 2,721 m at the Samapleu Extension 1, five (5) holes were drilled for 952 m at the Santa target area and 17 holes were performed at the newly discovered Yepleu target between January and December 2013.

Table 10.2 – Drilling - January to December 2013

Area	Target	Drill Holes	Total Lengths (m)
PR123	Samapleu Extension 1	14	2,721
	Yepleu	17	2,535
Exploration	Santa	5	952
	Various	5	833
	Total 2013	**41**	**7,041**

10.3 2014 Drilling Program

Sama drilled 14 holes between March to September 2014 (Table 10.3).

Table 10.3 – Summary of Drilling in 2014

Area	Target	Drill Holes	Total Lengths (m)
PR123	Main Deposit	2	1,166
	Extension1	3	1,359
	Yepleu	3	1,157
Exploration	Various	6	1,037
	Total 2014	**14**	**4,719**

10.4 2015 Drilling Program

Sama completed drilled 10 holes between March and November 2015 (Table 10.4).

Table 10.4 – Summary of Drilling in 2015

Area	Target	Drill Holes	Total Lengths (m)
PR123-300	Main Deposit	3	425
	Extension1	3	433
	Yepleu	4	825
	Total 2015	**10**	**1,683**

10.5 2017-2019 Drilling Program

Sama drilled 44 holes during the period of July 2017 to August 2019 (Table 10.5)

Table 10.5 – Summary of Drilling in 2017-2019

Area	Target	Drill Holes	Total Lengths (m)
PR123-300 (PR's 838-300)	Main & Extension 1	37	4,370
	Yepleu	6	4,991
	Regional	1	376
	Total 2017-2019	**44**	**9,737**

10.6 Compiled Drilling

Figure 10.1 illustrates a compilation of boreholes drilled to date per sector. Sama drilled 320 boreholes for a total of 46,164 m from July 2010 to May 2019, Table 10.6 gives a detailed compilation.

Table 10.6 – Drilling Programs from July 2010 to May 2019

Area	Contractor Drilling		Sama Drilling		Total Lengths
	Borehole	(m)	Borehole	(m)	(m)
Main Deposit	90	12,677	12	3,458	16,135
Samapleu Extension 1	57	7,643	19	4,349	11,992
Yepleu	5	4,401	25	4,891	9,292
Sipilou South Laterite	80	2,682			2,682
Yorodougou	4	734	2	291	1,025
Bounta			1	376	376
Bounta North chromite	6	684			684
Santa			5	952	952
Grata			2	771	771
Regional	12	2,255			2,255
Total 2010-2019	**254**	**31,076**	**66**	**15,088**	**46,164**

10.7 Methodology

A GPS was used by Sama's geologists to locate and peg the drill holes and to align the rig, on pre-prepared drill pads. In addition to site leveling, drill pad preparation also involved hand-digging unlined sumps to capture and store return waters.

The rigs were equipped to retrieve NQ sized core (47.6 mm diameter) through the entire length of the boreholes. The depth of weathering typically ranged from a few metres to 45 m. Upon completion of the hole, the steel casing was extracted and a 3 m long casing rod was left in order to keep the hole open for possible borehole survey or re-entry. The drill holes are marked with concrete monuments inscribed with the drill hole number, the orientation and the length of the hole.

A geologist is permanently present at the drill site to supervise the drilling operations, close the holes and ensure proper placing of the core and of the depth markers into the boxes. In addition, the geologist is responsible for measuring the core recovery, recording the core runs and marking the core boxes. The soft core is immediately wrapped in thick plastic to retain its humidity until the density measurements are completed.

The core boxes are securely closed and transported to the camp by Sama's personnel, thus preserving the chain of custody. Eventually, the boxes are clearly identified by an embossed aluminum strip stapled on the end plate of the boxes.

The drill sites were reclaimed upon completion of the drilling. All refuse or surplus material was removed and all water sumps were filled in and the site was leveled. The site was then inspected by a geologist/technician and the driller's foreman. A detailed environmental inspection checklist was completed and photographs were taken to provide a record of the reclamation of the site.

10.8 Survey – Collars and Deviation

Sama commissioned Envi Tech Surveyors from Abidjan to survey the borehole collars. Several topographic control points were established for future collar surveys. Downhole deviation for each drill hole was measured using a Flexi MultiMate survey tool.

10.9 Borehole Naming Convention

The system adopted by Sama for identifying the drill holes primarily consists of subdividing the entire area in blocks of 800 m x 800 m based on UTM coordinates. The borehole names are formed using a 10-digit alphanumeric number as per the following template: SMWW-XXXYYY. The first two digits, 'SM', represent the Samapleu Deposits prospect area within PR123; 'WW' represents the block number; 'XXX' and 'YYY' represent the distance going east from the specific block's top left corner and the measure going south from the block's top left corner. This system links the borehole name to its exact position in the field to the closest metre. For example, Hole SM44-423357 is located in Block 44, 423 m east and 357 m south of the upper left corner.

10.10 Drill Hole Results and Interpretation

The drilling campaigns completed by Sama were successful in improving the geological definition and understanding of the genetic model of Samapleu Main Deposit and of the two (2) mafic and ultramafic complexes and helped guide Sama toward the discovery of the Samapleu Extension 1 mineralization.

DRA/Met-Chem is not aware of any drilling or recovery factors that could materially impact the accuracy and reliability of the results and of the present resource estimation.

Figure 10.1 – Samapleu Deposits –Surface Map with the Drill Holes Location

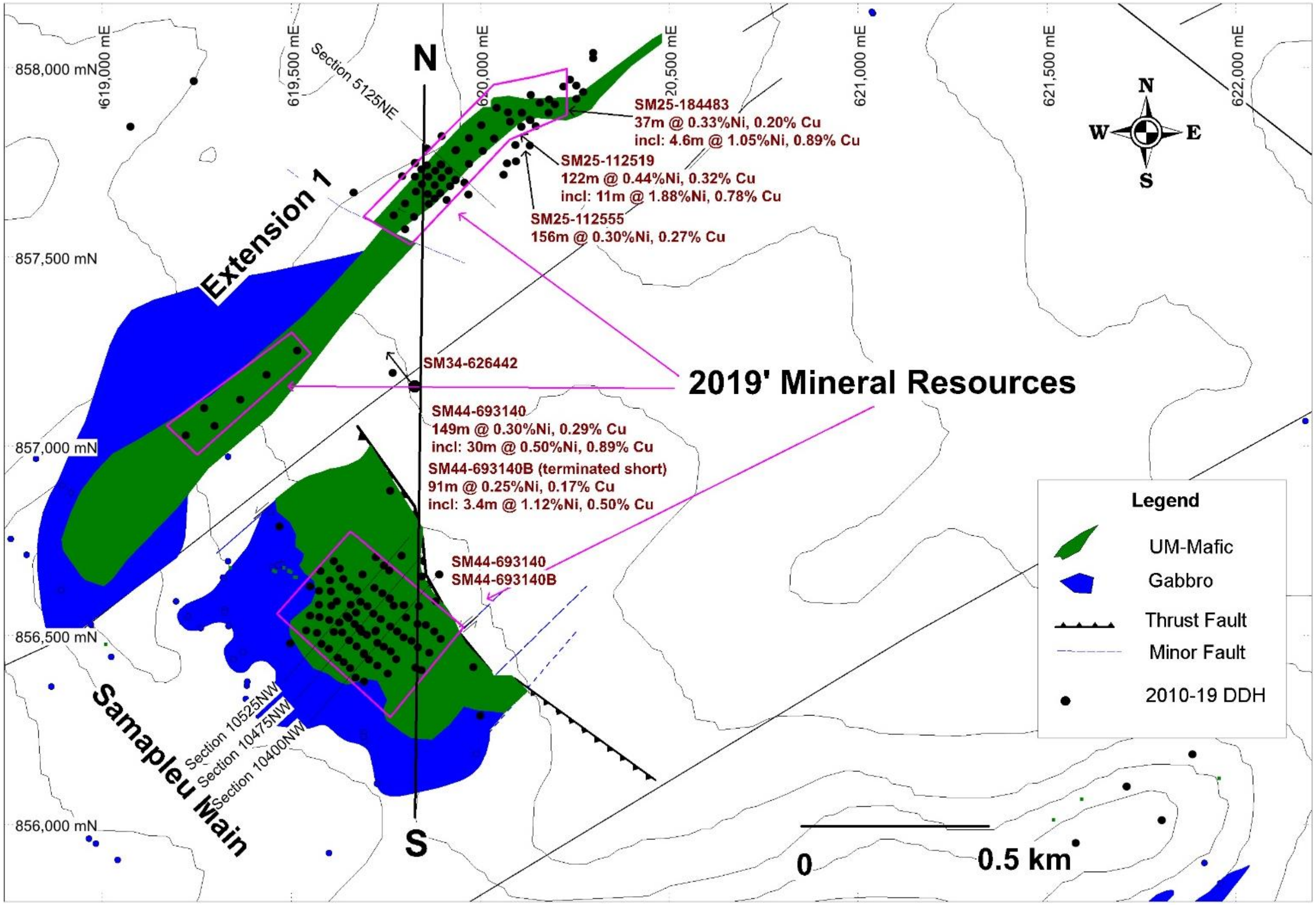
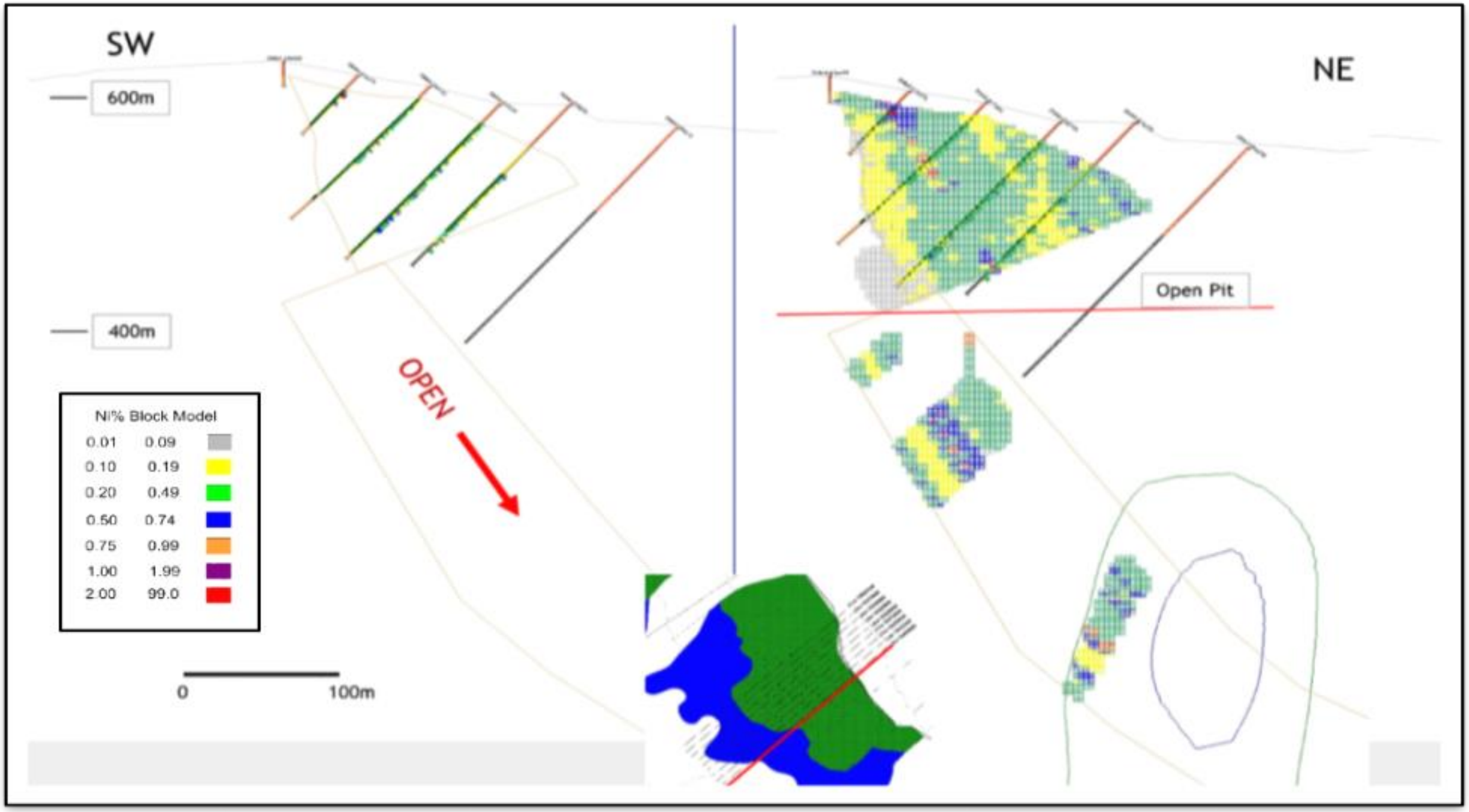
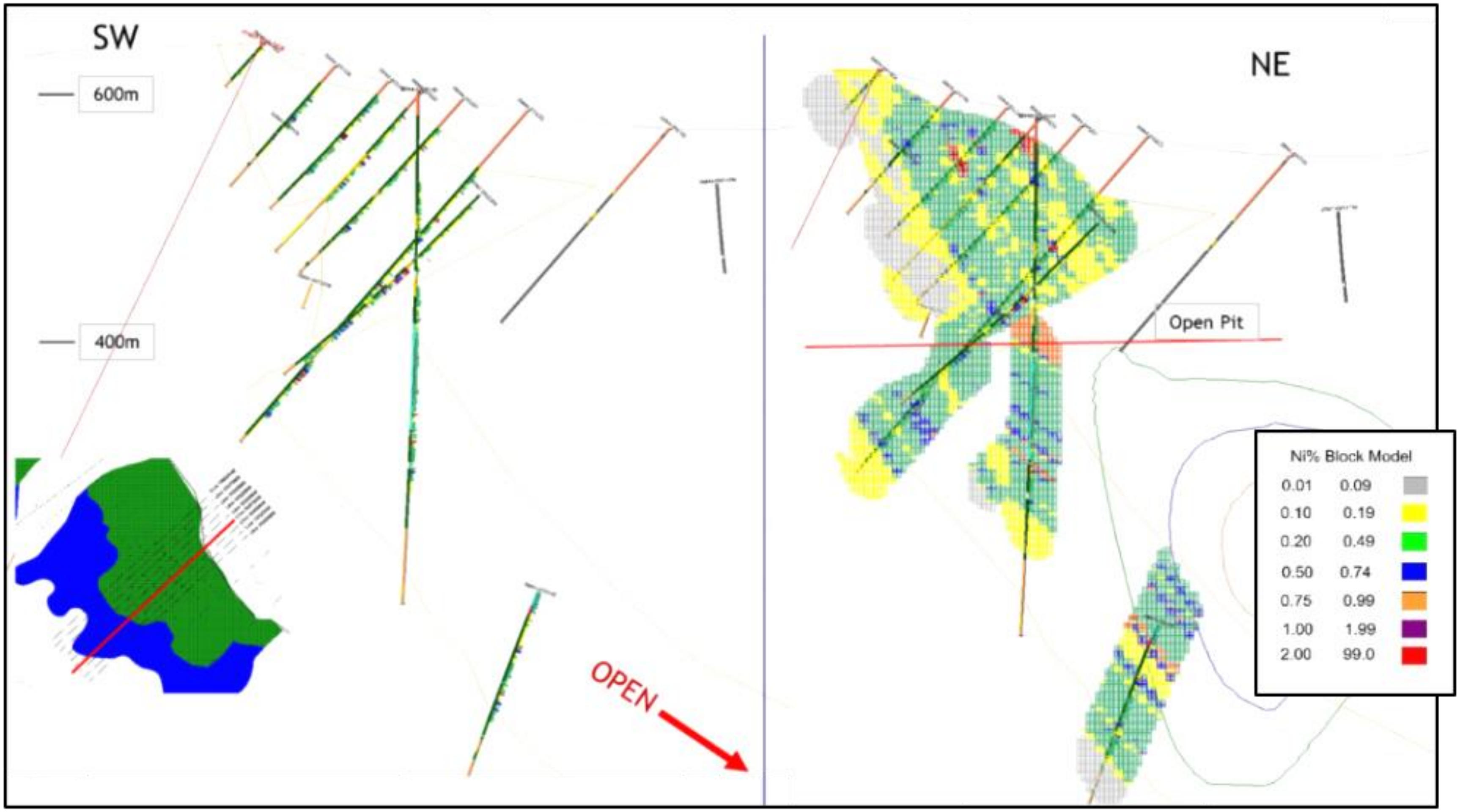


Figure 10.2 – Samapleu Main Deposit–Vertical Section 10400NW



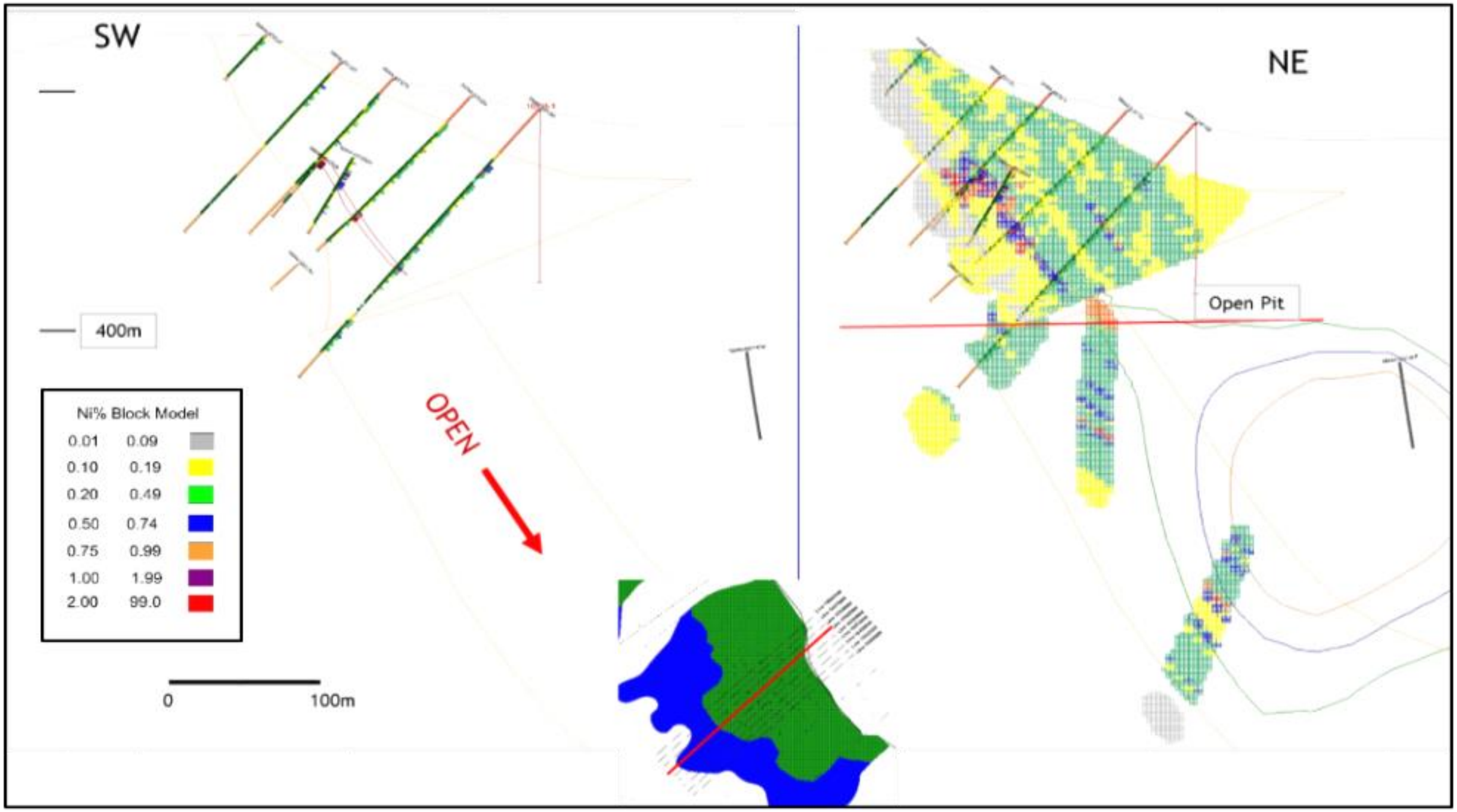
Refer to Figure 10.1 for the Section Location

Figure 10.3 – Samapleu Main Deposit –Vertical Section 10475NW



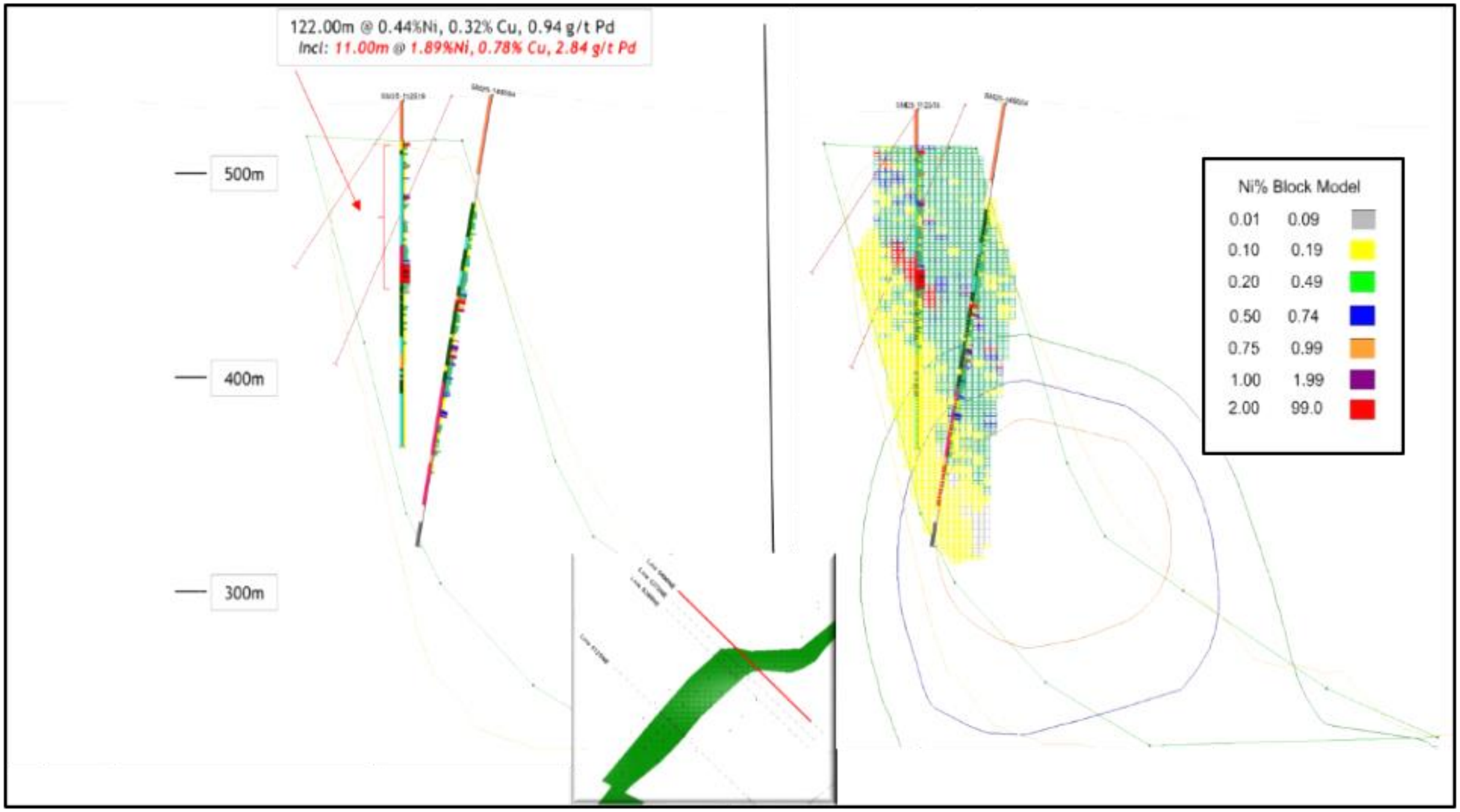
Refer to Figure 10.1 for the Section Location

Figure 10.4 – Samapleu Main Deposit – Vertical Section 10525NW



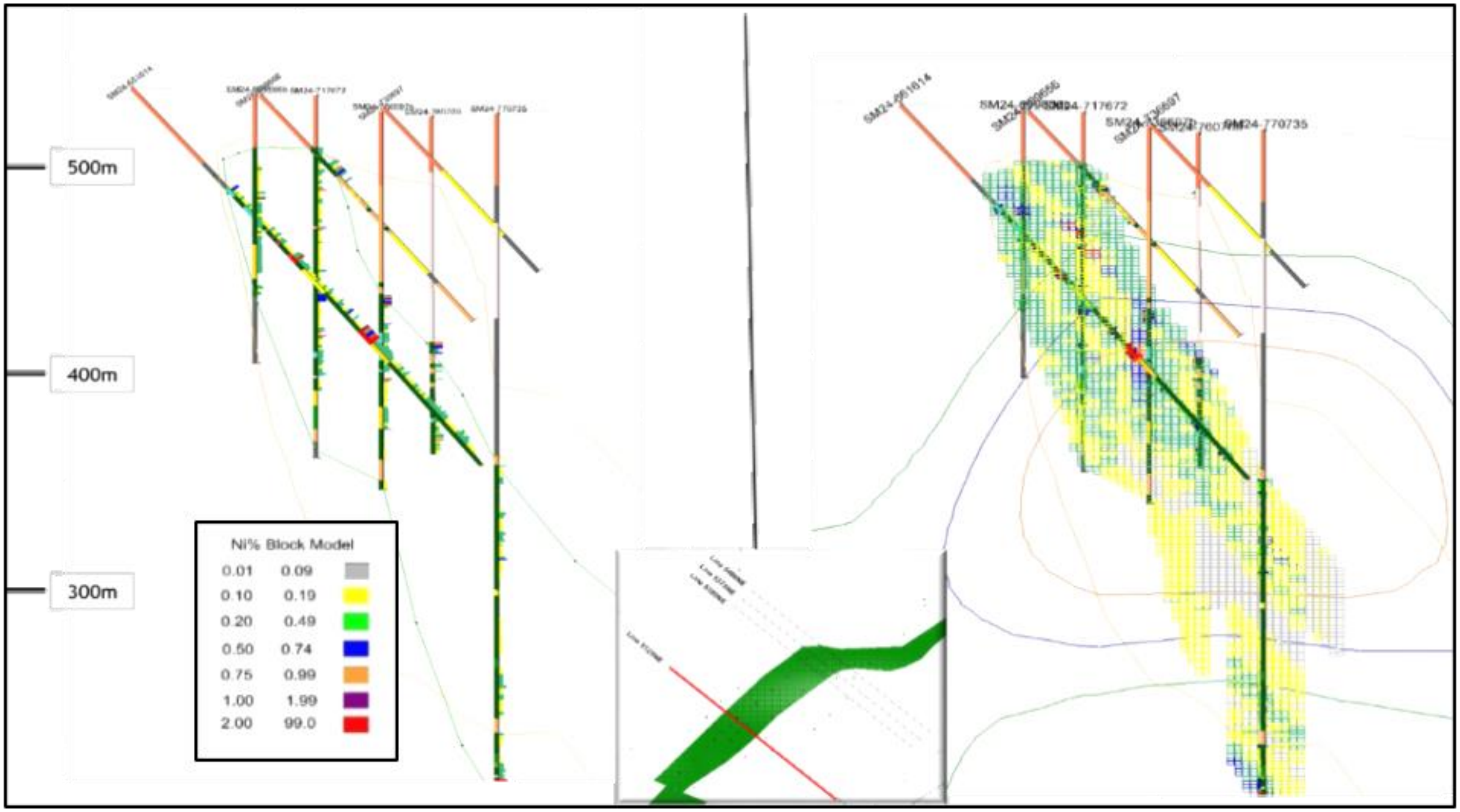
Refer to Figure 10.1 for the Section Location

Figure 10.5 – Samapleu Extension 1 Deposit – Vertical Section 5125NW



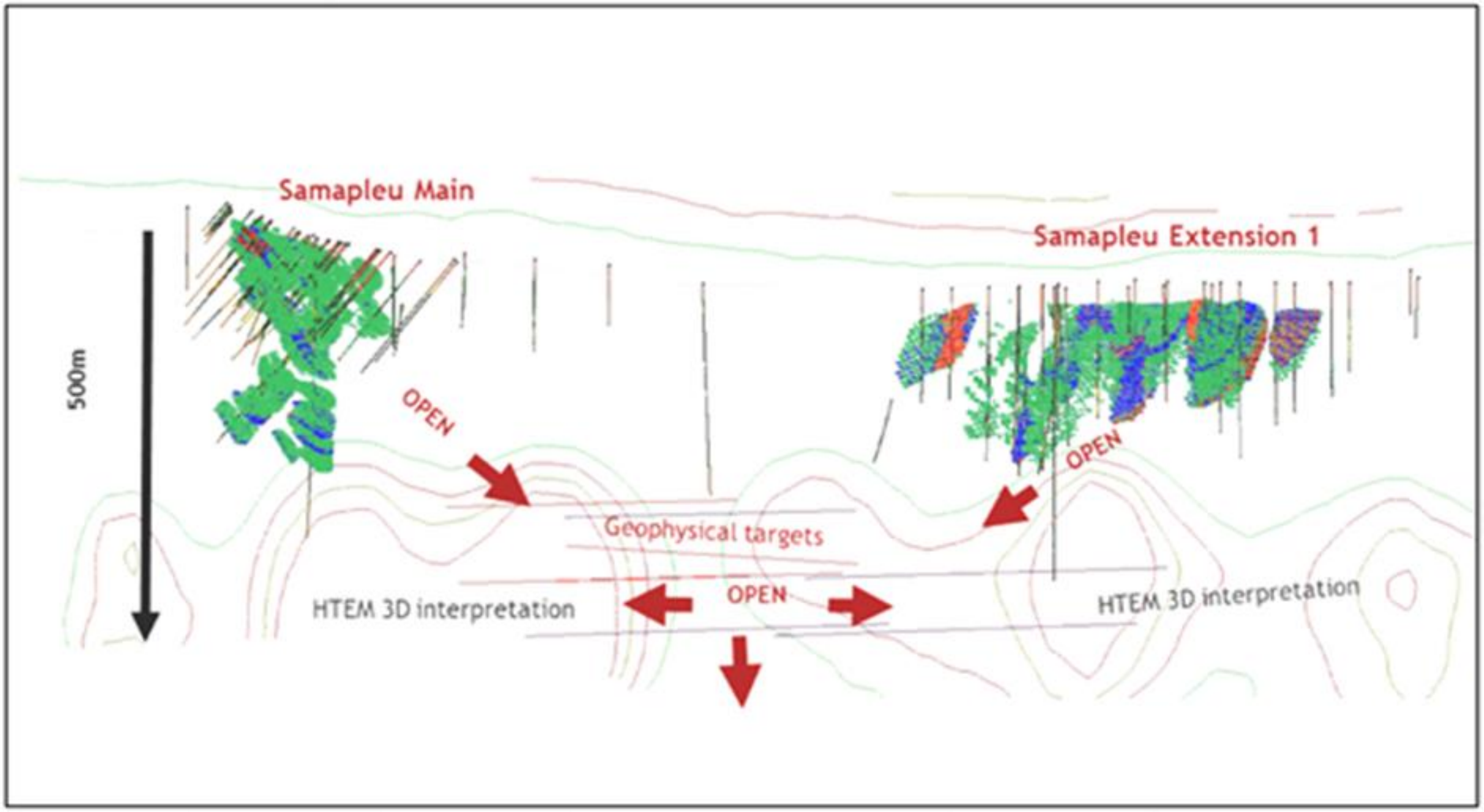
Refer to Figure 10.1 for the Section Location

Figure 10.6 – Samapleu Extension 1 Deposit – Vertical Section 5400NW



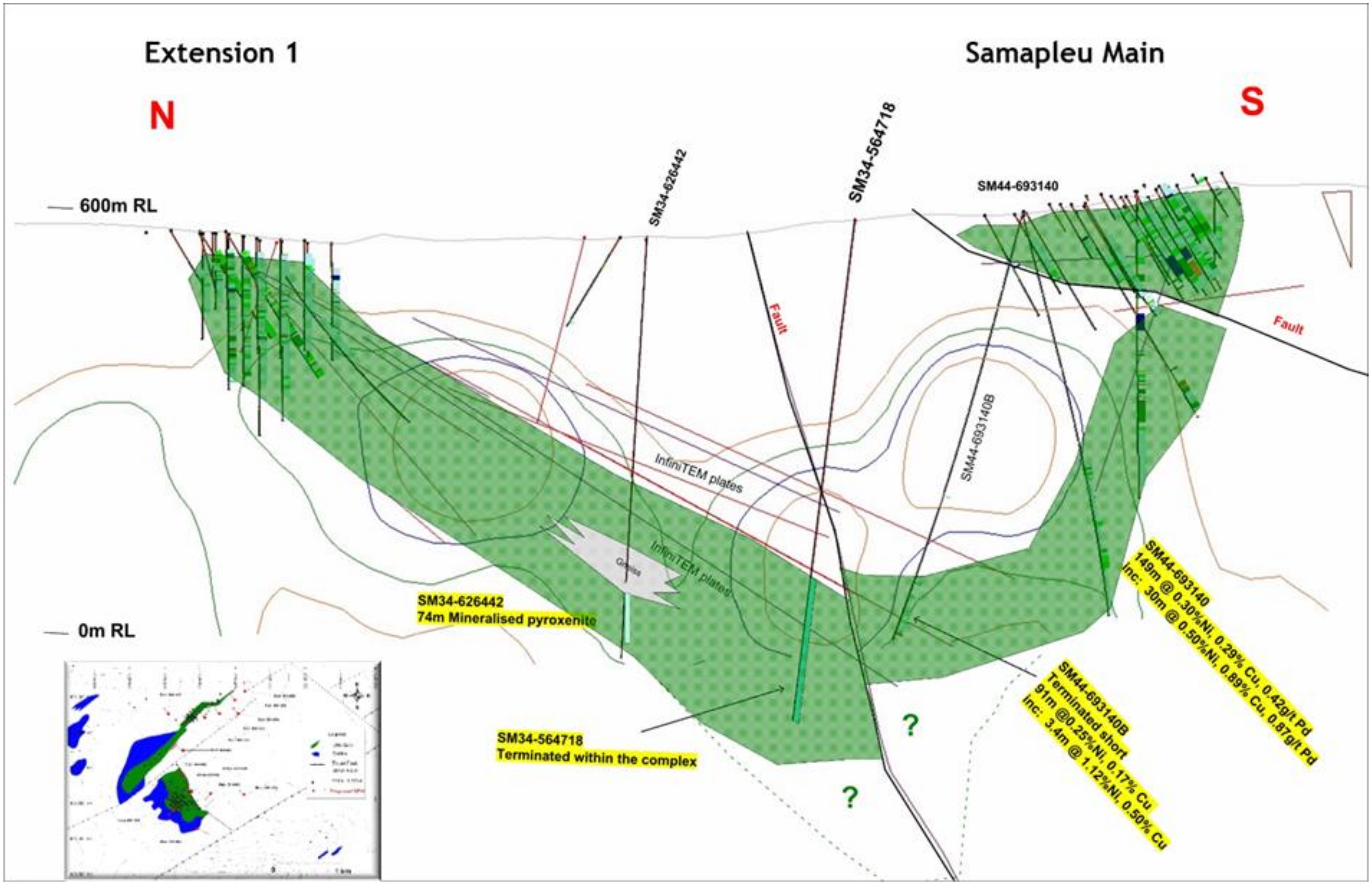
Refer to Figure 10.1 for the Section Location

Figure 10.7 – Samapleu Deposits – Vertical Longitudinal Section



Refer to Figure 10.1 for the Section Location

Figure 10.8 – Samapleu Deposits – N-S Vertical Section



Refer to Figure 10.1 for the Section Location

Figure 10.9 – Yepleu Occurrence – Surface Map Showing the Completed Drill Holes and the HTEM Anomaly

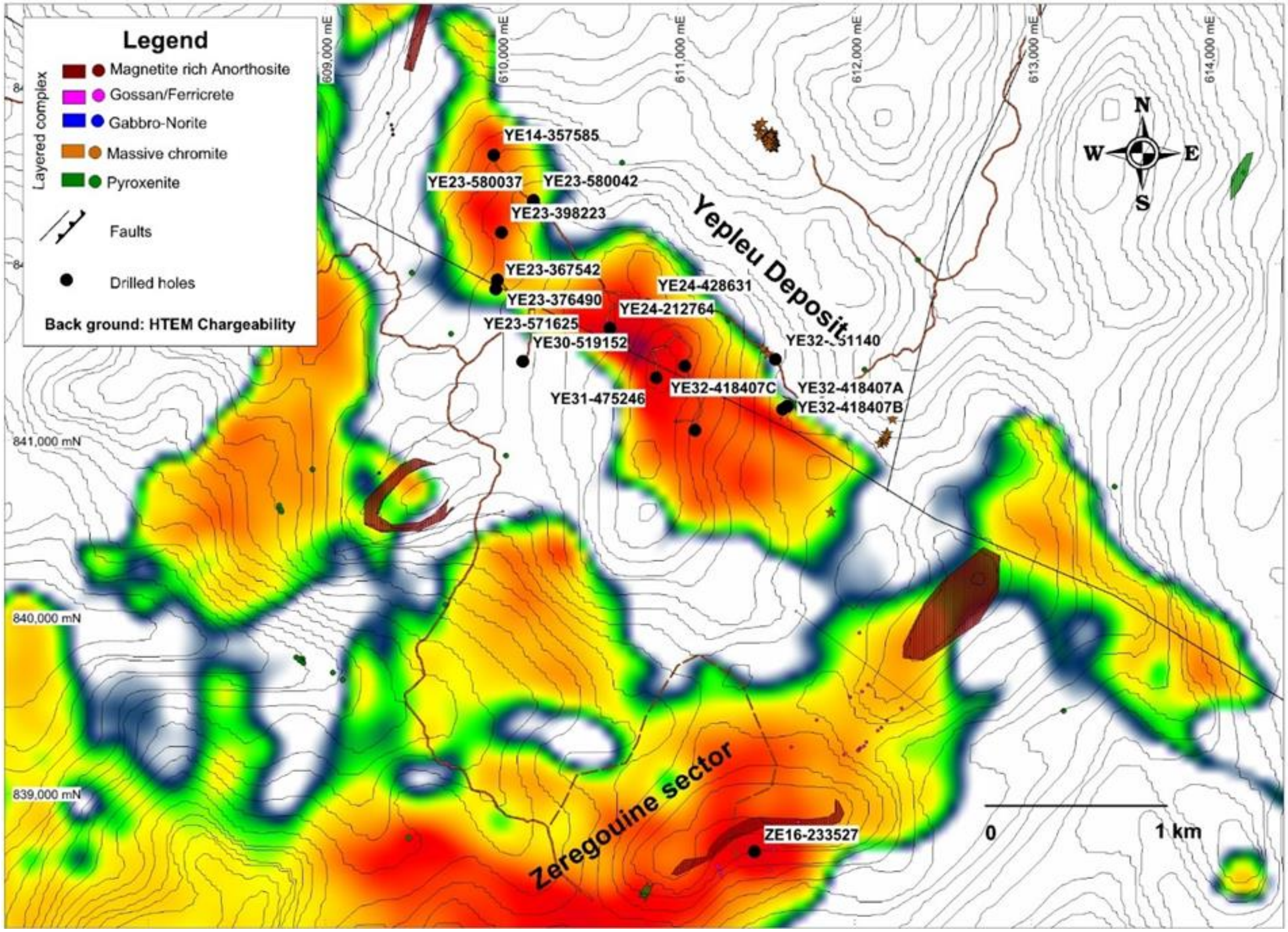
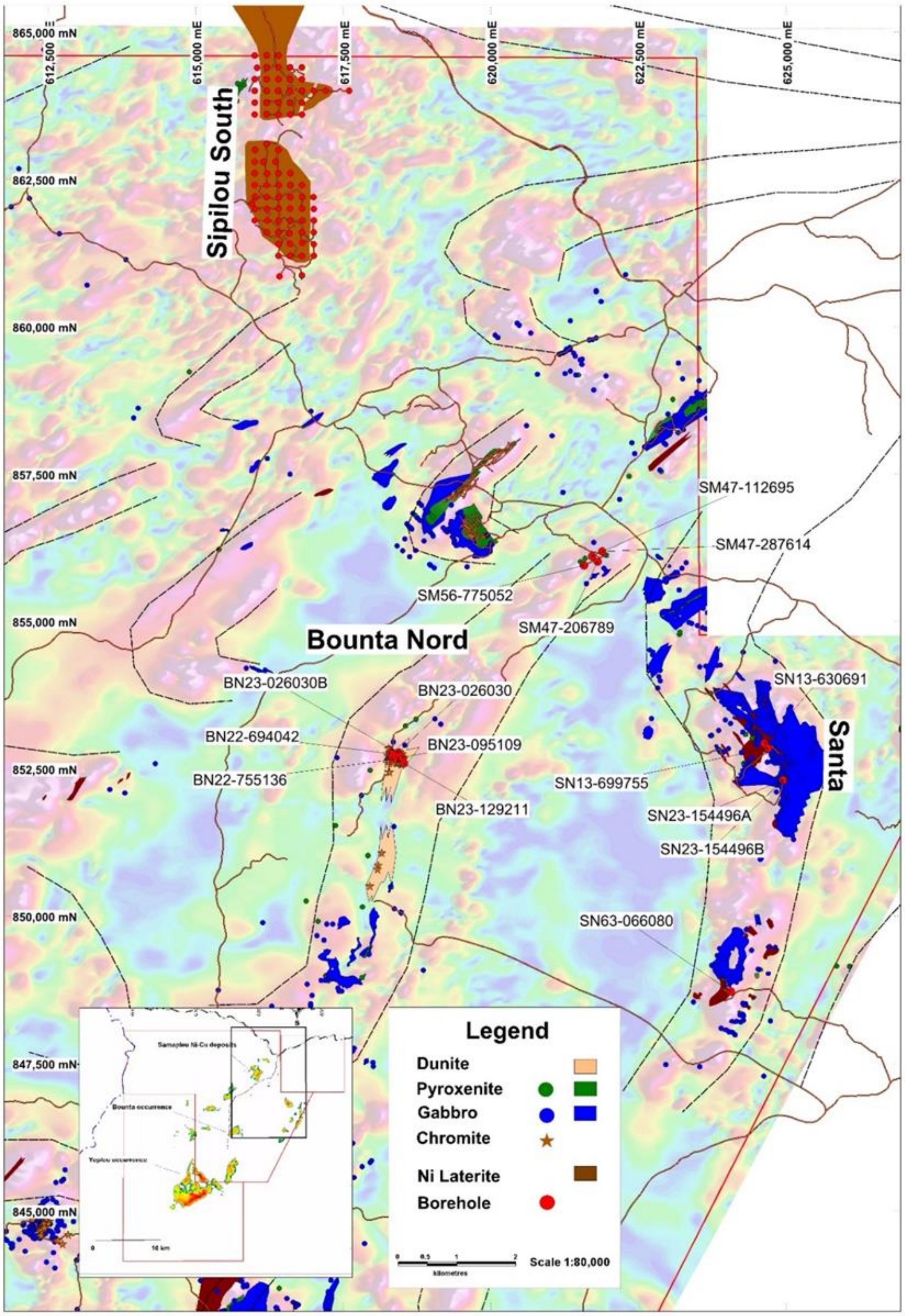


Figure 10.10 – Drilling Completed at Santa and Bounta North; Airborne Magnetic Survey Data in Background



11 SAMPLE PREPARATION, ANALYSIS AND SECURITY

The information in this section is largely drawn, modified or summarised from the Report available on SEDAR entitled: "Technical Report on the Samapleu Nickel and Copper Deposits Côte D'ivoire, West Africa", prepared by WSP Canada Inc. and dated December 2015.

11.1 Core Logging and Sampling

Core logging and sampling were performed at Sama's facility at Yorodougou. Internationally accepted procedures and standards were applied by Sama's technical team.

Digital photographs of the core were taken and the core recovery, RQD and basic geotechnical information were recorded in the drill logs, as well as the geological and structural elements. Three magnetic susceptibility readings were taken at 1-m intervals and the samples for density determination were selected.

Logging was done in hand-written format and all the information was transferred onto Excel spreadsheets. This method provides duplicate records of all the logging and sampling information and facilitates data verification and validation. Sama believes that these advantages outweigh the additional time required to copy the data.

Nominal sample intervals were 1.0 m and 1.5 m, but were adjusted, generally between 0.3 m and 2.0 m, to respect lithological contacts or abrupt changes in mineralization. The geologists marked a reference line on the core prior to sampling to ensure that the samples were cut perpendicularly to the fabrics.

The soft core was cut in two with a spatula and the hard core was split using a diamond blade saw. The contacts between the samples were cut with the rock saw and the operator of the saw cut the core along the line drawn by the geologists.

One half of the core was placed into a polyethylene bag with a sample tag and sent to the laboratory for analysis, while the other half was carefully placed into the core boxes, with the arrow drawn by the geologist always pointing down the hole, for future reference. The paper sample tags are stapled to the boxes at the end of the sample intervals. Sample books with pre-recorded, unique sequential number and tags reserved for QC samples at pre-determined locations were used by Sama.

11.2 Density Determination

Density determination was performed by Sama's geologists using the immersion method. This was completed in a dedicated room where the equipment is protected from disturbances, notably draft blowing onto the scale. The immersion method is appropriate to determine the in-situ density of rocks.

Sama's protocol calls for determination of wet (moisture percent) and dry densities on visually mineralized and barren samples. Full core stubs of about 10 to 15 cm are used for the determinations.

Once this is done, the core is split and one half is returned to the original locations in the core boxes with a piece of flagging tape stapled to the boxes to identify them.

Frequent calibration of the scale took place and measurements of a standard were taken for every five samples, but the results were not recorded. No duplicate samples are used, which is recommended by Y.A. Buro as part of the best QA practices.

11.3 Preparation and Analysis

Sample preparation for the phase 1 drilling program was performed at the *Société de Développement de Gouessesso* ("SODEGO") facilities in Gouessesso village.

The samples from the different drill programs were analyzed by independent, certified laboratories in Australia, South Africa and Canada as summarised in Table 11.1.

All the laboratories used the same analytical technique based on fusion of the sample followed by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) analysis for the major elements (Ni, Co, Cu,). The samples are fused with sodium peroxide and the melt is dissolved in hydrochloric acid and the resulting solution is analyzed. The electromagnetic emission spectra of a sample serve to identify and quantify the elements present.

The precious metals (Au, Pt and Pd) were determined by Fire Assay with an OES analytical finish. Actlabs used 30-g aliquots for the fire assays.

Additional details can be found in WSP's Report (2015).

Table 11.1 – Summary of the Laboratories, Accreditation, and Analytical Methods

Drill Program	Sample Preparation	Analytical Laboratory	Analytical Methods	Accreditation
Phase 1	SODEGO	SGS South Africa Pty via SGS South Africa Pty in Yamoussoukro	• Peroxide fusion & ICP-OES (Ni, Co, Cu,..) • Fire Assay & ICP-OES for Pt, Pd, Au.	ISO 17205
Phase 2	SODEGO	Ultra Trace Pty, Perth, Australia via Bureau Veritas Mineral Laboratories (BVML), Abidjan	Sodium Peroxide fusion & ICP-OES (Ni, Co, Cu, Fe, S, Pt, Pd, Rh).	BVML: ISO 900 :2008 (certificate FS 34143); Ultra Trace Pty: ISO/IEC 17025 : 2005 (Accreditation 14492)
June to September 2012	Veritas Abidjan	BVML, Rustenburg, South Africa; Some samples re- analyzed at BVML Ultra Trace Pty, Perth		Rustenberg: South-African accreditation (Sanas) and ISO/IEC 17025 : 2005 (No. T0551).
Since 2014-19	Veritas Abidjan	ACTLABS, Lancaster, Ontario, Canada	• Sodium Peroxide fusion & ICP-OES (Ni, Cu, Co, Fe, S); • Fire Assay & ICP OES for Pt, Pd, Au.	ISO 17025 (Lab 266) and ISO 9001 : 2008

11.4 Security – Chain of Custody

Core handling was under Sama's control from the drill site where the geologists supervised the operations to the Yorodougou base camp where the core boxes were transported at the end of each shift, and the samples were transported to the laboratory by Sama, thus preserving constant chain of custody.

Once logging and sampling are completed, the boxes are safely stored in a secured warehouse at Yorodougou, with the coarse rejects and pulps returned from the laboratories. Prior to using, the core boxes had been soaked in a solution to protect them from wood-eating termites.

11.5 QA-QC Protocol by Sama

As required by NI 43-101, Sama used a system of quality control to monitor the laboratory performance, in addition to the internal QA-QC system enforced by the laboratories. Sama used standards, blanks and duplicate samples to be inserted as Quality Control (QC) samples into the batches of core samples (Table 11.2). The proportion of Sama's QC samples relative to the core samples is adequate for a Ni-Co project and in line with industry standards.

Table 11.2 – Summary of the QC Samples used by Sama

Drilling Period	Standards (n=)	Standard Material	Blanks (n=)	Blank Material	Duplicates (n=)	Number of QP Samples (%)
March-July 2010	53	In-house pulp	26	• Quartz-feldspar; • Commercial blank	43	7.0
Nov. 2010 - Nov. 2011	209	• In-house (1); • Commercial (2).	105		156	7.3
May 2012 - July 2012	14		11		14	5.5
2013-2017	344	Oreas 73 a	148		229	5.3
2017-2018	128	Oreas 73 b	63		94	3.0

In-house and certified, commercial blanks and standards were used (Table 11.2). Standards with high, medium, and low nickel values were used.

The blanks performed well, and the standards showed lack of correlation with the original assays on batches sent to Veritas in South Africa. These batches were reanalyzed by Veritas in Australia. And acceptable variations were obtained form the standards.

Selected samples were submitted for check assays, using second laboratories (umpire), which is part of best industry practices.

Check assays were conducted, initially, at Ultra Trace Pty in Perth, Australia, and then at SGS Canada's laboratory in Lakefield, Ontario, Canada.

For the first phase of drilling, the assay techniques were slightly different than those of SGS SA and Ultra Trace Pty, which explains some of the observed variations (WSP, 2015). Identical analytical techniques were used by Ultra Trace Pty, Australia, and SGS, Lakefield, for the second drilling program.

A total of 344 check samples were submitted to SGS Canada during the 2010-2012 drilling campaign, representing 4.1% of the total batch of samples.

SGS laboratory in Canada have returned systematic lower bias in nickel and copper when assaying OREAS 73a standards, which explained some discrepancies observed between Veritas and SGS Canada for check samples. SGS Canada commented that the slight low bias on the OREAS 73a is similar to that shown by BVML and that the certification for OREAS 73a was done primarily by laboratories using Borate Fusion XRF and ICP-OES. SGS Canada's use of peroxide fusion could be a contributing factor to the low bias.

SGS Canada believes that they can confirm BVML data for the core samples, but accept the low biased on the OREAS 73a analyses. From a review of the laboratory certificates and procedures, it appears that the laboratory followed the industry's best practices as regards the analytical method used, the detection limits and the units used.

Sama agreed that the check assays demonstrate an acceptable precision in the repeatability of the assays.

A series of control charts and details on Sama's QA-QC protocol to monitor the laboratories performance are not reproduced in this Report as they are provided in WSP's technical report (2015).

12 DATA VERIFICATION

12.1 Site Visit

12.1.1 INTRODUCTION

A Personal Inspection of the Samapleu property was completed by two (2) of DRA/Met-Chem's independent QPs, Yves A. Buro, P.Eng. and Schadrac Ibrango, P. Geo, PhD, MBA, senior geologist responsible of the Mineral Resource modelling, as part of the NI 43-101 requirements for the preparation of a technical report. At the time of the visit, Y.A. Buro provided geological services to the Geology & Mines department of DRA/Met-Chem. Y.A. Buro was entitled to practice as a full-fledged Engineer in Québec. However, Mr. Buro changed his status from "Engineer" to "Retired Engineer" on April 1, 2020 and is currently registered on the OIQ's roll as a "Retired Engineer". Consequently, Y.A. Buro is no longer entitled to perform the activities reserved to the engineering profession. Y.A. Buro arrived at Yorodougou on April 4 and departed on April 8, 2018. The visit started with general discussions with Sama's technical team on topics such as the project geology and mineralization, data collection, compilation and interpretation, core logging and sampling, database construction, QA/QC system and general procedures.

Y.A. Buro examined some core from the 2017-2018 drill program and selected independent check samples. The results from previous drilling had been audited by another QP ("Technical Report, December 22, 2015; WSP Canada Inc."). Several outcrops and drill sites were visited.

A site visit was performed by Schadrac Ibrango, P. Geo, PhD, MBA on the Samapleu nickel and copper project in Ivory Coast from October 25 to 27, 2018. The objective of this site visit was to collect the project database which will be used for the Mineral Resource Estimates, perform a visit of both Samapleu's deposits and visit core from selected holes.

12.1.2 APRIL 2018 - FIELD VISIT

Y.A. Buro was accompanied during the field visit by Dr. Marc-Antoine Audet, P.Geo., Ph.D, a Qualified Person ("QP") and Founder, President and CEO of Sama Resources Inc. A day and a half was spent walking to different sectors on the Samapleu permit.

The most significant outcrops, either natural occurrences or exposures cleared by Sama, were visited, including a half dozen locations with exposed Ni-Cu mineralization or massive chromite.

The collar location of 15 former drill holes was recorded using a hand-held GPS and the inclination of the holes was noted. Comparisons of the readings in the field with the database entries showed that the coordinates for the hole collars picked up were well within the accuracy of the GPS instrument. No drilling was under way at the time of the visit.

All the holes examined were protected with a PVC casing and identified with a large concrete block with the XYZ coordinates, attitude and depth inscribed in the concrete. All the drill sites visited were perfectly clean and the sumps excavated to recover the drill mud and cuttings had been filled and levelled.

12.1.3 OCTOBER 2018 - FIELD VISIT

During this site visit all data from Sama's database required for the Mineral Resources Estimate were transferred by Dr. Marc-Antoine Audet. Such data were related to the drill holes database, topographical surfaces, a block model from an internal Mineral Resources Estimate performed by Sama, all geological solids developed internally by Sama's geologists, density measurements data and all previous geological and resource reports about the Samapleu nickel and copper project. A field visit was conducted by Dr. Audet on October 27, 2018 and consisted with the visit of selected drill holes collars previously surveyed by DTM and visits of the areas of the Samapleu Main and Samapleu Extension deposits. Visited drill collars were also related to both deposits.

Schadrac Ibrango used a hand GPS to take positions of all visited collars points. The registered coordinates were then downloaded and compared with surveyed collars location such as present in the drill holes database. No discrepancies were found.

The field visit also allowed Schadrac Ibrango to note the existence of a natural environment unaffected by Sama exploration activities. The fact that the projected mining approach will consist to open pit operations will help preserving the undisturbed natural environment.

Schadrac Ibrango also noted a well integration and acceptance of Sama exploration activities within all surrounding villages to the Project. The Project is well accepted by local communities and a high degree of communication them by Sama which hired a sociologist as manager of relationships with the local communities.

Selected drill cores were also checked by the author during the site visit accompanied by Sama site geologist and camp manager. This exercise allowed the author to attest the presence of sulphide mineralization in form semi-massive, locally massive, and dissemination. Geological description of checked holes corroborates with what was audited by the author. The author has noted the high degree of professionalism of Sama exploration team.

12.2 Geology

From the time spent by Y.A. Buro in Sama's office and in the field, it is clear that the technical team includes experienced geologists, some among them benefitting from several years of work on the Samapleu Project.

In addition to the data gained by mapping and drilling, the exploration work is supported by a wealth of geoscientific information derived from research publications or academic studies sponsored by Sama, including Ph.D. theses by Sama's employees in association with domestic and foreign universities.

12.3 Density Determinations

Density determination by Sama is performed by the immersion method, which is appropriate to determine the in-situ density of rocks.

Sama's protocol calls for determination of wet (moisture percent) and dry densities on visually mineralized and barren samples. Entire core stubs of about 10-15 cm are used for the determinations and are returned to their original locations in the core boxes and a piece of flagging tape is stapled on the boxes to identify them.

Sama's protocol calls for frequent calibrations of the scale and measurement on a standard every 5 samples. However, the results from these actions are not entered into the database.

No measurements were performed at the time of the visit, but Y.A. Buro inspected the dedicated room where the equipment is protected from disturbances, notably drafts that may blow onto the scale. Y.A. Buro counted more than 25 samples that had been submitted to density determination in each of two (2) holes that were laid out on the tables at Sama's core processing facilities. The results from a large number of determinations (2,199) are available for mineralized and barren samples.

Y.A. Buro recommends adding repeat measurements, at a frequency of one (1) every 20 samples or so, and recording the measurements of the standard into the database as good QA practices.

12.4 Procedures - Technical

Written procedures on the following operations are available for the geologists and copies were provided to Y.A. Buro:

12.4.1 Basic Geotechnical Record

The parameters recorded include:

- Core recovery;
- RQD measurements;
- Main joints systems;
- Hardness;
- Bedding angle.

12.4.2 General Drilling and Core Logging Procedures

- Positioning the drill holes in the field;
- System of drill hole identification (coordinates);
- Core handling;
- Core boxes identification;
- Digital photographic record;

- Magnetic susceptibility measurements with the Kappameter instrument of Exploranium;
- Core logging (geology, mineralization, basic "geotechnical" parameters);
- Sampling.

12.4.3 In-Situ Density Determination

- Wet and dry density
- Selection of mineralized and apparently non mineralized intervals and samples representative of different units;
- Handling of soft and hard samples.

12.5 Core Review

Holes SM44-454255 from the Main deposit and SM25-159493 from the Extension 1 deposit were inspected in detail by Y.A. Buro, in addition to selected intervals of interest in different holes. The location of the depth markers, the lithological and sample descriptions and contacts were checked and compared against the drill logs.

Chromite and norite intervals were identified and found by Sama's geologists to occur at specific locations in the rock assemblage. These units were carefully recorded as they proved to be useful marker horizons.

Y.A. Buro noted that the soft core had been wrapped in thick plastic to retain its humidity until the density measurements were completed. The hard core samples had been cut at right angle to the fabric with the rock saw that was also used to cut the contacts between the samples. The pieces of sawn core were carefully placed in the core boxes, with the paper sample tags stapled on the boxes at the end of the sample intervals.

Y. A. Buro found no errors in the placement of the core markers, the contacts locations and the lithological descriptions. Good agreement was observed between the visual estimation of the mineralization and the analytical result for nickel reported on the logs.

As noted by Y. A. Buro on several projects, whether under tropical or cold climate conditions, the red ink used to print the sample numbers in the sample books tend to fade relatively quickly, unlike the black ink of the other markings.

Each box is clearly identified by an embossed aluminum strip stapled on the end plate of the boxes. Y. A. Buro visited the secured warehouse near Yorodougou where the core boxes and the coarse rejects and pulps returned from the laboratories are safely stored.

12.6 QP Check Samples

12.6.1 Sample Selection

Y. A. Buro requested splits of sixteen (16) coarse rejects from drill core samples from eight (8) holes for independent check analysis. Six (6) half core samples were used instead of the coarse rejects, mainly for the samples that did not have sufficient mass of rejects left after the original analysis (Table 12.1).

Table 12.1 – Description of the Material Used for Check Sampling Purposes

Main Deposit		Extension 1 Deposit	
Sample ID	**Material**	**Sample ID**	**Material**
SM016890	Rejects	SM015899	Rejects
SM016930	Half Core	SM015900	Rejects
SM017121	Standard	SM016017	Rejects
SM017222	Half Core	SM016018	Rejects
SM017223	Half Core	SM016075	Standard
SM017632	Rejects	SM016130	Rejects
SM017633	Rejects	SM016131	Rejects
SM017801	Standard	SM016569	Half Core
SM017807	Rejects	SM016570	Half Core
SM017808	Half Core		

The coarse rejects were requested, as Y.A. Buro believes they are of superior quality in terms of repeatability than quarter core samples as field duplicates. The small split quarter core samples introduce a volume variance and producing mirror images from two quarter core samples can be difficult. Therefore, the second core halves left in the boxes were used to replace the coarse rejects with too low a mass.

The samples were selected in an attempt to represent both a fair distribution in the three dimensions (X, Y and Z) of the Main Deposit and of the Extension 1 Deposit and to cover a full range of nickel grades. Half of the samples were selected for their grades being close to the cut-off grade (0.10% Ni) and the average grade of the deposit (0.24% Ni).

The samples were selected from holes drilled in 2017 only (up to January 2018), as previous drill data on the Main and Extension 1 deposits had been audited by another QP ("Technical Report, December 22, 2015; WSP Canada Inc.").

The samples rejects were retrieved while Y.A. Buro was still on site. The selected rejects were easily found at the Sama's warehouse, where they had been carefully stored.

As no riffle splitter was available on site, the entire sample rejects were shipped to the laboratory for preparation of the splits to be pulverised, in order to preserve the integrity of the samples.

The OREAS 73b Certified Reference Material (CRM; standard) routinely used by Sama was inserted at three locations into the batch of QP check samples. OREAS 73b is prepared by Ore Research & Exploration P/L, Australia, from high grade massive nickel sulphide ore and barren ultramafic material sourced from Xstrata mines located in Western Australia. This CRM provides the certified value for forty elements determined by Fusion-ICP analysis, some of which are described in Table 12.2.

Table 12.2 – Analytical Results from CRM OREAS 73b Inserted into the QP Check Samples versus their Certified Values

Constituent (Selected)	Certified Values (OREAS 73b, Sodium Borate Fusion & ICP)			QP Check Sample Analyses (Sodium Borate Fusion & ICP)		
	Certified Value (%)	95% Confidence Level				
		High (%)	Low (%)	SM016075	SM017121	SM017801
Co	0.0252	0.0243	0.0262	0.025	0.025	0.024
Cu	0.0439	0.0420	0.0459	0.047	0.044	0.045
Fe	8.74	8.57	8.91	8.87	8.74	8.88
Ni	1.50	1.47	1.52	1.64	1.64	1.66
S	2.90	2.81	3.00	3.02	2.87	2.93

12.6.2 QP Check Samples Analysis

The pulps from the coarse rejects and from the core halves were prepared by *Société Veritas's* sample preparation facility in Abidjan and shipped to Actlabs, Lancaster, Ontario, Canada for analysis. The same preparation and analytical procedures used on Sama's original samples were applied to the QP check samples.

The method used for the major elements involved sodium peroxide fusion of the samples, followed by acid dissolution and analysis by ICP-OES (Code: 8 - Peroxide Fusion - ICP-OES). Au, Pt and Pd were determined by fire assaying on 30-g aliquots (Code: 1C-OES Fire Assay).

Actlabs is independent of Sama, is fully certified and accredited to international standard ISO/IEC 17025 and operates under a quality management system that complies with the requirements of ISO 9001: 2008.

12.6.3 Results

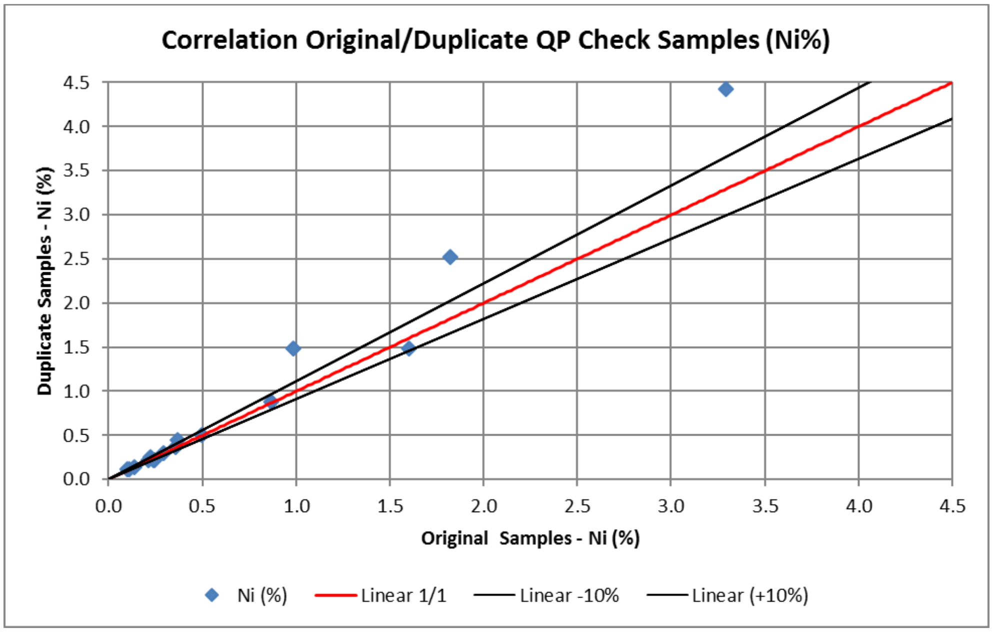
The analytical results and the basic statistical parameters for nickel and copper in the original and the QP samples are presented in Table 12.3. The plot of the Ni% results on a scatter diagram shows a good degree of correlation and a systematic positive bias toward the duplicate analyses (Figure 12.1).

Table 12.3 – Analytical Results for Ni and Cu in the Original and Duplicate QP Check Samples

Sector	Sample_ID	Estimated Sulphides (*) (%)	Ni - Original (%)	Ni - Check (%)	Cu - Original (%)	Cu - Check (%)
MAIN	SM016890	80-100	3.290	4.430	2.780	2.830
	SM016930	1-5	0.100	0.118	0.047	0.097
	SM017121	Standard	1.500	1.640	0.044	0.044
	SM017222	50-70	1.820	2.520	0.133	0.248
	SM017223	5-10	0.368	0.449	0.121	0.176
	SM017632	n/a	0.295	0.295	0.199	0.186
	SM017633	5-10	0.240	0.215	0.148	0.112
	SM017801	Standard	1.500	1.660	0.044	0.045
	SM017807	5-10	0.357	0.365	0.201	0.219
	SM017808	10-15	0.497	0.506	0.541	0.521
EXTENSION 1	SM015899	1-5	0.112	0.121	0.046	0.048
	SM015900	5-10	0.139	0.143	0.128	0.113
	SM016017	40-50	1.600	1.490	0.143	0.164
	SM016018	1-5	0.221	0.249	0.054	0.060
	SM016075	Standard	1.500	1.640	0.044	0.047
	SM016130	5-10	0.210	0.224	0.117	0.115
	SM016131	30-60	0.867	0.881	2.470	3.370
	SM016569	5-10	0.246	0.223	0.162	0.133
	SM016570	20-30	0.984	1.490	0.289	0.354
ALL		**MAX**	**3.290**	**4.430**	**2.780**	**3.370**
		MIN	**0.100**	**0.118**	**0.046**	**0.048**
		AVG	**0.709**	**0.857**	**0.474**	**0.547**
		STD	**0.865**	**1.165**	**0.850**	**1.008**

(*) As recorded in the Sama's geologists original logs.

Figure 12.1 – Scatter Diagram of the Original and Duplicate Sample Ni (%) Analyses



Five (5) sample pairs out of 16 significantly exceed the 10% difference between the original and duplicate analysis. However, relatively low figures are sensitive to differences expressed in percentage, a fact that is illustrated by the results generated by another rule effective at identifying pairs of results that are passable. Indeed, a widely used criterion in the mining industry, the Absolute Mean Percentage Difference (AMPD), was calculated and revealed that three (3) pairs out of 16 exceeded the 20% relative difference, which is somewhat high, but not of a major concern.

A generally accepted fail/pass threshold for coarse reject duplicate analyses stipulates that a 20% relative difference for individual pairs should not be exceeded in 90% of the cases. The average of all the original assays, expressed in percentage on low values, is significantly higher than the recommended 5% of the average for the duplicate analyses. However, by removing the influence of the highest two (2) pairs, the average of the two populations is the same. The criterion for duplicate assays on second half core are not well established, but are often set at 30% relative difference.

The same positive bias is observable in the results from the three CRMs, although the differences for the nickel values remain close to +10% (9.3% and 10.6%) (Table 12.2).

No duplicates from the QP check samples were requested. However, one sample (SM016131) duplicated by Actlabs as part of its internal QA system, as well as a split from SM017807, closely reproduced the original values. Good agreement is observable between the certified values and the analytical results from the CRMs used by the laboratory for their internal quality control.

It has to be stressed that part of the variability between the original and the duplicate analyses on the QP samples may originate from the facts that the QP samples were from both the oxide and the sulphide zone, and consisted of a mix of coarse rejects and of the second halves of the original core. Consequently, even though the repeatability shown by the QP check samples is not outstanding, we believe that the original results from Actlabs can be used in a resource estimate.

If the results from the duplicate analyses are any indication, the implication is that the original, lower analytical values obtained from Actlabs would have been used in the resource estimation.

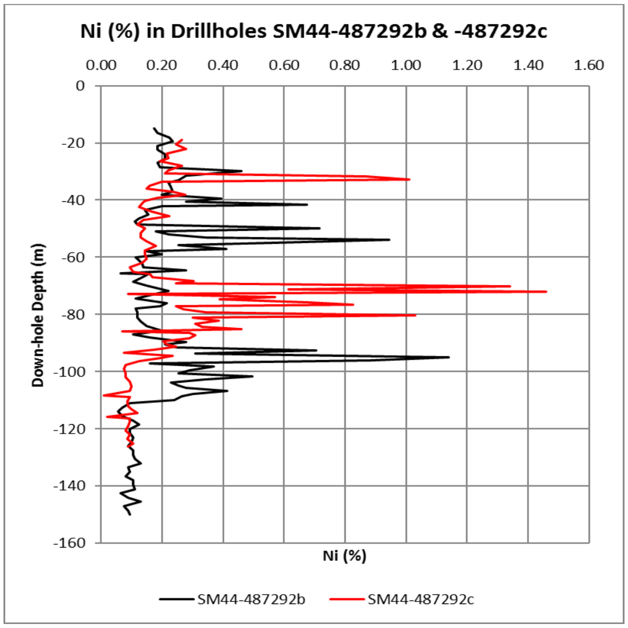
12.6.4 Short Distance Variability – Closely-Spaced Drill Holes

No twin holes were drilled by Sama to assess the short-range variability of the mineralization. In this perspective, Y.A. Buro examined the results from four (4) holes drilled from the same set-up (Table 12.4). Although the holes were drilled into different directions and plunges, they may be considered as twin holes, particularly in their upper portion, where the distance between them is relatively short. The correlation between the two (2) mineralized zones is illustrated by two (2) of the four (4) "quasi-twin" holes in Figure 12.2. The apparent offset of the mineralized zones is caused by the different distance from holes drilled at different plunges to reach the same mineralized zone.

Table 12.4 – Location and Attitude of Four (4) Drill Holes Started from the Same Setup

HOLE-ID		UTM_LOCATION			LENGTH	AZIMUTH	PLUNGE	START
Current	Original	X (m)	Y (m)	Z (m)	(m)	(°)	(°)	DATE
SM44-487292	P3-10500b	619687	856508	607	168	230	-65	Nov. 20, 2010
SM44-487292b	P3-10500c	619685	856515	607	189	210	-70	Nov. 22, 2010
SM44-487292c	P3-10500	619683	856516	606	165	225	-50	Nov. 24, 2010
SM44-487292d	P3-10500d	619683	856517	606	141	240	-65	Jan. 19, 2011

Figure 12.2 – Line Diagram of Two (2) Quasi-Twin Holes - Ni (%) Analyses



12.7 Conclusions

Y.A. Buro considers the personal inspection, as referred to in subsection 6.2(1) of the Instrument, to be complete and current, as no new material scientific or technical information that could impact the present resources estimate has been collected about the property between that personal inspection and the filing date of the technical report.

The geology and mineralization of the Samapleu property is complex, but Sama's geologists can rely on a wealth of information provided by the geophysical and drilling programs. Moreover, the exploration model used by Sama to direct the exploration and development of the property is supported by several academic and research studies sponsored by Sama and implemented by experienced geologists, some of them having worked on this Project for several years.

The Samapleu magmatic sulphide mineralization is part of a large mafic-ultramafic complex, the Yacouba Layered Complex, analogous to world-class, well-documented Ni-Cu deposits in the world.

The analytical results from the QP samples are not outstanding but acceptable. Sufficient pertinent information of appropriate quality has been gathered to form the basis of a resource estimation.

No factors that could compromise the reliability of the resources estimate or completion of the required work was observed during the site visit.

12.8 Recommendations

Duplicate density determinations every 20 samples should be performed and recorded as part of the QA-QC protocol.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

The information in Section 13.2 under Volodymyr Liskovych's responsibility is largely drawn, modified or summarised from the Report entitled: "Scoping Study Report Samapleu Flotation Concentrate, Nickel and Iron Extraction Using CVMR®'s Technologies, Toronto Ontario, Canada, October 17, 2017 (Internal Unpublished Report).

13.1 Mineral Processing Test Work

There have been four (4) metallurgical test programs for the Samapleu Project to date. The first study was carried out by SGS Vancouver in 2011 and was the first flotation test work carried out on the deposit. It developed a preliminary flow sheet for the process on different blends of the material available. The second study was an extension of the first, by SGS Vancouver in 2012, and focused on the mineralogy of a lower grade blend, the ability to desulphurise the tails, and the potential for pre-concentration by gravity. The third program was run by the Centre de Technologie Minérale et de Plasturgie ("CTMP") in Thetford-Mines in 2013: this study investigated the flow sheet developed in 2011 and the use of size classification and magnetic separation as a pre-concentration step to remove pyrrhotite and improve flotation grades. The most recent test work was done by SGS Lakefield in 2019. This established the grindability of the ore and developed a new flow diagram on which the flow sheet proposed in Section 17 is based. Parameters for flotation were optimised with different cleaning circuits and verified with two (2) locked cycle tests.

13.1.1 2011 - SGS Test Work, Vancouver, BC

The 2011 SGS test work campaign made use of drill core samples from the Samapleu property to benchmark different composites of ore and to develop a suitable flow sheet for treatment. Drill core samples were crushed to 100% passing 2 mm before being blended into three (3) composites: massive, low grade, and high grade (Table 13.1). Grinding test work was not completed as part of this study.

Table 13.1 – Head Chemical Analysis from 2011 SGS Test Work

Sample ID		Cu	Ni	S	Fe	Co	Au	Pt	Pd
Comp #	Name	%	%	%	%	%	g/t	g/t	g/t
1	Massive	1.71	1.71	14.8	20.5	0.072	0.08	0.08	1.88
2	Low grade	0.34	0.24	1.93	3.76	0.016	0.09	0.12	0.39
3	High grade	0.52	0.53	3.99	7.04	0.029	0.07	0.16	0.63

13.1.1.1 Mineral Characterisation

Composites 1 and 3 were analysed using Quantitative Evaluation of Minerals by SCANning electron microscopy ("QEMSCAN"). These samples were ground in a laboratory rod mill to a product size (P_{80}) of 155 µm and split to -210/+75 µm, -75/+38 µm, and -38 µm to be analysed. It was found that pentlandite and chalcopyrite tend to concentrate in the smaller particle sizes, suggesting potential for pre-concentration by size classification.

Nickel was found to be predominantly in pentlandite (87-90%), with approximately 9% in pyrrhotite and small amounts in solid solution with orthopyroxene and amphibole. The nickel deportment and liberation data for these samples shows that the maximum nickel recovery in pentlandite is limited to 69% for Composite 1 and 67% for Composite 3. Nickel liberation was measured at 76%, given a high association between pentlandite and pyrrhotite: indicating a 9% potential increase in Ni recovery if pyrrhotite can be accommodated in the concentrate (i.e., nickel recovery can be increased by diluting pentlandite concentrates with pyrrhotite). Mineralogy of Composite 2 was studied during a secondary study in 2012 and showed 74% liberation of pentlandite with a maximum recovery of 60%.

Copper was found to be predominantly in chalcopyrite. The liberation data shows 85 – 87% liberated copper in the samples.

13.1.1.2 Flotation

The three (3) composites were used to test the effect of head grade, grind size, and pH on bulk Cu/Ni rougher flotation performance. Batch cleaner tests investigated trends in the cleaning of the rougher concentrates, testing the effect of grind size and collector dosage and collector stage addition on cleaner flotation performance. A single locked cycle test was carried out on Composite 3.

a. Rougher Kinetic Testing

Grind size, pH, and feed grade were all varied to determine the effect of each parameter on grade and recovery. Composite 3 was used to test grind sizes at 250, 200 and 150 µm. In the range of primary grind sizes tested, there was no significant difference in rougher recovery for nickel or copper. The grade slightly improved at the smaller grind size; however, this could be due to a decrease in mass pull and would require more investigation to confirm.

To determine the effect of pH, composite 1 was tested at the natural pH of 7.4 and at a pH of 8.8 through addition of lime in the mill. There was minimal influence on mass pull, but the addition of lime did decrease the amount of valuable minerals going to tailings.

The tests utilised a reagent suite of lime, sodium isopropyl xanthate (“SIPX”), methyl isobutyl carbinol (MIBC), and Aero3477. The three composites were then benchmarked using the same test conditions (150 µm grind, natural pH, 95 g/t SIPX, and 10 g/t Aero 3477) (Table 13.2). From these tests, SGS determined that a primary grind size of 200 – 250 µm is appropriate for all samples; the rougher would need to achieve greater than 10% mass pull to achieve target nickel and copper recoveries; feed grade is linked to the tailings grade. It is noted that to achieve a rougher recovery of 90% for Composite 1, a mass recovery of 25% was required (compared to less than 10% for Composites 2 and 3).

Table 13.2 – Rougher Benchmarking Results (SGS 2011)

Test	Nickel Rougher Concentrate		Copper Rougher Concentrate	
	Ni (%)	Recovery (%)	Cu (%)	Recovery (%)
Comp 1	5.64	89.0	5.30	77.5
Comp 2	3.70	91.8	3.62	82.6
Comp 3	5.49	93.5	4.93	81.9

b. Cleaner Kinetic Testing

Cleaner flotation tests were carried out on composite 3 to determine a regrind size, pH, and collector addition for cleaning. The optimal parameters from composite 3 testing were used to benchmark Composites 1 and 2.

Tests were carried out by re-grinding down to 41, 50 and 65 µm. All sizes had similar Cu recoveries, however the coarser grind size of 65 µm saw an improvement in Ni recovery without affecting grade. Collector addition was tested in different dosages and in staged vs. single addition. An improvement in Ni recovery was seen with staged addition of collector.

The benchmarking tests on the other composites showed that bulk concentrate quality increased with increased feed grade.

c. Locked Cycle Test

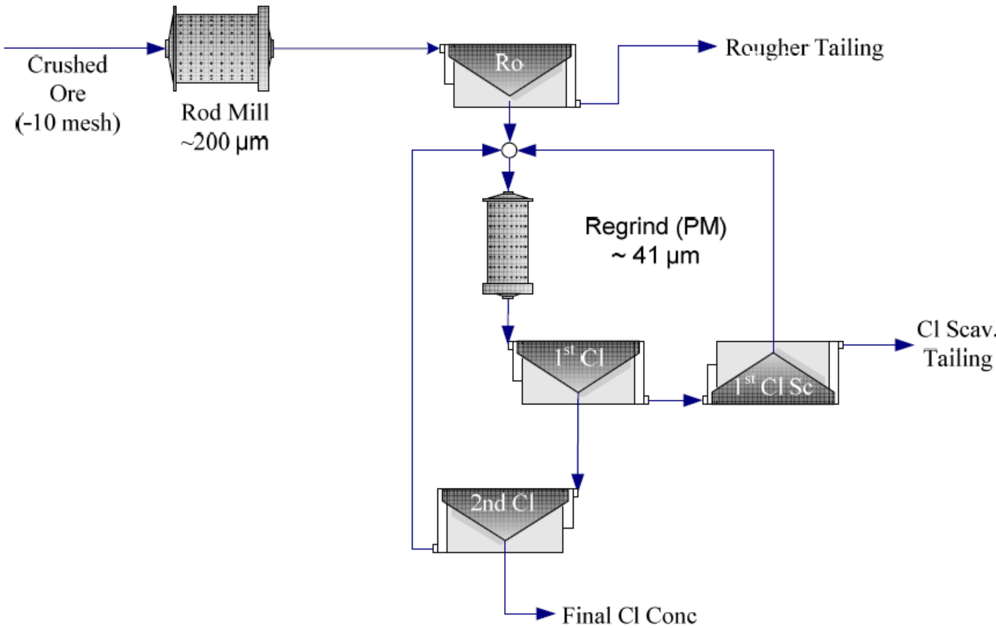
Open circuit cleaning resulted in high Ni losses and were expected to cause high circulating loads in a closed circuit flow sheet. To investigate, a locked cycle test of six (6) cycles was carried out with a rougher grind size of 200 µm, a pH of 7.4, a collector dosage of 95 g/t SIPX, a regrind size of 41 µm, and staged dosages of SIPX. The flow sheet used for the test is showed in Figure 13.1.

This resulted in an 89% Cu recovery at 9.8% Cu, and 75% Ni recovery at 8.7% Ni, which is significantly improvement over the open cycle testing. Grades and recoveries achieved in the locked cycle test are summarised Table 13.3.

Table 13.3 – Locked Cycle Test Results (SGS 2011)

Stream Name	Weight	Cu	Ni	Cu	Ni
	%	% Grade		% Distribution	
Cleaned Bulk Conc	4.7	9.76	8.72	89.3	74.6
Combined Tails	95.3	0.06	0.15	10.7	25.4
Head (Calc)	100.0	0.51	0.55	100.0	100.0

Figure 13.1 – Locked Cycle Test Flow Sheet (SGS 2011)



13.1.2 2012 - SGS Test Work, Lakefield, ON

13.1.2.1 Heavy Liquid Separation

A sample of Composite 3 was considered for heavy liquid separation testing to determine whether pre-concentration would be applicable for processing the deposit. The sample was screened to 1.80 mm and 0.850 mm, with the +1.80 mm fraction stored. Heavy liquid separation was trialled on the -1.80/+0.850 mm sample at specific gravities (“SG”) of 3.89, 3.50, 3.40, 3.30, and 3.10 g/cm^3. Sub-samples of the sinks and floats were submitted for chemical analysis: a summary of results is shown in Table 13.4.

Table 13.4 – Heavy Liquid Separation Test Results (SGS 2011)

Sample	Mass (g)	Ni (%)	Cu (%)
Comp 3 -10+20m	-	0.39	0.37
Comp 3 -10+20m 3.89 (Feed)	300.00	-	-
Comp 3 -10+20m 3.89 HLS Sink	19.86	3.27	2.03
Comp 3 -10+20m 3.89 HLS Float	279.75	0.13	0.23
Comp 3 -10+20m 3.50 (Feed)	400.00	-	-
Comp 3 -10+20m 3.50 HLS Sink	40.65	2.03	1.42
Comp 3 -10+20m 3.50 HLS Float	358.68	0.097	0.19

Sample	Mass (g)	Ni (%)	Cu (%)
Comp 3 -10+20m 3.40 (Feed)	400.00	-	-
Comp 3 -10+20m 3.40 HLS Sink	182.78	0.66	0.53
Comp 3 -10+20m 3.40 HLS Float	216.09	0.092	0.17
Comp 3 -10+20m 3.30 (Feed)	239.00	-	-
Comp 3 -10+20m 3.30 HLS Sink	199.95	0.42	0.40
Comp 3 -10+20m 3.30 HLS Float	38.44	0.098	0.16
Comp 3 -10+20m 3.10 (Feed)	2,026.00	-	-
Comp 3 -10+20m 3.10 HLS Sink	1,971.44	0.35	0.32
Comp 3 -10+20m 3.10 HLS Float	50.58	0.10	0.18

13.1.2.2 Flotation – Pyrrhotite circuit development

Samples composite 1 and 2, from the previous stage of test work, were used to create a new composite for continued testing. The goal of this test work was to investigate the addition of a pyrrhotite (“Po”) circuit after the nickel and copper circuit. The head grades of the new composite are shown in Table 13.5. Mineralogy performed on Composite 2 showed 88.4% liberation of pyrrhotite.

Table 13.5 – Head Grade of New Composite Sample SGS 2012

Element	%
Ni	0.35
Cu	0.46
S-Total	3.38

Three batch tests were used to create a pyrrhotite concentrate that would be suitable to roast and produce sulphuric acid. The first batch test began with the optimal test parameters from the first test work program to float nickel and copper, and a second rougher stage to float pyrrhotite. The effect of grind size (75, 165, and 177 µm) and sulphuric acid and copper sulphate ($CuSO_4$) were investigated. The use of sulphuric aid and $CuSO_4$ were found to be equivalent in promoting pyrrhotite flotation. As a result of these tests, a 4-cycle lock cycle flow sheet was developed (Figure 13.2).

While SGS noted that the number of cycles was insufficient to fully stabilise the flow sheet, it was able to produce a final bulk pyrrhotite concentrate grading 0.47% Cu, 1.69% Ni and 32% S. In the opinion of SGS, such a concentrate would be suitable for roasting and generating sulfuric acid (Table 13.6).

Figure 13.2 – Lock Cycle Flow Sheet Used for Desulphurisation Test Work (SGS 2012)

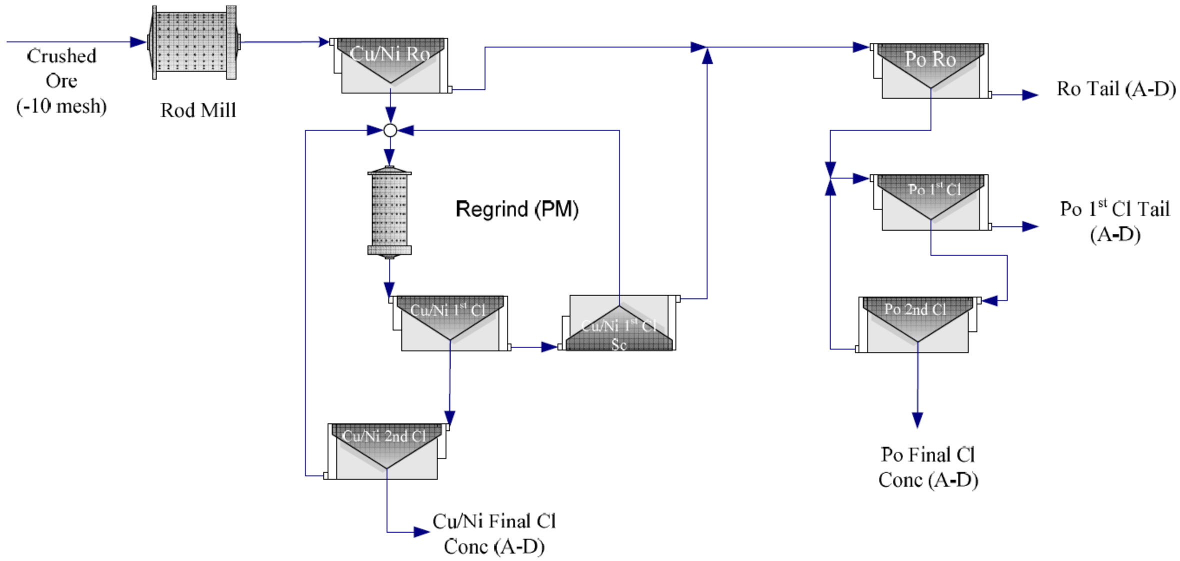


Table 13.6 – Lock Cycle Results for Desulphurisation (SGS 2012)

Stream Name	Weight	Cu	Ni	S	Cu	Ni	S
	%	% Grade			% Distribution		
Cu/Ni 2nd Cleaner Conc.	3.4	11.9	5.58	27.4	86.0	52.6	30.9
Po 2nd Cleaner Conc.	4.0	0.47	1.69	32.0	4.0	18.4	41.7
Combined Tails	92.6	0.05	0.11	0.90	10.0	29.0	27.4
Head (Calculated)	100.0	0.47	0.36	3.04	100.0	100.0	100.0

13.1.3 2013 - CTMP Test Work, Thetford Mines, QC

The Centre de Technologie Minérale et de Plasturgie ("CTMP") received four (4) barrels of sample from the Samapleu deposit. These were blended to create a homogeneous sample of 235.9 kg. The assays of the blended samples is shown in Table 13.7.

Table 13.7 – Assay of Blends Tested by CTMP 2013

Sample	Ni %	Cu %	Fe %	Co %	S %
Barrel 1 (-10 mesh)	0.30	0.22	13.91	0.16	1.63
Barrel 4 (-10 mesh)	0.28	0.23	13.91	0.16	1.66
Barrel 2 (-10 mesh)	0.31	0.26	13.46	0.16	1.67

The scope of test work at CTMP included grindability, heavy liquid separation, pre-concentration by size classification and magnetic separation, and flotation tests to build on the SGS 2011/2012 test work while incorporating lower grade ore.

A Bond Work Index test was conducted on the bulk sample alongside measures of the bulk density and specific gravity of the ore (on the -10 mesh fraction) (Table 13.8).

Table 13.8 – Physical Ore Parameters Measured by CTMP 2013

Parameter	Value	Comment
Bond Work Index (kWh/t)	13.9	Closing screen 212 µm
Bulk Density (g/cm^3)	2.03	Test on -10 mesh material
Specific Gravity (g/cm^3)	3.22 – 3.25	2 tests on -10 mesh material

13.1.3.1 *Pre-Concentration by Heavy Liquid Separation*

Heavy liquid separation testing was conducted on different size fractions of the bulk sample with a heavy liquid of 3.40 specific gravity. The results of this test work are shown in Table 13.9. The results demonstrated some potential for pre-concentration at size fractions below 2.8 mm, however the lost nickel was significant and CTMP rejected heavy liquid separation as a pre-concentration technique.

Table 13.9 – Heavy Liquid Separation of Bulk Sample (3.40 SG) CTMP 2013

Sample	Mass (g)	Ni (%)	Cu (%)
+6.35 mm; HLS Float	14.48	0.14	0.16
+6.35 mm; HLS Sink	4.20	0.14	0.14
-6.35 + 4 mm; HLS Float	4.20	0.17	0.10
-6.35 + 4 mm; HLS Sink	8.67	0.25	0.18
-4 + 2.8 mm; HLS Float	7.98	0.17	0.10
-4 + 2.8 mm; HLS Sink	8.67	0.17	0.15
-2.8 + 1.7 mm; HLS Float	18.84	0.16	0.15
-2.8 + 1.7 mm; HLS Sink	1.09	0.86	0.27
-1.7 + 0.850 mm; HLS Float	16.06	0.13	0.15
-1.7 + 0.850 mm; HLS Sink	3.98	0.43	0.27

13.1.3.2 *Flotation*

The first round of batch test work aimed to replicate the test conditions used by SGS in 2011 to understand how the results would vary on lower grade ore. The tests utilised the same reagent suite as SGS: lime, SIPX, MIBC, and Aero3477. In general, the recoveries and grades obtained by CTMP were lower than those achieved by SGS in 2011. The head grade of the CTMP material was also lower than SGS 2011.

The best conditions of the first test series was used to conduct a lock cycle test, the results of which are shown in Table 13.10. The lock cycle test utilised a rougher flotation time of 14 minutes, cleaner flotation time of 13 minutes, 105 g/t of lime, 100 g/t of SIPX, 25 g/t of Aero3477. The lock cycle test was able to achieve a nickel recovery of 72.3%, however the concentrate grade of 3.82% Ni was lower than anticipated.

Table 13.10 – Lock Cycle Test Results from LCT1 CTMP 2013

Stream Name	Weight	Cu	Ni	Cu	Ni
	%	% Grade		% Distribution	
2nd Cleaner Conc.	5.2	3.96	3.82	80.2	72.3
Combined Tail	94.8	0.03	0.08	19.8	27.7
Head (Calc)	100.0	0.26	0.28	100.0	100.0

a. Pre-Concentration by Size Separation

Two (2) samples were ground to a product size (P_{50}) of 212 and 150 µm. The samples were then screened at 212 µm, and the oversize and undersize assayed (Table 13.11). The coarse size fraction tends to contain less nickel than the fines. Further flotation tests removed +150 µm and +212 µm fractions prior to flotation.

Table 13.11 – Pre-Concentration by Size Separation CTMP 2013

Grind Size	Coarse Size Fraction (+212 µm)			Fine Size Fraction (-212 µm)		
	Mass (%)	Ni (%)	Cu (%)	Mass (%)	Ni (%)	Cu (%)
P_{50} (212 µm)	53.9	0.09	0.11	46.1	0.31	0.33
P_{50} (150 µm)	47.5	0.08	0.07	52.5	0.38	0.32

The flotation results of these tests are shown in Table 13.12. The 1st cleaner tails of these tests are not reported. Removing the coarse size fraction resulted in a higher 2nd cleaner concentrate grade, at the significant expense of recovery.

The use of an undisclosed pyrrhotite depressant was also trialled during the flotation test work with pre-concentration. This depressant was not found to have an effect on nickel grade or recovery.

Table 13.12 – Flotation Results of Pre-Concentration by Size Separation CTMP 2013

Details	Stream Name	Weight	% Grade		% Distribution	
		%	Cu	Ni	Cu	Ni
+150 µm removed Rghr time = 14 min	2nd Cleaner Conc.	3.4	4.23	4.10	72.2	60.3
Total clnr time = 13 min	Rougher Conc.	10.8	1.47	1.58	78.8	72.7
Lime = 105 g/t	Rougher Tail	36.6	0.03	0.06	5.6	9.0
SIPX = 100 g/t A3477 = 25 g/t	Coarse Reject	52.6	0.06	0.08	15.6	18.2
+212 µm removed Rghr time = 14 min	2nd Cleaner Conc.	3.4	4.67	4.23	78.0	61.4
Total clnr time = 13 min	Rougher Conc.	6.5	2.59	2.52	81.8	69.2
Lime = 105 g/t	Rougher Tail	76.0	0.04	0.08	14.8	25.7
SIPX = 100 g/t A3477 = 25 g/t	Coarse Reject	17.5	0.04	0.07	3.4	5.2

b. Pre-Concentration by Magnetic Separation

Several samples were treated by magnetic separation prior to flotation. It was found that 15-20% of the nickel reported to the magnetic concentrate. A magnetic separation step was incorporated prior to cleaning the rougher concentrate (with and without regrinding). The best results were obtained by using magnetic separation after 10 minutes of regrinding, with the final second cleaner concentrate grading 8.43% Cu and 6.52% Ni with a copper recovery of 60.2% and a nickel recovery of 42.1%.

These test conditions were used in a lock cycle test (8 cycles), the results of which are shown in Table 13.13.

Table 13.13 – Lock Cycle Test with Magnetic Separation (CTMP 2013)

Details	Stream Name	Weight	% Grade		% Distribution	
		%	Cu	Ni	Cu	Ni
Rghr time = 14 min	2nd clnr con	3.2	5.76	4.72	73.7	61.6
Total clnr time = 13 min	1st clnr scav tail	2.8	0.18	0.27	2.0	3.1
Mag float = 3.5 min	Ro Scav tail	70.8	0.05	0.07	14.4	20.6
Lime = 105 g/t	Coarse reject	21.9	0.09	0.09	8.0	8.2
SIPX = 100 g/t	Mag float tail	1.3	0.33	1.22	1.8	6.6
A3477 = 25 g/t	Combined tail	96.8	0.07	0.10	26.3	38.4
Aero 7261 = 100 g/t	Head (calc)	-	0.25	0.24	-	-

13.1.4 2019 - SGS Test Work, Lakefield, ON

The 2019 test work campaign at SGS Lakefield was conducted to demonstrate metallurgical performance. Four (4) samples grading 0.1%, 0.3%, 0.6%, and 1.9% Ni were sent to SGS from the Samapleu deposit. Material from the 0.1% and 0.6% sample were mixed with the 0.3% sample to create a master composite. A second sample of 0.3% material was sent to SGS at a later time. The head grades of the samples are shown in Table 13.14.

Table 13.14 – Head Grade of Samples Used in the 2019 SGS Test Work Campaign

Sample ID	Master Comp. 0.3% Ni	0.1% Ni	0.6% Ni	1.9% Ni	Second sample 0.3% Ni
Cu %	0.35	0.15	0.53	0.93	0.32
Ni %	0.30	0.10	0.54	1.68	0.35
Ni_S %	0.27	0.068	0.48	1.60	-
Co %	-	-	-	-	0.018
Ag g/t	0.6	0.6	1.1	1.6	1.0
Au g/t	0.06	0.03	0.05	0.06	0.05
Pt g/t	0.06	0.05	0.08	0.09	0.09
Pd g/t	0.36	0.12	0.59	2.41	0.44
S %	2.51	0.61	4.68	16.0	2.58

13.1.4.1 Mineral Characterisation

Four (4) samples (the master composite and sub samples from the 0.1%, 0.6%, and 1.9% samples) were submitted for QEMSCAN mineralogical analysis. Each sample was pulverised to 100% passing 90 µm and screened into four (4) size fractions for analysis: +75 µm, -75/+53 µm, -53/+20 µm, and -20 µm.

Magnesium bearing minerals were present (othropyroxene and clinopyroxene, amphibole, and chlorite); however, no serpentine or talc were detected in the samples. This implies that the use of carboxymethylcellulose (“CMC”) should be an effective magnesium depressant.

The deportment of nickel in each sample was measured (Figure 13.3), and found to be contained predominantly in pentlandite, with amounts in pyrrhotite, orthopyroxene, clinopyroxene, and amphibole. It is worth noting that in the 0.1%Ni sample, the amount of nickel present as pentlandite decreases significantly.

Mineral release curves were generated from the QEMSCAN data (Figure 13.4). This led SGS to choose a primary grind size of approximately 70 µm and a regrind size of approximately 25 µm for flotation test work.

Figure 13.3 – Nickel Deportment (SGS 2019)

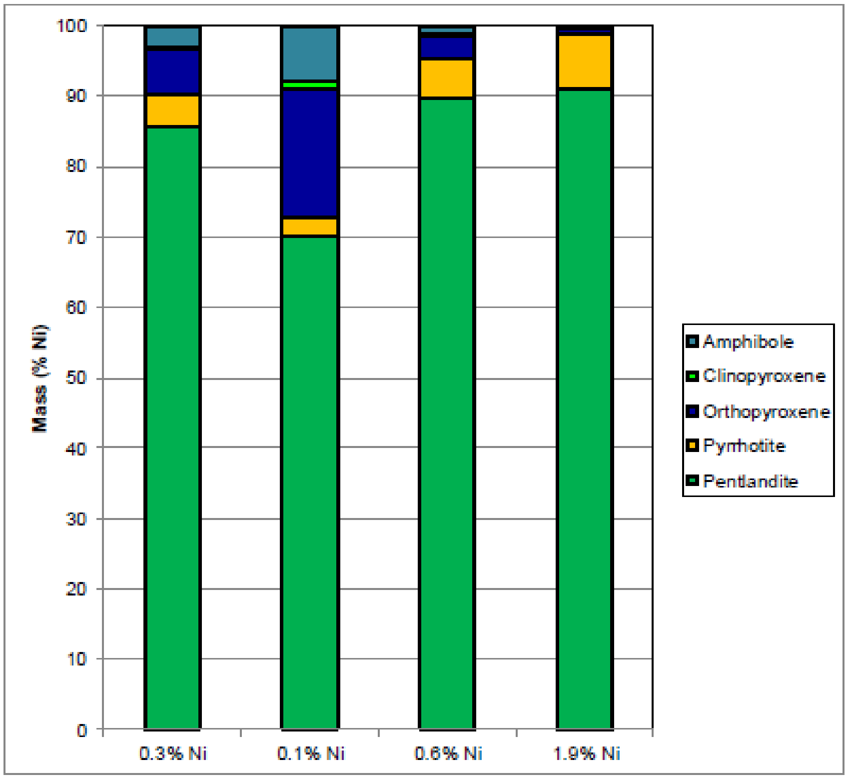
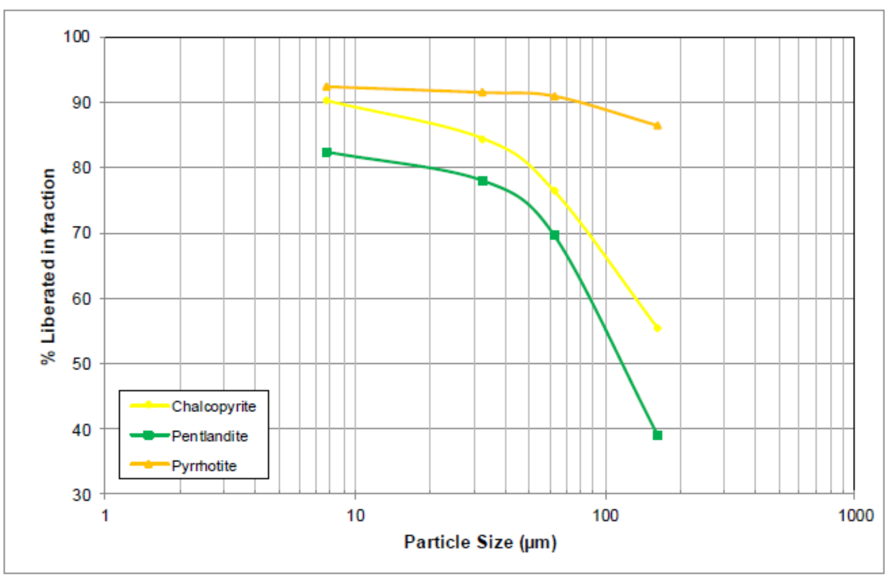


Figure 13.4 – Mineral Release Curves (SGS 2019)



13.1.5 GRINDABILITY

A sample from the master composite (0.3%) was characterised for hardness using an SMC test as well as a Bond Work Index test. The SMC results are reproduced from SGS in Table 13.15; and the Bond Ball Work Index test are reproduced from SGS in Table 13.16.

Table 13.15 – SMC Grindability Test (SGS 2019)

Sample Name	A	b	A x b	Hardness percentile	t 1 a	DWI (kWh/m^3)	Mia (kWh/t)	Mih (kWh/t)	Mic (kWh/t)	SCSE (kWh/t)	Relative density
Master Comp	70	0.76	53.3	39	0.41	6.4	14.9	10.9	5.6	9.5	3.39

Table 13.16 – Bond Ball Mill Grindability Test (SGS 2019)

Sample Name	Mesh of grind	F_{80} (μm)	P_{80} (μm)	Gram per revolution	Work Index (kWh/t)	Hardness percentile
Master Comp	170	2,423	74	0.95	19.0	88

13.1.5.1 Flotation

A total of twenty-two (22) bench scale flotation tests were conducted alongside two (2) lock cycle tests. A reagent scheme considered using sodium isobutyl xanthate ("SIBX"), diethyl triamine ("DETA"), sodium metabisulfite ("SMBS"), carboxymethyl cellulose ("CMC") and lime as a pH modifier.

The tests began by considering bulk roughing: four (4) tests were conducted on the 0.6% Ni sample and two (2) on the 0.3% nickel sample (F1-F6). These preliminary tests considered three roughing stages: Cu/Ni Roughing, Ni Scavenging, and Po concentration, varying reagent dosages to determine roughing conditions for the first lock cycle test.

Tests F7-F14 focused on determining conditions for cleaning the rougher concentrate, and conditions for cleaner scavenger. Tests F16-F17 considered open circuit cleaning test results, but on the 1.9%Ni samples.

The test results of F13 (Table 13.17), which gave the best open circuit cleaning results are shown alongside the results for the first lock cycle test (of 4 cycles) (Table 13.18). The lock cycle test was able to achieve a bulk Cu/Ni concentrate grading 11.6% Cu, 6.39% Ni, with a copper recovery of 89.1% and a nickel recovery of 68.1%. (Figure 13.5)

Table 13.17 – Test Results from F13 Open Circuit Cleaning Tests (SGS 2019)

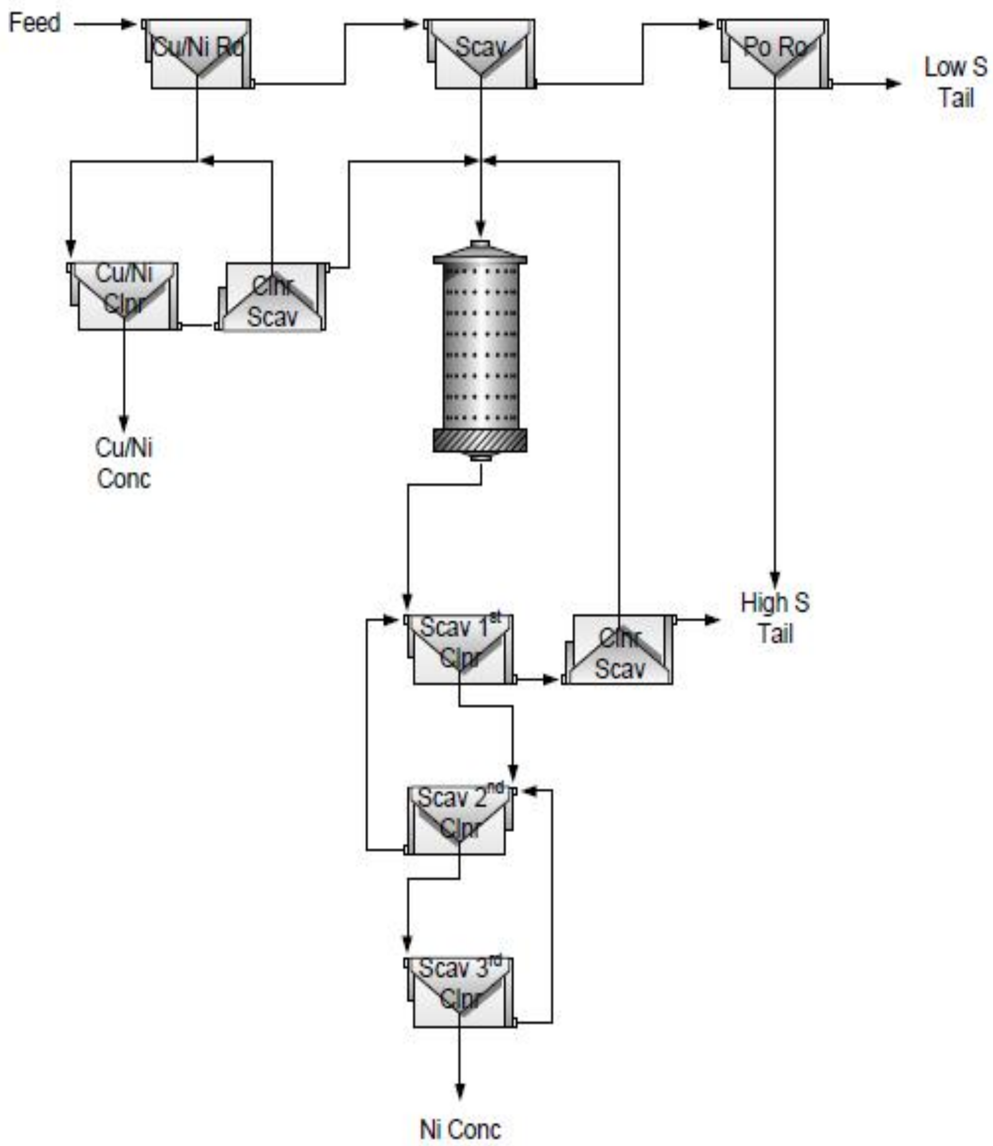
Conditions	Product	Wt	Assay (%)			Distribution (%)		
		%	Cu	Ni	S	Cu	Ni	S
Cu/Ni Ro/Clnr	Cu/Ni 1st Cl Conc	1.9	16.2	5.80	25.8	85.9	35.5	19.0
SIBX = 5 g/t	Cu/Ni 1st Cl Sc Conc	0.2	3.47	5.08	14.6	2.2	3.7	1.3
DETA = 37.5 g/t	Cu/Ni 1st Cl Sc Tail	2.7	0.26	0.40	2.52	2.0	3.6	2.7
SMBS = 150 g/t	Cu/Ni Ro Conc	4.8	6.60	2.72	12.1	90.1	42.8	23.0
CMC = 305 g/t	Sc 3rd Cl Conc	0.2	2.37	18.5	34.8	1.1	9.6	2.2
Scavenger/Clnr	Sc 2nd Cl Conc	0.3	2.37	16.1	32.5	1.8	13.8	3.4
SIBX = 26 g/t	Sc 1st Cl Conc	0.7	1.70	9.75	22.5	3.5	23.2	6.5
DETA = 17.5 g/t	Sc 1st Cl Sc Tail	4.8	0.12	0.55	6.7	1.6	8.6	12.6
SMBS = 70 g/t	Sc Conc	3.1	0.46	3.13	15.1	4.0	31.4	18.2
CMC = 5 g/t	Scav Cl Feed	5.8	0.36	1.85	9.17	6.0	34.9	20.9
Po Rougher	Po Ro Conc 1-5	8.6	0.14	0.49	16.5	3.4	13.8	56.0
pH = 5.0	Po Ro Tail	83.2	<0.01	0.043	0.08	2.4	11.7	2.6
SIBX = 120 g/t	Head (calc.)	100.0	0.35	0.31	2.54	100.0	100.0	100.0

Table 13.18 Lock Cycle Test Results LCT1 (SGS 2019)

Product	Weight	Assay (%)			Distribution (%)		
	%	Cu	Ni	S	Cu	Ni	S
Cu/Ni 1st Cl Conc	3.3	11.6	6.39	25.0	89.1	68.1	33.1
Sc 3rd Cl Conc	0.1	2.54	4.20	25.1	0.9	2.0	1.5
Sc 1s Cl Sc Tail	7.5	0.29	0.45	7.12	5.0	10.9	21.6
Po Rougher Conc	9.4	0.14	0.33	10.9	3.1	9.9	41.1
Po Rougher Tail	79.6	0.010	0.035	0.08	1.9	9.0	2.7
Head (Calc.)	100.0	0.43	0.31	2.49	100.0	100.0	100.0
Head (Dir.)	-	0.35	0.30	2.51	-	-	-

Small discrepancies may occur due to rounding.

Figure 13.5 – Locked Cycle Test Flow Sheet (SGS 2019)



After the LCT1 test, all of the master composite was used. The second shipment of 0.3%Ni sample was then used to continue the test work. Before completing the second lock cycle test, the new sample was tested using the conditions from F13, to validate performance on the new sample (F18). The Cu/Ni cleaner did not perform as expected, and xanthate dosage had to be increased (F19). The conditions from F19 were used to conduct LCT2 (Table 13.19). Generally, the Cu/Ni circuit in LCT2 performed poorly when compared to LCT1 and it is likely that more collector would be needed in the Cu/Ni rougher to increase overall nickel recovery.

Table 13.19 Lock Cycle Test Results LCT2 (SGS 2019)

Product	Weight	Assay (%)			Distribution (%)		
	%	Cu	Ni	S	Cu	Ni	S
Cu/Ni 1st Cl Conc	1.9	15.6	9.94	29.8	89.9	49.8	22.1
Sc 3rd Cl Conc	0.3	1.70	6.60	20.0	1.5	5.2	2.3
Sc 1st Cl Sc Tail	5.2	0.23	1.09	7.05	3.6	14.7	14.1
Po Rougher Conc	8.3	0.090	0.61	17.5	2.2	13.0	55.6
Po Rougher Tail	84.3	0.011	0.079	0.18	2.7	17.3	5.9
Head (Calc.)	100.0	0.34	0.39	2.60	100.0	100.0	100.0
Head (Dir.)		0.32	0.35	2.58			

Small discrepancies may occur due to rounding.

13.1.5.2 Copper Nickel Separation

The Cu/Ni combined concentrate from LCT1 was conditioned with lime to increase the pH to 11.5. The copper concentrate was floated (F15) at 26% Cu and 0.6% Ni, but at a low copper recovery (28%). The remainder of the copper was lost in intermediate cleaning stages. It is possible that recirculating the tails would increase recovery. The nickel concentrate graded 2.24% Cu and 11.4% Ni at 56.6% nickel recovery.

The Cu/Ni concentrate from LCT2 was split into three (3) for distinct copper-nickel separation trials (F20-22), however, copper recovery remained low for the three (3) trials.

13.2 Carbonyl Powder Production Test Work

CVMR Corporation (CVMR) is a technology developer in field of the carbonyl powder production conducted a test work and a pilot plant work campaign on the Samapleu concentrate. The work was done within the scope of the agreement between CVMR and SAMA to evaluate a suitability of Sama nickel concentrate for conversion to high purity carbonyl powders. The refining test work was conducted in CVMR lab in Toronto (April 18, 2017).

13.2.1 Study Objectives

CVMR has conducted several test campaigns to evaluate the feasibility of refining premium quality nickel and iron powders economically from Samapleu Flotation Concentrate (SFC).

The process demonstrated high recoveries as had been already seen from the bench scale study. The bench scale study earlier established that CVMR's carbonyl refining technology can recover 97.8% of nickel and 90.5% of iron from the SFC.

A summary of the work along with the major results and conclusions can be found below. The testing was based on the feed composition provided in Table 13.20.

Table 13.20 – SFCRP Feed Material Elemental Assay

SAMPLE	Units	Cu	Ni	Co	Fe
SFC	%	4.20	11.48	0.20	16.9

The objective of the studies was limited to evaluate an optimum for recovery of the payable metals from the SFC, and to produce nickel and iron powders with desired morphology, density, particle size, and purity. Studies of copper and cobalt, and any other metals recovery were excluded from scope of the study.

The work was conducted in batch regime with sample sizes 2 kg using the existing test setup proven for similar projects.

The SFC was first roasted to remove sulphur and to convert the nickel and iron to oxides. The roasted material was then reduced with hydrogen to convert the oxides of nickel and iron onto metallic state. Reduction was carried out in a vertical packed bed reactor, and then switched to carbonylation on the same vessel. The reduction circuit was an open and the reduction gaseous products were burnt after passing through the reactor. Reduced material was carbonylated by means of passing the carbon monoxide gas in a closed circuit system. The carbonyls produced were collected in cylinders (collectors) and then separated, passed through thermal decomposers which produced nickel and iron powders.

13.2.2 Feed Material Characterisation

Table 13.21 presents an assay of the SFC samples.

Table 13.21 – Elemental Analyses of as received SFC samples from SGS Canada

SAMPLE	Units	Cu	Ni	Co	Fe	S
SFC	wt %	4.33	3.20	0.14	38.4	30

13.2.3 Kinetics Study

Prior to conducting the pilot plant work, the Thermo Gravimetric Analyser (TGA) was conducted to study reduction and metal extraction parameters for SFC.

The kinetic study of roasting was not carried out on the SFC sample. The amount of SFC sample was limited to carrying out a fluidised bed roasting test work and, therefore, the operating parameters of the similar operations were used.

The reduction kinetic studies of the roasted concentrate samples were conducted on the custom built TGA unit (Figure 13.6). Several TGA tests were conducted to optimise the reduction parameters.

The optimised parameters are shown in Figure 13.7. The roasted concentrate was reduced at 650˚C during 1.5 hours in hydrogen medium. The total weight loss during reduction was around 22%.

Figure 13.6 – Thermo Gravimetric Analyzer (TGA)

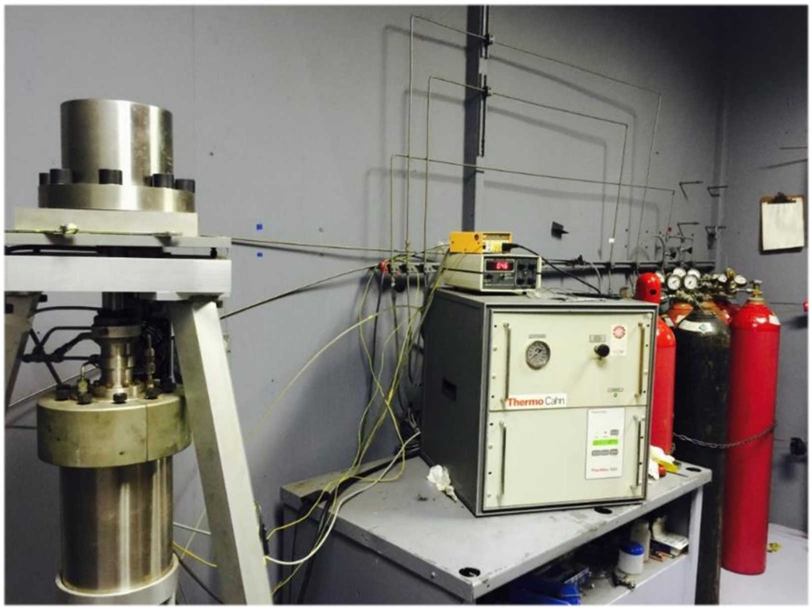
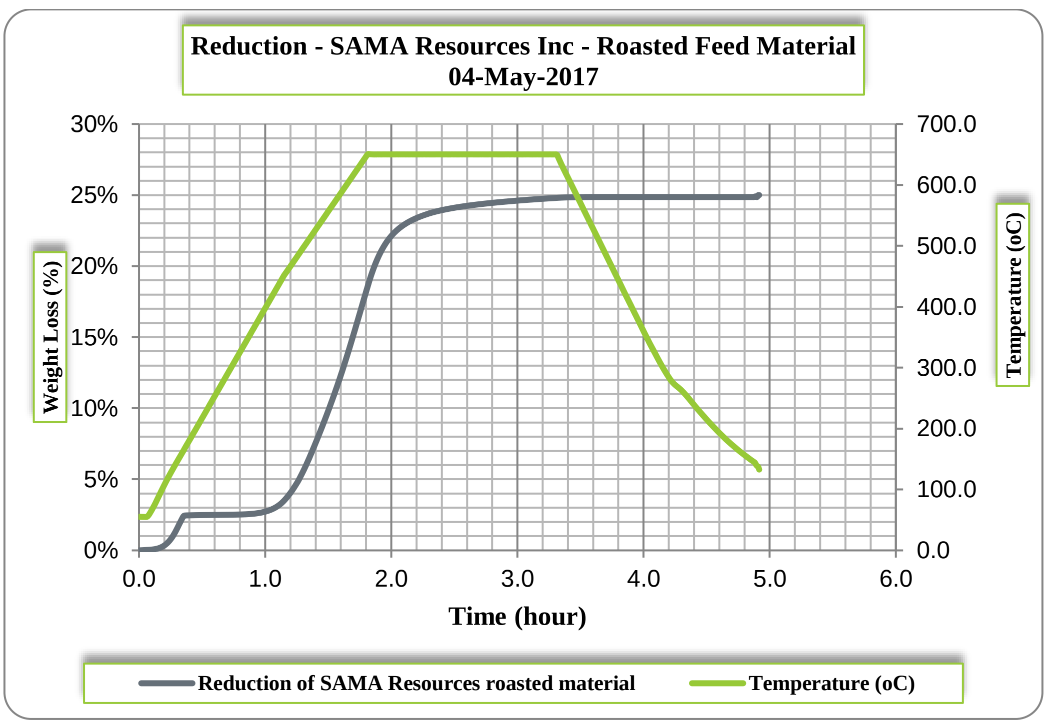


Figure 13.7 – TGA Optimised Reduction Parameters of SFC



Carbonylation kinetic studies continued following the reduction without opening the TGA. The TGA unit was cooled down to 130˚C and the reducing agent, hydrogen, was replaced with the carbonylation agent, carbon monoxide, and pressurised to 600 psi (40 bar). The reaction kinetics of carbonylation slowed down and started tailing off after 18 hours into the carbonylation. The reaction was terminated after 18 hours into the carbonylation and the TGA was purged prior to being opened.

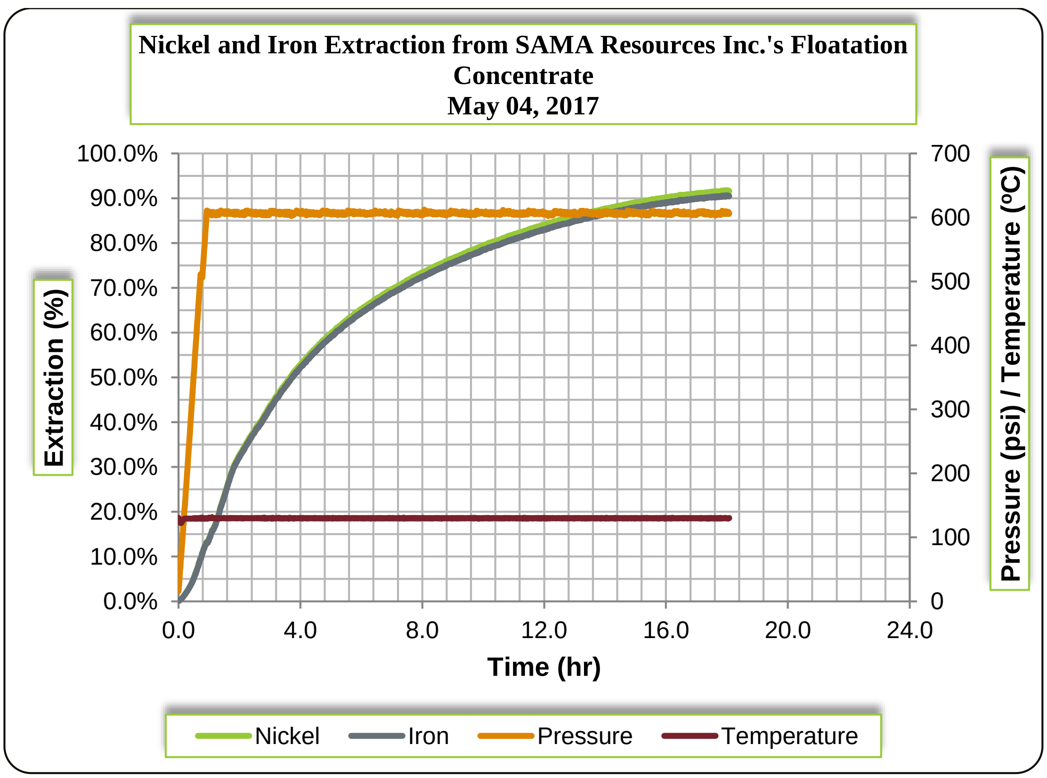
The residue from the TGA was XRF analyzed for nickel and iron. Based on the XRF results and TGA weight readings, the mass balance was estimated, and it is presented in Table 13.22.

Table 13.22 – TGA Test Mass Balance

Description	Units	Ni		Fe	
	grams	grams	%	grams	%
Feed	2.91	0.07	2.32	1.12	38.4
Residue	1.51	0.01	0.40	0.11	7.40
Extraction	1.40	0.06	91.0	1.01	90.0

Results of 91% of nickel and 90% of iron in the feed were recovered in 18 hours as shown in Figure 13.8.

Figure 13.8 – TGA Optimised Carbonylation Parameters of SFC



There were no other elements in the polymetallic SFC to consider during this TGA test work. The focus was on extracting nickel and iron from the polymetallic SFC. Other elements can be considered during further testing.

13.2.4 Carbonyl Refining - Metallurgical Tests

About 5 kg SFC in total were received in bags from SAMA Resources Inc. The samples as received were analysed by CVMR's on site XRF analyser, and then later by SGS Canada Inc.

13.2.4.1 Pilot Plant Campaign #1

The goal of the first campaign was to evaluate effectiveness of the identified operating parameters in the TGA test program and to refine nickel and iron to the possible maximum level achievable. Another task of the campaign was to produce a high premium nickel and iron powders from the SFC.

SFC is a polymetallic concentrate and, therefore, it was another goal of the first campaign to analyse the carbonyl residue and evaluate the degree of upgrading/concentrating of other valuable metals such as copper, cobalt, and platinum group metals.

Figure 13.9 – Nickel Pilot Plant 1 (NPP-1) Set Up

1.3 kg of the roasted SFC feed material was used for this piloting campaign. CVMR's NPP-1 set up (Figure 13.9) was used to conduct the campaign.

The roasted material was charged to the reactor, reduced with hydrogen at 650˚C for 1.5 hours, and carbonylated at 130˚C with carbon monoxide at 40 bar. The test was terminated after 24 hours, and the residue was collected. Based on the SGS Canada Inc. elemental analysis and weight of feed and residue, a mass balance was produced and presented in Table 13.23.

Table 13.23 – Mass Balance – Campaign #1

Description	Units	Nickel		Iron		Copper		Cobalt	
	grams	grams	%	grams	%	grams	%	grams	%
Feed material	1,300	41.1	3.16	548.6	42.2	54.1	4.16	1.82	0.14
Residue	440	1.28	0.29	27.2	6.19	53.2	12.1	1.41	0.32
Extraction		39.8	**96.90**	521.4	**95.00**				

Estimated recoveries for nickel and iron were 97% and 95% respectively over a 24-hour time period. Average extraction rates of nickel and iron were between 3% and 4 % per hour. Produced mixture of nickel and iron carbonyl was collected in the carbonyl storage tank equipped with a distillation column. After completion of extraction, nickel and iron carbonyl mixtures were separated at atmospheric pressure and decomposed in the nickel and iron decomposers.

Final residue was purged with nitrogen gas and followed by 2% oxygen in an argon mixture. No leftover Carbonyl was detected during reactor opening. Resulting residue was not pyrophoric. Bulk density of the residue was 0.6 g/cc.

a. Campaign #1 Objectives and Operating Parameters

The key objectives of the NPP-1 Campaign #1 were:

- Safe, continuous operation of NPP-1;
- Nickel extraction close to 90%;
- Iron extraction close to 85%;
- Extraction of Ni and Fe at 40 bar;
- Separating nickel and iron carbonyls by distillation;
- Producing nickel and iron carbonyl powders;
- Passivation of residue after removal of Ni and Fe;
- Analysis of residue after removal of Ni and Fe;
- Writing a campaign report;
- Campaign objectives and operating parameters detailed in Tables 13.24 and 13.25.

Table 13.24 – NPP1- Campaign #1 Objectives

Objective	Measure	Target	Technique/Description
Continuous extraction of nickel and iron	Reactor weight change	<90% Ni extraction and ~85% Fe extraction	XRF analyzer / SGS Canada Lab
Collection of metal carbonyls in the storage tank	Carbonyl storage tank weight change		
Separating of nickel and iron carbonyls mi	Nickel and iron carbonyl powder s analysis	No specific target	XRF analyzer / SGS Canada Lab
Nickel and iron product characteristics	Density	NA	
	Mean Particle Size	NA	
	Morphology	NA	
Residue production	Total Weight	100 g	
Powder Quantity	Total Weight Ni	NA	
	Total Weight Fe	NA	

Table 13.25 – NPP1Campaign # 1 Key Operating Set-Points

Description	Location	Set-Point	Units
Reduction			
Hydrogen flow rate	Hydrogen Flowmeter	2	l/min
Reactor temperature	Temperature controller	650	˚C
Residence time	N/A	2	Hours
Carbonylation			
CO flowrate to reactor	FIC1301	5	l/min
Reactor temperature	Temperature controller	120	˚C
Extraction time	WI1802	1-2	%/h
Residence time	N/A	24	Hours
Decomposer (Nickel)			
CO flowrate	FIC1301	1	l/min
Decomposer temperature	Temperature controller	300	˚C
Residence time	N/A	3	Minutes

Description	Location	Set-Point	Units
Decomposer (Iron)			
CO flowrate	FIC1301	3	l/min
Decomposer temperature	Temperature controller	350	˚C
Residence time	N/A	3	Minutes

b. Results

Feed Characteristics

The feed used for NPP-1 Campaign #1 was taken from the roasted material. The entire SFC sample received from SRI was roasted at once and split into two (2) portions to run two (2) campaigns. The elemental analysis of the SFC sample and the roasted SFC feed material is presented in Tables 13.21 and 13.26 respectively.

Table 13.26 – Elemental Analyzes of Calcined SFC Feed to the Reduction System

	SAMPLE	Units	Cu	Ni	Co	Fe	S
	SFC	%	5.50	4.10	0.18	48.8	0.2

Bulk density was 1.4 g/cc (as measured by Scott Volumeter)

Roasting

The entire SFC sample received from SRI was roasted at once using the operating parameters established at one of the plants designed and commissioned by the CVMR. Calcine sulphur grade of 0.2% was acceptable for carbonylation after roasting and hydrogen reduction (Table 13.26). The final carbonylation results of 96.9% of nickel and 95% iron grades also indicates a low residual sulphur levels in the calcine (Table 13.23). Therefore, the roasting operating conditions yielded satisfactory results.

Reduction

The reduction parameters identified during the TGA tests (Figure 13.7) were used during the campaign. Roasted material was reduced with a hydrogen at a flow rate of 2 litre / minute and at 650˚C and two hours residence time. The final carbonylation recovery results of 96.9% of nickel and 95% iron also indicates that almost all of the metal oxides have been reduced to the metallic state. Therefore, the reduction operating conditions produced a satisfactory result.

Carbonylation

The carbonylation parameters identified for SFC during the TGA testing (Figure 13.8) were applied during this campaign. The carbonylation results are shown in Table 13.27. The elemental assays produced in the campaign can be seen in Table 13.27. 97% nickel and 95%

iron were recovered during this test. Therefore, the carbonylation operating results are satisfactory.

Iron recovery rate exceeded the expected target of 85%. It is always desired to leave some iron in the carbonylation residue, especially for a polymetallic feed such as SFC to recover the other metallic values.

Carbonylation residue produced has had relatively high grade for cobalt, copper and PGM. Copper in the residue increased to 12.1% from 4.16% in the feed material, and the cobalt increased to 0.32% from 0.14%.

Mass balance data for the Campaign #1 can be found in Table 13.27.

Table 13.27 – Mass Balance – Campaign #1

Description	Units	Nickel		Iron		Copper		Cobalt	
	grams	grams	%	grams	%	grams	%	grams	%
Feed material	1,300	41.1	3.16	548.6	42.2	54.1	4.16	1.82	0.14
Residue	440	1.28	0.29	27.2	6.19	53.2	12.1	1.41	0.32
Extraction		39.8	**96.90**	521.4	**95.00**				

The iron recovery (95%) was higher than expected, and the nickel recovery (97%) was as expected. It should be noted that an iron and nickel recovery can be increased.

Carbonyls Collection

Mixture of carbonyls was collected in the carbonyl storage tank. After completion of extraction, nickel and iron carbonyl mixture was separated at atmospheric pressure. Each of carbonyls was decomposed in separate decomposers to produce nickel and iron powder.

Decomposition

Nickel carbonyl was decomposed in a dedicated nickel powder decomposer. 35 g of nickel powder was collected at the end of the decomposition. The targeted product type was CVMR® - SNP – 800. The powder produced during this campaign is identical to CVMR®'s –SNP – 800's chemical and physical characteristics.

Iron carbonyl was decomposed in a dedicated iron powder decomposer. 520 g of iron powder was collected at the end of the decomposition. The powder produced during this campaign is identical to CVMR®'s –CIP – 800's chemical and physical characteristics.

Residue Removal and Characteristics

A total of 440 g of residue was removed from the reactor. The average bulk density (Scott Volumeter) was determined to be 0.6 g/cc. The bulk density is similar to that observed in TGA tests. The bulk density of the residue is directly related to the amount of overall extraction.

Table 13.28 – SGS Canada Inc. Elemental Assay Report

Sample ID	Ni (%)	Cu (%)	Co (%)	Fe (%)	Au (g/t)	Pd (g/t)	Pt (g/t)	Ag (g/t)	Weight (g)
SRI-CAM-1-FC	3.2	4.33	0.14	38.4	0.63	4.10	1.28	6.7	55.8
SRI-CAM-1-RO	3.16	4.16	0.14	42.2	-	-	-	-	56.1
SRI-CAM-1-CR-001	0.29	12.1	0.32	6.19	1.60	11.8	3.76	-	4.10
SRI-CAM-1-CR-002-INT	0.57	10.8	0.33	14.4	0.81	9.97	2.94	26.7	36.7

Table 13.29 – Product Elemental Assay - Carbonyl Nickel Powder

Element	Result (%)
Ni	99.63
Co	0.058
Fe	0.001
Cu	<LOD
Ag	0.004
Sn	0.008
Ba	0.022
Balance	0.277

Table 13.30 – Product Elemental Assay - Carbonyl Iron Powder

Element	Result (%)
Fe	94.73
Co	<LOD
Ni	0.435
Cu	0.057
Ag	0.016
Au	0.039
Bi	0.0300
Cd	0.0058
Hg	0.062
Mn	0.077
Nb	0.004
Pb	0.052
Rb	0.004
Zn	0.445
Mo	0.002
Pd	0.007
Se	0.014
Sr	0.009
U	0.005
Zr	0.008
Balance	4.00*

* Carbonyl iron powder can be easily oxidized when exposed to atmosphere. It is a surface oxidation and it is preventable by post treatment. The product carbonyl iron powder reported here was not stored under argon or post treated to prevent surface oxidation.

13.2.4.2 Pilot Work – Campaign #2

Second campaign was conducted to evaluate the repeatability of the Campaign #1 and to optimise the nickel extraction parameters. Second goal of the Campaign #2 was to study the effect of suppression of iron extraction on nickel extraction and concentrating platinum group metals.

1.2 kg of the roasted SFC feed material was used for this piloting campaign. NPP-1 set up (Figure 13.9) was used to conduct the campaign.

The roasted material was charged into the reactor, reduced with hydrogen at 650˚C for 1.5 hours, purged with H_2S for 5 minutes, and carbonylated at 130˚C with carbon monoxide at 600 psi (40 bar). The test was terminated after 24 hours, and the residue was collected. The elemental analysis and weight of feed and residue indicate the mass balance as presented in Table 13.31.

Table 13.31 – Mass Balance – Campaign #2

		Nickel		Iron		Copper		Cobalt	
	grams	grams	%	grams	%	grams	%	grams	%
Feed material	1,200	37.9	3.16	506.4	42.20	49.9	4.16	1.68	0.14
Residue	490	0.78	0.16	98.5	20.10	43.6	8.90	2.01	0.41
Extraction		37.1	97.90	407.9	80.60				

Estimated recoveries of nickel and iron were 98% and 81% respectively over a 24-hour time period. Average metal extraction rate was between 3% and 4 % per hour. Pressure of extraction was 40 bar and temperature of reactor 130˚C. Produced mixture of nickel and iron carbonyls were collected in the carbonyl storage tank equipped with a distillation column. After completion of the extraction, nickel and iron carbonyl mixtures were separated at atmospheric pressure and decomposed in the nickel and iron decomposers.

Final residue was purged with nitrogen and followed by 2% oxygen in argon mixture. Carbonyl was not detected during the opening of the reactor. Resulting residue was not pyrophoric. Bulk density of the residue was 0.7 g/cc.

a. Campaign #2 Objectives

The key objectives of the NPP-1 Campaign #2 were:

- Safe, continuous operation of NPP-1;
- Nickel extraction close to 95%;
- Iron extraction close to 85%;
- Extraction of Ni and Fe at 40 bar;
- Separating nickel and iron carbonyls by distillation;
- Producing nickel and iron carbonyls powder;
- Passivation of residue after removal of Ni and Fe;
- Analysis of residue after removal of Ni and Fe;
- Writing a campaign report;
- Campaign objectives and operating parameters detailed in Tables 13.32 and 13.33.

Table 13.32 – NPP1- Campaign #2 Objectives

Objective	Measure	Target	Technique/Description
Continuous extraction of nickel and iron	Reactor weight change	<95% Ni extraction and ~85% Fe extraction	XRF analyzer / SGS Canada Lab
Collection of metal carbonyls in the storage tank	Carbonyl storage tank weight change		
Separating of nickel and iron carbonyls mi	Nickel and iron carbonyl powders analysis	No specific target	XRF analyzer / SGS Canada Lab
Nickel and iron product characteristics	Density	NA	
	Mean Particle Size	NA	
	Morphology	NA	
Residue production	Total Weight	100 g	
Powder Quantity	Total Weight Ni	NA	
	Total Weight Fe	NA	

Table 13.33 – NPP1 Campaign # 2 Key Operating Set-Points

Description	Location	Set-Point	Units
Reduction			
Hydrogen flow rate	Hydrogen Flowmeter	2	l/min
Reactor temperature	Temperature controller	650	˚C
Residence time	N/A	1.5	Hours
Carbonylation			
CO flowrate to reactor	FIC1301	5	l/min
Reactor temperature	Temperature controller	130	˚C
Extraction time	WI1802	3-4	%/h
Residence time	N/A	24	Hours
Decomposer (Nickel)			
CO flowrate	FIC1301	1	l/min
Decomposer temperature	Temperature controller	300	˚C
Residence time	N/A	3	Minutes
Decomposer (Iron)			
CO flowrate	FIC1301	3	l/min
Decomposer temperature	Temperature controller	350	˚C
Residence time	N/A	3	Minutes

b. Results

Feed Characteristics

The feed used for NPP-1 Campaign # 2 was taken from the roasted material. The entire SFC sample received from SRI was roasted at once and split into two (2) portions to run two (2) campaigns. The elemental analysis of the SFC sample and the roasted SFC feed material is presented in the Tables 13.34 and 13.35 respectively.

Table 13.34 – Elemental Analyzes of SFC feed to the FBR

SAMPLE	Units	Cu	Ni	Co	Fe	S
SFC	wt%	4.33	3.20	0.14	38.4	30

Table 13.35 – Elemental Analyzes of Calcined SFC feed to the Reduction System

SAMPLE	Units	Cu	Ni	Co	Fe	S
SFC	wt%	5.50	4.10	0.18	48.8	0.2

Bulk density was 1.4 g/cc (Scott Volumeter)

Roasting

The entire SFC sample received from SRI was roasted at once using the operating parameters established for one of the existing CVMR operations. The sulphur grade was reduced to 0.2% acceptable for carbonylation to (Table 13.35). The final carbonylation recovery results of 97.9% of nickel and 80.6% iron also indicates a high removal rate for the sulphur (Table 13.31). Therefore, the roasting results are satisfactory.

Reduction

The reduction parameters identified in the TGA tests program were applied during this campaign. The roasted material was reduced with hydrogen at a flow rate of 2 litre / minute and at 650˚C for two hours material residence time. The reduced material was then purged with H_2S for 5 minutes to passivate some of the iron in the feed to see the effect on nickel extraction and evaluation of other metallic values. The final carbonylation result of 98% of nickel also indicates that almost all of the metal oxides have been reduced to their metallic states. Therefore, the reduction operating conditions has given satisfactory results.

Carbonylation

The carbonylation parameters identified for SFC in the TGA test program were applied during this campaign. The carbonylation results are shown in Table 13.36. 98% nickel and 81% iron were recovered during this test. Therefore, the carbonylation operating conditions are satisfactory.

Nickel extraction rate went up to 98% from 97%, and the iron extraction rate has reduced down to 81% from 95% due to the additional step taken to suppress the iron recovery.

Copper grade in the residue increased to 8.9% from 4.16% in the feed concentrate, and so the and the cobalt to 0.41% from 0.14%. Table 13.36 provides a mass balance details for the Campaign #2.

Table 13.36 – Mass Balance – Campaign # 2

Description	Units	Nickel		Iron		Copper		Cobalt	
	grams	grams	%	grams	%	grams	%	grams	%
Feed material	1,200	37.9	3.16	506.4	42.2	49.9	4.16	1.68	0.14
Residue	490	0.78	0.16	98.5	20.1	43.6	8.9	2.01	0.41
Extraction		37.1	97.9	407.9	80.6				

The iron recovery (81%) and the nickel recovery (98%) are as expected.

<u>Carbonyls Collection</u>

Mixture of carbonyls was collected in the carbonyl storage tank. After completion of extraction, nickel and iron carbonyl mixtures were separated at atmospheric pressure. Each of carbonyls was decomposed in separate decomposers to produce nickel and iron powders.

<u>Decomposition</u>

Nickel carbonyl was decomposed in a dedicated nickel powder decomposer. 35 g of nickel powder was collected at the end of the decomposition. The targeted product type was CVMR® - SNP – 800. The powder produced during this campaign is identical to CVMR®'s –SNP – 800's chemical and physical characteristics.

Iron carbonyl was decomposed in a dedicated iron powder decomposer. 407.9 g of iron powder was collected at the end of the decomposition. The powder produced during this campaign was identical to CVMR®'s –CIP – 800's chemical and physical characteristics.

<u>Residue Removal and Characteristics</u>

A total of 490 g of residue was removed from the reactor. The average bulk density (Scott Volumeter) was determined to be 0.7 g/cc. The bulk density is similar to that observed in TGA tests. The bulk density of the residue is directly related to the quantity of the metals extracted.

14 MINERAL RESOURCES ESTIMATE

14.1 Summary

DRA/Met-Chem was mandated by Sama Resources to perform a mineral resource estimate update of the Samapleu nickel project located in Ivory Coast. The project encompasses two (2) main deposits, namely Samapleu Main and Samapleu Extension, and one (1) satellite deposit. The requested work is following exploration work completed on the project since the last Mineral Resource estimate performed in 2012. The effective date of that previous resource estimate was December 11, 2012. Since this date, fifty-one (51) diamond drill holes, with a cumulative drilled length of 8,791.1 m, were drilled over the Samapleu property between 2013 and 2018.

The current resource estimate update is based on a drill holes database which encompasses one hundred sixty-eight (168) drill holes of which one hundred sixty (160) drill holes have targeted the Sampleu Main and Samapleu Extension 1 deposits. The remaining eight (8) were exploratory and have targeted unsuccessfully the Samapleu Extension 2 and Samapleu Extension 3 exploration targets. The cumulative length of drill holes that served to source the current estimate is 25,666 m and are originating of exploration boreholes drilled between 2010 and 2018.

The first step carried out in the estimate process was to update the mineralization model by generating geological 2D sections using the sectional interpretation approach. With this approach the mineralization domains are subdivided into vertical sections with constant thickness. Geological polygons are digitised and snapped to lithological contacts on each section.

For each mineralized body the polygons are then linked from section to section to deliver resulted 3D geological envelopes. A 3D block modelling approach was used to segment the project domain into blocks with a regular size of 5 m by 5 m by 2 m respectively in the X, Y and Z directions. A geostatistical analysis was performed in order to determine the spatial continuity of the mineralization main attributes and help with the definition of suitable parameters to guide the mineral resource interpolation.

The mineral resource was interpolated using Ordinary Kriging approach which is a spatial estimation minimising the error variance. Three (3) interpolations passes were used to inform all blocks from the resource domain.

Under CIM definition standards, mineral resource should have a reasonable prospect of eventual economic extraction. In order to determine the mineralization zones that can be potentially mined economically an optimised pit shell was developed using the Lersch Grossman (LG) algorithm implemented in GEOVIA Whittle® softwareHxGN MinePlan 3D.

The Mineral Resources estimate was performed by Schadrac Ibrango, P. Geo, Ph.D, MBA, senior consulting geologist in association with Dr. Marc Antoine Audet, Sama. Mr. Ibrango is a Qualified Person (QP) independent from Sama Resources. The resource classification follows the CIM definition for classification of Indicated and Inferred Mineral Resources. The criteria used by the QP for classifying the estimated mineral resources are based on confidence and continuity of geology and grades. The CIM definition standards for resource classification are provided in Section 14.2.

A summary of the Mineral Resources is provided in Table 14.1. The effective date of the Mineral Resource Estimate is October 26, 2018 which corresponds to date of reception of the project drill hole database from Sama Resource.

Table 14.1 – Summary of the Mineral Resources (Cut-Off Grade of 0.1% NiEq)

Category	Resources (Mt)	NiEq (%)	Ni (%)
Measured [1,2,3]	-	-	-
Indicated [1,2,3]	33.18	0.269	0.238
Meas. + Ind.	**33.18**	**0.269**	**0.238**
Inferred [1,2,3,4]	17.78	0.248	0.224

1. Mineral Resources are exclusive of Mineral Reserves
2. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. There is no certainty that all or any part of the Mineral Resources estimated will be converted into Mineral Reserves. The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues
3. The CIM definitions were followed for the classification of Indicated and Inferred Mineral Resources.
4. The quantity and grade of reported Inferred Resources in this estimation are uncertain in nature and there has been insufficient exploration to define these Inferred Resources as an Indicated or Measured Mineral Resource. It is reasonably expected that a portion of Inferred Mineral Resources could be upgraded with continued exploration.
5. Pit shell defined using 52-degree pit slope, copper concentrate price of $2.1/lb and nickel powder price of $13.5/lb, $3/t mining costs, $15/t of processing and G&A costs, and a resulting cut-off grade of 0.1% NiEq.

14.2 Definitions

According to the final version of the CIM Definition Standards, which became effective on February 1, 2001 and was last revised on November 2019:

A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity. An Inferred Mineral Resource has a lower level of confidence than that applying to an Indicated Mineral Resource and must not be converted to a Mineral Reserve. It is reasonably expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued exploration.

An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit. Geological evidence is derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation. An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource and may only be converted to a Probable Mineral Reserve.

A Measured Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of Modifying Factors to support detailed mine planning and final evaluation of the economic viability of the deposit. Geological evidence is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation. A Measured Mineral Resource has a higher level of confidence than that applying to either an Indicated Mineral Resource or an Inferred Mineral Resource. It may be converted to a Proven Mineral Reserve or to a Probable Mineral Reserve.

14.3 Mineral Resource Estimate Estimation Procedures

The estimation of the Samapleu Nickel Mineral Resources includes the following procedures:

- Validation of the drill hole database received from Sama Resources as CSV and Excel files;
- Importation of the database into HxGN MinePlan 3D;
- Basic descriptive statistics to assess statistical parameters of the different quality attributes;
- Geological modelling on vertical 2D sections;
- Generation of 3D mineralized envelopes;
- Statistical analysis of the sampling length and decision on the compositing process and parameters;
- Geostatistical analysis to assess the spatial continuity of selected attributes of the mineralization;
- Generation of a 3D block model;
- Setup of all parameters required for the resource's interpolation;
- Interpolation of relevant quality variables, using Three (3) passes, of all blocks constrained within each mineralized 3D solid;
- Validation of the results of the resource interpolation;
- Classification of the Mineral Resource according to CIM/NI 43-101 standards;
- Statement of the Mineral Resources.

14.4 Drill Holes Database and Data Verification

14.4.1 Drill Holes Database

The drill hole database was supplied by Sama Resources as an Access file on October 25, 2018. In fact, it was a copy of the Excel based database used by Gemcom the 3D modelling software used internally by Sama. Relevant information was downloaded from this Access based database and reformatted to be imported into Torque, a SQL based database manager integrated into HxGN MinePlan 3D (previously MineSight) the 3D and resource modelling software package used by DRA/Met-Chem.

This database newly updated by Sama, by integration of all exploration work completed by the company since the last Mineral Resource Estimate performed in December 2012, contains one hundred seventy-seven (177) drill holes record entries with a cumulative length drilled of twenty-eight thousand three twenty-five (28,325 m). This encompasses all exploration holes drilled on the Samapleu property not matter of the targeted prospect.

All drill holes were drilled between 2010 and 2018. Table 14.2 presents statistics of drilled holes by targeted prospect. All holes present in the database are diamond drilled holes. The current Mineral Resources Estimate is focused on the prospects of Samapleu Main and Samapleu Extension 1 since exploration works were unsuccessful on the other prospects. Table 14.3 presents a summary of the drill holes database as formatted and imported into Torque.

Most of the drill holes in the database were drilled in 2010 and 2011 at the beginning of exploration over the property. Most part of the drill holes that were added in the drill hole database after completion of the previous resource estimate were drilled in 2017 and 2018.

A summary of items present in the imported drill hole database is presented in Table 14.4 while Table 14.5 displays summary descriptive statistics of attributes contained in the database with no consideration of geological units.

Table 14.2 – Statistics of Drilled Holes by Prospect

Prospect	Drill Hole Count	Cumulative Length	Drilling Years
Samapleu Main	95	14,318	2010 to 2018
Samapleu Extension 1	65	11,348	2010 to 2018
Samapleu Extension 2	3	439	2010
Samapleu Extension 3	5	872	2010
Yorodougou	5	961	2010 & 2012
Gangbapleu	4	388	2011

Table 14.3 – Statistics of Drilling Per Year

Year	Count	Drilled Length (m)	Sampled Length (m)
2010	42	7,446	3,059
2011	72	10,215	5,562
2012	11	1,781	1,022
2013	7	1,466	677
2014	5	2,525	428
2015	6	857	386
2017	22	2,940	1,965
2018	12	1,096	519

Table 14.4 – Attributes Items Present in the Drill Hole Database

File	Fields
Collar	Hole ID, LocationX, LocationY, LocationZ, Length, Azimuth, Dip, Date Start, Date compl., Sequence, Project
Surveys	Hole ID, Distance, Azimuth, Dip, Project
Litho	Hole ID, From, To, RCODE, Facies, Summary
Assays	Hole ID, Sample No, From, To, RCODE, Facies, SGdry, SGwet, Moist, Ni,Cu, Cu Eq, Fe, S, Co, Au, Pt, RH

Table 14.5 – Attributes Items Presented in the Drill Hole Database

	Mean	Median	Mode	St. Dev.	COV	Min.	Max.	Count
SGDRY	3.32	3.34	3.34	0.16	0.05	1.50	4.48	12,376
SGWET	3.35	3.35	3.35	0.14	0.04	1.70	4.49	12,366
MOIST	0.14	0.12	0.12	0.35	2.57	0.04	15.00	12,366
NI	0.26	0.18	0.17	0.36	1.39	0.00	5.16	12,179
CU	0.21	0.10	0.06	0.41	1.91	0.00	12.80	12,178
CU EQ	1.18	0.81	0.04	1.46	1.23	0.00	20.12	9,697
FE	12.32	11.40	10.70	4.38	0.36	0.05	52.90	10,578
S	1.77	0.76	0.32	3.25	1.83	0.01	37.50	10,470
CO	0.02	0.01	0.01	0.02	0.91	0.00	0.23	12,178
AU	0.03	0.02	0.02	0.07	2.14	0.00	2.56	11,679
PT	0.11	0.07	0.08	0.42	3.96	0.00	30.40	11,916
PD	0.36	0.21	0.02	0.49	1.38	0.00	5.72	11,966
RH	0.02	0.01	0.01	0.03	1.62	0.00	0.57	6,508

14.4.2 Data Verification

Following validation steps were performed to verify the soundness of the drill hole database received from Sama:

- Checking for location and elevation discrepancies and unusual values;
- Checking minimum and maximum values for each quality element to ensure that all values range within tolerable limits;
- Checking for inconsistency in the lithological units and for overlaps in the lithology and assay intervals;
- Checking for gaps in the lithological code intervals;
- Checking for repeated intervals/samples.

This first validation step was performed before importing the data into HxGN MinePlan®. A further validation process was completed when importing the data into Torque, the SQL based database manager linked with HxGN MinePlan®. No major discrepancies were found.

14.5 Geological Modelling Procedures

Geological modelling was performed by Sama geologists. The overlay of the assays analytical results and the lithological description allowed each sample assayed to be assigned a lithological code which is related to it description by logging geologists. The pyroxenite is the main geological facies considered for the purpose of the current Mineral Resource modelling.

The Samapleu Main deposit was subdivided into upper and lower facies. Both domains are separated by a fault. One (1) single facies was considered for the Samapleu Extension deposit. Geological interpretation was carried out on vertical cross-sections with a spacing of 25 m to 50 m. Polygons digitised in 2D during the sectional interpretation were joined to together to deliver 3D envelope for each mineralized body. A 3D solid was generated for each mineralized body. A topographic surface was used to control the resource modelling and ensure that no block or drill hole collar are located above the natural ground surface.

Figure 14.1 shows a typical vertical cross-section on the Samapleu Main deposit. Figure 14.2 displays a typical vertical cross-section on the Samapleu Extension deposit and Figure 14.3 shows a 3D view of the modelled solids.

Figure 14.1 – Typical Vertical Cross-Section for the Main Deposit (Section 619 736 E)

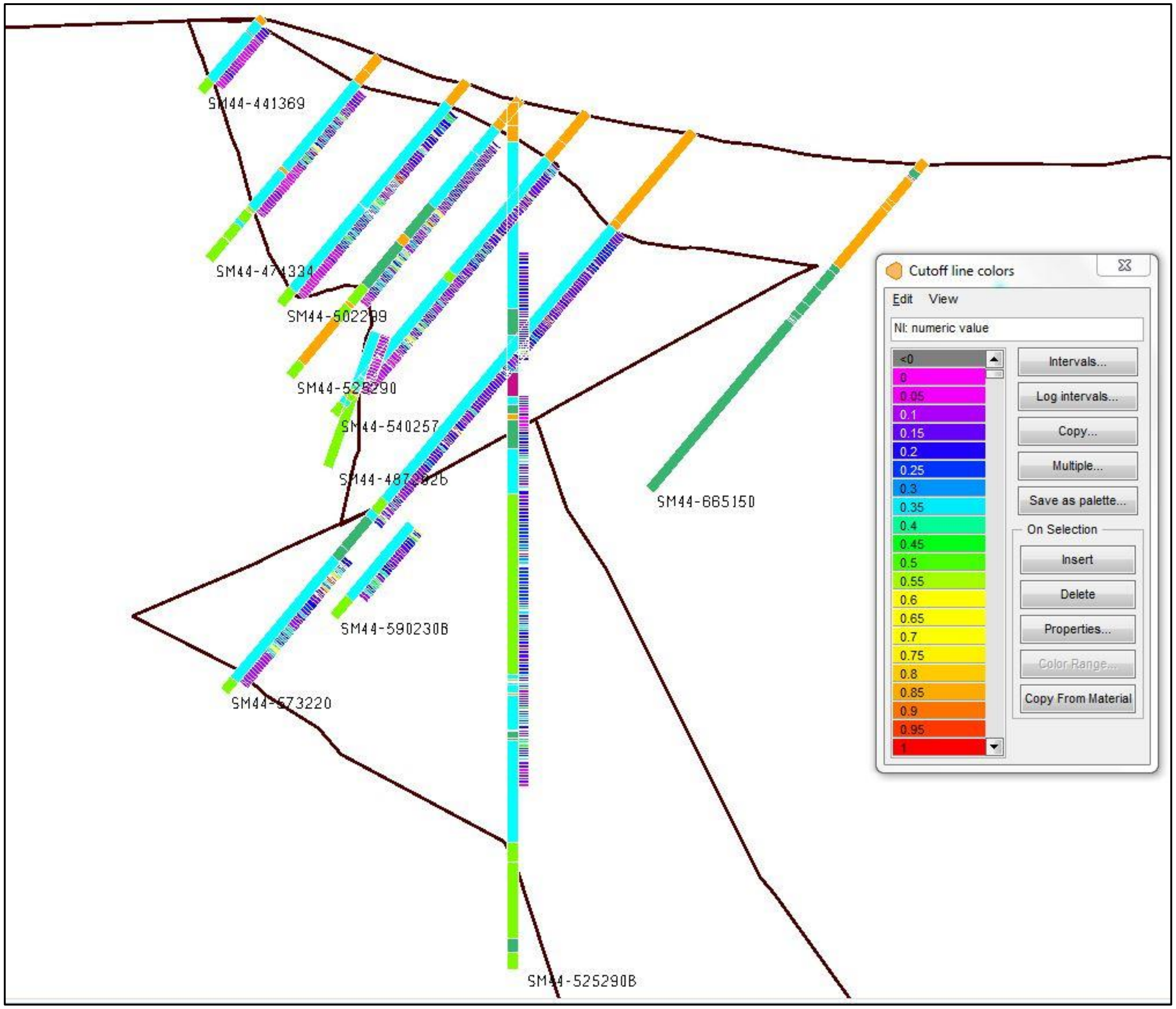


Figure 14.2 – Typical Vertical Cross-Section (Section 619 892E)

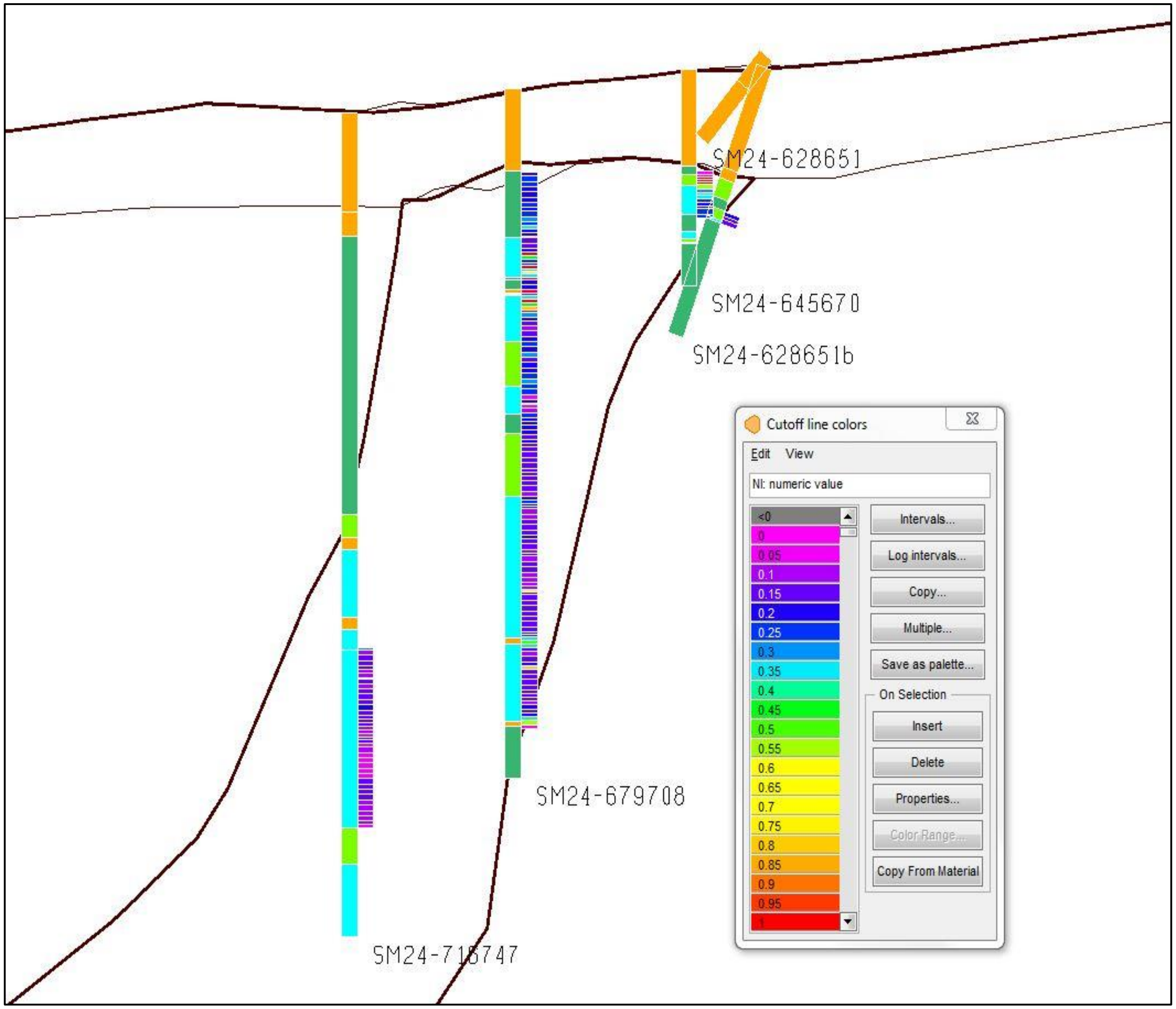
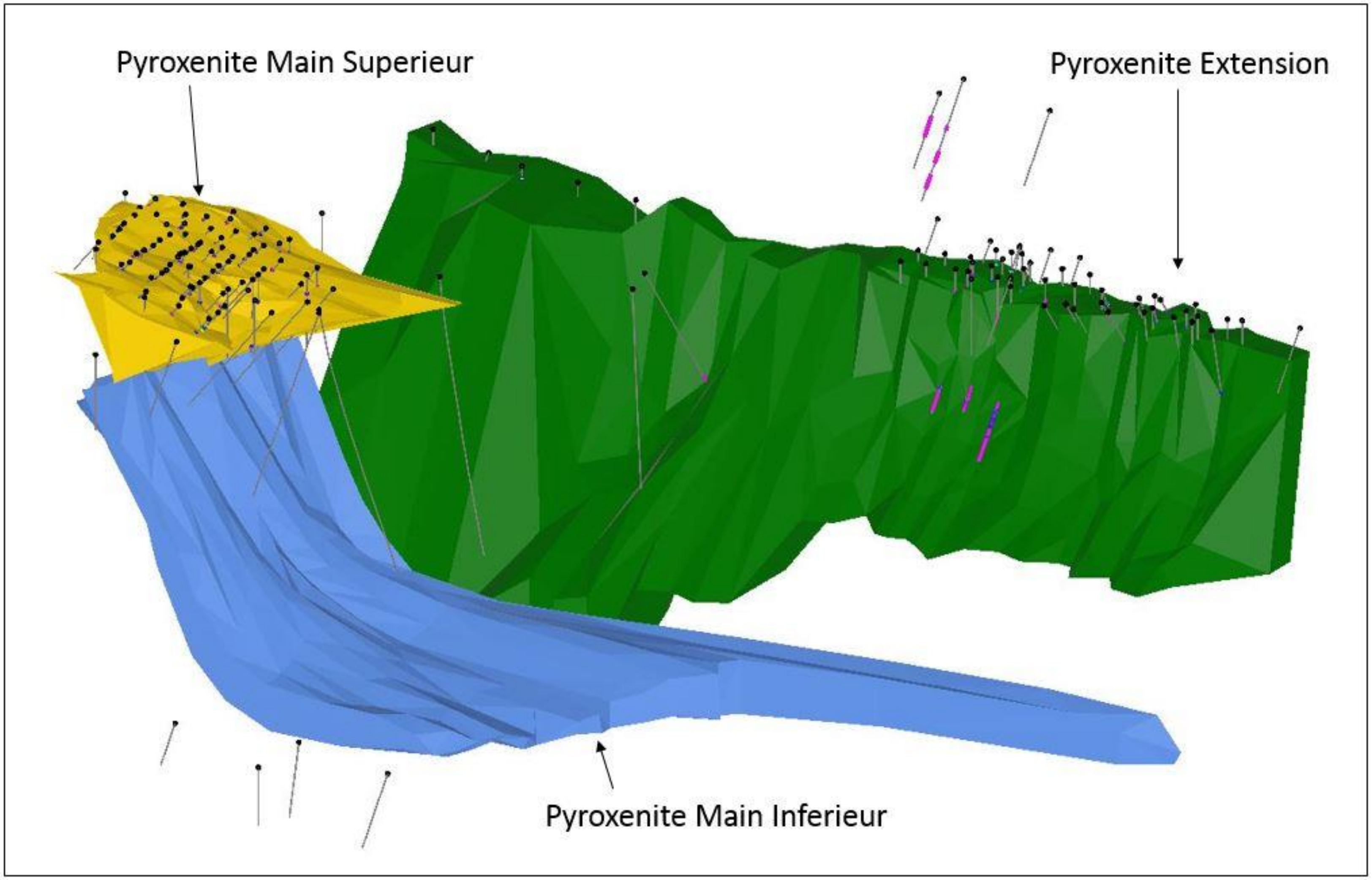


Figure 14.3 – 3D View of the Main (Inferior and Superior) and Extension Pyroxenite Solids



14.6 Statistical Analysis by Rock Code

Once the received database validated, imported into Torque and an overlay between the assays and lithological description performed the author has generated descriptive statistics in order to assess the statistical behaviour of nickel and copper depending of the lithological unit. For this reason, following rock codes and group of rock codes were considered:

- Rock Code 100: Laterite and Limonite;
- Rock Code 200: Gabbro;
- Rock Code 210 to 250: Pyroxenite and other Ultra Mafic (UM);
- Rock Code 600 & 800: Gneiss and Quartzite.

Descriptive Statistics generated by Rock Code or group of Rock Code are presented in Table 14.6 to Table 14.9.

Table 14.6 – Descriptive Statistics of Assays within Laterite and Limonite

Sampling within Laterite and Limonite		
Description	**NI (%)**	**CU (%)**
Arith. Mean	0.19	0.11
W. Mean	0.19	0.11
Median	0.17	0.08
Mode	0.17	0.07
St. Dev.	0.06	0.06
COV	0.00	0.00
Minimum	0.11	0.06
Maximum	0.27	0.23
Count	9	9

Table 14.7 – Descriptive Statistics of Assays within Pyroxenite and Others UM

Sampling within Pyroxenite and Others UM		
Description	**NI (%)**	**CU (%)**
Arith. Mean	0.24	0.20
W. Mean	0.22	0.17
Median	0.18	0.11
Mode	0.17	0.06
St. Dev.	0.23	0.32

Sampling within Pyroxenite and Others UM		
Description	**NI (%)**	**CU (%)**
COV	0.96	1.55
Minimum	0.00	0.00
Maximum	4.84	8.22
Count	8,954	8,954

Table 14.8 – Descriptive Statistics of Assays within Gabbro

Sampling within Gabbro		
Description	**NI (%)**	**CU (%)**
Arith. Mean	0.15	0.19
W. Mean	0.13	0.15
Median	0.08	0.06
Mode	0.03	0.02
St. Dev.	0.22	0.37
COV	0.05	0.14
Minimum	0.00	0.00
Maximum	2.12	6.55
Count	602	602

Table 14.9 – Descriptive Statistics of Assays within Gneiss and Quartzite

Sampling within Gneiss and Quartzite		
Description	**NI (%)**	**CU (%)**
Arith. Mean	0.04	0.05
W. Mean	0.03	0.04
Median	0.01	0.01
Mode	0.00	0.01
St. Dev.	0.08	0.12
COV	2.28	2.51
Minimum	0.00	0.00
Maximum	0.52	0.92
Count	172	172

14.7 Statistical Analysis by Geological Solid and Compositing

14.7.1 Statistical Analysis by Geological Solid

Assays were also exported by geological solid and used to generated descriptive statistics in order to compare them together and compare them with the descriptive statistics generated by rock code above. The solids considered are the upper and lower pyroxenite of the Main deposit and the pyroxenite of the Extension. Descriptive statistics were also generated for the upper Gabbro even though it was not included in the Mineral Resource Estimate due to its low nickel and copper content. The related statistical tables are presented in Table 14.10 to Table 14.13. The low potential of the upper gabbro is attested by low nickel and copper weighted average. The lower pyroxenite solid appears to be the richer in nickel and copper compared with the upper pyroxenite solid and the main pyroxenite solid.

Table 14.10 – Descriptive Statistics of Assays within the Upper Gabbro Solid

Assays within Upper Gabbro Solid		
Description	**NI (%)**	**CU (%)**
Arith. Mean	0.08	0.06
W. Mean	**0.08**	**0.06**
Median	0.08	0.04
Mode	0.03	0.02
St. Dev.	0.06	0.08
Coefficient of Variation (COV)	0.77	1.33
Minimum	0.02	0.00
Maximum	0.41	0.60
Count	142	142

Table 14.11 – Descriptive Statistics of Assays within the Extension Pyroxenite Solid

Assays within the Extension Pyroxenite Solid		
Description	**NI (%)**	**CU (%)**
Arith. Mean	0.26	0.19
W. Mean	**0.22**	**0.15**
Median	0.18	0.08
Mode	0.16	0.04
St. Dev.	0.29	0.35
COV	1.11	1.86

Assays within the Extension Pyroxenite Solid		
Description	**NI (%)**	**CU (%)**
Minimum	0.00	0.00
Maximum	3.53	6.88
Count	4,275	4,275

Table 14.12 – Descriptive Statistics of Assays within the Main Upper Pyroxenite Solid

Assays within the Main Upper Pyroxenite Solid		
Description	**NI (%)**	**CU (%)**
Arith. Mean	0.26	0.22
W. Mean	**0.23**	**0.19**
Median	0.19	0.13
Mode	0.10	0.06
St. Dev.	0.33	0.35
COV	1.27	1.60
Minimum	0.00	0.00
Maximum	4.99	8.22
Count	5,530	5,529

Table 14.13 – Descriptive Statistics of Assays within the Main Lower Pyroxenite Solid

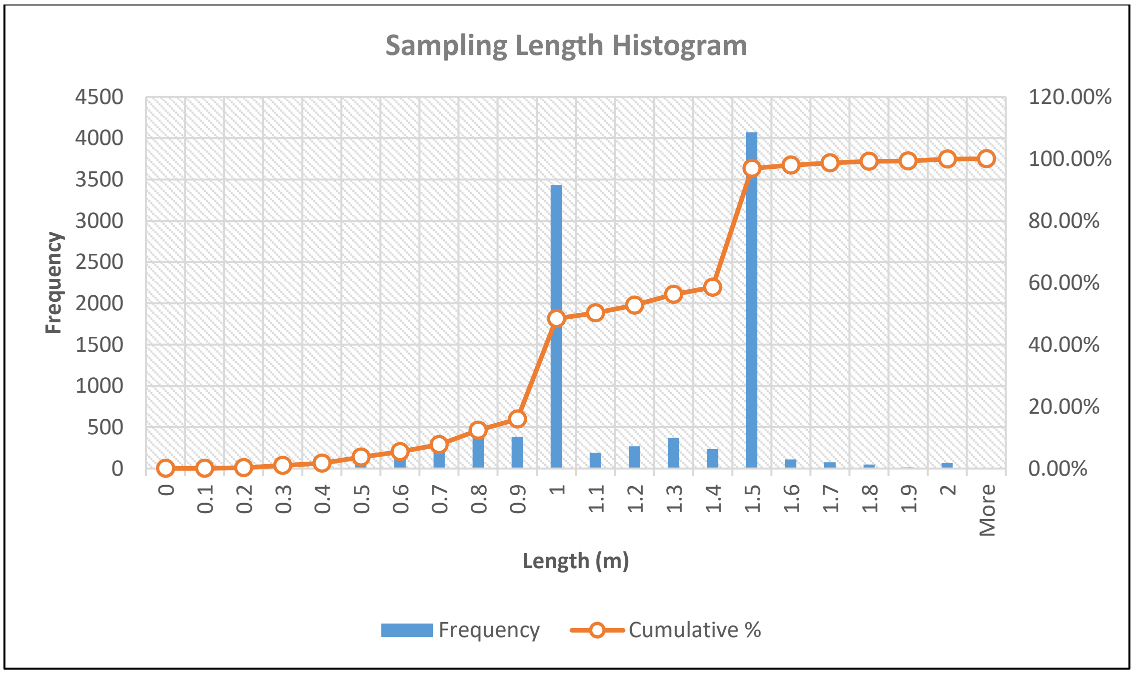
Assays within the Main Lower Pyroxenite Solid		
Description	**NI (%)**	**CU (%)**
Arith. Mean	0.33	0.32
W. Mean	**0.29**	**0.25**
Median	0.24	0.22
Mode	0.22	0.02
St. Dev.	0.32	0.49
COV	0.98	1.56
Minimum	0.00	0.00
Maximum	3.33	6.55
Count	550	550

14.8 Compositing

Considering the variable sampling length used over the different drilling program since 2010 it was necessary to normalise the assaying support prior the mineral resource interpolation. This process is called compositing. The choice of the normalisation length is usually based on statistical analysis of the sampling length.

A histogram of the sampling length of all samples falling within the pyroxenite solids was generated as support for choosing an adequate length for compositing. The related histogram is presented in Figure 14.4. The histogram shows a statistical mode of the sampling length of 1.5 m with a less pronounced mode at 1 m of sampling length. The normal practice is to composite at the statistical mode of the sampling since it will avoid introducing a bias related to samples over splitting.

Figure 14.4 – Sampling Length Histogram



A compositing process should consist in an aggregation process rather than a splitting process. A splitting process will result with introducing a bias since same analytical results are just repeated over lengths which did not reflect the reality of the mineralization. Another fact, that has to be considered, is the statistical behaviour of grade attributes, namely the Coefficient of Variation (COV) which gives an indication of the scattering of the statistical population.

A high COV indicates a population with high scattering. Additionally, to the need to respect lithological contacts through the sampling a population with a scattering may be the reason for controlling the sampling intervals in order to better highlight zones of higher concentration of mineralization versus zones less mineralized. In the case of the Samapleu deposits, there is a combination of massive to disseminated sulphide and changes between these types of mineralization occur on short intervals. Combining these considerations, it was decided to composite all assays to a uniform length of 1.5 m.

A downhole approach was used during the length regularisation process. Figure 14.5 presents a histograms superimposition of nickel histograms for the assays and the 1.5 m composites.

Figure 14.5 – Ni% Histograms for Assays and the 1.5 m Composites

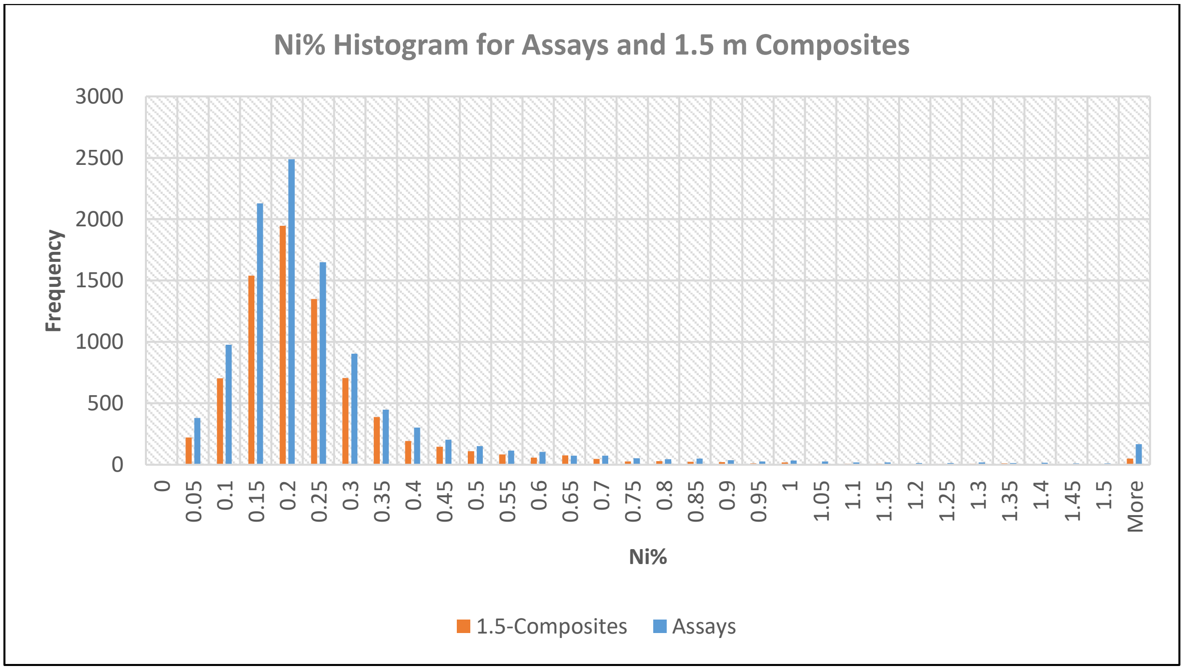


Table 14.14 to Table 14.16 present composites statistics for the main attributes. Comparing the weighted mean of assays for each mineralized solid with the arithmetic mean of composites it could be see that statistics of the main attributes (Nickel and Copper) are preserved after the normalisation process.

Table 14.14 – Descriptive Statistics of Composites within the Main Pyroxenite Solid

Composites within Main Pyroxenite Solid		
Description	**NI (%)**	**CU (%)**
Arith. Mean	**0.23**	**0.15**
Median	0.18	0.08
Mode	0.18	0.04
St. Dev.	0.20	0.22
COV	0.85	1.42

Composites within Main Pyroxenite Solid		
Description	**NI (%)**	**CU (%)**
Minimum	0.00	0.00
Maximum	2.30	2.85
Count	3,048	3,048

Table 14.15 – Descriptive Statistics of Composites within the Upper Pyroxenite Solid

Composites within Upper Pyroxenite Solid		
Description	**NI (%)**	**CU (%)**
Arith. Mean	**0.23**	**0.19**
Median	0.19	0.12
Mode	0.11	0.06
St. Dev.	0.19	0.23
COV	0.85	1.24
Minimum	0.00	0.00
Maximum	3.27	5.35
Count	4,215	4,215

Table 14.16 – Descriptive Statistics of Composites within the Lower Pyroxenite Solid

Composites within Lower Pyroxenite Solid		
Description	**NI (%)**	**CU (%)**
Arith. Mean	**0.28**	**0.25**
Median	0.24	0.17
Mode	0.26	0.02
St. Dev.	0.19	0.26
COV	0.65	1.06
Minimum	0.01	0.01
Maximum	1.34	1.95
Count	440	440

14.9 Variogram Modelling

Variograms were generated by Sama's geologists in order to assess the spatial continuity of the mineralization and ultimately help in the definition of optimal parameters to guide the mineral resource interpolation. Variograms were generated on the nickel attribute from the composite raw data. Tables 14.17 and 14.8 present variogram parameters for Samapleu Main and Extension deposits.

Table 14.17 – Variogram Parameters for Samapleu Main Deposit

Nickel Variogram Parameters for Samapleu Main Deposit						
Attribute	**Direction**	**Nugget**	**C1**	**Range 1** (m)	**C2**	**Range 2** (m)
Nickel	00-120	0.14	0.54	50	0.32	130
	00-065	0.14	0.54	50	0.32	130
	90-000	0.14	0.54	50	0.32	130

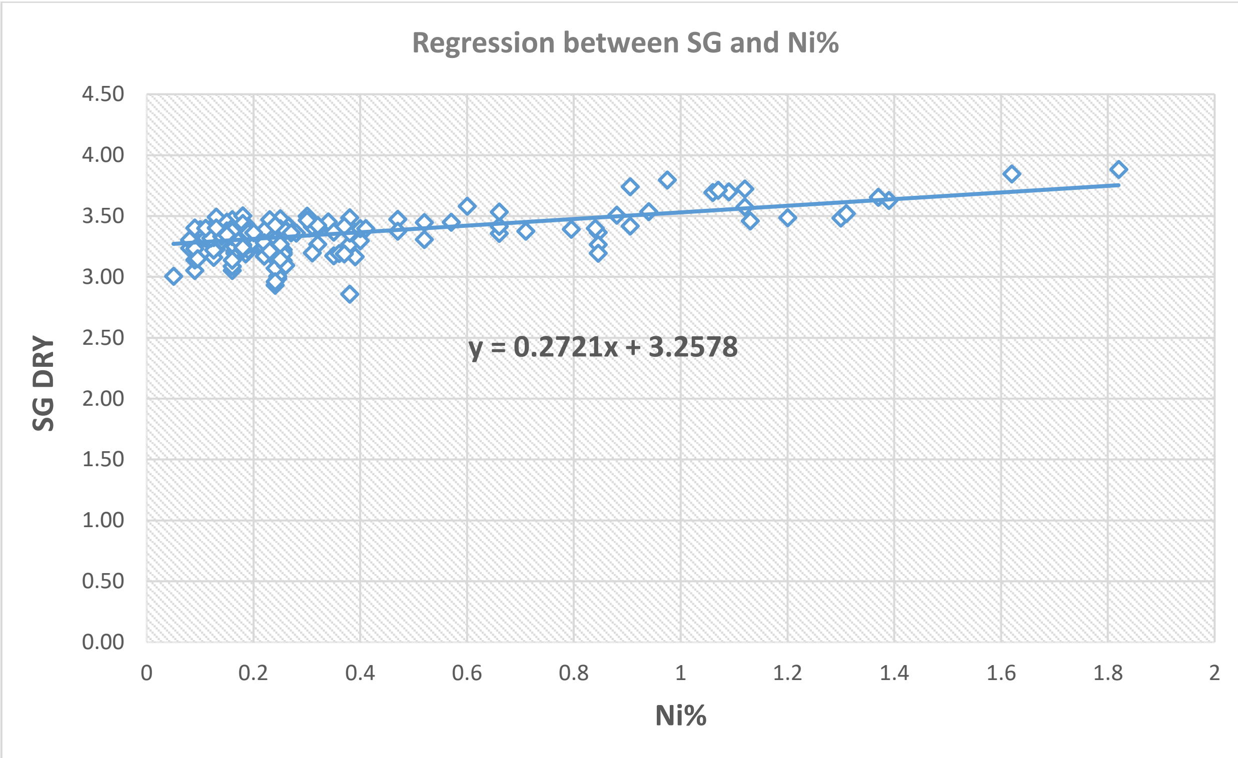
Table 14.18 – Variogram Parameters for Samapleu Extension Deposit

Nickel Variogram Parameters for Samapleu Extension Deposit						
Attribute	**Direction**	**Nugget**	**C1**	**Range 1** (m)	**C2**	**Range 2** (m)
Nickel	00-050	0.07	0.51	50	0.32	100
	00-140	0.07	0.51	63	0.32	100
	90-000	0.07	0.51	31	0.32	76

14.10 Density/Specific Gravity

A regression function was developed between the Specific Gravity (SG) and the nickel content to serve as mathematical support for the conversion of the volume of each block interpolated into a tonnage. The graphical correlation was developed using the results of 211 SG measurements. Since the density is generally correlated with Sulphur content, the use of a regression function appears to be the better way to convert volumes into tonnages than using an average density. The equivalent mathematical function obtained is SG = 0.2721*Ni% + 3.2578 and was implemented within the mineral interpolation module. A graphical representation of the relationship between both variables is presented in Figure 14.6.

Figure 14.6 – Regression Model between SG and Ni%



14.11 Block Model Setup/Parameters

A block model was created using the HxGN MinePlan 3D software package to generate a grid of regular blocks to estimates tonnes and grades attributes. A single block model was created for all mineralized zones. An industry standard is to consider block size in the range of one half (½) to one fourth (¼) of the average drill spacing. Block size is a particularly sensitive parameter for estimates that are based on geostatistical methods such as Kriging (Ordinary Kriging, Simple Kriging, Indicators Kriging, etc.).

In this case, the Kriging Variance of a selected block, which is interpreted as an indicator of a confidence level of the estimate, is intimately related to the distance of the centre of that block to the composites used for its interpolation. The smaller the blocks, the higher the Kriging Variance will be. Furthermore, even for estimates that are not based on geostatistical approaches such as Inverse Distance Method ("IDW"), a too small block size would lead to estimates that do not reflect the drilling density and the reality of the mineralization.

Drilling spacing are tighter for the Samapleu Main deposit than for the Samapleu Extension deposit. Sama's geologists have recommended the use of the block size of 5 m * 8 m * 2 m respectively in the X, Y, and Z direction to better account for an eventual use of small mining equipment during mining.

Although a such block size appears a little bit too small given the main drilling spacing of about 25 m on the Main deposit and 40 m on the Extension deposit, the author has elected to consider the blocks size proposed by Sama's geologists. This is motivated by the fact that interpolation simulations conducted by the author using different block sizes have not led to considerable differences on the results. Table 14.19 displays the block model parameters.

Table 14.19 – Samapleu – Blocks Model Parameters

Direction	Minimum (UTM)	Maximum (UTM)	Block Size	Number of Blocks	Model Origin (UTM)
Easting (X)	618,500	621,000	5	500	618,500
Northing (Y)	856,000	858,500	5	500	856,000
Elevation (Z)	-120	680	2	400	680
Rotation	N/A	N/A	N/A	N/A	N/A

14.12 Mineral Resources Interpolation

The mineral resources of the Samapleu deposits were interpolated using Ordinary Kriging (OK) as estimation approach. Block discretization used is 2*2*2.

Three (3) successive interpolation passes were used to inform the block model in the Samapleu Main deposit. In the first pass the search ellipse was set equal to 75 m × 30 m × 15 m. The maximum and minimum numbers of composites were respectively set to 15 and 9, while the maximum number of composites allowed for a single hole was fixed equal to 3. Consequently, the combination of these constraints dictates that at least three (3) different holes are required to allow a block to be interpolated during that pass.

In the second pass the search ellipse was kept same than in the initial pass (75 m × 75 m × 15 m) but the maximum and minimum numbers of composites were respectively set to 15 and 6, while the maximum number of composites allowed for a single hole was kept same. As consequences the search ellipse remains unchanged but at hole two (2) holes are required to allow a block to be interpolated during that pass. During the third pass of the Main deposit the search ellipse was kept at the same size and the minimum number of composites to allow a block to be coded was reduced to three (3). As consequence at least one (1) hole is required to allow a block to be interpolated during that pass.

Three (3) successive passes were also been used to interpolation on the Extension deposit. In the first pass the search ellipse was set equal to 100 m × 50 m × 15 m. The maximum and minimum numbers of composites were respectively set to 15 and 9, while the maximum number of composites allowed for a single hole was fixed equal to 3. Consequently, the combination of these constraints dictates that at least three (3) different holes are required to allow a block to be interpolated during that pass.

In the second pass the search ellipse was kept same than in the initial pass (100 m × 50 m × 15 m) but the maximum and minimum numbers of composites were respectively set to 15 and 6, while the maximum number of composites allowed for a single hole was kept same. As consequences the search ellipse remains unchanged but at hole two (2) holes are required to allow a block to be interpolated during that pass.

During the third pass of the Main deposit the search ellipse was kept at the same size and the minimum number of composites to allow a block to be coded was reduced to three (3). As consequence at least one (1) hole is required to allow a block to be interpolated during that pass.

The interpolation parameters are summarised in Table 14.20 for the Main deposit and Table 14.21 for the Extension Deposit.

Table 14.20 – Interpolation Parameters for the Main Deposit

Items	Description		
Grade Interpolation Method	Ordinary Kriging (OK)		
Compositing	By fixed length of 1.5 m		
High Values Capping	Not applicable		
Ellipse Orientation	335ROT, 0DIPN, -45DIPE		
Interpolation Pass	**Pass 1**	**Pass 2**	**Pass 3**
Min. Number of Composites/Block	9	6	3
Max. Number of Composites/Block	15	15	15
Max. Number of Composites/Hole	3	3	3
Ellipse Size on the Major Axis (Strike)	75	75	75
Ellipse Size on the Semi-Major Axis (Dip)	75	75	75
Ellipse Size on the Minor Axis	15	15	15

Table 14.21 – Interpolation Parameters for the Extension Deposit

Items	Description		
Grade Interpolation Method	Ordinary Kriging (OK)		
Compositing	By fixed length of 1.5 m		
High Values Capping	Not applicable		
Ellipse Orientation	45ROT, 0DIPN, 45DIPE		
Interpolation Pass	**Pass 1**	**Pass 2**	**Pass 3**
Min. Number of Composites/Block	9	6	3
Max. Number of Composites/Block	15	15	15

Items	Description		
Max. Number of Composites/Hole	3	3	3
Ellipse Size on the Major Axis (Strike)	100	100	100
Ellipse Size on the Semi-Major Axis (Dip)	50	50	50
Ellipse Size on the Minor Axis	15	15	15

14.13 Mineral Resources Validation

The first step in the validation of the estimated Mineral Resources is a visual comparison of estimated grades attributes, the output of the resource model, with grades attributes from the composites that are the input of the resource model. Comparisons were done both on the a 2D (sections) basis and on a 3D basis. Figures 14.7 and 14.8 show typical 2D sections with a superimposition of composites grades and block model grades.

Figure 14.7 – Typical Section with Blocks and Composites Grades (Section 619 892E)

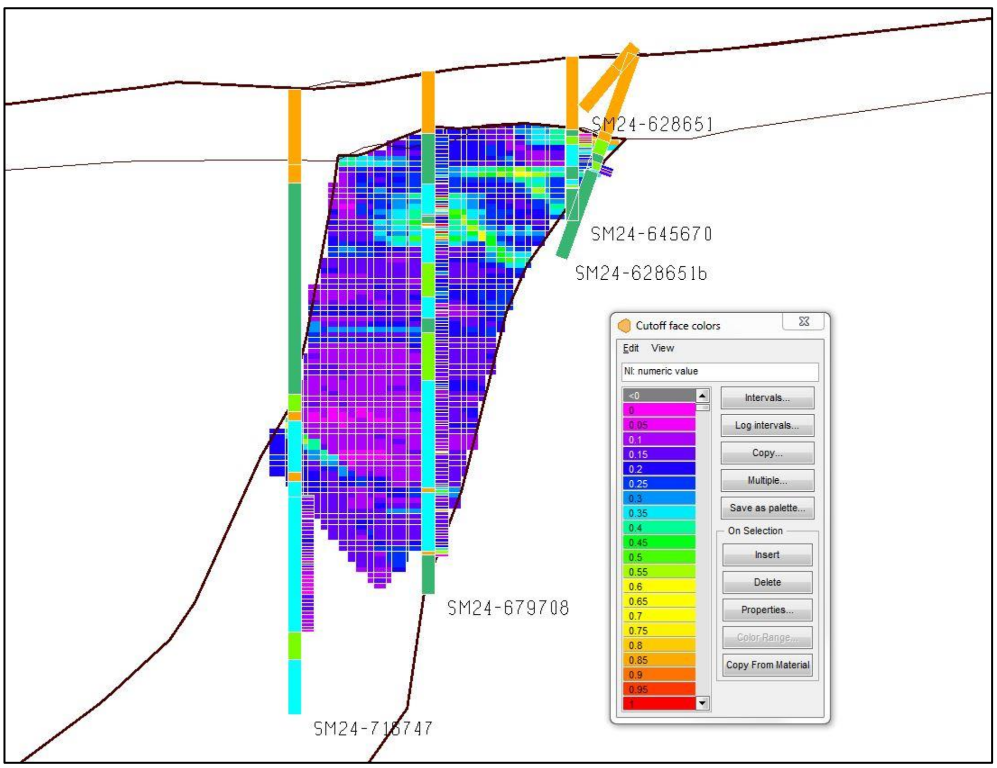
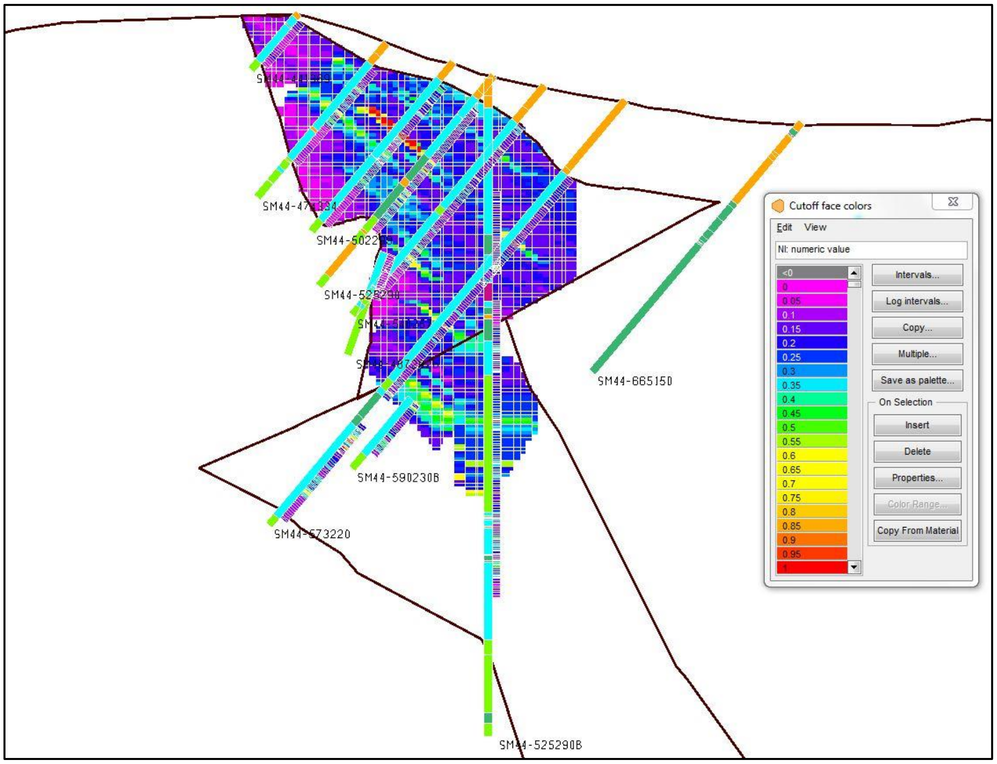


Figure 14.8 – Typical Section with Blocks and Composites Grades (Section 619 736E)



Figures 14.9 and 14.10 illustrate isometric 3D views of the block model and a 3D representation of the composites set used to inform the blocks during the estimation. The correlation is generally good between the composites and blocks grades. A further validation process consisted in the generation of basic descriptive statistics of blocks that are compared with the statistics of the composites set (Table 14.22). Composites show similar descriptive statistics than assays and the general patterns of composites are also preserved in the block model output at the difference of a small smoothing introduced in the block model by the interpolation methodology used in the estimate. Ordinary Kriging (OK) is known as a geostatistical estimation approach introducing a smoothing in the estimates. This could be considered as conservative.

Figure 14.9 – 3D view of the Block Model

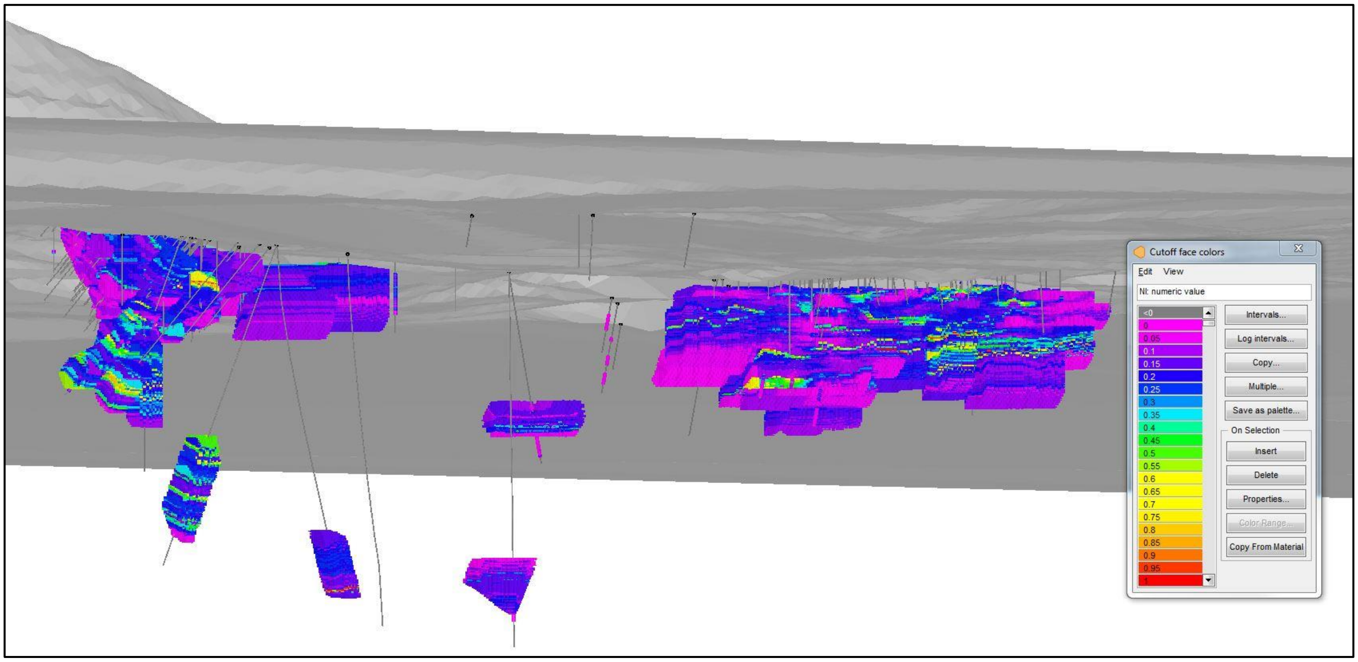


Figure 14.10 – 3D view of the Composites Set

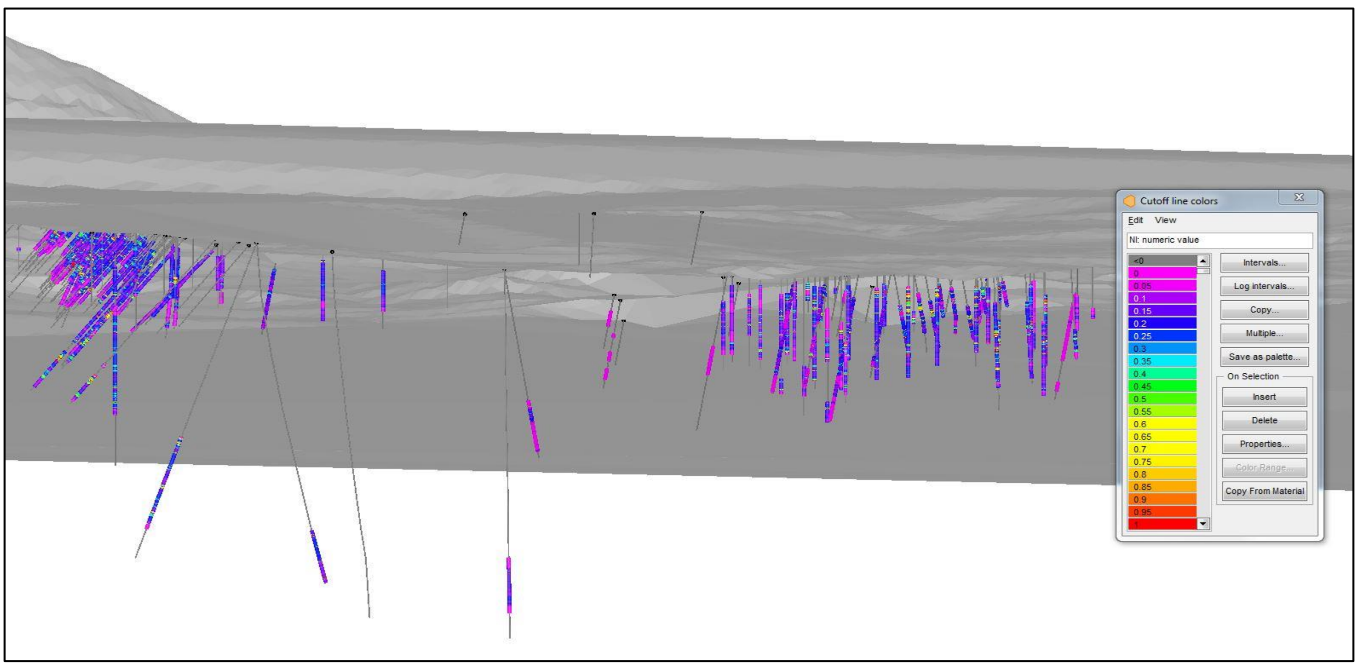


Table 14.22 – Nickel and Copper Comparison for Assays, Composites and Blocks

Description	Parameter	Ni (%)	Cu (%)
ASSAYS	W. Average	0.23	0.17
	St. Dev.	0.32	0.36
	COV	1.37	2.07
	Minimum	0.00	0.00
	Maximum	4.99	8.22
	Samples Count	10,355	
COMPOSITES	Average	0.23	0.17
	St. Dev.	0.19	0.23
	COV	0.84	1.29
	Minimum	0.00	0.00
	Maximum	3.27	5.35
	Samples Count	7,703	
BLOCKS	Average	0.21	0.15
	St. Dev.	0.12	0.15
	COV	0.57	1.00
	Minimum	0.00	0.00
	Maximum	2.36	3.55
	Samples Count	441,862	

14.14 Resource Classification

Mineral Resource classification is based on confidence and continuity of geology and grades, in most cases is related to the drilling density. Areas that are more densely drilled are usually better known and understood than areas with sparser drilling which could be considered to have a lower confidence level. However, in some rare cases, even a tight drill pattern may not allow for certainty on grades and geological continuity. This is particularly true in the case of deposits that show high variability on grades and high nugget effect.

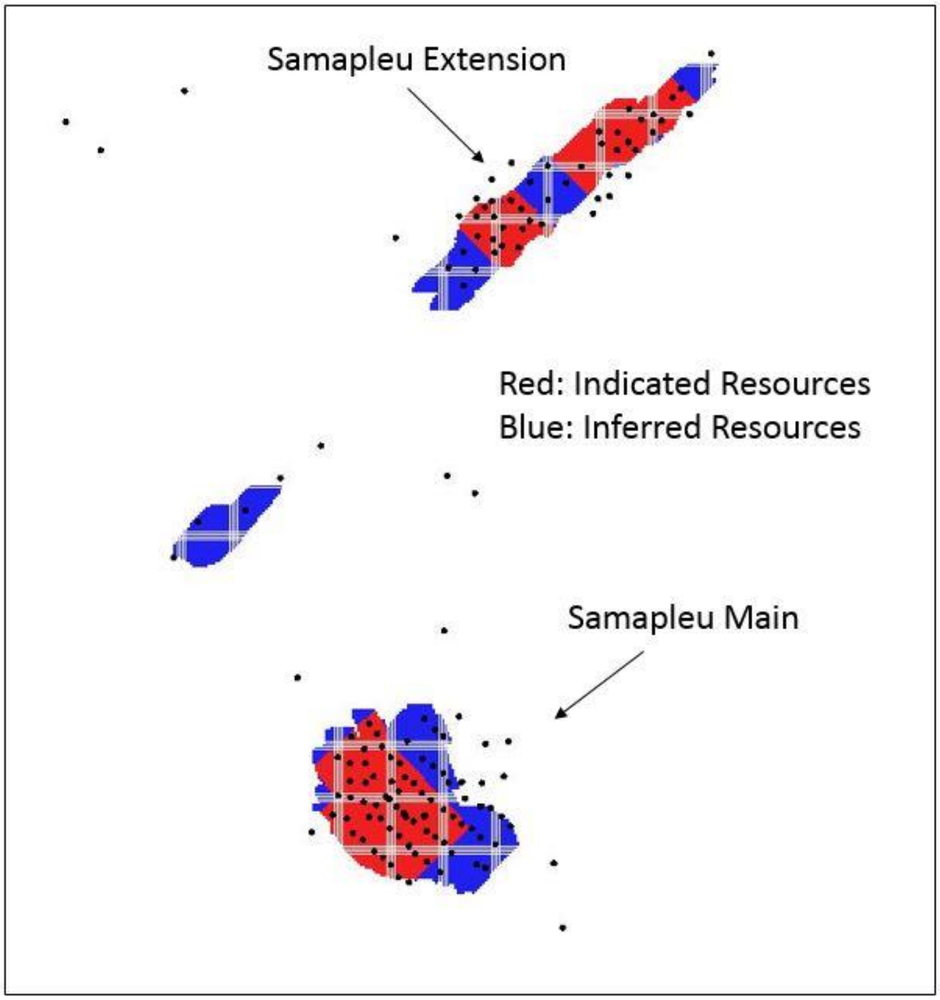
The author has considered the following factors for the Mineral Resources classification of the Samapleu Nickel and Copper deposits:

- The existence of previous Mineral Resource Estimates on the Samapleu property and the latest was the estimate of December 2012;
- The existence of Fault system separating an Upper and Lower domain on Samapleu Main deposit;

- The addition of fifty-two (52) new drill holes since the last estimate and the objective of the most part of these holes was too tight, the drilling spacing and upgrade part of the previous;
- The professionalism of Sama's exploration team and the implementation of a rigorous QA/QC internal procedures.

Taking all these factors into account, the author found it appropriate to upgrade all previous Inferred areas where new drill holes were added into Indicated Category. Previous Indicated Resources were kept same, and no Measured Resources were classified during this Mineral Resources Estimate. Figure 14.11 shows a representation of classified blocks in the Categories of Inferred and Indicated Mineral Resources.

Figure 14.11 – Mineral Resources Classification



14.15 Mineral Resources Statement

Under CIM definition standards, Mineral Resources should have a reasonable prospect of eventual economic extraction. In order to determine the mineralization zones that can be potentially mined economically an optimised pit shell was developed using the Lerchs-Grossman (LG) algorithm implemented in HxGN MinePlan 3D.

The Mineral Resources Estimate for the Samapleu Nickel and Copper deposits contains, at a Nickel Equivalent (NiEq = Ni + 0.167*Cu) Cut-Off Grade (COG) of 0.1%, 33.18 Mt of Indicated Mineral Resources at an average of 0.27% NiEq and 0.24% Ni and 17.78 Mt of Inferred Mineral Resources at an average of 0.25% NiEq and 0.22% Ni. The effective date of the Mineral Resources is October 26, 2018 which corresponds to the date of reception of the drill hole database from Sama.

Table 14.23 presents a summary of the Mineral Resources.

Table 14.23 – Summary of the Mineral Resources (COG of 0.1% NiEq)

Category	**Resources** (Mt)	**NiEq** (%)	**Ni** (%)
Measured [1,2,3]	-	-	-
Indicated [1,2,3]	33.18	0.269	0.238
Meas. + Ind.	**33.18**	**0.269**	**0.238**
Inferred [1,2,3,4]	17.78	0.248	0.224

1. Mineral Resources are exclusive of Mineral Reserves
2. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. There is no certainty that all or any part of the Mineral Resources estimated will be converted into Mineral Reserves. The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues
3. The CIM definitions were followed for the classification of Indicated, and Inferred Mineral Resources.
4. The quantity and grade of reported Inferred Resources in this estimation are uncertain in nature and there has been insufficient exploration to define these Inferred Resources as an Indicated or Measured Mineral Resource. It is reasonably expected that a portion of Inferred Mineral Resources could be upgraded with continued exploration.
5. Pit shell defined using 52-degree pit slope, copper concentrate price of $2.1/lb and nickel powder price of $13.5/lb, $3/t mining costs, $15/t of processing and G&A costs, and a resulting cut-off grade of 0.1% NiEq.

15 MINERAL RESERVES ESTIMATE

This Report is a PEA Report, and as such, no Mineral Reserves have been estimated for the Samapleu Project, as per NI 43-101 regulations.

16 MINING METHOD

The mining method selected for the Project is a conventional open pit operation with off-highway haul trucks, hydraulic excavators, and wheel loaders.

The Project consists of three (3) separate pits (Pit A, Pit B, and Pit C) with one (1) waste dump designed close by to reduce haulage distance.

The mineralised material and waste rock will be loaded into off-highway haul trucks with excavators and/or wheel loader.

This material will be hauled from the pits to the different destinations as follow:

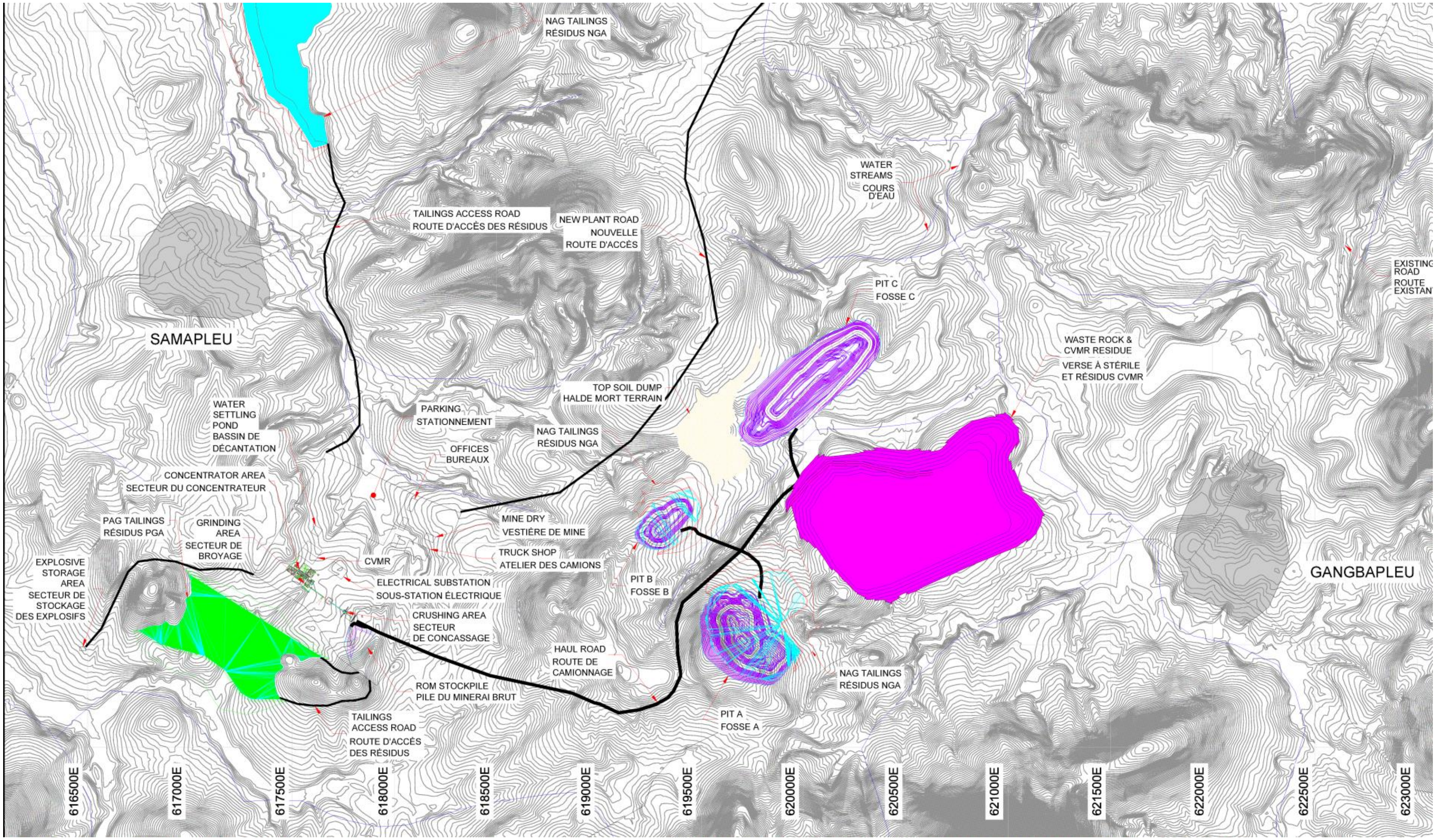
Table 16.1 – Haulage Distance (Average)

Source	**Destination (Km)**	
	To Primary Crusher	To Waste Dump
Pit A	3.06	1.24
Pit B	3.12	1.29
Pit C	3.82	1.10

To properly manage water infiltration into the pits, sumps will be established at the lowest point of each pit floor. Water collected in the sumps will be pumped to a collection point at surface.

Figure 16.1 illustrates the three (3) pits, one (1) waste dump and plant location.

Figure 16.1 – Mine Site Layout



16.1 Pit Optimisation

Open-pit optimisation was conducted on the deposit to determine the economic pit limits. The optimisation was carried out during the initial stage of the Project using initial cost, sales price, and pit and plant operating parameters. The pit optimisation was re-evaluated after a preliminary mine plan was completed, and the cost, sales price, and pit and plant operating parameters were better defined.

The pit optimisation was done using GEOVIA Whittle® software. The optimiser operates on a net value calculation for all the blocks in the model (i.e., revenue from sales of products less operating cost). The formula is presented below:

- Products Tonnage = Mineralised Tonnage x Recovery x Grade of Feed / Concentrate Grade.
- Revenue =Products Tonnage x Sales Price.
- Net Value = Revenue – (Mining Cost + Processing Cost + Transportation Cost + General & Administration Cost).

Since this study is at a PEA level, Measured, Indicated, and Inferred material have been considered in the optimisation and mine plan. Table 16.2 presents the pit optimisation parameters.

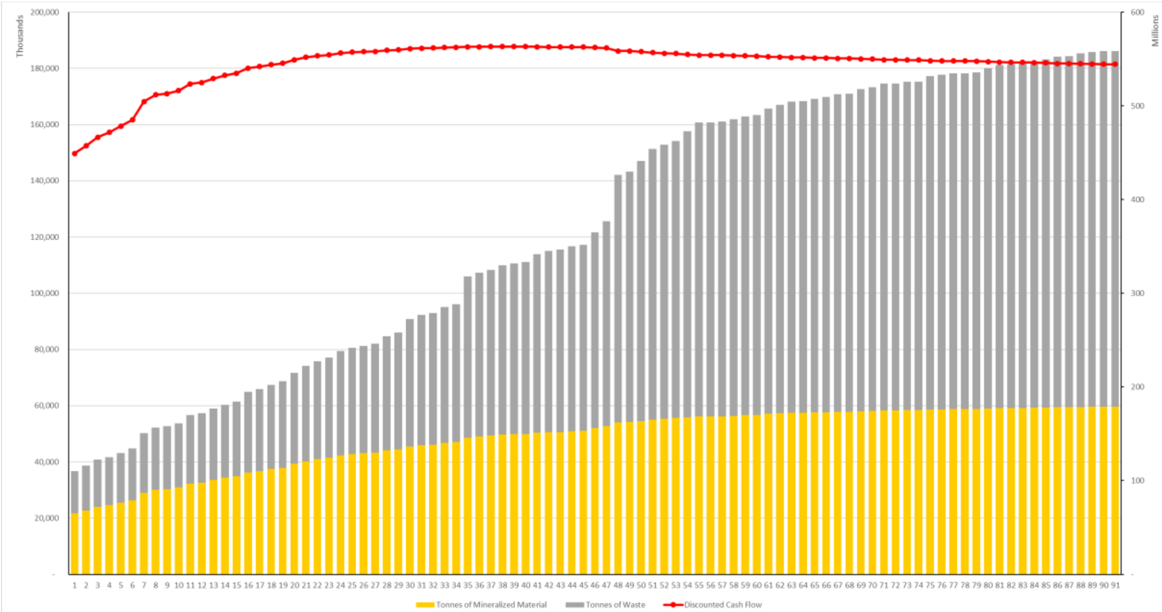
Table 16.2 – Pit Optimisation Parameters

Description	Units	Value
Mining cost	$US/t	3
Processing cost	$US/t	18
G&A cost	$US/t	2.3
Nickel Powder price	$US/lb	13.50
Copper Concentrate price	$US/lb	2.1
Nickel Concentrate Recovery	%	70.0
Copper Concentrate Recovery	%	85.0
Nickel Powder Recovery	%	99.2
CVMR Royalty (only on Ni powder Premium Price)	%	15
Overall Pit Slope	%	52

16.1.1 Pit Optimisation Results

Optimal open pit mining limits were established using GEOVIA Whittle®, which uses the Lerchs-Grossman algorithm for pit optimisation. The Net Present Value (NPV) sensitivity analysis was used as the main criterion to select the optimal pit. (Figure 16.2), NPV increases gradually until price reaches 0.13% Cut-off Grade (COG) NiEq (Pit 42). From this point on, NPV decreases slightly because the costs associated to waste production exceed profits generated from products sales

Figure 16.2 – NPV Sensitivity Analysis



16.1.2 Cut-Off Grade

Using the economic parameters presented above, a COG of 0.13% NiEq was calculated for the Project. The COG is used to determine whether the material being mined will generate a profit after paying for the processing, transportation, and administrative costs. Material that is mined below the COG is sent to the waste dump. The COG has been calculated according to the following formula:

$$COG = Products\ grade * \left(\frac{Mining\ cost + Procesing\ cost + G\&A}{(Sales\ Price - Transport\ Cost) * Mill\ Recovery}\right)$$

16.1.3 Recovery and Dilution

In every mining operation, it is impossible to perfectly separate the mineralisation and waste as a result of the large scale of the mining equipment and the use of drilling and blasting equipment. In order to account for this, DRA/Met-Chem assumes a mining recovery of 95%, in other words, 5% of the mineralised material is considered waste since this deposit is clearly defined given the contact between waste and zones containing mineral resources.

16.1.4 Material Properties

Table 16.3 defines the material properties used for the mine design and mine plan. The densities for the mineralization and waste rock were supplied by Sama with the block model while the remaining parameters were taken from DRA/Met-Chem's internal database. These properties are important to determine the mine equipment fleet requirement and dumps capacity. It has been assumed the density value for overburden material to be 2.5 t/m^3.

Table 16.3 – Material Properties

Material Type	**Dry Density** (t/m³)	**Moisture Content** (%)	**Wet Density** (t/m³)	**Swell Factor** (lcm/bcm)
Overburden	2.5*	5	2.63	1.35
Rock waste and mineralised material	3.2	5	3.44	1.35

*assume

16.2 Mining Operations

Samapleu mineralised material, contained into three (3) pits, are intended to be mined by surface operations. It is estimated that approximately 44.42 Mt of mineralised material is extractable over a 20-year mine life.

The mine will operate year-round, seven (7) days per week, twenty-four (24) hours per day (2 shifts, 12 hours each). Since the mill will operate seven (7) days per week, a run of mine stockpile will be maintained to provide a constant supply of feed to the crusher with a minimum of one (1) month of production capacity. During the days when the mine is not operating (for technical or weather reasons), the crusher will be fed by the front-end loader from the stockpile or with a production truck. The mine fleet requirements and manpower are based on this work schedule.

The total mineable mineralised material for each pit is summarised in Table 16.4, as well as the waste quantities for the different pits and the stripping ratios.

Table 16.4 – Mineable Mineralisation Material by Pit

Pit	Indicated			Inferred			Waste	S/R
	Mt	NiEq	Ni	Mt	NiEq	Ni	Mt	
A	16.21	0.278	0.243	6.98	0.256	0.231	15.85	0.68
B	-	-	-	2.43	0.231	0.211	3.65	1.50
C	12.35	0.290	0.260	6.45	0.269	0.243	32.35	1.72
Total	**28.56**	**0.283**	**0.250**	**15.86**	**0.257**	**0.233**	**51.84**	**1.17**

due to rounding errors, totals may not add-up exactly.

16.3 Mine Design

DRA/Met-Chem designed a pit that results in a 20-year mine life for the Project. The following section provides the parameters that were used for the detailed pit design.

16.3.1 Pit Design

Table 16.5 presents a general summary of the surface, maximum width, length, depth and roughly area for each of the three (3) pits designed for the Samapleu.

Table 16.5 – Pit Dimension

Pit	Length	Width	Depth	Surface
	(m)	(m)	(m)	(ha)
A	525	365	232	15.49
B	325	192	106	4.58
C	843	310	190	20.76

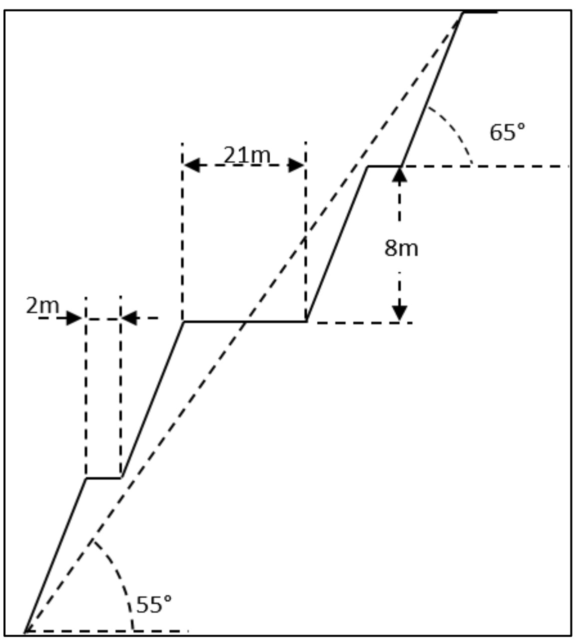
Pit design was made following geotechnical pit slope parameters and hauling road design detailed in the following points.

16.3.1.1 Geotechnical Pit Slope Parameters

Mine Design Engineering (MDEng) issued a scoping level review summarised in the Report #18022-104 Feasibility level site characterisation, Geotechnical Scoping Study for Samapleu Ni-Cu-PGE project, dated March 21, 2019.

Based on MDEng's recommendations for bench slopes, DRA/Met-Chem used a high wall slope within the unweather rock of 55° for the final pit walls. The recommended bench heights of 8m and a bench face angle (BFA) of 65°. The pit wall configuration is illustrated in Figure 16.3.

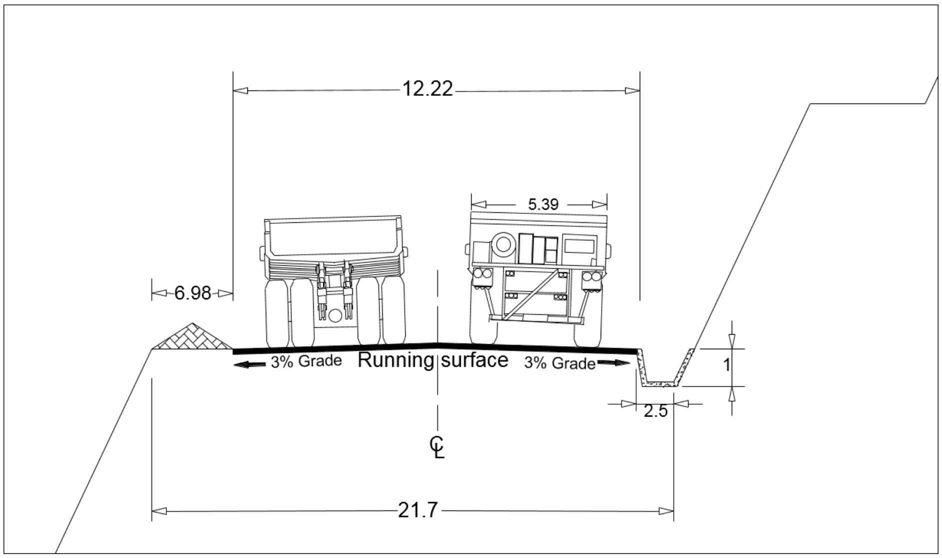
Figure 16.3 – Pit Wall Configuration



16.3.1.2 *Haul Road Design*

The ramps and haul roads were designed with an overall width of 21.7 m. For double lane traffic (Figure 16.4), industry practice indicates the running surface width to be a minimum of 2.5 times the width of the largest truck. The overall width of a 55-tonne off-highway haul truck is 5.39 m which results in a running surface of 12.22 m. The allowance for berms and ditches increases the overall haul road width to 21.7 m. A maximum ramp grade of ten (10) % was used.

Figure 16.4 – Double Lane Ramp Design



16.3.2 DUMP DESIGN

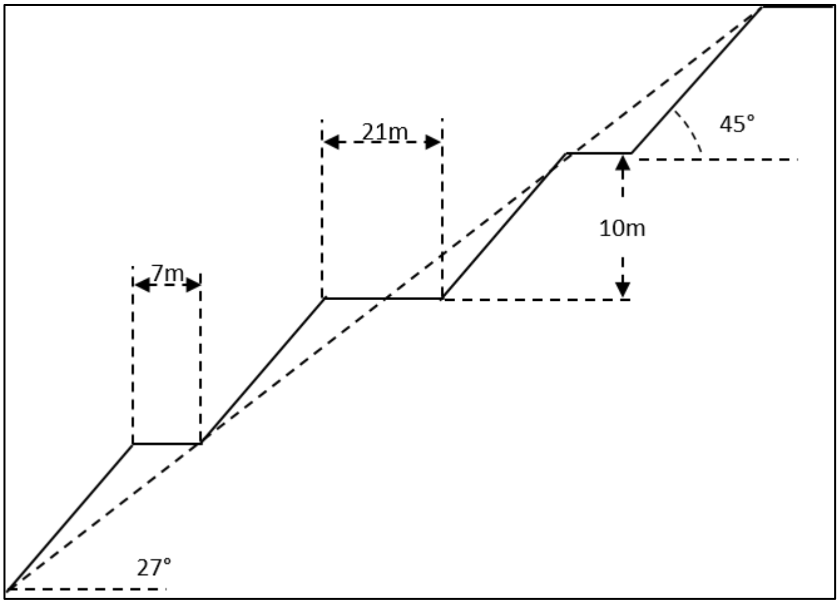
A waste dump close from pits have been planned for allocated all the waste material below COG. The total capacity is summarised as follows:

Table 16.6 – Waste Dump Capacity

Dump No.	Capacity (Mm³)
1	24.67

Based on similar studies, an overall slope angle (OSA) of 27° with bench heights of 10 m, from an operational point of view DRA/Met-Chem used 10 m bench heights. Figure 16.5 presents an OSA of 27° for the final slope angle for the dump.

Figure 16.5 – Wall Configuration – Dump



16.4 Mine Planning

The mine planning was established using MinePlan™ Schedule Optimizer (MSSO). This tool determines the most productive cut mining sequence and the optimum schedule requirements to achieve the highest Net Present Value (NPV) and practical schedules.

MSSO requires setup objectives, constraints and economic parameters for each period and subsequently performs multiple interactions until get satisfactory results. MSSO also handles the waste dump and Stockpile sequence. MS Haulage was also used to perform truck haulage cycle time estimates.

The MSSO schedule developed for the Samapleu Preliminary Economic Assessment Study was done with the goal of optimising the NPV of the operation within the range of constraints determined in the scheduling software.

A production schedule (mine plan) was developed for the Project to produce 39,960 tonnes of nickel concentrate per year. Using a variable mill recovery from 70.00% a targeted concentrate grade of 10% results in an average run of mine feed of 2.3 Mt per year (6,508 t/d) at an average diluted grade of 0.244% Ni.

A year of pre-production phase has been planned to achieve the following objectives:

- Clear vegetation and topsoil;
- Supply road construction material;
- Supply construction material for the tailings dyke;

- Strip overburden and waste rock to expose the mineralisation.

The schedule produces 27,972 tonnes of concentrate in the first year of production which accounts for a plant ramp-up. The mine plan has been developed by advancing several benches concurrently. An average of 13,743 tonnes of material will be mined each day during the 20-year mine life. The mine production schedule is presented in Table 16.8.

16.5 Mine Equipment Fleet

The mine will be operated with an owner fleet. Table 16.7 presents the mine equipment fleet that is required for the Project.

Table 16.7 – Mine Equipment Fleet

Equipment	Model	Description	Qty
Haul Truck	HD465-7	55t	4[1]
Shovel	R9100	7.5 m^3	2[1]
Track Dozer	PR754	8.9 m^3	2
Production Drill	DM30II	5-1/2" to 7,7/8"	2
Road Grader	GD705-5	14'	1
Wheel Loader	WA600-6R	6.4 m^3	1
Boom Truck[2]	CT660	354kW	1
Pick-up Truck	Hilux	-	4
Lighting plant	MLT3080	6kW	2

1. Average.
2. The boom truck will be equipped with a water tank to spray the roads for dust suppression

Table 16.8 – Mine Production Schedule

Description	Units	Pre-Prod	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11-15	Year 16-20	Total
CONCENTRATE	kt	0	28	40	40	40	40	40	40	40	40	40	200	172	**759**
% full production	%		70%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	96%	
TOTAL ROM to Plant	kt	0	1,417	2,221	2,369	2,359	2,399	2,340	2,359	2,046	2,204	2,321	12,686	9,698	**44,417**
Ni	%	0	0.282	0.257	0.241	0.242	0.238	0.244	0.242	0.279	0.259	0.246	0.225	0.253	**0.244**
Cu	%	0	0.261	0.205	0.184	0.221	0.167	0.185	0.157	0.222	0.218	0.196	0.156	0.155	**0.177**
Fe	%	0.00	12.87	12.78	12.57	12.08	11.44	11.93	11.60	12.20	12.09	12.06	11.53	11.66	**11.86**
Material to Stockpile	kt	324	0	0	0	0	0	0	0	0	0	0	0	0	**324**
Ni	%	0.209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.209**
Cu	%	0.220	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.220**
Fe	%	12.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**12.59**
Total Waste	kt	2,462	2,356	1,962	2,268	2,837	2,978	3,067	3,054	3,107	2,816	2,825	13,972	8,135	**51,838**
Waste Rock	kt	1,697	1,368	829	968	1,572	1,646	947	600	974	1,109	1,560	11,857	7,465	**32,593**
Overburden - Mine	kt	765	988	1,133	1,299	1,265	1,332	2,120	2,454	2,133	1,707	1,265	2,115	670	**19,246**
Total Material Moved	kt	2,786	3,773	4,183	4,636	5,196	5,377	5,407	5,413	5,153	5,020	5,146	26,657	17,833	**96,579**
Stripping Ratio		n/a	1.66	0.88	0.96	1.20	1.24	1.31	1.29	1.52	1.28	1.22	1.10	0.84	**1.17**

16.5.1 HAUL TRUCK

The haul truck selected for the Project is an articulated off-highway truck with a nominal payload of 55 tonnes. This size truck was selected since it matches well with the production requirements and offers the durability that is required for a mining operation. The following parameters were used to calculate the number of trucks required to carry out the mine plan. These parameters result in 5,038 working hours per year for each truck.

- Mechanical Availability – 85%;
- Utilisation – 90%;
- Nominal Payload – 55 tonnes (34.2 m^3 heaped);
- Shift Schedule – Two (2), twelve (12) hour shift per day, seven (7) days per week;
- Operational Delays – 55 min/shift (this includes 10 minutes for equipment inspection and 60 minutes for lunch and coffee breaks. Refueling will do during breaks or at the end of the shift;
- Job Efficiency – 90%;
- Rolling Resistance – 3%.

Haul productivities (tonne per work hour) were calculated for each haul route using the truck payload and cycle time. The load time is calculated using a shovel with a 6.7 m^3 bucket as the loading unit. This shovel, which is discussed in the following section, loads a 55-tonne haul truck in four (4) passes.

16.5.2 SHOVELS AND LOADERS

The main loading machine selected for the Project is a shovel with a 6.7 m^3 bucket. This size loader is a good match for a 55-tonne haul truck and is a suitable loader to handle the production requirements and the face heights expected. Although two shovels are sufficient to mine the tonnages presented in the mine plan, a wheel loader will be used to manage the stockpile re-handling and as a backup machine. The wheel loader is used as main loader equipment during Pre-Production period.

16.6 Manpower Requirements

The mine workforce for the project is 115 employees. The total number of employees is divided into 4 crews. The operators will be versatile employees, so they can operate all types of equipment.

17 RECOVERY METHODS

17.1 Mineral Processing Plant

The mineral processing plant consists of a crushing area and a concentrator where comminution, beneficiation, desulphurisation, dewatering, and product load out take place.

The process is designed to produce 118 dry metric tonnes per day of nickel concentrate at 10.34% Ni grade, from ore containing 0.24%Ni. Copper concentrate will also be produced as a saleable product. To achieve this concentrate target, the process flowsheet includes crushing, grinding, rougher flotation, and cleaner flotation. The back end of the concentrator includes tailings and concentrate thickening, concentrate filtration, and material handling.

The Potential Acid Generating tailings from the concentrator will be filtered by a filter press and stacked outside the concentrator area. The Non-Acid Generating tailings from the concentrator will be thickened and pumped to the tailings pond. Reclaiming water from the tailings pond has been considered in the process design to minimise fresh water make-up to the concentrator.

The nickel and copper concentrates will be recovered by a conventional flotation process. The beneficiation process has a global nickel recovery of 73.04%, 71.08% recovered in the nickel concentrate at a grade of 10.34% Ni. The overall copper recovery of 92.31%, 80.00% recovered in the copper concentrate at a grade of 23.00% Cu. The nickel concentrate will be filtered to 10% moisture content and fed to a CVMR process on-site for the production of ferro-nickel powders. The copper concentrate will be filtered to 8% moisture content and loaded into concentrate containers for periodic transport to port. Tailings containing Potential Acid Generating (PAG) content will be filtered to 12% moisture content and dry stacked on-site.

17.1.1 Key Process Design Criteria

The design of the processing plant will target production of high-grade copper and nickel concentrate. All nominal throughput rates are based on the nominal production of 118 dry metric tonnes per day of nickel concentrate at 10.34% Ni grade. These figures are based on past and current test work and may change according to ore composition.

The crushing plant and the concentrator will operate 24 hours per day, seven (7) days per week, 52 weeks per year. The crushing plant will operate at 68.5% run-time. The concentrator run-time is 91.2%, typical for sulphide processing facility operations, resulting in 333 days of net operation at the concentrator.

Concentrator feed throughput has been established at an average rate of 7,264 dry tonnes per day or a nominal throughput rate of 303 dry metric tonnes of material per hour. Table 17.1 summarises the design basis for the processing plant.

Table 17.1 – Processing Plant Key Design Criteria

Parameter	Unit	Value
Nominal ore processing rate	Dry tonnes per year	2,418,886
Crusher run-time	%	68.50
Nominal crushing rate	Wet tonnes per hour	424.32
Concentrator run-time	%	91.20
Nominal grinding rate	Dry tonnes per hour	302.66
Nominal nickel concentrate production rate	Dry tonnes per day	117.87
Final nickel concentrate grade	%	10.34
Nickel recovery to Nickel Concentrate	%	71.08
Nominal copper concentrate production rate	Dry tonnes per day	45.48
Final copper concentrate grade	%	23.00
Copper recovery to Copper Concentrate	%	80.00

17.1.2 Flow Sheet and Process Description

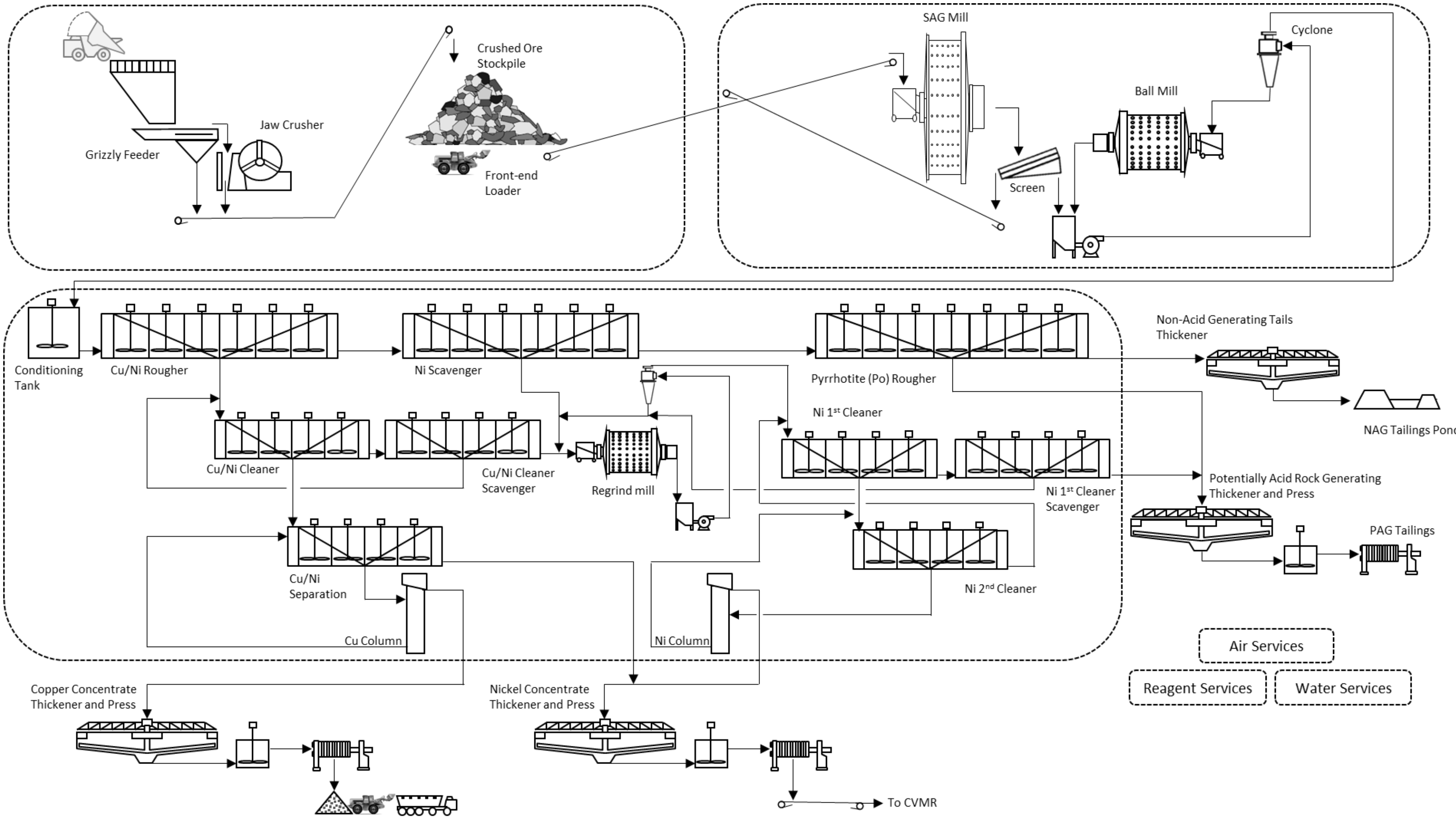
A simplified process flow sheet (Figure 17.1) summarises process flow routings within the major circuits of the processing plant.

The processing plant includes the following major areas:

- A crusher and crushed material storage that will provide crushed material to the downstream concentrator;
- A concentrator that will include grinding, conventional rougher and cleaner flotation for the production of concentrates, and conventional rougher and scavenger flotation for the desulphurisation of tailings;
- A concentrate dewatering area that will consist of thickening, filtration, handling, and loading;
- A tailings dewatering area that will consist of thickening, and filtration, and handling.

The process description by area is described in the following sections.

Figure 17.1 – Simplified Flow Sheet of the Samapleu Concentrator



17.1.3 CRUSHING AND STORAGE

The Run-of-Mine ("ROM") mineralised material will be deposited into a grizzly feeder using a front-end loader, at a maximum size of 600 mm, that will be assisted by a rock breaker. The -90 mm undersized material from the grizzly feeder will discharge onto a conveyor and transported to a crushed ore pile. The +90 mm oversized material will feed a jaw crusher and then discharge onto the conveyor to the crushed ore pile. 80% of the ore in the stockpile will be -112 mm.

To lower the Capex, the crusher material from the stockpile will not be reclaimed by feeders and a main conveyor located under the stockpile in a concrete reclaim tunnel, which would also require the emergency escape tunnel. The crusher material will be reclaimed from the stockpile and deposited directly into a crushed ore hopper using a front-end loader. A feeder, located under the hopper, will feed the crushed material onto belt conveyors to feed the SAG mill in the concentrator.

17.1.4 PRIMARY GRINDING CIRCUIT

The primary grinding circuit includes a SAG mill that will be operated in a closed circuit with a double-deck vibrating screen. The -3 mm screen undersize material is directed to the cyclone feed. The +3 mm oversized material reports back to the SAG mill feed. The SAG mill will have a diameter of 7.3 m and a length of 3.8 m, with a power draw of 3,100 kW.

17.1.5 SECONDARY GRINDING CIRCUIT

The secondary grinding circuit includes a ball mill and fifteen (15) 510 mm diameter cyclones. The circuit is fed in a feed forward configuration: from the SAG mill vibrating screen undersized discharge and ball mill discharge. The oversized material in the cyclone underflow flows into a ball mill. The ball mill operates in a closed circuit with the cyclones to obtain a grind size of 0.065 mm at the cyclone overflow, which feeds the flotation circuit. The ball mill will have a diameter of 6.1 m and a length of 9.4 m, with a power draw of 6,100 kW.

17.1.6 BULK FLOTATION

The overflow from the cyclones, at 0.18% Cu grade and 0.24% Ni grade, passes through a conditioning tank before being pumped to the Cu/Ni rougher flotation circuit. To aid the flotation process, the reagents used in the bulk flotation circuit are: lime as a pH modifier, diethyl triamine ("DETA"), sodium metabisulfite ("SMBS"), and carboxymethylcellulose ("CMC") as depressants, sodium isobutyl xanthate ("SIBX") as a collector, and methyl isobutyl carbinol ("MIBC") as a frother. Multiple addition points for each reagent will be present along the different banks in the bulk flotation circuit.

The Cu/Ni rougher flotation circuit recovers most of the copper and nickel from the ore, with 91% Cu recovery and 57% Ni recovery. The rougher flotation bank consists of six (6) conventional flotation cells, 50 m^3 each, which provides 12.5 minutes of residence time for the roughing. The pH target for the bank of cells is 8.2. Cu/Ni rougher concentrate is upgraded to 5.1% Cu grade and 4.3% Ni grade. The Cu/Ni rougher concentrate is pumped to the Cu/Ni cleaner circuit. The Cu/Ni rougher tailings is pumped to the Ni scavenger circuit.

The Cu/Ni cleaner circuit further upgrades the concentrate recovered from the Cu/Ni roughers. The cleaner flotation bank consists of four (4) conventional flotation cells, 1.4 m^3 each, which provides 5 minutes of residence time for the cleaning. The Cu/Ni cleaner upgrades the concentrate to 11.0% Cu grade and 9.0% Ni grade. The Cu/Ni cleaner concentrate is pumped to the Cu/Ni separation circuit. The Cu/Ni cleaner tailings flows to the Cu/Ni cleaner scavenger circuit.

The Cu/Ni cleaner scavenger circuit concentrates a recirculation stream that is pumped back to the feed of the Cu/Ni cleaners for further upgrading. The bank consists of four (4) 0.3 m^3 cells, giving 2.5 minutes of residence time. The tailings are pumped to the regrind mill of the nickel cleaning circuit.

17.1.7 Copper Cleaning

To aid the flotation process, the reagents used in the copper cleaning circuit are lime as a pH modifier, and SIBX as a collector.

The Cu/Ni separation circuit separates the copper and nickel, recovering copper in the concentrate and depressing nickel into the tailings of the bank. The separation flotation bank consists of four (4) conventional flotation cells, 1.4 m^3 each, which provides 6.25 minutes of residence time for the separation. The pH target for the separation bank of cells is 12. At a pH of 12, the copper material is more readily collected in the concentrate of the rougher bank, and the nickel can be depressed into the tailings. The Cu/Ni cleaner recovers 80% Cu, and the concentrate is upgraded to 22.2% Cu grade. The concentrate is pumped to the Cu cleaner column. The tailings of the bank, enriched in nickel at 14.3% Ni grade, are pumped to the Ni concentrate thickener.

The Cu cleaner column is the final upgrading stage of the copper cleaning circuit. The copper cleaning column is 1.5 m in diameter and 6 m tall, providing a residence time of 9.4 minutes. The concentrate is upgraded to a final grade of 23% Cu. The Cu cleaner column concentrate is pumped to the Cu concentrate thickener. The tailings are pumped back to the feed of the Cu/Ni separation circuit.

17.1.8 Nickel Cleaning

To aid the flotation process, the reagents used in the nickel cleaning circuit are lime as a pH modifier, DETA and SMBS as depressants, SIBX as a collector, and MIBC as a frother.

The Ni scavenger circuit recovers the remaining recoverable copper and nickel from the ore, with 6.4% Cu recovery and 14.2% Ni recovery. The scavenger bank consists of six (6) conventional flotation cells, 50 m^3 each, which provides 15 minutes of residence time for the scavenging. The Ni scavenger concentrate, at 0.9% Ni grade, is pumped to the regrind mill. The tailings are pumped to the pyrrhotite (“Po”) rougher circuit.

The regrind mill is fed with the Ni scavengers concentrate, the Cu/Ni cleaner scavenger tailings, the 2nd Ni cleaner tailings, and the underflow of the regrind cyclones. The regrind mill further grinds the ore to liberate the remaining nickel mineralization, and polishes ore surfaces that may have been oxidised for recovery in the next nickel cleaning steps. The undersized material in the regrind cyclones overflow is pumped to the 1st Ni cleaner circuit.

The 1st Ni cleaner circuit further upgrades the concentrate, to 2.0% Ni grade. The cleaning bank consists of four (4) conventional flotation cells, 5 m^3 each, which provides 5 minutes of residence time for the cleaning. The pH target for nickel cleaning banks of cells is 9. The 1st Ni cleaners concentrate is pumped to the 2nd Ni cleaner circuit. The tailings are fed to the 1st Ni cleaner scavenger circuit.

The 1st Ni cleaner scavenger circuit concentrates a recirculation stream that is pumped back to the feed of the regrind mill for further upgrading. The bank consists of four (4) cells, 1.4 m^3 each which provides 2.5 minute of residence time. The tailings are pumped to the Potential Acid Generating tailings thickener.

The 2nd Ni cleaner circuit further upgrades the concentrate, to 4.0% Ni grade. The bank consists of four (4) cells, 0.3 m^3 each which provides 3.75 minutes of retention time. The 2nd Ni cleaners concentrate is pumped to the Ni cleaner column. The tailings are pumped back to the feed of the regrind mill for further upgrading.

The Ni cleaner column is the final upgrading stage of the nickel cleaning circuit. The nickel cleaning column is 1.5 m in diameter and 6 m tall, providing a residence time of 6.25 minutes. The concentrate is upgraded to a final grade of 6.3% Ni. The Ni cleaner column concentrate is pumped to the Ni concentrate thickener. The tailings are pumped back to the feed of the 2nd Ni cleaner circuit.

17.1.9 Tailings Desulphurisation

Tailings desulphurisation is accomplished in the pyrrhotite rougher circuit. To aid the desulphurisation process, the reagents used in the desulphurisation circuit are sulphuric acid (H_2SO_4) as a pH modifier, SIBX as a collector, and MIBC as a frother.

The desulphurisation circuit's purpose is to minimise the quantity of sulphide-rich gangue deposited in the tailings pond and therefore, reduce the risk of acid-mine drainage. The pH target for the bank of cells is 5. At lower pH, the Potential Acid Generating material is more readily collected in the concentrate of the Po rougher bank.

The Po rougher circuit concentrate is pumped to the Potential Acid Generating tailings thickener. The tailings are pumped to the Non-Acid Generating tailings thickener.

17.1.10 Concentrate and Tailings Dewatering and Handling

The Cu and Ni concentrates are treated in separate dewatering circuits. To aid the thickening process, flocculant is used as a reagent. The concentrate is first thickened in a concentrate thickener.

The thickened underflow at 55% solids is pumped to a holding tank. The holding tank concentrate is then pumped to a filter press, the final dewatering stage, that produces copper filter cake at 92% solids and nickel filter cake at 90% solids. The nickel filter cake is fed via belt conveyors to CVMR. The copper filter cake is discharged into specialised concentrate containers.

The Potential Acid Generating (PAG) tailings are treated in a separate dewatering circuit from the concentrates. The tailings are first thickened in a tailings thickener. The thickened underflow at 55% solids is pumped to a holding tank. The holding tank concentrate is then pumped to a filter press, the final dewater stage, that produces tailings filter cake at 88% solids. The tailings cake is stacked outside the concentrator area.

The Non-Acid Generating (NAG) tailings are thickened in a tailings thickener. The thickened underflow at 65% solids is pumped to the tailings pond.

17.1.11 Mass Balance and Water Balance

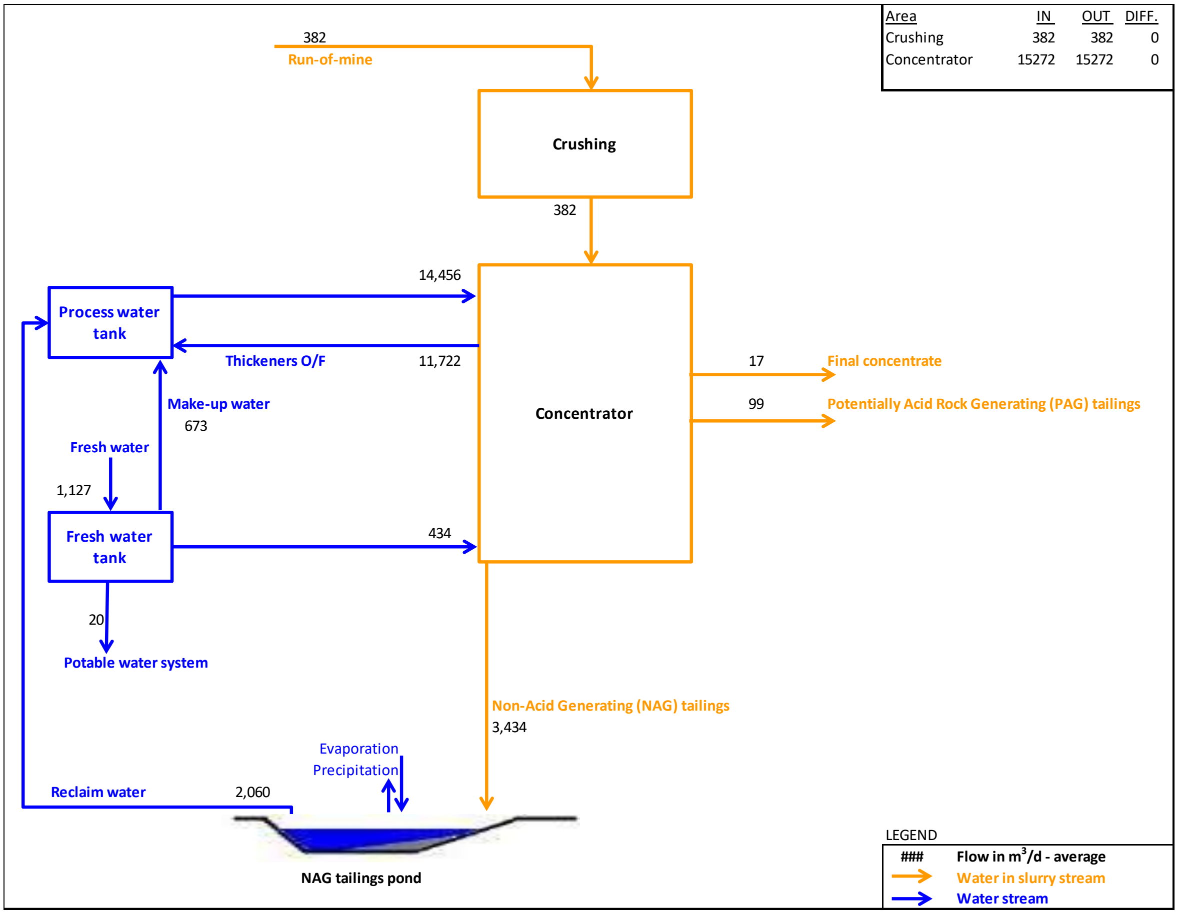
The processing plant mass balance is summarised in Table 17.2, and is based on the key design criteria and the process flow sheet as depicted in Figure 17.1. Throughput and flow rates in Table 17.2 are shown in metric tonnes per day (t/d) and cubic meters per day (m^3/d), where applicable.

Table 17.2 – Concentrator Mass Balance Summary

Mass Entering Concentrator				**Mass Exiting Concentrator**			
Streams	Dry solids (t/d)	Water (m^3/d)	Total mass (t/d)	Streams	Dry solids (t/d)	Water (m^3/d)	Total mass (t/d)
Ore to concentrator	7,264	382	7,646	Potable water system	-	20	20
Fresh water	-	1,127	1,127	Tailings to tailings pond	6,378	3,434	9,812
Reclaim water from tailings pond	-	2,060	2,060	Final concentrate cake	163	17	180
				PAG tails cake	723	99	821
Total entering	**7,264**	**3,570**	**10,834**	**Total exiting**	**7,264**	**3,570**	**10,834**

The water balance summary is shown in Figure 17.2. The tailings pond is not considered a part of the concentrator water system and is only added for illustrative purposes.

Figure 17.2 – Water Balance Summary



17.1.12 PROCESSING PLANT – REAGENTS AND UTILITIES

17.1.12.1 Concentrator Reagents

a. Lime

Lime, or calcium hydroxide, is used as a pH modifier for sulphide flotation, increasing the pH of the slurry when added. It is assumed that the lime will be slaked on site from dry bags that are shipped to site. The lime solution is stored in a dedicated 7 m^3 tank.

b. Diethyltriamine (“DETA”)

DETA is used as a depressant for sulphide flotation, hindering the collection of gangue minerals such as pyrrhotite in the concentrates. Metering pumps will be included with the system to dose the DETA to the addition points directly from the tote.

c. Sodium metabisulfite (“SMBS“)

SMBS is used as a depressant for sulphide flotation. When mixed with DETA, it increases the effectiveness of the solution as a depressing agent for gangue mineral such as pyrrhotite. SMBS will be mixed into solution on site, using a 7 m^3 tank for mixing and a 7 m^3 tank for storage and distribution.

d. Carboxymethylcellulose ("CMC")

CMC is used as a depressant for sulphide flotation, hindering the collection of gangue minerals such as talc in the concentrates. CMC will be mixed into solution on site, using a 20 m^3 tank for mixing and a 20 m^3 tank for storage and distribution.

e. Sodium isobutyl xanthate ("SIBX")

SIBX is used as a collector for sulphide flotation, promoting the collection of desired minerals such as chalcopyrite and pentlandite in the concentrates. Xanthate will be mixed into solution on site, using a 7 m^3 tank for mixing and a 7 m^3 tank for storage and distribution.

f. Methyl isobutyl carbinol ("MIBC")

MIBC is used as a frother for sulphide flotation. Metering pumps will be included with the system to dose MIBC to the addition points directly from the tote.

g. Sulphuric acid (H_2SO_4)

H_2SO_4 is used as a pH modifying agent in order, decreasing the pH to depress low sulphide material and promote the collection of high sulphide material. Metering pumps will be included with the system to dose H_2SO_4 to the addition points directly from the tote.

h. Flocculant

Flocculant is used in the four (4) thickeners to aid the settling of concentrate and tailings. Flocculation in the thickeners facilitates the settling of particles into the dense underflow and results in clear overflows with minimal solids. Two (2) flocculant preparation systems will be used, one for the concentrate thickeners and one for the tailings thickeners. At this point in time, it is assumed that the concentrates will share a type of flocculent and that the tails will share a type of flocculent. The sizing and dosages of the systems will need to be confirmed with further test work.

17.1.13 Concentrator Water Services

17.1.13.1 Fresh Water

The water will be pumped to a fresh water/fire water tank at a nominal rate of 1,127 m^3/d. Fresh water will be used as make-up water to meet process water demand, gland seal water, for the potable water system, and for fire protection.

The process water make-up is pumped from the fresh water/fire tank and requires a flow rate of 673 m^3/d.

The gland water is pumped from the fresh water/fire water tank and requires a flow rate of 383 m^3/d.

Twenty (20) m^3/d of fresh water has been allocated for the potable water system.

Fire water, sourced from the fresh water tank, will be distributed through the plant fire protection system by means of fire pumps and a dedicated fire water distribution network.

17.1.13.2 Process Water

Overflow from the thickeners and reclaimed water from the tailings pond are the major process water sources for the processing plant. The water from the thickeners' overflows is pumped to the process water tank at a nominal rate of 11,722 m^3/d. The reclaim water from the NAG tailings pond is pumped to the process water tank at a nominal rate of 2,060 m^3/d.

The plant's process water demand is pumped from the process water tank and requires a flow rate of 14,456 m^3/day.

17.1.14 COMPRESSED AIR

The crusher will include one (1) compressor to supply plant and instrument air. The system will include an air receiver, an air dryer, and an air filter.

The concentrator will include two (2) plant air compressors (one (1) operating and one (1) standby) to supply high pressure plant air and instrument air. The system will include a plant air receiver, an instrument air receiver, an air dryer, an air blower, and an air filter. The air systems will supply low pressure air to the flotation circuit.

The concentrator will also include four (4) filter press compressors (two (2) operating and two (2) standby) to supply dewatering air for the three filter presses. The system will include air receivers, an air dryer, air blowers, and air filters. The air system will supply high pressure air to the filter presses for dewatering.

For low pressure air: three (3) blowers have been considered to provide air to the flotation circuit.

17.2 Carbonyl Refining Plant

17.2.1 Introduction

The carbonyl refining plant will recover nickel and iron from SFC.

Table 17.3 – Carbonyl Refining Plant – Key Process Parameters

Parameter	Value	Unit
Feed Material Assay		
Nickel	10.34	%
Iron	26.58	%
Copper	1.36	%
Sulphur	24.6	%
Roasting Operation		
Processing Capacity	40,000	TPY
Nickel	10.34	%
Iron	26.58	%
Copper	1.36	%
Sulphur	24.6	%
Operating temperature	1050	^{o}C
Particle size	<3	Mm
Oxygen content in the Roaster exhaust gas	4	%
Sulphur Dioxide production	19,484	TPY
Calcined material production	29,958	TPY
Sulphur in the calcined material	<0.2	%
Reduction Operation		
Processing Capacity	29,958	TPY
Nickel	13.74	%
Iron	35.31	%
Copper	1.81	%
Operating temperature	650	^{o}C
% Hydrogen in the reduction gas	70	%
% Nitrogen in the reduction gas	30	%
Hydrogen requirement	993	Nm^3/hr
Residence time	2	hours

Parameter	Value	Unit
Carbonylation Operation		
Processing Capacity	23,750	TPY
Nickel	17.15	%
Iron	44.10	%
Copper	2.26	%
Operating temperature	130	^{o}C
Operating pressure	40	Bar
CO Requirement	25	Nm^3/hr
Carbonyl nickel powder production	4,032	TPY
Carbonyl iron powder Production	8,398	TPY
Residue	10,814	TPY

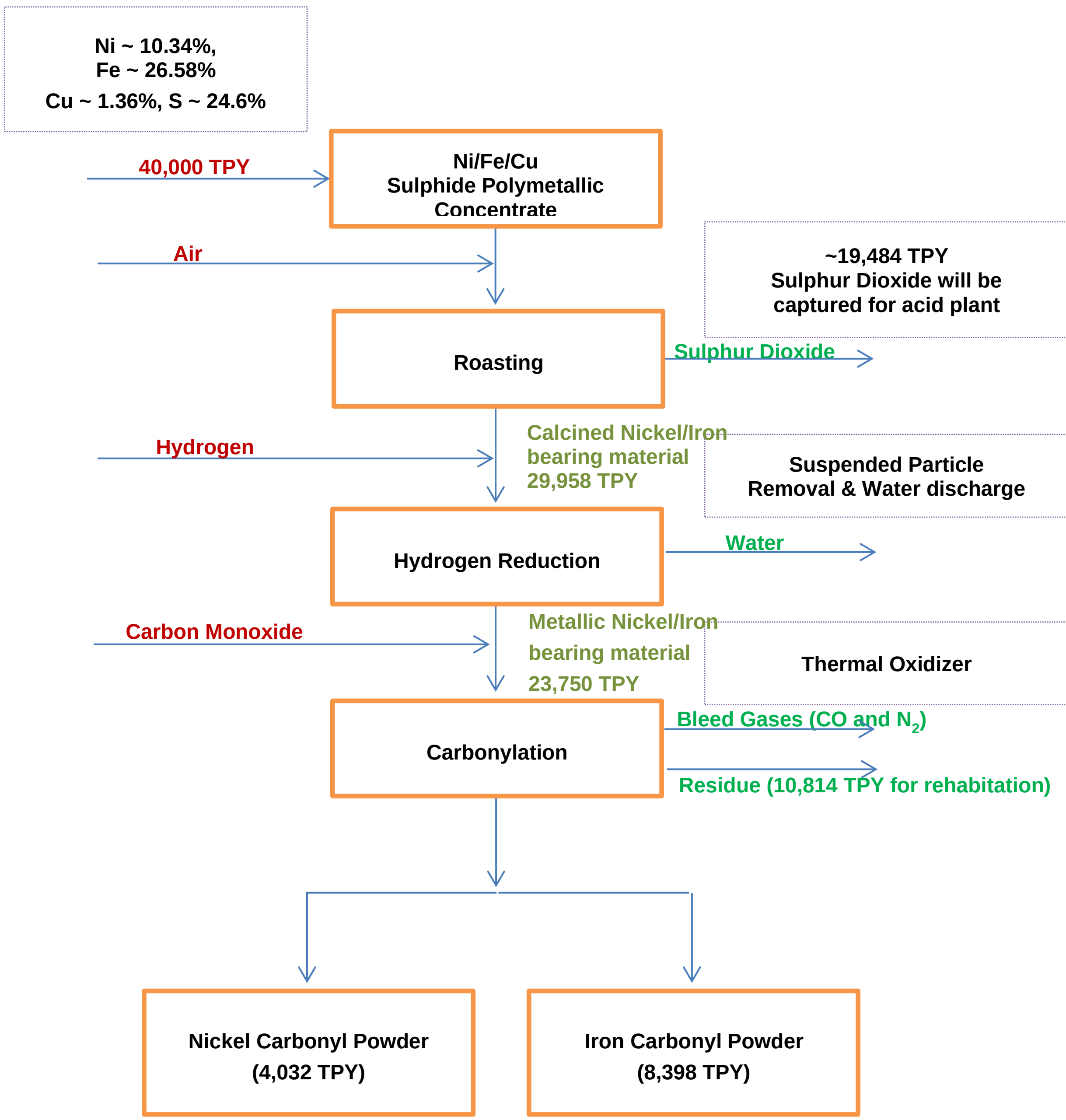
Low grade coal will be used to pre-heat the SFC and also to heat the SFC to reduction temperature. The current design assumes electrical heating for decomposers. Heating of decomposers with coal have been reviewed with suppliers to minimise plant dependency on electrical supply and to reduce Opex for the plant.

17.2.2 PROCESS FLOWSHEET

A high-level process flowsheet for the carbonyl plant can be found in Figure 17.3.

Figure 17.3 illustrates CVMR's carbonyl route of extraction of nickel, and iron from SFC. SFC will be roasted to covert the sulfide minerals to oxides in a Fluid Bed Roaster (FBR). If the SFC is so fine, the feed may have to be pelletized prior to feeding the FBR. Calcined SFC will then be reduced in rotary kiln with hydrogen to convert the nickel and iron oxides to metallic nickel and iron respectively. Nickel and iron will be extracted from reduced SFC in the form of volatile metal carbonyls through CVMR®'s carbonyl process, separated and decomposed to metal nickel and iron products.

Figure 17.3 – PFD for the 40,000 TPY Samapleu Concentrate



17.2.3 Roasting And Reduction of SFC

The first stage of the plant includes the roasting and reduction.

The feed material, SFC, will be received in the receiving area outside of the plant, stored and dried. The SFC will be transferred to tote bin and brought to a chute by a front-end loader.

The feed will be directly dumped into a chute, feeding a bucket conveyor controlled by a rotary valve. The bucket conveyor will discharge the material into a receiver hopper bin. Feed from the receiver hopper bin will be then charged to a Fluidized Bed Roaster (FBR) through another rotary valve.

The material fed to the FBR will be oxidized to remove the sulphur and metal oxides and sulphur dioxide will be produced as the result of the roasting operation.

The oxidized material will be cooled down and transferred to a reduction kiln. Sulfur dioxide produced will be sent to sulphur recovery plant. The reduction rotary kiln itself consists of a rotating metal tube, located within a heating chamber. The tube will be heated by burning low grade coal in the heating chamber. In the reduction kiln, the oxidized material will be heated intensely, and with the addition of hydrogen, reduced, releasing mainly water and other constituents of the feedstock.

The bed of material within the rotary kiln will be gently churned and progressed towards the discharge end by flights set in the reactor's wall. The rotational speed of the reactor is also controlled to obtain the proper retention time and feed rate. The material will be discharged from the outlet of the reactor into the cooling section. The hydrogen reducing gas will enter the rotary cooler counter current to the material.

After the feed has been reduced, it will pass through the cooling section of the rotary reduction kiln. The cooling section will be water cooled and will allow the temperature of the discharged material to cool down to approximately 50˚C. A totally encased bucket conveyor, under slight positive pressure and inert conditions, will transport the cooled material into a carbonylation feed receiver hopper bin, which will be likewise totally closed and under inert and slightly positive pressure conditions, in order to avoid exposure of the activated material to the atmosphere. Exposure of the activated material to air will render it inactive, which would require it to be sent back to the reduction reactor.

17.2.4 Carbonylation

Reduced material will be transferred to one of the carbonyl reactors. Prior to transferring the residue, reactor from previous batch run will be washed from the reactor, the reactor will be dried and vacuum purged with nitrogen and CO. Upon getting the reactor ready, reactor screw conveyer will be connected to the top hatch of the reactor and the reduced SFC is transferred from the feed bin to the reactor. The reactor is mounted on a load cells to enable the amount of feed material to be accurately measured.

After reduced SFC is transferred to the reactor, the reactor screw conveyer will be disconnected and the reactor will be sealed. The reactor will be then pressure tested and pressurised with carbon monoxide to the operating pressure. During pressurisation, the reactor's cooling system will be turned on to remove heat produced during the carbonylation. Carbon monoxide will be introduced to the reactor from CO booster and carbonyls containing gas mixture exiting from reactor will be directed to the condenser and separator. Inside temperature of the reactor will be monitored all the time to prevent overheating. The rate of reaction is dependent on sufficient heat removal. If the reaction bed is overheated the reaction rate goes down.

The nickel and iron carbonyl rich gas will be cooled down in the heat exchanger/condenser to 0-1ºC and liquid metal carbonyls are separated from CO gas in the separator. Liquid carbonyls will be dropped in to one of two high pressure storage tanks. Carbonyl storage tanks will be mounted on load cells to enable to control production rates of metal carbonyls. After the high pressure storage tank is 80% filled with the liquid carbonyls mixture, the system will be switched to the second high pressure storage tank. The first high pressure storage tank will be then connected to the CO supply and liquid carbonyl mixture is fed to the distillation system.

After the reaction is almost completed, the next reactor will be brought on line and CO gas will be redirected from the reactor to the next reactor before going to the condenser. Thus, the small amounts of nickel and iron are extracted without significantly changing feed rate to the high pressure storage tank. When the weight of the reactor is constant and extraction will be completed, CO flow will be redirected to the next reactor, and the reactor will be depressurised. The reactor will be then vacuum-purged with a nitrogen and nitrogen/oxygen mixture to passivate the residue, following by washing reactor with water to bring residue slurry to the residue bin.

17.2.5 Separation of Nickel and Iron carbonyls

Liquid mixture of nickel and iron carbonyls will be introduced into distillation column from high pressure storage tank through pressure control valve at 4.8 bars pressure. The mixture will be separated into iron carbonyl and nickel carbonyl. Liquid iron carbonyl will be collected into the iron carbonyl sump and transferred by pressure through vaporiser to iron carbonyl powder decomposer to produce premium powder products. The designed purity of Iron product is 99.9%.

Gaseous nickel carbonyl/CO mixture will be directed into the nickel carbonyl powder decomposer to produce nickel powders.

17.2.6 Production of Nickel Powders

The nickel carbonyl gas from the distillation system will be sent to electrically heated, cylindrical powder decomposer, where it will undergo decomposition into nickel powder and carbon monoxide gas. The powder decomposers will have its own filter bag-house to prevent fine powder from escaping to the downstream equipment.

The powder product inside the decomposers will be transferred to one of two final product bins where it will be purged and passivated with a lean oxygen gas mixture. The product bins will be equipped with reverse pulsed bag filters to eliminate dusting problems. A product filling station will be constructed beneath the product bins (including vibration screen), in order to handle loading into 50 kg capacity drums from any of the two product bins. The system will be designed to allow product loading to be handled by a single 8-hour shift.

17.2.7 Production of Iron powders:

Liquid iron carbonyl from distillation system will be sent to the vaporiser. Produced iron carbonyl gas will be mixed with CO and decomposed in the iron powder decomposer. Produced iron powder will be transferred to a product filling station in order to handle loading into 250 kg capacity drums.

18 PROJECT INFRASTRUCTURE

This section summarises the infrastructure, buildings and other facilities required for the operation of the Project. It consists of the following infrastructure, which are all located on site:

- Roads;
- Power Supply;
- Control System;
- Communication System;
- Tailings Storage Facility (TSF);
- Water Management Facility
- Site Buildings.

The overall site layout and access is shown in the Figure 18.1. Figure 18.2 illustrates the details of crushing area and stockpile and Figure 18.3 illustrates the concentrator plant layout. Figures 18.4 and 18.5 show the details of CVMR roaster and carbonylation plant layouts.

18.1 Roads

18.1.1 Main Access Road

A new access road will be constructed to connect the Project site with the existing from Yorodougou to Sipilou road, a distance of 11 km. The access road will be constructed to support a typical mining operation with an 8 m wide surface with ditches on each side. Road lighting has not been provided. Culverts will be provided for water crossings and no allowance has been provided for bridges over water crossing.

18.1.2 Site Roads

Site and service roads will be 6 m wide, except for mine roads. They will provide access to:

- Administration, plant and mine offices;
- Warehouse;
- General process areas;
- Tailings storage facilities;
- Explosives storage

Figure 18.1 – General Site Layout

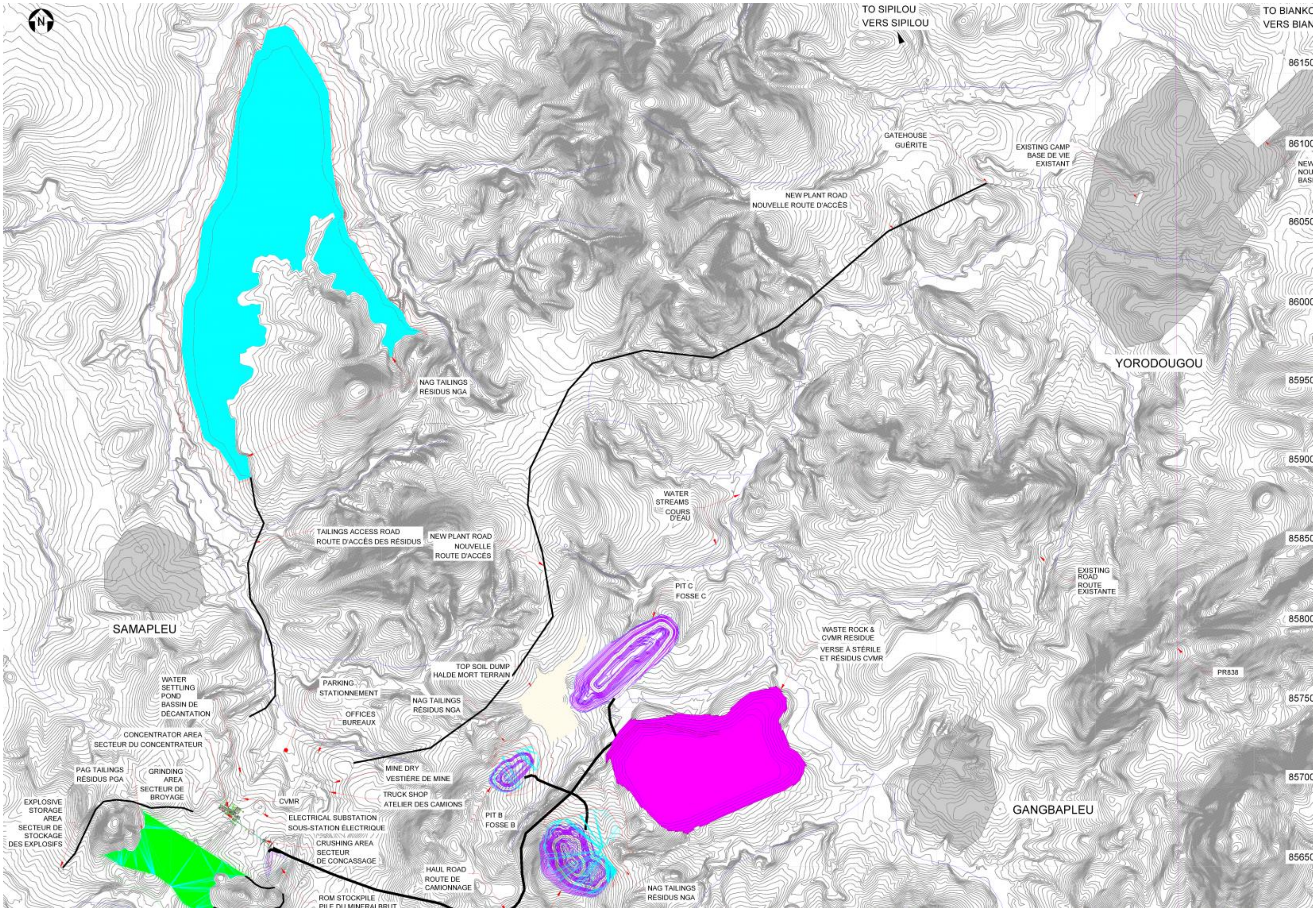


Figure 18.2 – Crushing Area and Stockpile Layout

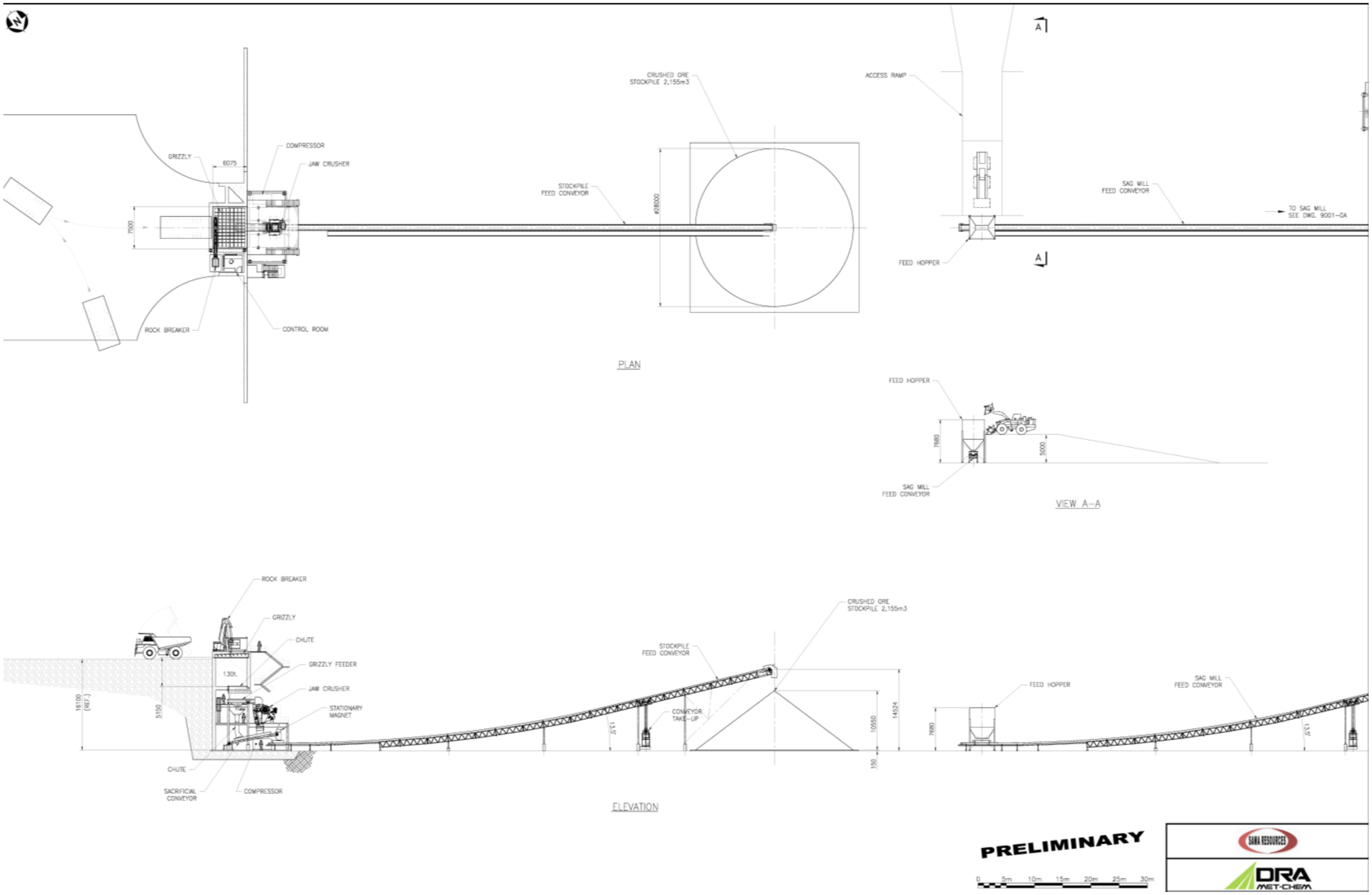


Figure 18.3– Concentrator Plant Layout

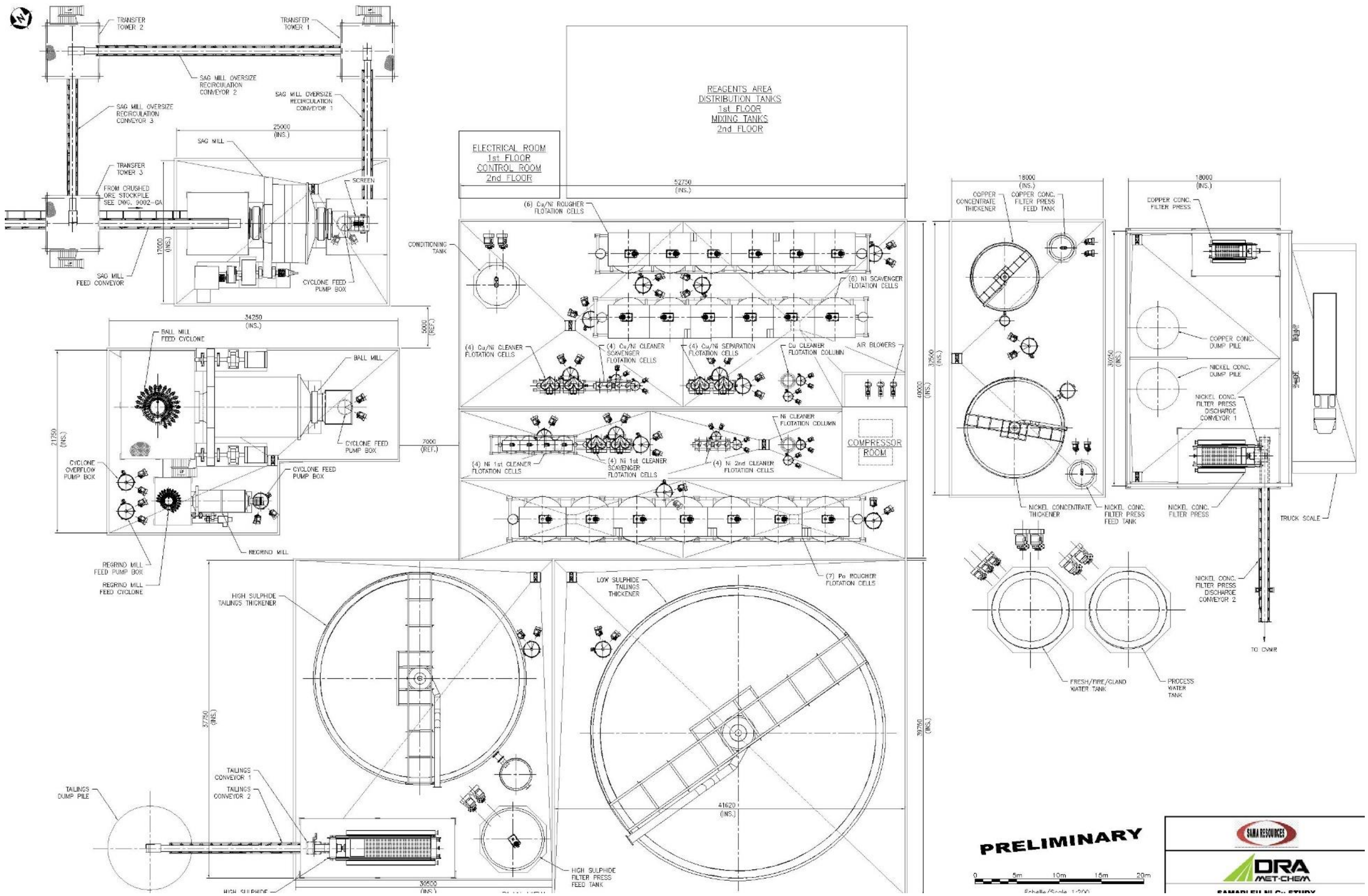

TRANSFER TOWER 2
TRANSFER TOWER 1
SAG MILL OVERSIZE RECIRCULATION CONVEYOR 2
SAG MILL OVERSIZE RECIRCULATION CONVEYOR 1
SAG MILL OVERSIZE RECIRCULATION CONVEYOR 3
SAG MILL
TRANSFER TOWER 3
FROM CRUSHED ORE STOCKPILE SEE DWG. 3002-CA
SCREEN
SAG MILL FEED CONVEYOR
CYCLONE FEED PUMP BOX
BALL MILL FEED CYCLONE
BALL MILL
CYCLONE FEED PUMP BOX
CYCLONE OVERFLOW PUMP BOX
REGRIND MILL
REGRIND MILL FEED PUMP BOX
REGRIND MILL FEED CYCLONE
REAGENTS AREA
DISTRIBUTION TANKS
1st FLOOR
MIXING TANKS
2nd FLOOR
ELECTRICAL ROOM
1st FLOOR
CONTROL ROOM
2nd FLOOR
(6) Cu/Ni ROUGHER FLOTATION CELLS
CONDITIONING TANK
(6) Ni SCAVENGER FLOTATION CELLS
(4) Cu/Ni CLEANER FLOTATION CELLS
(4) Cu/Ni CLEANER SCAVENGER FLOTATION CELLS
(4) Cu/Ni SEPARATION FLOTATION CELLS
Cu CLEANER FLOTATION COLUMN
AIR BLOWERS
Ni CLEANER FLOTATION COLUMN
COMPRESSOR ROOM
(4) Ni 1st CLEANER FLOTATION CELLS
(4) Ni 1st CLEANER SCAVENGER FLOTATION CELLS
(4) Ni 2nd CLEANER FLOTATION CELLS
(7) Po ROUGHER FLOTATION CELLS
COPPER CONCENTRATE THICKENER
COPPER CONC. FILTER PRESS FEED TANK
COPPER CONC. FILTER PRESS
COPPER CONC. DUMP PILE
NICKEL CONC. DUMP PILE
NICKEL CONC. FILTER PRESS DISCHARGE CONVEYOR 1
NICKEL CONCENTRATE THICKENER
NICKEL CONC. FILTER PRESS FEED TANK
NICKEL CONC. FILTER PRESS
TRUCK SCALE
NICKEL CONC. FILTER PRESS DISCHARGE CONVEYOR 2
TO CVMR
FRESH/FIRE/GLAND WATER TANK
PROCESS WATER TANK
HIGH SULPHIDE TAILINGS THICKENER
LOW SULPHIDE TAILINGS THICKENER
TAILINGS CONVEYOR 1
TAILINGS CONVEYOR 2
TAILINGS DUMP PILE
HIGH SULPHIDE FILTER PRESS FEED TANK
25000 (INS.)
52750 (INS.)
34250 (INS.)
18000 (INS.)
41620 (INS.)
39500 (INS.)
PRELIMINARY
SAMA RESOURCES
DRA MET-CHEM

Figure 18.4 – CVMR Roaster Plant Layout

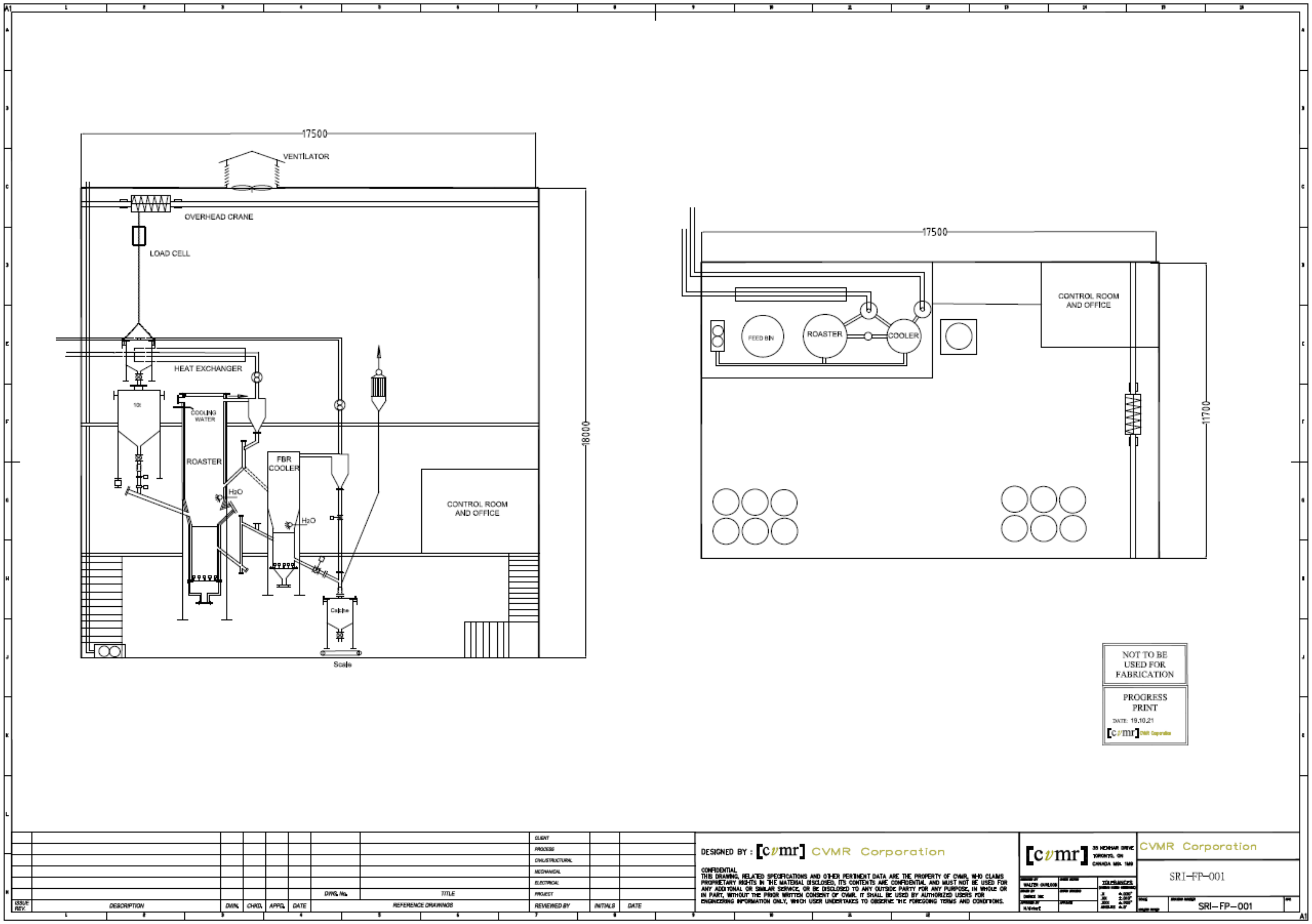
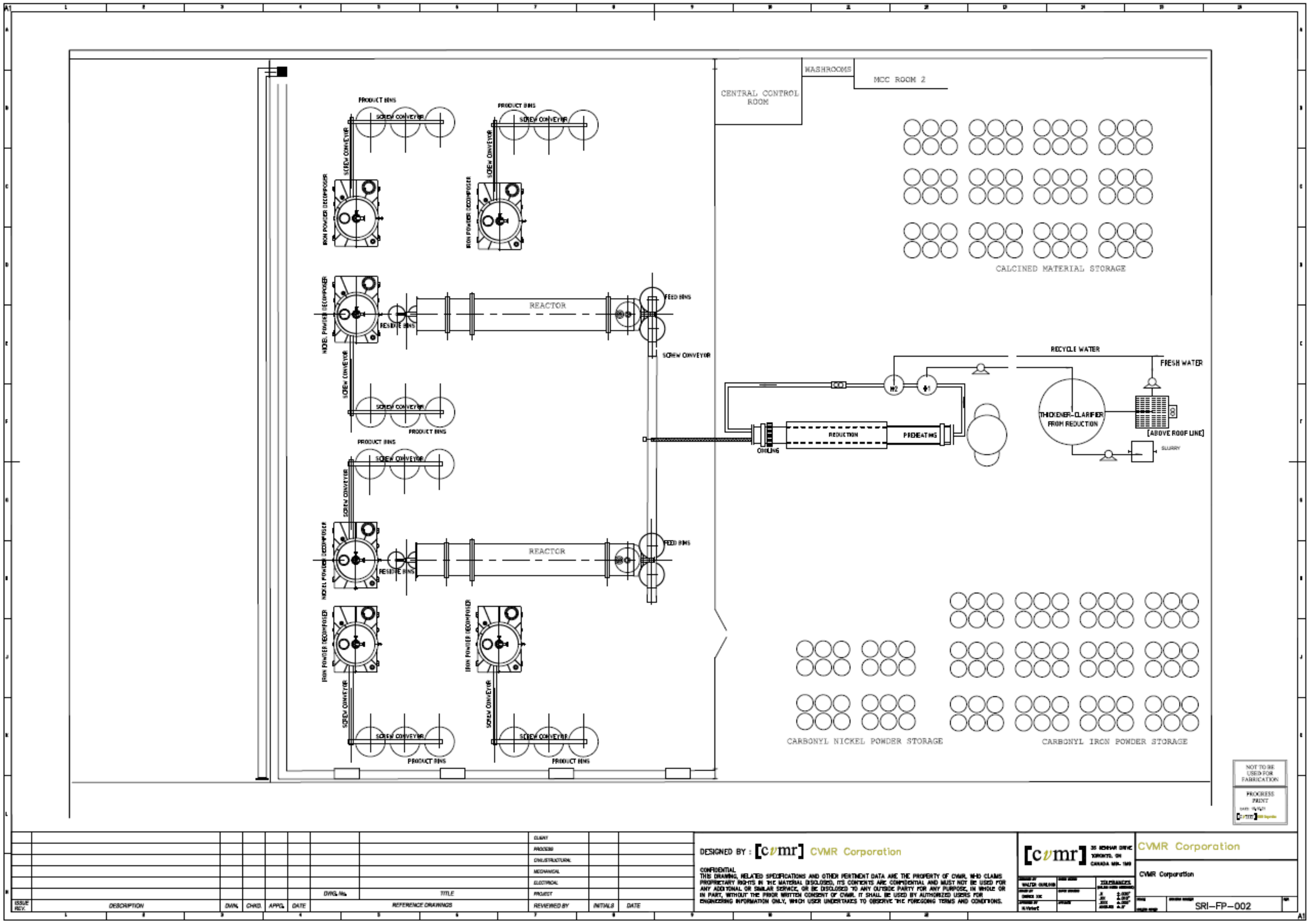


Figure 18.5 – CVMR Reduction and Carbonylation Plant Layout



18.1.3 MINE ROADS

Provision for a network of 3 km of haulage roads has been made. Mine roads will be 15 m wide and will provide access to:

- ROM stockpiling area;
- Waste Dump;
- Top Soil Dump
- Pit entrance;
- PAG tailings storage area; and
- Mine garage and tank farm.

18.2 Power Supply

18.2.1 POWER DEMAND

The power demand of the Samapleu site was determined to be 21.5 MW based on the estimated connected loads, running loads and running power for the process operation. Table 18.1 presents the power demand breakdown by sectors.

Table 18.1 – Estimated Total Power Demand Consumption

Area	Mechanical Operating Power kW_{mec}	Power Demand kW_{elec}
All process areas equipment except:	6,494	5,844
SAG mill	3,100	2,945
Ball mill	6,100	5,795
Regrind Mill	150	142
CVMR Facilities	8,500	6,000
PROCESS ONLY	24,344	20,726
Administration Building		162
Laboratory		32
Mechanical Shop		246
Plant Office		150
Other loads (including process lighting)		200
SERVICES ONLY		**790**
Total		**21,516**

Note: The power demand was calculated using an average efficiency factor, load factor and diversity factor.

18.2.2 INCOMING POWER

Power will be supplied to the Project site via a 90-kV overhead transmission line from Man to Danané, a distance of 80 km.

18.2.3 POWER PLANT AND DISTRIBUTION

The site will be supplied at 11 kV, 3 phase, 50 Hz from the main substation installed adjacent to the concentrator.

18.2.4 ELECTRICAL NETWORK

The electrical power network consists of 11 kV buried cable network and 11 kV pole lines. The 11 kV buried cable network starts from the main substation output feeders and ends at the power step-down transformers installed for each Electrical Room of the process plant.

The 11 kV pole line supplies, via step-down transformers and low voltage buried cables network, the remote loads of the site as: Gate House, Administration Building, Laboratory, Mechanical Shop, Plant Office, Mine Office.

18.2.5 MAIN ELECTRICAL EQUIPMENT

The electrical equipment, the motors, the cables and the other electrical materials shall be designed, constructed, tested and installed as per the International Electrotechnical Commission ("**IEC**") standards. The main electrical equipment is related to the process areas and is installed in Electrical Rooms.

There is a dedicated prefabricated Electrical Room for Crusher comprising the necessary equipment such as dry transformers, and low voltage MCC equipped with starters and VFDs to control the equipment in this area. In addition, the auxiliary transformers (lighting, services) and the Control Panels for the control and instrumentation are also included.

A second dedicated prefabricated electrical room for the Concentrator comprises the equipment necessary for the concentrator. Besides the switchgears and MCCs, there are also a VFD for the SAG mill.

A dedicated diesel generator has been provided to supply essential load to designated equipment.

18.3 Control System

18.3.1 AUTOMATION PROCESS NETWORK

The Samapleu Process Control System ("**PCS**") will be based on a redundant Ethernet network in a ring type topology. The network links all the main automation equipment, such as Supervisory Control and Data Acquisition ("**SCADA**") System, Historian, Human Machine Interface ("**HMI**") and Process Control System processors.

The proposed network includes fibre optic linking of the following main areas of the Samapleu plant:

- Central Control Room
- Power Plant
- Electrical Room for the crushing area;
- Electrical Room for the concentrator area;
- Electrical Room for the CVMR area;
- Gate House,
- Administration Building,
- Laboratory,
- Mechanical Shop,
- Plant Office,
- Mine Office.

Network automation communication services are:

- SCADA stations located in the Central Control Room;
- Process Control System processors inter-communication;
- PCS/Remote Input/Output ("**I/O**") communication;
- PCS direct interface to the Motor Control Centers ("**MCCs**");
- IEC61850 interface to the power distribution equipment;
- Field device communication including communication with 3rd parties Programmable Logic Controller ("**PLC**") supplied with mechanical equipment;
- Camera system installed in the plant for process control viewing purposes.

18.3.2 Process Control System

The process control system will be of PLC type. A PCS system will be supplied to control each strategic areas of the plant with remote I/O racks located generally in the Electrical Rooms.

The main processors will be included to control the following sectors: crushing, concentrator, CVMR and the remote loads connected to the 11 kV pole line. The major equipment such as the Mills could come with their own PLC and with a Local Control Panel. The MCC-s should be equipped with ″intelligent″ protection relay able to communicate. The protection relays shall be equipped with Ethernet ports. Near each motor shall be installed a Local Control Station. The central SCADA system has the capacity to control and supervise all the remote PCS equipment. In a communication outage situation, the critical equipment will be controlled locally.

18.3.3 SCADA

The SCADA system will be based on client/server technology and will include:

- Two (2) SCADA servers for redundancy;
- One (1) historian server;
- Two (2) HMI operator stations; and
- One (1) engineering station.

The system will be installed in the Central Control Room.

18.3.4 SCADA and PLC Power Sources

In case of plant power outage, the PCS, switches, main servers, phone system, and security systems will be fed by Uninterruptible Power Supply ("**UPS**"). UPS status will be monitored.

18.3.5 Redundancy

For the automation network, the redundant ring topology design insures a second route in case of a communication outage on one (1) segment.

18.4 Communication System

18.4.1 Telecommunication Local System

The telecommunication system will be based on Ethernet links throughout the plant buildings and administrative buildings following generally the electrical reticulation network (buried and/or installed on the pole lines).

Single-mode fibre optic backbone will be deployed through the plant to accommodate both automation and corporate services on the same fiber cable on different fiber.

18.4.2 Telecommunication and Mobile Radio Systems

The telecom service includes the tower located in a high elevation zone of the plant; it will be supplied by a third-party provider and will communicate with the Process plant communication interface.

The telecommunication systems will include:

- IP Phones;
- Process and Security Camera System;

- Fire Detection System;
- Access Control System (gate, door);
- Mobile Radio System.

The mobile radio system will be provided for the construction phase and will remain operational from the start and for the operation of the mine and plant site.

18.4.3 Telecommunication Services

The site will be connected to a local Internet Service Provider ("**ISP**").

A backup system will use a cellular modem or satellite technology.

The IP phone system will be connected to an Internet Telephone Service Provider ("**ITSP**").

18.4.4 Telecommunications Distribution

During the construction phase, all communication services, such as Internet and phone, will be distributed via Wi-Fi, Wimax and Microwave point-to-point radios to reach all areas of the plant site.

All mine trucks and pick-ups will be equipped with a Wimax/Wi-Fi antenna that shall also act as a Wi-Fi local access point.

The telecommunication distribution will be through the plant fiber optic network covering the crushing, concentrator and CVMR areas, Mine and Gate House, Administration Building, Laboratory, Mechanical Shop, Plant Office, Camp and Mine Office. If necessary, wireless communication will be provided for the other auxiliary outside of the plant.

18.4.5 Corporate Network

The automation Ethernet backbone network, in a ring type topology described in the previous section will be used for the automation, the camera and security video, the IP phone system and the corporate network applications.

All the major network equipment will be located in dedicated server rooms located in the administrative office, the telecom shelter, the control room and electrical rooms.

Corporate services are:

- Wired/Wireless Phones and System Server;
- Process and Security Camera System;
- Access Control System (gate, door);
- Fire Detection.

18.4.6 CAMERA SYSTEM

A camera system, with recorder and a viewer, will be installed in the main gate office. Aside from the gate cameras, other cameras will be installed in the plant for process control purposes. One (1) viewing station will be installed in each control room for process control purposes.

18.5 Tailings Storage Facilities (TSF)

A PEA level assessment of tailings disposal requirements was performed. The assessment aimed to estimate the quantities of materials required for the construction of confinement dykes for the proposed tailings impoundment facility.

The TSF consists of Non-Acid Generating (NAG)and Potential Acid Generating (PAG) tailings from the concentrator. The PAG tailings are collected in a thickener and then filtered to 12% moisture and transported to the PAG tailings impoundment by truck. The impoundment is protected by a membrane to ensure that the sulphur is properly contained within the tailings area.

The NAG tailings of 65 wt% solid content are collected in a tailings thickener and then pumped over 3 km to a tailings impoundment. Water is reclaimed from the tailings storage and returned to the process water tanks for reuse in the process.

At Year 11, the NAG tailings will be pumped to Pit A and in Year 17, the NAG will be pumped to Pit B.

Table 18.2 summarises the process information used for design of the TSF.

Table 18.2 – Tailings Design Basis

Description	Unit	Value
Life of Mine (LOM)	Year	20
PAG Tailings Volume (Years 1 to 20)	Mm^3	2.5
NAG Tailings Volume (Years 1 to 10)	Mm^3	15.8
Pit A (Years 11 to 16)	Mm^3	9.7
Pit B (Years 17 to 20)	Mm^3	2.0

Additional tailings and site characterisation should be undertaken before a final selection is completed to confirm storage capacities and dam volume requirements. The sulphur dioxide produced from CVMR plant is captured to produce sulphuric acid. An allowance is assumed to dispose the sulphuric acid in the PEA. It's recommended in the next phase of the Project to carry out a detailed study to evaluate the options of capturing SO_2.

18.6 Water Management Facility

Provision has been made in the project for the following site services:

- Mine dewatering system;
- Fresh water intake system for the mill fresh water and fire protection water tank;
- Reclaim water system from the tailings storage facilities;
- Domestic water treatment;
- Sewage waste treatment;

18.7 Site Buildings

In addition to the concentrator and CVMR buildings that will house the processing equipment, the site will include the following:

- Administration offices and mine offices;
- Mine repair shop and mine dry;
- Explosives storage facilities;
- A spare part warehouse as well as reagent storage;
- A metallurgical laboratory;
- An accommodation camp, and cafeteria; located off site in a nearby town;
- A security gatehouse;
- Security fence around process plant.

Although an existing camp is located in the village of Yorodougou, a new camp will be constructed, also in Yorodougou, to house approximately 400 construction workers and management staff. Following completion of the construction activities, the camp will be downsized and upgrade for the permanent non-local staff.

All these buildings have been considered in the Capex, but no formal detailed design has been done at this stage of the Project.

19 MARKET STUDIES AND CONTRACTS

DRA/Met-Chem has relied upon market studies provided by Sama. The information in this section is largely drawn or summarised key information regarding Carbonyl Nickel Powder, Carbonyl Iron Powder as well as Copper market overview. DRA/Met-Chem has reviewed the content of the market study presentation and believes that it provides a reasonable overview of the past and current market as well as projections according to various reputable website sources. The Reader is referred to these data sources, which are outlined in the "References", Section 27 of this Report, for further details.

19.1 Carbonyl Nickel Powder and Carbonyl Iron Powder Market

a. Carbonyl Nickel Powder

Carbonyl nickel powder is mainly used in electrodes, electronic products, controllable expansion alloys of batteries and fuel cells. With the increasing demand for special chemicals, new materials have been invented for personal applications. Carbonyl nickel powder has many advantages in electronic applications. It is used to improve the mechanical and fatigue properties of alloy steel. It enhances the conductivity and magnetism of electronic materials. Carbonyl nickel powders are also used as adhesives for fixed granular materials and can be used in filter assemblies in the form of high porosity products.

Diamond thin-walled drill bits, cutting blades for the construction industry, mineral diamond drill bits for oil and gas, and carcass bonding materials for carbide drills are mostly made of nickel powder; tools for metal material processing, automobile, and motorcycle mechanical grinding, etc. Most of them use diamond abrasives, and most of their carcass materials use nickel powder. With the rapid development of the diamond tool industry, electrical alloy industry, powder metallurgy machinery parts, and other industries, the demand for nickel powder has shown rapid development.

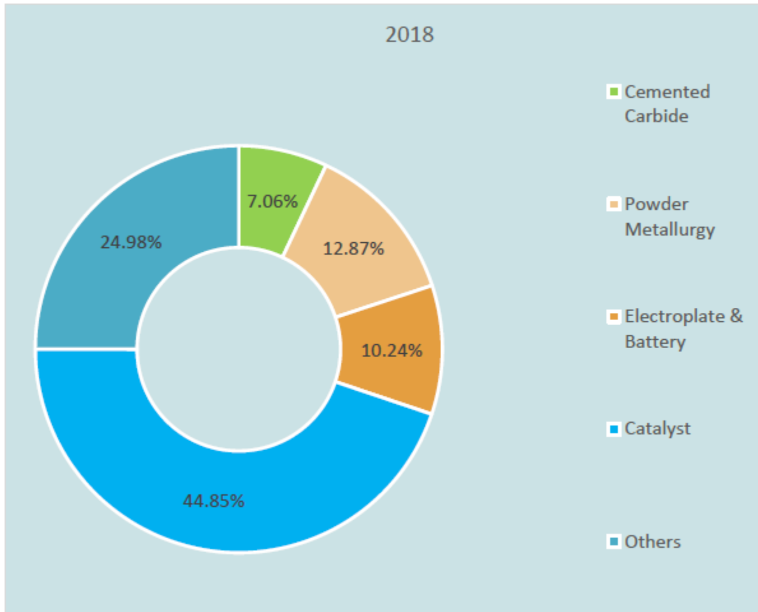
b. Carbonyl Iron Powder

Carbonyl iron powder has the characteristics of high activity, fine particle size, good formability and sintering property. Adding a small amount of carbonyl iron powder to iron-based powder metallurgical structural parts can reduce sintering temperature, improve the structure and mechanical properties of products, and is the raw material for producing high-quality powder metallurgical products. It can also be used as a noise suppressor in a filter choke. Carbonyl iron powder grades have many advantages over cobalt binders.

The carbonyl iron powder market has excellent fineness and homogeneity as well as excellent compatibility for higher density and strength. Thus, the carbonyl iron powder market is an ideal raw material for the manufacture of high-quality diamond tools. Carbonyl iron powder is also used for microwave and radar absorption. The carbonyl iron powder market has excellent broadband applications in a wide range of frequencies. The low average particle size of 3.5 microns covers a microwave skin depth of 1-2 microns and can be used as an insulating material for absorbing microwaves.

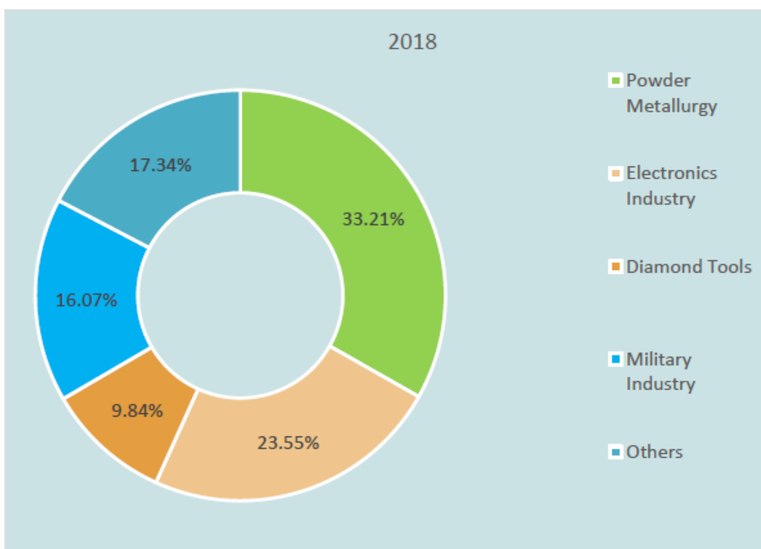
Figures 19.1 and 19.2 illustrate the 2018 Global Nickel and Iron Powder Market by Applications. 44.85% of global nickel powder is used for catalyst and 33.21% of global iron powder is used for powder metallurgy.

Figure 19.1 – Global Nickel Powder Market by Applications in 2018



(source: Maia Research Analysis, 2019)

Figure 19.2 – Global Iron Powder Market by Applications in 2018



(source: Maia Research Analysis, 2019)

According to Maia Research, Europe was the largest revenue market for nickel and iron powders with a market share of 38.56% in 2014 and 36.69% in 2018, a decrease of 1.87%. In 2018, the China market share was 34.15%, ranking second. Development of economy, increase downstream demand, and technology innovation progress in these areas will promote the nickel powder and iron powder market.

Asia Pacific is predicted to become the fastest growing region in the global nickel powder market over next 5 years, owing to increasing demand for stainless steel for various end use industries such as food and catering, automotive, energy and heavy industries, and others in emerging economies such as China.

Nickel powder and iron powder producers are mainly from the USA, Europe, and China. The top three (3) companies are Vale, Jinchuan Group, and Norilsk Nickel with a revenue market share of 52.40%, 18.33%, and 14.18% in 2018 respectively.

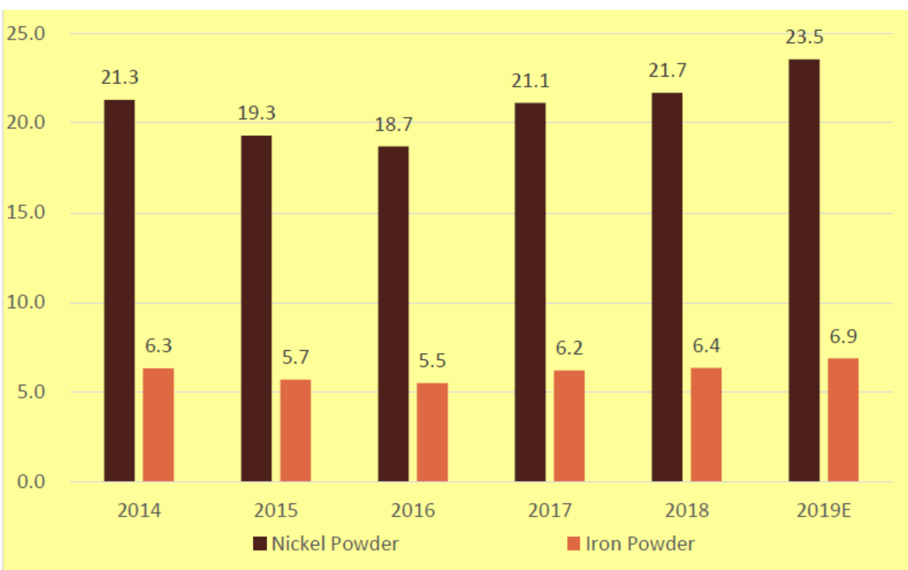
The growth of the nickel powder and iron powder market is partially driven by market demand. With the global economic growth, the industry of downstream applications of nickel powder and iron powder is also expanding, especially in the powder metallurgy and electronics industry. The expansion of the downstream application industries continues to play an active role in the expansion of the nickel powder and iron powder market.

19.1.2 Prices

The product prices were based on Maia Research Analysis report on nickel powder and iron powder, October 2019, as well as referencing current markets, forecasts and reports in the public domain.

Figure 19.3 presents the global prices for nickel and iron powders since 2014. It is forecasted that the price for global nickel powder will reach $23.50 US/kg in 2019 while the price for iron powder is forecasted to $6.90 US/kg.

Figure 19.3 – Global Nickel Powder and Iron Powder Prices ($US/kg)



Source: Maia Research Analysis

Nickel (99.8% Ni) and iron (98.5% Fe) powders will be sold directly onto markets as final products. Between 2015 to 2018, the nickel powders were sold with a premium of between $7.42US/kg to $10.71 US/kg shown in Table 19.1 as well as the London Metal Exchange (LME) value.

The average premium price between 2015 to 2018 of nickel powder is $8.95 US/kg.

It is assumed the average premium price of nickel powder is $8.95 US/kg with 2019 LME price of $16.53 US/kg, which amounts to $25.48 US/kg.

Based on Maia Research Analysis, the iron powder is expected to be sold at $6.90 US/kg.

Table 19.1 – Global Nickel Powder Average Price for the Period of 2015 to 2018

Year	Ni Powder Price (Maia 2019)	LME Price (Statista 2019)	Premium (Calculated)
	$US/kg	$US/kg	$US/kg
2015	19.29	11.86	7.42
2016	18.69	9.60	9.10
2017	21.12	10.41	10.71
2018	21.68	13.11	8.56
		Total Average	**8.95**

Maia Research Analysis has estimated that the global nickel powder market will grow by 31% from 2018 to reach 34.14 kilotonnes (kt) in 2024 while the iron powder market is estimated to increase by approximately 29% from 2018 to 28.98 kt in 2024 (Tables 19.2 and 19.3).

Table 19.2 – Global Nickel and Iron Powders Market in Tonnage -

Product	**Year**				
(kt)	2014	2015	2016	2017	2018
Nickel Powder	20.17	22.24	24.06	25.08	26.06
Iron Powder	17.50	19.23	20.75	21.61	22.41

Source: Maia Research Analysis, 2019

Table 19.3 – Global Forecast Nickel and Iron Powders Market in Tonnage

Product	**Year**					
(kt)	2019E	2020F	2021F	2022F	2023F	2024F
Nickel Powder	27.05	27.99	29.80	31.26	32.90	34.14
Iron Powder	23.22	23.94	25.41	26.64	27.98	28.98

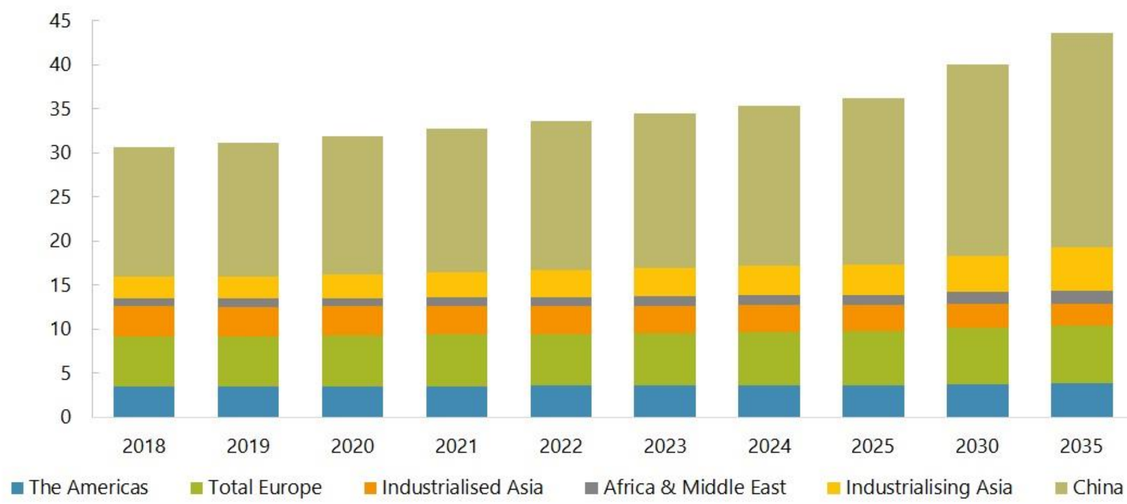
Source: Maia Research Analysis, 2019

19.2 Copper Market

Based on Roskill 1st Edition of the Copper Demand to 2035 Report, 60% of global copper consumption was directly related to its electrical conductivity properties in 2000. The balance was accounted for by its properties of thermal conductivity, machinability, malleability, aesthetics and signal transfer. However, by 2018, electrical conductivity had grown to represent 79% of the over 30 Mt of world copper demand in all forms (refined consumption and direct scrap use).

Based on the projections, Roskill believes that world total copper consumption might exceed 43Mt by 2035, implying per capita consumption of 5 kg by that date. Driven by population and GDP growth, urbanisation and electricity demand, applications utilising copper's excellent electrical and heat transfer properties will account for the overwhelming proportion of world volume growth. Electric vehicles and associated network infrastructure are just one facet of this and may contribute between 3.1–4.0 Mt of net growth by 2035. Direct use scrap use will fulfil a greater proportion of the total, but the expansion in the requirements for refined copper will remain substantial; fuelling the need for the next generation of brownfield expansions and greenfield mine projects.

Figure 19.4 – Global Copper Consumption Forecast (Mt)

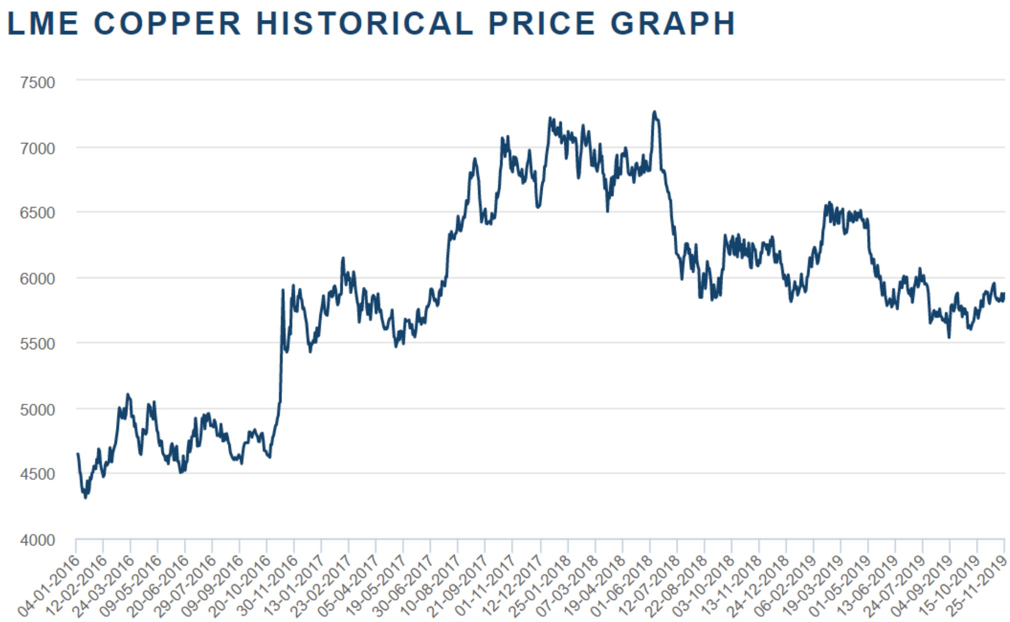


(source: Roskill, August 2019)

19.2.1 Price

Copper concentrates will be produced as one (1) of the three (3) products at Samapleu. The concentrate produced will have an estimated grade of 23% Cu. The Cu concentrate will require downstream smelting and refining to produce marketable copper. The equivalent metal price for copper concentrate (23%) for base case is estimated as 70% of copper metal LME price of $6,000 US/t to take into consideration of treatment charges, refining charges, and other costs, i.e. $0.966 US/kg. The LME Copper historical price between 2016 to 2019 is shown Figure 19.5.

Figure 19.5 – LME Copper Historical Price Graph (2016-2019)



Source: www.lme.com

19.3 Contracts

No contracts have been established to date by Sama Resources. The Company has not hedged, nor committed any of its production pursuant to an off-take agreement.

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

This Section was written by Simpa-Expert, Abidjan, Côte-d'Ivoire (SIMPA-CI) and reviewed by the QP to ensure in compliance to NI 43-101. The information presented in this Section is, for the most part, translated and summarised from the reports entitled document *"Étude de l'état initial du milieu bio-physique de la zone du projet Samapleu, SGS, July 2013*" and *"Étude de l'état initial socio-économique de la zone du projet Samapleu, SGS, July 2013*" (SGS, 2013).

As part of the environmental approval process in Côte d'Ivoire, in 2011, SAMA Nickel Côte d'Ivoire SARL (SAMA or the Company) started the Environmental and Social Impact Assessment ("ESIA") for the development of the Samapleu Project by inviting SGS Côte d'Ivoire, through its Environment Division, to conduct the Environmental Baseline Study.

In 2017, Sama Nickel contracted the Ivorian company SIMPA-CI to follow-up on the 2013's Environmental Baseline Study as well as to carry out the Environmental Impact Assessment. These studies are still ongoing.

20.1 Environmental and Social Baseline Studies

The main objective of the baseline study was to collect and analyze sufficient data on the human, biological and biophysical environment that will serve as a benchmark against which future changes will be compared to. The baseline study also serves as a basis for assessing the potential impacts and subsequently the actual impact of the project on this receiving environment.

For environmental biophysical analysist requirements, SGS relied on its network of accredited laboratories including the Monitoring & Analytical Services Laboratory (MASLAB) in Tema, Ghana.

SGS Environment in Abidjan, Côte d'Ivoire (SGS Environment) was given the mandate to conduct the Baseline Environmental Studies required for the eventual preparation for the social and environmental study.

A summary of the various topics covered by the July 2013 SGS Environmental and Social Baseline Study is presented in Table 20.1.

20.1.1 Development of the Project and Operations Description

The Samapleu Project will require the construction of some industrial facilities and surface infrastructure, as well as open pits for mineral ore extraction. Some of these components of the Project may affect the surrounding environment and communities. Although the characteristics of these infrastructure are not yet finalised, a list of the proposed facilities are summarised hereafter. The information presented in the 'Development of the Project and Operations Description' section was provided by Sama Resources to the best of their knowledge when this report was written.

Table 20.1 - Topics Covered by the 2013 SGS Environmental Baseline Study

Environmental Component	Sampling Season	Work Undertaken
Climate		Temperature, rainfall, humidity, wind speed data obtained from weather stations.
Soils		Soil characterisation including surface and subsurface samples submitted for chemical and physiochemical analyses.
Hydrography and Hydrology		Determination of watershed boundaries. Calculation of theoretical flows from the reference station of the Bafing at Bafingdala. Surface and groundwater water collection and analysis.
Air Quality		Ambient air quality parameters were studied as well as related standards, and the inventory of current sources of pollution in the region were evaluated.
Noise		Noise guideline values and the ambient noise parameters were evaluated.
Terrestrial Environment – Flora	Rainy Season Dry season	Botanical work including vegetation mapping and identification of important communities and species, including species at risk.
Terrestrial Environment – Fauna	Rainy Season Dry season	Amphibians, reptiles, birds, small and large mammal surveys were conducted during wet and dry seasons including identification of species at risk.
Aquatic Environment	Rainy Season Dry season	Identification and analysis of benthic invertebrates, of algae and fish.
Socio-Economic		Study area included villages of Gangbapleu, Gbangompleu, Samapleu, Yèpleu, Yorodougou and Zocoma. Data collection included demographics, religion, health, education, land tenure, regional economic activities, etc.

The Reader is invited to read the following reports: *ETUDE DE L'ETAT INITIAL DU MILIEU BIO-PHYSIQUE DE LA ZONE DU PROJET SAMAPLEU and ETUDE DE L'ETAT INITIAL SOCIO-ECONOMIQUE DE LA ZONE DU PROJET SAMAPLEU*, SGS Environnement CI, July 2013.

20.1.1.1 Surface Infrastructure and Open-Pit

Several facilities will be constructed at the mining site. They include mine offices, garage, fuel stations, concentrator and process plants, backup power station, etc. Accommodations for the some of the staff and workers will be in the town of Yorodougou.

The surface extent of the Samapleu orebodies stretch for about two (2) km in length and less than one (1) km in width. The exploitation of the Nickel-Copper-Platinum Group Elements deposit will be by open pits. The orebody is planned to be excavated from three (3) pits. The Samapleu Main pit has a maximum length of 525 m, 365 m maximum width, and a maximum depth of 232 m, the North pit has a maximum length of 843 m, 310 m maximum width, and a depth of approximately 190 m, the third and the smaller pit has a maximum length of 325 m, a width of 192m and a depth of approximately 106 m. The surface soil and some waste rock will have to be managed on the site and kept for soil coverage at final reclamation and closure. Geochemical testing will be performed at the next stage of engineering to ensure proper management, according to all regulations required, of the material before being used on site.

20.1.1.2 Waste Management

Waste will be managed out of site to eliminate potential soil and groundwater contamination. Best practices in waste management will be used during the Project.

20.1.1.3 Tailings Management

Preliminary evaluations have been started to locate and design the tailing ponds. More detailed work, including a condemnation drilling program and a geotechnical drilling program, will be carried out to characterise the area and determine the best design for the management of tailings for the Project. Geochemical testing will be performed at the next stage of engineering to ensure proper management, according to all regulations required.

20.1.1.4 Water Management

Surface runoff and drainage near the plant site will be directed to an on-site retention pond and re-used in the process. Some of the surface runoff will be directed away from the plant site to existing natural drainage and separated from the drainage of the Project area. To properly manage water infiltration into the pits, sumps will be established at the lowest point of each pit floor. Water collected in the sumps will be pumped to a collection point at surface. Studies need to develop in the next phase to determine the impact on water resources. These studies will include preparing a storm water management plan for the mining site and developing a mine water balance.

20.1.2 Physical Environment

Data collection for the bio-physical baseline was completed between September 2012 and March 2013.

20.1.2.1 Climate

The climatology of the Samapleu area is part of a mountain region situated West of Côte d'Ivoire, in the regions of Man, Danané and Toulepleu. It comprises only of two seasons. The dry season is short (November to February), while the rainy season runs from March to October with high precipitation in September. Annual rainfall ranges from 1,400 to over 2,300 mm. (Gerard et al, 1971).

The study area (western Côte d'Ivoire), like the Yorodougou observation post, has two wind regimes. The dominant direction of the wind is East at Yorodougou during the month of December and the prevailing wind direction in Yorodougou during the month of July is South-West.

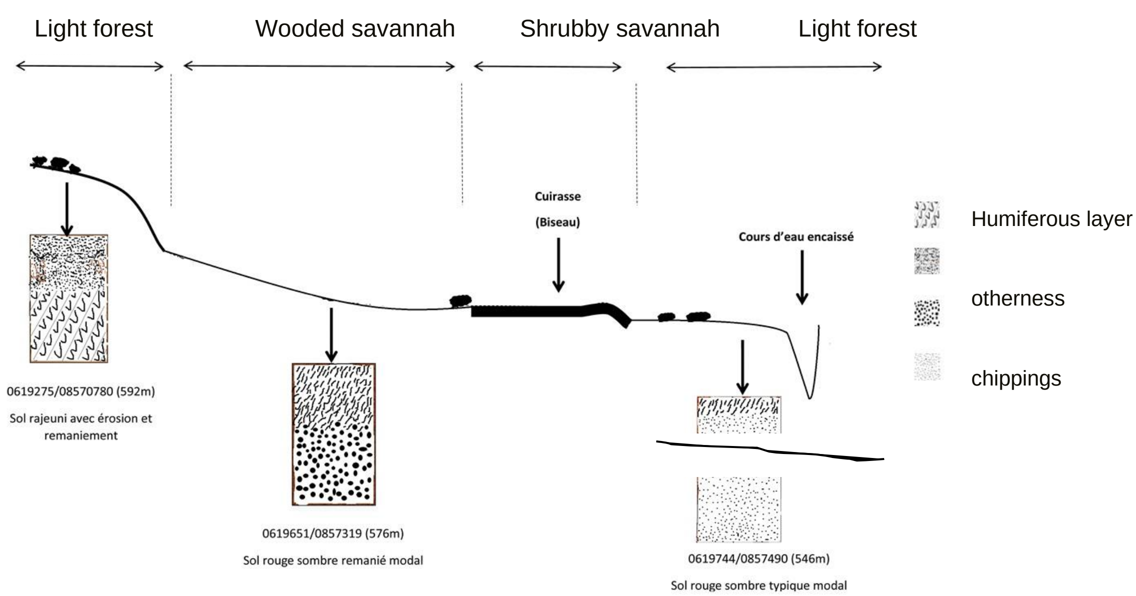
Wind speeds are generally low in the region. They vary between 0.3 and 3.1m/s, a monthly average of 1.4 m/s. High speeds are usually observed at the beginning of the rainy season. They can reach 2 m/s or 7.2 km/h.

20.1.2.2 Soils

The project area is covered with a mix between forest, dense or clear, and savanna (shrub or tree). The topographic relief and their associated soil, can be subdivided into three main morphological landscapes: hills and prevailing terrain elevation higher than or close to 600 m, slopes and plateaus between 600 and 500 m and finally plateaus and valleys below 500 m. (SGS, 2013)

Red soils are distributed along the slopes of the morphological landscape 1 (Figure 20.1). These red soils were observed under forest's cover at the planned Samapleu Main pit and under savannah at planned Samapleu Extension 1 pit.

Figure 20.1 - Morphological Red Soil Landscape 1 (Source: SGS, 2013)



Two (2) other types of morphological type of soil can be found in the area of the Project, Landscape 2 and Landscape 3 (Figure 20.2 and Figure 20.3).

Figure 20.2 - Other Soil Profiles; Landscape N° 2 (source: SGS, 2013)

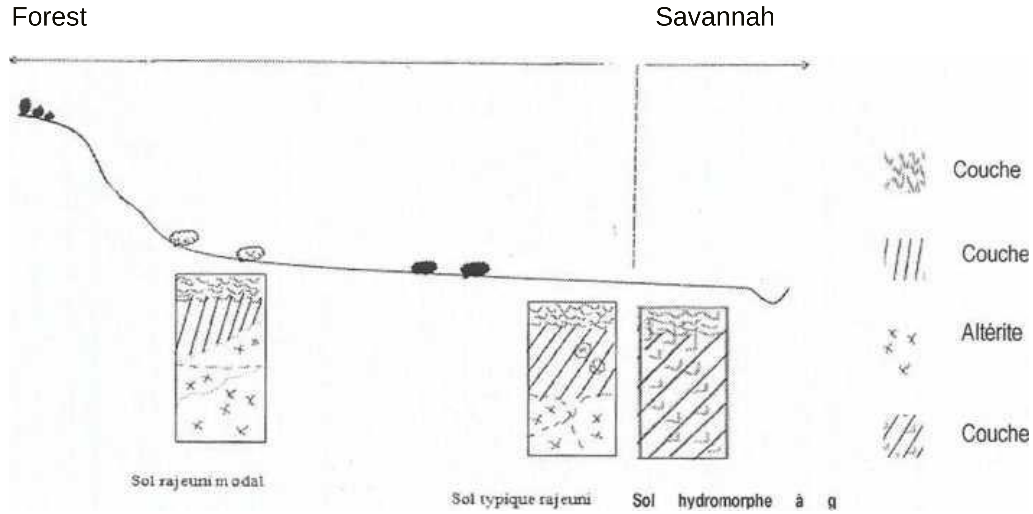
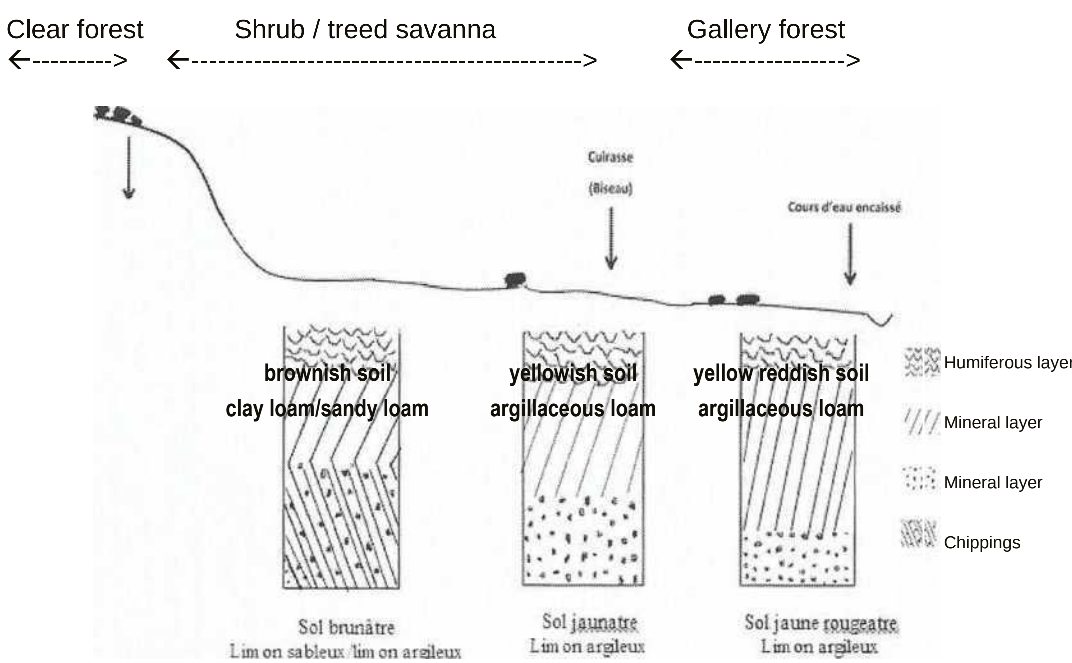


Figure 20.3 - Morphological Landscape N° 3 (Source: SGS, 2013)



Eight samples of soil were taken from the standard profiles on the 0/20 and 20/40 cm layers. Two typical profiles have been sampled on Landscape I, on which the mines are located and where the soils are distinguished by their dark red color and the strong structural development. A typical profile was taken from each of the other two landscapes.

The results of the particle size analysis are shown in Table 20.2.

Table 20.2 - Particle Sizes for Various Soils (Source: SGS, 2013)

N° Labo.	Coordo.	Paysage	Prof. (cm)	A	Lf	Lg	Sf	Sg
1	619744/857490	1	0/20	33,6	10,4	7,0	16,1	28,5
2	"		20/40	34,1	11,6	6,1	18,4	26,1
3	618867/860148	1	0/20	41,2	26,3	3,5	11,0	12,3
4	"		20/40	59,5	13,9	6,1	8,6	7,5
5	621727/855278	2	0/20	10,6	4,1	9,7	34,3	38,0
6	"		20/40	26,4	8,2	4,8	21,6	36,2
7	614783/860440	3	0/20	9,1	10,1	6,8	33,5	37,3
8	"		20/40	19,8	14,7	15,8	22,7	26,1

(A: Clay, Lf: fine loam, Lg: coarse Loam, Sf: fin sand, Sg: coarse sand)

Soils at the Landscape 1 are dominated by fine constituents, clay and fine silt. However, the two Profiles analyzed differ from each other in texture, silty clay at point 619744/857490 and clay at point 618867/860148. In the other two landscapes, coarse constituents are dominant. The texture of the mineral layer 20/40 cm is silty, sandy clay. The relative high consistency of the soils of Landscape 3 observed in few locations could result from the high proportion of fine sands.

Table 20.3 provides analytical results for soil chemistry; the references are identical to those in Table 20.2.

Table 20.3 - Results of Chemical and Physico-Chemical Analyses

N°	Ph	M.O %		Phos. (ppm)			Absorbent complex (cmol/kg)			
lab	water	Ct	Nt	Plot	Pass.	C.E.C.	Ca2+	Mg2+	K+	Na+
1	5.2	2.54	0.20	200	133	12.40	0.17	0.34	0.04	0.01
2	5.0	1.85	0.16	244	112	11.68	0.14	0.32	0.05	0.02
3	5.30	3.32	0.24	317	224	19.40	0.23	0.33	0.05	0.02
4	5.6	2.36	0.18	400	94	15.44	0.17	0.32	0.04	0.02
5	5.5	1.89	0.17	156	65	12.96	0.26	0.44	0.06	0.01
6	5.3	1.36	0.12	389	76	8.80	0.95	0.77	0.05	0.01
7	5.2	2.34	0.19	156	59	7.04	0.85	0.66	0.06	0.01
8	5.4	1.56	0.12	400	81	10.64	0.39	0.57	0.05	0.01

Ptot. : total phosphorus ; Pass. assimilable phosphorus; Ct : total carbon ; Nt : total nitrogen

Table 20.4 present the identified soil classes for landscapes 1, 2 and 3 compared to the AFES (*Association Française pour l'étude du sol*) and the BRM (*Base de Référence Mondiale*).

Table 20.4 - Soil Correlation between AFES and BRM (source: SGS, 2013)

Landscapes	AFES	BRM
1	Ferrallitic soil highly desaturated, rejuvenated	Cambisol
	Ferrallitic soil highly desaturated, typical reworked	Ferric cambisol
	Highly desaturated ferrallitic soil, typical modal	Rhodium ferralsol
2 and 3	Ferrallitic soil highly desaturated, reworked indurated	Ferric ferralsol
	Mineral hydromorphic soil, pseudogly	Molar gleysol

20.1.3 Hydrography and Hydrology

The semi-mountainous region of Man-Danané is drained by three (3) main rivers, namely the Méné River, the Cavally River and the Sassandra River. These rivers define specific hydro systems or watersheds. The hydrosystem of the Sassandra River is the most important in the region. It occupies the entire eastern part of the river. The main tributaries of this river are the Bafing, the Koué and the N'zo (Figure 20.4).

The project site is within the Sassandra river catchment area, precisely in the Bafing sub-watershed. Hydrographic data has been collected on the Bafing watershed at the Bafingdala bridge (Badala) since 1961. The Badala hydrological station is considered as the reference station for the study. The watershed at this outlet covers an area of 5,930 km².

Figure 20.4 – Hydrographic Network Reconstructed from Topographic Maps (Source: SGS, 2013)

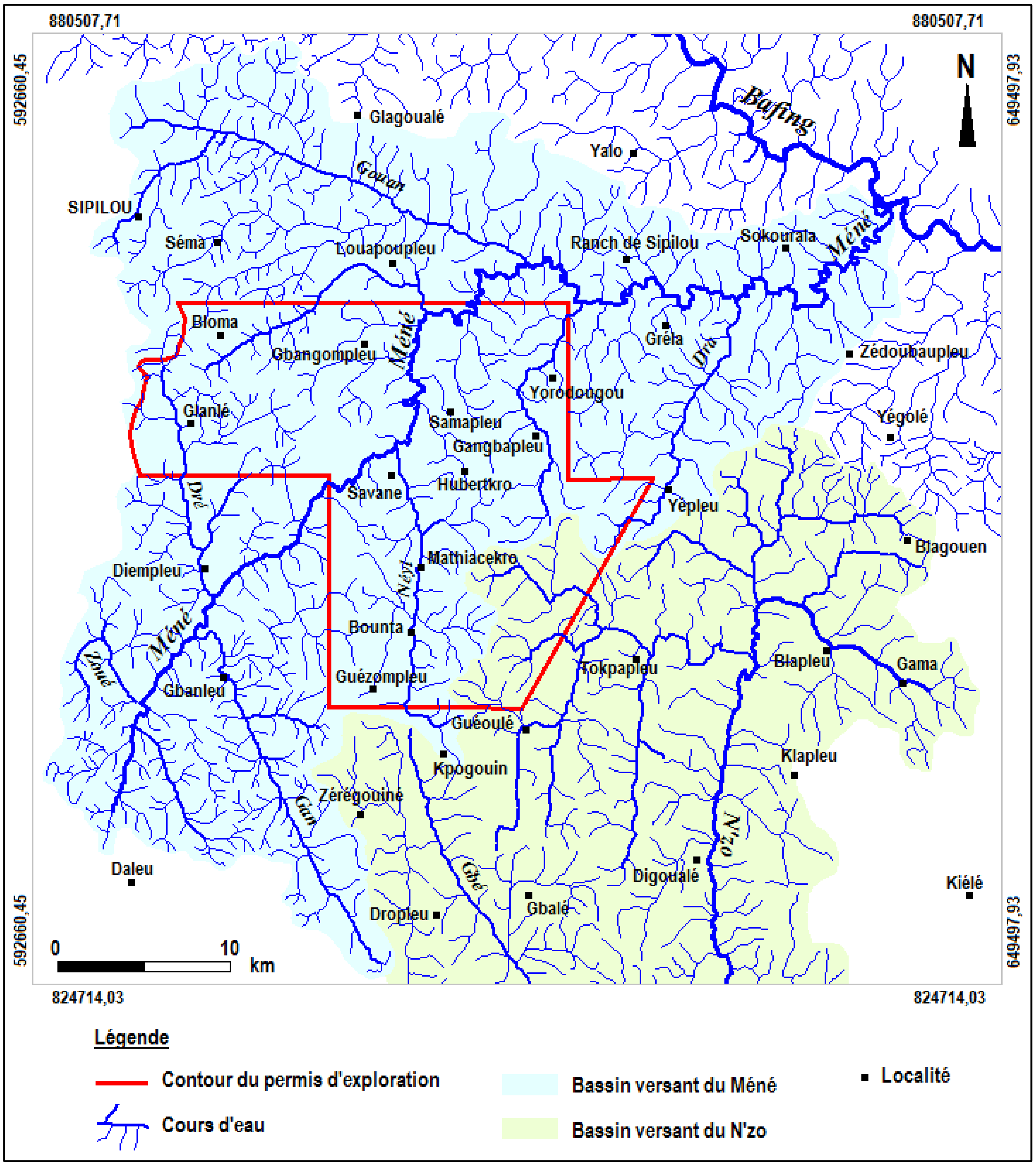
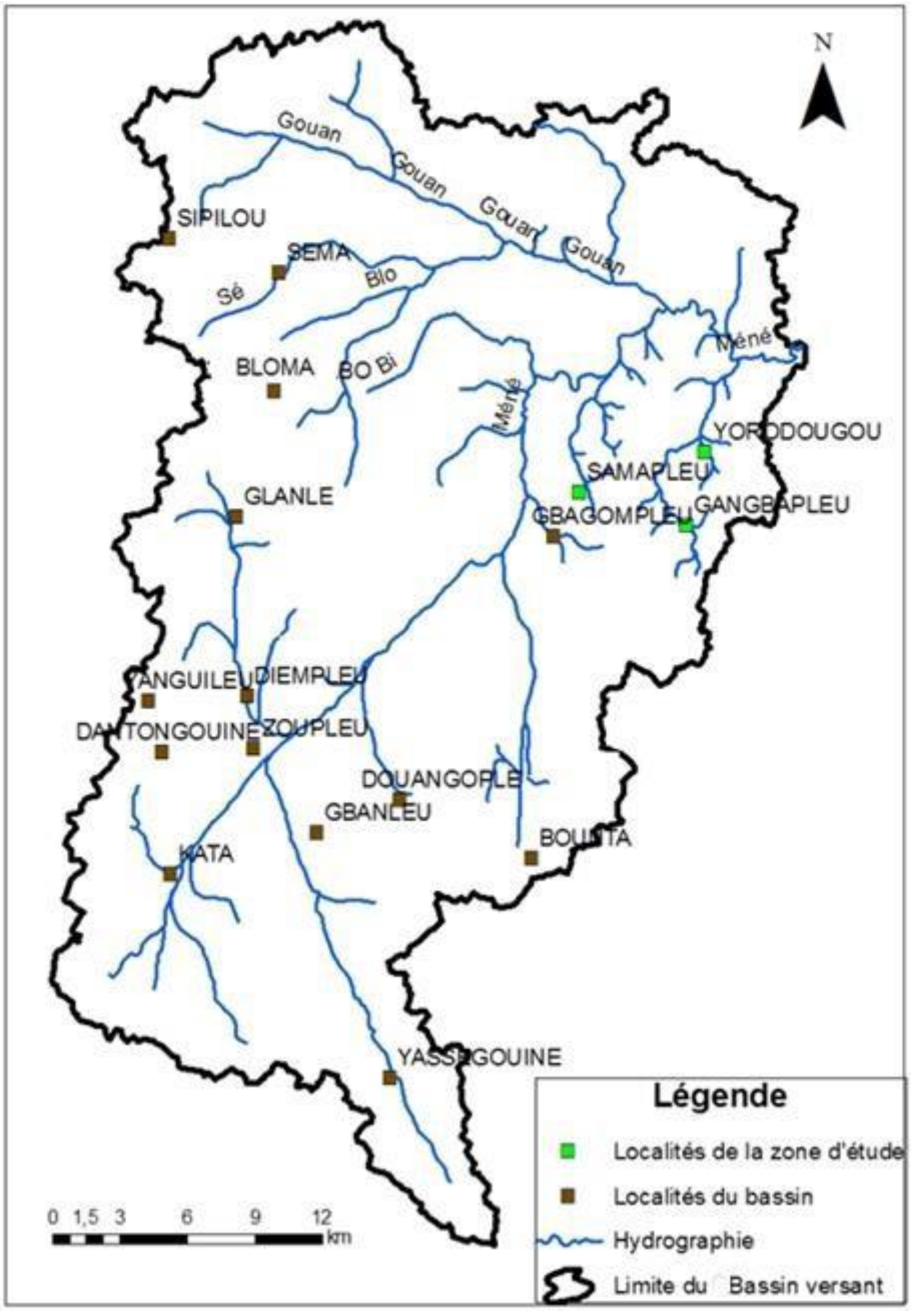


Figure 20.5 - Watershed Méné to Yorodougou (source: SGS, 2013)



Flow rates were calculated using the following steps and the HYDROMET software:

- Collecting and recording water levels;
- Interpretation of instantaneous flow rate;
- Calculation of daily flows;
- Estimation for the annual flow rates (average in m³/s).

Table 20.5 - Watershed and Recurrence Period (Source: SGS, 2013)

Name of the watercourse	Watershed Area (km²)	Average Annual Flow Rate (m³/s)	Flood flow rate 10 years (m³/s)	Flood flow 25 years (m³/s)	Flood flow 100 years (m³/s)
Bafing to Bafingdala	5,930	63.64	399	462	565
Méné to Yorodougou	1,070	11.48	72.0	83.4	102

The minimum flowrate needed to maintain the integrity of the ecological environment (ref: *Code de l'Eau, Article 19*) was assessed at 0.018 m³/s, at the Gouanin River hydrometric station in Samapleu. Typically, the minimum flowrate is about equal to one-tenth of the annual average flow. The annual interannual module (average flowrate) of the Bafing River over the period 1981-2000 is approximately 63,6 m³/s (SGS, 2013). The volume of water that the project can safely collect from the Gouanin River while preserving minimal flow has been established to 0,170 m³/s (SGS, 2013).

Surface water samples were collected December 2012 around the project site area. A total of 15 samples were collected (Figure 20.6). These results were compared to the WHO (World Health Organization) drinking water quality standards and discussed in this section (Tables 20.6 and 20.7).

Figure 20.6 - Location of Water Sampling Points. (Source: SGS, 2013)

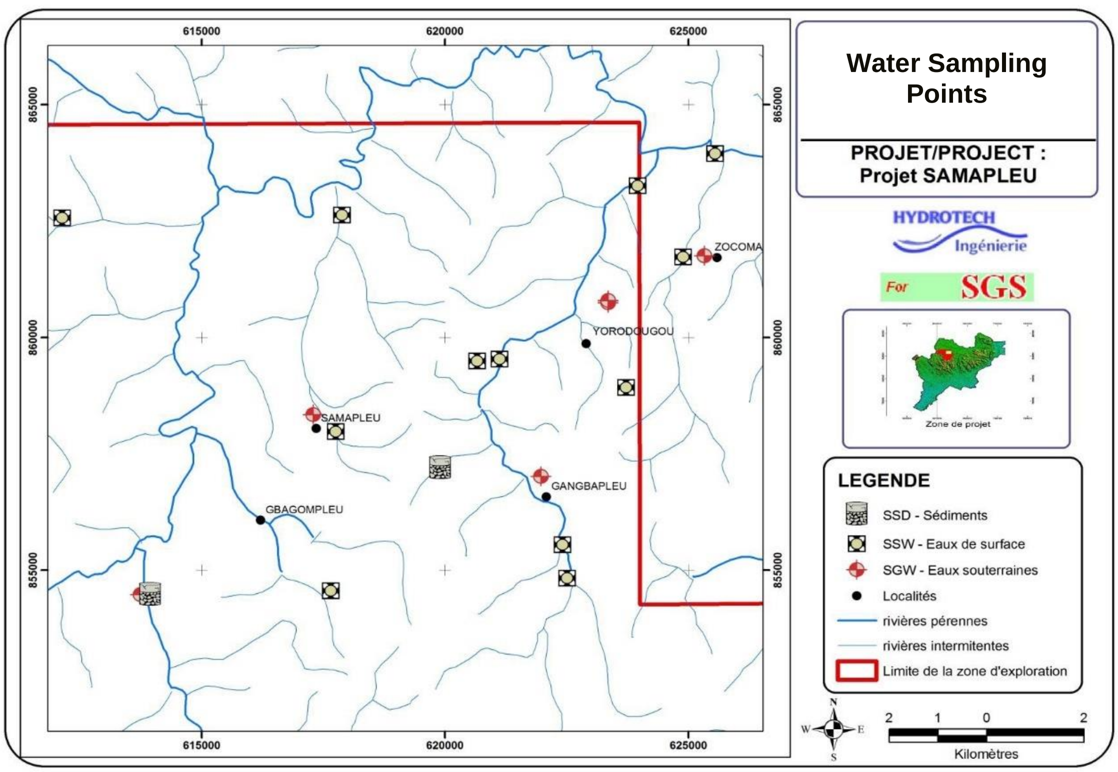


Table 20.6 - Summary of Surface and Groundwater Analysis Results (SGS, 2013)

Sample-ID	pH*	Conductivity*	Colour (real)	Turbidity	TDS	TSS or MES	DCO	DBO	OD	Oil & Grease	Alcalinity total CaC	Hardness (calcul	Ca	Mg	Na	K	Nitrate (NO3)	As	Si	Ag	AL	Ba	Cd	Co	Cr	Ni	Cu	Fe	Pb
		mS/cm	Pt/Co couleur	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
SURFACE Water																													
SSW01	6,66	0,066	<5	39,5	59	5	<25	<5	5,31	<5	24	22	4	2,9	4,2	1,4	1,04	<0,002	9,7	<0,02	0,23	0,09	<0,002	<0.05	<0,01	<0,02	<0,02	1,1	<0,01
SSW02	6,72	0,052	<5	35,2	48	26	29	<5	4,98	<5	20	17	4	1,9	4,0	2,5	0,54	0,002	11,8	<0,02	1,35	0,13	<0,002	<0.05	<0,01	<0,02	<0,02	4,3	<0,01
SSW03	6,67	0,060	<5	45,5	52	8	27	<5	5,75	<5	23	17	4	1,6	5,5	1,1	0,20	<0,002	11,3	<0,02	0,36	0,09	<0,002	<0.05	<0,01	<0,02	<0,02	1,0	<0,01
SSW04	7,03	0,064	<5	40,9	65	6	42	<5	5,50	<5	31	21	5	2,2	5,5	1,1	0,15	<0,002	12,2	<0,02	0,35	0,08	<0,002	<0.05	<0,01	<0,02	<0,02	1,0	<0,01
SSW05	6,69	0,102	<5	60,9	91	16	<25	<5	5,15	<5	46	37	5	5,9	4,8	2,6	0,08	0,002	16,9	<0.02	0,26	0,09	<0,002	<0.05	<0,01	<0,02	<0,02	2,6	<0,01
SSW06	7,09	0,204	5	75,8	138	180	90	<5	5,60	<5	88	90	9	16,4	6,8	1,8	2,48	<0,002	19,2	<0,02	0,36	0,08	<0,002	<0.05	0,01	0,02	0,05	2,0	<0,01
SSW07	7,09	0,204	<5	75,8	132	123	54	<5	5,60	<5	92	88	9	16,1	6,8	1,9	2,54	<0,002	19,4	<0,02	0,65	0,08	<0,002	<0.05	0,01	<0,02	<0,02	2,2	<0,01
SSW08	6,90	0,052	<5	28,6	49	9	<25	<5	3,80	<5	23	17	3	2,2	3,6	0,7	0,09	<0,002	10,5	<0,02	0,24	0,09	<0,002	<0.05	<0,01	<0,02	<0,02	3,3	<0,01
SSW09	7,19	0,100	<5	53,8	84	18	<25	<5	5,66	<5	48	39	5	6,6	4,0	1,9	<0,06	<0,002	13,9	<0,02	0,29	0,10	<0,002	<0.05	<0,01	<0,02	<0,02	3,3	<0,01
SSW10	7,09	0,380	<5	44,3	170	2	<25	<5	5,08	<5	113	121	12	22,2	4,0	1,8	5,14	<0,002	20,6	<0,02	0,10	0,06	<0,002	<0.05	<0,01	0,03	<0,02	0,3	<0,01
SSW11	6,44	0,097	<5	72,0	90	28	<25	<5	4,92	<5	47	32	5	4,6	6,6	2,5	0,12	<0,002	19,5	<0,02	0,68	0,08	<0,002	<0.05	<0,01	<0,02	<0,02	3,6	<0,01
SSW12	7,23	0,066	<5	35,3	59	4	<25	<5	5,58	<5	30	18	4	2,3	4,1	1,2	0,26	0,002	10,2	<0,02	0,18	0,07	<0,002	<0.05	<0,01	<0,02	<0,02	1,2	<0,01
SSW13	6,70	0,080	<5	50,4	79	12	<25	<5	4,44	<5	36	26	5	3,5	4,0	1,4	0,28	<0,002	12,7	<0,02	0,21	0,06	<0,002		<0,01	<0,02	<0,02	1,8	<0,01
SSW14	6,89	0,073	<5	37,7	66	18	<25	<5	5,06	<5	32	23	4	3,0	4,5	1,4	0,17	<0,002	12,1	<0,02	0,39	0,09	<0,002		<0,01	<0,02	<0,02	3,0	<0,01
SSW15	7,16	0,052	<5	35,0	48	10	<25	<5	5,22	<5	22	18	3	2,4	2,9	1,1	0,20	<0,002	7,85	<0,02	0,37	0,07	<0,002		<0,01	<0,02	<0,02	1,6	<0,01
Groundwater																													
SGW01	6,08	0,348	<5	10	280	2	<25	<5	3,51	<5	85	128	20	20,1	9,2	4,7	62,7	<0,002	25,9	<0,02	0,04	0,23	<0,002	<0,05	0,02	0,02	<0,02	<0,1	<0,01
SGW02	5,87	-	<5	83,3	79	36	<25	<5	3,02	9	25	26	3	4,8	2,5	0,9	1,13	<0,002	16,1	<0,02	1,16	0,14	<0,002	<0,05	0,03	0,05	<0,02	1,3	<0,01
SGW03	5,49	0,081	<5	5,3	112	<1	<25	<5	2,86	7	28	16	4	1,5	7,1	3,4	1,08	<0,002	27,3	<0,02	0,06	0,05	<0,002	<0,05	<0,01	<0,02	0,04	0,2	<0,01
SGW04	5,75	0,087	<5	10,8	81	1	<25	<5	3,15	8	29	20	5	2,7	5,6	2,5	5,50	<0,002	18,3	<0,02	0,16	0,17	<0,002	<0,05	<0,01	<0,02	<0,02	0,2	<0,01
SGW05	5,74	0,063	<5	17,1	70	1	<25	<5	3,31	8	18	17	4	2,0	3,5	2,2	1,58	<0,002	15,5	<0,02	0,08	0,12	<0,002	<0,05	<0,01	<0,02	<0,02	0,1	<0,01
SGW06	4,84	0,028	<5	11,8	45	<1	<25	<5	2,54	9	<2	<2	<1	<1	2,0	2,2	3,7	<0,002	6,82	<0,02	0,09	0,08	<0,002	<0,05	<0,01	<0,02	<0,02	0,2	<0,01
SSD01																													
SSD02																													
OMS 2006	6,5 –9,5*	-	-	-	1000*	-	-	-	-	-	-	200	-	-	20**	-	50	0,01	-	0,005-0,05**	0,2	0,7	0,003	-	0,05	0,07	2	0,5-50**	0,01

*: WHO has not provided a guide value but indicates an optimal value.
**: Concentrations normally found in surface water according to WHO
The bold cells show values above WHO guidelines.

Table 20.7 - Results for surface and groundwater analysis (SGS, 2013)

	Flore totale	Coliformes totaux	Coliformes fécaux	Eschérichia coli	Streptococcus fécaux	Salmonella
Criteria	20/ml	absent/100ml	absent/100ml	absent/100ml	absent/100ml	absent/100ml
Surface Water						
SSW01	360	present	present	present	absent	absent
SSW02	220	present	present	present	absent	absent
SSW03	200	present	present	present	absent	absent
SSW04	300	present	present	present	absent	absent
SSW05	220	present	present	present	absent	absent
SSW06	400	present	present	present	absent	absent
SSW07	380	present	present	absent	absent	absent
SSW08	240	present	present	absent	absent	absent
SSW09	320	present	present	absent	absent	absent
SSW10	300	present	present	absent	absent	absent
SSW11	301	present	present	absent	absent	absent
SSW12	280	present	present	absent	absent	absent
SSW13	180	present	present	present	absent	absent
SSW14	200	present	present	present	absent	absent
SSW15	160	present	present	absent	absent	absent
Groundwater						
SGW01	120	absent	absent	absent	absent	absent
SGW02	80	present	present	absent	absent	absent
SGW03	100	absent	absent	absent	absent	absent
SGW04	180	absent	absent	absent	absent	absent
SGW05	120	absent	absent	absent	absent	absent
SGW06	100	absent	absent	absent	absent	absent

Water resources in the project area (surface water and groundwater) generally have the characteristics of natural waters. However, almost all these waters are of poor microbiological quality. (SGS, 2013)

Aluminum and iron are the dominant metals in the surface waters in the area of the project, with normal concentration values for iron according to WHO. For aluminum, all surface water samples showed concentrations above the WHO guidelines, except samples SSW10 and SSW12. (SGS, 2013)

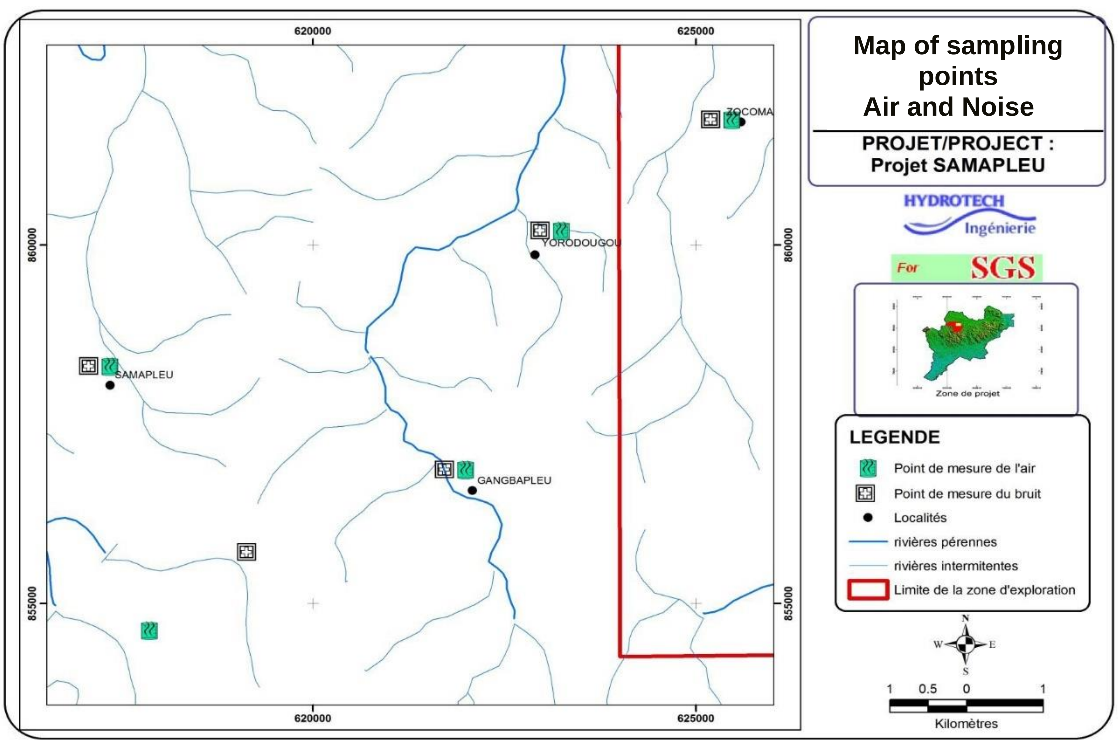
Aluminum, barium and iron are the dominant heavy metals in groundwater without reaching the WHO guidelines for the quality of drinking water. The pH of the water is relatively acidic (between 4.84 and 6.08). Only SGW02 (traditional well in Savane) had an aluminum concentration above WHO guidelines and a coliform load. (SGS, 2013)

The reader is invited to read the report: *ETUDE DE L'ETAT INITIAL DU MILIEU BIO-PHYSIQUE DE LA ZONE DU PROJET SAMAPLEU, SGS* Environment Cl, July 2013 for further details.

20.1.3.1 Air quality

Representative locations have been selected to allow sampling for air quality focusing on dust, SOx and NOx. Sites have been selected based on one or all of the following criteria (Figure 20.7).

Figure 20.7 - Location of the Air Measurement Points



The air quality results (dust, SOx and NOx) will be used as the baseline levels for subsequent studies. The project area is located in a rural environment with no industrial facilities. Most of the dust comes from dirt roads and get carried away with winds during the dry season. All dust concentrations results were above the World Bank guideline. SOx and NOx were low and often lower than the laboratory's detection limit. (SGS, 2013)

20.1.3.2 Noise

A noise study has been conducted to determine the ambient noise level around the project area. Noise measurements have been taken (day and night) in villages. These villages were selected due to their proximity with the proposed mining activities (Table 20.8). (SGS, 2013)

Table 20.8 - Location of Noise Measurement Stations (SGS, 2013)

Village	GPS Coordinates (UTM)		Remarks
	X	Y	
Yorodougou	623101	860205	Normal conditions
Zokoma	625328	861753	Dance in the old village during night
Samapleu	617214	858314	Normal conditions
Gangbapleu	621856	856870	Normal conditions
Delipleu	619274	855720	Rain during the day

During the daytime period the noise intensity varied between 51 dB(A) at Zokoma and 56.5 dB(A) at Yorodougou. Although, these values are aligned with the World Bank guidelines, with exception for Yorodougou, they are above the Ivorian regulatory levels applicable to rural areas with low traffic flow. For the evening period, the values recorded at Zokoma and Gangbapleu are above the World Bank/IFC recommended 55 dB(A) guideline. (SGS, 2013)

Compared with Ivorian regulations, noise levels recorded at all collecting points were above the standard of 40 dB(A). For the night period, only at the Samapleu location the recorded noise levels were below the 45 dB(A) guideline. The Ivorian regulatory value of 35 dB(A) has been exceeded at all measurement points. During the survey, it was observed that noise was generated by traffic noises, domestic activities (especially when returning from the fields in the evening) and domestic animals (roosters, dogs, goats, and sheep) (SGS, 2013).

20.1.4 BIOLOGICAL ENVIRONMENT

The Biological environment studies, which includes Fauna and Flora investigation were performed during the dry and rainy seasons in 2012 (SGS, 2013).

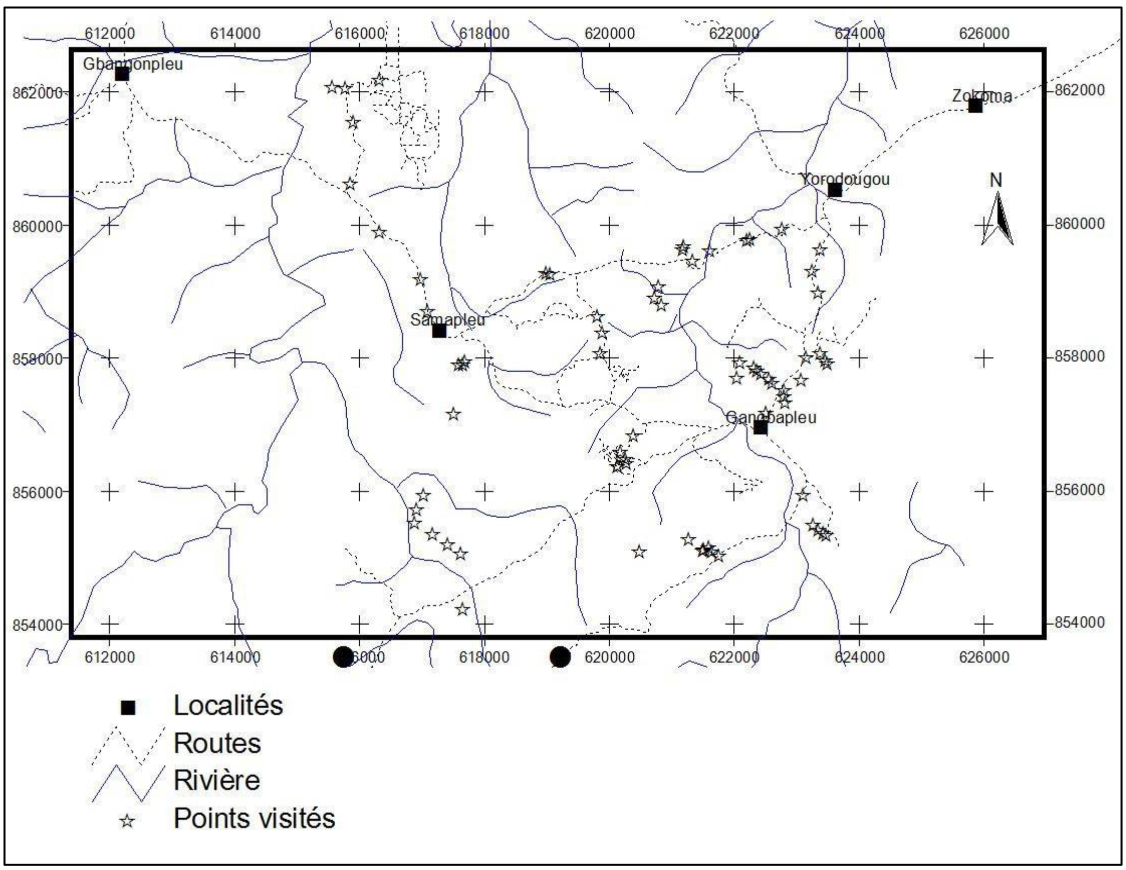
20.1.4.1 Flora in the Rainy Season

The procedures used for the flora inventory were:

- The "Itinerant Technic" adapted for rapid assessment of floristic diversity (Aké Assi 1984, Kouamé 1998),
- The surface survey method (Kouamé, 1998, Bakayoko, 1999).

For each surveyed site, a description of the flora was carried out. Special status species according to the IUCN red list have been identified. A total of 71 sites (20 X 20 m) distributed throughout the study area were inventoried (Figure 20.8). (SGS, 2013).

Figure 20.8 - Inventoried Areas for the Flora Study (SGS, 2013)



The exploration permit is located in the Guinean pre-forest savanna zone according to (Guillaumet & Adjanohoun, 1971). The study area is largely covered by savannah, forests, fallows and cultivated areas. Its very rugged terrain offers the possibility of observing forests on slopes above 600 m as well as medium altitude savannahs (Figure 20.9). In addition to belonging to the forest-savanna transition zone, the study area benefits from mountainous terrain; hence a great variability of habitats (mesophilous forest, open forest, savannah and Bowé). (SGS, 2013)

The various surveys carried out through the Samapleu project area made it possible to inventory a total of about 330 plant species distributed among 246 genera and 73 families. The dominant families of all species are Fabaceae (48 species), Rubiaceae (35 species), Euphorbiaceae (20 species), Apocynaceae (16 species), Annonaceae (14 species), Moraceae (14 species), Sterculiaceae (13 species), Meliaceae (11 species) and Poaceae (11 species). They constitute 55% of the total flora. (SGS, 2013)

Of the about 330 species identified, 18 are listed as endangered species on the IUCN Red List (IUCN, 2010). They belong to three IUCN categories (16 vulnerable: VU, one in danger: EN and one near threatened: NT) and are for the majority of species used as timber. The strong pressure of the wood industries on these species would explain their status, hence their identification as vulnerable species. Here are some examples: Entandrophragma candollei, Entandrophragma utile, Guarea cedrata, Guibourtia ehie, Khaya ivorensis, Lovoa trichilioides, Milicia excelsa, Milicia regia, Nauclea diderrichii, Nesogordonia papaverifera, Pterygota macrocarpa and Terminalia ivorensis. (SGS, 2013)

Only ten species are reported by Aké Assi as threatened. These include Cola attiensis, Psychotria ivorensis, Diospyros vignei, Milicia excels, Milicia regia, Piptostigma fasciculata, Cola heterophylla, Hibiscus comoensis, Synsepalum aubrevillei and Placodiscus boya. If Milicia excelsa and Milicia regia are exploitable species and valued by loggers, the other eight species have no commercial values, but they have ecological value. (SGS, 2013)

20.1.4.2 Flora in the Dry Season

In order to complete the inventory and take into account new species that could not be observed during the rainy season, the same sites were visited, but also new sites. A total of 71 sites were visited and distributed throughout the study area. For each site, a description of the vegetation and the flora was carried out. Special status species according to the IUCN Red List have been identified. (SGS, 2013)

The floristic inventory of the exploration area of the Samapleu project identified 469 plant species taxa of two (2) inventory missions, i.e. an increase of about 130 species. They are distributed among 83 families including 78 families of Angiosperms and 5 families of Pteridophytes. The main families are: Fabaceae (63 species), Rubiaceae (42 species), Poaceae (25 species), Euphorbiaceae (22 species), Apocynaceae (18 species), Annonaceae (16 species) species), Meliaceae (15 species), Moraceae (15 species), Sterculiaceae (15 species), Asteraceae (14 species) and Acanthaceae (12 species).

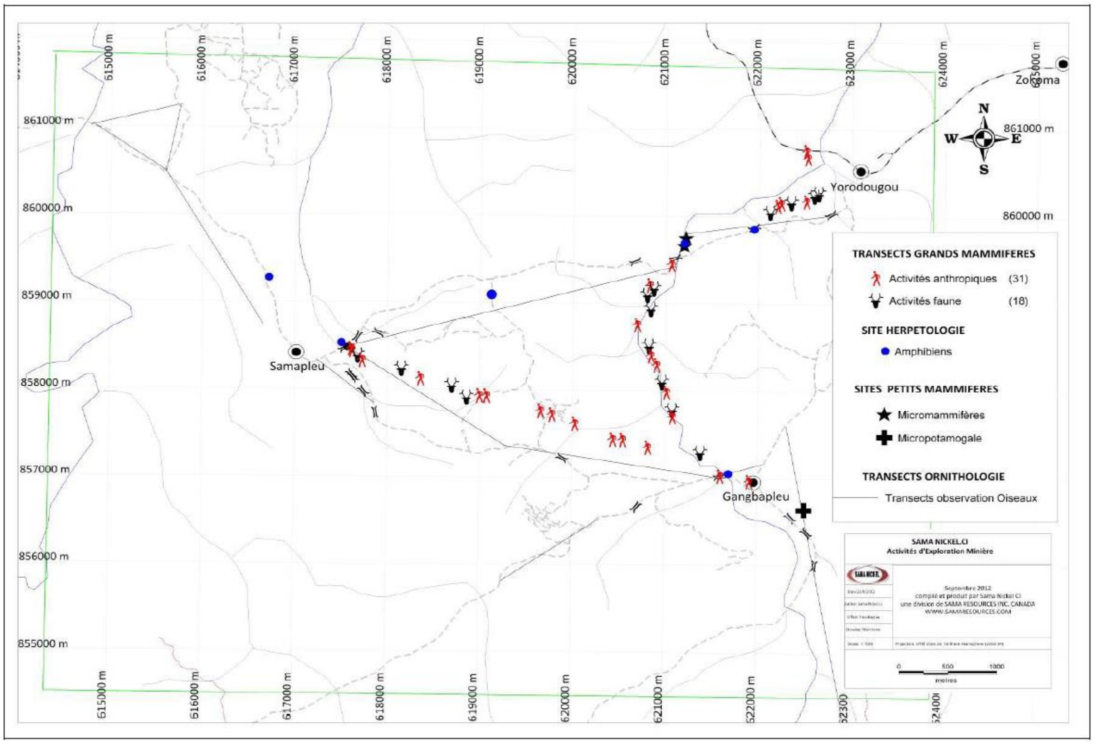
These families alone account for more than 50% of the total species. They are, according to several studies (Kouamé, 1998, Bakayoko et al., 2001, Nusbaumer et al., 2005), the most encountered in the

Ivorian forests. The Poaceae, Asteraceae and Acanthaceae among these families is the result of the surveys of the second phase which made it possible to take into account several species. More studies are ongoing to identify the flora in the area of the Project. (SGS, 2013)

20.1.4.3 Fauna in the Dry Season

Figure 20.9 presents the main sites and routes of wildlife sampling.

Figure 20.9 - Sampling of Wildlife (Amphibians, Birds and Mammals) (SGS, 2013)



The taxonomic composition of the amphibians in the study area shows that this fauna is similar to that of the savannah regions. Species such as Amietophrynus maculatus, Amietophrynus regularis, Hoplobatrachus occipitalis, Afrixalus dorsalis, Hyperolius fusciventris, Hyperolius guttulatus and Ptychadena mascareniensis have been described by Lamotte (1967), Schiøtz (1967), Barbault (1972) and Rödel (2000). as typical species of degraded habitats and savannah areas. They have therefore developed coping strategies to survive man-disturbed environments.

This behaviour is not the same in subservient species, which are known to be very sensitive to habitat fragility and can, therefore, disappear when the habitat is disturbed (Schiøtz 1964, Rödel et al. 2004, Rödel et al., 2005, Assemian et al., 2006). In contrast, the species Arthroleptis sp1 and 2, Phrynobatrachus latifrons, which are forest species, also have a capacity of adaptation for disturbed forest environments (Adeba et al., 2010).

This is not the case for Phrynobatrachus plicatus that has been observed in a swamp forest. The presence of this species in the area indicates that there are some forest relics in the area. This study shows that the taxonomic richness of Amphibians is low. It decreases when moving from the least disturbed transect 1 (gallery forest) to the most disturbed one (monoculture or rice growing zone).

These results corroborate the claims of the authors cited above on the sensitivity of amphibians to the deterioration of their habitat. This low taxonomic richness of the herpetofauna of disturbed environments is attributable to the effect of deforestation, but especially to the degradation of the entire ecosystem and its conversion into plantations. (SGS, 2013)

On the other hand, the high taxonomic richness in the gallery forest is favourable to the biology of these amphibians and also to the diversity of the habitats existing in this environment (ponds, edge, forest). None of the species caught during this season has endangered status when referring to the IUCN Red List of Species or species endemic to Côte d'Ivoire. (SGS, 2013)

Regarding reptiles, it is difficult to have a clear idea of the existing Serpentes community. Indeed, no specimen were found. Only the vague descriptions of the villagers confirm their presence in the area. Nevertheless, the consultation of the literature (Rödel 1998, Rödel and Mahsberg 2000, Ernst and Rödel 2002, Branch and Rödel 2003) allows us to suspect the presence of certain species of reptiles. (SGS, 2013)

With 103 species of birds, or 13.62% of all bird species encountered in Cote d'Ivoire, which is 756 (HALLE and BRUZON, 2006), the Samapleu project area can be considered relatively rich in avifauna. The presence of three (3) species whose protection is of world interest and five (5) species endemic to West Africa is a key factor for the appreciation of the birdlife of the site. Added to this are three (3) other species with restricted distribution. (SGS, 2013)

In addition, the number of individuals (2,792 individuals) recorded in so few days can support the idea of the importance of birdlife in the area. However, the study area is strongly disturbed by human activities such as poaching, intensive farming, logging, deforestation, etc. These different threats could explain the disappearance or departure of certain bird species whose known range in Côte d'Ivoire covers the study area. The virtual absence of migratory species in the bird population for this phase is related to the fact that the period of the inventories is not conducive to bird migration in Côte d'Ivoire. (SGS, 2013)

This did not allow to observe the movements of migratory birds and specially to know if the study area represents migratory routes for birds. Indeed, the most suitable season for migratory bird watching in in Côte d'Ivoire, is the long dry season, with peak migration in December and January (Thiollay, 1985). The analyzes show that the ornithological diversity of forest areas index is 5.73 and is higher than the index of other habitats. This could be justified by the fact that these forests would be potential safe havens for the majority of bird species. (SGS, 2013)

It is important to mention that the sampling efforts within habitats, being different from each other, the data collected in the different biotopes of the study area are not comparable from one biotope to another. However, it gives a clear idea of possible bird species and bird populations in the region. (SGS, 2013)

With regard to mammals, the ethnozoological survey carried out on the populations shows the existence of a great variety of large fauna species (36). However, the transects revealed that the Project site is poor in large fauna. Of the eight (8) species encountered, only the grasscutter is the most frequent with a Kilometer Abundance Index of 0.59. This means that it needs to travel 10 kilometers to hope to do a little more than 5 encounters of this kind. (SGS, 2013)

Large mammals are almost absent. Only the bushbuck and the black-backed duiker, medium-sized mammals were observed once each on the site. This impoverishment in large fauna is probably due to the destruction of the habitat by the farming. Indeed, animals are very sensitive to changes in their habitat (Fgu-Kronberg 1979, Schaller, 2000). The species encountered (especially rodents) find more food resources there than elsewhere. The bushbuck and the black-backed duiker remain the largest animals encountered in the field. These species would better adapt to changes in their environment. This is especially true for the bushbuck which is a commensal species of man. (SGS, 2013)

Small mammals are reported for the various damage caused to agricultural products. In general, it was not noted that any particular threats were present to small wildlife. However, the disappearance of natural habitats remains problematic for the conservation of species with low ecological plasticity. The intensification of activities in gallery forests as well as in wetlands is the main threat for Micropotamogale. (SGS, 2013)

20.1.4.4 Fauna in the Dry Season

Several species have been inventoried. The most common are Amietophrynus maculatus, Amietophrynus regularis, Hoplobatrachus occipitalis, Afrixalus dorsalis, Hyperolius fusciventris, Hyperolius guttulatus, Ptychadena mascareniensis described by Lamotte (1967), Schiøtz (1967) and Rödel (2000) as typical species of degraded habitats and savannah areas. In addition to these species that have adopted a strategy of adaptation to the fragmentation of their habitat, there is another group of species known for their high sensitivity to the modification of the natural environment (Schiøtz 1964, Rödel et al. Rödel et al., 2005, Assemian et al., 2006).

This is the case of Arthroleptis sp1 and 2, Leptopelis spiritusnoctis, Phrynobatrachus latifrons, Hylarana albolabris, which are forest species. They have a capacity of adaptation for disturbed forest environments (Adeba et al., 2010). This is not the case for the species Phrynobatrachus plicatus that has been observed in swamp forest, Phrynobatrachus alleni and Petropedetes natator were observed in a gallery forest precisely on rocks in a section of stream where the flow is fast enough (for Petropedetes natator). The presence of these species indicates that there are some forest relics in the area. This study shows that the taxonomic richness of Amphibians is high. (SGS, 2013)

This taxonomic richness decreases when one moves from the least disturbed transect 1 (gallery forest) to the most disturbed one (monoculture zone). These results reflect the sensitivity of Amphibians to the deterioration of their habitat. The low taxonomic richness of the herpetofauna of disturbed environments is attributable to the loss of various natural habitats for the benefit of agriculture. Ecosystems conducive to the establishment of Amphibians are increasingly destroyed. (SGS, 2013)

On the other hand, the high taxonomic richness in the gallery forest is due to the existence of a microclimate still favorable to the biology of Amphibians. Several microhabitats represented by ponds, swamps, islands of forests as well as forest galleries constitute undeniable refuges for the protection of many amphibian species. (SGS, 2013)

At the level of threatened species, three (3) of the 23 species observed are on the IUCN Red List (Hyperolius zonatus, Petropedetes natator and Phrynobatrachus alleni) and four (4) endemic species (Phrynobatrachus alleni, Hyperolius zonatus, Leptopelis spiritusnoctis and Petropedetes natator) in the Upper Guinea. Petropedetes natator is a species that has been observed in Côte d'Ivoire at Mount Sangbé National Park (Rödel and Branch, 2002) and in the Mount Nimba Wilderness Reserve (Rödel and Ernst, 2004). This species has just been recorded for the third time in the country. (SGS, 2013)

Regarding reptiles, the data are relatively insufficient to characterise the different communities of the site. However, it is noted that the site is of biogeographic importance and in terms of the diversity of the herpetological fauna. Indeed, the site is in a range of different families of reptiles, even some species as mentioned by several studies in the National Park of Comoé (Rödel, 1999), in the National Park of Tai (Rödel & Mahsberg 2000, Ernst & Rödel, 2002), in the classified forests of Haute Dodo and Cavally (Rödel & Branch, 2003), in the montane regions of Mount Nimba (Ineich, 2003), Mali and Burkina Faso (Böhme et al., 1996) and in Cameroon (Gonwouo et al., 2005). (SGS, 2013)

With 176 bird species, or 23.28% of all the bird species encountered in Côte d'Ivoire, which is 756 (Halle and Bruzon, 2006), it indicates that birdlife is rich. It is peculiar with the many species with special status: three belong to the species whose protection is of world interest, nine are endemic to West Africa and three, qualified as restricted species. The peculiarity of the site is also at the quantitative level (3810 individuals surveyed in 5 days). (SGS, 2013)

The stand of birds obtained in the dry season is larger (both in number of species than in number of individuals) than that of the rainy season. This could be explained by the fact that in the dry season, the weather is more favourable to bird activities. This makes them more visible and easily identifiable. Also, the importance of this stand would be related to the presence of migratory species. In fact, one-third of the number of bird species not observed in the rainy season is represented by migrants. However, the period of the present study (dry season) being favourable to bird migration in Côte d'Ivoire (Thiollay, 1985).

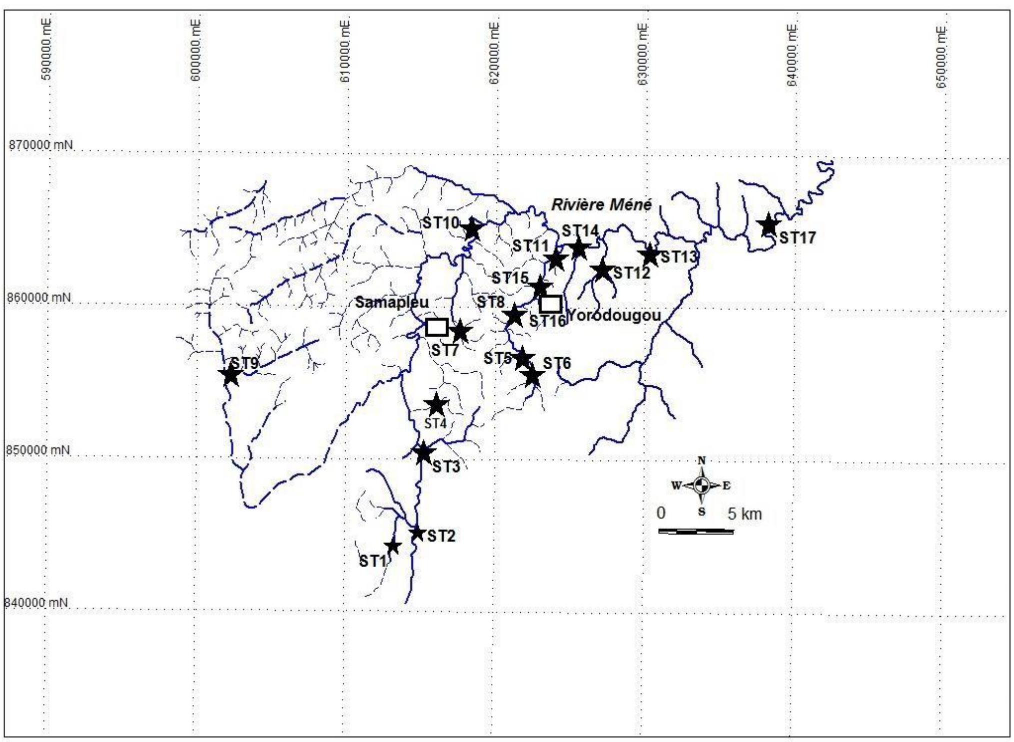
With regard to the bird composition of the different habitats in the study area, the analyzes show a bird diversity index of ornithological forest areas of 6,68. It is higher than in other habitats. This could be justified by the fact that these forests would be safe havens for the majority of bird species. It is important to mention that since sampling efforts within habitats are different from one another, the data collected in the different biotopes of the study area are not comparable from one biotope to another. However, it indicates a clear idea of the possible bird species and a global vision in terms of bird populations of the region. (SGS, 2013)

Observations on large mammals are restricted to a reduced species spectrum. This is a consequence of the different pressures exerted on the natural environment and its large fauna. Only anthropophilic species manage to maintain their populations in viable numbers. In addition to the fragmentation of natural environments, poaching appears to contribute to the reduction of large mammals, (Fgu-Kronberg 1979, Schaller, 2000). The few natural habitats still intact could be overexploited by residual fauna and increase intra and interspecific competitions. Micro-mammals are relatively well established, main species were inventoried. (SGS, 2013)

20.1.4.5 Aquatic life in Rainy Season

Samples sites are shown in Figure 20.10. Samples were taken from October 12 to 20, 2012.

Figure 20.10 - Location of sampled sites in the Méné River Basin (a secondary tributary of the Sassandra River) (Côte d'Ivoire) (SGS, 2013)



The sampling of the hydrobiological study consisted of biological sampling (phytoplankton, phytobenthos, zooplankton, benthic macroinvertebrates and fish fauna) through the Méné River watershed, a second-order tributary of the Sassandra River (Côte d'Ivoire). A total of 17 stations (ST1 to ST17) were sampled. Of these, 5 (ST1 to ST4, and ST9), 6 (ST5 to ST8, ST15 and ST16), and 6 (ST10 to ST14, and ST17) are located, respectively, in sectors that correspond to 1) upstream of the area to be exploited, 2) the area to be exploited and 3) downstream of the project area. (SGS, 2013)

In general, the diversity of planktonic organisms appeared relatively low with 17 phytoplankton taxa, 25 phytobenthos taxa and 7 zooplankton taxa. Analysis of plankton species showed that for phytoplankton and zooplankton the upstream stations were relatively more diversified. On the other hand, for zooplankton, the number of species harvested between upstream, middle and downstream are comparable. The benthic macroinvertebrate community appeared rather rich with 50 taxa, of which 26 (upstream), 29 (project site) and 20 (downstream). (SGS, 2013)

The calculation of the Hilsenhoff family biotic index, based on the benthic macroinvertebrate communities, showed, in general, that the sampled stations were in a good state, with the exception of 3 which are characterised by the fact that they are influenced by human activities (household, laundry and agriculture). A total of 31 fish species were identidied in the study area. None of these species are on the IUCN Red List of Threatened Species. (SGS, 2013)

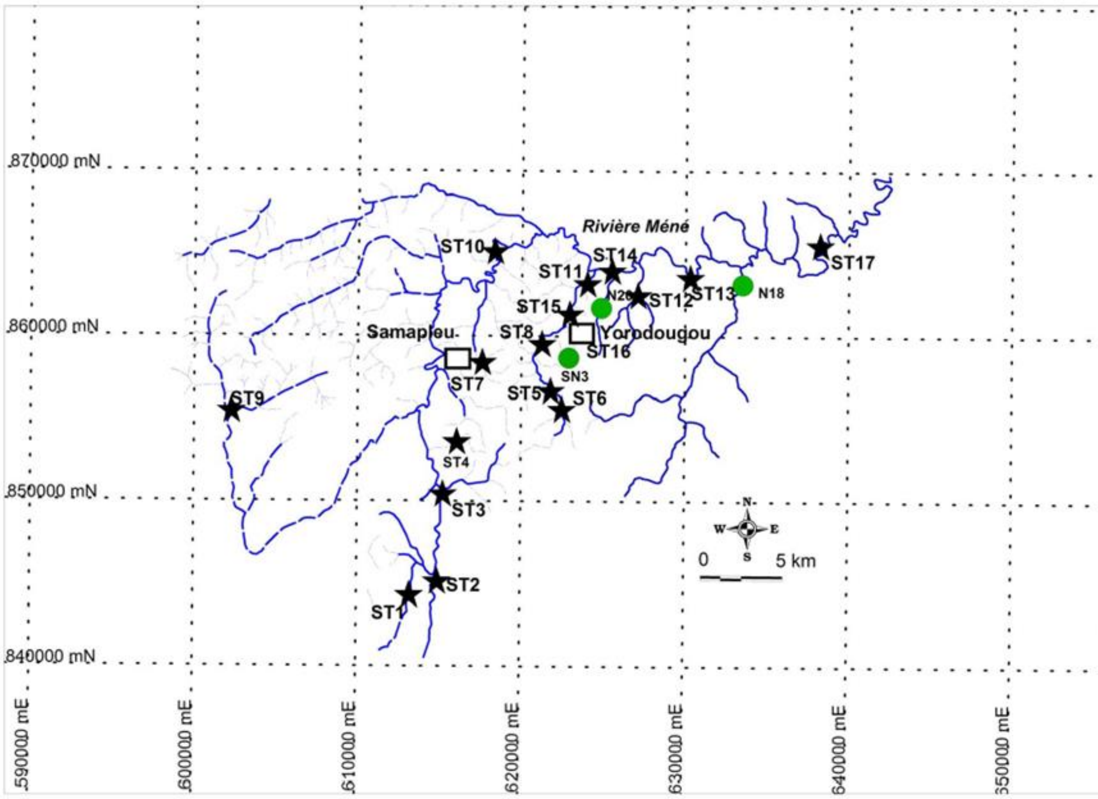
The good state of the sites prospected is confirmed by this diversity of the ichthyofauna (31 species) and especially by the presence within it of representatives (n=5) of the Mormyridae family which is considered to be very sensitive to disturbances and/or pollution of aquatic habitats. This ichthyological fauna appeared more diversified in the downstream zone, compared to the upstream and the middle course. Compared with previous work on the Sassandra fish fauna, the number of species listed in the present study seems low. (SGS, 2013)

Although it is possible that some species are not present in this part of the Méné River (because it is known that some are found only in particular habitats), it is also possible that the absence of others is related to the hydrological season (unfavorable to their presence) that prevailed during the sampling period or the equipment used. (SGS, 2013)

20.1.4.6 Aquatic Life Comparison between Dry and Rainy Seasons

Location of sampled sites in the Méné River basin (a secondary tributary of the Sassandra River) (Côte d'Ivoire) are presented in Figure 20.11. The star sites were sampled from 12 to 20 September and from 23 November to 01 December, 2012 and those in circles were sampled only between November and December 2012. (SGS, 2013)

Figure 20.11 - Location of Sampled Sites in the Méné River Basin



The sampling of the hydrobiological study consisted of biological sampling (phytoplankton, phytobenthos, zooplankton, benthic macroinvertebrates and fish fauna) through the Méné River watershed, a second-order tributary of the Sassandra River. These samplings covered two hydrological seasons: a first phase in the rainy season (from 12 to 20 September 2012) and a second in the dry season (from 23 November to 01 December 2012). (SGS, 2013)

A total of 20 stations (ST1 to ST17, N3, N18 and N20) were sampled. In general, the diversity of planktonic organisms appeared relatively low with a total of 27 phytoplankton taxa, 40 phytobenthos taxa and 14 zooplankton taxa. The benthic macroinvertebrate community, on the other hand, appeared rather rich with 62 taxa recorded. The calculation of the Hilsenhoff family biotic index, based on the benthic macroinvertebrate communities, showed, in general, that the sampled stations were in a good state, with the exception of 5 of them which stand out by the fact that they are influenced by human activities (household, laundry and agriculture). (SGS, 2013)

The results of field investigations revealed a seasonal variation in the species richness of phytoplankton, phytobenthos, zooplankton and zoobenthos. A total of 36 fish species were recorded in the study area. The study data also reveal a difference in the taxonomic composition of the fish fauna from one season to another. This difference appeared to be significant within the family Mormyridae which was only represented in the catches of the dry season by 1 species out of the 5 observed during the rainy season. None of the fish species identified in this study are on the IUCN Red List of Threatened Species. The overall good status of the sites surveyed is also confirmed by this diversity of ichthyofauna (36 species) and especially by the presence (n=5) of the Mormyridae family, which is considered to be very rare and sensitive to disturbances and/or pollutions of aquatic habitats. (SGS, 2013)

20.1.5 Socio-Economic Aspects

The objective of the socio-economic baseline study is to describe the socio-economic and cultural heritage aspects of the population living in the project's area prior to any mining activities, in order to subsequently assess the impacts of the project. (SGS, 2013)

The Sama-Nickel Project’s site is located in the Sub-Prefecture of Yorodougou which falls under Sipilou Department. Sipilou Department belongs to the Tonkpi Region, in the Mountains District (Figure 20.12). (SGS, 2013)

Six (6) localities of the Yorodougou Sub-Prefecture belong to this Project’s direct impact area; they are: Gangbapleu, Gbangompleu, Samapleu, Yèpleu, Yorodougou and Zokoma. These villages, and one (01) other, called Ouéma, belong to the Plépleu clan, of the founder ancestor Plé. The current leader of the Plépleu clan is Wohi Gilbert, from the village of Yèpleu. (SGS, 2013)

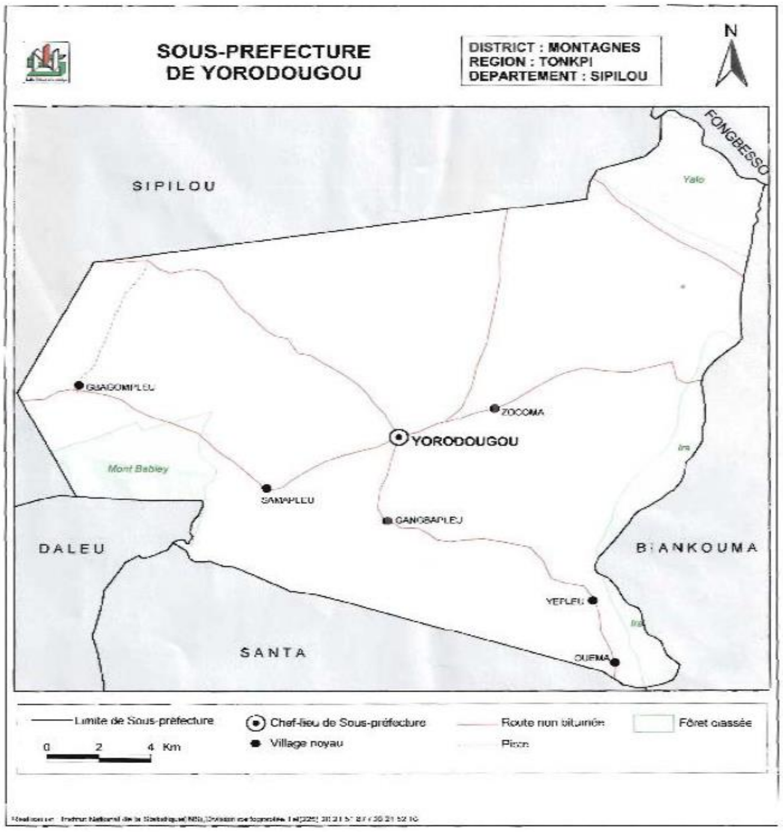
In terms of sociopolitical organisation, the Plépleu clan belongs, just as the Biassè, Glan and Sipilou clans, to the Sipilou canton. For a long time, it did not seem to be the object of dispute, the Plépleu elders state more and more to belong to the Plépleu canton of which Samapleu is the main town. (SGS, 2013)

According to the village elders of the Plépleu clan, the current regrouping of all the villages within the Sipilou canton arises from a desire to grab the sociopolitical power of the Plépleu clan by the political leaders of the Sipilou clan. According to them, this situation results from the combination of two (2) factors: the fact that the city of Sipilou, capital of the Sipilou clan, was erected as the department main town and the destructuring of the traditional power linked to the military-political crisis that the country recently experienced. (SGS, 2013)

Always according to the Plépleu elders, the chieftainship of the canton rightfully belongs to the Plépleu group, which main city is Samapleu, given that historically this group had a position of superiority. This power is exercised exclusively by the direct descendants of the ancestor Plé. The military-political crisis in Côte d’Ivoire deteriorated the traditional social structures and some individuals took this opportunity to take the title of canton chief. (SGS, 2013)

The current Sipilou canton chief is called Diomandé Aubin. As a rule, the power of canton chief is acquired by succession within the family of the first arrival in the area. Such power is exercised by the eldest male member. It is organised by a Council of Elders from all villages of the canton. (SGS, 2013)

Figure 20.12 – The Yorodoudou Administrative District (SGS, 2013)



20.2 Regulatory Context

The project will be subject to the laws of the Republic of Côte d'Ivoire. In 2016 until now, additional and complemental studies were performed to enhance the environmental database by including biological, hydrology, pedology, noise and socio-economic aspects through the Abidjan based SIMPA-CI. More information will be available at the next stage of engineering.

In accordance with the Ivorian legislation, an environmental and social impact assessment is required for any request for an exploitation lease. For this purpose, the Company requested the “Agence Nationale de l’Environnement” (National Environmental Agency) (ANDE) to supply the study’s Terms of Reference (TOR).

20.2.1 Law and Regulations in Côte d’Ivoire

The key legislation regulating with the study of the environmental and social impacts in Côte d’Ivoire is the Code de l’Environnement (“Environment Code”, Law No. 96-766 dated October 3, 1996) and the decree No. 96-894 dated November 8,1996, that details the rules and procedures that are to be applied to environmental and social impact assessments of any development.

The primary legislation governing mining in the Côte d'Ivoire is composed of various legislative texts and decrees that include the following:

- Code Minier ("Mining Code", law No. 95-553 dated July 18, 1995);
- Decree No. 96-600 (dated August 09, 1996) specifying application of the Mining law;
- Ordinance n ° 96-600 of August 09, 1996 fixing the royalties, the proportional taxes and the fixed rights relating to the activities governed by the Mining Code.

This framework is underpinned by other texts including the water code and the forest code. The legal and regulatory framework will be more detailed at the next stage of engineering phase. (SGS, 2013)

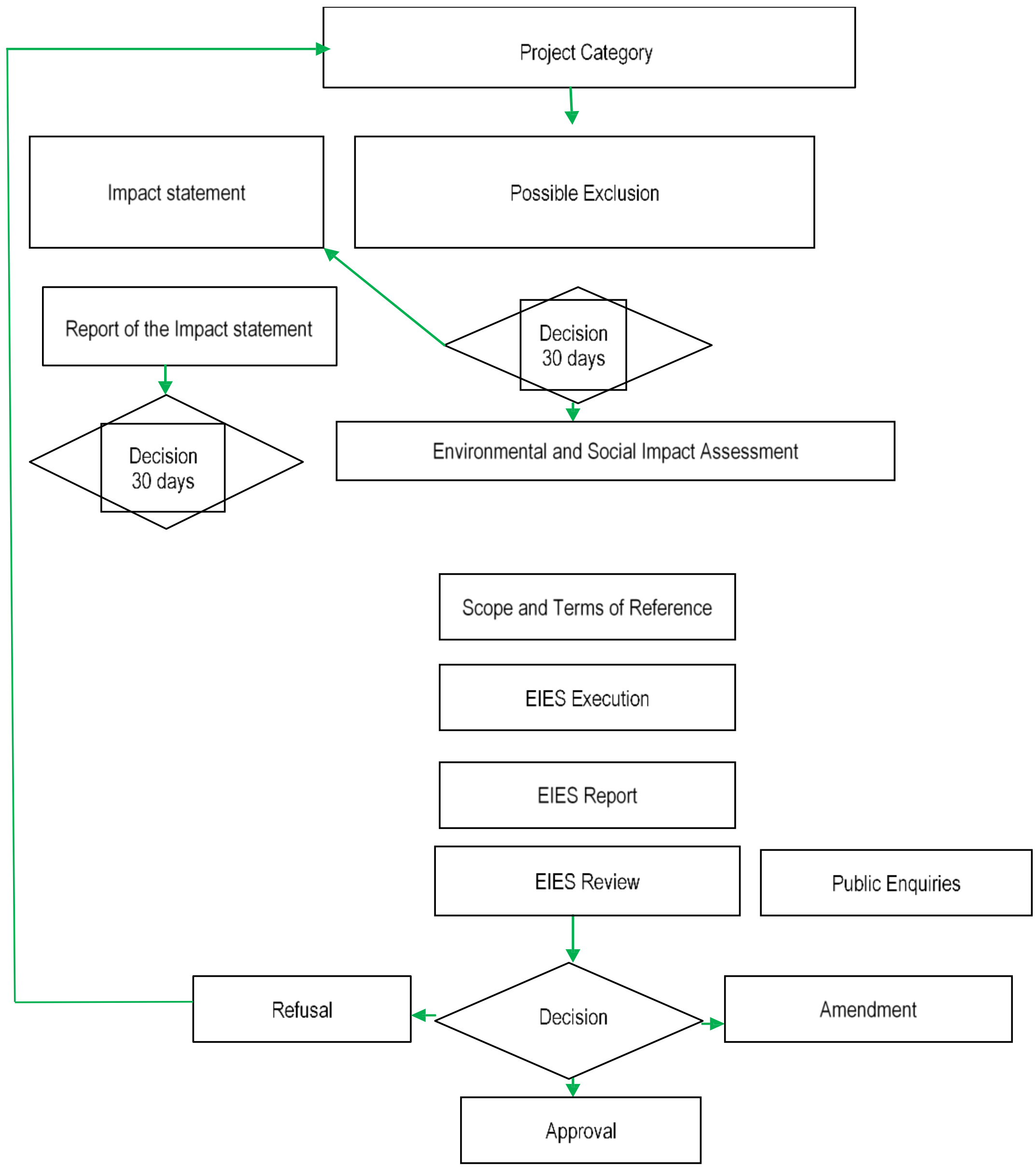
20.2.2 ESIA Process in Côte d'Ivoire

The procedure for the environmental and social impact study in Côte d'Ivoire is as follows:

- Submission of a letter of request for Terms of Reference (TOR) to the Agence National de l'Environnement (ANDE), accompanied by a technical document containing the description of the project;
- Site visit by the ANDE representatives and elaboration of the TOR;
- Conduct of the ESIA by an accredited consultant (accredited by the Ministry of Environment);
- Submission of the ESIA report to the ANDE;
- ANDE to organise public hearings;
- Presentation of the ESIA to an interdepartmental validation committee. The report can then be either: approved, approved with modifications or refusal;
- In case of modifications, the consulting firm must make the necessary corrections, finalise the report and resubmit the final version for approval;
- In case of refusal, further studies will be required by the ANDE;
- If approved, the process continues with the issuance of the study approval order and the environmental operating permit. (SGS, 2013).

The process is shown in Figure 20.13.

Figure 20.13 – ESIA process in Côte d'Ivoire (source: SGS, 2013)



20.2.3 PERMITTING REQUIREMENTS

As per the applicable Ivorian mining law and regulations, mining licenses/permits are mandatory before carrying out any exploration and mining activities.

It is anticipated that Sama Resources will have to apply and obtain various exploitation permits prior to and during operation such as:

- General permit for the industrial exploitation: base metals and other substances;
- Various mining activities (blasting, use of petroleum products, transportation, etc.).

Sama Resources will make an inventory and a review of the different permits and specify those that are applicable to the Samapleu Project at the next stage of engineering.

20.3 Relation with Stakeholders and Consultation Activities

Sama has been active in the region and has adopted a proactive approach to communications, local employment, education and health. Various social actions are taken to improve the daily life of local communities.

Sama has implemented a community consultation program to reinforce their community relations by explaining the exploration work and future project.

Several community meetings were held in the project area until now. These meetings were either under supervision of Sama itself or as part of the ongoing Environmental and Social studies.

Sama Resources provided the summary of the consultation's activities provided in Table 20.9.

20.4 Mine Closure and Rehabilitation

Following operations, the site will undergo decommissioning and reclamation. The decommissioning and reclamation plan will have to comply with Côte d'Ivoire regulations. Sama Resources will have to include a provision for site reclamation in the Project's budget. The reclamation costs will be detailed at the next stage of engineering. The mine closure plan will need to be approved before the start of operations.

The mine closure plan will address the following items:

- Securing the mining area after closure;
- Dismantling the mining infrastructures;
- Reclaiming waste rock disposal areas;
- Reclaiming tailings management facility;
- Contaminated soils and waste characterisation and disposal;
- Waste water management;
- Emergency plan and monitoring.

The performance of the implemented closure measures will be checked and tracked by means of post closure inspection and monitoring programs.

Table 20.9 - Consultation Activities, List provided by Sama Resources

Public Consultations 2012 & 2017				
Location	**Date**	**Consultant**	**Attendies**	
Biankouma	7 to 11/09/2012	SGS		Gouvernment officals
Samapleu	12/09/2012	SGS	102	Chief & Notability, villagers & landowners
Gbangonpleu	13/09/2012	SGS	49	Chief & Notability, villagers & landowners
Biankouma	14/09/2012	SGS		Town counsel & locals offcials
Gangbapleu	15/09/2012	SGS	128	Chief & Notability, villagers & landowners
Zokoma	16/09/2012	SGS	96	Chief & Notability, villagers & landowners
Biankouma	17/09/2012	SGS		Town counsel & locals offcials
Yepleu	18/09/2012	SGS	137	Chief & Notability, villagers & landowners
Yorodougou	19/09/2012	SGS	117	Chief & Notability, villagers & landowners
Yorodougou	20/09/2012	SGS		Chief & Notability, villagers & landowners
Sipilou	22/09/2012	SGS		Town counsel & locals offcials
Samapleu	01/12/2012	SGS	249	Prefet, Deputy-Prefet, Chiefs & Notability, villagers & landowners
Man	20/06/2017	Simpa-CI	5	Prefet & Deputy Prefet, Government officials
Man	20/06/2017	Simpa-CI	8	DG's gouvernment services
Man	21/06/2017	Simpa-CI	3	Department: Public Health
Man	21/06/2017	Simpa-CI	10	Department: SODEFOR
Man	21/06/2017	Simpa-CI	10	Department: Infrastructures
Man	21/06/2017	Simpa-CI	7	Department: Forest & National Park
Man	21/06/2017	Simpa-CI	11	Department: Environment
Yorodougou	22/06/2017	Simpa-CI	9	Deputy Prefet & Administration
Gangbapleu	26/06/2017	Simpa-CI	42	Chief & Notability, villagers & landowners
Gangbapleu	28/06/2017	Simpa-CI	27	Chief & Notability, villagers & landowners
Samapleu	27/06/2017	Simpa-CI	72	Chief & Notability, villagers & landowners
Yepleu	28/06/2017	Simpa-CI	116	Chief & Notability, villagers & landowners
Sipilou	30/06/2017	Simpa-CI	2	Department: Agriculture
Sipilou	30/06/2017	Simpa-CI	3	Department: Forest & National Park
Sipilou	30/06/2017	Simpa-CI	5	Department: Anader & Café-Cacao association

21 CAPITAL AND OPERATING COSTS

The Project scope covered in this Report is based on the construction of a green field mining and processing facility with an average mill feed capacity of 2.3 Mtpy of material and producing an average of 4 ktpy of carbonyl nickel powder, 8 ktpy of carbonyl iron powder and 14 ktpy of copper concentrate.

The capital and operating cost estimates related to the mine, the concentrator, and all required facilities and infrastructure have been developed by DRA/Met-Chem or consolidated from external sources.

The capital and the operating costs are reported in United States Dollars ("$").

21.1 Capital Cost Estimate (Capex)

The capital cost estimate ("Capex") consists of direct and indirect capital costs as well as contingency. Provisions for sustaining capital are also included, mainly for tailings storage expansion. Amounts for the mine closure and rehabilitation of the site have been estimated as well. The working capital is discussed in Section 22 – *Economic Analysis*.

21.1.1 Scope of the Estimate

The Capex includes the material, equipment, labour and freight required for the mine pre-development, processing facilities, tailings storage and management, as well as all infrastructure and services necessary to support the operation.

The Capex prepared for this PEA is based on a Class 4 type estimate as per the Association for the Advancement of Cost Engineering ("AACE") Recommended Practice 47R-11 with a target accuracy of ±35%. Although some individual elements of the Capex may not achieve the target level of accuracy, the overall estimate falls within the parameters of the intended accuracy.

The reference period for the cost estimate is Q1 2020.

21.1.1.1 Major Assumptions

The Capex is based on the Project obtaining all relevant permits in a timely manner to meet the Project schedule.

The Capex reflects an Engineering, Procurement and Construction Management ("EPCM") type execution wherein an EPCM contractor will provide the design, procurement and construction activities for all aspects of the Project. All sub-contracts would be managed by the EPCM contractor.

All back-fill materials will be available from gravel pits or other sources located close to the site. Mine waste rock is not suitable for use in road construction. All excavated material will be disposed of within the site battery limits.

21.1.1.2 Major Exclusions

The following items were not included in the Capex:

- Provision for inflation, escalation, currency fluctuations and interest incurred during construction;
- Project financing costs;
- All duties and taxes. However, they are considered in the economic analysis.

21.1.2 CAPITAL COSTS SUMMARY

Table 21.1 presents a summary of the pre-production initial capital. Sustaining capital costs is estimated at $179 M and is distributed over the life of the mine, but not included in the initial Capex.

Table 21.1 – Initial Capex Summary

Area	Area Description	Total Costs ('000 USD)
	Direct Costs	
1000	Mining	19,497
2000	Crushing	4,983
3000	Concentrator	48,285
4000	Tailings Management System	29,241
5000	General Site Infrastructure	22,196
6000	Power	22,968
C1000	CVMR Facilities	38,738
	Sub-total – Direct Costs	**185,908**
	Indirect Costs	
9000	Indirect Costs	59,341
9000	Contingency	36,788
	Sub-total –Indirect Costs	**96,128**
	TOTAL:	**282,037**

Numbers may not add due to rounding.

21.1.2.1 Sustaining Capital

Sustaining Capital comprises replacement of mining equipment amounting to $19.3 M over the LOM, and costs to increase the waste piles and the tailings impoundment. The initial Capex covers an allowance for two (2) years of operations for the tailings systems with an allowance to increase the dam structure on a yearly basis to accept the quantity of tailings added each year. The cost of the tailings impoundment structures over the LOM excluding the initial Capex value is $160 M.

21.1.2.2 Closure and Rehabilitation Costs

Based on site layouts, a provision of $15 M was estimated for the closure and rehabilitation of the mine site. Requirements were established and cost estimation was based on recent projects.

The expenses were accounted for in the economic analysis and incurred during the final years of the LOM.

No provision is required for the dismantling and disposal of the industrial facilities as it is assumed that the costs will be compensated by the salvage value.

21.1.3 Basis of Estimate

The capital cost estimate covers the facilities included in the scope of the work described in previous sections.

The Capex is based on the following key assumptions:

- The proposed construction work week is 8 hours per day, 5 days per week. All construction workers will be either from the nearby area or housed in a camp provided by the Owner;
- Fluctuations to nominated currency exchange rates are excluded;
- Allowance for industrial dispute or lost time arising from industrial actions is excluded;
- No allowance is made for acceleration or deceleration of the Project schedule;
- Project insurance is included in the Owner's cost.

The Capex is based on an advance period whereby the design concepts are frozen and basic engineering commences. The timing for this start follows approval of the EIS and obtaining initial permits. The work would then continue through its lifecycle until start of Project operations.

21.1.3.1 Currency

The Capex base currency is United States Dollars (**USD**). The Capex consists of items quoted in various foreign currencies which have been converted into USD using exchange rates as of November 2019. Table 21.2 shows the currency exchange rates used in this Report.

Table 21.2 – Currency Exchange Rates

Source Currency	Description	Base Currency	Currency Exchange Rate
USD	United States Dollar	USD	1.000
CAD	Canadian Dollar	USD	0.752
EUR	Euro	USD	1.100
CFA	West African Franc	USD	0.00173

21.1.3.2 Deliverables

The Capex estimate was developed based on the following list of deliverables:

- Project description;
- Mine plan, complete with initial mining equipment and pre-production costs;
- Mechanical equipment list;
- MTO for major electrical equipment, including the power plant;
- MTO for tailings storage, including tailings' roads as well as tailings and reclaim water pipelines;
- Overall general arrangement plan.

21.1.3.3 Estimating Software

The Capex was developed using MS Excel.

21.1.3.4 Labour Cost and Productivity

Labour manhours were developed internally, for each site activity. The productivity factors vary as a function of the expected qualifications as well as of the building height and the congestion; it varies from 1.16 to 1.64 with an overall weighted average of 1.40. It should be noted that a PF of 1.0 refers to projects being executed with better than average skill, base 40 hours workweek, within reasonable commuting distance, limited in-plant movement, favorable weather, etc.

Labour rates were developed based on salary information reflecting local labour. They are inclusive of salaries, contractors' indirect costs, namely mob and demob, small tools, construction equipment, consumables, PPE, temporary site establishments, supervision, administration as well as overhead and profit. The labour rates were provided by two contractors located in the region.

It is assumed that the local communities can accommodate the direct and indirect workforce estimated for the Project, including occasional site visits and vendor representatives. The peak workforce is estimated to reach 400, with an average of 300. Local accommodation consisting of an Owner provided camp as well as rotational transportation costs are included as part of construction field indirect costs.

21.1.3.5 Freight, Duties and Taxes

Based on recent surveys and studies and when not included in the cost, the freight was accounted for by adding a factor to the value of the goods; a factor of 15 % is applied.

All duties and taxes were excluded from the capital cost, but relevant factors were considered for the after-tax economic analysis.

21.1.4 METHODOLOGY

21.1.4.1 Data Sources

A mechanical equipment list was developed by Engineering. Conceptual estimates, supplemented by general arrangements drawings, were used for civil works, including earthworks, concrete and structural steel. To ensure the entire scope coverage, some allowances were added, based on DRA/Met-Chem's experience. Piping, electrical distribution downwards of electrical rooms as well as instrumentation and controls were factored from mechanical equipment costs.

The estimates for the plant equipment were developed from DRA/Met-Chem's internal database.

The incoming power line and substation cost was based on Option 5 from CI Energies which included a 80 km overhead line at 90 kV plus a substation at the site and interconnection facilities at the originating power facilities.

Bulk material pricing for earthworks, concrete, structural steel and architectural features were received from recognised local contractors and used in the development of the estimate.

21.1.4.2 EPCM Services

While the Project may not ultimately be executed via the EPCM model, the cost estimate was structured on that basis. EPCM services consist of the following:

- EPCM team salaries, fringes, uplifts, recruitment, overhead, etc.;
- EPCM team expenses (i.e. business travelling, room & board, accommodation, etc.);
- Home office support and expenses (communications, IT services, IT equipment, courier, printing, office space, furniture, consumables, stationaries, etc.).

For the initial Capex, EPCM services costs are estimated at 12% of the direct costs.

21.1.4.3 Construction Field Indirect Cost

Site construction indirect costs are included as a percentage of direct costs or as a calculation based on previous project costs experienced in the region:

- Construction of the main access road to the Project site;
- Site preparation for all temporary infrastructures and buildings, construction facilities, laydown areas, temporary services, etc.;
- Temporary roads, walkways, parking areas and fencing, c/w signage and including temporary lighting, complete with maintenance;
- Temporary buildings/construction facilities (offices – for EPCM and Owner's staff, camp, cafeteria, laundry facilities, medical clinic, security gate/office, etc.), complete with mobilisation, demobilisation, rental, operations and maintenance. It should be noted that contractors will be responsible for the provision of their own temporary facilities.

- Temporary infrastructure for the supply of power, fuel, gas, water and communications. It should be noted that contractors will be responsible for their own temporary infrastructure.
- Temporary infrastructure for the management of sewerage and construction waste (dry and wet, hazardous and non-hazardous), including collection, treatment and disposal. It should be noted that contractors will be responsible for their own requirements.
- Field office supply (IT equipment, courier, printing, office space, furniture, consumables, etc.);
- Access control and monitoring;
- Temporary lay down and storage areas, as well as warehousing, complete with, but not limited to, materials management and materials handling equipment;
- Mobilisation and demobilisation of all above listed temporary site establishments and restoration back to original site conditions;
- Site surveying
- Site security;
- Light vehicles;
- First aid and medical services;
- General and final clean-up.

21.1.4.4 Owner's Costs

Owner's direct costs include Owner's Project personnel during the Capex period plus legal requirements and Project insurance.

21.1.4.5 Other Costs

Costs for spare parts, special tools and initial fills are estimated at 5% of equipment costs for the initial capex phase. It is assumed that none will be required for sustaining Capex as they are included as part of normal operations.

21.1.4.6 Project Contingency

For initial Capex, the project contingency was assessed at $37 M, representing 15% of all costs.

21.1.4.7 Inflation

Inflation beyond this Capex estimate base date is explicitly excluded.

21.1.4.8 Risks

Risks, complete with mitigation plans, are explicitly excluded from this Capex estimate.

21.1.5 QUALIFICATIONS

All estimates are developed within a frame of reference defined by assumptions and exclusions, grouped under the estimate qualifications. Assumptions and exclusions are listed in the following paragraphs.

21.1.5.1 Assumptions

The following items are assumptions concerning the Capex:

- Estimate assumes that the work will be completed over a 24-month period starting with detailed engineering.
- Estimate for expatriate personnel is based on rotations schedule of 4 and 2, i.e. 4 weeks in and 2 weeks R&R, with travelling during the 2 weeks R&R;
- Estimate assumes aggregates used for fill, adequate both in terms of quality and quantity, will be available within a 5 km radius from site;
- Estimate assumes concrete, adequate both in terms of quality and quantity, will be available within a 15 km radius from site;
- Estimate assumes overburden disposal will be within a 5 km radius from the construction site;
- Estimate assumes fresh water, adequate both in terms of quality and quantity, is available locally at no costs and does not need any treatment to be used for concrete mix, leak/hydro testing, flushing, cleaning, etc.;
- Estimate assumes drinking water will be bottled;
- Estimate assumes EPCM and Owner's teams will be in sufficient quantity so as not to delay contractors;
- Estimate assumed smooth coordination between contractors' battery limits;
- Estimate assumes 95% of manual labour will be sourced within the Region while 5% will be expats from overseas;
- Estimate assumes no labour decree is in effect in the Ivory Coast;
- Estimate assumes that security fencing surrounding the mine, camp and processing facilities will not be necessary;
- Estimate assumes construction contracts types will be either lump sum, cost plus or unit rates;
- Estimate assumes no underground obstructions of any nature;
- Estimate assumes no hazardous materials in excavated materials.
- Estimate assumes no delay in Client's decision making;
- Estimate assumes no delay in obtaining permits and licenses of any kind;
- No interruption in job continuity;
- Estimate assumes normal peak workforce;

- Estimate assumes engineering progress prior to the execution will be sufficient so as to avoid rework.

21.2 Operating Cost Estimate (Opex)

This section provides information on the estimated operating costs of the Project and covers mining, concentrator processing, CVMR processing, water and tailings management, products transportation, and general and administrative. Table 21.3 presents the operating costs summary.

The sources of information used to develop the operating costs include in-house databases and outside sources.

Table 21.3 – Operating Costs Summary

Description	LOM Average Annual Cost ($) [2]	Cost / t milled ($/t)	Total (%)
Mining	9,236,111	4.01	16.8
Concentrator Processing	27,554,708	12.11	50.3
CVMR Processing	11,641,447	5.12	21.2
Water and Tailings Management [3]	50,000	0.02	0.1
Products Transportation	2,927,990	1.26	5.3
General and Administration [3]	3,406,258	1.45	6.2
Total Opex [1]	**54,816,514**	**23.96**	**100.0**

1 The totals may not add-up due to rounding errors.
2 Excludes first and last year.
3 Based on process plant throughput of 2,418,886 mt of mineralised material per year

A summary of the operating costs by area over the LOM is presented in

Figure 21.1.

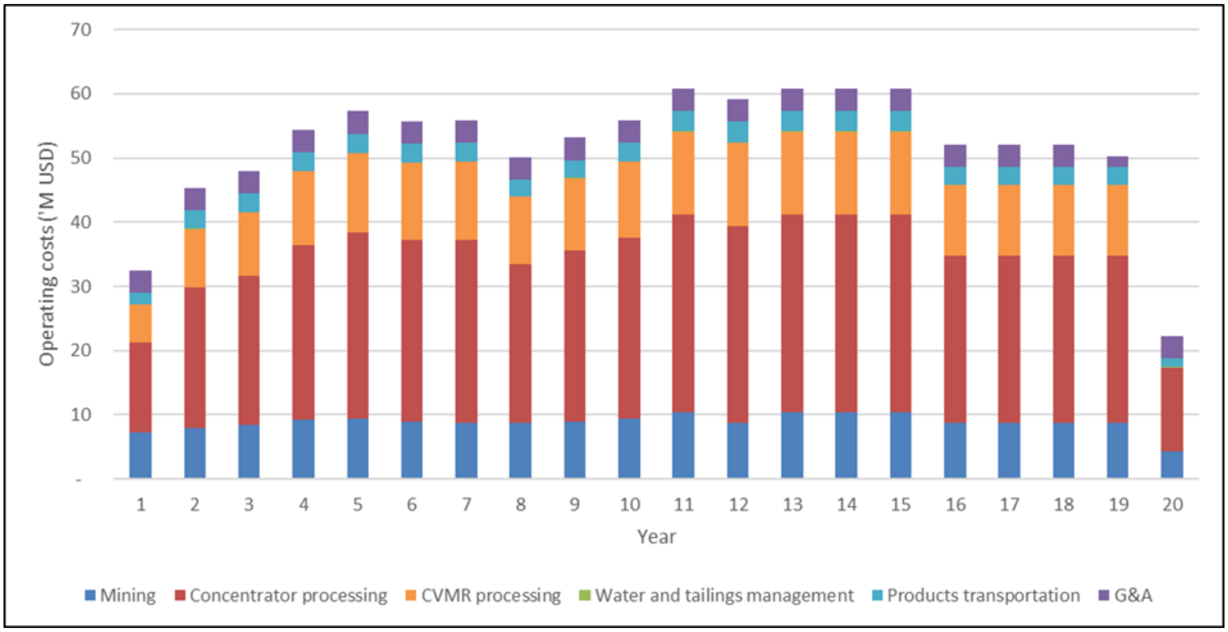
21.2.1 MANPOWER

Table 21.4 presents the personnel requirements for the Project.

Table 21.4 – Summary of Manpower Requirements

Area	Number of Personnel
Mine	115
Concentrator Process	154
CVMR Process	101
General and Administration	104
Total Manpower	**474**

Figure 21.1 – LOM Operating Costs



21.2.2 MINING OPERATING COSTS

The mine operating cost was estimated for each period of the mine plan. This cost is based on equipment operation costs, mine-related manpower, explosives costs as well as the costs associated with dewatering, mine road maintenance and other activities. The breakdown of these costs is summarised in Table 21.5.

In order to determine the operating cost, the following assumptions were used:

- Diesel fuel price: $0.9947 /l;
- Explosive – Emulsion: $0.57 /t.

The mine operating cost was estimated to average $1.90/t mined for the life of the mine. This cost is divided into $1.96/t for mineralised material, $1.65/t for overburden and $1.96/t for rock waste.

Table 21.5 – Summary of Estimated Annual Mining Operating Costs

Type of Material	LOM Average Annual Cost ($/y)	Cost ($/t mined)	Cost ($/t milled)	Total (%)
Overburden	1,567,656	1.65	0.69	17.2
Mineralised Material	4,457,914	1.96	1.96	48.9
Waste	3,098,291	1.96	1.36	34.0
Total Operating Costs	**9,123,861**	**1.90**	**4.01**	**100.0**

Mining cost doesn't include Pre-Production period.
The totals may not add-up due to rounding errors.

21.2.3 CONCENTRATOR PROCESS OPERATING COSTS

For a typical year at design processing rate, the estimated process operating costs are divided into six (6) main components: manpower, electrical power, grinding media and reagent consumption, consumables consumption, material handling, and spare parts and miscellaneous (Table 21.6).. These costs were derived from the DRA/Met-Chem database, factored from similar operations, supplier information and in conjunction with SAMA. The unit cost of on-site generated electricity was established at $0.10/kWh.

Table 21.6 – Summary of Process OPEX

Process Area	Cost			Total
	($/y)	($/t of milled)	($/t of conc.)	(%)
Manpower	4,048,400	1.67	74.42	13.8
Electrical power	10,992,801	4.54	202.09	37.5
Grinding media and reagent consumption	8,186,277	3.38	150.49	27.9
Consumables consumption	5,038,644	2.08	92.63	17.2
Material handling	530,216	0.22	9.75	1.8
Spare parts and miscellaneous	500,000	0.21	9.19	1.7
Total Process Opex	**29,296,338**	**12.10**	**538.57**	**100.0**

1. The totals may not add-up due to rounding errors.
2. Based on process plant throughput of 2,418,886 mt of mineralised material per year
3. Based on nickel and copper concentrate production of 54,397 mt per year
4. Consumables consumption, estimated as 15 % of total equipment capital cost

21.2.4 CVMR Process Operating Costs

The operating cost estimate for the 40,000 t/y nickel concentrate CVMR processing plant was completed by DRA/Met-Chem. The costs were based upon the consumption rates derived from the mass balance and mechanical equipment list. Unit pricing was based upon budgetary quotes or database. The following forms a basis of operating cost estimate:

- Manpower. CVMR process plant will be designed to operate 24 hours, 7 days per week. The number of manpower were determined by CVMR and the salaries were provided by Sama Resources. It is based on 5% shift overtime per year, and 30% fringe benefits for staff and hourly labor.
- Electric Power. The total installed power, excluding the gas plant and other peripherals is estimated to be 8.5 MW. The estimate is based on the effective equipment operating time and the energy balance. The unit price of the electricity used was $0.1 /kWh.
- Diesel. A diesel fuel consumption for the roaster and thermal oxidiser was estimated based on the budgetary quotes received. The diesel fuel unit cost of $0.8854 lL was derived from a similar project.
- Gas Plant Consumables. Methanol and gas plant process consumables costs were estimated based on gas plant quotation. The unit prices were sourced from DRA/Met-Chem database.
- Nitrogen Gas. The total consumption was estimated at 3,197 m^3/y. Nitrogen is mainly used for purging the equipment and products to remove residual carbonyls and trapped gases to ensure explosion and fire safety.
- Sulphuric Acid Disposal Charges. An allowance cost of $60/t for sulphuric acid disposal was included in the estimate.
- Refractories. An allowance cost for refractories replacement (5% of the refractories) was included in the estimate.
- Consumables. An allowance cost of $20,000/y for lubricants, filter cloth and screen panels were in included in the estimate.
- Maintenance. The maintenance cost number was estimated as 5% of the total of mechanical equipment cost, platework cost, structural steel cost, and 25% of electrical, instrumentation and piping cost.

The breakdown of these costs is summarised in Table 21.7.

Table 21.7 Summary of CVMR Process Plant Opex

Description	Cost[1]				Total[1]
	($/year)	($/t milled)[2]	($/t Ni conc.)[3]	($/t Ni and Fe Powders)[4]	(%)
Manpower	2,249,600	0.93	56.24	180.98	18.2
Electrical power	4,795,200	1.98	119.88	385.78	38.7
Diesel (roaster and thermal oxidiser)	1,396,630	0.58	34.92	112.36	11.3
Gas Plant Consumables	933,446	0.39	23.34	75.10	7.5
Nitrogen Gas	1,291	0.001	0.38	0.10	0.01
Sulphuric Acid Disposal Charges	1,790,093	0.74	44.75	144.01	14.5
Refractories	33,555	0.01	0.84	2.70	0.3
Consumables	20,000	0.01	0.50	1.61	0.2
Maintenance	1,165,488	0.48	29.14	93.76	9.4
Total CVMR Process Plant	**12,385,303**	**5.12**	**309.63**	**996.40**	**100.0**

1 Totals may not add-up due to rounding errors.
2 Based on process plant throughput of 2,418, 886 mt of mineralised material per year
3 Based on nickel concentrate production of 40,000 mt per year
4 Based on nickel powder and iron powder production of 12,430 mt per year

21.2.5 WATER AND TAILINGS MANAGEMENT COSTS

The cost of water and tailings management costs has been estimated at $ 50,000/year.

21.2.6 PRODUCTS TRANSPORTATION COSTS

There are three (3) products to transport from site, i.e. nickel powder, iron powder and copper concentrate. The nickel and iron powders will be transported in either steel drums or plastic barrels. The copper concentrate will be transported bulk in the container. The cost of transporting three (3) products from site to San Pedro Port, has been estimated at $110.28/t of products, which equals to $1.26/t of mineralised material.

21.2.7 GENERAL AND ADMINISTRATION OPERATING COSTS

General and administration operating costs have been sub-divided in three (3) categories: Manpower, General Services, and Site Services. Manpower includes finance, purchasing, warehouse, health & safety, environmental, human resources, security and other support personnel. General services include various office-related costs, as well as the lodging and travel expenses for expatriate personnel. Site services comprise the costs for operation and upkeeping of site service-related facilities.

Table 21.10 – Summary of General and Administration Opex

Description	Cost[1]			Total[1]
	($/year)	($/t milled)[2]	($/t of products)[3]	(%)
G&A Manpower	1,832,780	0.76	66.47	52.3
General Services	932,700	0.39	33.83	26.6
Site Services	738,100	0.31	26.77	21.1
Total G&A Costs	**3,503,580**	**1.45**	**127.06**	**100.0**

1 The totals may not add-up due to rounding errors.
2 Based on process plant throughput of 2,418,886 mt of mineralised material per year.
3 Based on three (3) products production (Ni powder, Fe powder and Cu concentrate) of 27,574 t/y

22 ECONOMIC ANALYSIS

It is to be noted that given the early stage of the Project, the economic analysis contained in this Report is based entirely on mineral resources that are not mineral reserves. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. There is no certainty that the reserves development, production, and economic forecasts on which this PEA is based will be realised. Thus, the following analysis is limited to the potential viability of the Project and serves only as a decision tool to proceed or not with additional field work and studies.

The Project economic evaluation is based on operating and capital costs as discussed in Section 20.

The economic assessment of the Samapleu Project has been generated in US dollars and based on 100% equity. In addition, current Ivory Coast tax regulations were applied to assess corporate tax liabilities. Table 22.1 summarises the base case economic/financial results of the Project.

Table 22.1 – Base Case Financial Results

Financial Results	Unit	Pre-tax	After-tax
NPV @ 8%	M USD	614.9	390.7
IRR	%	32.5	27.2
Payback Period	Year	2.5	2.6

The sections below explain the assumptions used in preparing the economic analysis. In addition, a detailed analysis of the financial results and a sensitivity analysis are included in Sections 22.2 and 22.3, respectively.

22.1 Assumptions

22.1.1 MACRO-ECONOMIC ASSUMPTIONS

Table 22.2 summarises the main macro-economic assumptions used in the base case. These assumptions are explained more detail in their corresponding sub-sections.

Table 22.2 – Macro-Economic Assumptions for Base Case

Item	Unit	Value (Base Case)
Carbonyl Nickel Powder Price	USD/tonne	25,483
Carbonyl Iron Powder Price	USD/tonne	6,900
Copper Concentrate Price	USD/tonne	966
Discount Rate	%	8

22.1.1.1 Products Price

The Samapleu Project aims to produce three (3) products. The price stated in Table 22.2 has been calculated considering the expected quantities of each product and their corresponding prices.

22.1.1.2 Discount Rate

The assessment was carried out on a 100% equity basis. and on a discount rate of 8% to represent the cost of equity capital for the project.

22.1.1.3 Exchange Rate

The economic assessment was done in US dollars. However, as mentioned in Section 21.1.3.1 costs were expressed in their native currency. Table 21.2 summarises the currency exchange rates for conversion into USD.

22.1.2 TAXES AND ROYALTIES ASSUMPTIONS

The following taxes and royalties shown in Table 22.3, provided by Sama, were considered in the financial model. In the next phase, a more detail review of Ivory Coast's tax laws and mining codes is recommended to identify tax-saving opportunities through accelerated depreciation schemes or tax breaks.

Table 22.3 – Taxes and Royalties for Samapleu Project

Description	%	Comments
Income Tax	25	Applies to taxable income, first five-year tax exemption
Government Royalty	2.5	Applies to net revenue
CVMR Royalty	15	Applies only on nickel powder premium price
Government Carried Interest	10	Applies to profit after income tax after the pay-pack period

22.1.3 Technical Assumptions

Table 22.4 summarises the technical assumptions used.

It is assumed the power line installation cost will be reimbursed by reducing electrical cost for the first three years based on information from Sama.

Table 22.4 – Technical Assumptions

Item	Units	Value
Total Mineral Resources Mined (LOM)	M tonnes	44.4
LOM	Year	20
Concentrator Cu Recovery	%	80
Cu Concentrate Grade	%Cu	23
Concentrator Ni Recovery	%	71.08
Ni Concentrate Grade	%Ni	10.34
Ni Concentrate Grade	%Fe	26.58
CVMR Ni Recovery	%	97.5
Ni Powder Grade	%Ni	99.84
CVMR Fe Recovery	%	80
Fe Powder Grade	%Fe	98.5
LOM Annual Average Production – Cu Concentrate (Excludes Year 1 and 20)	t/y	14,147
LOM Annual Average Production – Ni Powder (Excludes Year 1 and 20)	t/y	3,923
LOM Annual Average Production – Fe Powder (Excludes Year 1 and 20)	t/y	8,389
Average Mining Costs	USD/tonne products	357
Average Concentrator Processing Costs	USD/tonne products	1,026
Average CVMR Processing Costs	USD/tonne products	434
Average Water and Tailings Management Costs	USD/tonne products	2
Average Products Transport Costs	USD/tonne products	110
Average General & Administration Costs	USD/tonne products	134

22.2 Financial Model and Results

Figure 22.1 shows life of mine products production profile, including nickel powder, iron powder and copper concentrate.

Figure 22.1 – Life of Mine Products

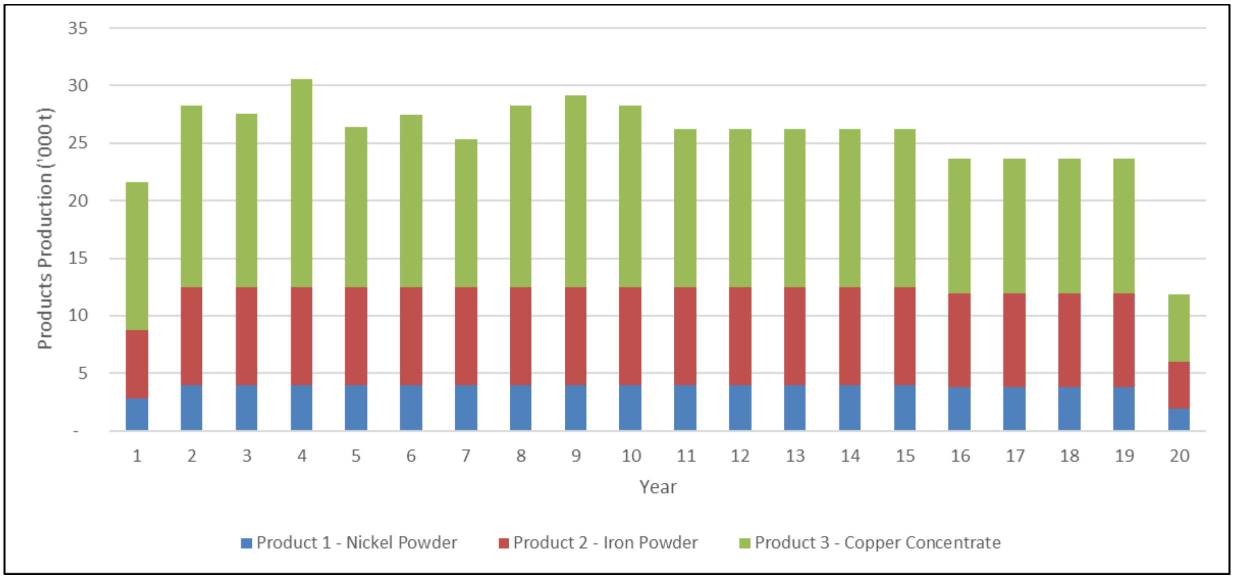


Figure 22.2 presents the life of mine net sales revenue for the three (3) products respectively.

Figure 22.2 – LOM Net Sales Revenue Profiles

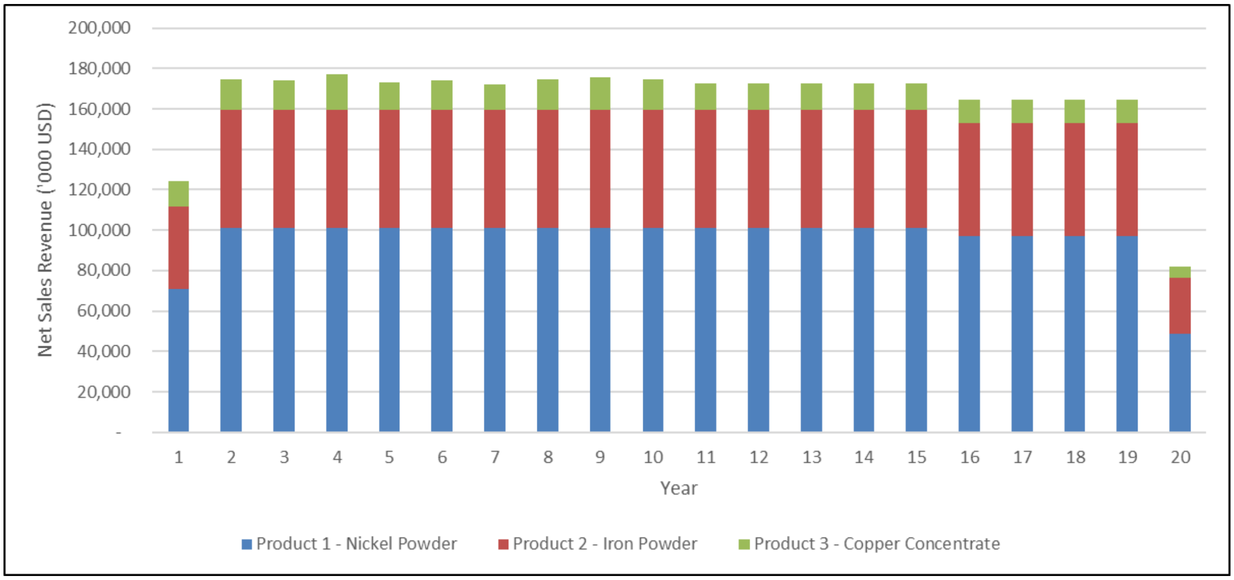
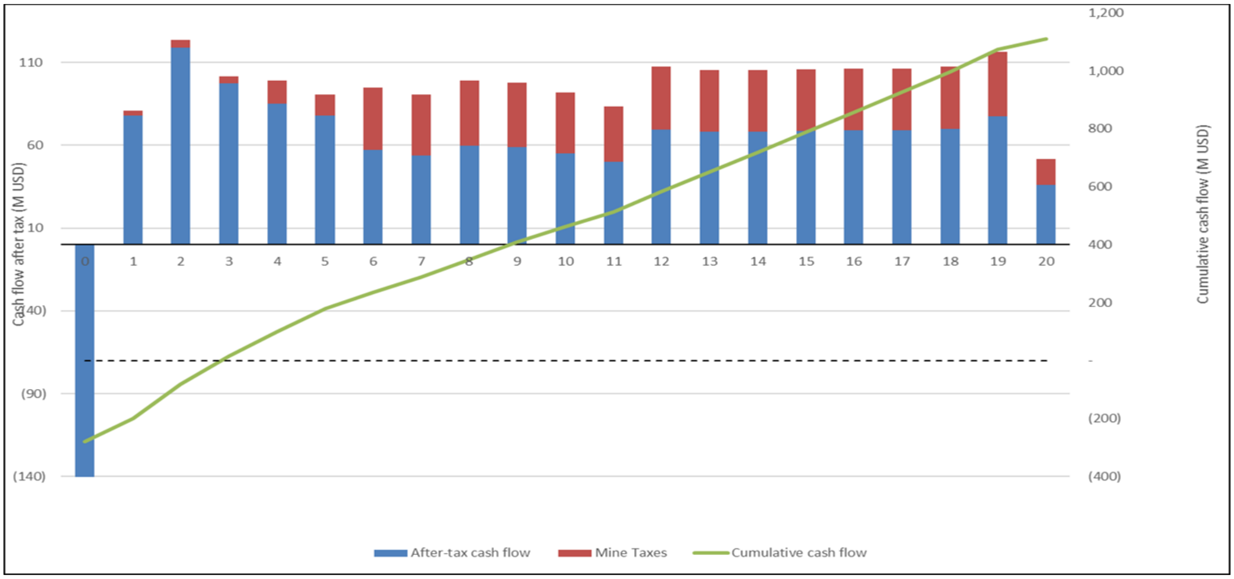


Figure 22.3 shows the after-tax cash flow and cumulative cash flow profiles of the Project for base conditions. The payback period was estimated at 2.6 years, and it is indicated in the figure as the point where the after-tax cumulative cash flow curve intersects the dashed line.

Figure 22.3 – After-Tax Cash Flow and Cumulative Cash Flow Profiles



A summary of the base case cash flow results is shown in Table 22.5 while Table 22.6 shows the annual cash flow projections.

Total pre-production (initial) capital costs were evaluated at $282 M and incurred over a period of one (1) year. Sustaining costs were estimated at $180 M. Mine closure costs of $15 M were allocated 50% at Year 11 and 50% at the end of the mine's life. Details on how these costs were estimated are included in Section 21.1.

Working capital was estimated as three (3) months of total annual operating costs.

Total operating costs over the life of the project were estimated at $1,051 M, or an average $2,062/t of products.

The financial results indicate a pre-tax Net Present Value ("NPV") of $614.9M at a discount rate of 8%. The pre-tax Internal Rate of Return ("IRR") is 32.5 % and the payback period is 2.5 years.

After-tax NPV is $390.7 M at a discount rate of 8%. The after-tax IRR is 27.2% and the payback period is 2.6 years.

Table 22.5 – Project Evaluation Summary – Base Case

Description	Unit	Value
Throughput¹	t/y	2,329,034
Total Products¹	t/y	26,458
Net Sales Revenue	'000 USD	3,293,100
Total Capex	'000 USD	282,037
Total Sust. Capex	'000 USD	179,300
Closure costs	'000 USD	15,000
Total Opex	'000 USD	1,050,863
Opex²	USD/t products	2,062
Pre-Tax		
NPV (discount rate=8%)	'000 USD	614,881
IRR	%	32.5
Payback period	Years	2.5
After-Tax		
NPV (discount rate=8%)	'000 USD	390,686
IRR	%	27,2%
Payback period	Years	2,6

Note:
¹ Excluding Years 1 &20
² Based on LOM results

Table 22.6 – Cash Flow Statement – Base Case

NPV

Cash Flow - Summary DRA
(in '000 USD)

Item		FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028	FY2029	FY2030	FY2031	FY2032	FY2033	FY2034	FY2035	FY2036	FY2037	FY2038	FY2039	FY2040	FY2041	FY2042	TOTAL
Net Sales Revenue		-	124,036	174,743	174,086	176,946	172,901	173,986	171,886	174,705	175,587	174,724	172,741	172,741	172,741	172,741	172,741	163,510	163,510	163,510	163,510	81,755	3,293,100
CVMR royalties		-	(3,723)	(5,319)	(5,319)	(5,318)	(5,319)	(5,319)	(5,319)	(5,319)	(5,319)	(5,319)	(5,319)	(5,319)	(5,319)	(5,319)	(5,319)	(5,080)	(5,080)	(5,080)	(5,080)	(2,540)	(101,046)
Gross Income		-	120,313	169,424	168,768	171,628	167,582	168,668	166,568	169,386	170,268	169,406	167,422	167,422	167,422	167,422	167,422	158,430	158,430	158,430	158,430	79,215	3,192,054
Operating Costs		(5,671)	(32,445)	(45,294)	(48,022)	(54,446)	(57,279)	(55,782)	(55,920)	(50,075)	(53,189)	(55,848)	(60,865)	(59,130)	(60,865)	(60,865)	(60,865)	(52,067)	(52,067)	(52,067)	(50,315)	(27,785)	(1,050,863)
EBITDA		(5,671)	87,868	124,130	120,746	117,181	110,303	112,886	110,647	119,311	117,079	113,558	106,556	108,292	106,556	106,556	106,556	106,363	106,363	106,363	108,115	51,430	2,141,191
			71%	71%	69%	66%	64%	65%	64%	68%	67%	65%	62%	63%	62%	62%	62%	65%	65%	65%	66%	63%	
Other Costs		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total		(5,671)	87,868	124,130	120,746	117,181	110,303	112,886	110,647	119,311	117,079	113,558	106,556	108,292	106,556	106,556	106,556	106,363	106,363	106,363	108,115	51,430	2,141,191
Mine Pre-production Capital Expenditure																							
Mine General Area		(19,497)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(19,497)
Crushing General Area		(7,862)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(7,862)
Concentrator General Area		(76,177)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(76,177)
Tailings Management Facilities		(46,133)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(46,133)
Infrastructure General Area		(36,236)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(36,236)
Power Facilities		(35,018)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(35,018)
CVMR Area		(61,114)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(61,114)
Total capital expenditure		(282,037)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(282,037)
Debt financement		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Equity portion of capital expenditure		(282,037)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(282,037)
Salvage value		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,537	-	-	
Change of Working Capital		(13,273)	(5,268)	309	178	742	(261)	274	(839)	149	329	666	(145)	145	-	-	421	-	-	(146)	8,342	7,904	
Sustaining Capital Expenditure																							
Mine Equipment		-	(1,725)	(990)	(1,026)	(699)	(990)	-	(1,026)	(2,016)	(1,398)	(4,099)	(1,070)	(1,070)	(1,070)	(1,070)	(1,070)	-	-	-	-	-	(19,318)
Waste Dump Clearing/Levelling		-	-	-	(842)	(842)	(842)	(842)	(842)	(842)	(842)	(842)	-	-	-	-	-	-	-	-	-	-	(6,735)
Top Soil Dump Clearing/Levelling		-	-	-	(112)	(112)	(112)	(112)	(112)	(112)	(112)	(112)	-	-	-	-	-	-	-	-	-	-	(898)
HS Tailings		-	-	-	(2,766)	(2,766)	(2,766)	(2,766)	(2,766)	(2,766)	(2,766)	(2,766)	-	-	-	-	-	-	-	-	-	-	(22,131)
LS Tailings		-	-	-	(14,513)	(14,513)	(14,513)	(14,513)	(14,513)	(14,513)	(14,513)	(14,513)	(14,513)	-	-	-	-	-	-	-	-	-	(130,621)
Investment for sustaining capital assets		-	(1,725)	(990)	(19,260)	(18,933)	(19,224)	(18,234)	(19,260)	(20,250)	(19,632)	(22,333)	(15,583)	(1,070)	(1,070)	(1,070)	(1,070)	-	-	-	-	-	(179,704)
Mine rehabilitation trust fund payments		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Closure costs		-	-	-	-	-	-	-	-	-	-	-	(7,500)	-	-	-	-	-	-	-	-	(7,500)	(15,000)
Debt payment		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pre-tax cash flow		(300,981)	80,876	123,450	101,663	98,990	90,818	94,926	90,548	99,210	97,777	91,891	83,328	107,366	105,486	105,486	105,907	106,363	106,363	107,754	116,457	51,834	1,665,514
Cumulative cash flow		(278,686)	(197,810)	(74,361)	27,302	126,293	217,111	312,037	402,585	501,795	599,572	691,463	774,791	882,157	987,644	1,093,130	1,199,037	1,305,401	1,411,764	1,519,518	1,635,975	1,687,809	
Fractions calculations		n/m	n/m	n/m	0.73	0.28	1.39	2.29	3.45	4.06	5.13	6.52	8.30	7.22	8.36	9.36	10.32	11.27	12.27	13.10	13.05	31.56	
Mid-year adjustment		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Discount factor	8.00%	0.926	0.857	0.794	0.735	0.681	0.630	0.583	0.540	0.500	0.463	0.429	0.397	0.368	0.340	0.315	0.292	0.270	0.250	0.232	0.215	0.199	
Discounted cash flow		(278,686)	69,338	97,998	74,726	67,371	57,231	55,388	48,920	49,630	45,290	39,410	33,091	39,478	35,914	33,254	30,913	28,747	26,617	24,968	24,986	10,297	
Government royalty	2.50%	-	(3,101)	(4,369)	(4,352)	(4,424)	(4,323)	(4,350)	(4,297)	(4,368)	(4,390)	(4,368)	(4,319)	(4,319)	(4,319)	(4,319)	(4,319)	(4,088)	(4,088)	(4,088)	(4,088)	(2,044)	(82,328)
Income tax	25.00%	-	-	-	-	-	-	(27,134)	(26,331)	(28,232)	(27,823)	(26,273)	(23,417)	(25,726)	(25,292)	(25,292)	(25,292)	(25,569)	(25,569)	(25,953)	(26,007)	(5,642)	(369,551)
CI Government Carried Interest	10.00%	-	-	-	-	(9,457)	(8,650)	(6,344)	(5,992)	(6,661)	(6,556)	(6,125)	(5,559)	(7,732)	(7,588)	(7,588)	(7,630)	(7,671)	(7,671)	(7,771)	(8,636)	(8,176)	(125,806)
After-tax cash flow		(300,981)	77,775	119,081	97,311	85,110	77,846	57,098	53,928	59,950	59,008	55,125	50,034	69,590	68,288	68,288	68,667	69,036	69,036	69,942	77,726	35,973	1,087,830
Cumulative cash flow		(278,686)	(200,911)	(81,830)	15,481	100,591	178,437	235,535	289,462	349,412	408,420	463,545	513,579	583,168	651,457	719,745	788,412	857,448	926,484	996,426	1,074,152	1,110,125	
Fractions calculations		n/m	n/m	n/m	0.84	0.18	1.29	3.13	4.37	4.83	5.92	7.41	9.26	7.38	8.54	9.54	10.48	11.42	12.42	13.25	12.82	29.86	
Discounted cash flow		(278,686)	66,680	94,530	71,527	57,924	49,056	33,316	29,135	29,990	27,332	23,642	19,869	25,588	23,250	21,527	20,043	18,658	17,276	16,206	16,676	7,146	390,686

22.3 Sensitivity Analysis

A sensitivity analysis was carried out to assess the impact of changes in total pre-production capital expenditure (“Capex”), operating costs (“Opex”) and concentrate price (“Price”) on the project’s NPV at 8% (i.e. base case) and IRR. Each variable was examined one-at-a-time. An interval of ±30% with increments of 10% was applied to the Capex, Opex and Price variables.

The pre-tax sensitivity analysis is shown in Figure 22.4. The Project’s pre-tax viability is not significantly vulnerable to the underestimation of capital or operating costs. If Opex increases by 30%, pre-tax NPV decreases to $474 M (i.e. 28% drop from current estimate) and pre-tax IRR decreases to 23%. Similarly, if Capex increases by 30%, pre-tax NPV drops to $537 M (i.e. 13% drop from current estimate) and pre-tax IRR decreases to 25%. As expected, the NPV is most sensitive to variations in Price.

The same conclusions in terms of viability of the Project can be made from the after-tax results of the sensitivity analysis as shown on Figure 22.5. If Opex increases by 30%, after-tax NPV decreases to $280 M and after-tax IRR decreases to 22%. An increase of 30% in Capex, results in after-tax NPV of $312 M and after-tax IRR of 20%.

Figure 22.4 – Pre-Tax NPV and IRR Sensitivity to Changes in: Capex, Opex, and Average Price

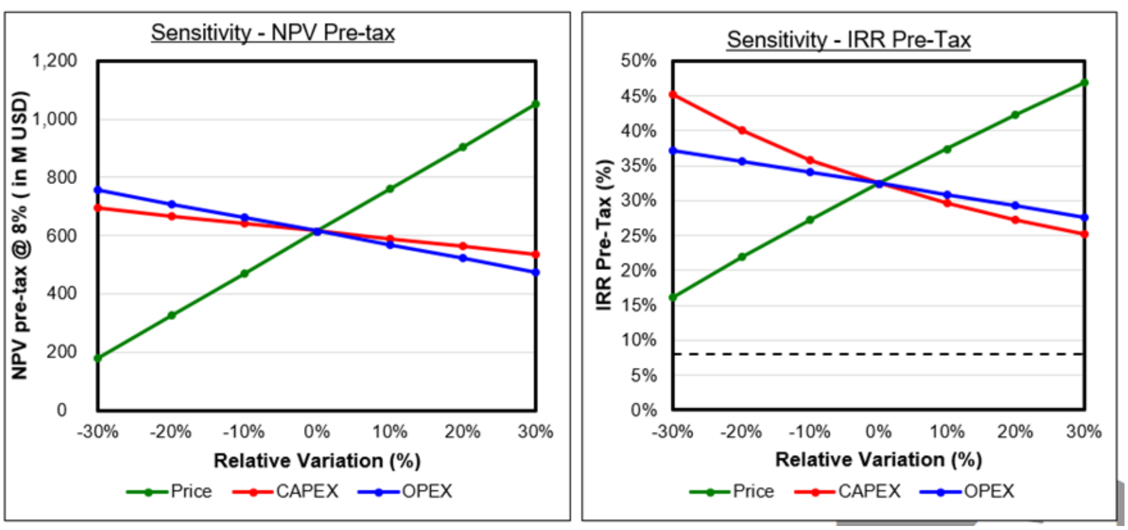
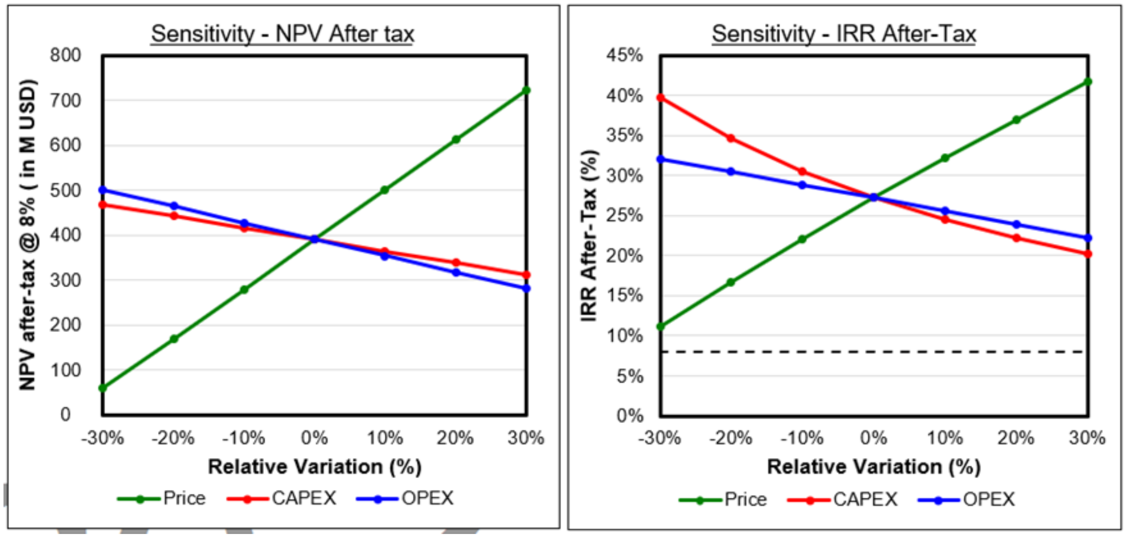


Figure 22.5 – After-Tax NPV and IRR Sensitivity to Changes in: Capex, Opex, and Average Price



23 ADJACENT PROPERTIES

The Samapleu East Exploration Permit 838 ("*Permis de recherche minière*"; PR838) is close to the village of Yorodougou, in west-central Ivory Coast, Montagnes District, Tonkpi Region. The Project is about 50 km west of Biankouma and 25 km east of the border with Guinea.

PR838 has an irregular shape with a maximum N-S extent of 24 km and 16 km along the E-W direction, for a total area of 258 km² (Figure 4.1). The permit is approximately centred on latitude 7° 43' 00" N and longitude 7° 55' 00" W (UTM 619,800E; 854,000N).

The Reader is referred to the Public Mining Cadastre Portal for Ivory Coast (Portail du Cadastre Minier de la Côte d'Ivoire) for official and up to date information on the adjacent properties, at the following link: http://portals.flexicadastre.com/CoteDIvoire/FR/. The Reader is cautioned that the information on adjacent properties is not necessarily indicative of the mineralisation on the property.

The Qualified Person has been unable to verify the information about the adjacent properties, but the Reader can find official information on the publicly available website of the mining registry by following the link provided above.

23.1 NOCI Exploration Permits PR585

Sama's properties are bounded to the north by the SODEMI/NOCI's Exploration Permit PR 585 (Nickel de l'Ouest Côte d'Ivoire ("NOCI") which contains the Sipilou North Ni-Co laterite deposit and the northern part of the Sipilou South Deposit (Figure 4.1 and Figure 23.1). The Sipilou South deposit extends partially into Sama's properties.

The property was worked by Falconbridge, under a Joint Venture agreement, between 1993 and 2002. The Sipilou North nickel-cobalt laterite deposit is up to 10 km long by 1.5 km wide and was well delineated by drilling.

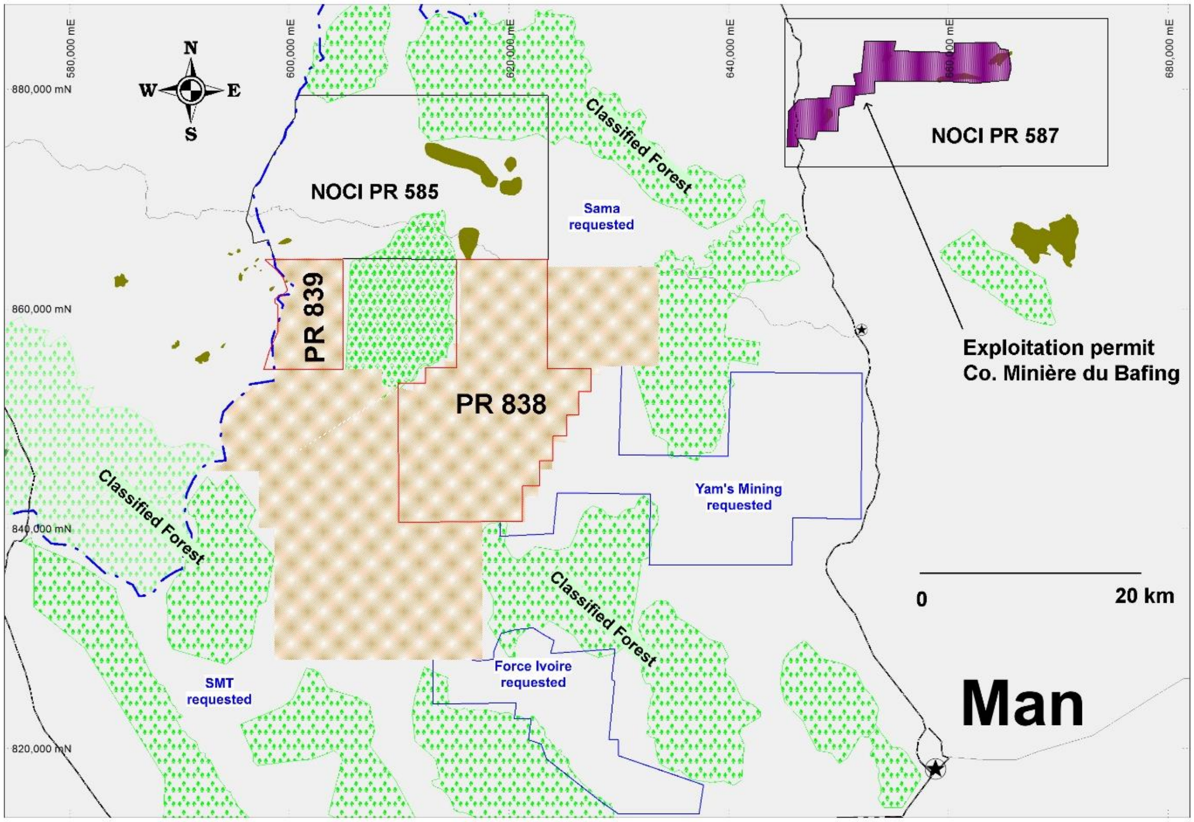
The property also includes the Sipilou South nickel-cobalt deposit with approximately 70% of the global surface area laying with the PR585 and the remaining within the Samapleu PR838.

23.2 Exploration Permits in Application

There are four (4) Exploration Permits in application with the Department of Mines surrounding the Sama's PRs, they are as follow:

1. Sama Nickel Côte d'Ivoire SARL: sector Grata North (NE of Sama's PR's);
2. Société Minière du Tonkpi SARL (SMT): Sector Daleu (SW of Sama's PR's);
3. Yams Mining: East of Sama's PR's;
4. Force Ivoire: South-East of Sama's PR's.

Figure 23.1 – Adjacent Property Map

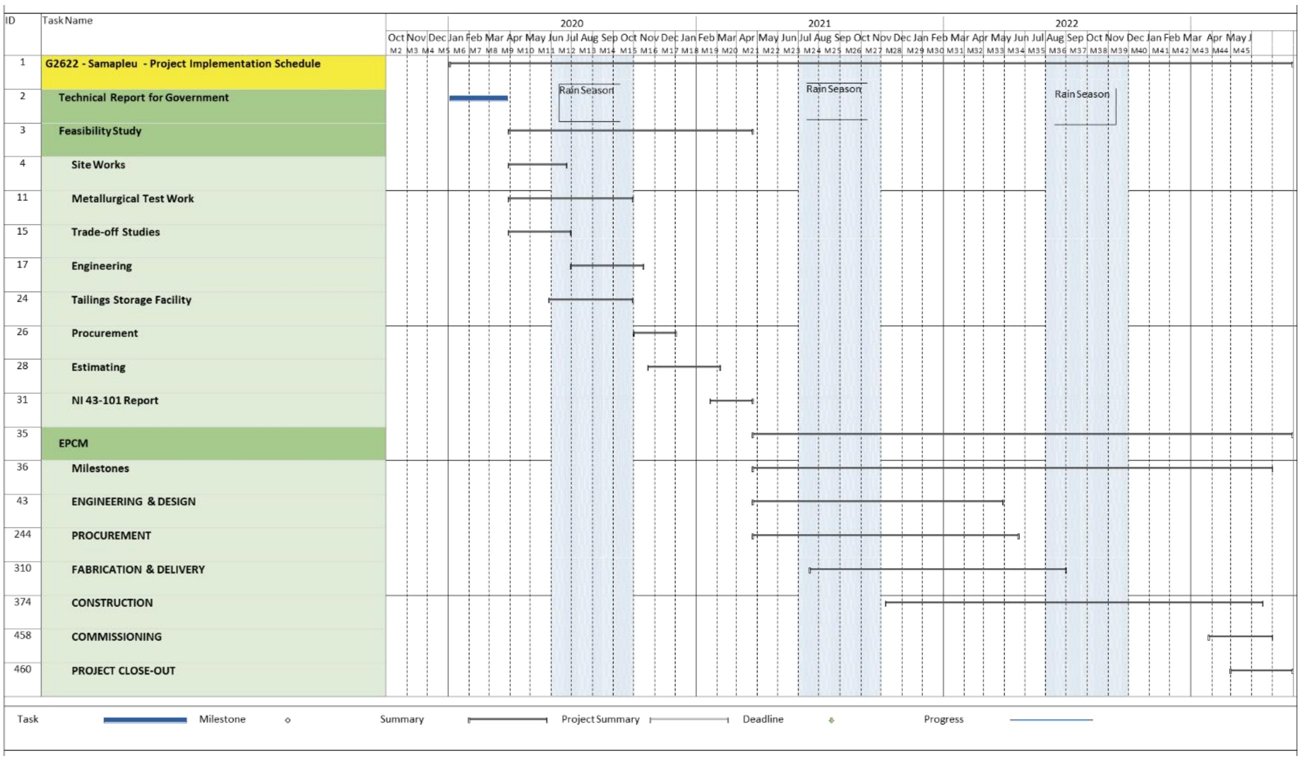


24 OTHER RELEVANT DATA AND INFORMATION

24.1 Preliminary Project Implementation Schedule

The preliminary project implementation schedule was developed to provide a high-level overview of all activities required to complete the Project. The project execution plan is summarised in Figure 24.1.

Figure 24.1 – Preliminary Project Implementation Schedule



25 INTERPRETATION AND CONCLUSIONS

This Report was prepared and compiled by DRA/Met-Chem, by or under the supervision of the QPs, at the request of Sama. This Report has been prepared in accordance with the provisions of National Instrument 43-101 Standards of Disclosure for Mineral Projects.

25.1 Conclusions

25.1.1 Mineral Processing and Metallurgical Testing

Mineral Processing Test Work

- The mineralised material from the Samapleu deposit has shown itself to be amenable to concentration by flotation. Given the relatively low grade of the deposit, different methods have been trialled to pre-concentrate the material to increase head grade prior to flotation.
- The use of heavy liquid separation was able to achieve a degree of pre-concentration at some SG values; however, the losses of nickel and copper were considerable. The same applies for pre-concentration via magnetic separation and size separation. The nature of the mineralised material deposit (finely disseminated) does not seem to lend itself well to pre-concentration.
- The results from CTMP were unable to achieve the results of the SGS 2011 campaign. The head grades from the 2011 test work campaign were significantly higher; however, the dosage of xanthate was kept relatively constant. Examination of the kinetic curves shows rapid, non-selective flotation; which could potentially be a symptom of an overdose of xanthate in the circuit.
- The poor copper/nickel separation results can be explained by the small quantity of material remaining after the lock cycle test and the fact that this portion of the flow sheet was tested in open circuit. Testing a larger sample would allow the copper/nickel separation step to be included in the lock cycle test work.

Carbonyl Powder Production Test Work

- Overall recovery of nickel was observed as 96.7% - 97.9%. These results correspond with extraction rates achieved during TGA tests.
- Overall recovery of iron can max 95.0%, and can be suppressed with sulphidation down to 80.6%.
- Sulphur has been roasted away from 30% to 0.2% at 1050°C. The reaction of desulphurisation is rapid.
- The metallic oxides were reduced with hydrogen at 650°C, during 2 hours residence time.
- Carbonylation was carried out at 40 bar CO pressure and at 130°C.
- Overall extraction time was 24 hrs with the average rate of extraction close to 3-4% per hour.
- Carbonylation residue was not pyrophoric and did not have any metal carbonyl contamination. Bulk density of residue was 0.60 – 0.70 g/cc.

- No cobalt was found in the ferronickel powder product.
- Based on the analytical result from the SGS Canada Inc. the copper upgrade in the carbonylation residue from the feed concentrate was observed 290% and the cobalt upgraded 230%.

25.1.2 Recovery Methods

Mineral Processing Plant

- The processing plant nominally processes 2.4 Mt/y of run-of-mine mineralised material to produce 39,000 t/y of nickel concentrate at 10.34% Ni grade and 15,000 t/y of copper concentrate at 23.00% Cu grade. Global nickel and copper recovery are 73.04% and 92.31%, respectively. A suitable process flow sheet has been developed which includes crushing, primary grinding, secondary grinding, bulk flotation, copper cleaning, nickel cleaning, desulphurisation, thickening, filtering, and material handling.
- The processing plant design detailed above provides sufficient basis for the development of the capital and operating cost estimates for the processing plant shown in Section 21.
- The design of the flotation test work stems largely from the test work campaign conducted by SGS in 2019 (summarised in Section 13). Where the test work is incomplete, design values have been based on experience in the industry.

Carbonyl Refining Plant

CVMR's metallurgical test and process design works allowed to develop a concept level flowsheet that supports annual production of 4000 t of premium Carbonyl nickel powders, and 8400 t of premium carbonyl iron powder along with the potentially marketable byproducts such as carbonyl residue and sulphuric acid.

An equipment selection work identified:

1. the required process circuits;
2. equipment units required for the economical operations.

Based on CVMR's previous design experience the basis for the key parameters, and operating protocols were established

25.2 Risk Evaluation

Risk and opportunity management is an important element of the project's operational strategy and implementation. It is used to avoid losses, anticipate problems and realize gains or benefits.

External risks are elements such as the political situation in the project area, the price of minerals, the exchange rate and government legislation. These external risks are generally applicable to all projects. A negative variation of these elements compared to the assumptions made in the economic model would affect the profitability of the project and the estimate of mineral resources.

These external risks are to some extent independent of the project and are much more difficult to predict and mitigate.

As with all mining projects, there are technical risks that could affect the feasibility and economic results of the project. There are a number of risks and uncertainties identifiable with all projects and generally cover the aspects of mineralization, process, financial, environmental and authorization. These risks are common to most mining projects, many of which can be mitigated by adequate engineering studies, design, planning and management.

There are risks to economic results such as:

- The search for financing is an uncertain activity as to the capital that will be made available, their conditions as well as the time to obtain them. Thus, there is nothing to guarantee that the estimated costs will be sufficient at the time of construction and during operation.
- The power of the electrical network throughout the life of the mine may not always be sufficient for operational needs. This could result in additional investment and operating costs to ensure reliable alternative power.
- Permit requirements and / or regulatory agency audit / approval periods may cause delays before construction begins and require design adjustments, as well as investment and capital costs. additional operations.

26 RECOMMENDATIONS

Considering the positive outcome of the PEA, it is recommended to pursue the definition of the Project through various aspects in order to get sufficient data to produce a Feasibility Study (FS).

26.1 Mining and Geology

For mining method, DRA/Met-Chem recommends certain work for the next stage of the Project:

- Definition drilling program aimed at identifying additional resources and upgrade resources
- Geotechnical or hydrogeological investigations for surface infrastructure to be carried out.
- Overburden will need to be estimated and modelled.
- A complete pit slope analysis by a geotechnical engineer.
- A hydrogeological study be carried out. This study will provide an estimate of the quantity of water that is expected to be encountered during the mining operation.

26.2 Geotechnical Investigation

To carry out geotechnical studies (stability analysis, bearing capacity, etc.) for the final locations of the various structures of the water transformation and treatment plants, roads, overburden, waste rock deposits, for NGA and PGA tailings, CVMR residue etc.

26.3 Mineral Processing and Metallurgical Testing

26.3.1 Mineral Processing Plant

DRA/Met-Chem recommends certain work for the next stage of the Project:

- Given the drastic change in nickel deportment between the 0.1%Ni and 0.3%Ni samples in the 2019 SGS test work, the overall recovery of nickel will likely be sensitive to head grade. It is highly recommended to conduct further mineralogical studies on material between 0.1% and 0.3% head grade to understand maximum nickel recovery;
- The change in deportment needs to be understood as the nickel recovery may be severely limited by the nickel available as pentlandite;
- Further test work should be conducted to understand variability within the ore deposit. These variability samples should be chosen in conjunction with the mining plan. These variability tests should include comminution as well as flotation;
- SGS and CTMP have measured different hardness values on similarly graded samples more comminution test work should be conducted to characterise hardness and adequately size milling equipment;
- Test work should be conducted on thickening and filtration to adequately size thickener and filtration equipment (on all final streams);
- Final streams should be submitted for environmental characterisation;

- Given the relatively low head grade of the deposit, further test work should examine coarse particle flotation. The use of coarse particle flotation, if applicable to this deposit, may significantly impact grinding costs.

26.3.2 Carbonyl Powder Production

The following recommendations can be made for further test work:

- Pilot plant work with the larger samples of the concentrate;
- Study of the concentrate feed variability;
- Evaluation of the potential upgrade of Cu and Co value in the carbonylation residue by gravity and magnetic separation;
- Some trade off studies on the sulphur abatement from the roasting off gas – alternatives to the acid production.

26.4 Recovery Methods

Certain work is recommended for the next stages of the project development:

<u>Concentrator</u>

- Revision of the design and costing with further test work. In particular, further grindability test work should be completed to ensure that the milling circuits are adequately sized; thickening and filtration test work should be completed to adequately size the flocculant systems, thickeners and filter presses;
- Further flotation test work should be conducted on the flow sheet;
- For the Potential Acid Generating tailings, there is also the possibility of generating a sulphuric acid product as suggested by SGS in 2012. This possibility could be discussed on a high level to see if it improves the project economics and facilitates the storage of Potential Acid Generating tailings;
- The primary grind size of 0.065 mm is fine and energy intensive. In conjunction with test work, it would be worth studying whether coarse particle flotation can be used to reject some material, reducing the amount of material to be milled (thereby reducing mill sizes and power draw).

<u>Carbonyl Refining Plant</u>

- Continue process definition work to PFS level;
- Conduct trade-off studies targeting on reduction of operating costs, and determining the additional value streams;
- Work with equipment vendors to evaluate the market and firm up an equipment list for the carbonyl plant.

26.5 Environment and Community

It is recommended to perform the following work in connection with environmental and community activities:

It is recommended to perform the following work in connection with environmental and community activities:

- Extend soil and surface water surveys to select the best location for the tailing ponds, waste rock, and overburden piles;
- Study options for water management strategy to take into consideration the future plant process water requirement and site water management;
- Carry out a hydrogeological study to collect field data in order to estimate from groundwater flow modelling dewatering rates and impacts;
- Continue ongoing consulting and environmental studies required to support permitting requirements and to optimise the site layout.

26.5.1 Hydrogeology

Surface and groundwater management plans are necessary to ensure a safe working environment and minimize disruption to operations. Precipitation and high levels of water saturation can negatively impact mining operations and slope stability. Additional hydrogeological research must be carried out for a better understanding on water management. These studies aim to obtain the fundamental hydrogeological characteristics and conditions for draining the pits as well as for the stability of their walls. Studies will need to be undertaken to establish an erosion control plan.

26.5.2 Geochemical Tests

Geochemical tests are necessary to characterize the ore, the host rock (sterile) of the property as well as the NGA and PGA tailings, and CVMR residue. These tests will identify any potential impact of metal leaching from operations.

26.5.3 Resettlement Action Plan

It’s recommended to develop the resettlement action plan which will include provisions for the phased approach to the livelihood resettlement and restoration process, based on the current schedule established for the life of the mine, as well as a full procedure for compensation.

26.6 Proposed Work Program

To ensure the potential viability of the mineral resources, proposed activities to be undertaken in the next phase have been identified. These activities along with estimated costs, are shown in Table 26.1.

Table 26.1 – Estimated Budget for Next Phase

Activities	Estimated Budget $ (USD)
Definition Drilling Campaign	400,000
Geotechnical and Hydrogeology Studies	500,000
Metallurgical Test Work Program (Concentrator and CVMR)	600,000
Environmental Studies	1,000,000
Feasibility Study (Concentrator and CVMR)	3,000,000
Sub-Total	5,500,000
Contingency (20 %)	1,100,000
Total	**6,600,000**

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28 ABBREVIATIONS

The following abbreviations may be used in this Report.

Abbreviation	Terms or Units
µg/m³	Microgram per Cubic Metre
µm	Microns, Micrometre
'	Feet
"	Inch
$	Dollar Sign
$/m²	Dollar per Square Metre
$/m³	Dollar per Cubic Metre
$/t	Dollar per Metric Tonne
%	Percent Sign
% w/w	Percent Solid by Weight
¢/kWh	Cent per Kilowatt hour
°	Degree
°C	Degree Celsius
2D	Two Dimensions
3D	Three Dimensions
AI	Abrasion Index
Actlabs	Activation Laboratories Ltd.
AMSL	Above Mean Sea Level
ARD	Acid Rock Drainage
ASL	Above Sea Level
AWG	American Wire Gauge
az	Azimuth
bank	Bank Cubic Metre
BDF	Bulk Density Factors
BFA	Bench Face Angle
BIF	Banded Iron Formation
BOF	Basic Oxygen Furnace
BQ	Drill Core Size (3.65 cm diameter)

Abbreviation	Terms or Units
BRGM	Bureau de recherches géologiques et minières
BSG	Bulk Specify Gravity
BTU	British Thermal Unit
BUMIFOM	Bureau minier de la France Outre-Mer
BWI	Bond Ball Mill Work Index
CAD	Canadian Dollar
CAPEX	Capital Expenditures
CDE	Canadian Development Expenses
CDP	Closure and Decommissioning Plan
Ce	Cesium
cfm	Cubic Feet per Minute
CFR	Cost and Freight
Cg	Graphitic
CIF	Cost Insurance and Freight
CIL	Carbon in Leach
CIM	Canadian Institute of Mining, Metallurgy and Petroleum
CIP	Carbon in Pulp
Cl	Clay
CL	Concentrate Leach
cm	Centimetre
CNT	Conseil National de transition
Co	Cobalt
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COG	Cut Off Grade
COV	Coefficient of Variation
CRM	Certified Reference Materials
CTAE	Comité Technique d'Analyse Environnementale
CTMP	Centre de Technologie Minérale et de Plasturgie Inc.
Cu	Copper
CWI	Crusher Work Index
d	Day

Abbreviation	Terms or Units
d/w	Days per Week
d/y	Days per Year
D2	Second Generation of Deformation
D3	Third Generation of Deformation
D4	Fourth Generation of Deformation
dB	Decibel
dBA	Decibel with an A Filter
DDH	Diamond Drill Hole
deg	Angular Degree
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DMS	Dense Media Separator
dmt	Dry Metric Tonne
DT	Davis Tube
DTM	Digital Terrain Model
DWI	Drop Weight Index
DWT	Drop Weight Test
DXF	Drawing Interchange Format
E	East
EA	Environmental Assessment
EAB	Environmental Assessment Board
EAF	Electric Arc Furnace
EBS	Environmental Baseline Study
EDS	Energy-dispersive X-ray spectroscopy
EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EM	Electromagnetic
EMP	Environmental Management Plant
EOH	End of Hole
EP	Environmental Permit
EPA	Environmental Protection Agency
EPCM	Engineering, Procurement and Construction Management

Abbreviation	Terms or Units
EQA	Environmental Quality Act
ER	Electrical Room
ESBS	Environmental and Social Baseline Study
ESIA	Environmental and Social Impact Assessment
FOB	Free on Board
ft	Feet
g	Grams
G&A	General and Administration
g/l	Grams per Litre
g/t	Grams per Tonne
gal	Gallons
GCP	Ground Control Points
GCW	Gross Combined Weight
GEMS	Global Earth-System Monitoring Using Space
GOH	Gross Operating Hours
GPS	Global Positioning System
Gr	Granular
H	Horizontal
h	Hour
h/d	Hours per Day
h/y	Hour per Year
H_2	Hydrogen
ha	Hectare
HDPE	High Density PolyEthylene
HF	Hydrofluoric Acid
HFO	Heavy Fuel Oil
HG	High Grade
HL	Heavy Liquid
hp	Horse Power
HQ	Drill Core Size (6.4 cm Diameter)
HVAC	Heating Ventilation and Air Conditioning

Abbreviation	Terms or Units
Hz	Hertz
I/O	Input / Output
ICP-AES	Inductively Coupled Plasma – Atomic Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma – Mass Spectroscopy
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy
ID	Identification
IDW	Inverse Distance Method
IDW2	Inverse Distance Squared Method
IFC	International Finance Corporation
In	Inches
IR	Infrared Radiation
IRA	Inter-Ramp Angle
IRR	Internal Rate of Return
IT	Information Technology
JORC	Joint Ore Reserves Committee
JV	Joint Venture
KE	Kriging Efficiency
kg	Kilogram
kg/l	Kilogram per Litre
Kg/t	Kilogram per Metric Tonne
kl	Kilolitre
km	Kilometre
km/h	Kilometre per Hour
kPa	Kilopascal
KSR	Kriging Slope Regression
kt	Kilotonne
kV	Kilovolt
kVA	Kilovolt Ampere
kW	Kilowatt
kWh	Kilowatt-hour
kWh/t	Kilowatt-hour per Metric Tonne

Abbreviation	Terms or Units
L	Line
l	Litre
l/h	Litre per hour
lbs	Pounds
LFO	Light Fuel Oil
LG	Low Grade
LG-3D	Lerchs-Grossman – 3D Algorithm
Li	Lithium
LIMS	Low Intensity Magnetic Separator
LPA	Lumière polarisée analysée
LPNA	Lumière polarisée non-analysée
LOI	Loss on Ignition
LOM	Life of Mine
LV	Low Voltage
m	Metre
m/h	Metre per Hour
m/s	Metre per Second
m^2	Square Metre
m^3	Cubic Metre
m^3/d	Cubic Metre per Day
m^3/h	Cubic Metre per Hour
m^3/y	Cubic Metre per Year
mA	Milliampere
MCC	Motor Control Center
MEB	Microscopie électronique à balayage
mg/l	Milligram per Litre
MIBK	Methyl Isobutyl Ketone
min	Minute
min/h	Minute per Hour
Min/shift	Minute per Shift
ml	Millilitre
ML	Metal Leaching

Abbreviation	Terms or Units
MLA	Mineral Liberation Analyzer
mm	Millimetre
mm/d	Millimetre per Day
Mm^3	Million Cubic Metres
MMER	Metal Mining Effluent Regulation
MMU	Mobile Manufacturing Units
MOLP	Multiple Objective Linear Programming
MOU	Memorandum of Understanding
Mt	Million Metric Tonnes
Mt/y	Million of Metric Tonnes per year
MV	Medium Voltage
MVA	Mega Volt-Ampere
MW	Megawatts
MWh/d	Megawatt Hour per Day
My	Million Years
N	North
NAG	Non Acid Generating
Nb	Number
NE	Northeast
NFPA	National Fire Protection Association
NGR	Neutral Grounding Resistor
Ni	Nickel
NI	National Instrument
Nm^3/h	Normal Cubic Metre per Hour
NPV	Net Present Value
NQ	Drill Core Size (4.8 cm diameter)
NSR	Net Smelter Return
NTP	Normal Temperature and Pressure
NTS	National Topographic System
NW	North West
O/F	Overflow
OB	Overburden

Abbreviation	Terms or Units
OK	Ordinary Kriging
OPEX	Operating Expenditures
oz	Ounce (troy)
oz/t	Ounce per Short Ton
P&ID	Piping and Instrumentation Diagram
PAG	Potential Acid Generating
PAPs	Project Affected Persons
Pd	Palladium
PEA	Preliminary Economic Assessment
PF	Power Factor
PFS	Pre-Feasibility Study
PGE	Platinum-Group Element
PGGS	Permit for Geological and Geophysical Survey
ph	Phase (electrical)
pH	Potential Hydrogen
PIR	Primary Impurity Removal
PLC	Programmable Logic Controllers
PP	Preproduction
ppb	Part per Billion
ppm	Part per Million
PR	Permis de recherche
psi	Pounds per Square Inch
Pt	Platinum
P-T	Pressure-Temperature
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QKNA	Quantitative Kriging Neighbourhood Analysis
QP	Qualified Person
RAP	Resettlement Action Plans
RCMS	Remote Control and Monitoring System
RER	Rare Earth Magnetic Separator

Abbreviation	Terms or Units
RMR	Rock Mass Rating
ROM	Run of Mine
rpm	Revolutions per Minute
RQD	Rock Quality Designation
RWI	Bond Rod Mill Work Index
S	South
S	Sulfur
S/R	Stripping Ratio
SAG	Semi-Autogenous Grinding
Sc	Scandium
scfm	Standard Cubic Feet per Minute
SCIM	Squirrel Cage Induction Motors
SE	South East
sec	Second
SEM	Scanning Electronic Microscope
Set/y/unit	Set per Year per Unit
SG	Specific Gravity
SGS-Lakefield	SGS Lakefield Research Limited of Canada
SIR	Secondary Impurity Removal
SMC	SAG Mill Comminution
SNRC	Système National de Référence Cartographique
SPI	SAG Power Index
SPLP	Synthetic Precipitation Leaching Procedure
SPT	Standard Penetration Tests
SR	Stripping Ratio
SW	South West
SW	Switchgear
t	Metric Tonne
t/d	Metric Tonne per Day
t/h	Metric Tonne per Hour
t/h/m	Metric Tonne per Hour per Metre
t/h/m²	Metric Tonne per Hour per Square Metre

Abbreviation	Terms or Units
t/m	Metric Tonne per Month
t/m²	Metric Tonne per Square Metre
t/m³	Metric Tonne per Cubic Metre
t/y	Metric Tonne per Year
Ta	Tantalum
TCLP	Toxicity Characteristic Leaching Procedure
TER	Travail d'Études et de Recherches
TIN	Triangulated Irregular Network
ton	Short Ton
tonne	Metric Tonne
ToR	Terms of Reference
TSS	Total Suspended Solids
U	Uranium
U/F	Under Flow
ULC	Underwriters Laboratories of Canada
USA	United Stated of America
USD	United States Dollar
USGPM	Us Gallons per Minute
UTM	Universal Transverse Mercator
V	Vertical
V	Volt
VAC	Ventilation and Air Conditioning
VFD	Variable Frequency Drive
VLF	Very Low Frequency
W	Watt
W	West
WAC	West African Archean Craton
WHIMS	Wet High Intensity Magnetic Separation
WHO	World Health Organization
WRA	Whole Rock Analysis Method
WSD	World Steel Dynamics

Abbreviation	Terms or Units
wt	Wet Metric Tonne
X	X Coordinate (E-W)
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence
y	Year
Y	Y coordinate (N-S)
Z	Z coordinate (depth or elevation)
Zr	Zirconium

29 CERTIFICATE OF QUALIFIED PERSON

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CERTIFICATE OF QUALIFIED PERSON

To accompany the Report entitled ""*NI 43-101 Technical Report – Preliminary Economic Study for the Samapleu Project"* which is effective as of May 22, 2019 and issued on June 1, 2020 (the "**Technical Report**") prepared for Sama Resources Inc. (the "**Company**").

I, *Daniel M.Gagnon, P. Eng.,* Quebec, do hereby certify that:

1. I am Project Manager with Met-Chem, a division of DRA Americas Inc. with an office at suite 600, 555 René-Lévesque Blvd. West, Montreal, Quebec, Canada;
2. I am a graduate from *l'École Polytechnique de Montréal*, Canada in 1995 a B.Eng. in mining engineering;
3. I am a registered member of "*Ordre des Ingénieurs du Québec*" (#118521). I am a Member of the Canadian Institute of Mining, Metallurgy and Petroleum;
4. I have worked continuously as a project manager for more than 25 years of experience in management, operational and technical in the mining consulting industry since graduating from University.

   My relevant experience in regard to the Samapleu Project Technical Report includes:

   - Participation in the drafting of numerous technical reports in compliance with National Instrument 43-101 (NI43-101).
   - Mine design, mine planning, mining methods including equipment and mining costs for numerous projects similar to Samapleu;
   - Mine operating and capital cost estimates, economic analysis and due diligence for base metals mines and projects in Canada, United States, and Africa.
5. I have read the definition of "qualified person" set out in the National Instrument 43-101 and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements to be an independent qualified person for the purposes of NI 43-101;
6. I am responsible for Sections 2 to 3, 16, 18, 19, 22, and 24 and contributed part of Sections 1, 21, and 25 to 27 of the Technical Report;

7. I have visited the Samapleu Project site on October 14-17, 2019;
8. I have not had prior involvement with the property that is the subject of the Technical Report;
9. I am independent of the issuer applying all of the tests in section 1.5 of NI 43-101.
10. I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this Report;
11. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with generally accepted Canadian mining industry practice.
12. As of the aforementioned Effective Date, to the best of my knowledge, information and belief, the sections of the Technical Report I am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 1st day of June 2020

"Original Signed and sealed"
Daniel M. Gagnon, P. Eng.

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I, *Schadrac Ibrango, P.Geo., Ph.D., MBA.,* do hereby certify:

1. I am a Principal Geologist with Met-Chem, a division of DRA Americas Inc, with an office at 555 René-Lévesque Blvd. West, 6th Floor, Montreal, Canada;
2. I am a graduate from University of Ouagadougou (Burkina-Faso) with a Master Degree in Geology in 1998, a Ph.D. in Engineering of Darmstadt University of Technology (Germany) in 2005 and an executive MBA from Université du Québec à Montréal (Canada) in 2016;
3. I am a registered member of the Ordre des Géologues du Québec (OGQ), membership # 1102 and Professional Engineers & Geoscientists of Newfoundland and Labrador, membership # 07633;

   I have worked continuously as a geologist for more than 20 years in the mining industry since my graduation from university;
4. I have worked on similar projects to the Samapleu Project in Quebec and in Africa; My experience for the purpose of the Technical Report includes:
   a) Hands-on experience in exploration and mining for nickel-cobalt-Platinum-Group Elements (PGE) and base metals deposits;
   b) Generation of base metals and Ni-Co-PGE exploration projects in Quebec (Abitibi) and Africa;
   c) Management of base metals and Ni-Co-PGE exploration projects in Quebec (Abitibi)
   d) Participation as QP in the preparation of a Ni43-101 technical report for in Ni-Co project in Africa;
   e) Design and supervision and implementation of drilling programs;
   f) Review, audits, interpretation of geoscientific data;
   g) Experience in exploration and drilling on several projects in weathered terranes under tropical conditions (Africa);
   h) Participation in the preparation of parts of several other NI 43-101 compliant Technical Reports.

5. 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 by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;
6. I have visited the site on October 25 to 27, 2018;
7. I have participated in the preparation of this Technical Report and am responsible for Sections 4 to 12, 14 as well as 23 and parts of Sections 1 and 25 to 27;
8. I have not had prior involvement with the property that is the subject of the Technical Report;
9. I am independent of the issuer applying all of the tests in section 1.5 of NI 43-101.
10. I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this Report;
11. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with generally accepted Canadian mining industry practice.
12. As of the aforementioned Effective Date, to the best of my knowledge, information and belief, the sections of the Technical Report I am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 1st day of June 2020

"Original Signed and sealed"

Schadrac Ibrango, P.Geo., Ph.D., MBA

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I, *Nalini Singh, M. Eng., P.Eng.,* do hereby certify:

1. I am a Process Engineer with Met-Chem, a division of DRA Americas Inc, with an office at 555 René-Lévesque Blvd. West, 6th Floor, Montreal, Canada;
2. I am a graduate from McGill University in Montreal, Quebec with a M. Eng. in Materials Engineering in 2014 as well as a B. Eng in Materials Engineering in 2011;
3. I am a registered member of the Professional Engineers of Ontario, membership # 100228180;

   I have worked continuously as a metallurgical or process engineer for more than 7 years in the mining industry since my graduation from university;
4. I have worked on similar projects to the Samapleu Project in Quebec and in New Brunswick; My experience for the purpose of the Technical Report includes:
   a) Experience working on engineering studies of all levels from scoping to feasibility, as well as experience in detailed engineering.
   b) Experience in test work supervision, data analysis, modelling, and simulation for many different resources/commodities similar to Samapleu Project.
   c) Experience gained working in an operating mine for a commodity similar to the Samapleu Project.
   d) Participation in the preparation of parts of NI 43-101 compliant Technical Reports.
5. 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 by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;
6. I have not visited the property site;
7. I have participated in the preparation of this Technical Report and am responsible for Section 13.1 and parts of Sections 1, and 25 to 27;
8. I have not had prior involvement with the property that is the subject of the Technical Report;

9. I am independent of the issuer applying all of the tests in section 1.5 of NI 43-101.
10. I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this Report;
11. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with generally accepted Canadian mining industry practice.
12. As of the aforementioned Effective Date, to the best of my knowledge, information and belief, the sections of the Technical Report I am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 1st day of June 2020

"Original Signed and sealed"

Nalini Singh, M. Eng., P.Eng.

555 René-Lévesque Blvd West / 6th floor / Montréal / Quebec / Canada / H2Z 1B1
T +1 514 288-5211 / **E** info@draglobal.com / met-chem.com

CERTIFICATE OF QUALIFIED PERSON

To accompany the Report entitled ""*NI 43-101 Technical Report – Preliminary Economic Study for the Samapleu Project"* which is effective as of May 22, 2019 and issued on June 1, 2020 (the "**Technical Report**") prepared for Sama Resources Inc. (the "**Company**").

I, *Volodymyr Liskovych, Ph.D., P. Eng.,* do hereby certify:

1. I am a Principal Process Engineer with DRA Americas with an office at 20 Queen Street West, 29th Floor, Toronto, Ontario, Canada.
2. I am a graduate from Zaporozhye State Engineering Academy, Zaporozhye, Ukraine in 1996 with a Metallurgical Engineer Degree, and a graduate from National Metallurgical Academy of Ukraine, Dnepropetrovsk (Dnipro), Ukraine with the PhD degree in Metallurgical Engineering in 2001.
3. I am a registered member of the Professional Engineers of Ontario (#100157409).

   I have worked continuously as a Metallurgical Engineer for more than 23 years since my graduation from Zaporozhye State Engineering Academy.

   My relevant experience for the purpose of the Technical Report is:

   - Review and report on mineral processing and metallurgical operations and projects around the world for due diligence and regulatory requirements;
   - Engineering study (PEA, PFS, FS, and Detailed Engineering) project work on mineral processing, hydrometallurgical and pyrometallurgical projects around the world, and in North America;
   - Experience in operations management and operational support positions in metallurgical and hydrometallurgical operations in Ukraine, Canada, and Brazil.
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 by 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 site.
6. I am responsible for Sections 13.2 and 17.2 and contributed parts of Sections 1, 21, and 25 to 27.
7. I have not had prior involvement with the property that is the subject of the Technical Report;

8. I have not had prior involvement with the property that is the subject of the Technical Report;
9. I am independent of the issuer applying all of the tests in section 1.5 of NI 43-101.
10. I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this Report;
11. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with generally accepted Canadian mining industry practice.
12. As of the aforementioned Effective Date, to the best of my knowledge, information and belief, the sections of the Technical Report I am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 1st day of June 2020

"Original Signed and sealed"
Volodymyr Liskovych, Ph.D., P. Eng.

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CERTIFICATE OF QUALIFIED PERSON

To accompany the Report entitled "*NI 43-101 Technical Report – Preliminary Economic Study for the Samapleu Project"* which is effective as of May 22, 2019 and issued on June 1, 2020 (the "**Technical Report**") prepared for Sama Resources Inc. (the "**Company**").

I, *Ryan Cunningham, M.Eng., P. Eng.,* do hereby certify:

1. I am a Process Engineer and was employed by Met-Chem at the effective date of the Technical Report, a division of DRA Americas Inc, with an office at 555 René-Lévesque Blvd. West, 6th Floor, Montreal, Canada;
2. I am a graduate from McGill University in Montreal in 2006 with a B.Eng. in Metals and Materials Engineering and in 2009 with a M.Eng. in Mineral Processing – Flotation.
3. I am a registered member of "*Ordre des Ingénieurs du Québec*" (# 145792). I am a Member of the Canadian Institute of Mining, Metallurgy and Petroleum;
4. I have worked continuously, since graduating from my Bachelors in 2005, as a mineral processing engineer. I have designed and reviewed projects very similar to "NI 43-101 Technical Report – Preliminary Economic Study for the Samapleu Project" such as:
   - Lead process engineer on the Cormidom zinc rejection project
   - Provided operation support to Canadian Royalties
   - Have been a QP for a similar responsibility on a NI 43-101 report
5. 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 by NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

6. I have not visited the property site;
7. I have participated in the preparation of this Technical Report and am responsible for Section 17.1 and parts of Sections 1, 21, and 25 to 27;
8. I have not had prior involvement with the property that is the subject of the Technical Report;
9. I am independent of the issuer applying all of the tests in section 1.5 of NI 43-101.
10. I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this Report;
11. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with generally accepted Canadian mining industry practice.
12. As of the aforementioned Effective Date, to the best of my knowledge, information and belief, the sections of the Technical Report I am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 1st day of June 2020

"Original Signed and sealed"
Ryan Cunningham, M. Eng., P.Eng.

L'INGÉNIERIE **INSPIRÉE**

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Montréal (Québec) H1J 3A1
514.351.8350
gcmconsultants.com

CERTIFICATE OF QUALIFIED PERSON

To accompany the Report entitled "*NI 43-101 Technical Report – Preliminary Economic Study for the Samapleu Project"* which is effective as of May 22, 2019 and issued on June 1, 2020 (the "**Technical Report**") prepared for Sama Resources Inc. (the "**Company**").

I, *Marie-Claude Dion St-Pierre, P. Eng., M.A.Sc.,* do hereby certify that:

1. I am the Manager of the Environmental Department with GCM Consultants inc. located at 9496, boulevard du Golf, Montréal (Québec), Canada, H1J 3A1.
2. I am a graduate of the Sherbrooke University, Sherbrooke (Québec) Canada of a Bachelor's degree in Chemical Engineering, 2004 and Master's degree in Chemical Engineering, 2007.
3. I am a member in good standing of the Ordre des ingénieurs du Québec (Québec) Canada, no.: 140947.
4. My relevant experience includes studies as Project Manager on characterization of mining wastes, characterization of surface water, proposed solutions for treatment of mine water effluent, as well as, studies on water management infrastructures design. I also acted as Project Manager on mine closure plan design and costing, as well as, the other aspects of permitting for mining projects and mines in operation
5. I have read the definition of "qualified person" set out in the NI 43-101 – Standards of Disclosure for Mineral Projects ("N 43-101") and certify that, by reason of my education, affiliation with a professional association, and past relevant work experience, I fulfill the requirements to be a qualified person for the purposes of NI 43-101.
6. I am independent of the issuer applying all the tests in Section 1.5 of NI 43-101.
7. I have participated in the preparation of this Technical Report and am responsible for Section 20.
8. I did not visit the property that is the subject to the Technical Report.
9. I have had no prior involvement with the property that is the subject of the Technical Report.

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10. I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this Report;
11. I have read NI 43-101 and Form 43-101F1 and have prepared the Technical Report in compliance with NI 43-101 and Form 43-101F1; and have prepared the report in conformity with generally accepted Canadian mining industry practice.
12. As of the aforementioned Effective Date, to the best of my knowledge, information and belief, the sections of the Technical Report I am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 1st day of June 2020

"Original Signed and sealed"
Marie-Claude Dion St-Pierre P.Eng., M.Sc,A.

Appendix A – Boreholes Heathers

SONDAGE	Séquence	LOCATIONX	LOCATIONY	LOCATIONZ	Longueur	Début	Fin	Secteur	AZIMUTH	Inclinaison
SM44-450250	1	619648.00	856550.00	607.46	125.30	Mars 22, 2010	Mars 26, 2010	Samapleu Main	230	-50
SM44-517178	2	619721.15	856625.61	582.87	197.40	Mars 26, 2010	Mars 31, 2010	Samapleu Main	225	-50
SM44-587090	3	619793.69	856710.27	567.57	176.90	Mars 31, 2010	avril 06, 2010	Samapleu Main	230	-50
SM44-525290	4	619726.00	856512.00	599.46	167.70	avril 06, 2010	avril 13, 2010	Samapleu Main	230	-50
SM44-590230	5	619800.00	856579.00	580.13	147.16	14 avril 2010	17 avril 2010	Samapleu Main	225	-50
SM44-665150	6	619847.77	856655.44	570.87	199.00	avril 17, 2010	avril 27, 2010	Samapleu Main	225	-50
SM24-480735	7	619666.88	857669.98	543.68	353.00	27 avril 2010	09 mai 2010	Samapleu Extension 1	135	-50
SM24-661614	12	619860.32	857786.92	547.72	342.00	29 mai 2010	04 juin 2010	Samapleu Extension 1	135	-50
SM44-525290B	17	619724.04	856510.02	599.46	402.20	24 juin 2010	03 juillet 2010	Samapleu Main		-90
SM44-409218	18	619607.31	856577.84	613.44	204.00	03 juillet 2010	05 juillet 2010	Samapleu Main	230	-50
SM24-628651	20	619829.44	857748.50	547.54	269.00	13 juillet 2010	17 juillet 2010	Samapleu Extension 1	135	-50
SM24-699580	21	619899.25	857820.16	545.94	243.00	17 juillet 2010	22 juillet 2010	Samapleu Extension 1	135	-50
SM24-594687	22	619794.44	857713.62	547.02	280.00	22 jullet 2010	28 juillet 2010	Samapleu Extension 1	135	-50
SM44-418293	26	619613.59	856508.58	628.05	156.00	27 oct 2010	06 nov 2010	Samapleu Main	225	-50
SM44-451301	27	619636.30	856506.71	620.60	180.00	06 nov 2010	8 nov 2010	Samapleu Main	225	-50
SM44-492354	28	619694.05	856451.70	620.04	120.00	08 nov 2010	10 nov 2010	Samapleu Main	225	-50
SM44-474334	29	619674.00	856470.88	619.36	123.00	10 nov 2010	11 nov 2010	Samapleu Main	225	-50
SM44-454315	30	619654.97	856485.78	620.31	126.00	11 nov 2010	12 nov 2010	Samapleu Main	225	-50
SM44-506367	31	619706.82	856435.08	620.65	123.00	12 Nov 2010	13 nov 2010	Samapleu Main	225	-50
SM44-533379	32	619729.52	856418.92	616.48	64.50	13 nov 2010	14 nov 2010	Samapleu Main	225	-50
SM44-557402	33	619757.00	856398.00	624.00	54.30	14 nov 2010	14 nov 2010	Samapleu Main	225	-50
SM44-487292	34	619687.00	856508.00	607.00	168.00	20 nov 2010	22 nov 2010	Samapleu Main	230	-65
SM44-487292b	35	619684.66	856514.92	607.16	189.00	22 nov 2010	24 nov 2010	Samapleu Main	210	-70
SM44-487292c	36	619682.90	856515.83	606.26	165.00	24 nov 2010	08 dec 2010	Samapleu Main	225	-50
SM44-467270	37	619669.03	856529.34	607.41	165.00	08 dec 2010	10 dec 2010	Samapleu Main	225	-50
SM44-450250b	38	619651.75	856546.15	607.46	144.00	10 dec 2010	12 dec 2010	Samapleu Main	215	-50
SM44-450250c	39	619650.24	856547.36	607.95	135.00	12 dec 2010	13 dec 2010	Samapleu Main	245	-50
SM44-352247	40	619551.48	856551.72	636.13	117.00	14 dec 2010	14 dec 2010	Samapleu Main	225	-50
SM44-405184	41	619605.67	856616.48	604.68	153.00	15 dec 2010	16 dec 2010	Samapleu Main	225	-50
SM44-298324	42	619498.98	856478.80	642.05	111.00	17 dec 2010	18 dec 2010	Samapleu Main		-90
SM44-680289	43	619879.44	856509.66	578.73	129.00	13 Jan 2011	14 Janvier 2011	Samapleu Main	225	-50
SM44-641332	44	619836.61	856467.85	591.15	156.00	15 Jan 2011	18 janvier 2011	Samapleu Main	225	-50
SM44-487292d	45	619682.78	856517.21	606.35	141.00	19 Jan 2011	20 Jan 2011	Samapleu Main	240	-65
SM44-645392	46	619846.25	856407.13	600.89	117.00	21 Jan 2011	24 Jan 2011	Samapleu Main		-90
SM44-784383	47	619984.00	856415.88	576.04	132.00	24 Jan 2011	27 Jan 2011	Samapleu Main	225	-70
SM44-801514	48	620001.90	856287.19	574.45	117.00	27 Jan 2011	28 Jan 2011	Samapleu Main		-90
SM44-458386	49	619657.70	856413.02	633.78	54.00	28 Jan 2011	31 Jan 2011	Samapleu Main	225	-50
SM44-564128	72	619761.46	856670.85	568.83	174.00	02 Mars 2011	04 Mars 2011	Samapleu Main	225	-50
SM44-541188	73	619742.01	856610.92	582.97	282.00	Mars 04 2011	10 Mars 2011	Samapleu Main	225	-50
SM44-560203	74	619761.52	856596.90	582.79	276.00	Mars 10 2011	Mars 16 2011	Samapleu Main	225	-50
SM44-600306	75	619799.19	856494.31	592.31	171.00	Mars 16 2011	Mars 18 2011	Samapleu Main	225	-50
SM44-582290	76	619782.08	856510.13	592.85	195.00	18 mars 2011	23 mars 2011	Samapleu Main	225	-50
SM44-563275	77	619763.23	856523.62	593.10	198.00	22 mars 2011	26 mars 2011	Samapleu Main	225	-50
SM44-540257	78	619738.05	856543.15	593.43	183.00	28 mars 2011	29 mars 2011	Samapleu Main	225	-50
SM44-523243	79	619719.60	856557.09	595.27	216.00	30 mars 2011	31 mars 2011	Samapleu Main	225	-50

SONDAGE	Séquence	LOCATIONX	LOCATIONY	LOCATIONZ	Longueur	Début	Fin	Secteur	AZIMUTH	Inclinaison
SM44-505224	80	619703.71	856577.04	593.72	171.00	01-Apr-11	04-Apr-11	Samapleu Main	225	-50
SM44-485210	81	619685.36	856588.19	594.31	174.00	04-Apr-11	06-Apr-11	Samapleu Main	225	-50
SM44-476185	82	619675.22	856617.11	592.11	177.00	07-Apr-11	09-Apr-11	Samapleu Main	225	-50
SM44-455171	83	619656.84	856628.28	592.20	141.00	09-Apr-11	12-Apr-11	Samapleu Main	225	-50
SM44-379132	84	619578.79	856669.90	595.70	132.00	12-Apr-11	14-Apr-11	Samapleu Main	225	-50
SM44-270012	85	619470.25	856787.46	572.12	99.00	14 Arpil 2011	15 Avril 2011	Samapleu Main		-90
SM44-375251	86	619576.74	856548.11	628.65	90.00	18 avril 2011	19 avril 2011	Samapleu Main	225	-50
SM44-382324	87	619581.76	856476.61	647.44	51.00	19 avril 2011	20 avril 2011	Samapleu Main	225	-50
SM44-402336	88	619601.31	856463.45	643.37	48.00	20 avril 2011	21 avril 2011	Samapleu Main	225	-50
SM44-423357	89	619624.11	856440.40	639.72	49.00	21 avril 2011	21 avril 2011	Samapleu Main	225	-50
SM44-441369	90	619641.01	856428.16	637.51	45.00	21 avril 2011	22 avril 2011	Samapleu Main	225	-50
SM44-473411	91	619671.97	856387.97	631.39	63.00	22 avril 2011	23 avril 2011	Samapleu Main	225	-50
SM44-494422	92	619693.75	856377.63	628.35	21.00	23 avril 2011	23 avril 2011	Samapleu Main		-90
SM44-568343	93	619764.45	856457.41	607.32	150.00	26 avril 2011	27 avril 2011	Samapleu Main	225	-50
SM44-545330	94	619746.94	856469.19	604.99	147.90	27 avril 2011	28 avril 2011	Samapleu Main	225	-50
SM44-525322	95	619728.94	856480.17	606.70	129.00	29 avril 2011	30 avril 2011	Samapleu Main	225	-50
SM44-502299	96	619702.41	856500.17	607.77	135.00	03 mai 2011	04 mai 2011	Samapleu Main	225	-50
SM44-405257	97	619602.57	856539.41	623.19	129.00	04 mai 2011	06 mai 2011	Samapleu Main	225	-50
SM44-590230B	98	619798.50	856579.06	580.13	288.00	6 mai 2011	12 mai 2011	Samapleu Main	225	-50
SM44-573220	99	619772.85	856578.12	584.53	339.00	13 mai 2011	25 mai 2011	Samapleu Main	225	-50
SM44-491136	100	619689.83	856661.03	582.92	183.00	25 mai 2011	28 mai 2011	Samapleu Main	225	-50
SM44-441148	101	619639.60	856649.26	591.31	135.00	28 mai 2011	31 mai 2011	Samapleu Main	225	-50
SM44-404153	102	619604.31	856645.17	597.69	99.00	01 juin 2011	02 juin 2011	Samapleu Main	225	-50
SM44-424210	103	619622.25	856589.96	603.10	93.00	02 juin 2011	03 juin 2011	Samapleu Main	225	-50
SM44-698307	104	619897.05	856490.33	576.63	111.00	6 juin 2011	8 juin 2011	Samapleu Main	225	-50
SM44-660272	105	619857.96	856526.79	579.92	132.00	9 juin 2011	15 juin 2011	Samapleu Main	225	-50
SM24-736697	106	619936.16	857703.39	537.40	109.00	17 juin 2011		Samapleu Extension 1	135	-50
SM24-699656	107	619899.00	857744.00	544.00	150.00	20 juin 2011	22 juin 2011	Samapleu Extension 1	135	-50
SM25-300360	108	620299.85	858039.28	546.19	105.00	23 juin 2011	24 juin 2011	Samapleu Extension 1	135	-50
SM34-070500	132	619271.00	857100.00	571.50	174.60	10 juillet 2011	14 juillet 2011	Samapleu Extension 1	135	-50
SM24-699656b	133	619897.00	857745.00	544.00	138.00	11-Jul-11	13-Jul-11	Samapleu Extension 1		-90
SM24-628651b	134	619829.00	857748.00	545.00	81.00	14-Jul-11	15-Jul-11	Samapleu Extension 1	135	-70
SM44-636270	135	619836.00	856530.00	592.00	177.00	16 juillet 2011	19 juillet 2011	Samapleu Main	225	-50
SM44-620315	136	619820.00	856485.00	602.00	176.00	16 juillet 2011	21 Juillet 2011	Samapleu Main	225	-50
SM24-664688	137	619864.00	857712.00	542.00	96.00	19 juillet 2011	20 juillet 2011	Samapleu Extension 1		-90
SM24-679708	138	619881.82	857690.50	539.89	196.00	20 juillet 2011	23 juillet 2011	Samapleu Extension 1		-90
SM24-645670	139	619845.38	857731.31	545.33	61.50	21 juillet 2011	25 juillet 2011	Samapleu Extension 1		-90
SM24-648707	140	619846.84	857692.42	542.24	124.00	23 juillet 2011	26 juillet 2011	Samapleu Extension 1		-90
SM24-683671	141	619882.20	857727.91	544.37	98.50	25 Juillet 2011	26 Juillet 2011	Samapleu Extension 1		-90
SM24-628688	142	619828.45	857712.64	544.66	70.90	26 juillet 2011	26 juillet 2011	Samapleu Extension 1		-90
SM24-699690	143	619899.09	857710.13	542.55	201.70	26 Juillet 2011	30 juillet 2011	Samapleu Extension 1		-90
SM24-696731	144	619896.00	857669.00	535.00	255.00	26 juillet 2011	30 Juillet 2011	Samapleu Extension 1		-90
SM24-717672	145	619918.46	857728.22	543.37	186.00	10 sept 2011	14 sept 2011	Samapleu Extension 1		-90
SM24-736697b	147	619936.00	857704.00	535.00	194.00	14 sept 2011	17 Sept 2011	Samapleu Extension 1		-90
SM24-760709	150	619959.56	857696.71	532.46	213.00	19 Sept 2011	23 Sept 2011	Samapleu Extension 1		-90

SONDAGE	Séquence	LOCATIONX	LOCATIONY	LOCATIONZ	Longueur	Début	Fin	Secteur	AZIMUTH	Inclinaison
SM24-737618a	152	619937.20	857782.64	544.64	61.00	2011-09-26	2011-10-10	Samapleu Extension 1		-90
SM24-737618b	153	619937.00	857782.00	544.00	108.00	2011-10-10	2011-10-13	Samapleu Extension 1		-90
SM24-772654	154	619972.00	857746.00	542.00	184.50	2011-10-14	2011-10-22	Samapleu Extension 1		-90
SM24-721711	155	619922.17	857687.65	535.79	249.00	2011-10-21	2011-10-29	Samapleu Extension 1		-90
SM44-494350a	191	619694.00	856450.00	620.00	66.00	2011-11-02	2011-11-04	Samapleu Main	210	-60
SM44-494350b	192	619694.00	856450.00	620.00	75.00	2011-11-04	2011-11-08	Samapleu Main	240	-50
SM24-631727	193	619831.00	857673.00	538.00	150.00	2011-11-09	2011-11-10	Samapleu Extension 1		-90
SM24-716747	194	619913.29	857650.33	532.69	234.00	2011-10-31	2011-11-10	Samapleu Extension 1		-90
SM24-665760	195	619865.00	857640.00	534.00	208.00	2011-11-10	2011-11-15	Samapleu Extension 1		-90
SM24-627794	196	619827.00	857606.00	533.00	150.00	2011-11-15	2011-11-17	Samapleu Extension 1		-90
SM24-771588	197	619971.51	857813.90	543.63	105.00	2011-11-17	2011-11-18	Samapleu Extension 1		-90
SM25-009620	198	620009.00	857780.00	544.00	183.00	2011-11-18	2011-11-19	Samapleu Extension 1		-90
SM25-039587	199	620039.00	857813.00	542.10	161.80	09 mai 2012	11 mai 2012	Samapleu Extension 1		-90
SM25-080542	200	620080.00	857858.00	538.00	159.00	11 mai 2012	15 mai 2012	Samapleu Extension 1		-90
SM24-603758	201	619803.00	857642.00	536.92	156.00	15 mai 2012	17 mai 2012	Samapleu Extension 1		-90
SM24-572790	202	619772.00	857610.00	535.34	144.00	17 mai 2012	18 mai 2012	Samapleu Extension 1		-90
SM34-603026	203	619803.00	857574.00	531.40	153.00	18 mai 2012	28 mai 2012	Samapleu Extension 1		-90
SM44-684210	204	619884.00	856590.00	572.00	355.00	23 mai 2012	23 juin 2012	Samapleu Main	225	-50
SM25-004552	205	620004.00	857848.00	542.63	72.00	25 juin 2012	27 juin 2012	Samapleu Extension 1		-90
SM25-045506	206	620045.00	857894.00	538.35	48.00	27 juin 2012	29 juin 2012	Samapleu Extension 1		-90
SM34-098547	207	619298.00	857053.00	576.37	123.75	29 juin 2012	02-Jul-12	Samapleu Extension 1		-90
SM34-313349	214	619517.00	857253.00	564.00	81.00	05 aug 2012	08 Aug 2012	Samapleu Extension 1		-90
SM34-236411	215	619436.00	857188.00	571.00	123.00	08 aug 2012	09 Aug 2012	Samapleu Extension 1		-90
SM34-170475	216	619366.00	857123.00	579.00	117.00	13 Aug 2012	14 Aug 2012	Samapleu Extension 1		-90
SM34-023171	217	619223.00	857029.00	599.25	105.30	14 Aug 2012	15 Aug 2012	Samapleu Extension 1		-90
SM25-112519	220	620112.00	857881.00	537.00	180.10	Jan 04-2013	Jan 10 2013	Samapleu Extension 1		-90
SM25-112555	221	620111.00	857845.00	540.00	200.20	Jan 10 2013	Jan 16 2013	Samapleu Extension 1		-90
SM25-184483	222	620184.00	857917.00	539.00	173.20	Jan 16 2013	Jan 18 2013	Samapleu Extension 1		-90
SM25-256447	223	620256.00	857953.00	540.00	61.40	Jan 18 2013	Jan 28 2013	Samapleu Extension 1		-90
SM25-274464	224	620274.00	857936.00	540.00	119.78	Jan 29 2013	Fev 02 2013	Samapleu Extension 1		-90
SM25-256482	225	620256.00	857918.00	540.00	158.50	Feb 04 2013	Fev 08 2013	Samapleu Extension 1	315	-75
SM25-183519	226	620183.00	857881.00	540.00	197.82	Feb 11 2013	Fev 16 2013	Samapleu Extension 1	315	-75
SM25-133605	227	620133.00	857795.00	540.00	172.24	Feb 16 2013	Fev 25 2013	Samapleu Extension 1	315	-50
SM25-096647	228	620096.00	857753.00	536.00	172.14	Feb 25 2013	Mars 04 2013	Samapleu Extension 1	315	-50
SM25-063682	229	620063.00	857718.00	534.00	191.10	Mars 04 2013	Mars 12 2013	Samapleu Extension 1	315	-50
SM24-770735	230	619970.00	857665.00	534.00	395.00	Mar 12 2013	avril 12 2013	Samapleu Extension 1		-90
SM25-148554	235	620148.00	857846.00	540.00	238.65	09 dec 2017	14 dec 2017	Samapleu Extension 1	315	-80
SM25-301375	236	620301.00	858025.00	546.00	60.30	June 24 2013	juillet 02 2013	Samapleu Extension 1		-90
SM34-570407	238	619770.00	857193.00	539.00	400.90	Sept 13 2013	Oct 20 2013	Samapleu Extension 1	315	-50
SM44-693140	250	619893.00	856660.00	568.00	561.20	Mai 07 2014	Mai 29 2014	Samapleu Main	225	-70
SM44-693140B	251	619893.00	856660.00	568.00	604.40	Mai 30 2014	juillet 04 2014	Samapleu Main	315	-70
SM34-626442	253	619826.00	857158.00	536.00	618.00	juillet 06 2014	Aout 05 2014	Samapleu Extension 1	315	-85
SM34-564718	254	619764.00	856882.00	561.00	620.50	Aout 13 2014	September 17 2014	Samapleu Extension 1	315	-80
SM25-133537	255	620133.00	857863.00	540.00	120.80	Mars 04 2014	Mars 14 2015	Samapleu Extension 1	310	-58

SONDAGE	Séquence	LOCATIONX	LOCATIONY	LOCATIONZ	Longueur	Début	Fin	Secteur	AZIMUTH	Inclinaison
SM25-133538	256	620134.00	857862.00	540.00	151.00	Mars 14, 2015	Mars 20 2015	Samapleu Extension 1	313	-85
SM44-428267	257	619628.00	856533.00	616.00	122.00	Mars 17 2015	Mars 20 2015	Samapleu Main	225	-52
SM44-473240	258	619673.00	856560.00	601.00	167.75	Mars 20 2015	Mars 25 2015	Samapleu Main	222	-50
SM25-111555	259	620111.00	857845.00	540.00	118.30	Mars 24 2015	Mars 31 2015	Samapleu Extension 1	313	-55
SM44-459220	260	619659.00	856580.00	601.00	163.30	Mars 26 2015	Mars 30 2015	Samapleu Extension 1	217	-50
SM44-429266	261	619628.00	856533.00	616.00	135.00	Mars 31 2015	avril 01 2015	Samapleu Main	213	-62
SM24-681746	266	619881.00	857654.00	534.00	143.25	09 juillet 2017	13 juillet 2017	Samapleu Extension 1		-90
SM24-663733	267	619863.00	857667.00	541.00	96.80	14-Jul-17	19-Jul-17	Samapleu Extension 1		-90
SM24-660657	268	619860.00	857743.00	546.00	55.50	20 juillet 2017	21 juillet 2017	Samapleu extension 1		-90
SM25-073652	269	620073.00	857748.00	537.00	170.40	22 juillet 2017	25 juillet 2017	Samapleu Extension 1	315	-50
SM25-239431	270	620239.00	857969.00	545.00	89.00	26 juillet 2017	31 juillet 2017	Samapleu Extension 1		-90
SM25-222449	271	620222.00	857951.00	543.00	105.60	31 juillet 2017	01 aout 2017	Samapleu Extension 1		-90
SM25-200496	272	620200.00	857904.00	536.00	208.10	02 aout 2017	17 aout 2017	Samapleu Extension 1		-90
SM25-159493	273	620159.00	857907.00	540.00	168.00	17 aout 2017	19 aout 2017	Samapleu Extension 1		-90
SM25-080542b	274	620080.00	857858.00	538.00	90.40	20 aout 2017	23 aout 2017	Samapleu Extension 1	315	-60
SM25-112519b	275	620112.00	857881.00	544.00	85.00	23 aout 2017	25 aout 2017	Samapleu Extension 1	315	-50
SM25-039587b	276	620039.00	857813.00	542.00	93.00	25 aout 2017	26 aout 2017	Samapleu Extension 1	315	-60
SM25-075517	277	620075.00	857883.00	538.00	122.50	27 aout 2017	11 sept 2017	Samapleu Extension 1		-90
SM25-135472	278	620135.00	857928.00	540.00	136.50	11 sept 2017	17 set 2017	Samapleu Extension 1		-90
SM25-095604	279	620095.00	857796.00	542.00	139.50	18 sep 2017	03 dec 2017	Samapleu Extension 1	315	-50
SM44-454255	280	619654.00	856545.00	607.00	132.10	04 dec 2017	07 dec 2017	Samapleu Main	225	-50
SM44-546116	281	619746.00	856684.00	577.00	112.50	07 dec 2017	09 dec 2017	Samapleu Main		-90
SM44-526094	282	619725.00	856706.00	579.00	209.65	09 dec 2017	14 dec 2017	Samapleu Main	225	-50
SM44-526094b	283	619725.00	856706.00	579.00	100.65	14 dec 2017	18 dec 2017	Samapleu Main		-90
SM44-430124	284	619630.00	856676.00	588.00	171.80	18dec 2017	21 dec 2017	Samapleu Main		-90
SM44-414103	285	619614.00	856696.00	587.50	154.50	21dec 2017	29 dec 2017	Samapleu Main		-90
SM44-542189	286	619742.00	856611.00	583.00	115.50	30 dec 2017	03 jan 2018	Samapleu Main		-90
SM44-565203	287	619762.00	856597.00	583.00	112.50	04 jan 2018	08 jan 2018	Samapleu Main		-90
SM44-640233	288	619840.00	856577.00	578.00	85.50	08 jan 2018	13 jan 2018	Samapleu Main		-90
SM44-606254	289	619806.00	856546.00	587.50	106.50	13 jan 2018	15 jan 2018	Samapleu Main		-90
SM44-582290b	290	619782.00	856510.00	592.80	172.10	16 jan 2018	18 jan 2018	Samapleu Main		-90
SM44-667346	291	619867.00	856454.00	590.00	144.00	19 jan 2018	23 jan 2018	Samapleu Main	225	-50
SM44-630386	292	619830.00	856414.00	604.30	100.00	23 jan 2018	24 jan 2018	Samapleu Main	225	-50
SM44-579363	293	619779.00	856437.00	607.00	91.40	24 jan 2018	25-janv.-18	Samapleu Main	225	-50
SM44-375183	294	619575.00	856617.00	614.00	61.25	25-janv.-18	26-janv.-18	Samapleu Main	225	-50
SM44-352171	295	619551.00	856629.00	616.50	75.30	26-janv.-18	27-janv.-18	Samapleu Main	225	-50
SM44-375219	296	619575.00	856581.00	621.60	61.50	27-janv.-18	28-janv.-18	Samapleu Main	225	-50
SM44-369294	297	619569.00	856506.00	630.00	43.40	28-janv.-18	29-janv.-18	Samapleu Main	225	-50
SM44-341287	298	619541.00	856513.00	644.00	42.00	29-janv.-18	30-janv.-18	Samapleu Main	225	-50
SM44-435272	299	619635.00	856528.00	616.00	139.50	19 jan 2019	31 jan 2019	Samapleu Main		-90
SM44-427266	300	619627.00	856534.00	622.00	120.00	01 fev 2019	6 fev 2019	Samapleu Main		-90
SM44-417263	301	619617.00	856537.00	620.00	118.50	8 fev 2019	16 fev 2019	Samapleu Main		-90
SM44-409258	302	619609.00	856542.00	620.00	196.76	7 fev 2019	11 fev 2019	Samapleu Main		-90

SONDAGE	Séquence	LOCATIONX	LOCATIONY	LOCATIONZ	Longueur	Début	Fin	Secteur	AZIMUTH	Inclinaison
Sondages hors Samapleu gisement										
SONDAGE	**LOCATIONX**	**LOCATIONY**	**LOCATIONZ**	**Longueur**	**Début**	**Fin**	**Séquence**	**Secteur**	**AZIMUTH**	**Inclinaison**
SM28-465020	622864.00	858381.83	545.89	162.80	10 mai 2010	13 mai 2010	8	Yorodougou	135	-50
SM18-650730	623052.00	858476.00	548.00	139.40	14 mai 2010	17 mai 2010	9	Yorodougou	135	-50
SM19-420430	623619.76	858775.49	553.00	255.60	18 mai 2010	24 mai 2010	10	Yorodougou	195	-50
SM18-650730b	623054.47	858472.36	543.94	177.00	24 mai 2010	28 mai 2010	11	Yorodougou	190	-50
SM23-675562	619076.15	857844.86	529.12	120.80	04 juin 2010	07 juin 2010	13	Samapleu Extension 2	135	-50
SM24-045436	619243.90	857964.60	545.43	120.00	07 juin 2010	09 juin 2010	14	Samapleu Extension 2	135	-50
SM23-610506	619005.61	857902.16	523.08	198.00	09 juin 2010	15 juin 2010	15	Samapleu Extension 2	135	-50
SM13-643477	619022.19	858735.94	596.57	300.00	18 juin 2010	24 juin 2010	16	Samapleu Extension 3	135	-50
SM12-602773	618202.71	858428.62	524.00	105.00	05 juillet 2010	15 juillet 2010	19	Samapleu Extension 3	135	-50
SM13-210578	618608.15	858621.61	572.14	81.00	10 oct, 2010	15 oct 2010	23	Samapleu Extension 3	135	-50
SM13-509544	618906.03	858654.53	648.44	234.75	16 oct 2010	23 oct 2010	24	Samapleu Extension 3	135	-50
SM13-390536	618790.85	858661.07	634.11	151.00	23 oct 2010	25 oct 2010	25	Samapleu Extension 3	135	-50
SM47-206789	621806.00	856011.00	550.00	90.00	10 sept 2011	14 Sept 2011	146	Gangbapleu		-90
SM56-775052	621578.00	855950.00	550.00	67.00	14 Sept 2011	16 Sept 2011	148	Gangbapleu	135	-50
SM47-287614	621886.00	856185.00	550.00	119.50	16 Sept 2011	24 Sept 2011	149	Gangbapleu	135	-50
SM47-112695	621712.00	856100.00	550.00	111.00	26 Sept 2011	28 Sept 2011	151	Gangbapleu	135	-75
SM19-467515	623667.00	858685.00	564.00	226.00	Dec 11 2012	Dec 25 2012	218	Yorodougou		-90
SM28-504085	622904.00	858313.00	560.00	64.90	Dec 24 2012	Dec 28 2013	219	Yorodougou		-90
							50 à 71	Sipilou Sud		
							156 à 190	Forages régional inclant Yepleu		

Appendix B –
Boreholes Composite 0.1, 0.3, 0.7% Ni

HOLE-ID	SEQUENCE	Composite	Starting From	Total Length	NI	CU	CO	PT	PD	AU
			m	m	%	%	%	gpt	gpt	gpt
SM44-450250	1	Composite 0.1% COG	13.50	102.70	0.59	0.56	0.02	0.27	0.52	0.09
		incl Composite 0.3% COG		4.55	0.35	0.30	0.01	0.10	0.56	0.03
SM44-517178	2	Composite 0.1% COG	46.29	117.61	0.25	0.23	0.02	0.11	0.34	0.04
		incl Composite 0.3% COG		1.41	0.31	0.20	0.02	0.02	0.27	0.03
SM44-587090	3	Composite 0.1% COG	Nil							
SM44-525290	4	Composite 0.1% COG	23.00	95.50	0.28	0.24	0.02	0.11	0.27	0.05
		incl Composite 0.3% COG		0.90	1.18	0.25	0.05	0.16	1.12	0.03
SM44-590230	5	Composite 0.1% COG	76.70	70.40	0.20	0.08	0.01	0.12	0.29	0.02
SM44-665150	6	Composite 0.1% COG	Nil							
SM24-480735	7	Composite 0.1% COG	166.00	3.70	0.14	0.21	0.01	0.08	0.13	0.02
SM19-420430	10	Composite 0.1% COG	94.00	78.60	0.19	0.17	0.01	0.08	0.30	0.04
SM24-661614	12	Composite 0.1% COG	67.30	213.40	0.25	0.21	0.02	0.10	0.48	0.03
		incl Composite 0.3% COG		1.50	0.50	0.28	0.03	0.11	0.87	0.04
SM13-643477	16	Composite 0.1% COG	65.00	7.15	0.14	0.00	0.01	0.02	0.02	0.02
SM44-525290B	17	Composite 0.1% COG	69.00	223.00	0.28	0.21	0.02	0.09	0.33	0.05
SM44-409218	18	Composite 0.1% COG	18.50	34.20	0.20	0.18	0.01	0.07	0.19	0.03
SM24-628651	20	Composite 0.1% COG	38.55	116.05	0.31	0.20	0.02	0.09	0.44	0.03
		incl Composite 0.3% COG		16.35	0.58	0.50	0.03	0.24	0.94	0.04
SM24-699580	21	Composite 0.1% COG	72.00	117.00	0.20	0.13	0.01	0.06	0.27	0.03
		incl Composite 0.3% COG		1.50	0.34	0.15	0.02	0.03	0.41	0.02
SM24-594687	22	Composite 0.1% COG	37.00	171.80	0.18	0.11	0.01	0.08	0.31	0.02
SM13-509544	24	Composite 0.1% COG	39.00	3.55	0.12	0.12	0.01	0.00	0.02	0.02
SM44-418293	26	Composite 0.1% COG	14.00	30.50	0.27	0.29	0.02	0.10	0.19	0.04
		incl Composite 0.3% COG		10.00	0.39	0.45	0.02	0.10	0.28	0.04
SM44-451301	27	Composite 0.1% COG	13.20	45.80	0.18	0.16	0.01	0.10	0.13	0.04
SM44-492354	28	Composite 0.1% COG	10.00	51.00	0.70	0.60	0.03	0.10	0.44	0.05
		incl Composite 0.3% COG		28.80	1.05	0.90	0.05	0.12	0.64	0.07
		incl Composite 0.7% COG		9.00	1.11	0.93	0.05	0.07	0.67	0.04
SM44-474334	29	Composite 0.1% COG	18.00	57.80	0.24	0.30	0.02	0.10	0.17	0.08
SM44-454315	30	Composite 0.1% COG	17.00	54.95	0.20	0.22	0.01	0.08	0.15	0.05
		incl Composite 0.3% COG		1.50	0.35	0.41	0.02	0.09	0.24	0.26
SM44-506367	31	Composite 0.1% COG	7.00	60.00	0.25	0.24	0.02	0.10	0.17	0.03
		incl Composite 0.3% COG		20.53	0.45	0.40	0.02	0.10	0.31	0.04
SM44-533379	32	Composite 0.1% COG	15.90	32.10	0.30	0.24	0.02	0.09	0.18	0.04
		incl Composite 0.3% COG		3.95	1.20	0.97	0.05	0.06	0.69	0.10
		incl Composite 0.7% COG		3.95	1.20	0.97	0.05	0.06	0.69	0.10
SM44-557402	33	Composite 0.1% COG	Nil							
SM44-487292	34	Composite 0.1% COG	35.60	95.30	0.20	0.20	0.01	0.09	0.16	0.04
		incl Composite 0.3% COG		2.90	0.34	0.29	0.02	0.16	0.49	0.02
SM44-487292b	35	Composite 0.1% COG	15.00	115.50	0.23	0.23	0.02	0.09	0.23	0.04
SM44-487292c	36	Composite 0.1% COG	19.00	84.15	0.27	0.23	0.02	0.12	0.29	0.05
SM44-467270	37	Composite 0.1% COG	18.00	69.73	0.21	0.18	0.01	0.11	0.22	0.04
SM44-450250b	38	Composite 0.1% COG	33.50	59.40	0.83	0.82	0.04	0.23	0.77	0.08

HOLE-ID	SEQUENCE	Composite	Starting From	Total Length	NI	CU	CO	PT	PD	AU
			m	m	%	%	%	gpt	gpt	gpt
		incl Composite 0.3% COG		15.50	0.50	0.58	0.03	0.47	0.45	0.10
SM44-450250c	39	Composite 0.1% COG	38.00	54.60	0.42	0.70	0.02	0.25	0.43	0.10
SM44-352247	40	Composite 0.1% COG	3.00	19.75	0.16	0.13	0.01	0.09	0.13	0.03
SM44-405184	41	Composite 0.1% COG	32.00	38.90	0.22	0.18	0.02	0.09	0.15	0.03
		incl Composite 0.3% COG		12.00	0.38	0.32	0.02	0.09	0.23	0.03
SM44-298324	42	Composite 0.1% COG	74.00	4.60	0.15	0.12	0.01	0.01	0.01	0.01
SM44-680289	43	Composite 0.1% COG	36.00	51.00	0.37	0.32	0.02	0.15	0.68	0.04
		incl Composite 0.3% COG		7.00	0.53	0.74	0.02	0.11	1.10	0.05
		incl Composite 0.7% COG		2.00	0.74	1.53	0.03	0.09	1.73	0.10
SM44-641332	44	Composite 0.1% COG	19.00	115.00	0.22	0.17	0.01	0.10	0.26	0.04
SM44-487292d	45	Composite 0.1% COG	16.00	103.15	0.30	0.31	0.02	0.11	0.31	0.05
SM44-645392	46	Composite 0.1% COG	40.00	23.50	0.23	0.17	0.02	0.09	0.36	0.13
SM44-784383	47	Composite 0.1% COG	Nil							
SM44-801514	48	Composite 0.1% COG	Nil							
SM44-458386	49	Composite 0.1% COG	9.40	18.60	0.13	0.09	0.01	0.11	0.09	0.03
SM44-564128	72	Composite 0.1% COG	42.00	113.40	0.20	0.10	0.02	0.08	0.29	0.03
SM44-541188	73	Composite 0.1% COG	57.20	155.25	0.27	0.23	0.02	0.13	0.57	0.05
		incl Composite 0.3% COG		5.95	0.55	0.69	0.03	0.11	1.21	0.06
SM44-560203	74	Composite 0.1% COG	87.80	159.55	0.23	0.17	0.02	0.13	0.29	0.05
SM44-600306	75	Composite 0.1% COG	20.70	137.80	0.26	0.25	0.01	0.11	0.31	0.07
SM44-582290	76	Composite 0.1% COG	25.00	131.00	0.24	0.19	0.01	0.09	0.25	0.05
SM44-563275	77	Composite 0.1% COG	38.35	122.48	0.23	0.16	0.02	0.10	0.25	0.04
SM44-540257	78	Composite 0.1% COG	28.50	126.00	0.24	0.15	0.01	0.09	0.26	0.03
		incl Composite 0.3% COG		2.85	0.34	0.26	0.02	0.11	0.60	0.02
SM44-523243	79	Composite 0.1% COG	27.25	122.75	0.20	0.14	0.01	0.08	0.22	0.02
SM44-505224	80	Composite 0.1% COG	28.50	127.25	0.26	0.20	0.02	0.15	0.31	0.04
SM44-485210	81	Composite 0.1% COG	27.95	95.20	0.23	0.18	0.02	0.11	0.28	0.02
		incl Composite 0.3% COG		0.80	0.31	0.18	0.02	0.49	2.42	0.07
SM44-476185	82	Composite 0.1% COG	27.20	95.90	0.21	0.14	0.01	0.10	0.26	0.03
SM44-455171	83	Composite 0.1% COG	22.50	87.80	0.21	0.16	0.01	0.12	0.25	0.03
SM44-379132	84	Composite 0.1% COG	13.00	47.00	0.20	0.15	0.02	0.08	0.12	0.02
		incl Composite 0.3% COG		8.65	0.42	0.35	0.03	0.06	0.23	0.03
SM44-270012	85	Composite 0.1% COG	Nil							
SM44-375251	86	Composite 0.1% COG	6.50	41.15	0.20	0.18	0.01	0.08	0.17	0.03
		incl Composite 0.3% COG		1.50	0.45	0.29	0.02	0.14	0.41	0.05
SM44-382324	87	Composite 0.1% COG	Nil							
SM44-402336	88	Composite 0.1% COG	2.00	19.00	0.20	0.21	0.02	0.09	0.16	0.06
		incl Composite 0.3% COG		1.50	0.34	0.30	0.02	0.09	0.34	0.10
SM44-423357	89	Composite 0.1% COG	4.20	31.80	0.14	0.19	0.01	0.09	0.09	0.05
SM44-441369	90	Composite 0.1% COG	3.45	21.55	0.14	0.15	0.01	0.12	0.11	0.02
SM44-473411	91	Composite 0.1% COG	Nil							
SM44-494422	92	Composite 0.1% COG	Nil							
SM44-568343	93	Composite 0.1% COG	13.00	95.50	0.22	0.17	0.01	0.10	0.20	0.03

HOLE-ID	SEQUENCE	Composite	Starting From	Total Length	NI	CU	CO	PT	PD	AU
			m	m	%	%	%	gpt	gpt	gpt
SM44-545330	94	Composite 0.1% COG	7.40	105.45	0.24	0.20	0.02	0.11	0.27	0.05
		incl Composite 0.3% COG		18.05	0.42	0.33	0.02	0.22	0.64	0.13
SM44-525322	95	Composite 0.1% COG	15.30	87.95	0.26	0.28	0.02	0.09	0.23	0.04
		incl Composite 0.3% COG		9.00	0.50	0.80	0.02	0.14	0.60	0.11
SM44-502299	96	Composite 0.1% COG	15.50	89.00	0.39	0.30	0.02	0.11	0.37	0.05
		incl Composite 0.3% COG		4.75	0.43	0.40	0.02	0.17	0.59	0.07
SM44-405257	97	Composite 0.1% COG	5.85	54.60	0.28	0.28	0.02	0.09	0.22	0.05
		incl Composite 0.3% COG		6.70	0.38	0.39	0.02	0.09	0.26	0.06
SM44-590230B	98	Composite 0.1% COG	92.65	170.40	0.29	0.32	0.01	0.28	0.49	0.04
SM44-573220	99	Composite 0.1% COG	58.10	252.15	0.26	0.19	0.01	0.10	0.37	0.03
SM44-491136	100	Composite 0.1% COG	21.60	137.40	0.20	0.15	0.01	0.11	0.20	0.02
SM44-441148	101	Composite 0.1% COG	17.00	81.00	0.22	0.16	0.02	0.07	0.17	0.02
SM44-404153	102	Composite 0.1% COG	13.00	58.25	0.28	0.23	0.02	0.08	0.20	0.02
		incl Composite 0.3% COG		27.10	0.40	0.33	0.02	0.09	0.28	0.02
SM44-424210	103	Composite 0.1% COG	15.00	58.70	0.22	0.13	0.02	0.09	0.22	0.02
SM44-698307	104	Composite 0.1% COG	32.00	68.70	0.23	0.10	0.02	0.10	0.33	0.03
SM44-660272	105	Composite 0.1% COG	47.50	78.00	0.25	0.11	0.02	0.05	0.30	0.02
		incl Composite 0.3% COG		6.15	0.50	0.43	0.02	0.07	0.91	0.03
SM24-736697	106	Composite 0.1% COG	Nil							
SM24-699656	107	Composite 0.1% COG	46.65	10.90	0.39	0.48	0.02	0.12	0.80	0.05
		incl Composite 0.3% COG		8.70	0.42	0.47	0.02	0.12	0.88	0.06
SM25-300360	108	Composite 0.1% COG	Nil							
SM34-070500	132	Composite 0.1% COG	29.00	131.00	0.17	0.10	0.01	0.07	0.13	0.02
		incl Composite 0.3% COG		2.10	0.39	0.31	0.02	0.07	0.27	0.03
SM24-699656b	133	Composite 0.1% COG	36.00	61.00	0.24	0.12	0.02	0.09	0.40	0.01
SM24-628651b	134	Composite 0.1% COG	42.80	3.60	0.19	0.09	0.01	0.04	0.26	0.01
SM44-636270	135	Composite 0.1% COG	75.00	85.50	0.24	0.13	0.02	0.10	0.37	0.03
		incl Composite 0.3% COG		3.90	0.37	0.26	0.02	0.19	1.12	0.09
SM44-620315	136	Composite 0.1% COG	23.00	132.50	0.21	0.15	0.01	0.08	0.22	0.03
SM24-664688	137	Composite 0.1% COG	27.50	56.50	0.29	0.20	0.02	0.11	0.54	0.01
SM24-679708	138	Composite 0.1% COG	24.00	157.10	0.27	0.15	0.02	0.07	0.35	0.01
SM24-645670	139	Composite 0.1% COG	29.00	11.80	0.53	0.31	0.03	0.10	0.77	0.03
		incl Composite 0.3% COG		6.30	0.78	0.42	0.04	0.14	1.21	0.03
		incl Composite 0.7% COG		2.20	1.53	0.56	0.08	0.24	2.56	0.03
SM24-648707	140	Composite 0.1% COG	21.00	89.20	0.21	0.13	0.02	0.06	0.27	0.01
SM24-683671	141	Composite 0.1% COG	25.50	56.10	0.21	0.11	0.02	0.08	0.32	0.01
		incl Composite 0.3% COG		1.50	0.37	0.13	0.02	0.10	0.41	0.01
SM24-628688	142	Composite 0.1% COG	22.50	20.20	0.37	0.32	0.02	0.14	0.65	0.04
		incl Composite 0.3% COG		15.70	0.41	0.35	0.03	0.15	0.70	0.04
SM24-699690	143	Composite 0.1% COG	57.50	132.10	0.22	0.15	0.02	0.07	0.32	0.01
SM24-696731	144	Composite 0.1% COG	31.75	168.00	0.18	0.11	0.01	0.11	0.28	0.01
SM24-717672	145	Composite 0.1% COG	26.70	122.45	0.24	0.17	0.02	0.07	0.33	0.01
SM24-736697b	147	Composite 0.1% COG	81.03	73.60	0.25	0.13	0.02	0.10	0.34	0.02

HOLE-ID	SEQUENCE	Composite	Starting From	Total Length	NI	CU	CO	PT	PD	AU
			m	m	%	%	%	gpt	gpt	gpt
SM24-760709	150	Composite 0.1% COG	29.00	61.45	0.25	0.24	0.02	0.12	0.46	0.03
SM24-737618a	152	Composite 0.1% COG	26.00	22.00	0.39	0.25	0.02	0.12	0.95	0.04
		incl Composite 0.3% COG		1.00	0.42	0.30	0.03	0.13	0.88	0.02
SM24-737618b	153	Composite 0.1% COG	25.00	75.50	0.21	0.12	0.01	0.11	0.34	0.02
		incl Composite 0.3% COG		1.00	0.34	0.18	0.02	0.08	0.66	0.01
SM24-772654	154	Composite 0.1% COG	31.50	150.25	0.26	0.16	0.02	0.07	0.32	0.01
		incl Composite 0.3% COG		10.00	0.58	0.65	0.03	0.12	1.13	0.04
SM24-721711	155	Composite 0.1% COG	59.00	65.95	0.21	0.13	0.02	0.12	0.38	0.02
SM44-494350a	191	Composite 0.1% COG	16.00	47.00	0.46	0.29	0.03	0.09	0.27	0.03
		incl Composite 0.3% COG		15.15	0.97	0.50	0.05	0.09	0.53	0.03
SM44-494350b	192	Composite 0.1% COG	11.00	53.00	0.50	0.49	0.03	0.09	0.31	0.04
		incl Composite 0.3% COG		15.50	0.97	0.92	0.04	0.10	0.54	0.03
		incl Composite 0.7% COG		1.50	0.74	0.25	0.03	0.07	0.38	0.03
SM24-631727	193	Composite 0.1% COG	17.00	99.80	0.24	0.13	0.02	0.06	0.29	0.01
SM24-716747	194	Composite 0.1% COG	151.70	42.80	0.15	0.07	0.01	0.07	0.22	0.01
		incl Composite 0.3% COG		0.90	0.31	0.22	0.02	0.06	0.46	0.02
SM24-665760	195	Composite 0.1% COG	32.00	104.10	0.20	0.16	0.01	0.09	0.31	0.02
SM24-627794	196	Composite 0.1% COG	31.00	63.55	0.27	0.14	0.02	0.20	0.34	0.01
SM24-771588	197	Composite 0.1% COG	70.00	18.35	0.34	0.45	0.02	0.10	0.58	0.03
		incl Composite 0.3% COG		9.15	0.50	0.75	0.02	0.14	0.95	0.04
SM25-009620	198	Composite 0.1% COG	31.00	148.25	0.38	0.25	0.02	0.09	0.57	0.03
		incl Composite 0.3% COG		37.00	0.65	0.68	0.03	0.17	1.13	0.05
		incl Composite 0.7% COG		10.40	0.88	0.63	0.04	0.25	1.40	0.04
SM25-039587	199	Composite 0.1% COG	32.60	129.20	0.26	0.18	0.01	0.06	0.41	0.02
		incl Composite 0.3% COG		11.80	0.68	0.91	0.03	0.04	1.01	0.03
		incl Composite 0.7% COG		5.80	0.89	1.21	0.04	0.05	1.37	0.04
SM25-080542	200	Composite 0.1% COG	25.00	108.00	0.32	0.36	0.02	0.09	0.63	0.03
		incl Composite 0.3% COG		20.55	0.67	0.72	0.04	0.13	1.05	0.05
		incl Composite 0.7% COG		2.50	1.17	0.61	0.07	0.08	1.44	0.04
SM24-603758	201	Composite 0.1% COG	18.30	108.45	0.19	0.11	0.02	0.06	0.25	0.01
		incl Composite 0.3% COG		1.20	0.34	0.57	0.02	0.09	0.57	0.13
SM24-572790	202	Composite 0.1% COG	17.00	73.35	0.16	0.06	0.02	0.04	0.14	0.01
SM34-603026	203	Composite 0.1% COG	41.00	83.30	0.20	0.12	0.01	0.07	0.27	0.02
		incl Composite 0.3% COG		0.40	0.44	0.36	0.03	0.03	0.63	0.07
SM44-684210	204	Composite 0.1% COG	270.50	53.60	0.36	0.39	0.02	0.10	0.55	0.05
		incl Composite 0.3% COG		19.00	0.60	0.65	0.03	0.10	1.06	0.06
SM25-004552	205	Composite 0.1% COG	32.00	25.00	0.27	0.15	0.01	0.21	1.25	0.04
		incl Composite 0.3% COG		6.80	0.39	0.25	0.02	0.41	2.33	0.09
SM25-045506	206	Composite 0.1% COG	Nil							
SM34-098547	207	Composite 0.1% COG	13.20	75.25	0.25	0.18	0.01	0.06	0.24	0.02
		incl Composite 0.3% COG		19.60	0.48	0.41	0.02	0.10	0.46	0.02
		incl Composite 0.7% COG		2.25	0.81	0.85	0.04	0.03	0.68	0.04
SM34-313349	214	Composite 0.1% COG	Nil							

HOLE-ID	SEQUENCE	Composite	Starting From	Total Length	NI	CU	CO	PT	PD	AU
			m	m	%	%	%	gpt	gpt	gpt
SM34-236411	215	Composite 0.1% COG	26.00	67.50	0.19	0.09	0.01	0.07	0.20	0.02
SM34-170475	216	Composite 0.1% COG	16.00	91.00	0.20	0.08	0.02	0.04	0.10	0.03
		incl Composite 0.3% COG		1.50	0.69	0.61	0.03	0.09	0.38	0.32
SM34-023171	217	Composite 0.1% COG	87.00	1.50	0.10	0.03	0.01	0.00	0.01	0.00
SM25-112519	220	Composite 0.1% COG	22.00	155.25	0.36	0.25	0.02	0.13	0.73	0.03
		incl Composite 0.3% COG		1.50	1.02	1.46	0.05	0.02	2.24	0.05
		incl Composite 0.7% COG		1.50	1.02	1.46	0.05	0.02	2.24	0.05
SM25-112555	221	Composite 0.1% COG	31.70	156.80	0.30	0.27	0.02	0.14	0.75	0.05
		incl Composite 0.3% COG		18.30	0.50	0.50	0.03	0.17	0.90	0.05
SM25-184483	222	Composite 0.1% COG	42.50	108.60	0.26	0.17	0.02	0.13	0.46	0.02
		incl Composite 0.3% COG		10.00	0.74	0.61	0.04	0.20	1.19	0.03
		incl Composite 0.7% COG		5.60	1.00	0.83	0.05	0.21	1.54	0.03
SM25-256447	223	Composite 0.1% COG	Nil							
SM25-274464	224	Composite 0.1% COG	Nil							
SM25-256482	225	Composite 0.1% COG	106.30	37.29	0.33	0.20	0.02	0.11	0.53	0.01
SM25-183519	226	Composite 0.1% COG	57.60	127.83	0.24	0.15	0.02	0.12	0.43	0.04
		incl Composite 0.3% COG		3.30	0.48	0.67	0.02	0.34	0.86	0.05
SM25-133605	227	Composite 0.1% COG	81.00	65.65	0.31	0.22	0.02	0.14	0.64	0.02
		incl Composite 0.3% COG		15.10	0.68	0.58	0.04	0.21	1.40	0.04
SM25-096647	228	Composite 0.1% COG	64.50	94.50	0.26	0.17	0.02	0.10	0.45	0.02
		incl Composite 0.3% COG		16.80	0.59	0.51	0.03	0.16	0.96	0.05
SM25-063682	229	Composite 0.1% COG	71.00	100.85	0.24	0.14	0.02	0.11	0.34	0.02
		incl Composite 0.3% COG		6.40	0.50	0.41	0.03	0.30	0.83	0.05
SM24-770735	230	Composite 0.1% COG	174.00	141.28	0.20	0.14	0.01	0.06	0.28	0.01
SM25-148554	235	Composite 0.1% COG	57.10	138.70	0.31	0.21	0.02	0.11	0.59	0.02
SM25-301375	236	Composite 0.1% COG	Nil							
SM34-570407	238	Composite 0.1% COG	280.50	38.60	0.22	0.23	0.09	0.00	0.00	0.00
SM44-693140	250	Composite 0.1% COG	345.50	150.85	0.30	0.29	0.02	0.10	0.42	0.04
		incl Composite 0.3% COG		9.65	0.53	0.90	0.02	0.15	1.00	0.07
SM44-693140B	251	Composite 0.1% COG	513.20	91.20	0.24	0.13	0.02	0.04	0.24	0.01
SM34-626442	253	Composite 0.1% COG	484.00	70.70	0.18	0.17	0.01	0.08	0.18	0.03
SM34-564718	254	Composite 0.1% COG	Nil							
SM25-133537	255	Composite 0.1% COG	30.00	33.00	0.38	0.31	0.02	0.13	0.63	0.03
		incl Composite 0.3% COG		9.60	0.65	0.53	0.03	0.28	1.00	0.02
		incl Composite 0.7% COG		4.20	1.06	0.92	0.05	0.49	1.72	0.04
SM25-133538	256	Composite 0.1% COG	84.80	41.45	0.61	0.46	0.03	0.17	1.06	0.02
		incl Composite 0.3% COG		30.50	0.75	0.57	0.04	0.19	1.28	0.03
SM44-428267	257	Composite 0.1% COG	15.00	53.95	0.97	0.77	0.04	0.09	0.75	0.07
		incl Composite 0.3% COG		9.00	0.45	0.72	0.02	0.17	0.46	0.12
SM44-473240	258	Composite 0.1% COG	22.10	79.40	0.27	0.29	0.01	0.17	0.28	0.03
		incl Composite 0.3% COG		4.20	1.09	0.61	0.04	0.08	1.00	0.03
		incl Composite 0.7% COG		2.70	1.34	0.62	0.05	0.10	1.08	0.04
SM25-111555	259	Composite 0.1% COG	36.50	49.50	0.30	0.28	0.02	0.15	0.58	0.03

HOLE-ID	SEQUENCE	Composite	Starting From	Total Length	NI	CU	CO	PT	PD	AU
			m	m	%	%	%	gpt	gpt	gpt
		incl Composite 0.3% COG		16.65	0.44	0.45	0.02	0.13	0.81	0.03
SM44-459220	260	Composite 0.1% COG	18.10	74.30	0.32	0.23	0.02	0.09	0.33	0.02
SM44-429266	261	Composite 0.1% COG	15.50	67.25	0.22	0.33	0.01	0.12	0.22	0.05
SM24-681746	266	Composite 0.1% COG	22.80	110.55	0.20	0.16	0.01	0.06	0.27	0.02
SM24-663733	267	Composite 0.1% COG	17.30	56.20	0.22	0.15	0.01	0.09	0.36	0.02
SM24-660657	268	Composite 0.1% COG	32.50	8.10	0.20	0.10	0.01	0.13	0.26	0.01
SM25-073652	269	Composite 0.1% COG	48.50	71.75	0.32	0.26	0.02	0.11	0.52	0.02
SM25-239431	270	Composite 0.1% COG	71.20	9.95	0.14	0.06	0.01	0.06	0.21	0.01
SM25-222449	271	Composite 0.1% COG	49.00	33.10	0.14	0.05	0.01	0.07	0.22	0.01
SM25-200496	272	Composite 0.1% COG	85.00	113.90	0.23	0.14	0.01	0.09	0.48	0.02
SM25-159493	273	Composite 0.1% COG	25.50	139.25	0.26	0.15	0.02	0.15	0.58	0.03
SM25-080542b	274	Composite 0.1% COG	37.50	43.65	0.19	0.07	0.01	0.06	0.26	0.01
SM25-112519b	275	Composite 0.1% COG	31.50	35.05	0.20	0.10	0.01	0.08	0.29	0.01
SM25-039587b	276	Composite 0.1% COG	29.25	56.45	0.31	0.14	0.01	0.09	0.36	0.01
		incl Composite 0.3% COG		6.65	0.61	0.40	0.03	0.18	0.77	0.04
		incl Composite 0.7% COG		2.55	1.10	0.64	0.06	0.38	1.42	0.07
SM25-075517	277	Composite 0.1% COG	27.00	89.60	0.23	0.07	0.01	0.06	0.21	0.01
SM25-135472	278	Composite 0.1% COG	18.90	53.50	0.22	0.06	0.01	0.05	0.15	0.03
SM25-095604	279	Composite 0.1% COG	42.90	76.80	0.26	0.18	0.01	0.14	0.48	0.02
SM44-454255	280	Composite 0.1% COG	12.30	99.10	0.62	0.61	0.03	0.22	0.72	0.06
		incl Composite 0.3% COG		0.35	1.07	0.69	0.04	0.01	0.04	0.01
		incl Composite 0.7% COG		0.35	1.07	0.69	0.04	0.01	0.04	0.01
SM44-546116	281	Composite 0.1% COG	28.00	55.65	0.14	0.06	0.01	0.04	0.17	0.02
SM44-526094	282	Composite 0.1% COG	24.20	173.80	0.17	0.12	0.01	0.07	0.17	0.02
SM44-526094b	283	Composite 0.1% COG	27.30	52.10	0.20	0.12	0.01	0.06	0.25	0.01
SM44-430124	284	Composite 0.1% COG	12.00	118.95	0.19	0.12	0.01	0.08	0.21	0.03
SM44-414103	285	Composite 0.1% COG	19.70	119.15	0.19	0.12	0.01	0.10	0.23	0.03
SM44-542189	286	Composite 0.1% COG	40.00	67.00	0.19	0.06	0.01	0.06	0.24	0.01
SM44-565203	287	Composite 0.1% COG	70.50	34.40	0.39	0.33	0.02	0.12	0.77	0.02
		incl Composite 0.3% COG		12.50	0.67	0.75	0.03	0.15	1.45	0.02
		incl Composite 0.7% COG		6.00	0.86	0.84	0.04	0.08	1.68	0.01
SM44-640233	288	Composite 0.1% COG	Nil							
SM44-606254	289	Composite 0.1% COG	Nil							
SM44-582290b	290	Composite 0.1% COG	29.35	80.55	0.25	0.11	0.01	0.13	0.62	0.06
		incl Composite 0.3% COG		6.00	0.34	0.19	0.02	0.34	1.50	0.17
SM44-667346	291	Composite 0.1% COG	19.80	95.40	0.20	0.14	0.01	0.10	0.27	0.03
		incl Composite 0.3% COG		4.50	0.44	0.37	0.02	0.20	1.01	0.03
SM44-630386	292	Composite 0.1% COG	14.25	46.60	0.23	0.16	0.01	0.13	0.28	0.05
		incl Composite 0.3% COG		12.55	0.34	0.23	0.02	0.17	0.45	0.08
SM44-579363	293	Composite 0.1% COG	23.00	53.90	0.27	0.28	0.01	0.13	0.28	0.06
		incl Composite 0.3% COG		24.80	0.37	0.43	0.02	0.15	0.38	0.07
SM44-375183	294	Composite 0.1% COG	8.60	41.90	0.18	0.13	0.01	0.07	0.12	0.02
SM44-352171	295	Composite 0.1% COG	4.50	30.25	0.12	0.06	0.01	0.06	0.07	0.02

HOLE-ID	SEQUENCE	Composite	Starting From	Total Length	NI	CU	CO	PT	PD	AU
			m	m	%	%	%	gpt	gpt	gpt
SM44-375219	296	Composite 0.1% COG	9.25	36.35	0.19	0.18	0.01	0.08	0.15	0.03
SM44-369294	297	Composite 0.1% COG	7.50	19.50	0.15	0.16	0.01	0.09	0.13	0.05
SM44-341287	298	Composite 0.1% COG	16.80	1.65	0.11	0.08	0.01	0.06	0.05	0.01
SM44-435272	299	Composite 0.1% COG	14.60	85.40	0.36	0.36	0.02	0.06	0.23	0.04
		incl Composite 0.3% COG		4.45	0.36	0.27	0.02	0.02	0.07	0.00
SM44-427266	300	Composite 0.1% COG	10.50	77.00	0.31	0.28	0.02	0.05	0.18	0.03
SM44-417263	301	Composite 0.1% COG	15.20	66.55	0.18	0.17	0.01	0.07	0.14	0.03
SM44-409258	302	Composite 0.1% COG	15.00	81.55	0.19	0.16	0.01	0.05	0.12	0.02
SM34-313349b	304	Composite 0.1% COG	106.00	80.30	0.16	0.08	0.01	0.05	0.15	0.01
SM34-459218	305	Composite 0.1% COG	62.00	56.45	0.41	0.28	0.02	0.04	0.48	0.01
		incl Composite 0.3% COG		2.00	0.43	0.84	0.03	0.05	0.82	0.04