



NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic

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1.0 SUMMARY

The Banio Potash Project (Banio or the Project) is a greenfields potash exploration project located in the Congo Basin, in the Gabonese Republic. Millennial Potash Corp. (Millennial or the Company) entered into an option agreement with Equatorial Potash Pty Limited (Equatorial Potash) to acquire up to a 100% interest in the company and since then have commenced an exploration diamond drilling programme to confirm historical resource estimates and report new Mineral Resources in accordance with the Canadian National Instrument (NI) 43-101 Standards of Disclosure for Mineral Projects, Form NI 43-101 (NI 43-101).

The base case for this PEA has assumed a production rate of 400 kt/a of Muriate of Potash (MOP), which will be obtained from underground caverns using solution mining methods. Two alternative production rate options were also investigated, including Option 2 for 600 kt/a and Option 3 for 800 kt/a.

A Mineral Resource Estimate (MRE) was prepared by ERCOSPLAN Ingenieurgesellschaft Geotechnik und Bergbau mbH (ERCOSPLAN) using information from the 2017 potash drill holes and the extension of hole Ba-002, which was completed by Millennial in 2023. The Mineral Resources have been classified as Indicated and Inferred made up of a combination of sylvinite and carnallite mineralogy. The Banio Project Mineral Resources are summarised in Table 1.1 and have an effective date of 7th November 2023.

Table 1.1: Summary Mineral Resources for the Banio Project

Mineralogy	Category	Tonnage (Mt)	KCl Grade (%)	Tonnage (Mt KCl)
Sylvinite	Inferred	43.79	21.2	9.28
	Indicated	20.12	21.6	4.34
Total Sylvinite		63.91	21.3	13.62
Carnallite	Inferred	1,115.35	15.8	176.04
	Indicated	636.53	15.8	100.23
Total Carnallite		1,751.88	15.8	276.27

Solution mining has been selected as the optimal mining method for the Banio Project. This mining method is low cost, has a low impact on the environment during installation and during operation, and it produces minimal dust, noise, and solid waste. The Banio Project is planned to commence using cold leach solution mining in order to reduce the need for additional infrastructure and to reduce initial CAPEX costs. Once the initial caverns are mined-out, in Year 11, the operation will switch over to hot leach mining, which will result in a higher KCl grade in the production brine being pumped to the production plant.

The potash-loaded production brine will be pumped via a 60 km pipeline along the Atlantic coast to a process plant facility ±7 km south of the town of Mayumba. Processing will involve heating the potash brine to >90°C and loading it into evaporation vessels for crystallisation. The resultant debrined filter cake is then dried, compacted, and stored for export.

From Mayumba the bulk potash will be exported to the Brazil market as granular Muriate of Potash (gMOP) making use of the Mayumba Deep-Water Port, which is currently being considered by the Gabonese Government and is planned to have a 14 m draft.

The results of the economic analysis indicate that Option 3, with a production rate of 800 kt/a is the most appealing scenario for the Project at present with a net present value (NPV) of over double that of the initial CAPEX and is the option with the shortest payback. This option requires US\$480 million in initial CAPEX, but also has the best post-tax internal rate of return (IRR) at 32.6%.

1.1 INTRODUCTION

Micon have been engaged by Millennial to prepare a PEA Technical Report to comply with NI 43-101 requirements on the Banio Project.

Millennial is a Canadian company listed on the Toronto Stock Exchange (TSX-V:MLP), the venture Market (OTCQB:MLPNF) and the Frankfurt Stock Exchange (Frankfurt:X0D). Millennial's board and management team have a successful track record of building and exiting resource companies, such as Millennial Lithium (TSXV-ML), Allana Potash (TSX:AAA) and Potash One (TSX:KCL).

The Mayumba Permit for the Banio Project, No. G5-595, is held by Mayumba Potasse SARL (Mayumba Potasse), a Gabonese registered company and 100% subsidiary of Equatorial Potash. On 24th January 2023 Millennial entered into an option agreement with Equatorial Potash to acquire up to a 100% interest in Equatorial Potash.

Banio is a potash exploration project located in the south of the Gabonese Republic. A MRE was released by Millennial on 16th January 2024 for the northern part of the Project area including 657 Mt of Indicated Resources at a grade of 15.9% KCl and 1,159 Mt of Inferred Resources at a grade of 16% KCl.

This Report is intended to be used by Millennial subject to the terms and conditions of its agreement with Micon. That agreement permits Millennial to file this Report as an NI 43-101 Technical Report with the Canadian Securities Administrators (CSA) pursuant to provincial securities legislation. Except for the purposes legislated under provincial securities laws, any other use of this Report, by any third party, is at that party's sole risk.

The conclusions and recommendations in this Report reflect the authors' best judgment in light of the information available to them at the time of writing. The authors and Micon reserve the right, but will not be obliged, to revise this Report and conclusions if additional information becomes known to them subsequent to the date of this Report. Use of this Report acknowledges acceptance of the foregoing conditions.

Micon does not have, nor has it previously had, any material interest in Millennial or related entities or interests. The relationship with Millennial is solely a professional association between the client and the independent consultant. This Report is prepared in return for fees based upon agreed commercial rates and the payment of these fees is in no way contingent on the results of this Report.

This Report includes technical information which requires subsequent calculations or estimates to derive sub-totals, totals and weighted averages. Such calculations or estimations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, Micon does not consider them to be material.

1.2 PROJECT DESCRIPTION, LOCATION AND MINERAL TENURE

The Banio Project is a greenfields exploration stage potash project situated in the Nyanga Province in the southwest coastal region of the Gabonese Republic (Figure 1.1).

Figure 1.1: Location Map of the Banio Potash Project



Source: Micon, 2024

The 1,238 km² Exploration Permit (“Permis de recherches minières”) is located near the Atlantic coast of central Africa, immediately south of the equator, between latitudes 3°S and 4°S, and longitudes 10°E and 11°E. A portion of the permit area falls within the Mayumba National Park and the buffer zone around the park.

Mining activities in the Gabonese Republic have been governed and regulated by *Law No. 037/2018* since 11th June 2019 (Journal Officiel de la République Gabonaise, 2019). This law was established to stimulate the development of mining and to guarantee the property rights of both local and foreign investors. According to the law, the State owns all the mineral resources, but exploration and exploitation of these resources by private parties is permitted through different types of mining permits, which are granted by decrees. For a commodity like potash in the Gabonese Republic the mining rights are obtained in two stages:

1. The Exploration Permit (“Permis de recherches minières”) gives the holder exclusive prospecting and exploration rights in a defined area to unlimited depth for the mineral substances it is issued for. The maximum size for an exploration permit is 1,500 km². The permit is valid for three years and can be extended twice for a period of three years each time upon application by the holder. The operational aspects of the exploration (and also

exploitation) activities are specified and formalised by a mining convention that is negotiated between the operator and the Ministry responsible for mining (Ministère de l'Industrie et des Mines). Depending on the results of the exploration activities carried out under the exploration permit, the permit holder shall have priority as regards to the granting of an exploitation permit for the mineral substances covered by the exploration permit. This requires that a feasibility study and an Environmental Impact Assessment (EIA) have been prepared and have been accepted by the ministries responsible for mining, economics and the environment.

2. The “large scale Exploitation Permit” (“le Permis d'Exploitation Minière à grande échelle”) gives the holder exclusive rights to carry out exploitation activities in an area defined by the licence, to an unlimited depth and in respect of those mineral substances for which the exploitation permit is granted. The validity of the permit depends on the lifetime of the project reported in the official feasibility study and is either 10 years, which can be extended upon request by the permit holder for a period of five years per extension, or 20 years which can be extended upon request by the permit holder for a period of 10 years per extension. When the licence expires and no request for extension is filed, a mine closure plan must be submitted. The operational modalities of the exploitation are specified and formalised by a mining convention that is negotiated between the operator and the Ministère de l'Industrie et des Mines.

The Banio Project comprises an exclusive Exploration Permit (“Permit” or “licence”) for potash salts and associated salts. The exclusive mineral exploration rights for potassium and associated salts within permit No. G5-595, was awarded to Mayumba Potasse, 100% owned by Equatorial Potash, a 100% subsidiary of Plymouth Minerals Limited (Plymouth) by Presidential Decree No. 0161/MMI/SG/DGPEM/DCMAE on 23rd February 2016. Mayumba Potasse is a company registered in the Gabonese Republic whose only assets are the Mayumba Permit.

Millennial has entered into an option agreement with Equatorial Potash to acquire up to a 100% interest in Equatorial Potash.

For an exploration licence no special royalties or taxes are due beyond the registration fee and annual payments. Royalties and taxes are due to the Gabonese Government during commercial production, requiring a Large-Scale Exploitation Licence. These consist of:

- A levy of between 5% and 10% on the gross value of the product, less processing, transportation and insurance costs (mining royalties), to be settled in the mining convention; and,
- A 30% tax on the income of the company. The amount of corporate tax to be paid is affected by a number of items that have to be negotiated in the mining convention.

To obtain a Large-Scale Exploitation Licence, a mining convention has to be negotiated with the Gabonese Government.

Millennial complies with the requirements allowing access to the surface without restriction assuming adherence to the mining *Law No. 037/2018* as well as with *Law No. 007/14* dated 1st August 2014 (Journal Officiel de la République Gabonaise, 2014) regarding the protection of the environment of the Gabonese Republic. Millennial will need to engage environmental consultants to manage the preparation of Environmental Impact Assessments (EIA) for the exploration programme according to *Law No. 007/14* regarding the protection of the environment of the Gabonese Republic.

The EIA, completed by Plymouth/Mayumba Potasse and accepted by the Gabonese Government in 2017, remains in effect allowing the planned exploration activities to continue on the Project. For Phase 2 drilling further south Millennial may need a new EIA.

1.3 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

The Banio Project is located approximately 650 km to the southwest of Libreville, the capital city of the Gabonese Republic (Figure 1.1). The licence area stretches approximately 78 km along the Atlantic Coastline starting adjacent to the small port of Mayumba and ending on the border with the Republic of Congo.

Access to the Banio Project is via the 650 km dual-lane bitumen/gravel RN1 and gravel RN6 roads from Libreville towards Lambaréné and Ndendé which terminate in Mayumba, northwest of the permit area. Ongoing access to the Banio Project from Mayumba is either via gravel tracks leading to the Banio oil production centre of Maurel & Prom and then into the property area or alternatively, the area can be accessed via small boat along the Banio Estuary that feeds the Banio Lagoon. Boat is the preferred option to access the exploration site in the southern area of the Banio Project as the road access is restricted by the park rangers of the Mayumba National Park. On the Banio property itself the only roads are those that have been created by various exploration activities.

Libreville, the capital of the Gabonese Republic, has several direct international flights from Europe and several African capitals daily. The town of Mayumba has a sealed air strip, however no regular flights. Currently Mayumba has small ports, however there have been recent plans to significantly extend the Mayumba port to facilitate export of resources from the area.

The Banio Project is located in the Congo coastal basin which has a tropical climate characterised by high humidity and a hot climate. During the wet season some mitigation measures may be required to allow continued access to the Banio Project area, especially for heavy equipment.

The Banio Project is remote and to undertake exploration work it will be necessary to have nearly all the technical equipment and personnel available at the site. The previous exploration camp has been modernised and refurbished by Millennial to support the ongoing exploration work.

Millennial is planning to access water from the adjacent freshwater lagoon for exploration purposes in the immediate future and for processing needs in the long term which will require a permit.

The Republic of Gabon is ranked among the top 10 petroleum-producing countries in Africa, producing from several onshore and offshore oil and gas fields. For an eventual exploitation stage project, energy will be a major requirement. Natural gas can be used for co-generation of steam and electrical power as well as for drying of the product. The Gabonese Government, Perenco Oil & Gas Gabon (Perenco), and the Gabon Power Company have signed a memorandum of understanding for the development of a 21 megawatt (MW) power plant to be powered by natural gas, and the installation of a gas collection network and treatment facility, with a 32 km gas pipeline to the town of Mayumba. Combined with the commitment of the Gabonese Government through its Grande Mayumba partnership for port construction this will significantly improve the infrastructure of the area.

Even though it is not yet clear whether and where a plant will be constructed, shipment of the final product (several 100,000 t/a to 1.6 Mt/a), will require the construction of adequate port facilities near Mayumba. The existing plans for port expansion should be re-discussed to ensure that there is an adequate place for a potash facility and mooring for Handymax 45 kt to 55 kt vessels with a draft of 10 m to 12 m preferable. This is in line with the proposed Phase 2a port construction. Millennial may need to build their own barges and will need to adopt the Cleveland Cascade for loading. Port alternatives include a deep-water port with a 14 m draft which is being considered by the Government (secured initial funding for the work); or a long jetty out into the ocean that would need a 3 m draft and then barge.

The town of Mayumba, with a population of around 5,000 people, and the nearby villages have previously provided labourers for the exploration work. Technical personnel will have to come from either Port Gentil (~136,500 people) or Libreville (~704,000 people) and for specialised tasks expatriate personnel will need to be brought in.

The Banio Project can be divided into two areas. The southwest area consists mainly of low-lying sand ridges (maximum circa 30 metres above sea level (masl), up to 3 km wide, which separate the lagoon from the Atlantic Ocean. This area is relatively flat, swampy in places and is covered with primary jungle dotted with areas of open grassland clearings that may reach a few 100 m² in size. The northeast and eastern areas of the Banio Project rise relatively steeply to a maximum of approximately 85 m from the south and then slope gradually towards the northeast to elevation levels of around 40 m. This sloped area is intersected by steep sided and sometimes deep gullies at between 20 masl to 30 masl.

1.4 HISTORY

Potash was discovered in the coastal Gabonese-Congolese Basin during oil prospecting in the Gabonese Republic in 1935. In the early 1950s, the Société Petrolière de l'Afrique Française Equatoriale (SPAFE) a predecessor company to Elf Aquitaine, was granted the Mabora petroleum concession in an area around the town of Lambaréné. In 1954, SPAFE drilled hole Mabora Mamana-1 (MM-1) near Lake Azingo targeting oil below the salt layers. The MM-1 drill hole encountered the first ever indication of potash mineralisation in central West Africa by intersecting a high grade sylvinite potash seam that reportedly graded 29% K₂O. Several more holes were drilled also intersecting potash, however, potash exploration and hydrocarbon exploration concentrated on the Congo coastal basin further to the south.

The exclusive mineral exploration rights for potassium and associated salts within permit No. G5-595, "Banio" was awarded by Presidential Decree No. 0161/MMI/SG/DGPEM/DCMAE dated 23rd February 2016 to Mayumba Potasse SARL (Mayumba Potasse). There is no public information available about the ownership of the Mayumba Permit for potash and related salts prior to the ownership of Mayumba Potasse.

Mayumba Potasse SARL is a subsidiary of Equatorial Potash Pty. Limited (Equatorial Potash). On 16th March 2016 Equatorial Potash was acquired by Plymouth Minerals Limited and became an 100% owned subsidiary.

Black Mountain Gold USA Corp. (Black Mountain) entered into a binding MOU with Equatorial Potash on 5th September 2022, the agreement was fully executed on 24th September 2022. Black Mountain Gold USA Corp. became Millennial Potash Corp. on 25th January 2023.

Historical seismic exploration consists of 2D seismic surveys which were carried out in the 1970's, 1990's and more recently 2011/2012, Although it can be established from historic reports that seismic exploration was carried out on the older Banio wells in the 1970's, this data is not available. The available seismic data was collected in three different campaigns: BAN90 (1990's), TMB90 (1990's) and MNPM11 (2011/2012). The full available dataset spanning an area of approximately 600 km² across the southern part of the licence area was interpreted by CSA Global Pty Ltd (CSA Global) and outlined in their 2016 report.

Historical drilling campaigns of six drill holes drilled between 1972 and 2010 were primarily drilled for oil exploration, however, the Banio-2 oil well was cored at five depth intervals through the salt formation and a complementary study of the salt composition and potash potential was conducted.

In 2017 three potash exploration drill holes (Ba-001 to Ba-003) were drilled by Mayumba Potasse in order to better define the sylvinite mineralisation.

In 2016 initial Exploration Targets were generated by CSA Global (2016) by using a study of the available drill hole, geophysical and seismic data from 1972 to 2012 which they produced for the then owner of the Banio Project, Plymouth Minerals.

The Infinity Lithium Corporation (Infinity) produced an Inferred Mineral Resource Estimate in 2018 in accordance with the guidelines of the JORC Code (2012). The Inferred Mineral Resources totalled 1,673.6 Mt at an overall grade of 16.1% KCl.

There has been no historical production within the Banio Project Area as the project is still at the exploration stage.

1.5 GEOLOGICAL SETTING AND MINERALISATION

The Banio Project is predominantly located within the Congo Basin. The Congo Basin is part of the equatorial West African Aptian salt basin that extends from Cameroon to Namibia and includes the Douala, Kribi-Campo, Rio Muni, Gabon, Congo, Kwanza, Benguela, and Namibe Basins (Figure 1.2). The basins were grouped together as they share common structural and stratigraphic characteristics. Separate basins of the Aptian salt basin are delimited by east-west-trending faults and other structural arches and highs related to syn-rift tectonics (Brownfield & Charpentier, 2006, 2006). The basins crop out for 20 km to 80 km width onshore and extend for 100 km to 300 km offshore (Pedley A, et al., 2016).

Evaporitic salt deposition occurred during the late Aptian (113 Ma to 125 Ma $\pm$ 1 Ma) throughout the basin in a large steadily and relatively evenly subsiding sub-sea-level basin. The Loeme Evaporite Formation in the Congo Basin is dominated by a halite and potash salt member overlain by a thinner anhydrite member. The top of the potash salts is at a depth of approximately 150 m to 500 m below the surface and ranges in thickness from 100 m to 950 m, thinning towards the east. The evaporites are typified by sub-horizontal layers (<5° dip) with small-scale undulations, and typically abrupt upper and basal contacts (Pedley et al., 2016).

Figure 1.2: Map Showing the Approximate Locations of the Congo Basin in Relation to the Aptian Salt Basin Included in the West-Central Coastal Province



Source: Micon, modified from Brownfield and Charpentier (2006).

Note: The West-Central Coastal Province is an area of oil and gas exploration and exploitation that includes the Aptian salt basin. The western limit of the province was set at 4,000 m water depth.

The major potash seams are generally continuous across the basin except at the basal unconformity of the overlying anhydrite member or within localised dissolution features. In complete, or near-complete, sections of the salt member it is made up by volume of approximately 30% potash-bearing layers, 55% rock salt (halite), 8% to 10% bischofite/tachyhydrite, and minor insoluble material, anhydrite, and carbonates.

The Congo Basin is divided into large blocks by NW-SE striking fault zones that are generally interpreted as normal faults parallel to the coast (MDPA Ingénierie, 1989, in van der Klauw & Gröschow, 2007). Uplifted blocks between relatively closely spaced NW-SE striking fault zones can occur, which are also responsible for secondary sylvinite mineralisation.

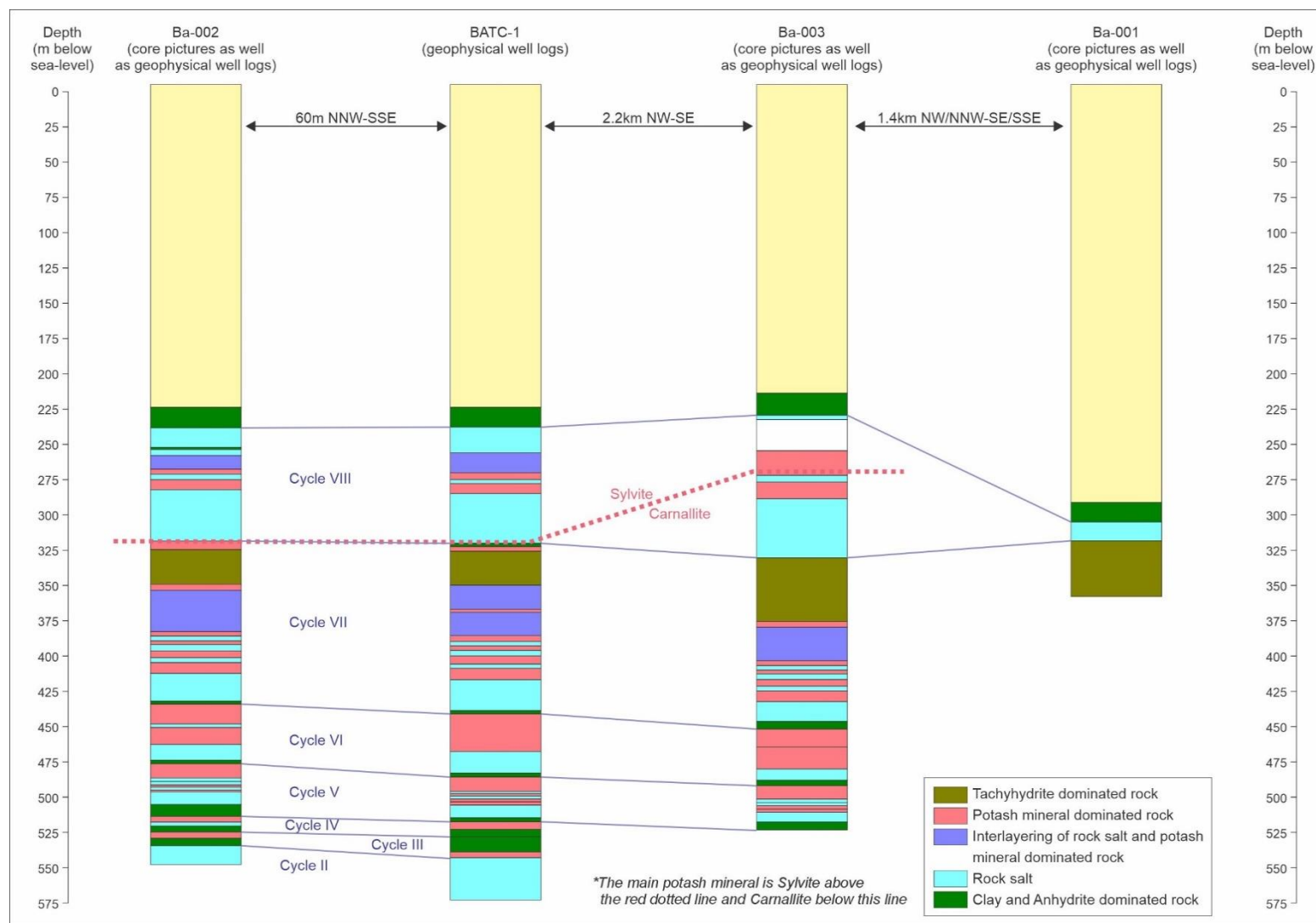
Within the Rock Salt Formation of the Congo Basin, ten sedimentary evaporite cycles (I to X) have been identified. These cycles are consistent with rapid periods of sea water inflow and protracted evaporation resulting in the precipitation of salts. A cycle, from bottom to top, generally consists of a basal shale or clay layer, a layer of rock salt (halite), a mixture of halite and carnallite, and sometimes an end member of bischofite or tachyhydrite (de Ruiter, 1979). The potash seams are predominantly primary carnallite except in certain areas where it has been transformed into secondary sylvite (Pedley et al., 2016).

The potash seams vary in thickness from cm-scale up to 20 m thick and are separated by rock salt with clay layers that vary in thickness from cm-scale to over 100 m thick (Rauche & van der Klauw, 2015). Rocks with interlayered potash and rock salt where the rock salt dominated layers are <1 m are grouped together as a single potash seam.

The evaporite cycles as well as individual potash seams within the cycles can be correlated over large areas of the basin, reflecting minimal disturbance of the evaporites at the time of deposition (Pedley et al., 2016). Depending on the location within the basin syn-deposition and the geological processes post-deposition, the thickness of seams or cycles can vary between absent (not deposited or eroded near basin rim) to hundreds of metres thick in the central part of the basin.

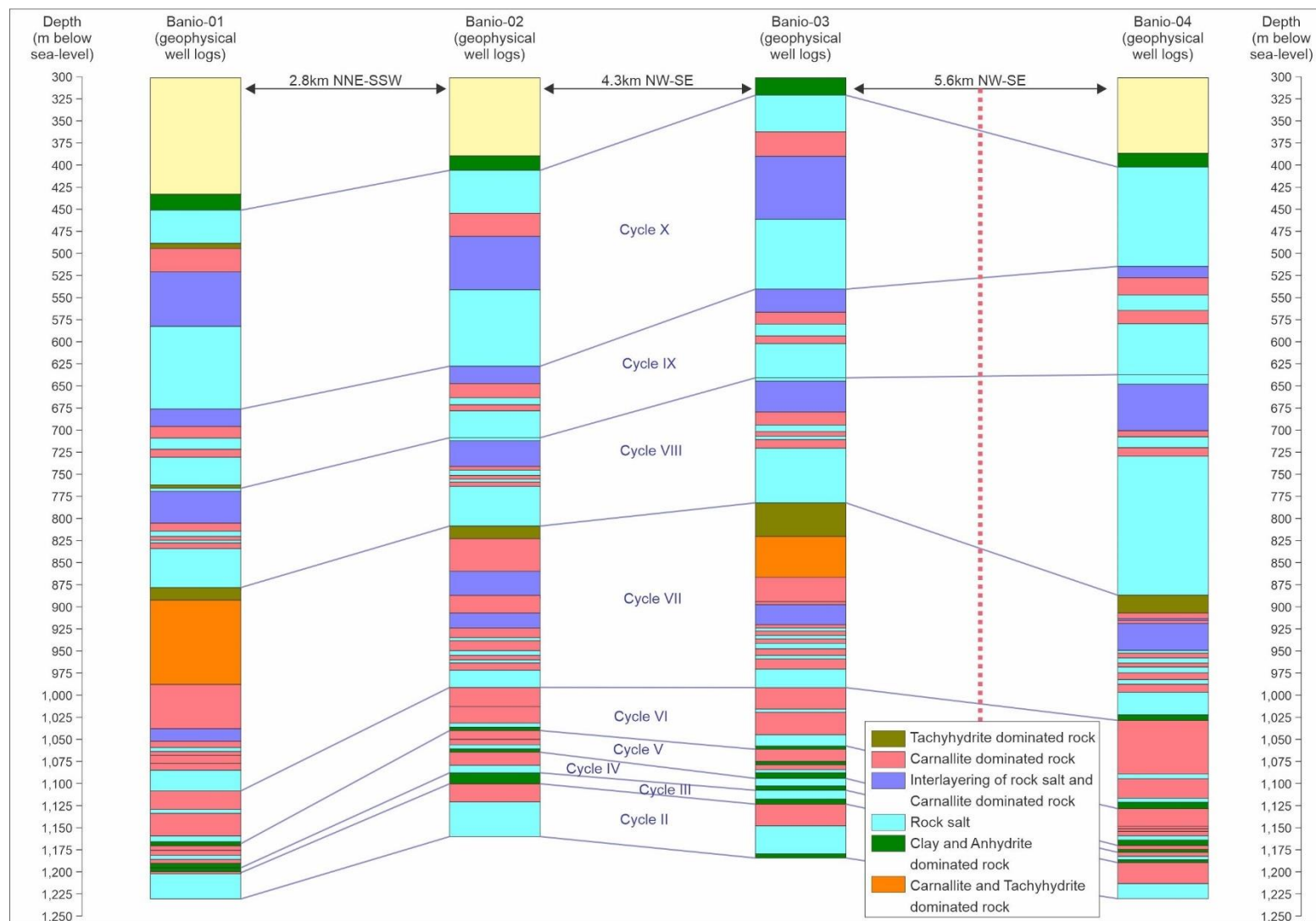
To evaluate the extent of potash mineralisation within the Banio Project area, three potash exploration drill holes and the six historical hydrocarbon exploration drill holes were used. A good correlation of potash seams and horizons between the potash exploration drill holes in the NW and the hydrocarbon exploration drill holes in the SE for evaporite Cycles VII to V, combined with observations from elsewhere in the Congo Basin, suggest that wherever the seismic interpretation shows salt bearing sections (>300 m), there is a reasonable prospect of finding similar potash seams or horizons (Figure 1.3, Figure 1.4).

Figure 1.3: Interpretation and Correlation of the Evaporite Cycles and Potash Seams for Potash Holes Ba-001, Ba-002, Ba-003 and Hydrocarbon Hole BATC-1



Source: Micon, modified from ERCOSPLAN (2023)

Figure 1.4: Interpretation and Correlation of the Evaporite Cycles and Potash Seams for Hydrocarbon Holes Banio-01 to Banio-04



Source: Micon, modified from ERCOSPLAN (2023)

The basis for the conceptual geological model is that the potash was originally deposited as carnallite seams and are present within three fault blocks separated by two NE-SW trending near vertical strike slip or transform faults. Within each block the carnallite seams were originally deposited as near horizontal layers which now shallowly dip towards the SW. The horizontal seams after deposition have been offset by NW-SE trending normal faults (locally reversed) with a dip in the range of 65° to 70°. This resulted in the relative uplift of the fault block containing the NE drill holes in the range of 150 m to 200 m, initiating the carnallite to sylvite transformation in the upper potash cycle.

1.6 DEPOSIT TYPES

The deposits of the Banio Project are classified as evaporites within the Congo Basin, part of the larger Aptian salt basin that stretches across equatorial West Africa. They can be considered as primary sedimentary rocks.

The Congo Basin evaporite cycles as well as individual potash seams within the cycles can be correlated over large areas of the basin. The continuity of the potash seams is comparable with the potash seams in the Elk Point basin in Saskatchewan, Canada. Mineable potash seams in the Congo Basin sequence sum up to a potential economic thickness of >100 m. This is larger than the Saskatchewan deposits mined using solution mining (combined thickness of 30 m to 50 m) and the conventionally mined potash in the Upper Kama basin in Russia.

Carnallite was the main potash mineral at the start of potash fertiliser production in Germany in 1865 and is still used for the production of KCl fertiliser at two locations. It is mined using solution mining techniques where the deposit has a thickness of between 15 m and 35 m.

1.7 EXPLORATION

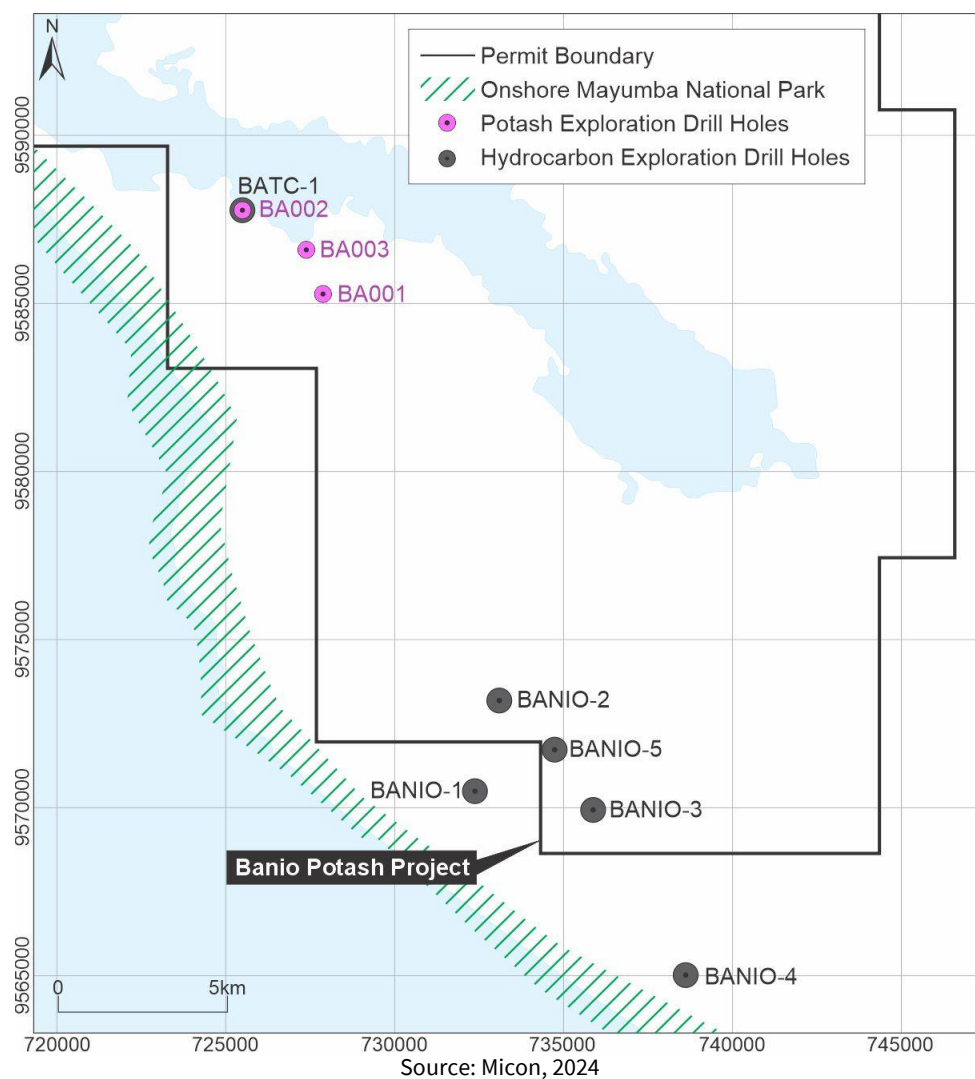
In 2023 SW Geophysics Limited (SW Geophysics) used the historical seismic data collected in three different campaigns: BAN90 (1990's), TMB90 (1990's) and MNPM11 (2011/2012) to re-interpret the data at the request of Millennial. The full available dataset is comprised of 34 lines, spaced broadly on a 2.5 km by 3.5 km grid, with a combined length of approximately 411 km, spanning an area of approximately 600 km² across the southern part of the licence area.

Under instruction from Millennial, Micon took the seismic interpretation carried out by SW Geophysics and put it into 3D using Leapfrog Geo. The top and bottom reflectors of each section were then digitised and used to create an upper and lower surface for the salt sequence. The upper and lower surfaces were then clipped to avoid projecting the sequence too far laterally. The modelled potash seam roof and floor surfaces will be used as an exploration tool for the continued drilling that is planned at Banio.

Historical drilling campaigns of six drill holes drilled between 1972 and 2010 were primarily drilled for oil exploration, however, the Banio-2 oil well was cored at five depth intervals through the salt formation and a complementary study of the salt composition and potash potential was conducted.

Mayumba Potasse drilled three potash exploration drill holes (Ba-001, Ba-002 and Ba-003) in 2017 to better define the sylvinitic mineralisation within the Banio Project area. Figure 1.5 shows the detailed location of the Mayumba Potasse drill holes and the hydrocarbon exploration drill holes within the Banio Project Area and the nearby vicinity.

Figure 1.5: Drill Holes Completed within the Banio Project Area and the Nearby Vicinity



A summary of drilling from 1972 to 2010 is provided in Table 1.2.

Table 1.2: Summary of Historic Exploration Drill Hole Data in the Banio Area

Year	Drill Hole No.	Easting	Northing	Elevation (m)	Depth (m)	Owner	Exploration Purpose
1972	Banio-1	732,483.8	9,570,340	50	2,800	Elf Gabon	Hydrocarbon
1975	Banio-2	733,198.1	9,573,157	47	2,477	Elf Gabon	Hydrocarbon
1977	Banio-3	735,989.5	9,569,811	70	1,997	Elf Gabon	Hydrocarbon
1978	Banio-4	738,680.9	9,564,872	38	1,978	Elf Gabon	Hydrocarbon
2010	Banio-5	734,865	9,571,623	47	1,843	Maurel & Prom	Hydrocarbon
1991	BATC-1	725,636.9	9,587,646	12	903	Elf Gabon	Hydrocarbon
2017	Ba-001	727,893	9,585,295	5	368	Mayumba Potasse	Potash
2017	Ba-002	725,483	9,587,774	6	516.3	Mayumba Potasse	Potash
2017	Ba-003	727,379	9,586,599	5	528	Mayumba Potasse	Potash

Carrying on from previous work, Millennial has extended the existing drill hole Ba-002 that was originally drilled by Mayumba Potasse in 2017 on the Banio Project site and has plans to extend Ba-001. A summary of the Millennial drilling is provided in Table 1.3.

Table 1.3: Summary of Millennial Drilling

Drill Hole	UTM X	UTM Y	Z	Dip	Azimuth	Depth EOH (m)	Progress
Ba-001	727909	9585292	5	90	0	364	In progress (to be extended)
Ba-002	725483	9587774	6	90	0	552.5	Completed (extended)
Ba-003	727379	9586599	5	90	0	528	Completed
Ba-004	731685	9585314	N/A	90	0	~700	Planned

1.8 DATA VERIFICATION

Micon completed a site visit in November 2023. During Micon's site visit the Micon Team verified the location of Millennial drill holes Ba-002 and Ba-001. The exploration camp was visited where the historical drill core was logged and photographed.

ERCOSPLAN completed a site visit to the Banio Project in October 2022 and on 16th October 2022 examined core material from Ba-003 and Ba-001. The review confirmed that the core pictures provided by Mayumba Potasse are of actual cores from the drill holes and that sampling had taken place as shown on the sample protocols. The actual location of drill hole Ba-002 was verified by ERCOSPLAN in the field. In addition spot checks were made to verify that the Excel files with the analytical results conformed to the analysis protocols.

For drill holes Ba-002 and Ba-003 ERCOSPLAN completed a qualitative comparison between estimated mineralogy from assays and the natural gamma ray logs. These comparisons showed that there is a reasonable correspondence between thickness and mineral grade for potash seams from the assay and width and intensity of the natural gamma peaks. The presence of high grade carnallite seams at these depth intervals has been confirmed by ERCOSPLAN.

The laboratories used for sample analysis have established internal QA/QC procedures, but the extent of QA/QC samples submitted to these laboratories by Millennial/previous owners of the Project is somewhat limited. Of the three laboratories used for sample analysis, only SRC had QA/QC samples submitted. No blanks were submitted, and the number of duplicates submitted does not satisfy the typically accepted minimum industry standard of 5% of total samples submitted.

The results of the check/round robin samples between the three laboratories show incredibly strong correlations, with high levels of precision and very low levels of error far below typically accepted industry thresholds.

Because of these strong correlations between laboratories and the internal QA/QC procedures of each of them, Micon believes that the dataset can be considered robust and adequate for resource estimation purposes. Micon strongly recommends that in future analyses are kept to one laboratory if possible, and 5% of the total number of assays submitted is submitted as duplicate, standard and blank samples with regular monitoring of these results to observe and rectify any possible issues should they arise.

1.9 MINERAL PROCESSING AND METALLURGICAL TESTING

The Banio Project is at an early stage of exploration and no mineral processing has been completed on the Project at this time.

Within the context of this Project, solution mining and subsequent brine processing are not metallurgical processes in the strictest sense. Once the solvent has dissolved the salts present within the cavern and the brines are delivered to the processing plant, it becomes a chemical engineering exercise whose outputs are dictated by known principles of salt chemistry. These are completely predictable and require no re-invention.

The principal driver for the mining process is the dissolution rate within the cavern and the steady-state brine composition that will be reached. A tried and tested means of approximating the rate of mass transfer is by simple dissolution tests using drill cores from the resource area, which should be conducted during the next phase of study.

Of equal importance to the dissolution rate of the core is the composition of the final brine that will exit the cavern. Once this is known, the performance of the evaporators and crystallisers can be predicted using manufacturer forecasting models. Likewise, the performance of the debrining centrifuges and product dryers can be predicted once the mass flow and crystal size distribution is provided by the crystalliser package provider. Finally, the performance of the compactors (to manufacture granular potash) can be forecast from the mass flow, temperature and particle size distribution of the standard MOP feed.

It is well known that the presence of $MgCl_2$ within the leach brine will have an impact on the solubility of the respective Na and K salts within the evaporation and crystallisation environments. In highly carnallitic solutions, it may be required to decompose a synthetic carnallite produced in a later process step in a decomposition evaporator.

It is therefore recommended that further metallurgical testing required to upgrade to the feasibility stage includes dissolution rate testing, and testwork to determine if there is a requirement for a decomposition evaporator to reduce the negative effect of $MgCl_2$ -rich brines on Na and K solubility. The remaining processing parameters are well-documented and can be forecast with accuracy.

1.10 MINERAL RESOURCE ESTIMATES

The evaluation of the Mineral Resources used geological and assay data from historic drill holes Ba-001, Ba-002, Ba-003 and the recently drilled extension to Ba-002. The geological model of Banio Potash mineralisation identified 16 carnallitite seams and three sylvinite seams in drill holes Ba-002 and Ba-003. Each of the seams identified met the required thickness and grade to be considered potentially suitable for solution mining.

The flat-lying nature of the Congo Basin, confirmed in the Project area by results from extensive seismic studies coupled with drill hole geological information, allows for extrapolation of the various cycles and seams over significant distances. The results confirm the continuity of potash seams over 2,260 m based solely on drill holes Ba-002, BATC-1 and Ba-003.

In calculating the Mineral Resource grade and tonnages, the following methodology was used (Mineral Resources are given as mineralisation in situ):

- Around each drill hole, a Radius of Influence (ROI) was defined and by intersection of these ROI's, polygons around drill holes were constructed;
- Each polygon was clipped by the coast of the Banio Lagoon and restricted to only onshore areas within the Mayumba Permit. The volume for each potash seam was calculated by multiplying the clipped polygon area with the thickness of the potash seam;
- The carnallite tonnage was calculated by multiplying the volume assigned to each seam with a carnallite tonnage factor (density). The density for each seam was determined individually from the relative abundance of the salt minerals in the carnallite seam. For sylvinite seams, a sylvinite tonnage factor was similarly determined; and,
- The KCl grade of each seam was calculated from a weighted average grade of drill holes sample results collected from the individual seams.

The MRE classifies the carnallite and sylvinite mineralisation as Indicated and Inferred Mineral Resources as defined by NI 43-101. It is the opinion of the author that the potash seams identified in the Banio Project have the potential for economical extraction using the solution mining method and a saleable product can be produced by processing the brine from solution mining. The Mineral Resources are reported as in-situ material, without any deductions for potential mining and processing recoveries.

The 2024 MRE was prepared by Dr. Sebastiaan van der Klauw of ERCOSPLAN. The Mineral Resources have been reviewed by Mrs. Liz de Klerk of Micon. Mrs. de Klerk has sufficient experience which is relevant to the style of exploration, mineralisation and type of deposit under consideration and to the activity which she is undertaking to qualify as a QP under the terms of NI 43-101. The Mineral Resources for the Banio Project have an effective date of 7th November 2023.

The resulting Indicated and Inferred Mineral Resources for the Banio Project are presented in Table 1.4 and Table 1.5.

Table 1.4: Indicated Mineral Resources for the Banio Project
(Effective Date of 7th November 2023)

Mineralogy	Drill Hole	Evaporation Cycle	Tonnage (Mt)	KCl Grade (%)	Tonnage (Mt KCl)
Sylvinite	Ba-002	VIII	7.73	24.9	1.93
	Ba-003	VIII	12.38	19.5	2.41
	Total		20.12	21.6	4.34
Carnallite	Ba-003	VIII	37.02	15.7	5.79
	Ba-002	VII	88.69	14.8	13.11
	Ba-003	VII	102.9	15.8	16.26
	Ba-002	VI	105.72	15.1	16.01
	Ba-003	VI	144.78	16.5	23.81
	Ba-002	V	51.72	15	7.73
	Ba-003	V	72.12	15.9	11.5
	Ba-002	IV	15.79	17.1	2.69
	Ba-002	III	17.76	18.7	3.33
	Total		636.53	15.8	100.23

Notes:

1. Tonnage is for in-situ resources with no discount for recovery as mining and processing methods are to be finalised. Potash deposits have been mined by underground, open pit and solution mining methods.
2. The numbers for tonnage and average KCl % are rounded figures.
3. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. The estimates of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, sociopolitical, marketing, or other relevant issues.
4. Densities used in resource calculations are 2.11 g/cm³ to 2.14 g/cm³ for sylvinite and 1.67 g/cm³ to 1.92 g/cm³ for carnallite.

**Table 1.5: Inferred Mineral Resources for the Banio Project
(Effective Date of 7th November 2023)**

Mineralogy	Drill Hole	Evaporation Cycle	Tonnage (Mt)	KCl Grade (%)	Tonnage (Mt KCl)
Sylvinite	Ba-002	VIII	13.94	24.9	3.47
	Ba-003	VIII	29.85	19.5	5.81
	Total		43.79	21.2	9.28
Carnallite	Ba-003	VIII	43.16	15.7	6.76
	Ba-002	VII	160.76	14.8	23.76
	Ba-003	VII	173.82	15.8	27.46
	Ba-002	VI	191.64	15.1	29.02
	Ba-003	VI	244.57	16.5	40.22
	Ba-002	V	93.74	15	14.01
	Ba-003	V	121.83	15.9	19.42
	Ba-002	IV	40.39	17.1	6.88
	Ba-002	III	45.42	18.7	8.51
	Total		1,115.35	15.8	176.04

Notes:

1. Tonnage is for in-situ resources with no discount for recovery as mining and processing methods are to be finalised. Potash deposits have been mined by underground, open pit and solution mining methods.
2. The numbers for tonnage and average KCl % are rounded figures.
3. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. The estimates of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, sociopolitical, marketing, or other relevant issues.
4. The quantity and grade of reported Inferred Mineral 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 and it is uncertain if further exploration will result in upgrading them to an Indicated or Measured mineral resource category.
5. Densities used in resource calculations are 2.11 g/cm³ to 2.14 g/cm³ for sylvinite and 1.67 g/cm³ to 1.92 g/cm³ for carnallite.

1.11 MINERAL RESERVE ESTIMATES

This section, which forms part of the NI 43-101 reporting requirements for advanced projects or properties, is not relevant to this Technical Report as the Banio Project is at an early stage of exploration.

1.12 MINING METHODS

Solution mining has been proven to be the most efficient way of exploiting underground potash resources, particularly for mining large deposits globally. A few trade-offs were evaluated, and the solution mining method selected for Banio Project is the single well vertical cavern method.

To mine multiple carnallite and sylvinite seams using the single well vertical cavern method at the Banio Project, the seams are grouped into a few sections based on the interbed thicknesses between the seams. For the solution mining of each section, the solution-mining method is divided into three phases: (1) sump development, (2) roof development, and (3) continuous mining. Once the last section of the well is mined, cavern closure is performed.

Each individual well is planned to have a 5 m deep sump developed beneath the carnallite seam. The sump is developed by pumping water at a rate of approximately 25 m³/h through the annulus of the well and recovering partially saturated brine through the tubing in the well located towards the bottom of the sump. It is estimated that sump development will require approximately 60 days.

Upon successful development of the sump, roof development begins. Ambient-temperature water is injected at a rate of 25 m³/h at the top of the sump through the injection annulus, and partially saturated brine is recovered through the production tubing. The roof is developed until approximately 70% to 80% of the designed cavern roof area is established. It is estimated that this phase will require 80 to 100 days for completion, based on the estimated dissolution rate and from operating experience.

For continuous solution mining the solvent from the process plant is injected into the annulus and through the perforations to dissolve the potash minerals. The production tubing retrieves production fluid from the lower portion of the cavern. The injection rate is expected to average approximately 25 m³/h over the life of the continuous mining phase. It is estimated that each cavern will produce approximately 19,008 t/a and 14,256 t of KCl with hot mining and cold mining, respectively. The plan is to operate each well in solution-mining mode until the cavern roof area reaches a radius of approximately 50 m, or 7,854 m². Production continues until the KCl brine grade declines below a concentration of 60 g/L.

Upon completion of mining, the injection tubing can be removed from the wells, and cement plugs can be inserted in the intermediate casings above the solution mining cavern.

The design for the single-well caverns is based on a radius of 50 m, with cavern centres spaced at 210 m apart. This layout results in an aerial extraction ratio of 21%. There are six types of cavern:

- Type I caverns mine the Cycle III-IV carnallite, Cycle V-VII carnallite, and Cycle VIII sylvinite;
- Type II caverns mine the Cycle III-IV carnallite, and Cycle V-VII carnallite;
- Type III caverns mine the Cycle V-VII carnallite, Cycle VIII carnallite, and Cycle VIII sylvinite;
- Type IV caverns mine the Cycle V-VII carnallite and Cycle VIII carnallite;
- Type V caverns mine the Cycle V-VII carnallite; and,
- Type VI caverns mine the Cycle V-VII carnallite and Cycle VIII sylvinite.

There are 58 Type I caverns, 107 Type II caverns, 55 Type III caverns, 61 Type IV caverns, 67 Type V caverns, and 22 Type VI caverns. The total number of caverns to be mined is 370.

For the Banio Potash Project, both hot mining and cold mining options are evaluated. For the hot mining option, the Project will need to heat the solvent before injecting into the cavern which requires additional capital investment on the heating system. However, due to the long distance between the processing plant and the wellfield, the hot mining option may have very high costs due to the temperature loss along the pipelines. An alternative option is to heat the solvent at the wellfield location, however, this option requires significant infrastructure on the wellfield. For this reason, it is decided that cold mining will be used for the initial caverns with the option to switch to hot mining after the completion of the initial caverns.

For cold mining, it is assumed that ambient temperature solvent will be injected into the cavern and the cavern brine will be maintained at 32.5°C. For hot solvent mining, it is proposed that the

injection solvent temperature is 80°C. With a cavern located at approximately 500 m in depth in the area, the expected temperature drop in the hot injection fluid is estimated to be between 10°C and 20°C with resulting brine temperatures in the cavern between 60°C to 70°C. With this elevated temperature, the KCl content in production brine will be much higher than the case with cold solvent injection.

An empirical method is used to assess the ultimate subsidence over the planned mine site. The maximum predicted ultimate subsidence for the preliminary mine plan is approximately 6.7 m. The maximum horizontal strains in the east-west direction are 8.1×10^{-3} and -7.4×10^{-3} for tensile and compressive strains, respectively. The maximum horizontal strains in the north-south direction are 8.5×10^{-3} and -7.4×10^{-3} for tensile and compressive strains, respectively.

The Life of Mine (LoM) production schedule was developed to plan drilling, development, and production mining stages for each cavern in the current mine plan so that a MOP (K62) product could be maintained at the target rate during steady-state mining operations. Three case scenarios of production schedule were developed for the three target production rate options, i.e. 400 kt/a, 600 kt/a, and 800 kt/a, which result in a LoM expectancy of 112, 79 and 56 years, respectively.

1.13 RECOVERY METHODS

The Banio Project shall produce MOP which meets the global standard, containing a minimum of 60% K₂O which equates to approximately 95% KCl and 5% NaCl. It is intended to market the potash predominantly in Brazil where a granular product (2 mm to 4 mm) is preferred. To provide this, a Compaction Plant has been incorporated within the process flowsheet, however, it will also be possible to market an uncompacted “standard” MOP, subject to market demands.

A high-grade (99% NaCl) vacuum salt will also be produced from the process facility. This is essentially a by-product of the evaporation of loaded brines from the production wellfield. Facilities for the drying and bagging of vacuum salt have been included in the process flowsheet.

Loaded brines from the wellfield are heated to over 90°C using steam and fed to evaporation vessels. During the process of supersaturating the brines, NaCl crystals are precipitated preferentially and are withdrawn from the vessels. The crystal slurry is subsequently debrined using filters or centrifuges and the NaCl filter cake is dried, screened and bagged for export.

The KCl-rich brine from the evaporators is passed to a train of cooling crystallisers in which KCl crystals precipitate as the brine continues to evaporate and boil under a vacuum. The crystal slurry is subsequently debrined and dried to yield “standard” MOP. The standard MOP is then passed through the Compaction Plant where a granular product (2 mm to 4 mm) is produced.

Finally, the granules are subjected to a glazing and oiling (post-treatment) process which removes sharp edges and strengthens the granules prior to export. Re-screening of the granules at the port is also required for the removal of any fines which may form during transportation.

1.14 PROJECT INFRASTRUCTURE

The infrastructure required to support the Banio Project includes a processing plant site, roads, a port facility, water supply, brine disposal, natural gas and electrical power supply.

A ±60 km² clearing has been identified within an industrial area located some 10 km from the proposed Mayumba Deep-Water Port. It is proposed to locate the processing facility within this area,

which has good connections to the national road system via the Banio Bridge and is also close to the current airport. It is proposed to upgrade the condition of the road connecting the plant site to Mayumba and onto the port. The establishment of a road connecting the plant site to the wellfield, a distance of some 60 km has also been provided for. This road will also serve as the pathway for the twin pipelines transporting loaded brine from the wellfield and for the high-tension electrical supply.

The proposed port will be constructed and funded by others. The port will provide a sheltered breakwater for safe loading in all but extreme conditions. The proposed draft of 14 m will accommodate Panamax (+60 kt) vessels and the more common Handymax (+40 kt) varieties. The port will be equipped with product storage warehouses and a 1,000 t/h ship-loader which will be able to wharf on the quayside and load products into ships with multiple holds.

The water supply for the Banio Project will be provided by the abstraction of fresh water from the Banio Lagoon using a penstock or floating raft system. Once ashore, the water will be filtered to remove fine particulates and delivered to the solution wells at high-pressure using multi-stage centrifugal pumps through an extensive piping network.

The injection of solvent at high pressure into the solution wells will displace loaded brines which will be directed to a common collection tank. The loaded brine will subsequently be pumped to a collection facility at the processing plant site through twin 500 mm diameter pipelines. During the establishment of a new solution well where the brine does not contain potash, one of the pipelines will be used to deliver this brine directly to the sea for disposal.

Waste brine from the processing plant (“bittern”) will be directed to sea via a short, dedicated jetty.

It is proposed to supply natural gas to the region from existing offshore rigs. A gas supply will be required for a combined heat and power (CHP) plant which will deliver electrical power using gas turbines, the exhaust from which will be used to generate steam and preheat the air required to dry both potash and salt. The operation of a CHP facility will give the Project good control of its energy supply and will minimise the Project’s carbon footprint. The CHP plant is to be located at the processing plant site to enable the delivery of high-grade exhaust gas and steam to the former without undue heat losses. An 11 kV HT transmission line will be extended to the processing plant and solution mining wellfield. Natural gas will also be used in an auxiliary mode within the steam boilers and product dryers.

1.15 MARKET STUDIES AND CONTRACTS

No material contracts are in place or under negotiation.

The primary use of potash is in fertilisers, which account for over 90% of its use and are integral to the agriculture industry. Potassium salts like potassium chloride (KCl) and sulphate (SO_4), used in fertilizers are essential for crop nutrition. Potash resources are found in underground deposits formed by the evaporation of ancient saltwater bodies, inland drainage basins, and shallow sea lagoons. The most economically important potash mineral salts are sylvite (KCl) and carnallite ($\text{MgCl}_2 \cdot \text{KCl} \cdot 6\text{H}_2\text{O}$). Sylvinite is the highest-grade ore source.

The potash market is dominated by MOP, which accounts for over 90% of usage. It is followed by Sulphate of Potash (SOP) and potassium-magnesium sulphate (SOPM), which cater to crops

sensitive to chloride. The global capacity for MOP stands at 99 Mt, with significant production concentrated in Canada, Russia, and Belarus, which benefit from sylvinite ores, contributing to two-thirds of the supply. Global reserves are estimated at 3,300 Mt K₂O, predominantly in these countries. China leads in SOP production, mainly through secondary processes.

The demand for potash is driven by agricultural needs, with projections indicating a rise to meet food supply requirements for the increasing global population. MOP demand is expected to grow, particularly in South Asia, Southeast Asia, Latin America, and China, with a forecasted increase to 86.4 Mt by 2037, highlighting the essential role of potash in global food security and agricultural sustainability.

The Argus (2023) model indicates a potential oversupply in the potash market until 2043, excluding the impact of sanctions on primary producers. The geopolitical landscape, particularly China's participation in global trade, could significantly influence market dynamics.

Price trends have shown volatility, with recent fluctuations influenced by geopolitical events, supply constraints, and demand shifts. In the short term, prices are expected to stabilise. However, medium to long-term forecasts suggest a struggle to rise due to easing supply constraints and ongoing inflationary pressures affecting production costs.

The Banio Project is strategically positioned to cater to the growing regional and international demand for MOP, focusing on the Brazilian market. Brazil is recognised for its significant potash imports and future demand increase. Brazil's status as one of the largest MOP importers, coupled with its distant supply sources, absence of significant local production and the hurdles new mining ventures face, underscores the critical need for potash and the potential for the Banio Project to serve this demand. The Project's geographic location, advantageous export shipping routes, and associated freight costs present a compelling opportunity to supply MOP to Brazil.

In addition, the African potash market, characterised by low fertiliser application rates, offers untapped demand growth potential. South Africa has been responsible for most of the consumption, but other countries, like Nigeria and Egypt, have seen increased demand. Although demand growth is predicted, recent declines due to the Covid-19 pandemic and falling affordability have demonstrated the vulnerability of the growth potential. Potassium demand growth may be met by growing NPK consumption, and large fertilizer producers are investing in downstream distribution in the continent. Potash production in Africa is limited, and there are no commercial operations to develop the few economically viable sources. The largest producer of sulphate of potash in Africa is Evergrow in Egypt, where fertilizer production is concentrated.

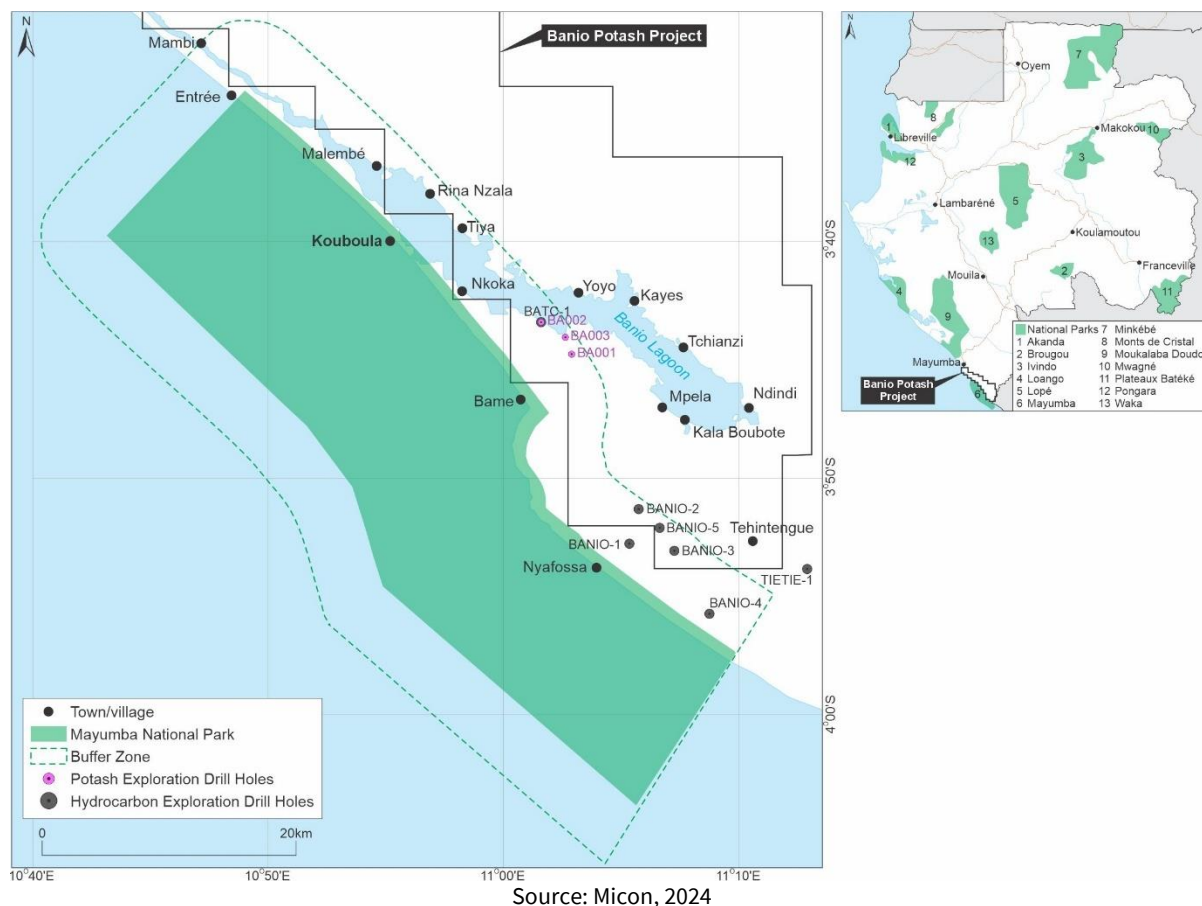
1.16 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

The EIA, completed by Plymouth and accepted by the Gabonese Government in 2017, remains in effect, allowing the current planned exploration activities to continue on the Project.

Millennial is committed to developing and managing the Banio Project consistent with best international industry practice and national legislation, focusing on sustainable development, minimising environmental and socio-economic risks, and obtaining a social licence to operate from the Project's communities and the host country.

The Banio Project is situated along the coast of the Gabonese Republic, with a portion of the permit area falling within the Mayumba National Park and the buffer zone around the park (Figure 1.6). The Mayumba National Park is comprised of a sea coastal area, a thin tongue of beach dunes, savannah and rain forest. The offshore area of coastal sea is 15 km by 60 km and the onshore area of beach and dunes is 1 km by 60 km.

Figure 1.6: Mayumba National Park and Banio Project Area



The vicinity of the Project to the Mayumba National Park, composed of terrestrial and marine protected areas, could present a potential risk to the park. The potentially affected area will be identified when the feasibility study and the EIA will be completed.

For drilling further south on the Banio Project area Millennial may need a new EIA study to be completed and approved by the Direction Generale de l'Environnement et de la Protection de la Nature (DGEPN). Therefore the next step will be for Millennial to engage an independent Environmental Consultancy company to assess whether a new EIA study is required.

Millennial must ensure that if an EIA is required that it is carried out in consultation with the communities that could be affected in any area of the Project. The local authorities will ensure that communities likely to be affected have been consulted and their views incorporated into the EIA report.

1.17 CAPITAL AND OPERATING COSTS

CAPEX and OPEX cost parameters have been based on benchmark data and are order of magnitude estimates with an accuracy of $\pm 30\%$.

The 400 kt/a base case option requires the least CAPEX and has the slowest production rate, resulting in a 112-year LoM that concludes in 2137. The second option for 600 kt/a option has a LoM of 79 years, concluding in 2104, whilst the third and largest option for 800 kt/a has the highest production rate, requires the most amount of capital and investment but benefits from economies of scale. As this is the most aggressive production rate the LoM is 56 years concluding in 2081.

The initial CAPEX ranges from US\$320 million for the base case, US\$402 million for the 600 kt/a Option 2 case and US\$480 million for the 800 kt/a Option 3 case.

Table 1.6: Initial CAPEX Summary Breakdown

Parameter	400 kt/a (US\$ 000')	600 kt/a (US\$ 000')	800 kt/a (US\$ 000')
Mine	74,959	97,942	123,250
Processing	125,377	159,999	190,416
G&A	78,205	92,001	104,216
Contingency	41,781	52,136	62,198
Total	320,323	402,078	480,080

The OPEX cost ranges from US\$83/t for the base case, US\$68/t for the 600 kt/a Option 2 case and US\$61/t for the 800 kt/a Option 3 case, as the higher production rate results in a lower denominator value for the unit rate calculation and economies of scale.

Table 1.7: Summary of OPEX Costs

Item	Description	400 kt/a (US\$ million)	600 kt/a (US\$ million)	800 kt/a (US\$ million)
Natural Gas	Based on US\$0.10 per Nm ³	8.2	12.1	16.4
Maintenance	Based on 2% of mining CAPEX and 4% of processing and G&A CAPEX	9.9	12.3	15.0
Labour	410 Employees, all three scenarios	9.8	9.8	9.8
Consulting	Ongoing	1.0	1.0	1.0
Legal	Contract Drafting etc.	1.0	1.0	1.0
Marketing	MOP and Salt Products	0.8	1.0	1.3
Port Fees	Estimated US\$2.00/t	0.8	1.2	1.6
Product Trucking	Estimated US\$2.00/t	0.8	1.2	1.6
Social Costs	Sponsor Local Projects	0.5	0.5	0.5
Diesel	Estimated US\$1.00/L	0.1	0.2	0.2
Demin Water	For Steam Raising	0.2	0.3	0.4
Total OPEX US\$/a		33.0	40.5	48.7
Unit Cost US\$/t MOP		83	68	61

1.18 ECONOMIC ANALYSIS

A Discounted Cash Flow (DCF) model was built for the three proposed production rate options, applying at 10% discount rate.

The DCF model material input parameters are presented in Table 1.8.

Table 1.8: DCF Model Material Input Parameters

Input Parameters	Unit	Value
Project Commencement	Date	01/01/2024
Valuation Base Date	Date	01/01/2027
gMOP K60 Brazil (25-year average)	US\$/t	387
NaCl 99% CFR	US\$/t	100
Shipping Cost CFR to Brazil	US\$/t	22
Royalty	%	7.5%
Corporate Tax (CIT)	%	30%
Working Capital Retention	Days	30
Escalation Rate	%	5%
Contingency for CAPEX	%	15%
Plant Recovery	%	90%
Plant Product MOP Quality	%	95%
Discount Rate	%	10%
NPV calculation	Years	25

Post-Tax NPV is US\$440 million for the base case, US\$769 million for the 600 kt/a case and US\$1,071 million for the 800 kt/a case. Post-Tax IRR is 26% for the base case, 30% and 33% for the 600 kt/a case and 800 kt/a cases respectively.

Pre-Tax NPV is US\$721 million for the base case, US\$1,218 million for the 600 kt/a case and US\$1,680 million for the 800 kt/a case. Pre-Tax IRR is 33% for the base case, 38% and 41% for the 600 kt/a case and 800 kt/a cases, respectively.

The DCF Model results for the Base Case Option 1 (400 kt/a), Option 2 (600 kt/a) and Option 3 (800 kt/a) cases are presented in Table 1.9.

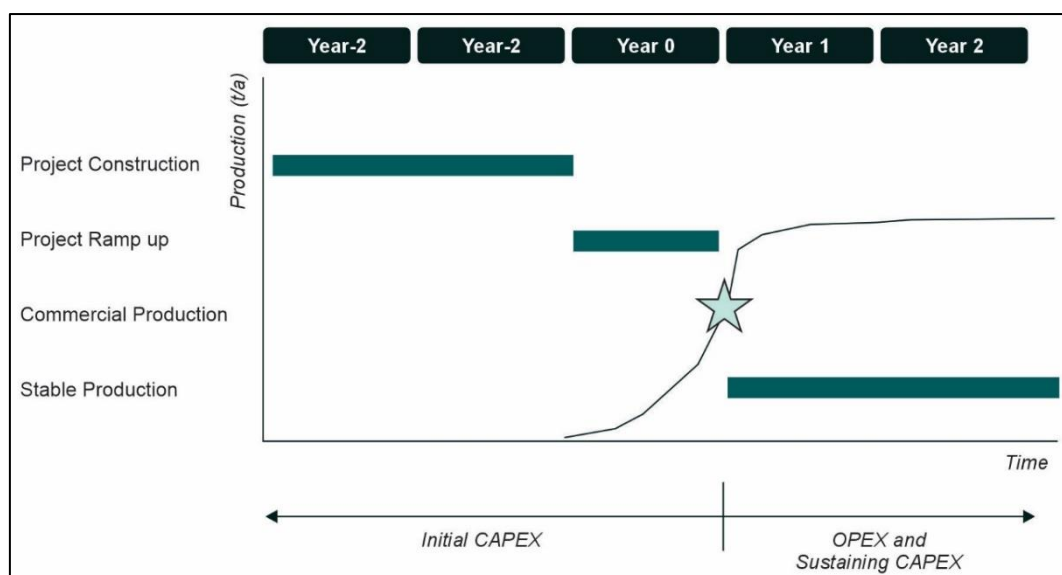
Table 1.9: DCF Model Results for Base Case 400 kt/a, and 600 kt/a and 800 kt/a Cases

Line Item	Unit	Option 1 (400 kt/a)	Option 2 (600 kt/a)	Option 3 (800 kt/a)
Max Production Rate MOP	t/a	422,222	633,333	844,444
Total MOP Production	kt	9,743	14,543	19,297
Total Revenue	US\$ million	5,147	7,612	10,036
Total Selling Cost	US\$ million	764	1,122	1,472
Net Revenue	US\$ million	4,383	6,490	8,564
Total Initial CAPEX	US\$ million	320	402	480
Capital Intensity (US\$/t MOP)	US\$/t	800	670	600
Total Sustaining CAPEX	US\$ million	92	143	180
Total CAPEX	US\$ million	413	545	660
Total OPEX	US\$ million	676	828	987
Mine OPEX LoM	US\$/t	17	13	11
Plant OPEX LoM	US\$/t	39	33	31
G&A OPEX LoM	US\$/t	27	21	19
Total OPEX LoM	US\$/t	83	68	61
EBITDA	US\$ million	3,524	5,450	7,335
AISC	US\$ million	1,687	2,264	2,849
Tax	US\$ million	-940	-1,488	-2,025
Free Cash Flow	US\$ million	2,132	3,382	4,599
Cumulative Free Cash Flow	US\$ million	1,776	2,800	3,808
Peak Funding Requirement	US\$ million	305	391	456
Payback Period	Years	1.9	1.5	1.4
Margin	%	68%	72%	73%
Pre-Tax Cashflow	US\$ million	2,561	4,045	5,500
Pre-Tax NPV	US\$ million	721	1,218	1,680
Pre-Tax IRR	%	33%	38%	41%
Post-Tax Cashflow	US\$ million	2,132	3,382	4,599
Post-Tax NPV	US\$ million	440	769	1,071
Post-Tax IRR	%	26.2%	30.2%	32.6%
Capital Efficiency	Ratio	2.1	2.4	2.6

Option 3, with a production rate of 800 kt/a demonstrates the highest NPV and optimal IRR, with only a 1.4 year payback period.

The conceptual Project time schedule is illustrated in Figure 1.7.

Figure 1.7: Conceptual Project Time Schedule



As the sensitivity analysis shows that MOP and salt prices are two of the three most sensitive parameters to both NPV and IRR a detailed market price study is required. Argus provided forecasts for this study, but more detail is necessary including the potential price for selling the product locally, to the African continent, as opposed to Brazil. A detailed market study would include the potential price for MOP and salt in Africa, the preferred MOP and salt product presentation, preferred packaging, (bulk in ship's hull, containers, super sacks, 50 kg, or 25 kg sacks) and a shipping or freight cost.

In the next stage of the Project, more detailed engineering is required for the CAPEX items to obtain fabricators quotes for equipment and increase the confidence in initial and sustaining CAPEX in the financial model. Updated CAPEX quotes will eliminate the need for escalation in the financial model.

1.19 ADJACENT PROPERTIES

There are no direct adjacent potash properties to the Banio Project. There are four properties with similar mineralisation relevant to Banio, namely three properties in the Sintoukola Potash District: the Kola Project, the Dougou Carnallite Project, and the Dougou Extension (DX) Project which are situated 60 km from Banio, and the Kanga Potash project which is located approximately 120 km to the southeast in the Kouilou Province; all these properties are located in the Republic of Congo (Figure 23.1). The three Kore Potash Plc (Kore) deposits are characterised by high-grade, shallow mineralisation and are situated near the coast with access to infrastructure. They are 97% owned by Kore (formerly known as Elemental Minerals Ltd) and consist of two mining licences and an exploration licence for the three different projects: Kola Project, Dougou Project, and Dougou Extension (DX) Project.

The Kanga Potash project is being developed by Sarmin Mining Inc (23.88%), a subsidiary of the Sarmin Mining Group, African Mineral Exploration and Development (AMED) (68.57%), a Luxembourg-based private equity group, and Baker Steel Resources Trust (7.55%), an LSE-listed investment company. An NI 43-101 compliant DFS was completed on the Kanga Potash project in August 2020 for an initial 600 kt/a production rate. The MOP product is intended to be produced via solution mining of carnallite seams with a mining thickness of >210 m with an average grade of 17.5% KCl.

1.20 CONCLUSIONS

The Banio Project is a greenfields potash exploration project located in the Congo Potash Basin, in the Gabonese Republic. Millennial entered into an option agreement with Equatorial Potash to acquire up to a 100% interest in the company and since then have commenced an exploration diamond drilling programme to confirm historical resource estimates and report new Mineral Resources in accordance with NI 43-101.

Ten potash cycles have been identified on the property based on seismic interpretations and evaluation of drill hole results from three potash exploration drill holes and six historical hydrocarbon exploration drill holes.

In August 2023 Millennial commenced drilling with an extension of historical drill hole Ba-002. The extension resulted in identification of seven potentially economic cycles, dominated by carnallite mineralisation. Drilling work commenced on Ba-001, but this has not yet been completed due to drill rig breakdowns.

A Mineral Resource estimate was filed on 20th February 2024 totalling 656.65 Mt of Indicated Resources grading of 15.9% KCl and an Inferred Resource of 1,159.14 Mt grading of 16.0% KCl. The large Mineral Resource situated in the north of the prospective Banio licence area is sufficient to support a long mine life and is closer to the infrastructure in Mayumba. In the southernmost part of the licence area, there are significant resources that have been identified in historical hydrocarbon drill holes. Millennial intends to explore this potential in the future, although the current wellfield design already has substantial resource potential. Therefore, it is not an immediate focus.

Millennial plan to extract the potash using solution mining methods, with a process plant located approximately 60 km away in Mayumba. Non-selective solution mining has been chosen for the Banio Project utilising one well per cavern, drilled to a vertical depth of approximately 530 m to 550 m. The design for the single-well caverns is based on a radius of 50 m.

Ambient-temperature water, drawn from the Banio Lagoon, and partially saturated brine will be recovered through the production tubing. Assuming a production rate of 400 kt/a of MOP the LoM is expected to be 112 years. For 600 kt/a of MOP production the LoM will be 79 years and for 800 kt/a of MOP production the LoM will be 56 years.

The proposed solution mining aerial extraction ratio is estimated to be 21%. To minimise ground disturbance and slow surface subsidence, solution brine will be left in the caverns after mining is complete. Therefore, subsidence at the Project site is expected to be gradual and non-disruptive. A surface subsidence analysis was completed based on the cavern layout design. The maximum predicted ultimate subsidence for the preliminary mine plan is approximately 6.7 m.

The processing flowsheet recommended in this PEA is designed to produce MOP with a guaranteed purity of 95% KCl (K60) with a maximum of 5% impurities, most of which is NaCl. The intended products from the process plant are saleable grade K60 MOP in both standard and granular form together with a saleable grade industrial vacuum salt containing a minimum of 99% NaCl which is suitable for a variety of chemical applications such as the chlor-alkali process.

The base case for this PEA has assumed a production rate of 400 kt/a of MOP, which will be exported to the Brazil market as granular MOP making use of the Mayumba Deep-Water Port. The most crucial element of the Banio Project is currently the required infrastructure, especially the ability to export the MOP product. The Gabonese Government plans to build a Deep-Water Port and securing allocation at the port will be integral to the Project success. Alternative port options are also available, and Millennial could also investigate building a long jetty into the ocean from which MOP product could be loaded onto ships for export. These export options require further investigation as part of the next phase of the Project.

Two alternative scenarios were considered, including a production rate of 600 kt/a of MOP and 800 kt/a of MOP.

A discounted cash flow model has been built for the Banio Project to consider the 400 kt/a base case and the two alternative scenarios. CAPEX and OPEX cost inputs are $\pm 30\%$ accuracy. The results of the DCF are summarised in Table 1.10.

Table 1.10: DCF Analysis Conclusions

Line item	Unit	Option 1 (400 kt/a)	Option 2 (600 kt/a)	Option 3 (800 kt/a)
Total Initial CAPEX	US\$ million	320	402	480
Total OPEX LoM	US\$/t	83	68	61
Post-Tax NPV ₁₀	US\$ million	440	769	1,071
Post-Tax IRR	%	26.2%	30.2%	32.6%
Payback Period	Years	1.9	1.5	1.4

The results of the economic analysis indicate that Option 3, with a production rate of 800 kt/a is the most appealing scenario for the Project at present with an NPV of over double that of the initial CAPEX and the option with the shortest payback. This option requires US\$480 million in initial CAPEX, but also has the best post-tax IRR at 32.6%.

Selecting the best option becomes a strategic decision and trade-off between the Company's risk appetite and ability to raise capital whilst improving economic statistics such as NPV, IRR and payback period. Within the industry, other commodities such as lithium, are finding it difficult to raise funds for large initial CAPEX near and above the US\$ billion marker. The 800 kt/a option has a CAPEX of <US\$500 million, which is likely to be more appealing to the current market appetite, and also places Millennial in an advantageous position with options to reduce production to 600 kt/a and still maintain strong positive project economics, or alternatively investigate larger production rates to further increase NPV.

An additional option is to phase the ramp-up and commissioning processes from, for example, Phase 1, 600 kt/a up to Phase 2, 800 kt/a. This will enable a lower initial CAPEX and will de-risk the Project by commissioning and starting to produce revenue before expanding and transitioning into phase two to increase throughput and improve economies of scale.

1.21 RECOMMENDATIONS

The next stage of the Project is to move from a PEA to a Feasibility Study (FS), where CAPEX and OPEX numbers are required to carry a confidence of 15% to 20%. The following is a list of

recommendations to create further understanding and confidence in both the inputs and outputs of the technical approach and financial model:

Exploration and Mining

- Continue exploration drilling, firstly completing Ba-001 and then moving on to a new hole, Ba-004, located about 4 km east of Ba-001, to test the potential of potash mineralisation in that region of the basin. Compile updated Mineral Resources based on the results of new drill holes;
- Large diameter geotechnical drilling should also be carried out during the next drilling phase so that creep testwork can be performed for cavern design;
- Further detailed numerical modelling of single-well cavern deformations and surface subsidence can be conducted in the next phase of the study using information from the additional drill holes; and,
- Complete a trade-off study looking at the cost-benefit of using hot (pre-heated) water for solution mining as opposed to using ambient-temperature water for solution mining. Quantify the impact that hot leach mining, and a higher potassium content in the mining brine has on the gas consumption at the process facility and the power requirements at the mine site.

Processing and Metallurgy

- Dissolution testwork is needed to understand the dissolution rate within the cavern and the steady-state brine composition that will be reached, including the waste composition. This can be carried out using new drill cores from Ba-001 and Ba-004; and,
- Testwork to determine if there is a requirement to provide a decomposition evaporator and hot leach tank to accommodate the high-levels of MgCl within the carnallitic leach brine which would negatively impact the solubility of Na and K salts.

Environmental and Social Governance

- Commence with baseline studies and assessments required for the EISA. Develop preliminary environmental management plans and increase regular communication with local communities.
- Commence with baseline social studies, understand the Project's sphere of influence, identify local stakeholders and start to build a community presence with open communication with local stakeholders.

Marketing

- Complete an in-depth market study of NaCl 99% salt to understand possible markets to sell the salt, focus on the African market to analyse the demand and the possibility for geographically closer purchasing clients in order to minimise freight cost and maximise profit. This will eventually lead to a better understanding of the sale price of the salt product as an input to the financial model; and,
- An in-depth MOP market study is also required to improve the understanding of the Brazilian potash market and the local African potash market for granular and standard SOP. During operations it is very likely that a small proportion of granules or pellets are crushed or damaged and not all products can be sold as granular MOP. It is probable that only 95%

of the annual MOP production will be granular (gMOP) and the remaining MOP will be classified as standard (sMOP). The amount of sMOP that is likely available for sale from the Project varies between 20 kt/a for the 400 kt/a Option and 40 kt/a for the 800 kt/a Option. Commonly sMOP is purchased for use in fertilizer blending plants and it is possible the local West African market could absorb the quantities available for sale.

Transport and Logistics

- The Gabonese Government is still finalising the location and conceptual design of the Deep-Water Port at Mayumba. There are a number of potential large mining clients in the region which would need a port to load their final product and send it to market. This final port design and layout will allow for more detailed costing of size and CAPEX for storage of products, transport options, relative distances between the mining area, processing plant and location of port for both CAPEX and OPEX reasons etc.;
- An infrastructure and logistics study is required to determine the optimal methods of moving the potash brine from the wellfield to the plant and from the plant to the port and must include a survey of the proposed pipeline, road and electricity routes;
- A separate transport and logistics study is required to review the different port options and the infrastructure required to export potash as bulk, containers, 25 kg, 50 kg and 1 t bags. The study must also investigate the different port options including loading bay logistics and vessel handling capabilities; and,
- Bench scale testwork of brine composition using core chemistry analytical results to synthesise a brine and determination of what the waste product will be.

Finance

- Some of the OPEX costs such as labour and sustaining CAPEX have been simplified in the financial model as fixed costs. In the next pass of the model, with more detailed information these costs can be modelled as fixed and variable which will bring more accuracy to comparison between cases and the effect of economies of scale;
- The effect of stockpiling the final product as a strategy or as a consequence of delayed or offset sales has been ignored and simplified. In the next version, an effect of lagging sales or seasonal sales can be modelled;
- Taxation, Royalties and tax holidays are subject to negotiation with the Gabonese Government and are conducted when the exploration licence is converted to a mining licence. For this study Micon selected the midway point of possible tax ranges, and no tax holiday was applied. These should be investigated during the Feasibility Study; and,
- Test the appetite of the market for raising US\$402 vs US\$480 million CAPEX, which are the current modelled requirements for the 600 kt/a and 800 kt/a options. This could explore an option to fund and construct the mine in phases; Phase 1 at 600 kt/a with a low initial CAPEX and lower throughput, ramping up to commissioning production then expansion into Phase 2.

2.0 INTRODUCTION

Micon International Co Limited (Micon) have been engaged by Millennial Potash Corp. (Millennial or the Company) to prepare a Preliminary Economic Assessment Technical Report to comply with the Canadian National Instrument (NI) 43-101 Standards of Disclosure for Mineral Projects, Form NI 43-101F1 requirements on the Banio Potash Project (Banio or the Project), located in the Gabonese Republic.

Millennial is a Canadian company listed on the Toronto Stock Exchange (TSX-V:MLP), the venture Market (OTCQB:MLPNF) and the Frankfurt Stock Exchange (Frankfurt:X0D). Millennial's board and management team have a successful track record of building and exiting resource companies, such as Millennial Lithium (TSXV-ML), Allana Potash (TSX:AAA) and Potash One (TSX:KCL).

The Mayumba Permit for the Banio Project, No. G5-595, is held by Mayumba Potasse SARL (Mayumba Potasse), a Gabonese registered company and 100% subsidiary of Equatorial Potash Pty Limited (Equatorial Potash). On 24th January 2023 Millennial entered into an option agreement with Equatorial Potash to acquire up to a 100% interest in Equatorial Potash.

Banio is a potash exploration project located in the south of the Gabonese Republic. A Mineral Resource Estimate (MRE) was released by Millennial on 16th January 2024 for the northern part of the Project area including 657 Mt of Indicated Resources at a grade of 15.9% KCl and 1,159 Mt of Inferred Resources at a grade of 16% KCl.

2.1 PURPOSE AND SCOPE OF REPORT

This Report is intended to be used by Millennial subject to the terms and conditions of its agreement with Micon. That agreement permits Millennial to file this Report as an NI 43-101 Technical Report with the Canadian Securities Administrators (CSA) pursuant to provincial securities legislation. Except for the purposes legislated under provincial securities laws, any other use of this Report, by any third party, is at that party's sole risk.

The conclusions and recommendations in this Report reflect the authors' best judgment in light of the information available to them at the time of writing. The authors and Micon reserve the right, but will not be obliged, to revise this Report and conclusions if additional information becomes known to them subsequent to the date of this Report. Use of this Report acknowledges acceptance of the foregoing conditions.

2.2 CAPABILITY AND INDEPENDENCE

Micon is an independent consultancy firm established over 30 years ago with senior geologists, mining engineers, metallurgists, and environmental specialists. The company has offices in the United Kingdom and Canada and full-time consultants in Moscow and France. All of Micon's professionals have extensive mining experience working with international mining companies and leading consulting firms.

Micon offers a broad range of consulting services to clients involved in the mining industry. The firm maintains a substantial practice in the geological assessment of prospective properties, the independent estimation of resources and reserves, the compilation and review of feasibility studies,

the economic evaluation of mineral properties, due diligence reviews and the monitoring of mineral projects on behalf of financing agencies.

Micon's practice is worldwide and covers all of the precious and base metals, the energy minerals (coal and uranium) and a wide variety of industrial minerals. The firm's clients include major mining companies, most of the major United Kingdom and Canadian banks and investment houses, and a large number of financial institutions in other parts of the world. Micon's technical, due diligence and valuation reports are typically accepted by regulatory agencies such as the London Stock Exchange, the US Securities and Exchange Commission, the Ontario Securities Commission, the Toronto Stock Exchange, and the Australian Stock Exchange.

Micon does not have, nor has it previously had, any material interest in Millennial or related entities or interests. The relationship with Millennial is solely a professional association between the client and the independent consultant. This Report is prepared in return for fees based upon agreed commercial rates and the payment of these fees is in no way contingent on the results of this Report.

This Report includes technical information which requires subsequent calculations or estimates to derive sub-totals, totals and weighted averages. Such calculations or estimations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, Micon does not consider them to be material.

2.3 PERSONNEL

This Report was prepared by or under the supervision of the Qualified Persons (QPs) listed below:

- Liz de Klerk, M.Sc., Pr.Sci.Nat., FIMMM, (QP); Micon Managing Director, Senior Geologist, and Project Manager and Qualified Person;
- Dr. Chris Gilchrist, Ph.D. (Eng.), CEng, FIMMM (QP); Micon Associate Mineral Processing Specialist; and,
- Dr. Biao Qiu, B.Sc., M.Sc., Ph.D., P.E., P.Eng. (QP); Micon Associate Solution Mining Specialist.

Additional professional contributors to the report include:

- Dr. Ryan Langdon, Ph.D., MCSM, MEarthSci, CGeol, FGS.; Micon Senior Resource Geologist;
- Ricardo Smith, M.Sc., MEng, ACGI; Micon Economic Mining Engineer;
- Dr. Mike Hardy, Ph.D., P.E.; Agapito Associates, Inc., Chairman of Board, Associate Solution Mining Specialist;
- Matt Ball, MSci, AAusIMM; Micon Junior Geologist, and,
- Sandra Stark, B.Sc., FGS; Micon Geologist.

Liz de Klerk, M.Sc., Pr.Sci.Nat., FIMMM who is a professional registered with the South African Council for Natural Scientific Professionals (SACNASP) has over 20 continuous years of exploration and mining experience in a variety of mineral deposit styles. Mrs. de Klerk has sufficient experience which is relevant to the style of exploration, mineralisation and type of deposit under consideration and to the activity which she is undertaking to qualify as a Qualified Person under the terms of NI 43-101.

Dr. Chris Gilchrist, Ph.D. (Eng.), CEng, FIMMM is a professional registered Chartered Engineer and Fellow with the Institute of Materials, Minerals and Mining (FIMMM) and has over 40 continuous years of exploration and mining experience in the potash industry. Dr. Gilchrist has sufficient experience which is relevant to the style of exploration, mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Qualified Person under the terms of NI 43-101.

Dr. Biao Qiu, B.Sc., M.Sc., Ph.D., P.E., P.Eng. is a registered Professional Engineer in Colorado and Saskatchewan, a Professional Member of the Association of Professional Engineers and Geoscientists of Saskatchewan and a Professional Licensee in Alberta. Dr. Biao has over 11 years of experience as a mining engineer and has provided services to solution mining projects in industrial minerals such as salt (halite), potash, trona, borate, and nahcolite. Dr. Biao has sufficient experience which is relevant to the style of exploration, mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Qualified Person under the terms of NI 43-101.

2.4 SITE VISITS

The Banio Project was visited between 21st and 22nd November 2023 by Mrs. Liz de Klerk and Dr. Chris Gilchrist to complete the NI 43-101 required site visits. The scope of the site inspection was to discuss and review general data acquisition procedures, sampling procedures including quality assurance/quality control (QA/QC), inspect the drill core storage area and drill core, visit historical drill pads, review the current infrastructure and discuss permits, and environmental and social issues. Mrs. de Klerk and Dr. Gilchrist were accompanied and hosted by Millennial CEO Mr. Jason Wilkinson.

During the site visit Mrs. de Klerk and Dr. Gilchrist viewed a diamond drill rig positioned on drill hole Ba-002. The drill rig is suffering from a breakdown so was not operating at the time of the site visit and will be re-positioned to Ba-001 once fixed. Mrs. de Klerk and Dr. Gilchrist also visited the planned position of Ba-004.

2.5 SOURCES OF INFORMATION

The key sources of information for this Technical Report include the previous technical reports listed below:

- CSA Global Pty Ltd (CSA Global) Appraisal of the Potash potential in the Banio Permit Gabon, CSA Report N^o: R324.2016 for Plymouth Minerals Limited, 20th December 2016;
- Technical Report on the Banio Potash Project, Mayumba Permit, Republic of Gabon, by ERCOSPLAN for Black Mountain Gold USA Corp., 3rd January 2023; and,
- Technical Report Initial Mineral Resource Estimate for the North Target of the Banio Potash Project, Mayumba Permit, Republic of Gabon, by ERCOSPLAN for Millennial Potash Corp., 20th February 2024.

Additional information was sought from Millennial and Micon personnel where required, all other sources referenced are listed in Section 28.0.

2.6 DISCLAIMER

Whilst Micon has reviewed the exploration and mining licences, permits and entitlements of the Project in so far as these may influence the investigation and development of the mining assets, Micon has not undertaken legal due diligence of the asset portfolio described in this Report. The reader is therefore cautioned that the inclusion of exploration and mining properties within this Report does not in any form imply legal ownership.

2.7 UNITS OF MEASUREMENT

Quantities are generally stated in SI units, as utilised by international mining companies. These include metric tonnes (t), million metric tonnes (Mt), kilogrammes (kg) and grammes (g) for weight; kilometres (km), metres (m), centimetres (cm) and millimetres (mm) for distance; cubic metres (m³), million cubic metres (M m³) litres (L), millilitres (ml) and cubic centimetres (cm³) for volume, square kilometres (km²) and hectares (ha) for area, weight percent (%) for potash grades and tonnes per cubic metres (t/m³) for density. All currency amounts are stated either in US dollars (US\$) or the Central African Communauté Financière Africaine (CFA) Franc.

A glossary and list of abbreviations are provided in Section 30.0.

3.0 RELIANCE ON OTHER EXPERTS

Micon has reviewed and analysed data provided by Millennial, its consultants and previous operators of the property, and has drawn its own conclusions therefrom, augmented by a direct field examination. Micon has not carried out any independent exploration work, drilled any holes, or carried out any sampling and assaying programmes.

Dr. Biao Qiu, is a Solution Mining Specialist at Agapito Associates, Inc. and the QP for Section 16.0 Mining Methods of this Report. Dr. Qiu has over 11 years' experience as a mining engineer and has provided services to solution mining projects in industrial minerals such as salt (halite), potash, trona, borate, and nahcolite. He is a Professional Engineer in Colorado and a Professional Member of the Association of Professional Engineers and Geoscientists of Saskatchewan. Dr. Qiu has sufficient experience which is relevant to the style of exploration, mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a QP under the terms of NI 43-101.

While exercising all reasonable diligence in checking, confirming, and testing it, Micon has relied upon Millennial's presentation of the Project data from previous operators and from Millennial's exploration experience at the Banio Potash Project in formulating its opinion.

Micon has not reviewed any of the documents or agreements under which Millennial holds title to the Project or the underlying mineral concessions and Micon offers no opinion as to the validity of the mineral titles claimed. A description of the properties, and ownership thereof, is provided for general information purposes only. The existing environmental conditions, liabilities and remediation have been described where required by NI 43-101 regulations. These statements also are provided for information purposes only and Micon offers no opinion in this regard.

The descriptions of geology, mineralisation, and exploration are taken from reports prepared by Millennial or their contracted consultants. The conclusions of this Report rely on data available in published and unpublished reports, available information from other companies that have conducted exploration on the property, and information supplied by Millennial. The information provided to Millennial was supplied by reputable companies and Micon has no reason to doubt its validity.

Some figures and tables for this Report were reproduced or derived from reports written by Millennial. Where the figures and tables are derived from sources other than Micon, the source is acknowledged below the figure or table.

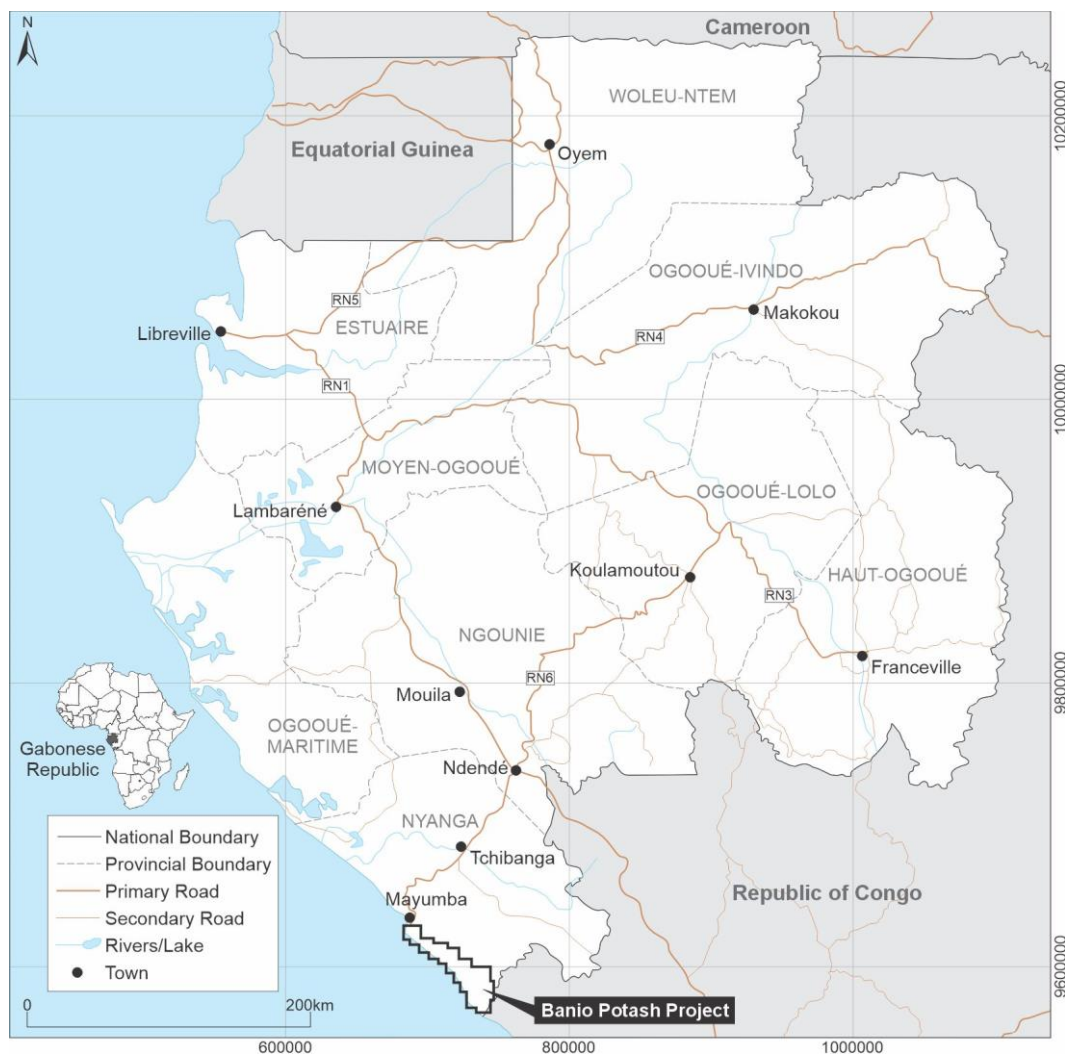
4.0 PROPERTY DESCRIPTION AND LOCATION

4.1 LOCATION

The Banio Project is a greenfields exploration stage potash project situated in the Nyanga Province in the southwest coastal region of the Gabonese Republic (Figure 4.1).

The 1,238 km² Exploration Permit (“Permis de recherches minières”) is located near the Atlantic coast of central Africa, immediately south of the equator, between latitudes 3°S and 4°S, and longitudes 10°E and 11°E (refer to Section 4.2.2).

Figure 4.1: Location Map of the Banio Potash Project



Source: Micon, 2024

4.2 LICENCES AND PERMITS

4.2.1 Property Title in the Gabonese Republic

Mining activities in the Gabonese Republic have been governed and regulated by *Law No. 037/2018* since 11th June 2019 (Journal Officiel de la République Gabonaise, 2019). This law was established

to stimulate the development of mining and to guarantee the property rights of both local and foreign investors. According to the law, the State owns all the mineral resources, but exploration and exploitation of these resources by private parties is permitted through different types of mining permits, which are granted by decrees. The permit holders have both rights and obligations, as defined by *Law No 037/2018*. For different commodities and scales of mining (artisanal, small-scale, large scale) the law defines different ways to obtain the mining rights. For a commodity like potash in the Gabonese Republic the mining rights are obtained in two stages:

1. The Exploration Permit (“Permis de recherches minières”) gives the holder exclusive prospecting and exploration rights in a defined area to unlimited depth for the mineral substances it is issued for. The maximum size for an exploration permit is 1,500 km². The permit is valid for three years and can be extended twice for a period of three years each time upon application by the holder. The operational aspects of the exploration (and also exploitation) activities are specified and formalised by a mining convention that is negotiated between the operator and the Ministry responsible for mining (Ministère de l'Industrie et des Mines). Depending on the results of the exploration activities carried out under the exploration permit, the permit holder shall have priority as regards to the granting of an exploitation permit for the mineral substances covered by the exploration permit. This requires that a feasibility study and an Environmental Impact Assessment (EIA) have been prepared and have been accepted by the ministries responsible for mining, economics and the environment.
2. The “large scale Exploitation Permit” (“le Permis d'Exploitation Minière à grande échelle”) gives the holder exclusive rights to carry out exploitation activities in an area defined by the licence, to an unlimited depth and in respect of those mineral substances for which the exploitation permit is granted. The validity of the permit depends on the lifetime of the project reported in the official feasibility study and is either 10 years, which can be extended upon request by the permit holder for a period of five years per extension, or 20 years which can be extended upon request by the permit holder for a period of 10 years per extension. When the licence expires and no request for extension is filed, a mine closure plan must be submitted. The operational modalities of the exploitation are specified and formalised by a mining convention that is negotiated between the operator and the Ministère de l'Industrie et des Mines.

At each stage of the mining rights acquisition process several steps are required (e.g. application, “publication”, registration/filing payments, notarisation, tax payments) before the application is converted to a permit. A full description of the process is documented in *Law No. 037/2018*.

The registration payments to obtain an Exploration Permit amount to 1.5 million Central African CFA francs with payments for the first extension amounting to 2.5 million Central African CFA francs and for the second extension 3.0 million Central African CFA francs. When the Exploration Permit is leased or sold to another company a payment of 10% of the transaction value is due. An annual payment of 1,000 Central African CFA francs/km² of the permit area is due every year during the first validity period of the permit, 3,000 Central African CFA francs/km² is due every year of the second validity period of the permit and 5,000 Central African CFA francs /km² is due every year of the third validity period of the permit.

The registration payments for a “Large Scale Exploitation Permit” depend on whether the permit has a validity of 10 years or 20 years amount to 15 or 30 million Central African CFA francs, respectively. For every extension of the permit registration payments of 30 or 60 million Central

African CFA francs, respectively. When the exploitation permit is leased or sold to another company a payment of 15% of the transaction value is due.

Annual payments based on the surface area of a Large Scale Exploitation Permit are due as listed in Table 4.1.

Table 4.1: Annual Payments Due for a “Large Scale Exploitation Permit” for the Original Validity Period and for Extension Periods

Area (km ²)	10 Year Validity		20 Year Validity	
	Initial 10 Year (CFA million)	Annually During 5 Year Extension (CFA million)	Initial 20 Year (CFA million)	Annually During 5 Year Extension (CFA million)
≤ 10	5.0	6.0	6.0	7.0
>10 ≤ 20	6.0	7.0	7.0	8.0
>20 ≤ 30	7.0	8.0	8.0	9.0
>30 ≤ 40	8.0	9.0	9.0	10.0
>40 ≤ 50	9.0	10.0	10.0	11.0
>50 ≤ 70	10.0	11.0	11.0	12.0
>70 ≤ 90	11.0	12.0	12.0	13.0
>90 ≤ 100	12.0	13.0	13.0	15.0
> 100	0.1 x area / in km ²		0.12 x area / in km ²	

Within a year after obtaining an Exploration or Exploitation Permit the owner has to sign a mining convention with the Ministère de l'Industrie et des Mines. The mining convention is valid for the time period of the permit and can be renegotiated for an extension.

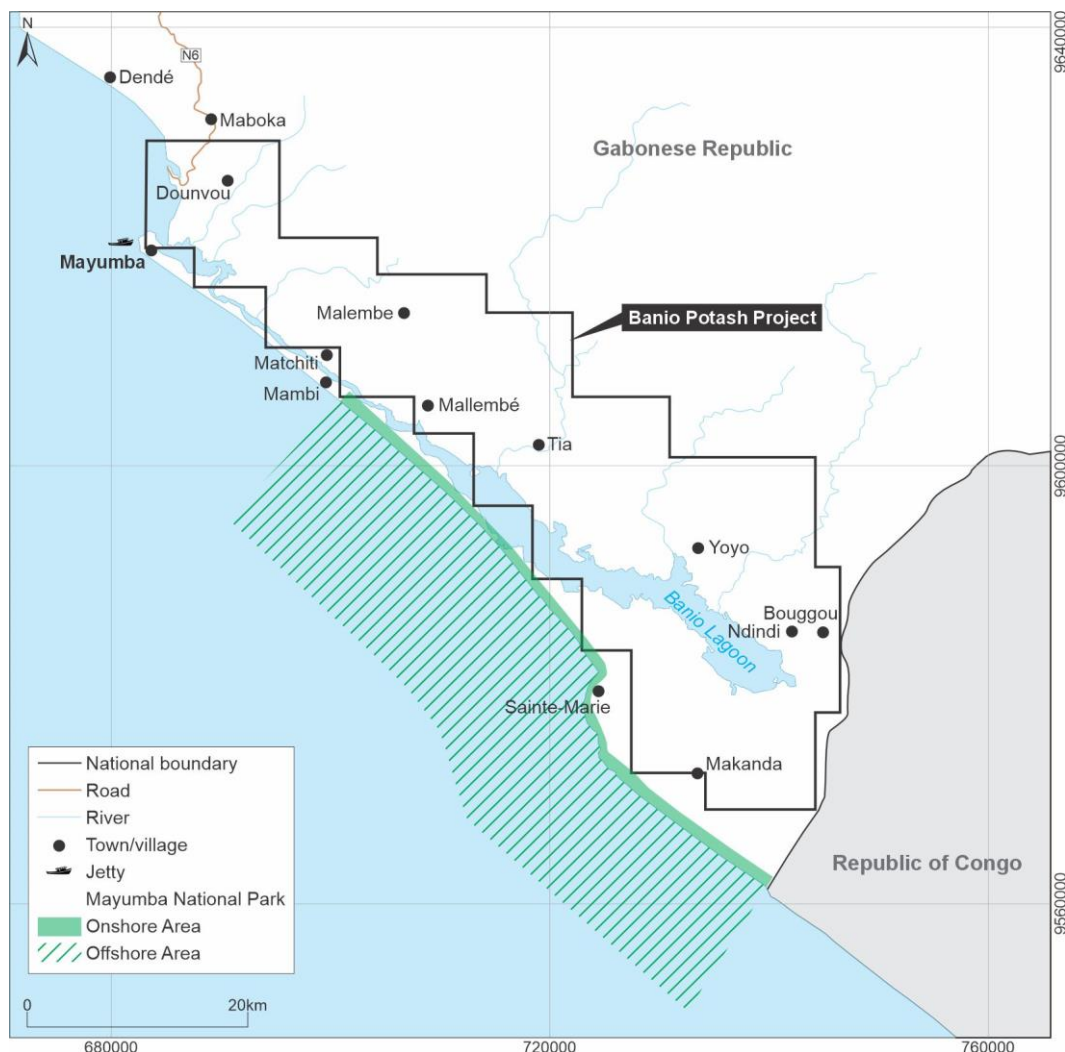
In the case of the Exploration Permit the mining convention describes the minimum obligations the owner of the permit has made regarding exploration work in the permit area as well as special legal, fiscal, economic, customs and financial conditions negotiated between owner and the Ministère de l'Industrie et des Mines. If the owner of the permit does not comply with the minimum obligations regarding the exploration work or within 12 months of signature of the convention, sanctions can be issued by the Ministère de l'Industrie et des Mines ranging from fines over reduction of the permit area to withdrawal of the permit.

In the case of a Large Scale Exploitation Permit the mining convention describes the investment schedule of the owner of the permit to construct the mine as well as special legal, fiscal, economic, customs and financial conditions negotiated between owner and ministry. This can also affect the free carried interest of 10% in the project that is stipulated in *Law No. 037/2018*. Sanctions can be issued by the Ministère de l'Industrie et des Mines when the exploitation development work has not started 48 months after signature of the mining convention and range from fines to withdrawal of the permit.

4.2.2 Banio Exploration Permit

The Banio Project comprises an exclusive Exploration Permit (“Permit” or “licence”) for potash salts and associated salts. The licence covers a combined area of approximately 1,238 km² (Figure 4.2) The apices of the licence area are provided in Table 4.2.

Figure 4.2: Location Map of the Banio Project Exploration Permit



Source: Micon, 2024

The exclusive mineral exploration rights for potassium and associated salts within permit No. G5-595, was awarded to Mayumba Potasse, 100% owned by Equatorial Potash, a 100% subsidiary of Plymouth Minerals Limited (Plymouth) by Presidential Decree No. 0161/MMI/SG/DGPEM/DCMAE on 23rd February 2016. Plymouth was notified that grant of tenure covering the Banio Project was approved by the Gabonese Minister of Mines on 23rd April 2016, which was then renewed by Ministerial Decree No. 0006/MPMG/SG/DGMG/DLMEM on 4th February 2022. Mayumba Potasse is a company registered in the Gabonese Republic whose only asset is the Mayumba Permit.

Millennial has entered into an option agreement with Equatorial Potash to acquire up to a 100% interest in Equatorial Potash.

Table 4.2: Banio Exploration Permit Apices

Apex No.	Longitude	Latitude	WGS_84_East (m)	WGS_84 North (m)	Zone
A	10.65	-3.35	683,317	9,629,566	WGS84_32S
B	10.76	-3.35	695,542	9,629,545	WGS84_32S
C	10.76	-3.43	695,526	9,620,698	WGS84_32S
D	10.84	-3.43	704,417	9,620,681	WGS84_32S
E	10.84	-3.46	704,410	9,617,363	WGS84_32S
F	10.93	-3.46	714,412	9,617,343	WGS84_32S
G	10.93	-3.49	714,406	9,614,025	WGS84_32S
H	11.00	-3.49	722,185	9,614,009	WGS84_32S
I	11.00	-3.56	722,168	9,606,267	WGS84_32S
J	11.08	-3.56	731,059	9,606,247	WGS84_32S
K	11.08	-3.61	731,046	9,600,717	WGS84_32S
L	11.20	-3.61	744,382	9,600,686	WGS84_32S
M	11.20	-3.70	744,358	9,590,730	WGS84_32S
N	11.22	-3.70	746,581	9,590,725	WGS84_32S
O	11.22	-3.82	746,547	9,577,451	WGS84_32S
P	11.20	-3.82	744,325	9,577,456	WGS84_32S
Q	11.20	-3.90	744,302	9,568,607	WGS84_32S
R	11.11	-3.90	734,303	9,568,633	WGS84_32S
S	11.11	-3.87	734,311	9,571,951	WGS84_32S
T	11.05	-3.87	727,645	9,571,967	WGS84_32S
U	11.05	-3.77	727,672	9,583,028	WGS84_32S
V	11.01	-3.77	723,228	9,583,038	WGS84_32S
W	11.01	-3.71	723,243	9,589,674	WGS84_32S
X	10.97	-3.71	718,798	9,589,684	WGS84_32S
Y	10.97	-3.65	718,813	9,596,320	WGS84_32S
Z	10.92	-3.65	713,257	9,596,332	WGS84_32S
AA	10.92	-3.59	713,271	9,602,968	WGS84_32S
AB	10.87	-3.59	707,715	9,602,980	WGS84_32S
AC	10.87	-3.56	707,722	9,606,297	WGS84_32S
AD	10.81	-3.56	701,055	9,606,311	WGS84_32S
AE	10.81	-3.52	701,064	9,610,734	WGS84_32S
AF	10.75	-3.52	694,396	9,610,747	WGS84_32S
AG	10.75	-3.47	694,407	9,616,276	WGS84_32S
AH	10.69	-3.47	687,739	9,616,288	WGS84_32S
AI	10.69	-3.44	687,745	9,619,606	WGS84_32S
AJ	10.65	-3.44	683,300	9,619,614	WGS84_32S

4.2.3 Royalties and Taxes

For an Exploration Permit no special royalties or taxes are due beyond what has been described in Section 4.2.1. Royalties and taxes are due to the Gabonese Government during commercial production, requiring a Large-Scale Exploitation Licence. These consist of:

- A levy of between 5% and 10% on the gross value of the product, less processing, transportation and insurance costs (mining royalties), to be settled in the mining convention; and,

- A 30% tax on the income of the company. The amount of corporate tax to be paid is affected by a number of items that have to be negotiated in the mining convention.

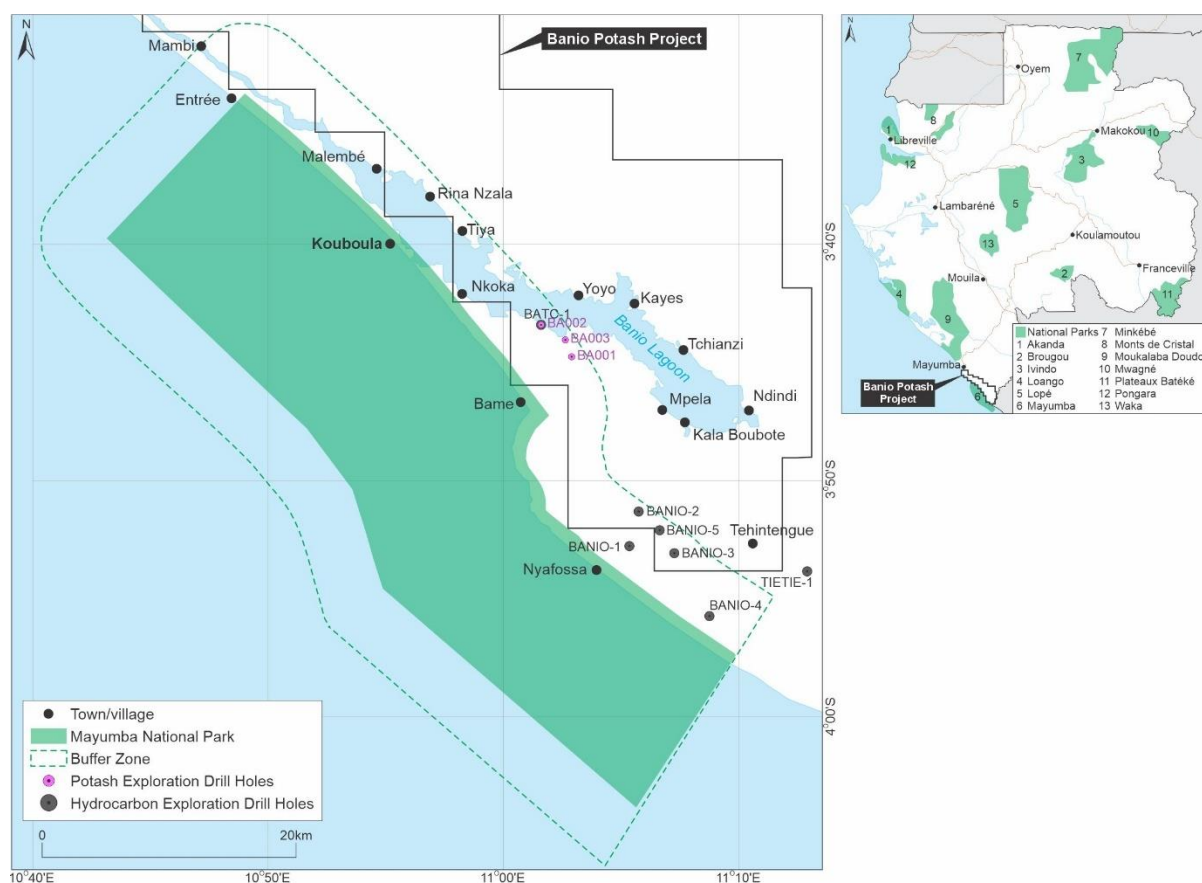
To obtain a Large-Scale Exploitation Licence, a mining convention has to be negotiated with the Gabonese Government. This convention can regulate, for example, the percentage of free carried interest that the Gabonese Government attains in the project (10% according to *Law No. 037/2018*, but negotiable), and what further percentage in the Company the Gabonese Government may obtain as any other investor. It is also used to negotiate a relation between income tax and royalties (income tax not below 25% and royalty not below 5%) as well as eventual tax exemptions for the Company during construction and initial operation.

Further royalties and taxes due are not known to the author of this Report.

4.2.4 Environmental Permits, Liabilities

The Banio Project is situated along the coast of the Gabonese Republic, with a portion of the permit area falling within the Mayumba National Park and the buffer zone around the park (Figure 4.3). The Mayumba National Park is comprised of a sea coastal area, a thin tongue of beach dunes, savannah and rain forest. The offshore area of coastal sea is 15 km by 60 km and the onshore area of beach and dunes is 1 km by 60 km.

Figure 4.3: Mayumba National Park and the Mayumba Permit



Source: Micon, 2024

Millennial complies with the requirements allowing access to the surface without restriction assuming adherence to the mining *Law No. 037/2018* as well as with *Law No. 007/14* dated 1st August

2014 (Journal Officiel de la République Gabonaise, 2014) regarding the protection of the environment of the Gabonese Republic. Millennial will need to engage environmental consultants to manage the preparation of Environmental Impact Assessments (EIA) for the exploration programme according to *Law No. 007/14* regarding the protection of the environment of the Gabonese Republic.

The EIA, completed by Plymouth/Mayumba Potasse and accepted by the Gabonese Government in 2017, remains in effect allowing the planned exploration activities to continue on the Project. For Phase 2 drilling further south Millennial may need a new EIA (see Section 20.7).

5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 ACCESSIBILITY

The Banio Project is located approximately 650 km to the southwest of Libreville, the capital city of the Gabonese Republic in the Nyanga Province (Figure 5.1). The licence area stretches approximately 78 km along the Atlantic Coastline starting adjacent to the small port of Mayumba and ending on the border with the Republic of Congo. Mayumba is 66 km from Tchibanga, the Nyanga provincial capital.

Figure 5.1: Road Network and Access to the Banio Project

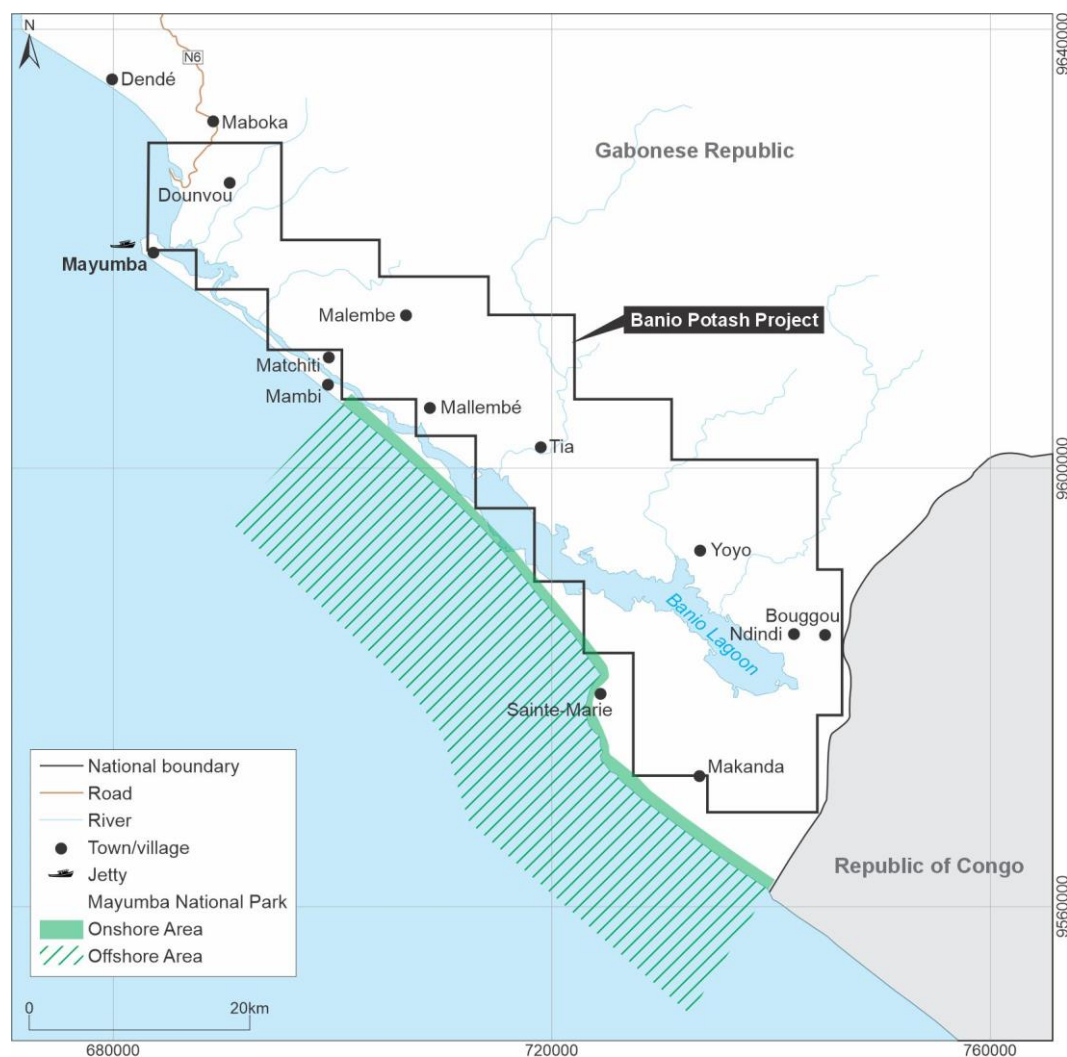


Source: Micon, 2024

Access to the Banio Project is via the 650 km dual-lane bitumen/gravel RN1 and gravel RN6 roads from Libreville towards Lambaréné and Ndendé which terminate in Mayumba, northwest of the permit area. Ongoing access to the Banio Project from Mayumba is either via gravel tracks leading

to the Banio oil production centre of Maurel & Prom and then into the property area or alternatively, the area can be accessed via small boat along the Banio Estuary that feeds the Banio Lagoon (Figure 5.2). The road access is controlled and limited by the park rangers of the Mayumba National Park, who restrict the use of the unpaved tracks that run parallel to the ocean along the southwest boundary of the Banio licence. Boat is the preferred option to access the exploration site in the southern area of the Banio Project. The 2,831 km² Nyanga-Mayombé oil production centre owned by Maurel & Prom is currently on care and maintenance.

Figure 5.2: Close Up View of the Banio Project and Infrastructure



Source: Micon, 2024

It is also possible to access the southern part of the Banio licence by car from the city of Pointe-Noire in the southwest of the Republic of Congo, located 300 km to the southeast (Figure 5.1). However approximately 250 km of the route is made up of unpaved roads, that whilst passable in the dry season with a 4 x 4 vehicle, in the wet season access is often impossible. In addition, this southern route involves two ferry crossings.

On the Banio property itself the only roads are those that have been created by various exploration activities. This comprises a network of dirt roads that connect the historical hydrocarbon holes and now the new Millennial drill holes and exploration camp. In the southwest of the licence area there is a further network of dirt roads near the village of Ndindi.

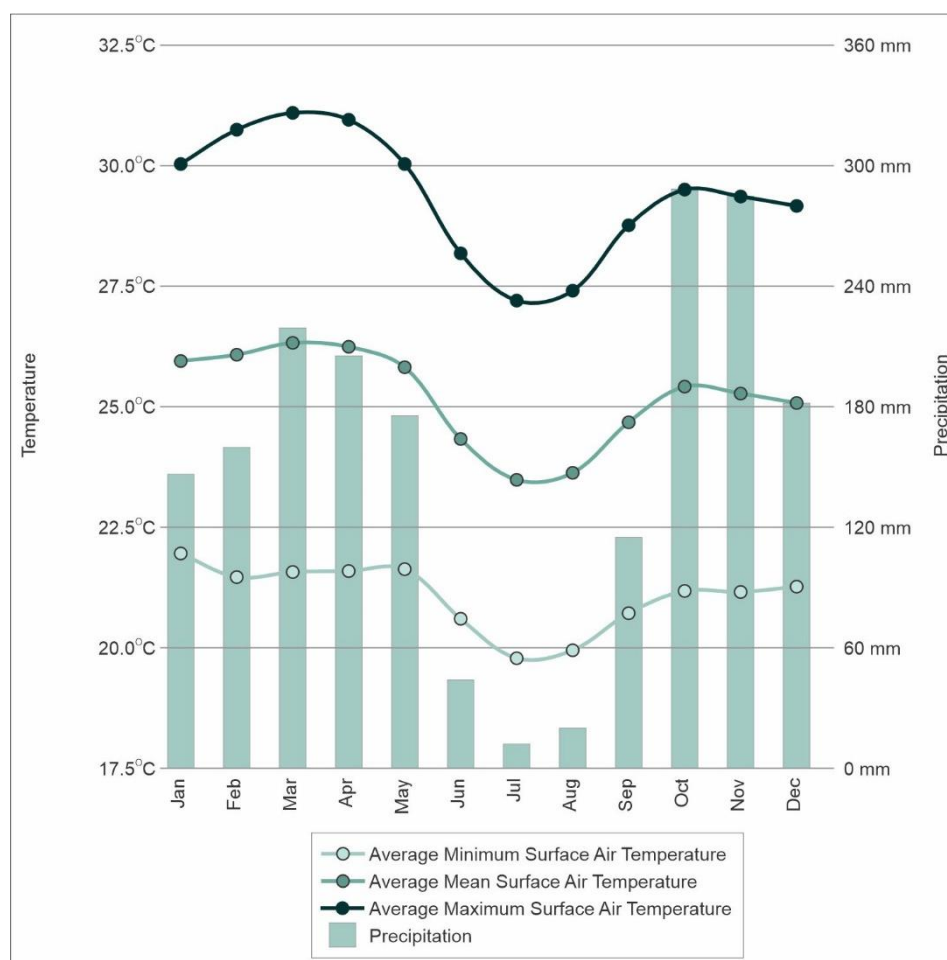
Libreville, the capital of the Gabonese Republic, has several direct international flights from Europe and several African capitals daily. The town of Mayumba has a sealed air strip, however no regular flights. Pointe-Noire is also serviced by several direct international flights from Europe and Africa.

Currently Mayumba has small ports however, there have been recent plans to significantly extend the Mayumba port to facilitate export of resources from the area (see Section 5.4).

5.2 CLIMATE

The Banio Project is located in the Congo coastal basin which has a tropical climate characterised by high humidity and a hot climate. Temperatures are high and remain relatively constant throughout the year, averaging 25°C to 27°C in coastal lowlands and 22°C to 25°C inland. The dry season occurs from mid-May until mid-October with virtually no precipitation. The wet season is from mid-October until mid-May with an average precipitation of >150 mm per month, mostly falling as short, but strong showers. The average air temperatures and precipitation for the Gabonese Republic are shown in Figure 5.3.

Figure 5.3: Gabonese Republic Climate Data



Source: <https://climateknowledgeportal.worldbank.org/country/gabon/climate-data-historical>

During the wet season some mitigation measures may be required to allow continued access to the Banio Project area, especially for heavy equipment.

5.3 LOCAL RESOURCES

The Banio Project is remote and to undertake exploration work it will be necessary to have nearly all the technical equipment and personnel available at the site. An independent exploration camp has previously been constructed and run by Mayumba Potasse between 2017 and 2018 in the southern part of the Banio Project. This camp has been modernised and refurbished to support the ongoing exploration work.

A mobile phone connection covers large parts of the northern part of the Mayumba property, however limited mobile phone connection exists in the southern part of the property. There are mobile phone towers in nearby villages in the south that can eventually be upgraded to allow mobile phone connection to cover most of the property, including access to the internet. For emergency back-up a satellite telephone connection has been installed.

5.3.1 Water

Millennial is planning to access water from the adjacent freshwater lagoon for exploration purposes in the immediate future and for processing needs in the long term which will require a permit. This needs to be verified.

5.3.2 Energy

5.3.2.1 Gas and Oil

The Republic of Gabon is ranked among the top 10 petroleum-producing countries in Africa, producing from several onshore and offshore oil and gas fields. The Banio Project area lies above a significant natural gas field complex (Maurel & Prom (Figure 5.4) and adjacent to the large M'Bayo Nord Marine gas field (Perenco) which lies directly offshore and has energy infrastructure that can readily supply natural gas.

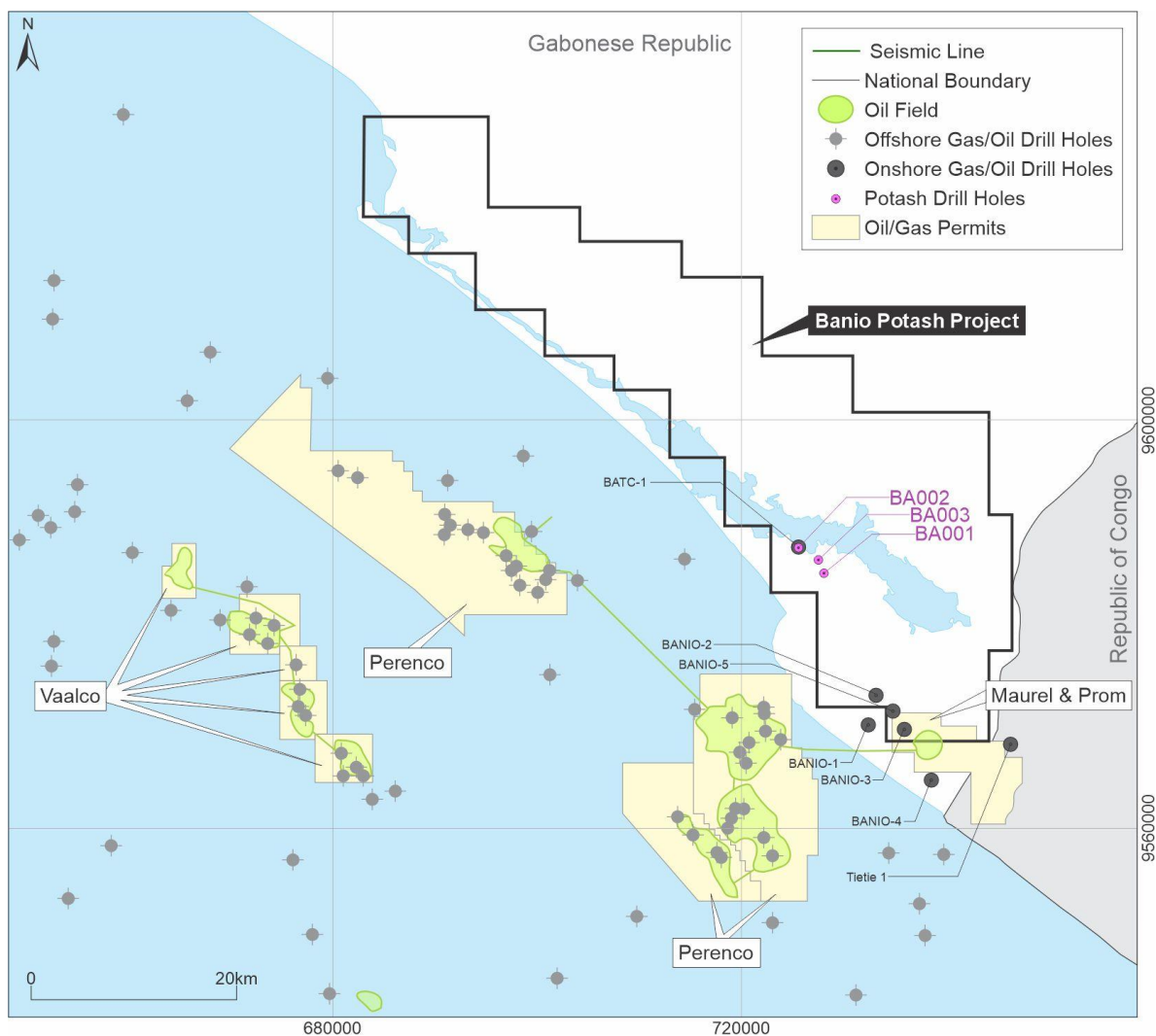
For an eventual exploitation stage project, energy will be a major requirement. Construction of a natural gas pipeline is now underway connecting the town of Mayumba with the adjacent oil and natural gas fields located just offshore. Connection to the natural gas pipeline from the landing terminal onshore will be required to support the potash operation. Natural gas can be used for co-generation of steam and electrical power as well as for drying of the product.

The Gabonese Government, Perenco Oil & Gas Gabon (Perenco), and the Gabon Power Company have signed a memorandum of understanding for the development of a 21 megawatt (MW) power plant to be powered by natural gas, and the installation of a gas collection network and treatment facility, with a 32 km gas pipeline to the town of Mayumba. Combined with the commitment of the Gabonese Government through its Grande Mayumba partnership for port construction this will significantly improve the infrastructure of the area.

5.3.2.2 Electricity

A small electrical supply will be required for some pieces of equipment on-site for exploitation such as water pumps, workshops, monitoring equipment and lighting, which will be supplied from the plant site power station by overland cable.

Figure 5.4: Oil Fields and Wells in and Adjacent to the Banio Project Area



Source: Micon, 2024

5.3.3 Human Resources

The town of Mayumba, with a population of around 5,000 people, and the nearby villages have previously provided labourers for the exploration work. Technical personnel will have to come from either Port Gentil (~136,500 people) or Libreville (~704,000 people) and for specialised tasks expatriate personnel will need to be brought in. Food and fuel can be obtained locally in Mayumba or from the provincial capital Tchibanga (~24,000 people), however most materials as well as spares for equipment will have to come from Libreville or out of country.

5.4 INFRASTRUCTURE

The current infrastructure within or nearby the Project is sufficient to support ongoing exploration activities. An independent exploration camp previously existed that was constructed and run by Mayumba Potasse between 2017 and 2018 in the southern area of the Mayumba Project. This camp has been modernised and refurbished to support the ongoing exploration work. Figure 5.5 presents the potential infrastructure of the Banio Project.

Figure 5.5: Potential Infrastructure of the Banio Project



Source: Micon, 2024

Even though it is not yet clear whether and where a plant will be constructed, shipment of the final product (several 100,000 t/a to 1 Mt/a), will require the construction of adequate port facilities near Mayumba. The existing plans for port expansion (Section 5.3.2.1) should be re-discussed to ensure that there is an adequate place for a potash facility and mooring for Handymax 45 kt to 55 kt vessels with a draft of 10 m to 12 m preferable. This is in line with the proposed Phase 2a port construction. Millennial may need to build their own barges and will need to adopt the Cleveland Cascade for loading.

Port alternatives include a deep-water port with a 14 m draft which is being considered by the Government (secured initial funding for the work); or a long jetty out into the ocean that would need a 3 m draft and then barge.

5.5 PHYSIOGRAPHY

The Banio Project can be divided into two areas. The southwest area consists mainly of low-lying sand ridges (maximum circa 30 metres above sea level (masl), up to 3 km wide, which separate the lagoon from the Atlantic Ocean. This area is relatively flat, swampy in places and is covered with primary jungle dotted with areas of open grassland clearings that may reach a few 100 m² in size (e.g. the camp area, Figure 5.5). The northeast and eastern areas of the Banio Project rise relatively steeply to a maximum of approximately 85 m from the south and then slope gradually towards the northeast to elevation levels of around 40 m. This sloped area is intersected by steep sided and sometimes deep gullies at between 20 masl to 30 masl.

The fauna of the area reportedly consists of large mammals including elephant, gorilla, chimpanzee, hippopotamus, and antelope, in addition to numerous small mammals, reptiles and birds. In the swampy parts of the property small amphibians can also be found. Figure 5.6 presents site visit photos.

Figure 5.6: Site Visit Photos

A Barge Accessing the Shore of the Banio Lagoon



Looking from the Banio Shore Towards the Lagoon, Showing the Easy Access



One of the Clearings on the Access Road from Mayumba to the Mine Site



Example of Some of the Poor Conditions of the Access Road



Example of the Forest Density Away from the Road



A Clearing Created by Millennial for Infrastructure/Drilling



Source: Millennial and Micon, 2023

6.0 HISTORY

6.1 INTRODUCTION

Potash was discovered in the coastal Gabonese-Congolese Basin during oil prospecting in the Gabonese Republic in 1935. In the early 1950s, the Société Petrolière de l'Afrique Française Equatoriale (SPAFE) a predecessor company to Elf Aquitaine, was granted the Mabora petroleum concession in an area around the town of Lambaréné. In 1954, SPAFE drilled hole Mabora Mamana-1 (MM-1) near Lake Azingo targeting oil below the salt layers. The MM-1 drill hole encountered the first ever indication of potash mineralisation in central West Africa by intersecting a high grade sylvinite potash seam that reportedly graded 29% K₂O. Several more holes were drilled also intersecting potash, however, potash exploration and hydrocarbon exploration concentrated on the Congo coastal basin further to the south.

6.2 HISTORICAL OWNERSHIP

The exclusive mineral exploration rights for potassium and associated salts within permit No. G5-595, "Banio" was awarded by Presidential Decree No. 0161/MMI/SG/DGPEM/DCMAE dated 23rd February 2016 to Mayumba Potasse SARL (Mayumba Potasse). There is no public information available about the ownership of the Mayumba Permit for potash and related salts prior to the ownership of Mayumba Potasse.

Mayumba Potasse is a company registered in the Gabonese Republic whose only assets are the No. G5-595 Mayumba Permit. Mayumba Potasse is a subsidiary of Equatorial Potash Pty. Limited (Equatorial Potash). On 16th March 2016 Equatorial Potash was acquired by Plymouth Minerals Limited (Plymouth) and became an 100% owned subsidiary.

Plymouth/Mayumba Potasse was notified that grant of tenure covering the Banio Potash Project was approved by the Gabonese Minister of Mines on 23rd April 2016, decree No. 0161/MMI/SG/DGPEM/DCMAE, Arete No. 161. This was then renewed on 4th February 2022 under Ministerial Decree No. 0006/MPMG/SG/DGMG/DLMEM.

Black Mountain Gold USA Corp. (Black Mountain) entered into a binding MOU with Equatorial Potash on 5th September 2022, the agreement was fully executed on 24th September 2022.

Black Mountain Gold USA Corp. became Millennial Potash Corp. (Millennial) on 25th January 2023.

Millennial can acquire a 100% interest through staged cash payments, Millennial share payments and by making minimum work expenditures on the Banio Project as outlined in Table 6.1. The initial payment on the signing of the MOU, the second payment on the signing of the Definitive Agreement and the third payment based on completion of the Resource Estimate, have been made. Millennial has now earned a 51% interest of Equatorial Potash.

The mining convention between Mayumba Potasse and the Gabonese Government of 2017, remains in effect allowing the exploration activities planned by Millennial (Section 9.0) to continue on the Project.

The Banio Exploration Permit was awarded for an initial period of three years, and was renewed for a further three years on 4th February 2022. The licence was deemed on hold during 2020 and 2021 due to the COVID 19 pandemic which saw the Gabonese Republic enter strict lock down.

Table 6.1: Millennial Share Payments and Project Ownership with Minimum Exploration Expenditures for the Different Project Development Phases

Milestone	Cash	Shares	Minimum Exploration Expenditure (US\$)	Earned Ownership in Project (%)
Signing of the MOU (paid)	CD\$25,000	0	-	-
Signing and TSXV approval of the definitive agreement (paid)	US\$257,000	650,000	-	25
Resource Estimate completion of Phase 2 drilling - #1 (paid)	US\$150,000	550,000	2,500,000	51
Resource Estimate completion of Phase 2 drilling - #2	US\$150,000	-	-	-
Completion of PEA/Scoping Study	US\$300,000	1,000,000	1,500,000	70
Completion of Phase 3 drilling, revised Resource Estimate	US\$500,000	1,500,000	3,000,000	-
Completion of Feasibility Study	US\$3,000,000	2,500,000	5,000,000	100
Total	US\$4,375,750	6,200,000	12,000,000	100

6.3 HISTORICAL EXPLORATION AND RESOURCES

6.3.1 Seismic Surveys

2D seismic surveys which were carried out in the 1970's, 1990's and 2011/2012. Although it can be established from historic reports that seismic exploration was carried out on the older Banio wells in the 1970's, this data is not available. The available seismic data was collected in three different campaigns: BAN90 (1990's), TMB90 (1990's) and MNPM11 (2011/2012) (Figure 9.1). The full available dataset is comprised of 34 lines, spaced broadly on a 2.5 km by 3.5 km grid, with a combined length of approximately 411 km, spanning an area of approximately 600 km² across the southern part of the licence area.

The surveys from the BAN90 and TMB90 campaigns have been Pre-Stack Time Migrated, as indicated by the PTSM suffix on their filenames. There is no PTSM suffix on the MNPM11 campaign survey files, but the stacks look similar so it can be inferred that they have also been migrated (ERCOSPLAN, 2022).

The available seismic data has been interpreted on two separate occasions, firstly by CSA Global, as outlined in their 2016 report and later in 2023 by SW Geophysics Limited, under the instruction of Millennial.

For further details on the seismic surveys see Section 9.1.1.

6.3.2 Drilling 1972 to 2017

The Banio Project Area is at an early stage of assessment, based on the absence of any potash production. The closest historical production of potash occurred approximately 130 km to the south at the St Paul potash mine at Holle (~25 km from Pointe Noire in the Republic of Congo, Figure 5.1). The potash deposits in the Banio Project Area are subsurface deposits, therefore there are no outcrops in the Project area. The only historical data available for an initial evaluation is the existing drill hole data compiled during oil and gas exploration which consisted of geophysical logs, summary geological logs, some oil well completion reports, and 2D seismic survey data and maps.

Originally within the permit area there were no drill holes drilled (1972 to 2010) for the sole purpose of potash exploration however, the Banio-2 oil well was cored at five depth intervals through the salt formation and a complementary study of the salt composition and potash potential was conducted. The Banio-1 to Banio-5 drill holes and the BATC-1 hole were drilled for the purpose of oil and natural gas exploration and gamma logs were used for stratigraphic correlation and petroleum source/reservoir property interpretation.

In 2017 three potash exploration drill holes (Ba-001 to Ba-003) were drilled by Mayumba Potasse in order to better define the sylvinite mineralisation (Table 6.1 and Figure 6.1)

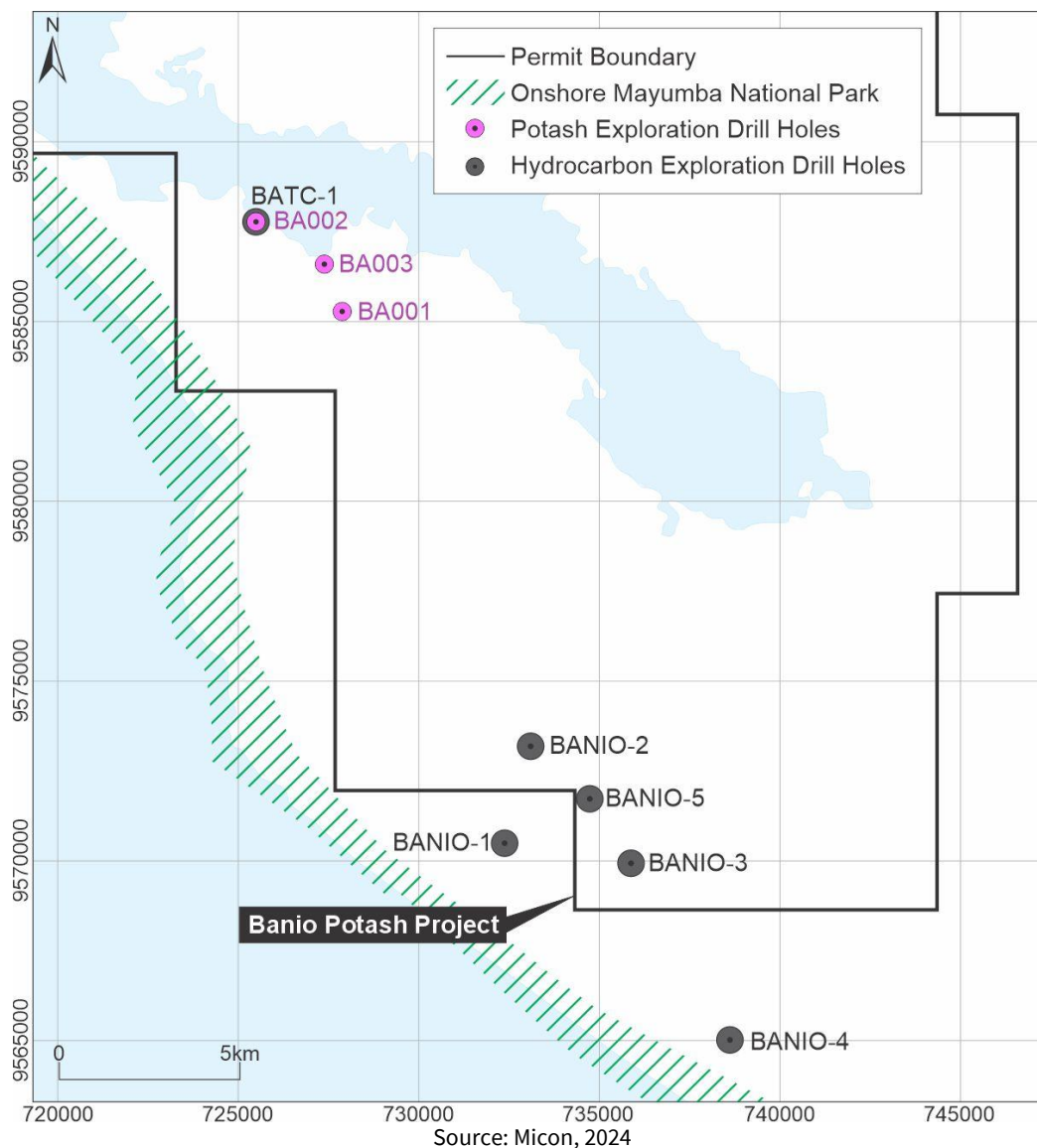
Table 6.1 summarises the details of the drilling completed between 1972 and 2017 and the drill hole locations are illustrated in Figure 6.1.

Table 6.2: Summary of Historic Exploration Drill Hole Data in the Banio Area (1972 – 2017)

Year	Drill Hole No.	Easting	Northing	Elevation (m)	Depth (m)	Owner	Exploration Purpose
1972	Banio-1	732,483.8	9,570,340	50	2,800	Elf Gabon	Hydrocarbon
1975	Banio-2	733,198.1	9,573,157	47	2,477	Elf Gabon	Hydrocarbon
1977	Banio-3	735,989.5	9,569,811	70	1,997	Elf Gabon	Hydrocarbon
1978	Banio-4	738,680.9	9,564,872	38	1,978	Elf Gabon	Hydrocarbon
2010	Banio-5	734,865	9,571,623	47	1,843	Maurel & Prom	Hydrocarbon
1991	BATC-1	725,636.9	9,587,646	12	903	Elf Gabon	Hydrocarbon
2017	Ba-001	727,893	9,585,295	5	368	Mayumba Potasse	Potash
2017	Ba-002	725,483	9,587,774	6	516.3	Mayumba Potasse	Potash
2017	Ba-003	727,379	9,586,599	5	528	Mayumba Potasse	Potash

Further information on the historical drilling is detailed in Section 10.2.

Figure 6.1: Historical Drill Holes Completed Between 1972 and 2017



6.3.3 Historical Mineral Resources

6.3.3.1 CSA Global (2016)

In 2016 initial Exploration Targets were generated by CSA Global (2016) by using a study of the available drill hole, geophysical and seismic data from 1972 to 2012 which they produced for the then owner of the Banio Project, Plymouth Minerals.

CSA Global (2016) concluded that the technical information available at the time was sufficient to support Exploration Targets for sylvinite and carnallite-type mineralisation. The targets were estimated based on data availability, data interpretation and knowledge of the mineral system in the Banio Project area. It was inferred that within the northern part of the studied Project area there is the potential for a syit doeslvinite-type Exploration Target in the uppermost potash interval and a carnallite-type Exploration Target in the lower potash intervals (Table 6.3).

Table 6.3: CSA Global Exploration Target Details

Area	Target Type	Area of Influence (2.5 km Radius)	Area of Influence (3.5 km Radius)	Thickness Minimum (m)	Thickness Maximum (m)	Estimated Grade Range (K ₂ O/KCl)	Tonnage Range (Mt)
Northern Target	Sylvinite	2.5	3.5	-	2.90	18% to 22% K ₂ O	262 to 415
	Carnallitite	-	3.5	15	25	12% to 14% K ₂ O	2,600 to 5,200
Southern Target	Carnallitite	-	3.5	15	27	12% to 14% K ₂ O	3,100 to 4,800

Millennial is not treating the historical Exploration Targets reported by CSA Global (2016) as a current estimate.

6.3.3.2 Infinity (2018)

The Infinity Lithium Corporation (Infinity) produced an Inferred Mineral Resource Estimate in 2018 in accordance with the guidelines of the JORC Code (2012) (Table 6.4). The Inferred Mineral Resources totalled 1,673.6 Mt at an overall grade of 16.1% KCl.

Infinity used the historical drilling and seismic data that was utilised to create the Exploration Target by CSA Global in 2016 and the new drill data that was obtained from drilling three new purpose-drilled potash exploration holes in the southern portion of the licence area by Mayumba Potasse in 2017; Ba-001, Ba-002 and Ba-003. The drilling data, details and locations of these three holes are provided in Section 10.2.2.

The drill hole data from Ba-002 and Ba-003, which are located approximately 2.2 km apart, were used for the Mineral Resource estimation. The drill holes were orientated vertically and therefore intersected the flat-lying salt sequence at right angles. Combined with the support of the seismic data and interpretations, Infinity deemed the data spacing sufficient to establish geological and grade continuity appropriate for Mineral Resource estimation.

Table 6.4: Infinity Inferred Mineral Resources at a Cut-Off of 12% KCl as at 23rd October 2018

Cycle	Dominant Mineralogy	Thickness (m)	KCl (%)	Density (t/m ³)	Geo Loss (%)	Tonnage (Mt)
5	Carnallitite	7.19	12.5	1.86	10	176.6
	Carnallitite	4.80	13.9	1.83	10	116.2
	Carnallitite	9.38	15.3	1.80	10	223.2
4	Sylvinitite	5.25	25.3	1.59	50	30.7
	Carnallitite	5.19	15.3	1.80	10	123.4
	Carnallitite	7.25	17.4	1.76	10	168.4
3	Carnallitite	12.79	16.1	1.78	10	301.7
	Carnallitite	7.41	18.5	1.73	10	169.7
2	Carnallitite	7.78	15.2	1.80	10	185.3
	Carnallitite	7.32	13.1	1.84	10	178.4
Total			16.1	1.79	-	1,673.6

Notes:

1. Mineral Resources stated as at 23rd October 2018.
2. The cut-off grade of 12% KCl and minimum reported thickness of 4.80 m is based on reasonable prospects for eventual economic extraction by in-situ leach extraction.
3. The Mineral Resource thickness is estimated from average drilling widths per seam.
4. The lateral extent of the Mineral Resource is constrained by a 1,600 m radius from Ba-002 and Ba-003, and is supported by seismic survey data.
5. Density is estimated from the grade vs. density relationship at the Kola Potash Deposit.
6. All tabulated data have been rounded and as a result minor computational errors may occur.
7. Mineral Resources which are not Ore Reserves have no demonstrated economic viability.
8. $KCl = K_2O \times 1.58$.

Millennial is not treating the historical Inferred Mineral Resources reported by Infinity (2018) as a current estimate.

6.3.4 Historical Mineral Reserves

There has been no historical Mineral Reserves reported for the Banio Project Area.

6.3.5 Historical Production

There has been no historical production within the Banio Project Area as the project is still at the exploration stage.

7.0 GEOLOGICAL SETTING AND MINERALISATION

7.1 REGIONAL GEOLOGY AND MINERALISATION

The Banio Project is predominantly located within the Congo Basin. The Congo Basin is part of the equatorial West African Aptian salt basin that extends from Cameroon to Namibia and includes the Douala, Kribi-Campo, Rio Muni, Gabon, Congo, Kwanza, Benguela, and Namibe Basins (Figure 7.1). The basins were grouped together as they share common structural and stratigraphic characteristics. Separate basins of the Aptian salt basin are delimited by east-west-trending faults and other structural arches and highs related to syn-rift tectonics (Brownfield & Charpentier, 2006), 2006). The basins crop out for 20 km to 80 km width onshore and extend for 100 km to 300 km offshore (Pedley A, et al., 2016).

Figure 7.1: Map Showing the Approximate Locations of the Congo Basin in Relation to the Aptian Salt Basin Included in the West-Central Coastal Province



Source: Micon, modified from Brownfield and Charpentier (2006).

Note: The West-Central Coastal Province is an area of oil and gas exploration and exploitation that includes the Aptian salt basin. The western limit of the province was set at 4,000 m water depth.

The Congo Basin is part of the passive continental margin of West Africa that formed during the Late Jurassic to Early Cretaceous breakup of Gondwana (North America, South America, and Africa), (Brownfield & Charpentier, 2006); (Chen, et al., 2013). It is sited on the eastern margin of the pre-Atlantic continental rift basin and is stratigraphically similar to the Sergipe-Algoas Basin of Brazil on the western margin, where potash has been mined for decades.

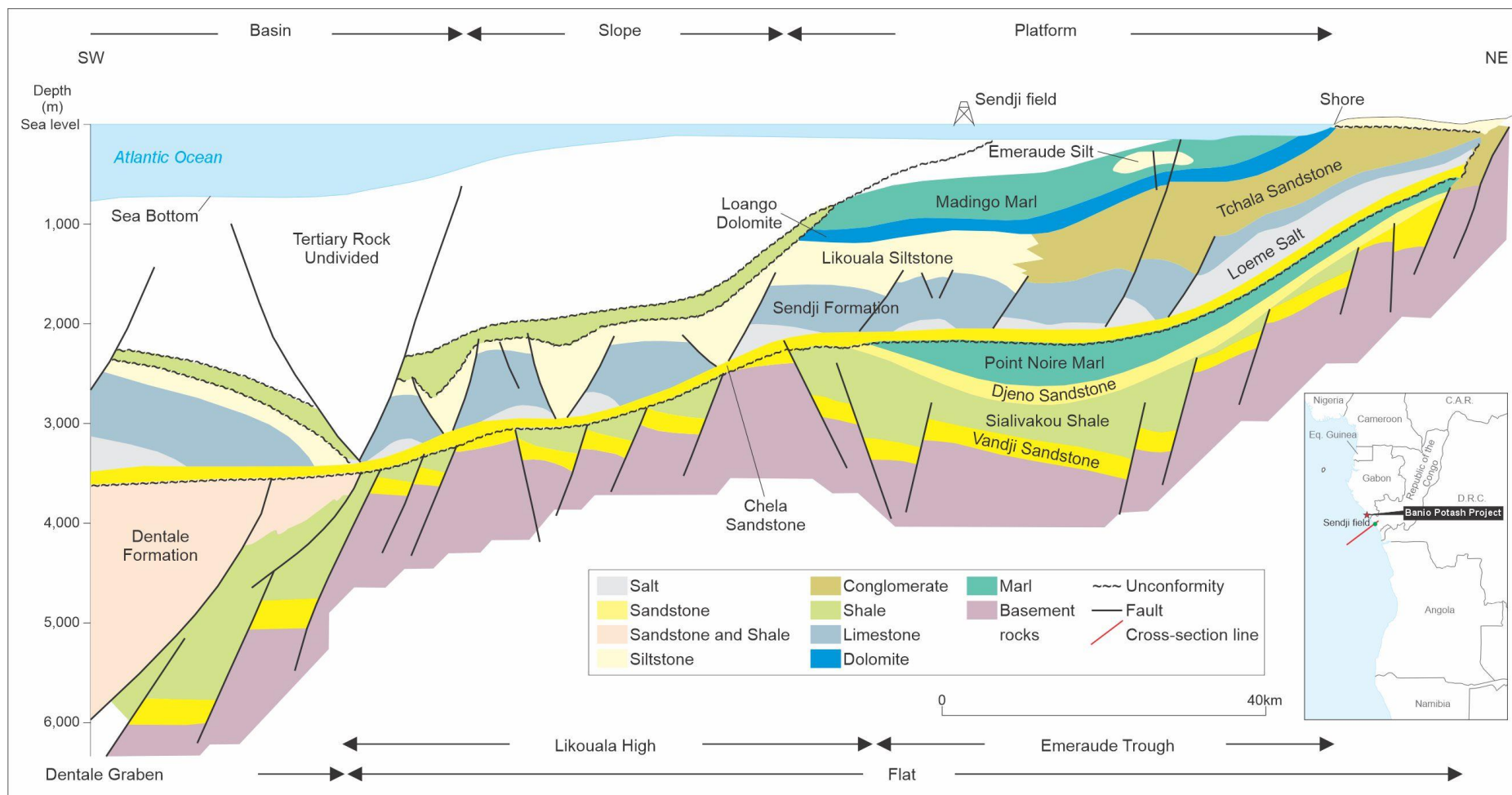
A thick sequence of Lower Cretaceous to Miocene continental and marine clastic and evaporite sediments fills the Congo Basin (Pedley et al., 2016), and to the east, it is bordered by Pre-Cambrian Mayombe igneous and metamorphic basement rocks (de Ruiter, 1979).

The geological development of the Aptian salt basin is complex and can be subdivided into three stages, (1) pre-rift, (2) syn-rift, and (3) post-rift (Brownfield and Charpentier, 2006), (Figure 7.2, Figure 7.3). The pre-rift stage lasted until the Late Jurassic and is characterised by intracratonic basin formation that are infilled with up to 1,000 m of clastic rocks.

During the syn-rift stage, thick sequences of fluvial and lacustrine rocks were deposited in a series of asymmetric horst and graben basins orientated parallel to the current coastline. These organic rich rocks are important hydrocarbon source rocks.

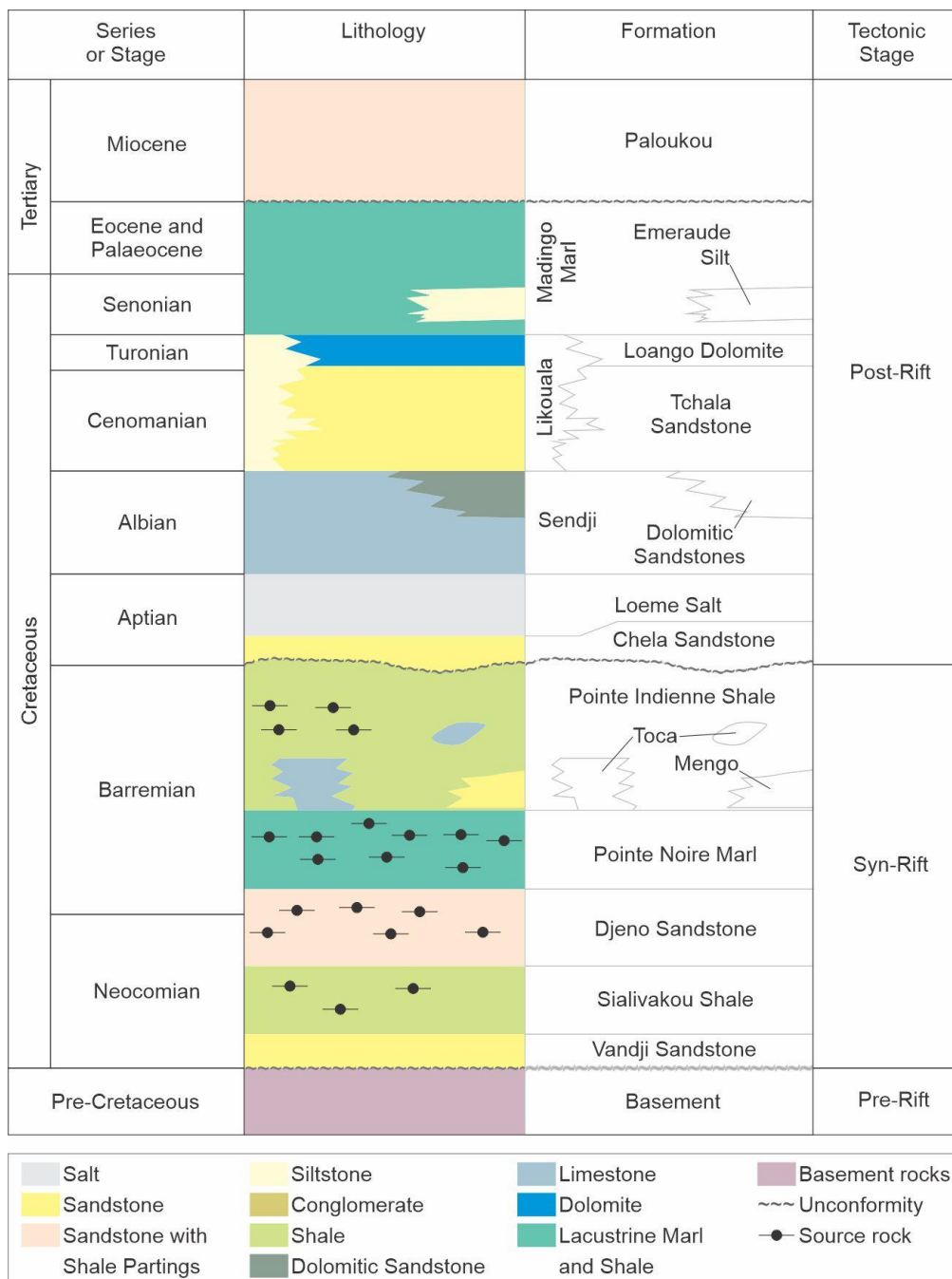
The post-rift rocks are representative of the initial opening of the Atlantic Ocean. As rifting ceased, continental, fluvial, and lagoonal rocks were deposited. This was followed by an extensive period of predominantly evaporitic salt deposition. These are the targeted potash layers at the Banio Project. Younger post rift rocks can be classified as either, transgressive shelf clastic and carbonate rocks followed by progradational units, or open-ocean deep-water units.

Figure 7.2: Schematic Cross-Section of the Congo Basin Showing the Complex Geological Sequence Associated with the Development of the Aptian Salt Basin



Source: Micon, modified from Brownfield and Charpentier (2006).

Figure 7.3: Generalised Stratigraphic Column of the Congo Basin

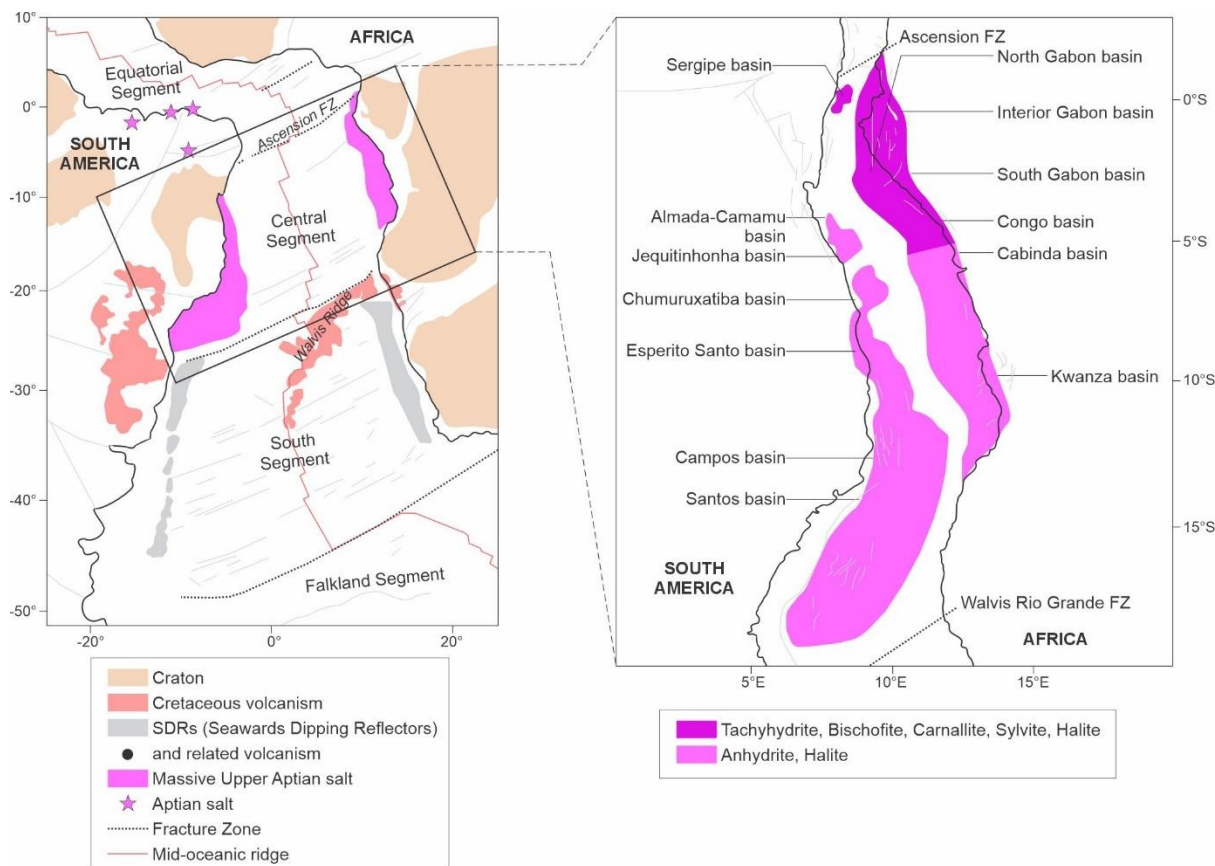


Source: Micon, modified from Brownfield and Charpentier (2006).

7.1.1 Salt Formation

Evaporitic salt deposition occurred during the late Aptian (113 Ma to 125 Ma $\pm$ 1 Ma) throughout the basin in a large steadily and relatively evenly subsiding sub-sea-level basin (Chaboureaux, et al., 2012) (Figure 7.4). The basin was fed by seepage inflow from the proto-Atlantic (Pedley et al., 2016). The Walvis Ridge, formed by the migrating Tristan da Cunha hot spot, restricted circulation from the open marine ocean to the south, and the Cameroon Fracture Zone limited the northern extent of the Aptian salt basin (Brownfield and Charpentier, 2006).

Figure 7.4: Salt Distribution by Salt Facies along the Central African and South American Craton Margins



Source: Micon, modified from (Chaboureaud, et al., 2012)

The Loeme Evaporite Formation in the Congo Basin is dominated by a halite and potash salt member overlain by a thinner anhydrite member. The top of the potash salts is at a depth of approximately 150 m to 500 m below the surface and ranges in thickness from 100 m to 950 m, thinning towards the east. The evaporites are typified by sub-horizontal layers (<5° dip) with small-scale undulations, and typically abrupt upper and basal contacts (Pedley et al., 2016). To the east where the top of the salt sequence is shallower, only the lower cycles of the sequence are preserved, or the upper cycles have not been deposited. Whereas in the west, where the top of the salt sequence is deeper all the cycles are preserved.

The major potash seams are generally continuous across the basin except at the basal unconformity of the overlying anhydrite member or within localised dissolution features. In complete, or near-complete, sections of the salt member it is made up by volume of approximately 30% potash-bearing layers, 55% rock salt (halite), 8% to 10% bischofite/tachyhydrite, and minor insoluble material, anhydrite, and carbonates.

7.1.2 Tectonics

The Aptian salt basin can be sub-divided into a number of north-south orientated basins that include the Gabon and Congo basins (Figure 7.1). These are divided by east-west-trending faults and other structural arches and highs related to syn-rift tectonics (Brownfield and Charpentier, 2006). The northern boundary of the Congo Basin in Gabon has been associated with the Casamaria High (Brownfield and Charpentier, 2006) and the Mayumba fracture zone (Chen et al., 2013). The Mayumba fracture zone is mapped just north of Mayumba town, and may cross the north-eastern

corner of the Banio exploration permit. However, the area of focussed exploration and drilling is thought to be wholly within the Congo Basin.

The Congo Basin is divided into large blocks by NW-SE striking fault zones that are generally interpreted as normal faults parallel to the coast (MDPA Ingénierie, 1989, in Van der Klauw & Gröschow, 2007). Uplifted blocks between relatively closely spaced NW-SE striking fault zones can occur, as at the former Holle Mine in the Republic of the Congo (MDPA, 1987, 1989, in van der Klauw & Gröschow, 2007). Similar structures are also responsible for the sylvinite mineralisation in the Kola permit area in the Republic of Congo, held by Kore Potash Plc (Pedley et al., 2016).

The basin is further subdivided into smaller blocks by subordinate and less pronounced NE-SW striking faults as at Mengo in the Republic of Congo (Rauche & van der Klauw, 2015). These faults were likely active during the Cretaceous opening of the South Atlantic and divide the basin into blocks with similar stratigraphy, but different thicknesses of formations (Brownfield & Charpentier, 2006).

7.1.3 Lithostratigraphy

Due to the intensive exploration for oil and potash in the Congo Basin, its stratigraphy is well known. In general, the sedimentary strata are thicker along the coast and thin towards the east as you approach the Mayombe basement boundary. From the bottom (older strata) to the top (younger strata) a number of formations have been differentiated which are described below (Figure 7.5).

The **Cocobeach Formation** (Série du Cocobeach, or Chela Formation) occurs on top of the **Crystalline Basement** as a series of grey-green sandstones with interbedded pyrite bearing green claystones. The contact between the Cocobeach Formation and the overlying evaporites is an unconformity.

The overlying evaporite sequence contains three individual formations (in stratigraphic order), including the **Rocksalt (halite) Formation**, **Anhydrite Formation**, and **Dolomitic Limestone Formation**.

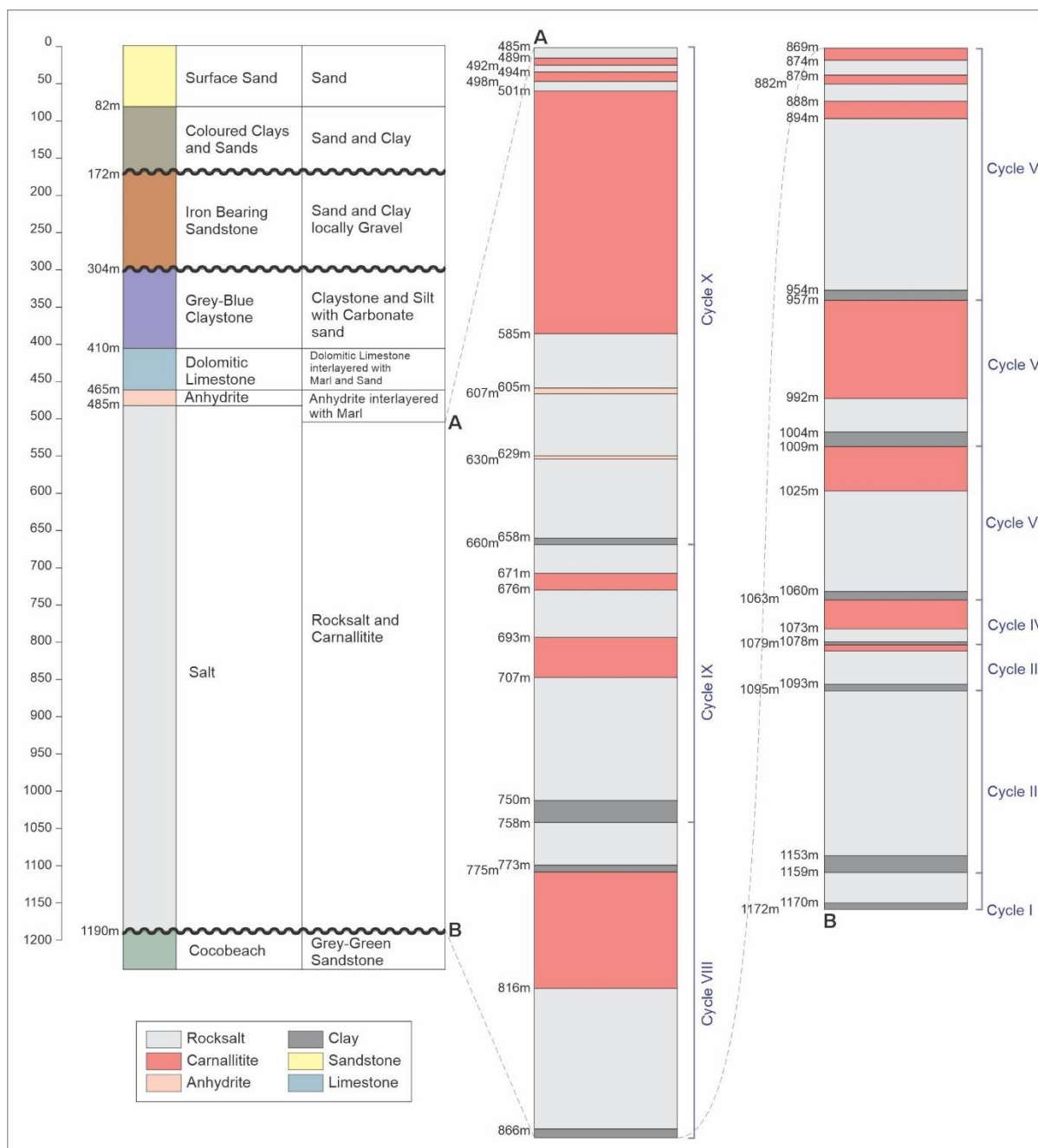
The **Rock Salt (halite) Formation** (Série Salifère, Loeme Formation) is divided into ten large depositional cycles, numbered by Roman numerals (from bottom to top). Each of these cycles consists of several alternations of the sequence of rock salt, carnallite and sometimes with layers rich in bischofite and/or tachyhydrite. A thicker layer rich in insoluble material (clay) defines the base of each cycle.

The **Anhydrite Formation** (Série Anhydritique, also Loeme Formation) overlays the Rock Salt Formation and consists of alternating anhydrite and marls each up to 5 m thick. The anhydrite is variable in appearance varying from nodular, brecciated, or laminated to massive. The marls are blue-grey to black in colour and are locally very clay rich.

The Anhydrite Formation is overlain by the **Dolomitic Limestone Formation** (Sendji Formation), which consists of variably dolomitised limestones with some layers of marl. The contact to the overlying strata, the Grey-Blue Claystone Formation, is gradational.

The **Grey-Blue Claystone Formation** (Série Argilo-Gréso-Dolomitique, Sendi Formation) consists of grey-blue to grey-green claystones, siltstones, and fine grained sandstones with a dolomitic cement and some layers/lenses of limestone. The contact with the overlying Iron Bearing Sandstone Formation is an unconformity.

Figure 7.5: Simplified Stratigraphy of the Congo Basin



Source: Micon, modified from Schlund & Vandenbroucke (1960) in van der Klauw & Gröschow (2007).

The **Iron Bearing Sandstone Formation** (Sables Grossiers Ferrugineux, Paloukou Formation) consists of layers of relatively coarse-grained sandstones that locally contain iron concretions which are separated by layers of plastic red clay strata. Occasionally, thin discontinuous lenses of gravel are observed. At the top of this series, phosphate horizons can be present. The unconformable contact with the overlying Coloured Clays and Sands Formation suggests that the region has been tectonically active and locally the phosphate horizons have been removed by erosion.

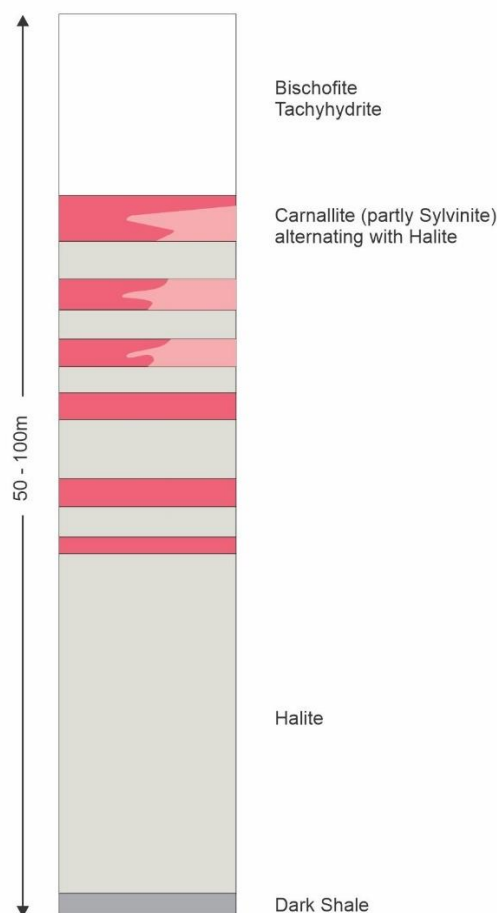
The **Coloured Clays and Sands Formation** (Série de Cirques) consists of alternating layers of sand and clay, which through lateritisation range in colour from yellow, to pink, to dark red. If the phosphate horizons are missing, it is not always possible to distinguish between the Coloured Clay and Sands and the Iron Bearing Sandstones and they are referred to as the latter.

The **Surface Sands** are usually distinguished as a separate unit, and are comprised of washed out or weathered Coloured Clays and Sands. It is not possible to precisely establish the boundaries for the four upper formations from drill hole cuttings and/or geophysical wireline logs only.

7.1.4 Stratigraphic Potash Distribution

Within the Rock Salt Formation of the Congo Basin, ten sedimentary evaporite cycles (I to X) have been identified whose mineralogy are consistent with typical brine evolution models (Pedley et al., 2016), (Table 7.1). The original subdivision of the evaporite cycles was made by the MDPA geologists (e.g. Schlund & Vandenbroucke, 1960). These cycles are consistent with rapid periods of sea water inflow and protracted evaporation resulting in the precipitation of salts. A cycle, from bottom to top, generally consists of a basal shale or clay layer, a layer of rock salt (halite), a mixture of halite and carnallite, and sometimes an end member of bischofite or tachyhydrite (de Ruiter, 1979), (Figure 7.6). The potash seams are predominantly carnallite except in certain areas where it has been replaced by sylvinite (Pedley et al., 2016).

Figure 7.6: Simplified and Idealised Salt Cycle Precipitation Sequence



Source: Micon, modified from de Ruiter (1979).

The replacement of carnallite by sylvinite principally occurs along the flanks of gentle antiformal features and within the upper 50 m to 100 m of the evaporite sequence (Pedley et al., 2016). Low tensional strain associated with the antiforms may have caused fracturing in the Anhydrite Formation cap allowing the gradual seepage of brines into the evaporite sequence from overlying aquifers. The interaction of brines resulted in the dissolution of carnallite leading to the formation of secondary halite, sylvite, and a chloride rich brine. The grade of the sylvinite is directly proportional to the grade of the precursor carnallite.

The potash seams vary in thickness from cm-scale up to 20 m thick and are separated by rock salt with clay layers that vary in thickness from cm-scale to over 100 m thick (Rauche & van der Klauw, 2015). Rocks with interlayered potash and rock salt where the rock salt dominated layers are <1 m are grouped together as a single potash seam. The boundaries of these inhomogeneous seams are not clearly fixed. Potash seams are named by the cycle within which the seam is found followed by the seam number within that cycle, sequenced from the base upwards.

Table 7.1: Cycles with Potential Number of Potash Seams and Some Typical Patterns

Cycle	Number of Seams	Remarks
X	9	Seam 1 is a thin high grade carnallite seam 3 m to 5 m below the remaining seams. Seams 2 to 6 consist of interlayers with variable thicknesses dominated by carnallite or rock salt. Seam 7 is a 15 m to 20 m thick high grade carnallite seam, with a ~0.5 m thick clay rich barren zone near the middle. Typically, there is at least approximately 80 m of rock salt between the first seam of Cycle X and the last seams of Cycle IX.
IX	10	Seam 1 and 2 are high grade, but thin and sometimes absent. Seam 3 is typically 6 m to 10 m thickness at a very high grade carnallite, the upper seams are high grade, but thinner and can be mineable where the rock salt between the upper seams is relatively thin.
VIII	8	Seam 3 typically has >8 m thickness of high grade carnallite. Seam 4 is variable in thickness between 1 m and 15 m, with high grade carnallite. Higher seams are usually relatively thin and separated by several metres of rock salt. Typically there is 35 m to 50 m of rock salt between the first seam of Cycle VIII and the last seam of Cycle IX.
VII	14	The lowermost seven seams have a very typical thickness pattern of carnallite and rock salt dominated layers. Seam 8 to seam 13 consist of interlayering of rock salt and carnallite dominated layers, near the top carnallite and tachyhydrite dominated layers are interlayered. Seam 14 can occur on top of a variable thickness tachyhydrite.
VI	12	Seam 12 can occur on top of a variable thickness tachyhydrite bearing section, the remaining seams are not very typical.
V	9	The base of Cycle V is a relatively thick (5 m to 10 m) clay rich rock salt layer, the upper five seams can be grouped into a single thick seam, whereas the relatively thin lower four seams have a typical thickness pattern.
IV	1	This single seam is typically high grade carnallite in the lower part and consists of cm to tens of cm scale interlayers of halite and carnallite in the upper part.
III	2	Seam 1 is thin, low grade and often absent. Seam 2 is a relatively thick homogeneous seam and is readily recognisable.
II	3	The two upper seams are low grade and often absent or thin, the lower seam is usually relatively thick with high grade carnallite.
I	0	This cycle is not developed basin wide.

The evaporite cycles as well as individual potash seams within the cycles can be correlated over large areas of the basin, reflecting minimal disturbance of the evaporites at the time of deposition (Pedley et al., 2016). Depending on the location within the basin syn-deposition and the geological

processes post-deposition, the thickness of seams or cycles can vary between absent (not deposited or eroded near basin rim) to hundreds of metres thick in the central part of the basin. Even though the potash seams do not have a constant thickness or are absent from the sequence, the thickness of the rock salt layers between the seams varies gradually over the basin and allows correlation of the potash seams (or their positions within the sequence) over the entire basin.

A natural gamma ray log is the best tool to correlate cycles and seams between drill holes within the basin, however, the seams near the top of cycle VI and cycle VII can be extremely variable depending on the extent of the tachyhydrite mineralisation present.

7.1.5 Hydrogeology

In the Congo Basin, the Coloured Clays and Sand Formation is the first potential aquifer with direct contact to surface water, it usually has hydrostatic pressure. At depth, groundwater is pressurised and can be encountered in coarse sand lenses of the Iron Bearing Sandstone Formation and coarse-grained parts of the Grey-Blue Claystone Formation. The base of the strongly jointed Dolomitic Limestone Formation should also be considered as a potential aquifer (MDPA, 1987, and van der Klauw & Gröschow, 2007). In contrast to other evaporite basins, drilling has shown that the contact of the Rock Salt Formation with the Anhydrite Formation is generally dry.

7.2 LOCAL GEOLOGY AND MINERALISATION

This section presents the interpretation of the available Banio Project exploration data in the context of the regional geology. The interpretation uses the recognised cycle and seam nomenclature for the Congo Basin developed by MDPA geologists. In some instances, seams have been combined into horizons where the seam boundaries cannot be clearly defined.

7.2.1 Potash Mineralisation in the Banio Project

To evaluate the extent of potash mineralisation within the Banio Project area, the three potash exploration drill holes (Ba-001, Ba-002 and Ba-003) and the six historical hydrocarbon exploration drill holes (Banio-1, Banio 2, Banio 3, Banio 4, Banio-5 and BATC-1) were used. The drill hole locations are shown in Figure 7.7.

The down hole geophysical logs allowed the identification of overburden, clay, and anhydrite dominated rocks. Within the evaporite sequence it was used to distinguish between rock salt layers, carnallite seams, interlayered rock salt and carnallite, tachyhydrite layers, and interlayered carnallite and tachyhydrite. The geophysical logging data of the historic Banio drill holes was insufficient to obtain a robust estimate of the carnallite content of the seams, even for drill holes where natural gamma ray, density, and calliper logs were available. This is likely due to the use of an inadequate drilling mud when intercepting the evaporite sequence.

The lithological and stratigraphic interpretation using the geophysical logs and available core data are shown in Figure 7.8 for drill holes Ba-001 to Ba-003 and BATC-1, and in Figure 7.9 for the drill holes Banio-1 to Banio-4.

The map displays the Banio Potash Project area, which is outlined by a permit boundary. A green shaded region indicates the potential potash deposit. Exploration drill holes are marked with pink dots, and hydrocarbon exploration drill holes are marked with black dots. Seismic lines are shown as blue lines. The map includes a north arrow and a scale bar (0 to 5 km). The map is labeled with various well identifiers and seismic line names.

Legend:

- Permit Boundary
- Potash Exploration Drill Holes
- Hydrocarbon Exploration Drill Holes
- Seismic Lines
- Potential Potash Deposit

Well Identifiers:

- BATC-1
- BA002
- BA003
- BA001
- BANIO-1
- BANIO-2
- BANIO-3
- BANIO-4
- BANIO-5

Seismic Lines:

- BAN90-01_PSTM
- BAN90-03_PSTM
- BAN90-05_PSTM
- BAN90-07_PSTM
- BAN90-08_PSTM
- BAN90-09_PSTM
- BAN90-11_PSTM
- BAN90-13_PSTM
- BAN90-113B_PSTM
- MPNM11-18_FIN
- MPNM11-20_FIN
- MPNM11-22_FIN
- MPNM11-24_FIN
- MPNM11-26_FIN
- MPNM11-09_FIN
- MPNM11-11_FIN
- MPNM11-13_FIN
- MPNM11-32HR_FIN
- MPNM11-35HR_FIN
- MPNM11-28_FIN
- MPNM11-30_FIN
- MPNM11-19_PSTM
- TMB90-108_PSTM
- TMB90-106_PSTM
- TMB90-115_PSTM
- TMB90-117_PSTM
- TMB90-104_PSTM
- TMB90-102_PSTM
- TMB90-100_PSTM
- TMB90-113A_DAS

Source: Micon, modified from ERCOSPLAN (2023).

7.2.1.1 NE Drill Holes Interpretation

The NE drill holes include Ba-001, Ba-002, Ba-003, and BATC-1 as shown in the location map (Figure 7.7) and logs (Figure 7.8). The following interpretations were made from the available data:

- The logs indicate that core data from Ba-002 correlates well with the geophysical log of nearby drill hole BATC-1, except for Cycles III and IV. This is likely due to the interlayering of relatively thin potash, rock salt, and clay seams. The thin potash seams cannot be clearly distinguished from the geophysical logs due to the data resolution and interference with clay minerals, which also return a higher than background gamma signature;

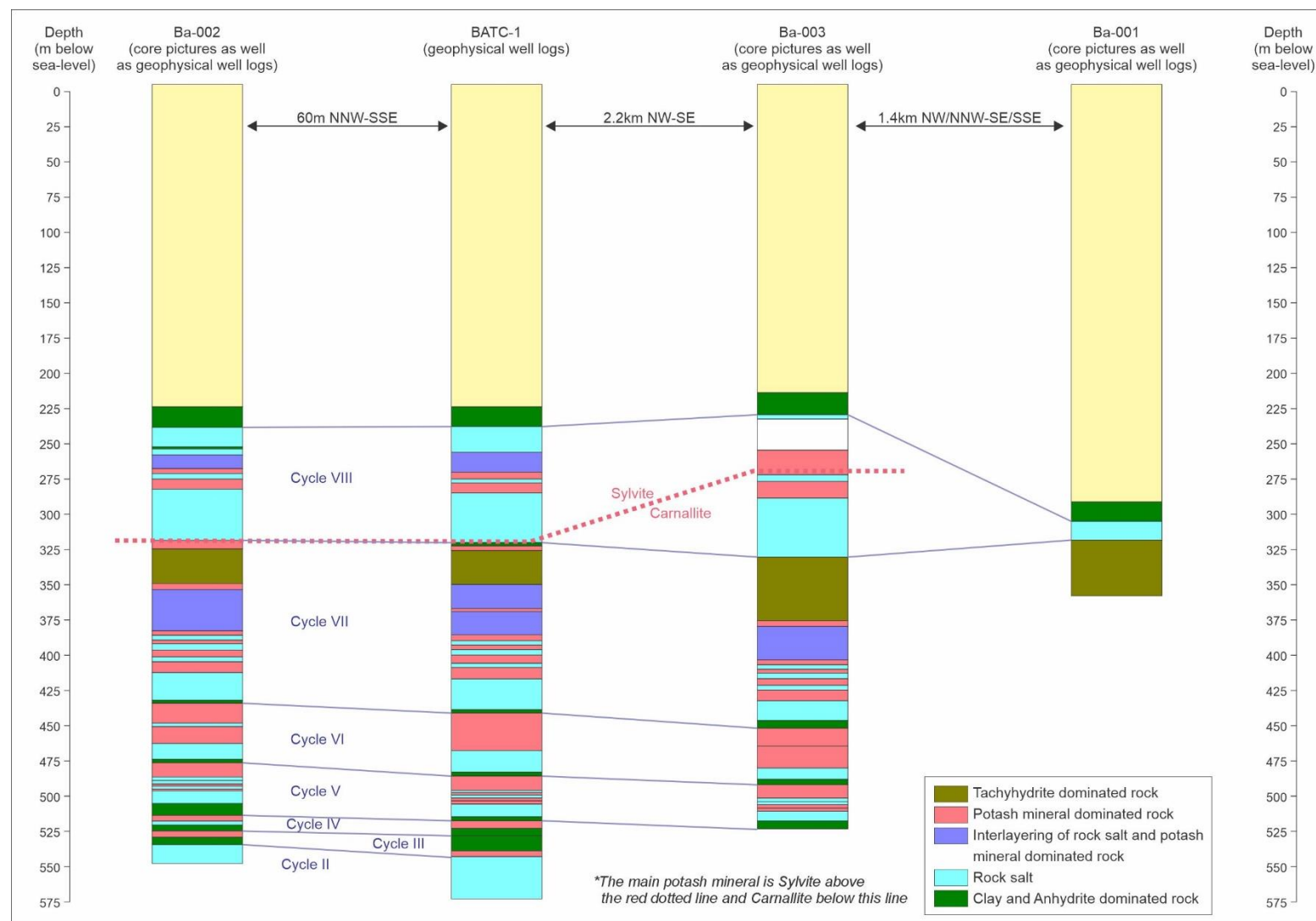
- The top of the evaporite sequence, a potential erosional surface, shallowly dips (<2°) towards the SW and the stratigraphic boundary (base of Cycle VIII) dips at a lower angle to the SW. This will be confirmed by future drilling in the area;
- The interpretation of Cycle VIII is difficult as the carnallite has been variably transformed to sylvite. Depending on the intensity of the transformation, it can reduce the thickness of the seams by 65% to 100%;
 - In Ba-002 all the carnallite has been transformed into sylvite, whereas in Ba-003 only the upper seams are transformed into sylvite;
 - In Ba-003 the two lowermost carnallite seams, separated by 2 m of rock salt, are identified as Seam 3, based on the Congo Basin nomenclature. The seam with carnallite at the base and sylvite at the top is considered as Seam 4. The top of Seam 4 is difficult to define due to the sylvite transformation reaction. It has resulted in interlayered rock salt and rock salt with up to 25% sylvite on an approximately 0.5 m scale. Further gamma ray peaks higher in the section are interpreted to represent the transformed thin carnallite seams, now present as low grade sylvinite seams near the top of Cycle VIII;
 - In Ba-002 Seam 3 and Seam 4 appear to be present as relatively low grade sylvinite seams interlayered with rock salt. There are no clear indications that that upper seams from Cycle VIII are present in Ba-002 or BATC-1; and,
 - There is no available information for the sylvite-carnallite interface in Ba-001 and therefore the dip and dip direction of this contact.
- Cycles V to VII in Ba-002, BATC-1, and Ba-003 correlate well, indicating the following:
 - In Cycle VII the top section consists of rocks dominated by tachyhydrite followed by a section of interlayered carnallite and rock salt. Drill hole Ba-001 was stopped in the tachyhydrite dominated layer. The individual carnallite layers within this interlayered section might locally have an adequate grade and thickness to be considered for mining. The lowermost seven carnallite seams within Cycle VII can be grouped together into four horizons that correlate well between the drill holes,
 - There is no tachyhydrite present in Cycle VI. The 12 potash seams can be grouped into two horizons dominated by carnallite with interlayered rock salt. The horizons have similar thicknesses between drill holes and are separated by approximately 1 m of rock salt; and,
 - For Cycle V that the upper seams together form a carnallite dominated horizon. The four thinner lower seams can also be readily identified from the geophysical logs and in the core.
- The core data from the extension of Ba-002 confirms that:
 - For Cycle IV the carnallite dominated seam is high grade at the bottom and in the upper part is lower grade due to interlayered rock salt;
 - For Cycle III, only a single high grade potash seam with minor rock salt interlayers is present; and,
 - At this location in the basin no potash seams are present in Cycle II.

7.2.1.2 SW Drill Holes Interpretation

The SW drill holes include Banio-1, Banio 2, Banio 3, Banio 4, and Banio-5 as shown in the location map (Figure 7.7) and logs (Figure 7.9). The following interpretations were made from the available data:

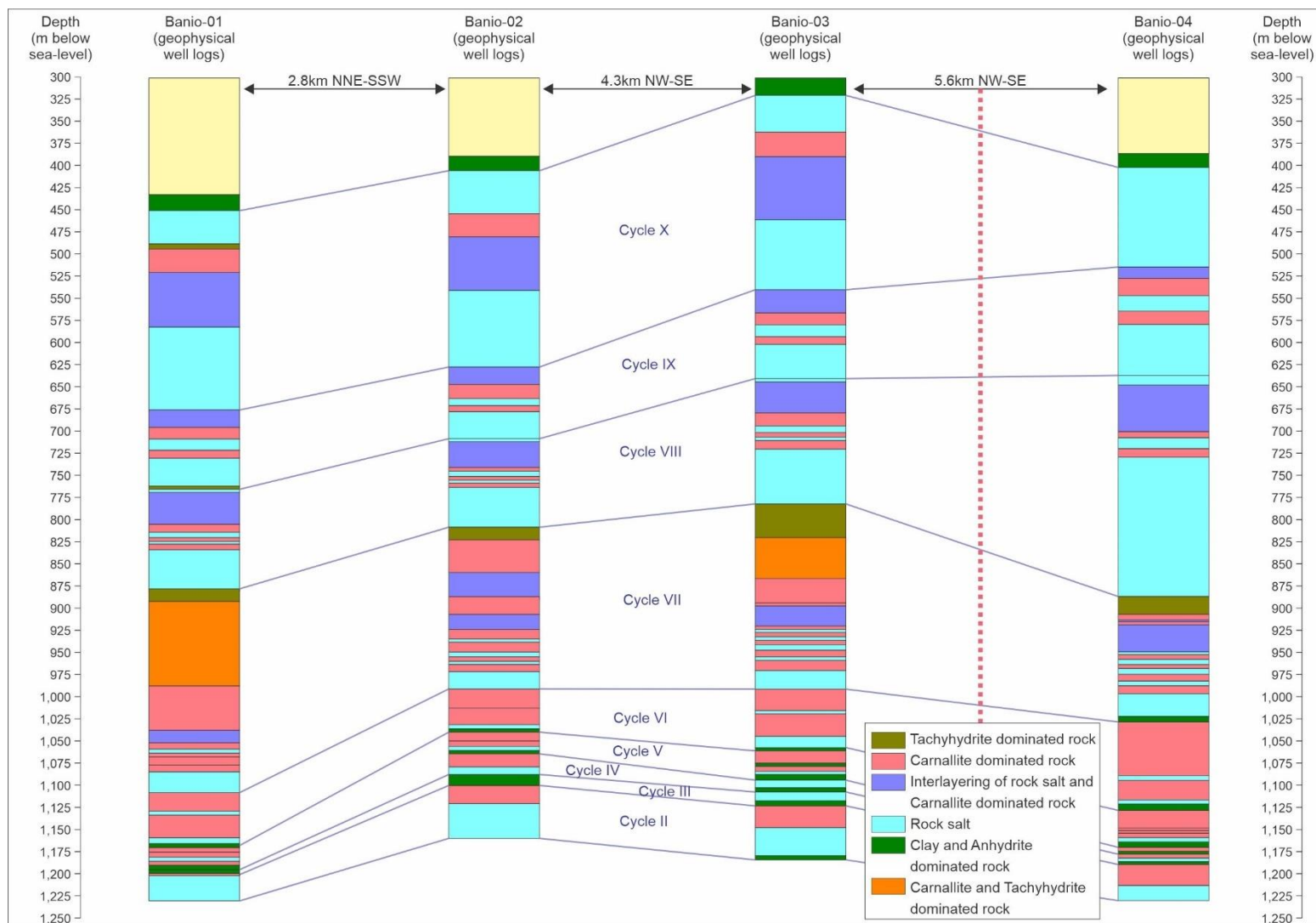
- With the exception of Banio-5 (probably due to problems with the measurement of the natural gamma log during drilling), all drill holes show a number of carnallite seams or horizons in Cycles VIII to X;
 - In Cycle VIII Seam 3 and Seam 4 can be identified and a few stratigraphically higher seams are present interlayered with thicker rock salt seams;
 - In Cycle IX Seam 3 can be identified, but in contrast to the Republic of Congo another thicker carnallite seam has also been identified. Above this newly identified seam, the typical thin upper seams interlayered with rock salt are identified; and,
 - The Cycle X carnallite seams are present in Banio-1 to Banio-3 drill holes, but not in Banio-4, where the top of the salt sequence appears to cut these seams. Banio-4 is different in other respects too, for Cycle VIII to X it has a thicker rock salt sequence between the basal clastics and the first carnallite seam.
- For Cycles V to VII the thickness and distribution of most of the potash seams or horizons from the Banio drill holes are comparable with drill holes Ba-002 and Ba-003. Differences in the overall thickness of Cycle VII is mainly due to the thickness of the tachyhydrite at the top of Cycle VII. Furthermore, the Banio holes, generally have thicker lower rock salt sections in each cycle;
- The carnallite in Cycles III and IV from Ba-002 have been identified in Banio-4 and Banio-5. In the other Banio holes only one carnallite seam (Banio-3) or no carnallite seams of reasonable thickness could be identified;
- Banio-1 is comparable to Ba-002 and shows only thin carnallite seams in Cycle II, whereas all other Banio drill holes show an appreciable thickness of Cycle II carnallite; and,
- The Banio holes do not show any indication that carnallite has been transformed to sylvite.

Figure 7.8: Interpretation and Correlation of the Evaporite Cycles and Potash Seams for Drill Holes Ba-001, Ba-002, Ba-003 and BATC-1



Source: Micon, modified from ERCOSPLAN (2023)

Figure 7.9: Interpretation and Correlation of the Evaporite Cycles and Potash Seams for Drill Holes Banio-01 to Banio-04



Source: Micon, modified from ERCOSPLAN (2023)

7.2.1.3 Potential Potash Deposit

The available exploration drill hole results and the seismic interpretations enable definition of a potash deposit consisting mainly of carnallite over most of the southern part of the licence area (Figure 7.7).

The good correlation of potash seams and horizons between the Ba-holes in the NW and the Banio holes in the SE for Cycles VII to V, combined with observations from elsewhere in the Congo Basin, suggest that wherever the seismic interpretation shows a salt bearing section (>300 m), there is a reasonable prospect of finding similar potash seams or horizons when drilling within this area.

7.2.2 Mineable Potash Seams in the Banio Project

Although numerous potash seams and horizons have been identified as detailed in Section 7.2.1 it is only possible to provide accurate information about thickness and grade of the seams and horizons that are present in drill holes Ba-002 and Ba-003. These drill holes have assay data from cores and high-resolution natural gamma ray logs that have been used to verify depth and thicknesses of the identified seams and horizons.

For the other drill holes only an approximation of the seam and horizon thicknesses from the geophysical logs can be made. Information on grades is limited to extrapolation of assay data from Ba-002 and Ba-003, or published data from other projects in the Congo Basin.

Considering that the seams and horizons defined may be used for Mineral Resource estimation, only potentially mineable seams that can be processed to a Muriate of Potash (MOP) product are discussed. To be considered as potentially mineable via solution mining the following cut-off parameters were applied to the carnallite and sylvinite seams or horizons from Ba-002 and Ba-003:

- Carnallite: seam thickness had to be >2.5 m when single, and >1.25 m when other seams are present within a 5 m vertical distance, and carnallite content >47%; and,
- Sylvinite: seam thickness had to be >2 m and the sylvite content >16%. Combined sylvite/carnallite seams (e.g. Cycle VIII Seam 4 in Ba-003, Cycle VII Seam 14 in Ba-002) have been considered as separate seams.

For the Banio drill holes without assay data, the minimum thickness of a seam or horizon to be considered as mineable is ≥ 2 m, with an average natural gamma reading over the section of 65 API to 90 API, depending on the measured maximum intensity from the drill hole. The potential mineable potash seams and horizons will be discussed from top to bottom.

7.2.2.1 Cycle X

In Cycle X there is a thick and potentially mineable potash seam (Seam 7) present in several of the Banio drill holes (Table 7.2). A seam in a similar stratigraphic position at the Mengo Project in the Republic of Congo has an estimated composition of approximately 68% carnallite (18.2% KCl), 23% halite, 9% tachyhydrite, with traces of clay and anhydrite. A thickness of 15 m to 21 m is reported (Rauche & van der Klauw, 2016).

Table 7.2: Cycle X Carnallite Seams in the Banio- Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 7	27	23	26	x	*

Note: x not present, * no information available

At the Mengo Project a further combined horizon has been identified in Cycle X consisting of interlayered rock salt and carnallite with an average carnallite content of 44% (11.8% KCl). It is possible that a similar horizon has been intercepted in the Banio drill holes, but the historical geophysical log data is not sufficient to define the horizon and it is therefore not considered further.

7.2.2.2 Cycle IX

For Cycle IX the uppermost seams can be identified from the Banio drill holes. However, with only historical geophysical logging data it is not possible to confidently define a thickness by combining the thin seams into a horizon with a reasonable KCl grade for mining. The data does suggest that some of the middle seams (Seam 6 and 7) could be combined into a mineable horizon not present in the Republic of Congo, and that Seam 3 is mineable (Table 7.3).

At the Mengo Project Seam 3 has an average composition of 90% carnallite (~24% KCl), 10% halite, and trace amounts of bischofite, anhydrite and clay with a thickness of 8 m to 12 m (Rauche & van der Klauw, 2016). Seam 3 is called the Hanging Wall Sylvite Seam (HSS) in the Kola area with a thickness of approximately 3 m and up to 55% sylvite (SRK et al., 2012).

Table 7.3: Cycle IX Carnallite Seams in the Banio Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 6-7	14	8	13	12	*
Seam 3	8	6	8	14	*

Note: * limited information available

7.2.2.3 Cycle VIII

Based on the assay data and the geophysical logging data the potentially mineable potash Seams 2, 3, and 4 have been identified in Cycle VIII of drill holes Ba-002 and Ba-003 (Table 7.4). The historical geophysical logging data indicates that the same seams can also be identified in the Banio drill holes as well as Seam 8 that may have an adequate thickness and grade for solution mining (Table 7.5).

Table 7.4: Summary of Seams Considered Mineable in Cycle VIII in Drill Holes Ba-002 and Ba-003

Seam	Ba-002 Thickness (m)	KCl Grade (%)	Mineral	Ba-003 Thickness (m)	KCl Grade (%)	Mineral
Seam 4a	-	-	-	2.7	18.4	sylvite
Seam 4b	-	-	-	2.3	19.0	sylvite
Seam 4c	-	-	-	2.5	21.1	carnallite
Seam 3	2.1	24.6	sylvite	4.6	17.0	carnallite
Seam 2	2.7	25.2	sylvite	5.1	14.5	carnallite

**Table 7.5: Cycle VIII Carnallite Seams in the Banio Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data**

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 8	3	3	4	7	*
Seam 4	8	5	15	8	*
Seam 3	5	4	6	10	*
Seam 2	6	4	11	9	*

Note: *No information available.

Seam 4 has been described from the Mengo Project with a thickness of <1 m to 15 m at an average carnallite grade of 65% (~17% KCl), (Rauche & van der Klauw, 2016). This combined seam is called the Upper Sylvite Seam (USS) in the Kola area, where it is 4 m to 5 m thick at a sylvite (KCl) grade of 40% to 50% (SRK et al., 2012). Seam 4 within the Banio Project may be relatively thick, but appears to be much more inhomogeneous regarding grade distribution than further south in the Republic of Congo.

Seam 2 and Seam 3 for the Banio Project are separated by 2 m to 3 m of rock salt. They have also been described in the Mengo area with a 1 m rock salt layer between them (Rauche & van der Klauw, 2016). The average grade of the combined seams and rock salt is reported as an average of 65% carnallite (~17% KCl) at Mengo. This combined seam is called the Lower Sylvite Seam (LSS) in the Kola area, where it is 4 m to 5 m thick with a sylvite (KCl) grade of 40% to 50% (SRK et al., 2012). Compared to the Banio Project the combined seams may have a higher KCl grade in the Republic of Congo to the south.

No thickness or grade information has been reported from any Republic of Congo projects for Seam 8.

7.2.2.4 Cycle VII

Based on the assay data and the geophysical logging data the potentially mineable potash horizons or seams for Cycle VII at the Banio Project are Seam 1-2, 3-4, 5, 6-7, 8, 9 and 10 (Table 7.6). Seams 8 to 13 consist of highly irregular interlayering of rock salt and carnallite making the definition of the top and bottom of the seams difficult (Figure 7.10). These seams are often marginal as to whether they can be considered mineable.

Table 7.6: Summary of Seams Considered Mineable in Cycle VII in Drill Holes Ba-002 and Ba-003

Seam	Ba-002 Thickness (m)	KCl Grade (%)	Mineral	Ba-003 Thickness (m)	KCl Grade (%)	Mineral
Seam 10	1.3	13.4	carnallite	-	-	carnallite
Seam 9	1.5	14.0	carnallite	-	-	carnallite
Seam 8	1.6	12.6	carnallite	1.4	14.5	carnallite
Seam 6-7	3.1	13.2	carnallite	3.3	15.0	carnallite
Seam 5	2.6	15.5	carnallite	2.6	16.8	carnallite
Seam 3-4	5.4	14.6	carnallite	5.0	15.0	carnallite
Seam 1-2	7.5	16.2	carnallite	7.0	16.7	carnallite

Figure 7.10: Drill Hole Ba-002 Core, Cycle VII Showing Banded Rock Salt with Carnallite Growth at the Layers Rich in Insoluble Material, Resulting in an Irregular Carnallite Rock Salt Interlayering



Note: Core box length 1.0 m.

At the top of Cycle VII, drill hole Ba-002 shows a relatively high-grade potash seam (Seam 14), containing 2 m of sylvinite with 30.8% sylvite at the top, and 2.9 m carnallitite with 62.8% carnallite at the bottom. This seam overlies a thick sequence of tachyhydrite and is not feasible to mine because of this.

From historical geophysical logging data, it is not possible to define a thickness with a reasonable KCl grade for mining of Seams 8 to 13 for the Banio drill holes. The Seams or horizons 1 to 7 can readily be identified in the Banio drill hole logs and these are given in Table 7.7. No information about the grade or thickness of these seams or horizons is available from projects in the Republic of Congo.

Table 7.7: Cycle VII Carnallite Seams in the Banio Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 6-7	2	6	5	5	6
Seam 5	3	3	4	4	4
Seam 3-4	7	5	8	8	9
Seam 1-2	7	7	11	9	11

7.2.2.5 Cycle VI

The potentially mineable potash horizons (combined seams) 2-5 and 6-11 identified in Cycle VI from drill holes Ba-002 and Ba-003, are shown in Table 7.8. The two horizons are separated by approximately 1.5 m of rock salt with only traces of carnallite.

Although the horizons also consist of interlayered carnallite with rock salt, the carnallite dominated sections are generally thicker than in the upper part of Cycle VII (compare Figure 7.10 to Figure 7.11). Therefore, it is possible to define the thickness of the horizons from the geophysical logs of the Banio drill holes (Table 7.9). No information about grades or thicknesses of these horizons is available from the projects in the Republic of Congo.

Table 7.8: Summary of Seams Considered Mineable in Cycle VI in Drill Holes Ba-002 and Ba-003

Seam	Ba-002 Thickness (m)	KCl Grade (%)	Mineral	Ba-003 Thickness (m)	KCl Grade (%)	Mineral
Seam 6-11	13.8	14.7	carnallite	11.8	15.9	carnallite
Seam 2-5	13.8	15.6	carnallite	15.7	16.9	carnallite

Table 7.9: Cycle VI Carnallite Seams in the Banio Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 6-11	20	22	24	61	16
Seam 2-5	25	19	16	21	33

Figure 7.11: Drill Hole Ba-002 Core, Cycle VI Showing Banded Rock Salt with Carnallite Growth at the Layers Rich in Insoluble Material combined with more massive Carnallite, Resulting in a Carnallite Dominated Rock with Rock Salt



Note: Core box length 1.0 m.

7.2.2.6 Cycle V

The potentially mineable potash seams and horizons identified in Cycle V from drill holes Ba-002 and Ba-003 are Seams 2, 3 and 5-9 (Table 7.10). The seams in the lower cycles (III to V) consist of layers dominated by nodular carnallite with minor insoluble material and rock salt, these are separated by interlayered rock salt and insoluble material (Figure 7.12). It is possible to define similar seams and horizons based on the geophysical logging data from the Banio holes (Table 7.11). No information about the grade or thickness of these seams or horizons are available for projects in the Republic of Congo.

Table 7.10: Summary of Seams Considered Mineable in Cycle V in Drill Holes Ba-002 and Ba-003

Seam	Ba-002 Thickness (m)	KCl Grade (%)	Mineral	Ba-003 Thickness (m)	KCl Grade (%)	Mineral
Seam 5-9	10.1	13.6	carnallite	9.8	14.6	carnallite
Seam 3	1.9	21.6	carnallite	2.2	20.1	carnallite
Seam 2	1.6	16.2	carnallite	1.6	19.1	carnallite

**Table 7.11: Cycle V Carnallitite Seams in the Banio Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data**

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 5-9	5	10	15	21	10
Seam 3	#	2	3	2	2
Seam 2	#	2	2	4	#

Note: # is considered not mineable.

Figure 7.12: Drill Hole Ba-002 (extension) Core, Cycle IV Showing thick Layers Dominated by Nodular Carnallite, Separated by an Interlayering of Rock Salt and Insoluble Material



7.2.2.7 Cycle IV and Cycle III

For Cycle IV and Cycle III only core and assay data are available for drill hole Ba-002. Based on this drill hole, Seam 1 was identified in both cycles (Table 7.12, Table 7.13).

Interpretation of the historic geophysical logs for the Banio drill holes is difficult for Cycle IV and Cycle III. As such the thicknesses for Seam 1 in Cycle IV (Table 7.14) and Seam 1 in Cycle III (Table 7.15) from the Banio drill holes should be considered indicative only. No information about the grade or thickness of this seam is available for the projects in the Republic of Congo.

Table 7.12: Summary of Seams Considered Mineable in Cycle IV in Drill Holes Ba-002 and Ba-003

Seam	Ba-002 Thickness (m)	KCl Grade (%)	Mineral	Ba-003 Thickness (m)	KCl Grade (%)	Mineral
Seam 1	4.2	17.1	carnallite	-	-	-

Table 7.13: Summary of Seams Considered Mineable in Cycle III in Drill Holes Ba-002 and Ba-003

Seam	Ba-002 Thickness (m)	KCl Grade (%)	Mineral	Ba-003 Thickness (m)	KCl Grade (%)	Mineral
Seam 1	4.8	18.7	carnallite	-	-	-

Table 7.14: Cycle IV Carnallite Seams in the Banio Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 1	2	14	x	5	5

Note: x not present.

Table 7.15: Cycle III Carnallite Seams in the Banio Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 1	#	x	x	6	6

Note: Note: x not present, # is considered not mineable.

7.2.2.8 Cycle II

Drill hole Ba-002 was extended to a depth where any potash mineralisation present in Cycle II, as known from the Republic of Congo, should have been intersected. Therefore, it is concluded that at this drill hole location there is no carnallite mineralisation in Cycle II.

For the Banio drill holes, Seam 1 can be identified in the geophysical logs (Table 7.16). At the Makola permit in the Republic of Congo, this seam has an average KCl grade of 17% (Rauche & van der Klauw, 2010).

Table 7.16: Cycle II Carnallite Seams in the Banio Drill Holes (1-5)
Estimated Thicknesses based on Geophysical Logging Data

Seam	Banio-1 Thickness (m)	Banio-2 Thickness (m)	Banio-3 Thickness (m)	Banio-4 Thickness (m)	Banio-5 Thickness (m)
Seam 1	2	21	23	24	18

7.2.3 Tectonics in the Investigated Area of the Banio Project

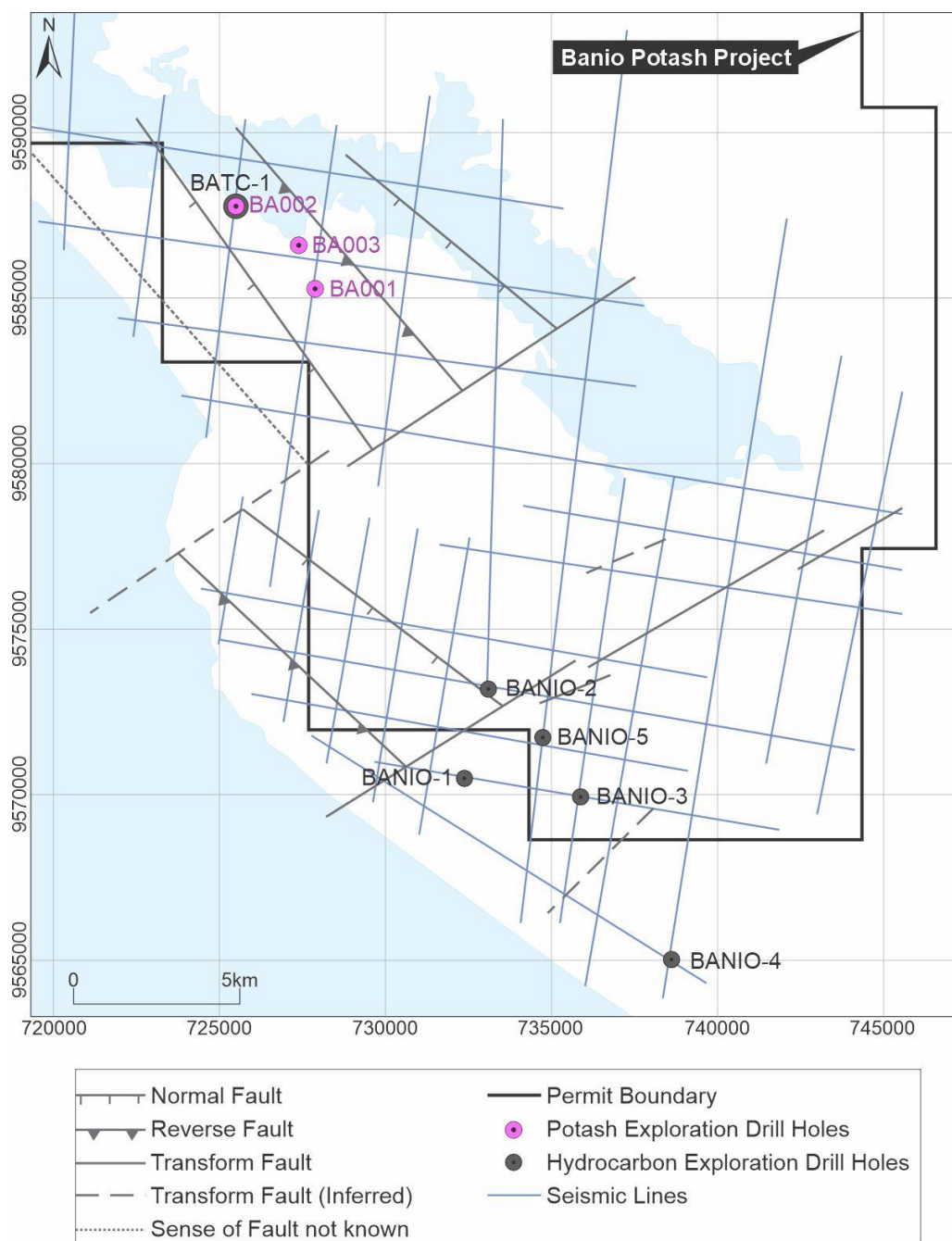
This section describes the tectonic setting and its implications for the extent of the mineralisation at the Banio Project. It is based on the regional tectonics, interpretation of the seismic data (see Section 9.0), and observations from the drill hole data.

The Congo Basin is divided into large blocks by NW-SE striking fault zones that are generally interpreted as normal faults parallel to the coast (MDPA, 1989, in van der Klauw & Gröschow, 2007). Uplifted blocks between relatively closely spaced NW-SE striking fault zones can occur, as at the former Holle Mine in the Republic of the Congo (MDPA, 1987, 1989, in van der Klauw & Gröschow, 2007). Similar structures are also responsible for the sylvinite mineralisation in the Kola permit area in the Republic of Congo, held by Kore Potash Plc (Pedley et al., 2016). The interpreted seismic data suggests a similar uplift structure for the block hosting drill holes Ba-001, Ba-002, and Ba-003 that can be seen in Figure 7.13. The layering within these fault blocks generally dips shallowly towards

the coast. The modelled base of the evaporite sequence from the interpreted seismic sections for the Banio Project shows an overall shallow dip towards the SW (Figure 7.14).

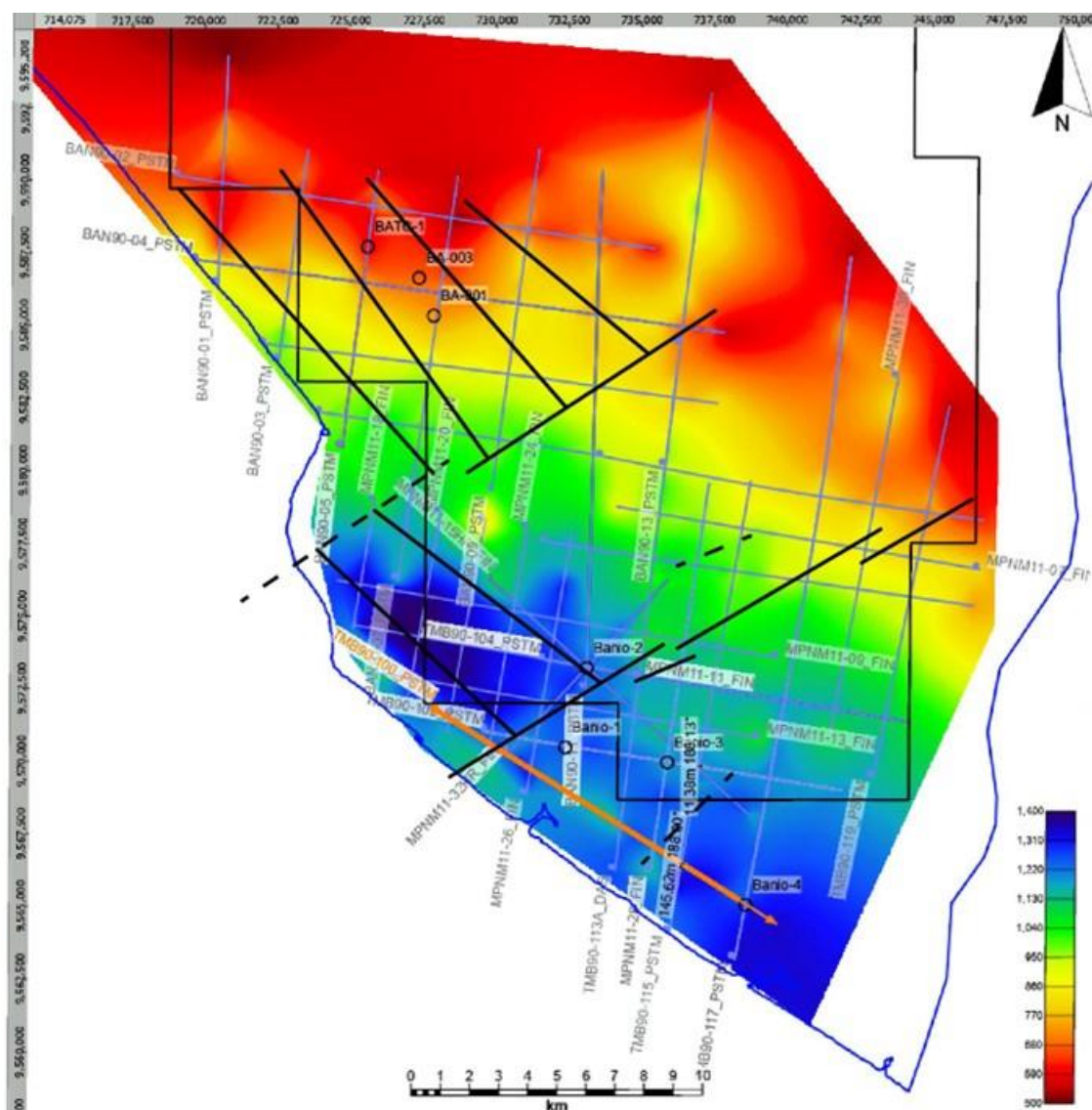
The basin is further subdivided into smaller blocks by subordinate and less pronounced NE-SW striking faults as at Mengo in the Republic of Congo (Rauche & van der Klauw, 2015). These faults were likely active during the Cretaceous opening of the South Atlantic and divide the basin into blocks with similar stratigraphy, but different thicknesses of formations (Brownfield & Charpentier, 2006). Such faults also have also been interpreted from the seismic data from the southern part of the Banio Project Figure 7.13).

Figure 7.13: Fault Structures Constructed from the Offsets of Top and Bottom of the Evaporite Sections Interpreted from the Seismic Sections



Source: ERCOSPLAN (2023)

**Figure 7.14: Depth Contours for the Base of the Salt from the Seismic Interpretation
(overlain by the interpreted faults from Figure 7.13)**



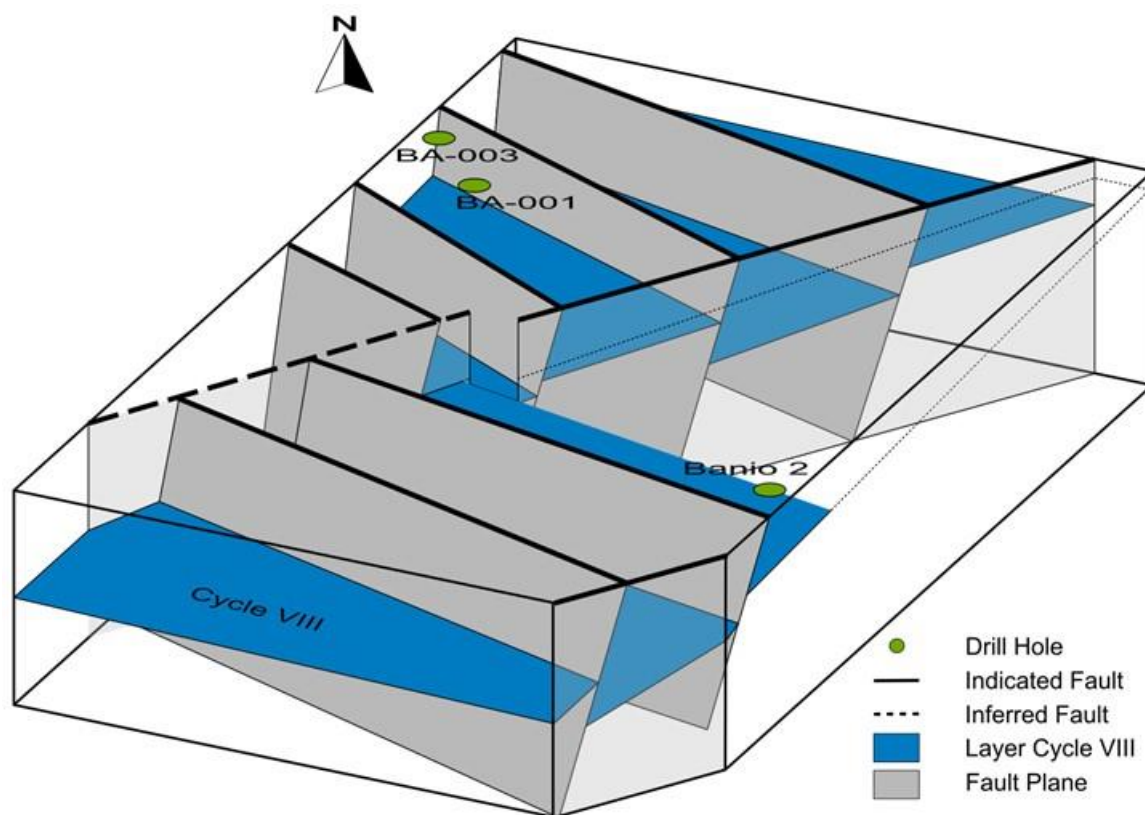
Source: SW Geophysics Ltd (2023)

7.2.3.1 Tectonic Model

The fault pattern for the Banio Project was constructed using the interpreted seismic sections and the depth contours of the base of the evaporite sequence (Figure 7.13, Figure 7.14). It shows that the fault blocks containing the NW drill holes Ba-001, Ba-002, Ba-003, and BATC-1 has experienced a reversal of movement along the NE boundary fault whereas the other NW-SE trending faults in the northern block are normal faults (Figure 7.15).

The NW-SE trending faults in the northern block are cut by a NE-SW striking fault. This NE-SW striking fault either acted as a strike slip fault off-setting the normal faults from the northern block towards the south (e.g. interpretation shown in Figure 7.15) or acted as a transform fault.

Figure 7.15: Interpreted Relative Movements of the Faults from Seismic Investigations, Through a Visualisation of the Position of the Base of the Cycle VIII Stratigraphic Boundary for the Area Between Drill Holes Ba-003 and Banio-02



Source: ERCOSPLAN (2023)

The relative uplift of the fault block containing the NE drill holes is estimated to be in the range of 150 m to 200 m. This is consistent with the observation that the Cycle VIII of Ba-002 had to be uplifted above the palaeo groundwater level to initiate the carnallite to sylvite transformation (see Section 7.2.1). The relative position of this transition in the other NE drill holes suggests a complicated uplift and subsidence history of the fault block.

A NE-SW trending near vertical fault is required between the Banio-4 and other Banio drill holes (SW drill holes). This fault must have been active during salt deposition, as Banio-4 shows an increased thickness of the complete Cycles VIII and IX and the absence of the potash bearing part of Cycle X (Figure 7.9). The faults constructed from the seismic interpretations indicate the presence of a NE-SW striking transform fault that could explain these observations (Figure 7.13).

South of this postulated transform fault, it cannot be excluded that further unidentified normal faults are present, that have not been identified due to gaps in the seismic data.

7.2.4 Conceptual Geological Model for the Investigation Area of the Banio Project

The basis for the conceptual geological model is that the potash was originally deposited as carnallite seams and are present within three fault blocks separated by two NE-SW trending near vertical strike slip or transform faults. Within each block the carnallite seams were originally deposited as near horizontal layers which now shallowly dip towards the SW. The drill hole log correlation diagrams confirm that this is a reasonable interpretation (Figure 7.8, Figure 7.9).

The horizontal seams after deposition have been offset by NW-SE trending normal faults (locally reversed) with a dip in the range of 65° to 70°. The orientation and offset of the faults were interpreted from the seismic exploration data. The carnallite seams can be offset along these faults, but all seams present in the relative upthrown block are also present in the downthrown block. If a drill hole on a downthrown block shows the presence of stratigraphically higher seams, these are only extended over a relative upthrown block, when there is independent information about the magnitude of the vertical movement along the fault structure.

The transformation of the carnallite deposit to a sylvite deposit, requires fluid infiltration and only takes place in uplifted blocks (Pedley et al., 2016). Therefore, seams with sylvite mineralisation are not extended over faults in downthrown blocks. These seams are probably present as carnallite seams, but are only modelled if they have been shown to be present in a drill hole in a downthrown block.

8.0 DEPOSIT TYPE

The deposits of the Banio Project are classified as evaporites within the Congo Basin, part of the larger Aptian salt basin that stretches across equatorial West Africa. They can be considered as primary sedimentary rocks.

The Congo Basin is part of the passive continental margin of West Africa that formed during the Late Jurassic to Early Cretaceous breakup of Gondwana (North America, South America, and Africa), (Brownfield and Charpentier, 2006; Chen et al., 2013). Evaporitic salt deposition occurred during the late Aptian (113 Ma to 125 Ma $\pm$ 1 Ma) throughout the basin in a large steadily and relatively evenly subsiding sub-sea-level basin. The basin was fed by seepage inflow from the proto-Atlantic (Pedley et al., 2016). The Walvis Ridge, formed by the migrating Tristan da Cunha hot spot, restricted circulation from the open marine ocean to the south, and the Cameroon Fracture Zone limited the northern extent of the Aptian salt basin (Brownfield and Charpentier, 2006).

Within the Rock Salt Formation of the Congo Basin, ten sedimentary evaporite cycles (I to X) have been identified whose mineralogy are consistent with typical brine evolution models (Pedley et al., 2016). These cycles are consistent with rapid periods of sea water inflow and protracted evaporation resulting in the precipitation of salts. A cycle, from bottom to top, generally consists of a basal shale or clay layer, a layer of rock salt (halite), a mixture of halite and carnallite, and sometimes an end member of bischofite or tachyhydrite (de Ruiter, 1979), Figure 7.6). The potash seams are predominantly primary carnallite except in certain areas where it has been transformed into secondary sylvinite (Pedley et al., 2016).

The replacement of carnallite by sylvinite principally occurs along the flanks of gentle antiformal features and within the upper 50 m to 100 m of the evaporite sequence (Pedley et al., 2016). Low tensional strain associated with the antiforms may have caused fracturing in the Anhydrite Formation cap allowing the gradual seepage of brines into the evaporite sequence from overlying aquifers. The interaction of brines resulted in the dissolution of carnallite leading to the formation of secondary halite, sylvite, and a chloride rich brine.

The evaporite cycles as well as individual potash seams within the cycles can be correlated over large areas of the basin, reflecting minimal disturbance of the evaporites at the time of deposition (Pedley et al., 2016). Depending on the location within the basin syn-deposition and the geological processes post-deposition, the thickness of seams or cycles can vary between absent (not deposited or eroded near basin rim) to hundreds of metres thick in the central part of the basin.

The continuity of the potash seams is comparable with the potash seams in the Elk Point basin in Saskatchewan, Canada. Mineable potash seams in the Congo Basin sequence sum up to a potential economic thickness of >100 m. This is larger than the Saskatchewan deposits mined using solution mining (combined thickness of 30 m to 50 m) and the conventionally mined potash in the Upper Kama basin in Russia.

Carnallite was the main potash mineral at the start of potash fertiliser production in Germany in 1865 and is still used for the production of KCl fertiliser at two locations. It is mined using solution mining techniques where the deposit has a thickness of between 15 m and 35 m, and also using conventional mining where structurally controlled thickness of the carnallite can reach up to 60 m.

9.0 EXPLORATION

Exploration activities on the Banio Project, other than drilling, has included seismic surveys as discussed in the sections below.

9.1 EXPLORATION PRE-MILLENNIAL

Potash was discovered in the coastal Gabonese-Congolese Basin during oil prospecting in the Gabonese Republic in 1935. Additional work carried out in the late 1930s and 1950s discovered that the salt basin existing in the Gabonese Republic was only a portion of a vast littoral basin which extended south through the Republic of Congo into Cabinda, Angola and to the north towards Cameroon. The onshore portion of the basin ranges from 5 km to 40 km in width and is over 2,000 km in length.

In the early 1950s, SPAFE (Société Petrolière de l'Afrique Française Equatoriale), a predecessor company to Elf Aquitaine, was granted the Mabora petroleum concession in an area around the town of Lambaréné. In 1954, SPAFE drilled well Mabora Mamana-1 (MM-1) near Lake Azingo targeting oil below the salt layers. The MM-1 well encountered the first ever indication of potash mineralisation in the Congo Basin by intersecting a high grade sylvinite potash seam that reportedly graded 29% K₂O.

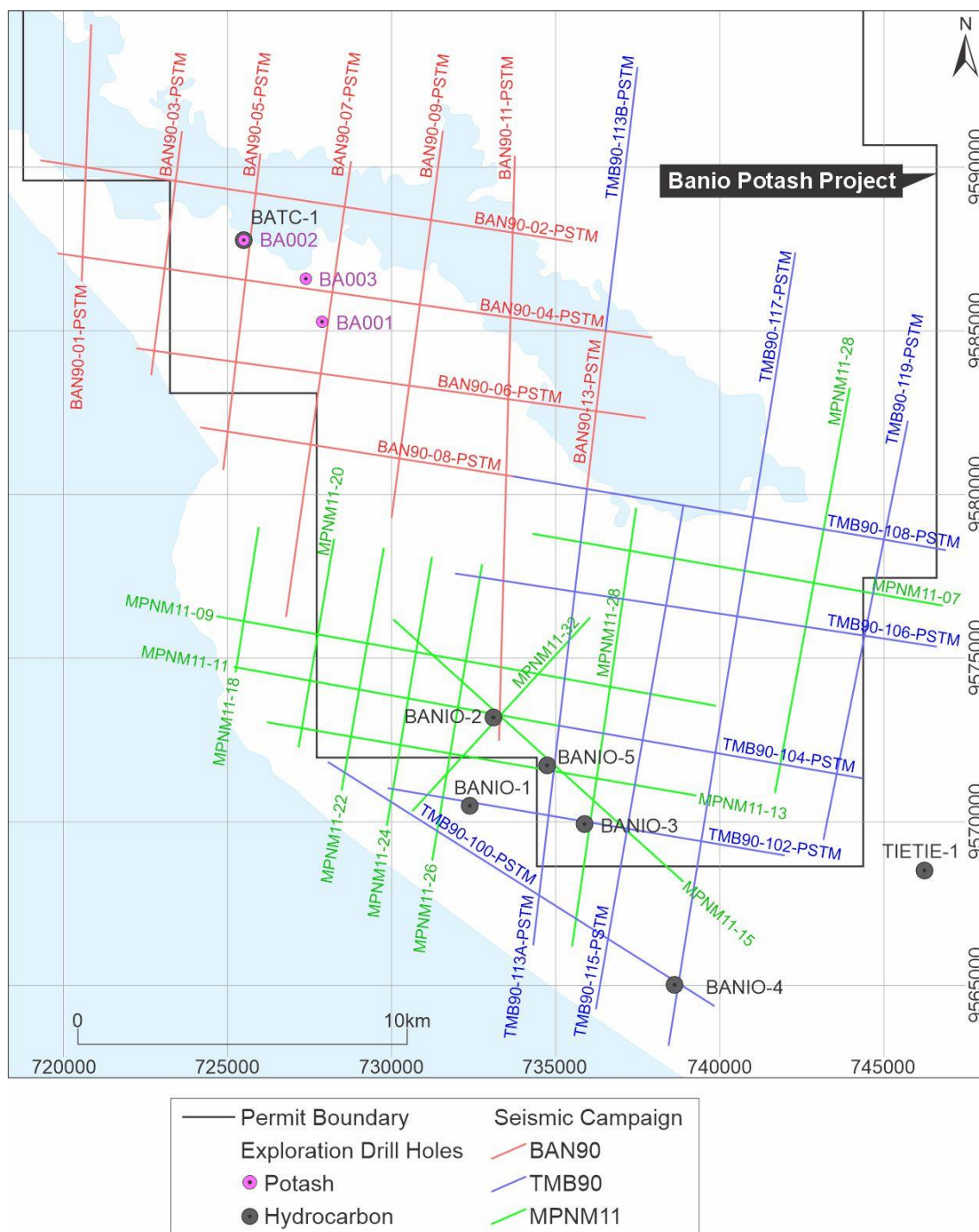
In 1960 a company, Syndicat de Recherches de Potasse au Congo, was established to explore for potash in the Congo Basin. The company was initially granted an exploration permit covering the entire Congo coastal plain (8,450 km²). The potash exploration effort centred on the Congolese part of the basin where significant high-grade sylvinite mineralisation was discovered at Holle and later exploited via the St Paul underground mine. While oil exploration continued on the coastal plains of the Gabonese Republic, no significant, on the ground potash exploration work was undertaken in the country except for various unpublished desktop studies until the most recent grants of exploration permits. Recent work followed the success achieved by potash explorers in nearby Republic of Congo and the obvious continuity and geological similarities.

9.1.1 Seismic Interpretation

Further historical exploration consisted of 2D seismic surveys which were carried out in the 1970's, 1990's and 2011/2012. Although it can be established from historic reports that seismic exploration was carried out on the older Banio wells in the 1970's, this data is not available. The available seismic data was collected in three different campaigns: BAN90 (1990's), TMB90 (1990's) and MNPM11 (2011/2012) (Figure 9.1). The full available dataset is comprised of 34 lines, spaced broadly on a 2.5 km by 3.5 km grid, with a combined length of approximately 411 km, spanning an area of approximately 600 km² across the southern part of the licence area.

The surveys from the BAN90 and TMB90 campaigns have been Pre-Stack Time Migrated, as indicated by the PTSM suffix on their filenames. There is no PTSM suffix on the MNPM11 campaign survey files, but the stacks look similar so it can be inferred that they have also been migrated (ERCOSPLAN, 2022).

Figure 9.1: Map of Seismic Survey Lines and Hydrocarbon and Potash Exploration Drill Holes



Source: Micon, 2024

The available seismic data has been interpreted on two separate occasions, firstly by CSA Global, as outlined in their 2016 report and later in 2023 by SW Geophysics Limited, under the instruction of Millennial. Both seismic interpretations were carried out with the intention of identifying the top and base of the salt formation and rely on drill hole ties from the Banio wells to correlate seismic reflectors with the observed geological logs. Both CSA Global and SW Geophysics concluded that it was not possible to reliably correlate internal reflectors within the salt formation.

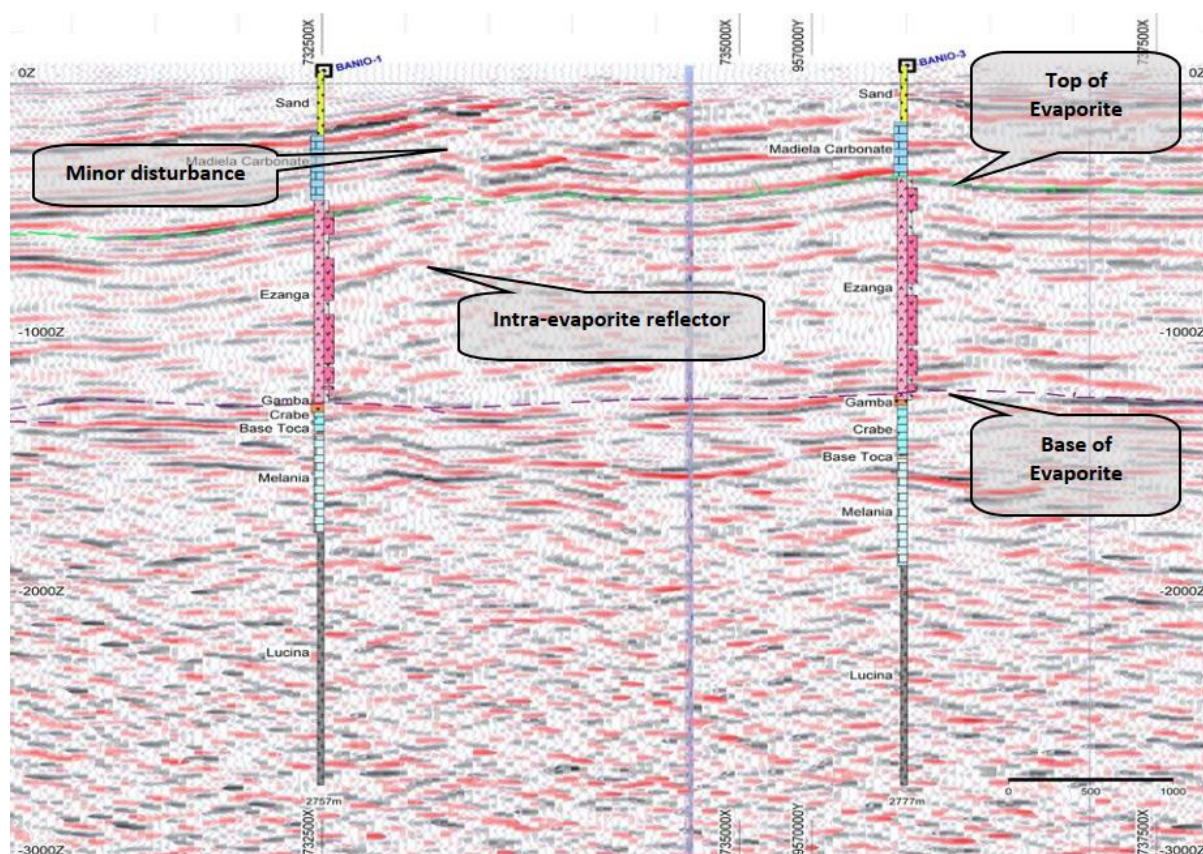
9.1.1.1 CSA Global Seismic Interpretation in 2016

The information in this section was summarised from CSA Global (2016) Report No. R324.2016.

In 2016 CSA Global interpreted the data from the 1990's campaigns (BAN90 and TMB90), it is unclear why they did not use the MNPM11 campaign data and whether it was available to them or not. The dataset used by CSA Global only includes 18 profiles, spanning an approximate length of 275 km as opposed to the full 34 profiles mentioned above.

CSA Global's seismic interpretation extends down to a depth of approximately 1,500 m (800 to 990 milliseconds of Two-Way Travel Time), encompassing the roof (depth of around 700 m) and base (depth of around 1,200 m to 1,300 m) of the evaporite sequence as well as the overlying Tertiary to Lower Cretaceous sedimentary sequence (Figure 9.2). CSA Global calculated the mean thickness of the evaporite sequence to be around 650 m, fluctuating between 500 m and 800 m. CSA Global commented on the seismic contrast within the evaporite sequence and how it likely related to density variations caused by the various salt layers, but was unable to accurately correlate these reflectors with specific potash intervals that correlated with the drill holes.

Figure 9.2: Seismic Line TMB90_102 Showing Correlation Between Reflectors at the Top and Base of the Salt Formation



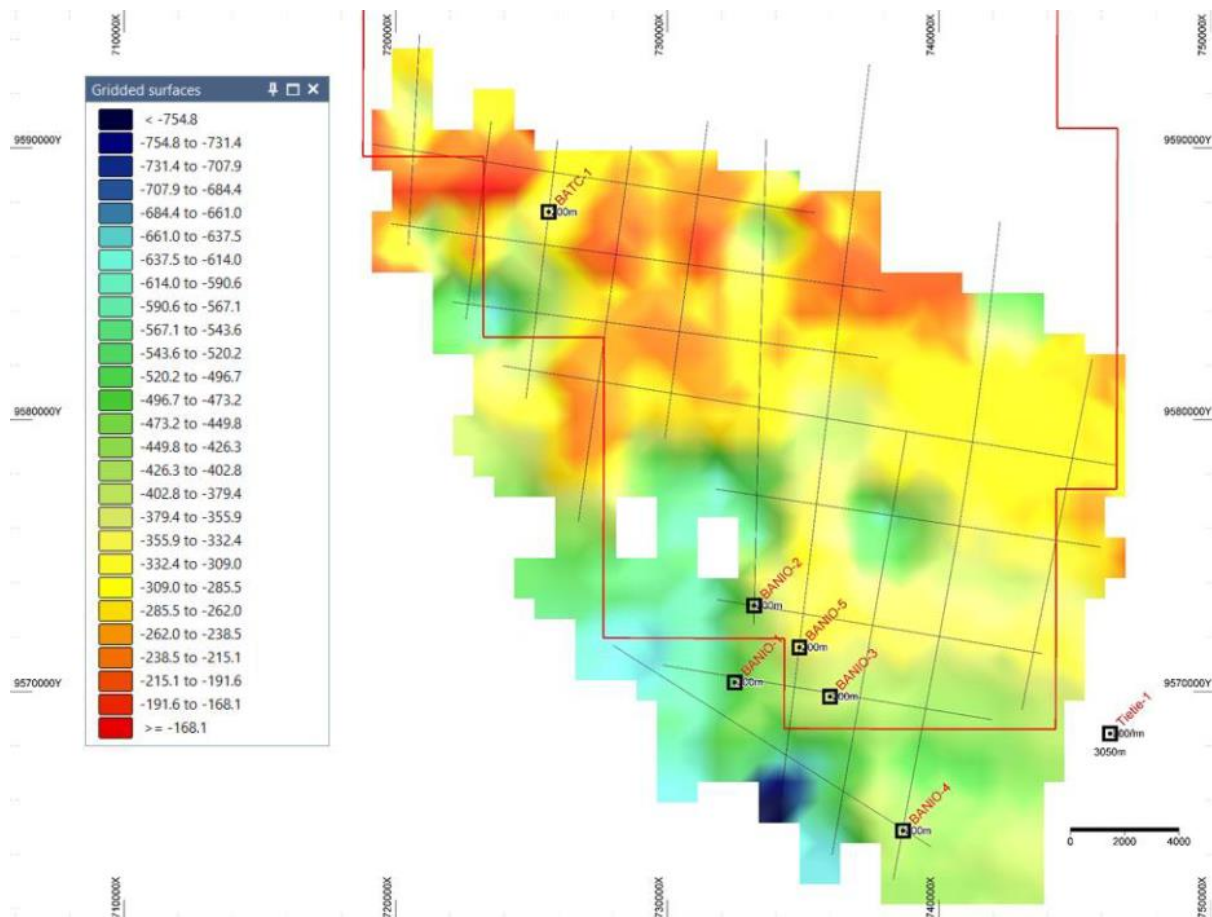
Source: CSA (2016)

Note: 2x Vertical Exaggeration

CSA Global highlighted that the conversion of time sections to depth sections used to integrate the seismic data into their geological model were only approximate and that the thick overburden and poorly consolidated sediments could lead to errors in the range of up to 20 m to 40 m for the depth

of a particular horizon. CSA Global expressed that the depth discrepancies were “within acceptable accuracy for the current stage of the Project and therefore this data was used in the generation of a 3D geological model” (Figure 9.3).

Figure 9.3: Gridded Depth Data of the Top of the Salt Formation



Source: CSA (2016)

CSA Global stated that although the roof and base of the evaporite sequence could be well defined using seismic techniques there is insufficient contrast between the halite and sylvite densities to delineate individual potash beds within the sequence.

Due to varying levels of confidence in the seismic interpretation, the reader was cautioned that, although there is no real evidence indicating so, there may be areas of the model that vary more significantly for the interpreted geometry.

CSA Global expressed the opinion that “the exploration conducted by petroleum exploration and production companies is of sufficient quantity and quality to allow the evaluation and targeting of the Project for potash mineralisation”.

Although it is clear from CSA Global’s report that they interpreted the seismic profiles in 3D space and produced a geological model Micon is not able to comment on this model, as it was not provided for analysis.

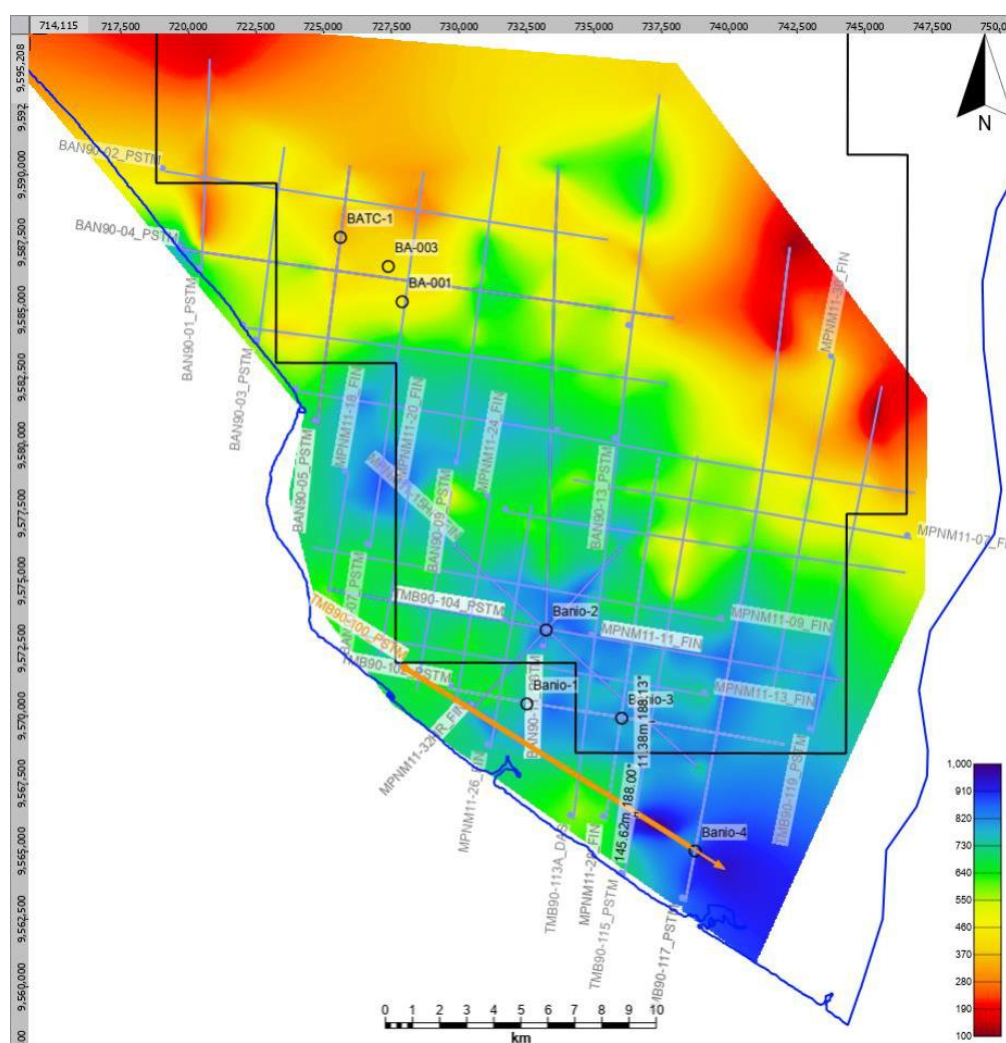
9.1.1.2 SW Geophysics Ltd.

The information in this section was summarised from SW Geophysics Ltd. (2023) Reports “Millennial Potash Legacy Seismic Interpretation” and “Millennial Potash, Interpretation of Top and Base Salt in Banio Potash Licence area, Gabon”.

In April 2023 Millennial provided the available seismic data to SW Geophysics for re-interpretation. The aim of this re-interpretation was similar to that of the work carried out previously by CSA Global, with the aim of re-interpreting the top and base of the salt formation using the available seismic data.

For interpretation of the horizons a constant salt velocity of 4,500 m/s was used, and horizons were tied to the drill holes using an overburden of 2,700 m/s at the BATC-1 well and 3,400 m/s at Banio-2 with a smooth transition in-between. Once horizons had been identified for the upper and lower surfaces of the salt formation they were smoothed and interpolated to create 3D grids. Using these 3D grids the depth of the upper and lower surfaces and overall salt thickness were calculated and mapped (Figure 9.4) (SW Geophysics, 2023).

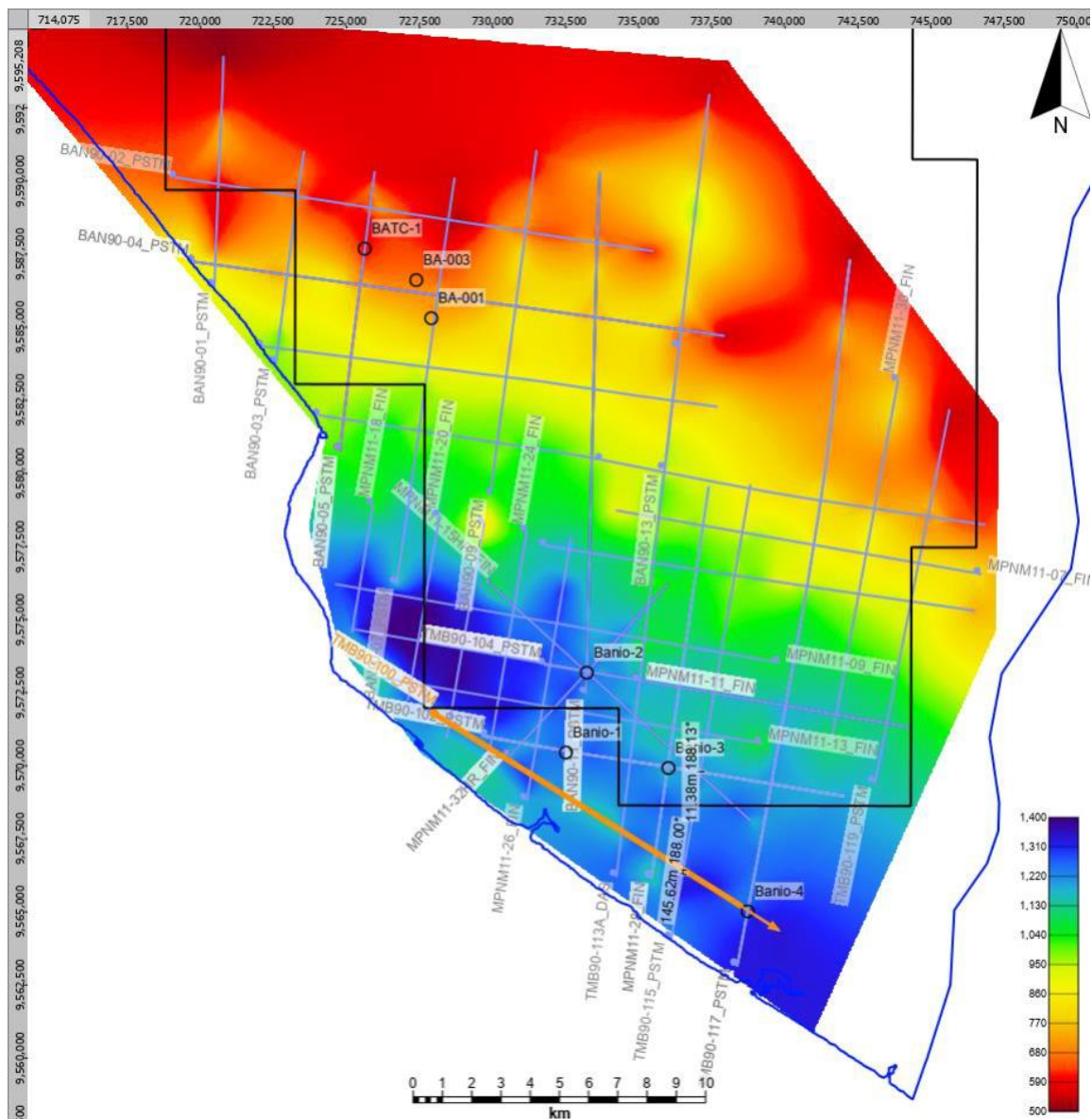
Figure 9.4: SW Geophysics Salt Thickness Map



Source: SW Geophysics (2023)

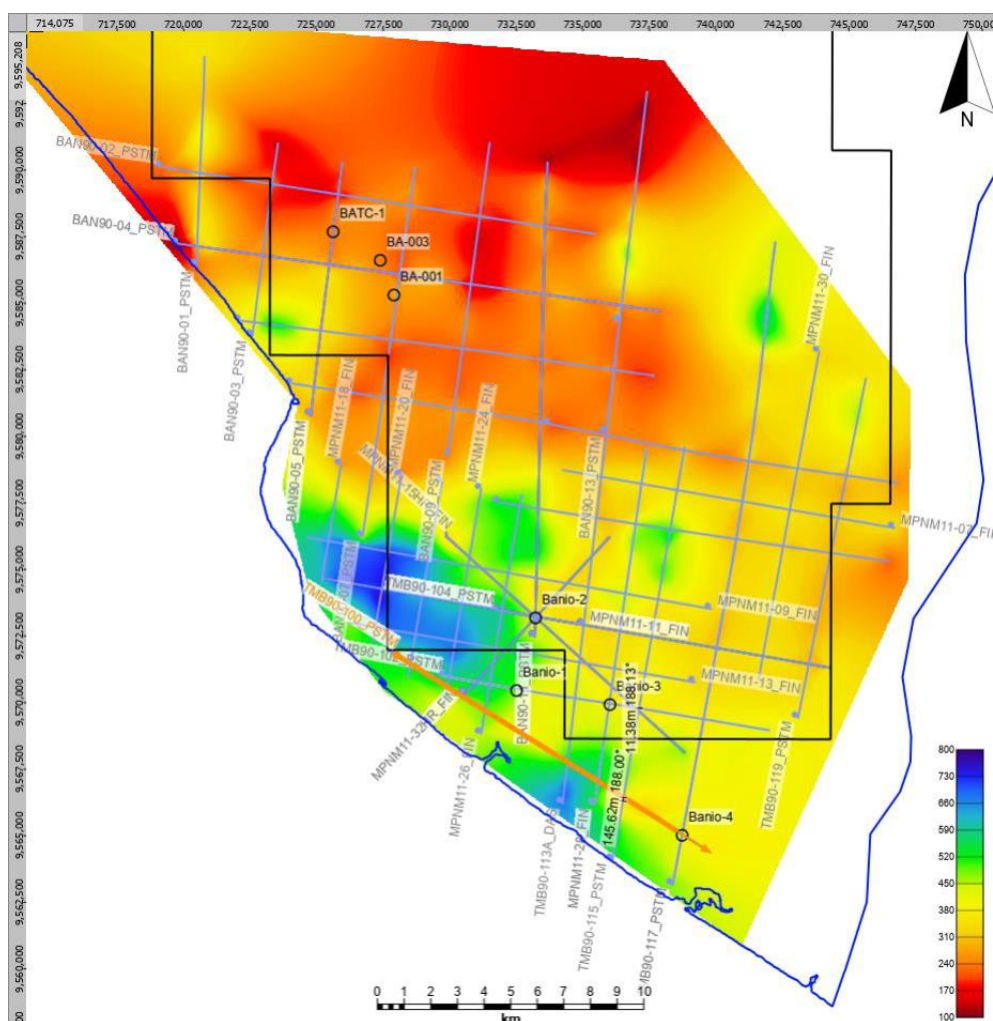
SW Geophysics made comment on the fact that the image quality of deeper structures in the MPNM11 dataset is poorer than the BAN90 and TMB90 datasets and as such the confidence in the base of the salt unit is lower in areas which relied on MPNM11 surveys. From SW Geophysics' work we can see that the base of the salt formation shows a fairly constant South-North dip (Figure 9.5), whereas the top of the salt unit is much less uniform (Figure 9.6).

Figure 9.5: SW Geophysics Base of Salt Depth Map



Source: SW Geophysics (2023)

Figure 9.6: SW Geophysics Top of Salt Depth Map



Source: SW Geophysics (2023)

9.1.1.3 Micon Salt Unit Geomodelling

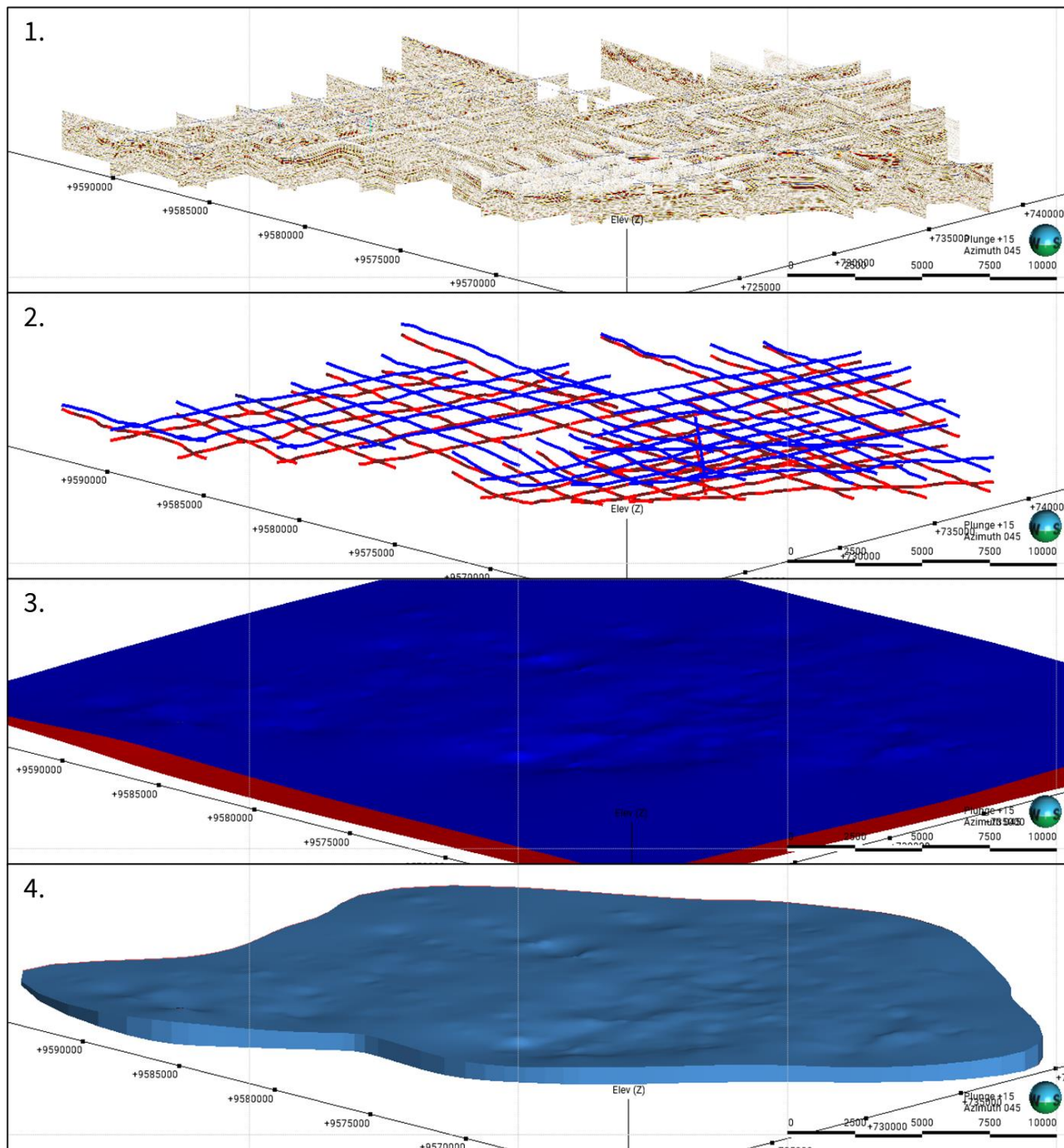
Under instruction from Millennial, Micon took the seismic interpretation carried out by SW Geophysics and put it into 3D using Leapfrog Geo. The top and bottom reflectors of each section were then digitised and used to create an upper and lower surface for the salt sequence. The upper and lower surfaces were then clipped to avoid projecting the sequence too far laterally. A clipping distance of ~2 km was chosen as it was gauged visually to be the approximate average spacing between seismic profiles across the area.

Figure 9.7 visually outlines the main stages of wireframe creation from the interpreted seismic profiles:

1. Orientate the interpreted seismic profiles in 3D space.
2. Digitise the upper and lower salt surfaces from the seismic profiles.
3. Produce a top and bottom surface from the digitised profiles.
4. Clip the top and bottom surface and create a 3D wireframe.

The modelled potash seam roof and floor surfaces will be used as an exploration tool for the continued drilling that is planned at Banio.

Figure 9.7: Stages of Micon's Wireframe Creation from SW Geophysics' Seismic Interpretation



Source: Micon, 2023

10.0 DRILLING

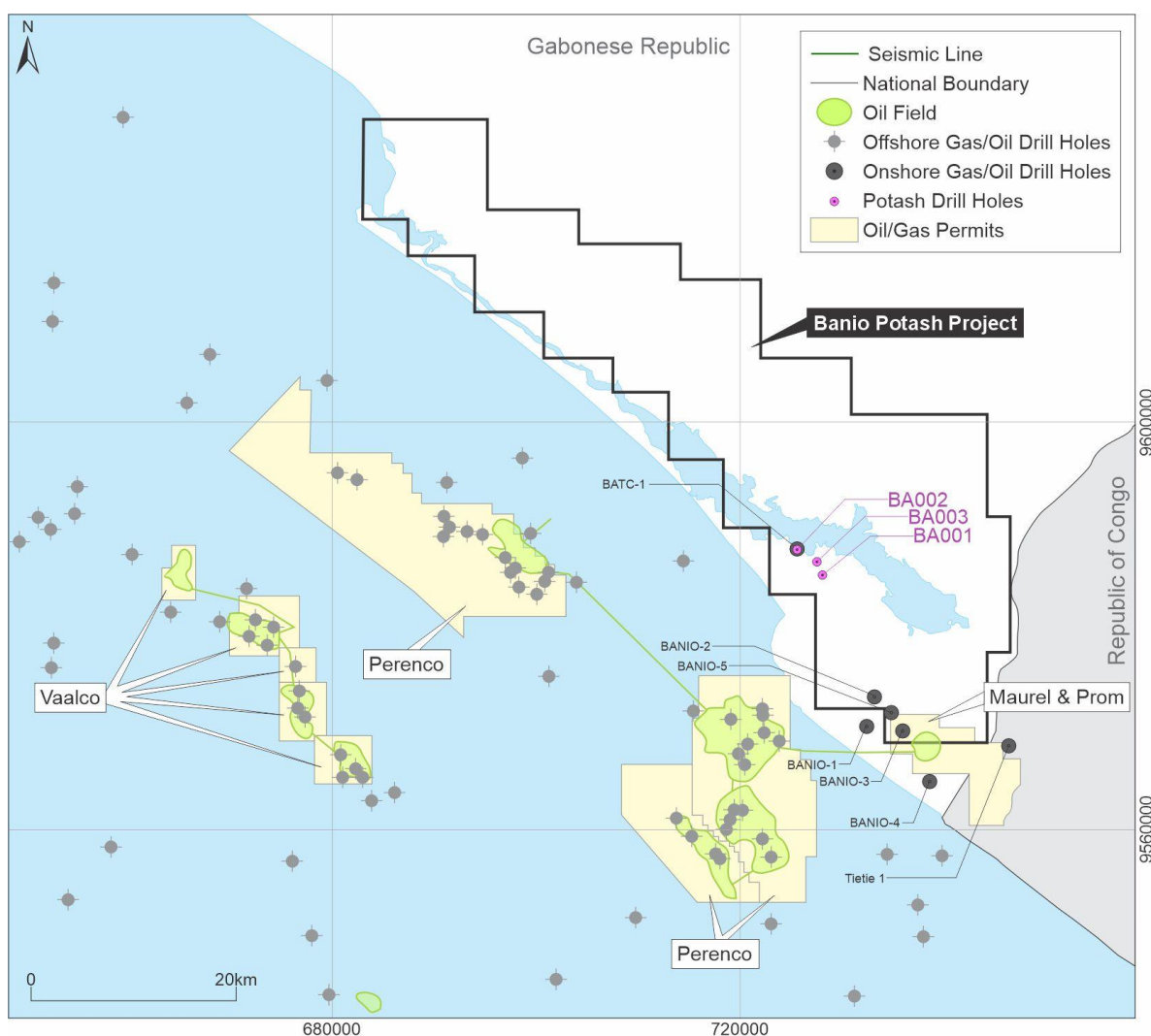
10.1 INTRODUCTION

The Congo coastal basin has been intensively explored by numerous off-shore and on-shore drill holes and seismic surveys carried out since the 1950's. Most exploration was completed for hydrocarbons and information is available from some of the drill holes from either the archive of Mines de Potasse d'Alsace (MDPA) or from published sources. There have also been several exploration campaigns specifically focused on potash.

10.2 HISTORICAL DRILLING

The historic drilling completed within Banio Project area and the surrounding vicinity from 1972 to 2010 consists of six historical hydrocarbon drill holes Banio-1 to Banio-5 and BATC-1 and three potash exploration drill holes (Ba-001 to Ba-003) drilled in 2017. Information about all nine drill holes is given in Table 10.1 and the location of the drill holes is shown in Figure 10.1. along with numerous offshore hydrocarbon drill holes.

Figure 10.1: Drill Hole Locations Completed in the Banio Project Area



Source: Micon, 2024

Table 10.1: Summary of Historic Exploration Drill Hole Data in the Banio Area

Year	Drill Hole No.	Easting	Northing	Elevation (m)	Depth (m)	Owner	Exploration Purpose
1972	Banio-1	732,483.8	9,570,340	50	2,800	Elf Gabon	Hydrocarbon
1975	Banio-2	733,198.1	9,573,157	47	2,477	Elf Gabon	Hydrocarbon
1977	Banio-3	735,989.5	9,569,811	70	1,997	Elf Gabon	Hydrocarbon
1978	Banio-4	738,680.9	9,564,872	38	1,978	Elf Gabon	Hydrocarbon
2010	Banio-5	734,865	9,571,623	47	1,843	Maurel & Prom	Hydrocarbon
1991	BATC-1	725,636.9	9,587,646	12	903	Elf Gabon	Hydrocarbon
2017	Ba-001	727,893	9,585,295	5	368	Mayumba Potasse	Potash
2017	Ba-002	725,483	9,587,774	6	516.3	Mayumba Potasse	Potash
2017	Ba-003	727,379	9,586,599	5	528	Mayumba Potasse	Potash

10.2.1 Oil and Gas Drilling

Information about the historical drill holes Banio-1 to Banio-4, BATC- 1 and Banio-5 was obtained from the companies Maurel & Prom and Elf Gabon. The information consisted of the historical geological drilling reports and the geological drilling logs for the drill holes Banio-1 to Banio- 5 as well as for BATC-1. This documentation typically contains the information about the location and elevation of the drill hole, start and finish of the drilling operation, depth and lithologic information of any cored sections along the drill hole, information about the type cuttings in the mud log and the stratigraphic interpretation of the geophysical well logs for the drill hole as well as an interpretation of eventual hydrocarbon reservoir rocks. Especially the younger geological drilling reports often provide further information about the geothermal gradient (e.g. BATC-1, Banio-5). With exception of drill hole Banio-5, which has a natural gamma ray log of the evaporite section from measurement while drilling, all other drill holes have a suite of geophysical wireline logs, recorded after drilling the salt section. The available logs over the evaporite section from the holes other than Banio-5 are summarised in Table 10.2.

Table 10.2: Sections with Different Available Geophysical Wireline Logs over the Evaporite Sections of the Drill Hole

Log	Banio-1 From – to (m)	Banio-2 From – to (m)	Banio-3 From – to (m)	Banio-4 From – to (m)	BATC-1 From – to (m)
Caliper	0 – 1,290	383 – 1,219	356 – 1,259	-	26 – 600
Natural Gamma	-	0 – 1,219	0 – 1,259	80 – 1,289	0 – 600
Spectral Gamma	175 – 1,290	-	-	-	0 – 600
Resistivity	-	-	-	-	236 – 600
Density	-	384 – 1,219	-	-	231 – 600
Neutron Porosity	-	-	-	-	26 – 600
Photoelectric	-	-	-	-	0 – 600
Sonic	170 – 1,290	380 – 1,219	0 – 1,259	400 – 1,289	0.5 - 600

Technical Drilling Reports describing the different sections of the holes with equipment and consumables used for drilling are available from the Banio-3, Banio-4 and BATC- 1 drill holes. For drill hole Banio-5 this information is included in the more extensive geological drilling report. The Banio-5 report states that for this drill hole an oil-based drilling fluid has been used over the drilling

of the evaporite section, which should minimise dissolution of all salt rocks present. From the other technical drilling reports the mud reports show that for the drilling of the evaporite section a NaCl saturated water-based drilling fluid has been used. The use of such drilling fluid will result in dissolution of carnallite and tachyhydrite from the drill hole walls, which increases the uncertainty when interpreting wireline data from such drill holes. For Banio-1 and Banio-2 the information from the geological drilling logs suggests that these drill holes also have been drilled over the evaporite sequence using a NaCl saturated water-based mud.

Six spot cores of 18 m length have been taken from the evaporite section of drill hole Banio-2, with recovery of parts of the potash bearing sections in three cores. These sections have been assayed, but no detailed assay information is provided in the “Salt Investigation Report”, except that the mineralogy of the potash bearing section is carnallite, halite and sylvite. The description and the low-quality scanned core pictures show significant dissolution of the core over the carnallite bearing sections. The dissolution and low quality of the core pictures makes interpretation of the core data difficult.

The drill hole coordinates for all wells are given in UTM coordinates, but only for the hole Banio-5 from 2010, the reference system is provided (M’Poraloko). Since this is the youngest drill hole, it is assumed that the coordinates of all the older drill holes are also given with respect to this local reference system. The original M’Poraloko coordinates have been transformed to UTM (zone 32S) coordinates with the WGS 84 reference and these are provided in Table 10.1. When the transformed WGS 84 coordinates of the drill holes are plotted on a WGS 84 referenced map or satellite image there are clearings or other indications of drilling platforms at these locations, suggesting that the assumption that M’Poraloko was the reference system for the original coordinates is correct.

The original drilling protocols for these hydrocarbon drill holes are not available and all information about the drilling conditions comes from CSA Global (2016). This Report states that for each hydrocarbon drill hole the following data items were available:

1. Table showing stratigraphic tops.
2. Summary geological description of facies and mineralogy; reference is made to salt minerals in the evaporite formation.
3. Gamma ray – neutron log scanned from original oil drill hole record with stratigraphic tops marked on the log.
4. Tables showing drill hole technical information in metric units.
5. Geological report for drill hole.
6. Seismic line with interpretation of key stratigraphic reflectors and correlation of drill hole.

10.2.2 Potash Drilling

In the 1960’s the MDPA drilled for the Syndicat de Recherches de Potasse au Congo (CPC) approximately 88 on-shore holes for potash exploration in the Republic of Congo area of the basin (historical drill holes with numbering K xx). Many of these drill holes were concentrated near the later Holle mine (latitude 4°36'48" S and longitude 12°02'37" E) to define the sylvite mineralisation there, but this campaign also provided a general outline of the potash deposit in the Republic of Congo area of the basin. This campaign ended with the opening of the Holle mine in 1969, which flooded in 1977 (Feuga et al., 2005). The information from this drilling campaign is not publicly

available from the MDPA archive, but some information from some of the drill holes has been summarised in technical reports or literature for specific areas.

In the early 1990's MDPA drilled another series of 18 on-shore exploration holes (KOU xx) to delineate potential sylvite mineralisation at specific locations within the basin. This was combined with geophysical investigations near Lake Youbi, but this did not result in further exploration or definition of an area with Mineral Resources. The information from this drilling campaign is not publicly available from the MDPA archive.

Between 2005 and 2010, MagIndustries Corp. ran an exploration programme and drilled 12 exploration holes and around 20 production holes for a carnallite solution mining project near Mengo, Kouilou Province, Republic of Congo. The results of all this drilling have been summarised in technical reports (e.g. Rauche & van der Klauw, 2015).

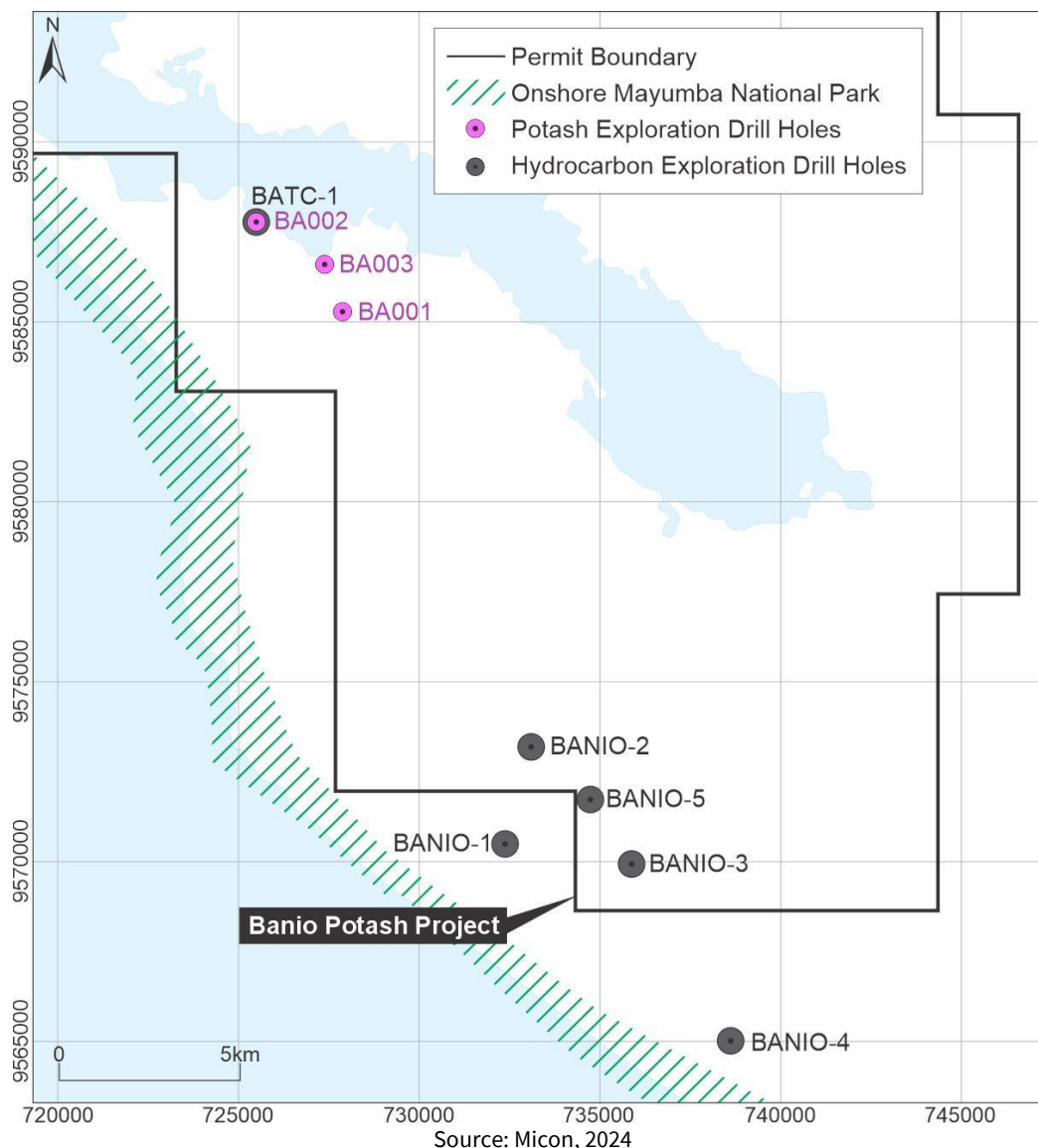
Kore Potash Limited (formerly Elemental Minerals Limited) has carried out exploration and development work in their Sintoukola Exploration Licence area and have within this licence defined sylvinite reserves for their Kola Project (SRK et al, 2012). The report contains locations, depth intervals and an analysis of the 44 new drill holes used for resource definition. Further drilling has taken place near Dougou (two holes) that in combination with historical holes resulted in the definition of carnallite resources and for the Dougou Extension Project (DX 18 holes) in the definition of sylvinite resources. The location of these holes can be obtained and also whether carnallite or sylvinite is present from the reports, but no exact thickness and grade information is available from these 20 drill holes (Kore, 2015, Kore, 2020).

Further potash exploration work has been carried out between 2010 and the present within the Congo Coastal Basin, but the results are not publicly available or accessible. The company African Potash Limited has drilled two exploration drill holes in 2014 at their Lake Dinga prospect, but no information about location, depth, thickness and grade of the potash seams is provided (African Potash, 2017). The Chinese company Zhengwei Technique Congo, drilled an exploration hole south of the Lake Dinga area, but except for coordinates no information is available about this hole.

Kanga Potash drilled three exploration drill holes within their Kanga Licence area south of the Kouilou River (Strauss & Rigny, 2022). This summary does not provide detailed information about the location and mineralisation of these holes.

Mayumba Potasse drilled three potash exploration drill holes (Ba-001, Ba-002 and Ba- 003) in 2017 to better define the sylvinite mineralisation within the Banio Project area. Figure 10.2 shows the detailed location of the Mayumba Potasse drill holes and the hydrocarbon exploration drill holes within the Banio Project Area and the nearby vicinity.

Figure 10.2: Historical Drill Holes Completed within the Banio Project Area and the Nearby Vicinity



10.2.2.1 Mayumba Potasse Drilling

Drill hole Ba-001 was drilled between 17.03.2017 and 07.04.2017 using a S5000 rig with destructive drilling from surface to a depth of 329 m (within the top of the anhydrite) using a bentonite-based mud with a diameter of 7 5/8". At this depth the hole was cased (5 1/2") and cemented to prevent any groundwater inflow during drilling of the salt section. The anhydrite and salt section was continuously cored with wireline coring using a tri-salt mud. The cored section ranged from 328 m to 364 m, with only fragments of preserved cores (anhydrite) from 330 m to 341.8 m. A comparison with the geophysical log suggested this core loss section was located in the clay/marl section with minor anhydrite. The available core sections are stored at the Banio Project camp site and were reviewed by ERCOSPLAN and Micon during their site visits.

The drilling was discontinued at 364 m, because the last core sections showed steeply dipping carnallite. This was interpreted to be due to drilling into a large-scale fault. Experience from other locations in the basin, however, indicates that steeply dipping carnallite sections do often occur

as loose blocks floating in a tachyhydrite matrix. The normal horizontal potash bearing sequence continues below the tachyhydrite bearing section and it is planned to extend this hole to prove this.

Drill hole Ba-002 was drilled between 11.04.2017 and 20.04.2017 using an S5000 rig with destructive drilling from surface to a depth of 230 m (within the top of the anhydrite) using a bentonite-based mud with a diameter of 7 5/8". At this depth the hole was cased (5 1/2") and cemented to prevent any groundwater inflow during drilling of the salt section. The anhydrite and salt section was continuously wireline cored (PQ diameter) with a GEMSA rig using a tri-salt mud. The cored section ranged from 230 m to 516 m, with no significant core loss. The remaining core sections after sampling for assaying are stored at the Banio Project camp site.

The drilling for Ba-002 was discontinued at 516.3 m. The reason to discontinue the drilling was not provided in the documentation, but since the geophysical log of the hydrocarbon drill hole of BATC-1 showed only minor natural gamma peaks below this section it was inferred that no further potash bearing sections were expected at increased depths and the organic decomposition smell suggested the eventual presence of high pressure hydrocarbons further downhole.

In August 2023 the drill hole Ba-002 was extended by Millennial and the details are presented in Section 10.3.

Drill hole Ba-003 was drilled between 16.05.2017 and 14.06.2017 using an S5000 rig with destructive drilling from surface to a depth of 220 m (assumed in top of the anhydrite) using a bentonite-based mud with a diameter of 7 5/8". At this depth the hole was cased (5 1/2") and cemented to prevent any groundwater inflow during drilling of the salt section. The cement did not set properly and with the start of drilling and PQ size with the GEMSA rig using a tri-salt mud, mud losses were observed. The hole was recemented with the PQ rods as casing at a depth of 225.6 m. Drilling was continued with HQ diameter with the GEMSA rig using a tri-salt mud. The cored section ranged from 222 m to 528 m, with no significant core loss. The remaining core sections after sampling for assaying are stored at the Banio Project camp site and were reviewed by ERCOSPLAN and Micon during their site visits.

The drilling for hole Ba-003 was discontinued at 528 m for the same reason as the drilling was discontinued for Ba-002, that the geophysical log of drill hole BATC-1 showed only minor natural gamma peaks below this section so it was inferred that no further potash bearing sections were expected at increased depths and the organic decomposition smell suggested the eventual presence of high pressure hydrocarbons further downhole.

After reaching the final depth in 2017, all three drill holes were geophysical wireline logged with the following logs being obtained:

- Caliper log;
- Azimuth and Tilt log;
- Natural gamma ray log;
- Fluid temperature log;
- Sonic logs (not in Ba-001); and,
- Density log.

10.3 CURRENT MILLENNIAL DRILL HOLES

Carrying on from previous work, Millennial has extended the existing drill hole Ba-002 that was originally drilled by Mayumba Potasse in 2017 on the Banio Project site and has plans to extend Ba-001.

In August 2023 the Ba-002 drill hole was extended, by drilling contractor Merlin, to a depth of 552.5 m using a BD2000M rig and a tri-salt mud to evaluate for the presence of carnallite bearing rocks in the deeper parts of the evaporite section (Figure 10.3). The extension took PQ cores between 516.3 m to 522.5 m in depth and as the PQ core barrel got stuck at that depth, HQ cores from 522.5 m depth to 552.5 m depth. No casing was used. Over these sections there was no significant core loss, with a minimum core recovery of 83% and an average of 98%. The remaining core sections after sampling for assaying are currently stored at the Banio Project camp site.

Drill hole Ba-001 is planned to be extended as Millennial believes that it was stopped prematurely by Mayumba Potasse in 2017. The hole was stopped due to reaching steeply dipping carnallite, which was interpreted to indicate the presence of a large-scale fault however, evidence from other locations within the basin indicates that steep dipping carnallite sections can occur as inclusions within a tachyhydrite matrix. Elsewhere in the basin the potash sequence continues below this tachyhydrite unit, so an extension to Ba-001 is planned to prove this hypothesis and see if further potash is found downhole. Table 10.3 presents a summary of the Millennial drilling.

Figure 10.3: Drill Rig Set Up to Drill the Extension to Hole Ba-002



Source: Millennial, 2023

Table 10.3: Summary of Millennial Drilling

Drill Hole	UTM X	UTM Y	Z	Dip	Azimuth	Depth EOH (m)	Progress
Ba-001	727909	9585292	5	90	0	364	In progress (to be extended)
Ba-002	725483	9587774	6	90	0	552.5	Completed (extended)
Ba-003	727379	9586599	5	90	0	528	Completed
Ba-004	731685	9585314	N/A	90	0	~700	Planned

10.3.1 Logging

Geological logging was carried out on the Ba-002 extension with an average interval length of 1.02 m, a minimum of 0.05 m and a maximum of 10.79 m. The only attribute described in the geological logging was a lithological description.

10.3.2 Sampling

16 core samples were taken from the Ba-002 extension, with a minimum sample length of 0.17 m, a maximum length of 1.64 m and an average length of 0.97 m. Samples from a depth of 516.75 m to 522.50 m (drilled as PQ core) were sampled by taking a quarter of the core and samples from 522.50 m to 535.54 m (drilled as HQ core) were sampled by taking half the core.

10.3.3 Recovery

The 16 samples taken from the Ba-002 extension do not show any significant core loss, with a minimum core recovery of 83% and an average of 98%.

10.3.4 Collar Surveys

Micon has not seen any documentation detailing the collar surveying method(s).

10.3.5 Downhole Surveys

Micon has not seen any documentation detailing the downhole surveying method(s).

Table 10.4 shows the typical drill hole intercepts encountered on the Banio Project composited by Cycle and Seam.

Table 10.4: Typical Drill Hole Intercepts Encountered on the Banio Project Compositied by Cycle and Seam

Hole ID	East	North	Elevation	Mineralisation	Cycle	Seam	Depth From (m)	Depth To (m)	KCl (%)
Ba-002	725483	9587774	6	Sylvinite	VIII	Seam 3-11	280.2	282.3	24.55
Ba-002	725483	9587774	6	Sylvinite	VIII	Seam 2	284.35	287.05	25.18
Ba-002	725483	9587774	6	Carnallitite	VII	Seam 10	364.79	366.04	13.35
Ba-002	725483	9587774	6	Carnallitite	VII	Seam 9	368.79	370.29	13.96
Ba-002	725483	9587774	6	Carnallitite	VII	Seam 8	374.69	376.24	12.63
Ba-002	725483	9587774	6	Carnallitite	VII	Seam 6-7	387.76	390.86	13.24
Ba-002	725483	9587774	6	Carnallitite	VII	Seam 5	394.41	396.96	15.53
Ba-002	725483	9587774	6	Carnallitite	VII	Seam 3-4	400.71	406.06	14.55
Ba-002	725483	9587774	6	Carnallitite	VII	Seam 1-2	409.66	417.16	16.24
Ba-002	725483	9587774	6	Carnallitite	VI	Seam 6-11	438.71	452.52	14.69
Ba-002	725483	9587774	6	Carnallitite	VI	Seam 2-5	453.72	467.52	15.60
Ba-002	725483	9587774	6	Carnallitite	V	Seam 5-9	481.8	491.85	13.61
Ba-002	725483	9587774	6	Carnallitite	V	Seam 3	496.35	498.25	21.57
Ba-002	725483	9587774	6	Carnallitite	V	Seam 2	499.5	501.05	16.19
Ba-002	725483	9587774	6	Carnallitite	IV	Seam 1	518.34	522.5	17.05
Ba-002	725483	9587774	6	Carnallitite	III	Seam 1	529.14	533.9	18.73
Ba-003	727379	9586599	5	Sylvinite	VIII	Seam 4a	262.89	265.59	18.37
Ba-003	727379	9586599	5	Sylvinite	VIII	Seam 4b	268.68	270.99	18.98
Ba-003	727379	9586599	5	Sylvinite	VIII	Seam 4c	273.03	275.48	21.11
Ba-003	727379	9586599	5	Carnallitite	VIII	Seam 3	282.16	286.79	16.98
Ba-003	727379	9586599	5	Carnallitite	VIII	Seam 2	288.7	293.81	14.48
Ba-003	727379	9586599	5	Carnallitite	VII	Seam 8	397.84	399.25	14.54
Ba-003	727379	9586599	5	Carnallitite	VII	Seam 6-7	409.09	412.35	14.99
Ba-003	727379	9586599	5	Carnallitite	VII	Seam 5	415.39	418.03	16.75
Ba-003	727379	9586599	5	Carnallitite	VII	Seam 3-4	421.98	427	15.02

Hole ID	East	North	Elevation	Mineralisation	Cycle	Seam	Depth From (m)	Depth To (m)	KCl (%)
Ba-003	727379	9586599	5	Carnallitite	VII	Seam 1-2	430.02	437.01	16.66
Ba-003	727379	9586599	5	Carnallitite	VI	Seam 6-11	456.98	468.75	15.86
Ba-003	727379	9586599	5	Carnallitite	VI	Seam 2-5	469.88	485.6	16.90
Ba-003	727379	9586599	5	Carnallitite	V	Seam 5-9	497.24	507.06	14.58
Ba-003	727379	9586599	5	Carnallitite	V	Seam 3	511.23	513.45	20.12
Ba-003	727379	9586599	5	Carnallitite	V	Seam 2	514.2	515.75	19.08

11.0 SAMPLE PREPARATION, ANALYSES AND SECURITY

11.1 INTRODUCTION

The information in this section was summarised from the ERCOSPLAN (2023) Report “Initial Mineral Resource Estimate for the North Target of the Banio Potash Project, Mayumba Permit, Republic of Gabon”.

Infinity Lithium Corporation Limited, the past owner of the Banio Project through its subsidiary Mayumba Potasse SARL, in 2017 established a standard operating procedure to guide the sampling process from source at the drill rig to delivery to the laboratory, which was monitored by their staff. These sample preparation, handling and security, and analysis procedures for two of the drill holes drilled by Mayumba Potasse, Ba-002 and Ba-003, are described in Section 11.2. With minor modifications to these procedures that will be detailed in Section 11.3 this has been adhered to by Millennial during the ongoing exploration drilling.

11.2 CORE HANDLING AND SAMPLING PROCEDURE

The standard practice to ensure high core quality was a continuous control of the mud chemistry and physical properties by a dedicated mud technician, who adjusted chemistry and properties when necessary to avoid dissolution of potassium and magnesium bearing minerals from the core material. Chemistry and mud properties were recorded in daily drilling reports for each hole. Inspection of the core by ERCOSPLAN as detailed in their 2023 report indicates that the tri-salt used was properly maintained and there are no signs of dissolution of carnallite or sylvite from the core surface. Since it is not possible to design a water-based mud in equilibrium with tachyhydrite, in sections of the core bearing this mineral some dissolution has taken place. The assessment process to ensure core recovery includes the recording of drilling advance at the rig on the drill string against the length of core recovered. Core recovery was recorded at between 95% and 100% for all potash seams and the intervening evaporitic sequence. After measurement of the core, the core was divided into sections of a maximum 1 m length and wrapped in plastic liner after drilling, to prevent contact with the atmosphere. This was completed to minimise the reaction of the carnallite with humidity from the air. The core with depth markers and top and bottom indicators was boxed in properly marked boxes and thereafter stored in a de-humidified core storage room where it is stored permanently except when logging or being prepared for sampling over short periods. For the relevant carnallite and sylvite sections of the core, good recovery with no indications for dissolution at the core surface was recorded.

Before sampling all core was photographed and logged with delineation of different rock types and recording the depth of the boundaries of different lithologies (Figure 7.10 to Figure 7.12). The sampling was completed as per Infinity’s sampling protocol. The original Infinity protocol envisaged marking samples between 15 cm to 50 cm length on the core over the visually determined boundaries between potash bearing rock and rock salt. One or two further samples were then taken in the rock salt section beyond the boundary to confirm the low potash content of these sections. For the sylvite bearing sections with relatively thin seams this provides a good resolution for the mineralised sections. This protocol applied to the interlayering of rock salt and carnallite seams that are present in most cycles results in a very large number of samples and a resolution of mineralised sections which is not practical for the definition of Mineral Resources.

Therefore, Millennial for the carnallite bearing sections has increased the length of the samples to between 80 cm for irregular interlayering and 180 cm for very regular interlayering or homogeneous carnallite sections. Only one sample was taken from a rock salt section beyond the carnallite boundary to confirm the low potash content of these sections.

Core to be submitted for analysis was sawn into two halves, one of which was retained and stored on-site for record purposes and the other submitted to the laboratory for preparation and analysis. The core was orientated to ensure both halves were as similar as possible. Sampling of the core was conducted with core pieces with lengths between 15 cm and 25 cm after which the core was cut along a marked centre line which is orientated to bisect the maximum dip of the bedding where possible. The core was cut dry with a core cutting machine by Infinity staff under the supervision of an Infinity geologist. The core was packed in sealed plastic bags to prevent contact with air humidity.

The samples were then delivered and accompanied by Infinity staff to DHL couriers in Libreville in locked transportation crates, after which the crates were airfreighted to the laboratory. The remaining core at the exploration site is wrapped in plastic, placed in core trays, indexed and then stored in a secure and de-humidified storeroom at the Banio camp site.

As the exact mineralogical composition of the tachyhydrite bearing sections are not of commercial interest for the evaluation of the potash prospects of the property the author of the report does not consider the surface dissolution of tachyhydrite bearing cores problematic. Taking into account the potential crystal size of the carnallite as observed in the cores halving the core for a sample is definitely necessary for HQ core to obtain a representative sample, whereas with PQ or larger size core, quarter core sections are acceptable.

In the opinion of the author the procedure described has been adhered too and the potential relating to bias due to selective recovery/loss of material from the core ore preferential sampling is not considered an issue.

11.3 SAMPLE ANALYSIS

The initial sample analysis was undertaken by the ALS Global Laboratory (ALS Seville Laboratory) in Seville, Spain. Then a second analysis was performed by K-UTEC AG Salt Technologies (K-UTEC), Sonderhuasen, Germany and the SRC Geoanalytical Laboratory (SRC Laboratory) in Saskatoon, Canada who both re-analysed the potash rich samples.

11.3.1 ALS Global Laboratory Analysis

The sealed half core samples were sent to the ALS Seville Laboratory, where they were crushed and split. The powdered sample was then sent to the ALS Global Laboratory in Loughrea, Ireland for analysis. ALS adheres to strict internal QA/QC procedures during sample preparation and analysis. The ALS Seville Laboratory operates in accordance with International Organisation for Standardisation (ISO) Standard ISO 9001:2015. The ALS Loughrea Laboratory management system and selected analytical methods are accredited by the Irish National Accreditation Board (INAB) under the registration number 173T.

At the ALS Loughrea Laboratory all samples were crushed to -2 mm, a 1 kg sample was then riffle split, pulverised to 75 µm and a 100 g sample utilised for the analysis. The method used was ME-ICP for the elements Ca, Fe, K, Mg, Na and S. The sample preparation for the ME-ICP analysis (dissolution in water) has not been provided.

The mass of insoluble residue remaining after dissolving the soluble salt minerals was not reported. The main element Cl, which can constitute nearly 50% of the sample mass cannot be analysed with ME-ICP, however it is considered good practice to have it analysed by another method.

ERCOSPLAN has reviewed the Excel files reporting the Na, K, Ca, Mg and S content in percentage per mass for all samples and standards from the ALS laboratories. For evaporite rocks this suite of elements is considered an incomplete assay as the information about the Cl⁻ content (main anion component) as well as the mass of non-soluble material in a specified mass of water per mass of sample water (typically clay minerals, dolomite and anhydrite) are not available.

The analyses provided important boundary conditions for the QA/QC. The Cl⁻ content requires a separate analytical procedure and therefore an ion-balance, the main cations (Na⁺, K⁺, Mg²⁺ and Ca²⁺) and main anions (SO₄²⁻ (from S) and Cl⁻) provide important information about the potential bias in the analysis. The amount of non-dissolved material (insoluble) is important to ensure that the mineralogy (relatively simple in salt rocks) calculated from the assays sums up close to 100%. If this is not the case, there is reason to scrutinise the calculation scheme, which is based on an evaluation of the X-ray diffraction analysis of representative samples, or there is an error in the assay result.

ERCOSPLAN independently checked the analytical results by determining the mineralogy of the samples from the assays. This was completed by first adding Cl⁻ to the assay to make up the charge balance. Afterwards a mineralogical composition was established based on ERCOSPLAN's experience with the mineralogy of the deposit in other parts of the basin for each sample as follows:

1. Na combined with Cl to halite.
2. Ca combined with SO₄ to anhydrite.
3. Remaining SO₄ combined with Mg (rarely) to kieserite, any remaining Ca combined with Mg and Cl to tachyhydrite.
4. Remaining Mg combined with K and Cl to carnallite.
5. Any remaining Mg combined with Cl to bischofite, any remaining K combined with Cl to sylvite.

Using this estimated mineralogy, the mass of the minerals was calculated (including any mineral water for example in carnallite) and totalled. With the insoluble content added this total should be close to 100% provided the mineralogy is correctly estimated. A total sum between 95% and 101% has been considered acceptable, with a relatively low sum as a lower boundary as no insoluble content has been determined for the laboratory analyses. This is conservative for the laboratory as within the basin, according to the ERCOSPLAN's experience the insoluble content of the potash bearing samples is generally low.

The majority of the samples produced a mineralogy which is acceptable with minimal amounts of kieserite, tachyhydrite/bischofite and sylvite (except in the sylvinite sections), suggesting that the relative amounts of the cations have been determined correctly. A significant number of carnallite samples (> 40%) have a sum total too high, suggesting that although the relative amounts of cations are correct, there is an overestimation of either:

- All cations (dilution error in the laboratory), improbable because it only occurs in carnallite samples not in halite samples;
- Na, improbable for the same reason; and,
- K and Mg together, which is probably the cause, since only carnallite samples are involved.

As this effect is not observed in the standards inserted into the analysis batch it suggests that the supplied standards were not suitable to check the quality of the laboratory procedure.

The effect is usually small (<5%), but single analyses do occur with a 115% total sum, which suggests an error in the determination of the K(Cl) content $\pm 3.5\%$ (with KCl content typically in the range of 10% to 24%).

Because the evaluation of the original ALS analysis results produced high potash content mineralogical compositions for a significant number of samples that did not appear to be so rich in potash, it was decided to re-analyse all the powder rejects of the samples with a potash content of over 5% in other laboratories. The samples with a high potash content from Ba-003 were re-analysed by the SRC Laboratory and the samples with high potash content from Ba-002 were re-analysed at K-UTEC.

11.3.2 SRC Laboratory and K-UTEC

The core samples of the Ba-002 extension were sent to the SRC Laboratory in Saskatoon, Canada. The SRC Laboratory is certified by the Standards Council of Canada (SCC) to conform to the requirements of ISO/IEC 17025:2005 (CAN-P-4E).

At the SRC Laboratory the Potash ICP Analysis package designed for multi-element analysis of potash samples was used. Upon arrival the core samples are jaw crushed to 60% passing -2 mm and a 100 g sub sample is split out using a riffle splitter and transferred to vials. The subsample is pulverised to 90% passing -106 μm using a puck and ring grinding mill to create a pulp. The grinding mills are cleaned between groups using Quintus quartz. The pulp is then transferred to a labelled plastic snap top vial. An aliquot of the pulp is placed in a test-tube with 15 ml of 30°C deionised water. The sample is shaken. The soluble solution is then analysed by inductively coupled plasma optical emission spectrometry (ICP-OES). The method is suitable for the soluble analysis of commercial potash (sylvite). The soluble solution is then analysed by inductively coupled plasma mass spectrometry (ICP-MS). In addition, samples are analysed for Br and Cl by mass spectrometry (MS), plus the insoluble content by gravimetry.

The SRC Laboratory used a large suite of analysed elements for every sample, which are mostly present in minimal amounts and not relevant for the evaluation of the deposit. From the suite of elements analysed with ICP-OES the relevant components CaO, K₂O, MgO and Na₂O as percentage by mass (m%) as well as sulphur in ppm have been selected for further evaluation. Added for the evaluation is the amount of Cl (m%) and the amount of insoluble material (m%).

K-UTEC's analytical laboratory is accredited in accordance with the requirements of EN ISO/IEC 17025, by the German Accreditation Body (DAKKS).

At the K-UTEC laboratory the caked powdered samples were milled again to get a representative sample with a grain size of approximately 50 μm (90%). A 5 g aliquot of sample was dissolved in 300 ml boiling deionised water (100°C), filtered for insoluble content and diluted to a 500 ml volume to be used for all the other analyses. The determination of sodium, potassium, magnesium, calcium and sulphur, was completed according to DIN EN ISO 11885 by ICP-OES in dilutions of the original dissolved sample. The sulphur content was recalculated to sulphate (SO₄) content. Chloride was determined according to DIN 38405-1, by potentiometric titration with a silver nitrate solution. The insoluble content was determined gravimetrically from the dried material remaining in the filter after the initial dissolution of the solid sample in 300 ml of water.

K-UTEC reported the relevant elements Ca, K, Mg, Na, Cl, and SO₄ in addition to the mass of insoluble material in m%.

11.4 QA/QC

11.4.1 Infinity QA/QC Procedures

The QA/QC procedure used by Infinity relies on inserting standard and blanks samples within the sample batches sent to the laboratory, this is usual QA/QC procedure for a mineral project. For the assays for drill holes Ba-002 and Ba-003 either standard BCR-113 (~50.1% K, 47.8% Cl) or standard BCR-114 (~41.8%, 53.3% SO₄), were inserted as every 20th sample (in total 24 standards, 13 of BCR-113 and 11 of BCR-114). Sand was used as blank samples which were inserted every 40th sample (in total 23 blanks).

For the blanks the average potassium content was 0.066% and there was a tendency for the second half of the Ba-003 samples to be above this average. This also seems to hold for the potassium content of standard BCR-113, but not so for BCR-114. The standards and blanks having either extreme low or extreme high potassium values compared to the assays and did not contain significant amounts of magnesium. Therefore these standards do not provide the best control on the overall assay quality, taking into account that magnesium and sodium are also major cations present in the material.

Although the assay results show reasonable reproducibility for the assay results the standards and blanks used are not the optimal choice for analysing a potash project in salt. The sand as a blank has the advantage that in principle nothing will go into solution and in the laboratory, for all elements analysed, zero should be the result as for de-ionised water. Since the standards used show that the element of interest is potassium it would have been more realistic to have pure sodium chloride as background for the zero measurement for potassium. The standards used consist of a high grade KCl material (BCR-13) and a high grade K₂SO₄ material (BCR-14). The maximum potassium content in the samples which consist of a mixture of potash minerals and other salt minerals is significantly smaller and the eventual influence on the assay of the elements from these other salt minerals is not accounted for.

To the knowledge of the author of this Report Infinity did not send any samples to a secondary laboratory for check analysis.

11.4.2 Millennial QA/QC Procedures

The QA/QC procedures used by Millennial rely on the laboratory internal QA/QC for measurement of blanks and standards and on check analyses by different laboratories with experience in the analysis of potash salt rock samples to verify the results.

11.4.2.1 Laboratory Internal QA/QC

Both the K-UTEC and SRC laboratories have internal QA/QC procedures. At the K-UTEC laboratory the procedures consists of:

- A daily blank control for every analytical parameter, (in the case of brine samples, this is deionized water);

- Every determination run is also controlled by the measurement of a commercially available standard solution of at least one of the specified ions;
- Daily, one selected sample is analysed twice for the control of the standard deviation of every single parameter;
- All quality control data is graphed for long-term quality analysis and it is reviewed by the laboratory quality manager; and,
- The laboratory periodically takes part in Round-Robin Tests to prove the reliability of its analytical methods.

The internal QA/QC procedures operated by the SRC Laboratory consists of a minimum of:

- Every 20th sample one of two available internal potash standards is analysed;
- At least every 40th sample a randomly selected sample is analysed twice for the control of the standard deviation of every single parameter;
- All quality control data is graphed for long-term quality analysis and it is reviewed by the laboratory quality manager; and,
- The laboratory periodically takes part in Round-Robin Tests to prove the reliability of its analytical methods.

These are standard laboratory procedures and the reported data for the standards show that both laboratories produce results that have a reproducible accuracy and precision.

11.4.3 Results of the Check Samples

The assay results for the Ba-002 samples from the ALS Laboratory and the K-UTEC Laboratory can be compared. The assay results from Ba-003 samples provide a comparison between the ALS Laboratory and the SRC laboratory. In addition ten Ba-002 samples were also analysed by the SRC Laboratory and ten Ba-003 samples by the K-UTEC laboratory a comparison between these two laboratories is also possible. In this section the results will be presented for the main elements analysed (usually present at concentrations >5%) and the implications are discussed in Section 11.5.

11.4.3.1 ALS vs K-UTEC

The comparison between the ALS Laboratory and K-UTEC for chlorine, calcium, potassium, magnesium, sodium and sulphur for the samples of Ba-002 are shown in Figure 11.1 to Figure 11.6 and summary statistics are presented in Table 11.1. In these figures the black line represents a 1:1 correlation between the results of the laboratories, the red line marks a 10% difference between the results of the laboratories and the green line marks a 20% difference between the results of the laboratories. With regards to potassium, magnesium and sulphur, the ALS Laboratory clearly tends to overestimate the content of the sample when compared with K-UTEC, quite often by more than 10%. For sodium the discrepancies are smaller with a slight tendency by the ALS Laboratory compared to the K-UTEC laboratory to overestimate the sodium content at low sodium levels (<15%) and to underestimate the sodium content at higher sodium levels (>20%).

Figure 11.1: Correlation Plot of ALS vs K-UTEC Chlorine Results for Hole Ba-002

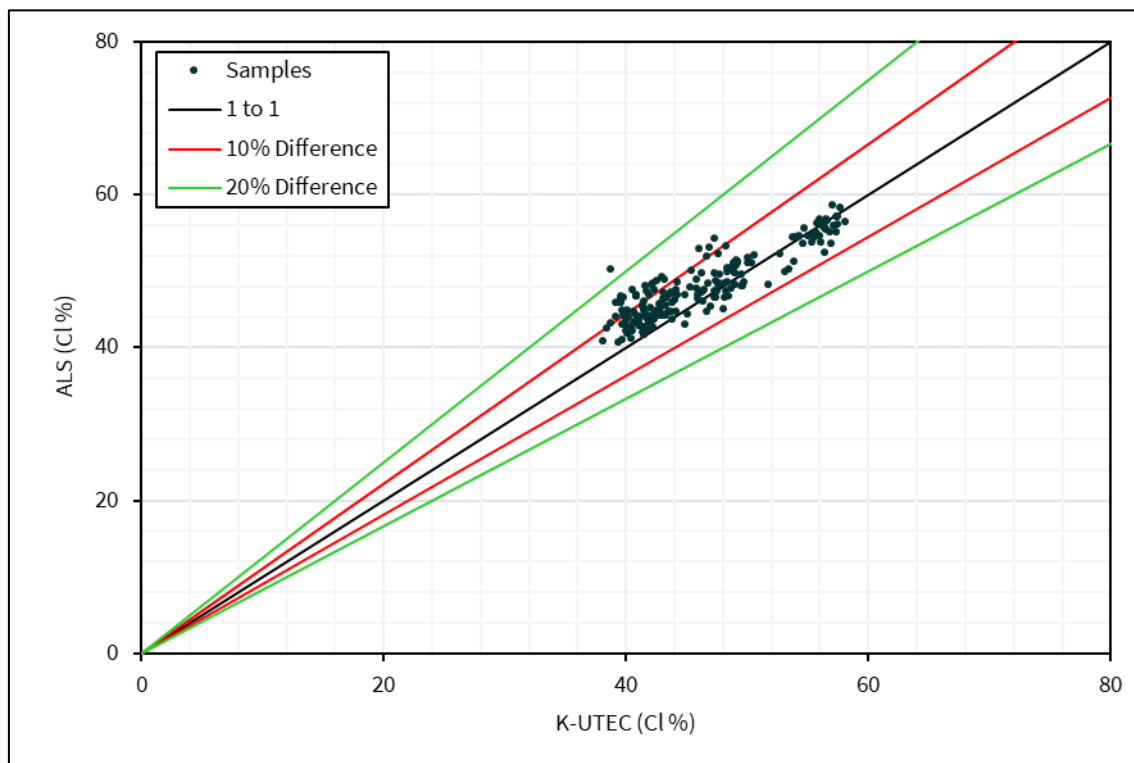


Figure 11.2: Correlation Plot of ALS vs K-UTEC Calcium Results for Hole Ba-002

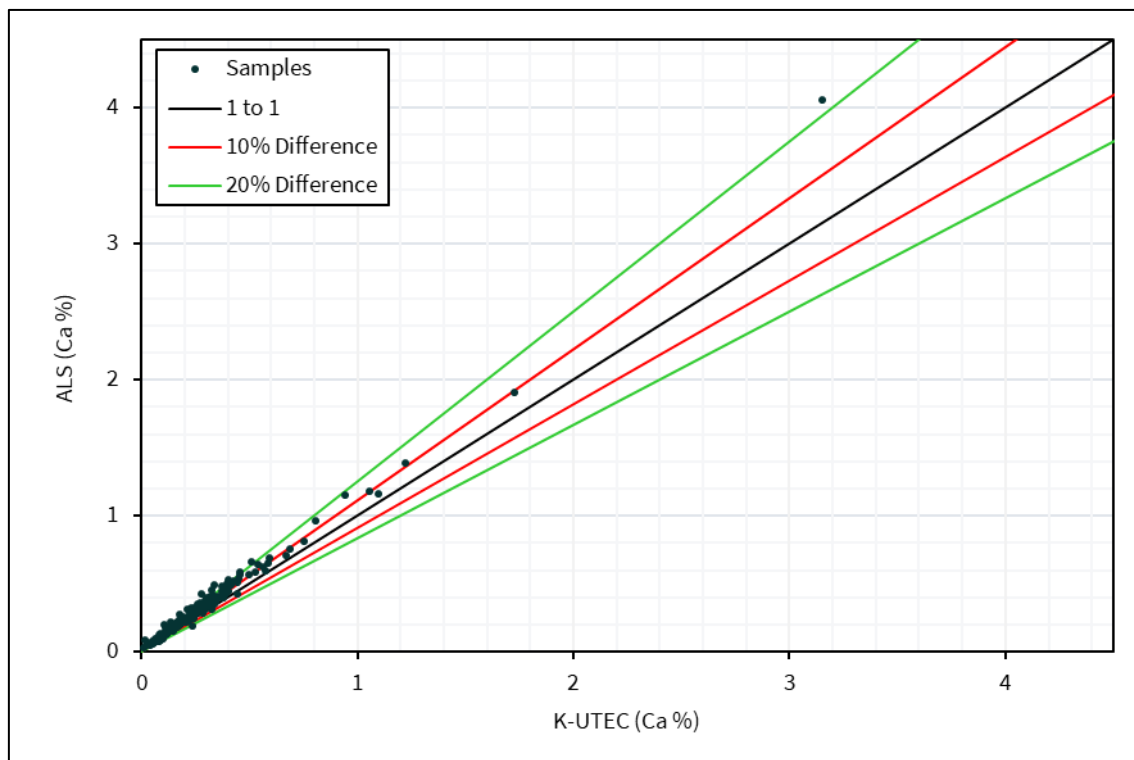


Figure 11.3: Correlation Plot of ALS vs K-UTEC Potassium Results for Hole Ba-002

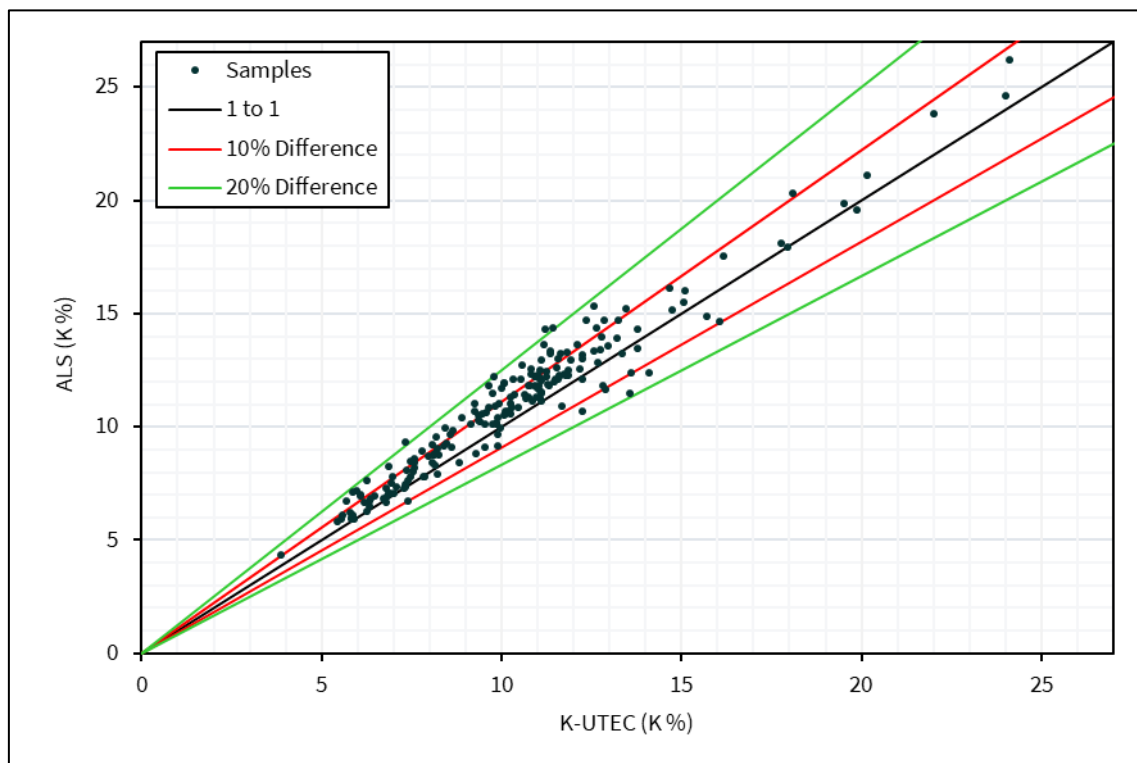


Figure 11.4: Correlation Plot of ALS vs K-UTEC Magnesium Results for Hole Ba-002

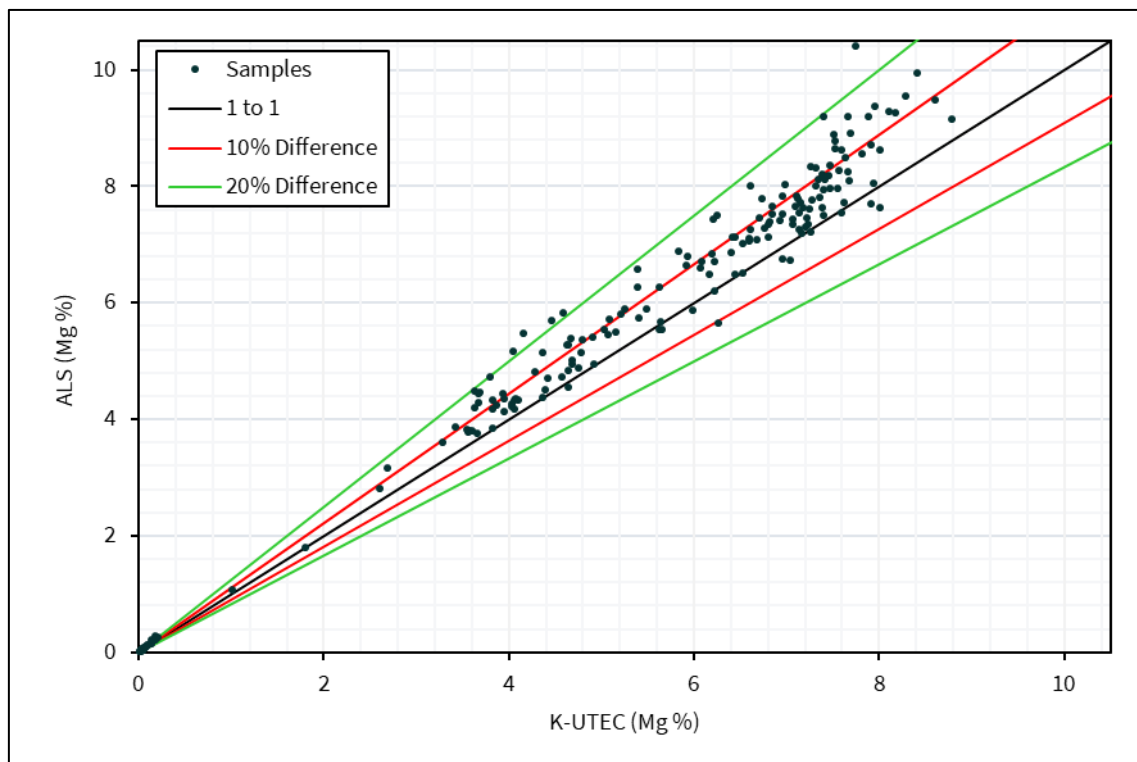


Figure 11.5: Correlation Plot of ALS vs K-UTEC Sodium Results for Hole Ba-002

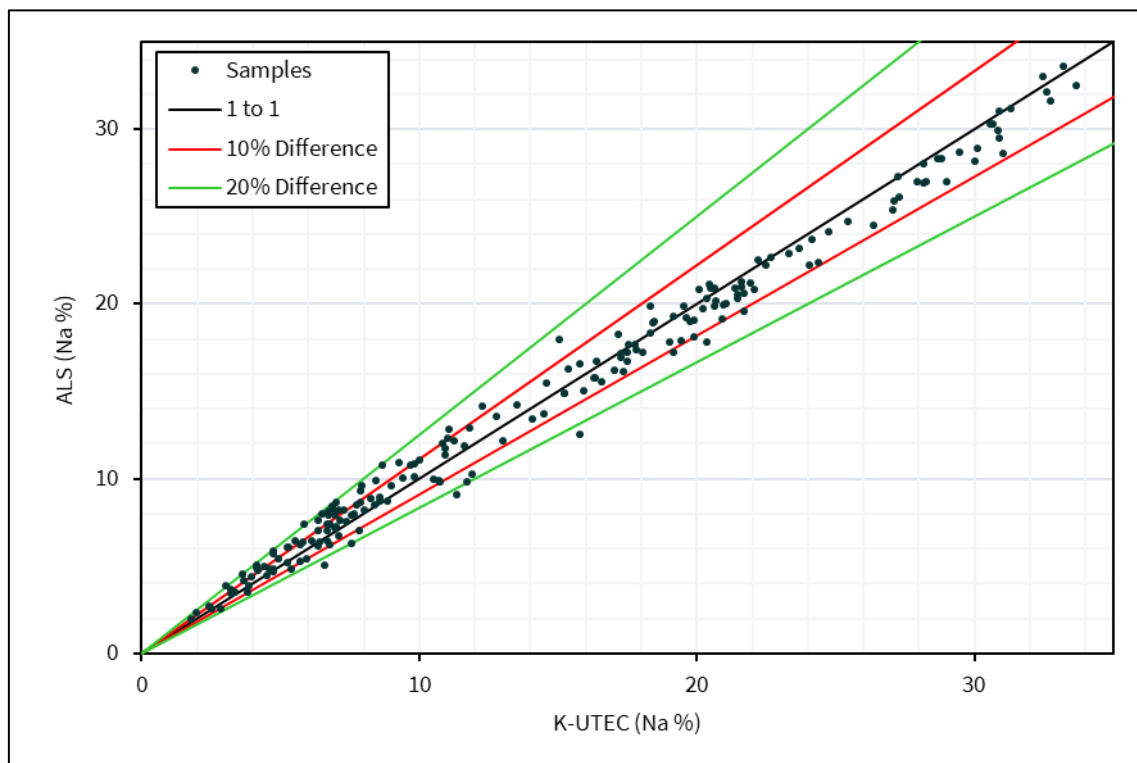


Figure 11.6: Correlation Plot of ALS vs K-UTEC Sulphur Results for Hole Ba-002

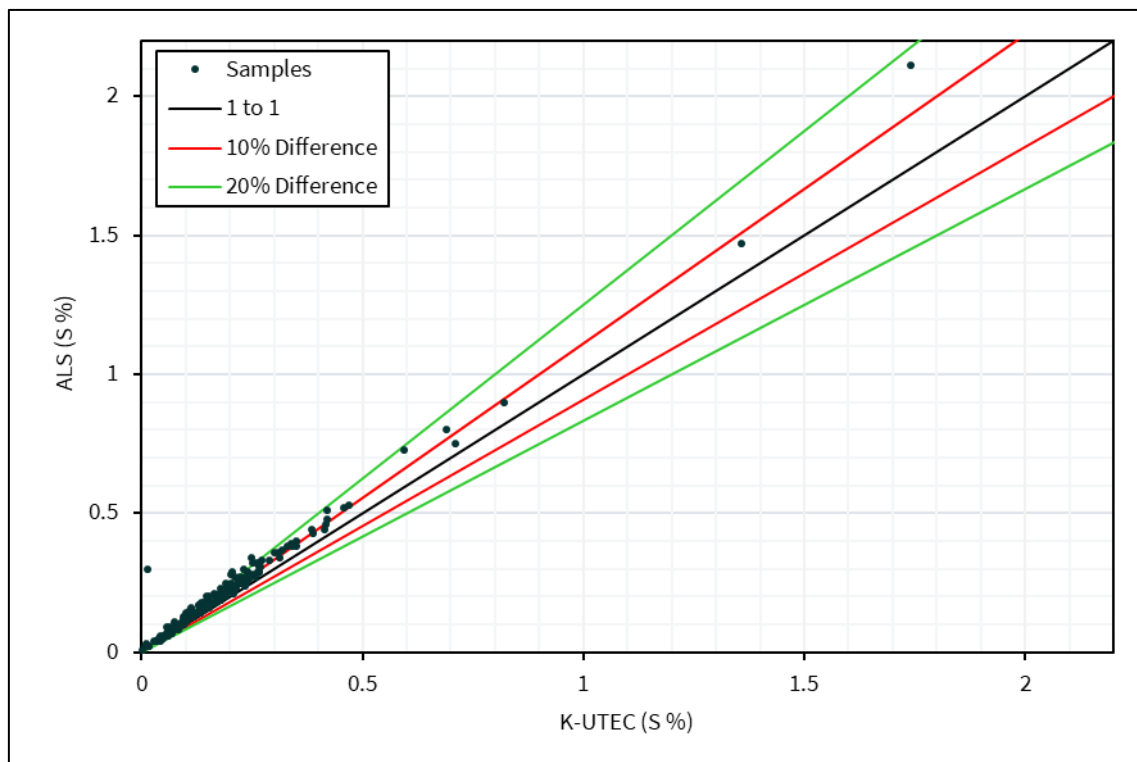


Table 11.1: Summary of ALS vs K-UTEC Results for Hole Ba-002

Element	Parameters	ALS	K-UTEC
Cl (%)	Mean	47.96	46.06
	Standard Deviation	4.37	5.61
	Correlation Coefficient	0.895	
	No. of Samples	198	
Ca (%)	Mean	0.32	0.27
	Standard Deviation	0.36	0.30
	Correlation Coefficient	0.994	
	No. of Samples	198	
K (%)	Mean	11.05	10.33
	Standard Deviation	3.44	3.29
	Correlation Coefficient	0.972	
	No. of Samples	198	
Mg (%)	Mean	5.35	4.90
	Standard Deviation	2.96	2.70
	Correlation Coefficient	0.991	
	No. of Samples	198	
Na (%)	Mean	14.43	14.49
	Standard Deviation	8.21	8.68
	Correlation Coefficient	0.994	
	No. of Samples	198	
S (%)	Mean	0.21	0.18
	Standard Deviation	0.21	0.19
	Correlation Coefficient	0.992	
	No. of Samples	198	

Precision plots were generated for all the duplicate samples, these plots present the precision of the sample pairs as respective percentages of the original grades (ALS in this case). The precision plots are presented in Figure 11.7 to Figure 11.12 and a table summarising the analytical errors is presented in Table 11.2.

Figure 11.7: Precision Plot of ALS vs K-UTEC Chlorine Results for Hole Ba-002

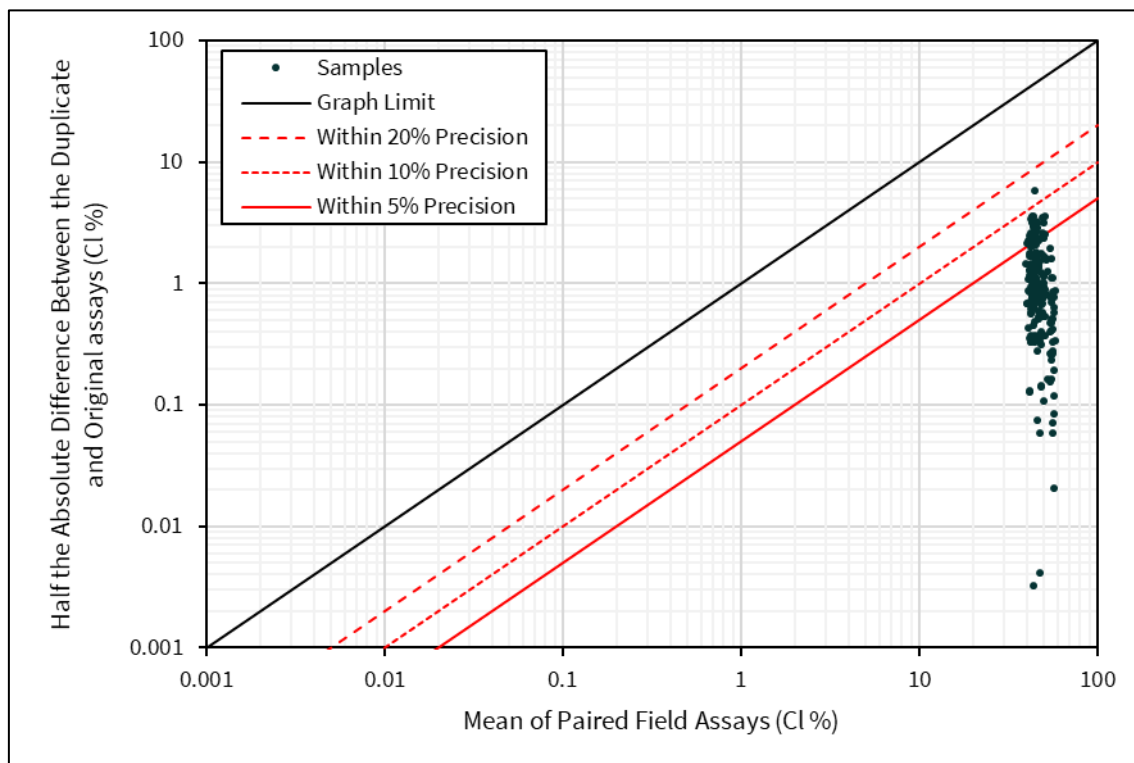


Figure 11.8: Precision Plot of ALS vs K-UTEC Calcium Results for Hole Ba-002

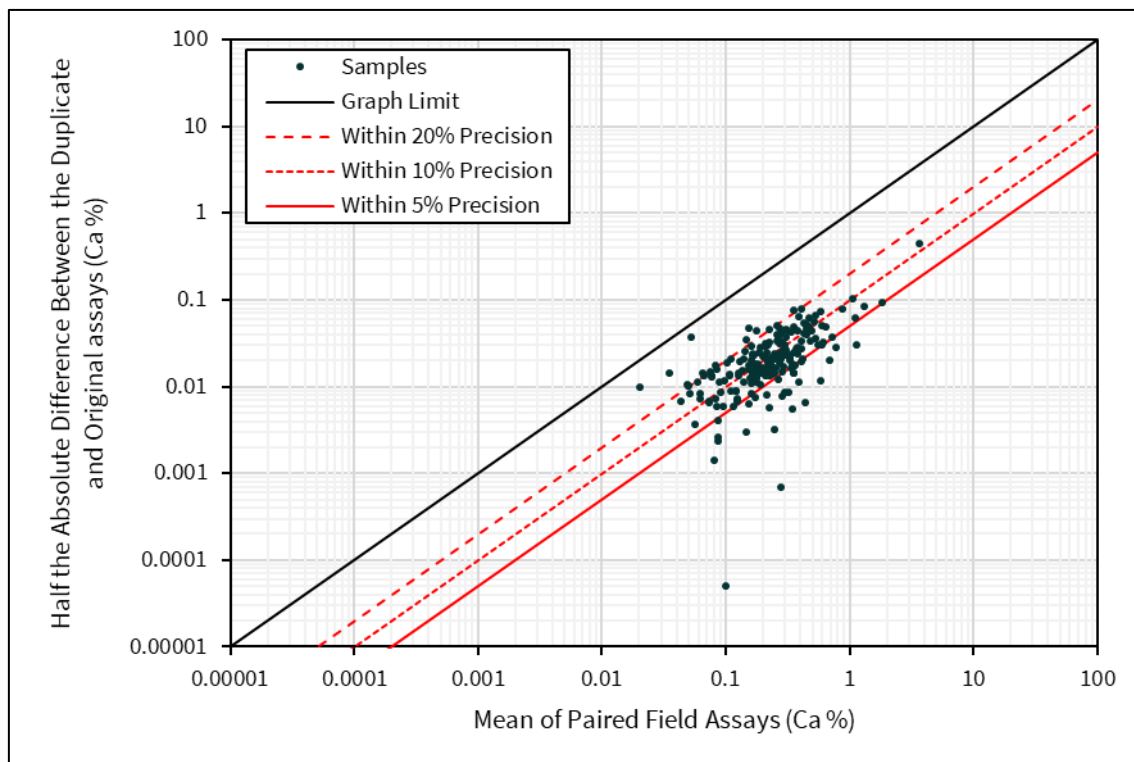


Figure 11.9: Precision Plot of ALS vs K-UTEC Potassium Results for Hole Ba-002

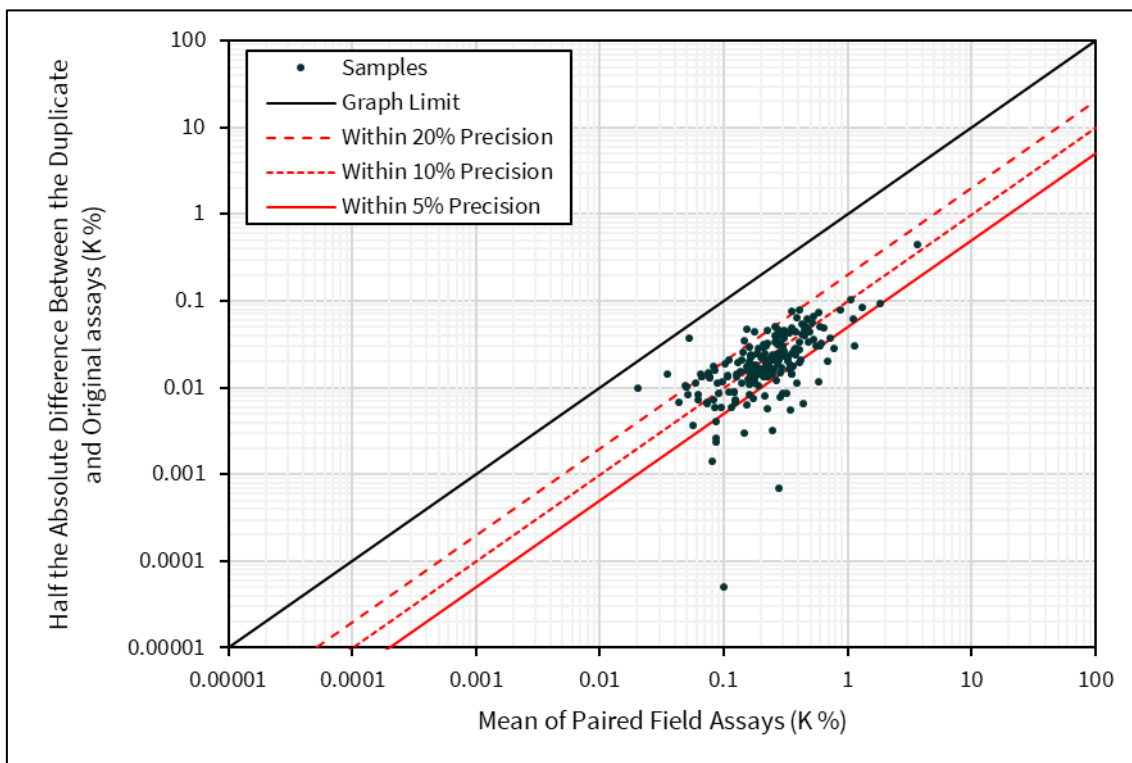


Figure 11.10: Precision Plot of ALS vs K-UTEC Magnesium Results for Hole Ba-002

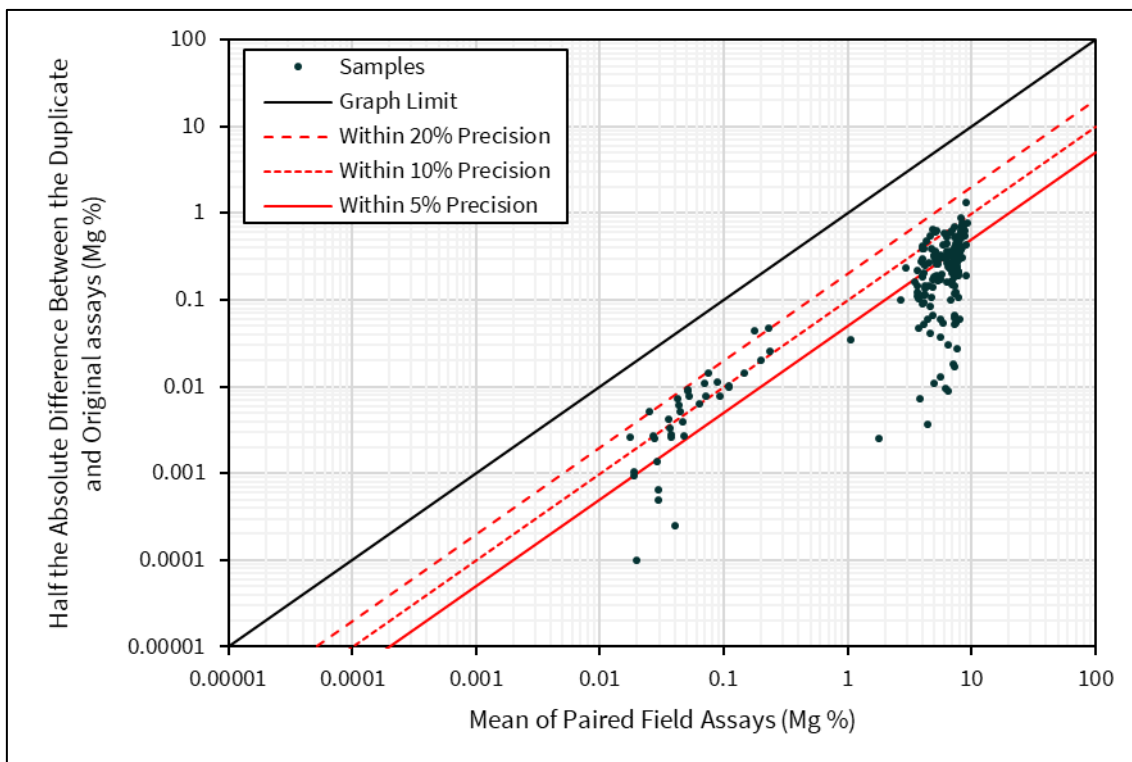


Figure 11.11: Precision Plot of ALS vs K-UTEC Sodium Results for Hole Ba-002

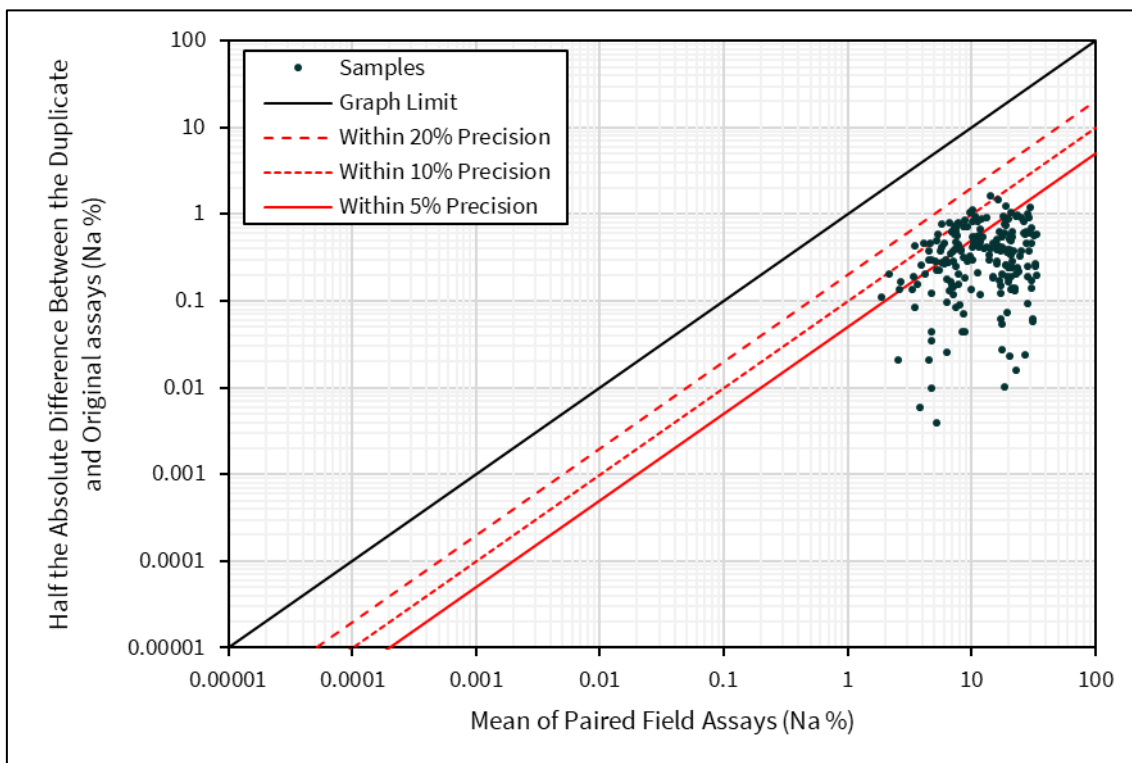


Figure 11.12: Precision Plot of ALS vs K-UTEC Sulphur Results for Hole Ba-002

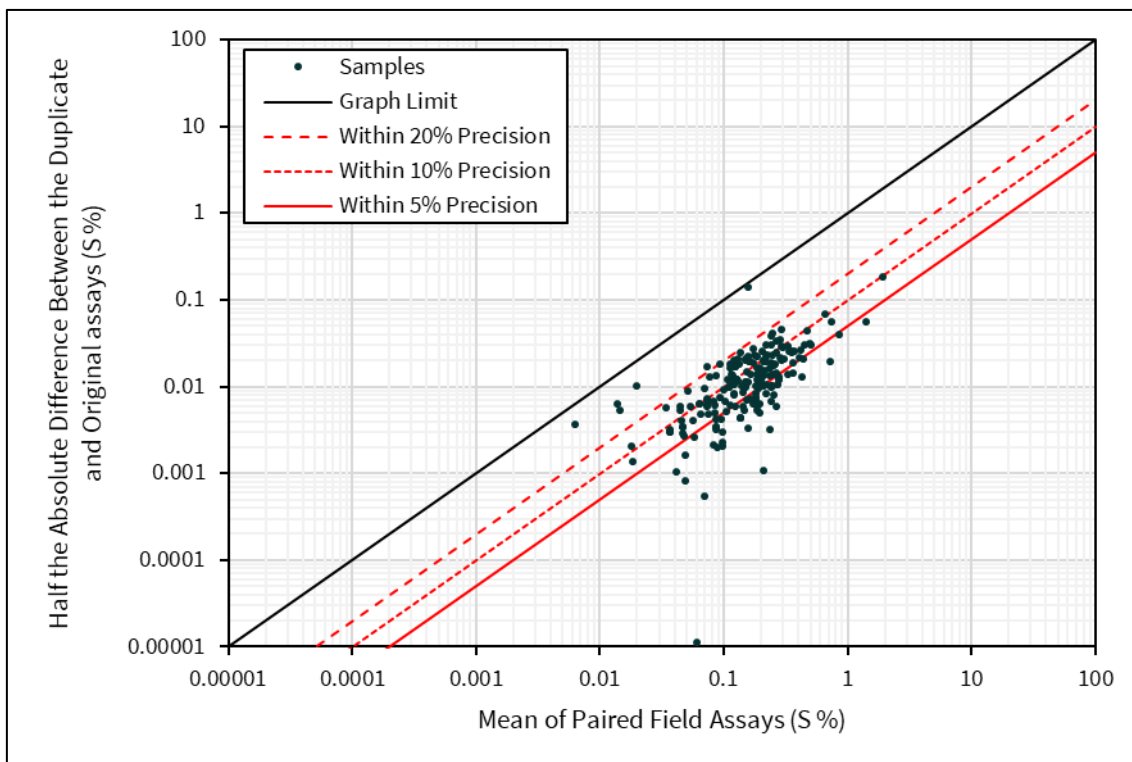


Table 11.2: Analytical Error of the ALS vs K-UTEC Sample Pairs

Error	Cl (%)	Ca (%)	K (%)	Mg (%)	Na (%)	S (%)
Pairs with Analytical Errors Less than $\pm 20\%$	100.00	93.94	100.00	98.48	100.00	96.97
Pairs with Analytical Errors Less than $\pm 10\%$	99.49	60.61	96.97	86.87	94.95	75.25

Micon concludes that the results of the check samples between ALS and K-UTEC demonstrate a good level of reproducibility, with all elements having less than 10% of pairs exhibiting $\pm 20\%$ analytical error (up to 20% of samples with more than $\pm 20\%$ analytical error would be deemed acceptable).

11.4.3.2 ALS vs SRC

The comparison between the ALS Laboratory and SRC Laboratory for chlorine, calcium, potassium, magnesium, sodium and sulphur in the Ba-003 samples are shown in Figure 11.13 to Figure 11.18 and summary statistics are presented in Table 11.3. In these figures the black line represents a 1:1 correlation between the results of the laboratories, the red line marks a 10% difference between the results of the laboratories and the green line marks a 20% difference between the results of the laboratories. With regards to potassium and magnesium the ALS Laboratory tends to slightly overestimate the potassium and magnesium contents of the sample when compared with the SRC Laboratory. For sodium the discrepancies are smaller with a slight tendency by the ALS Laboratory to underestimate the sodium content.

Figure 11.13: Correlation Plot of ALS vs SRC Chlorine Results for Hole Ba-003

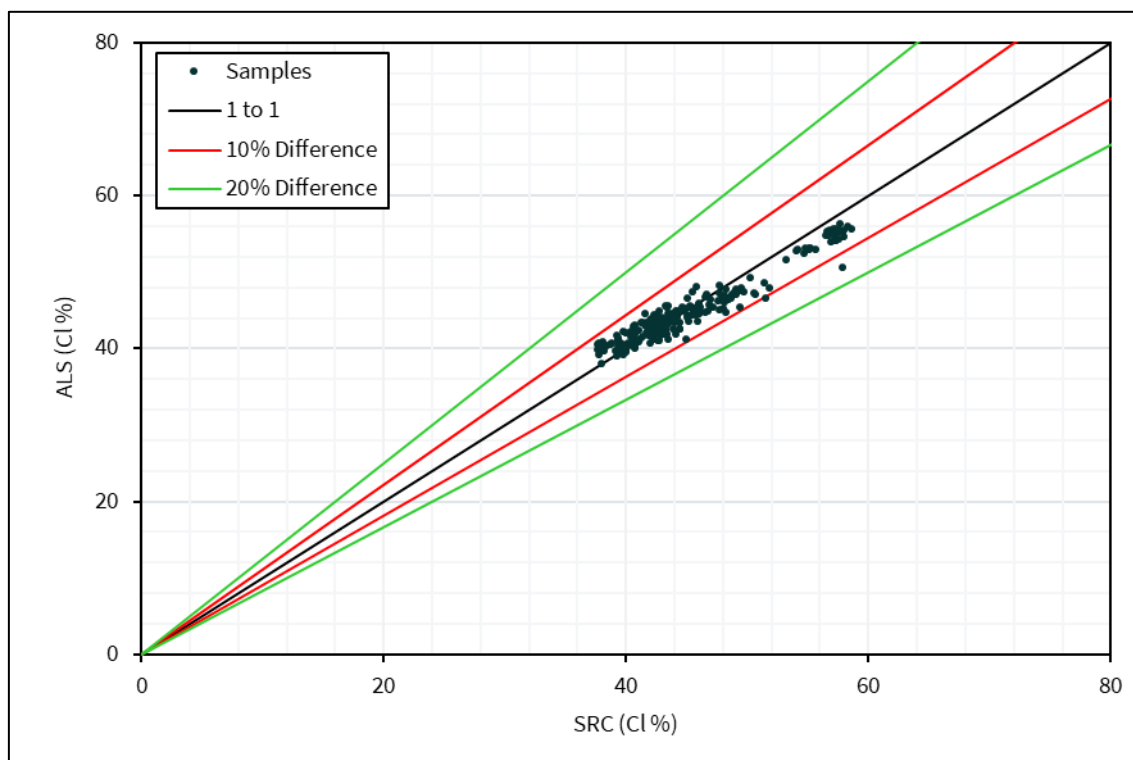


Figure 11.14: Correlation Plot of ALS vs SRC Calcium Results for Hole Ba-003

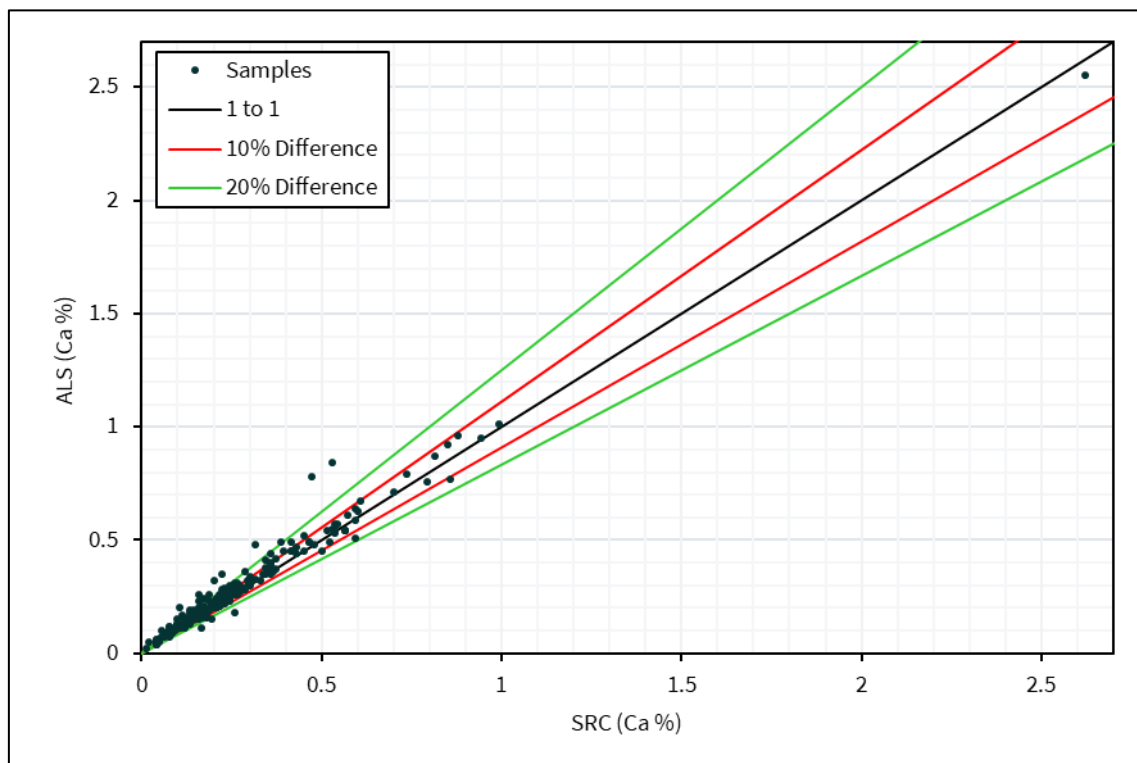


Figure 11.15: Correlation Plot of ALS vs SRC Potassium Results for Hole Ba-003

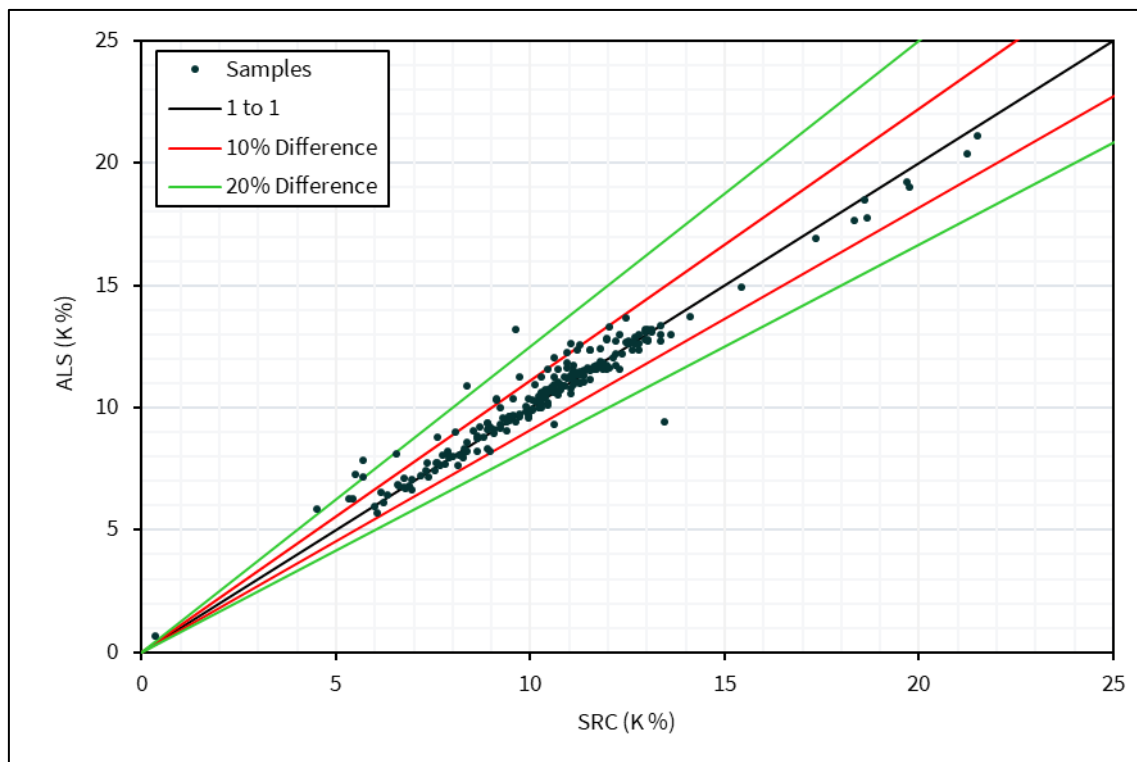


Figure 11.16: Correlation Plot of ALS vs SRC Magnesium Results for Hole Ba-003

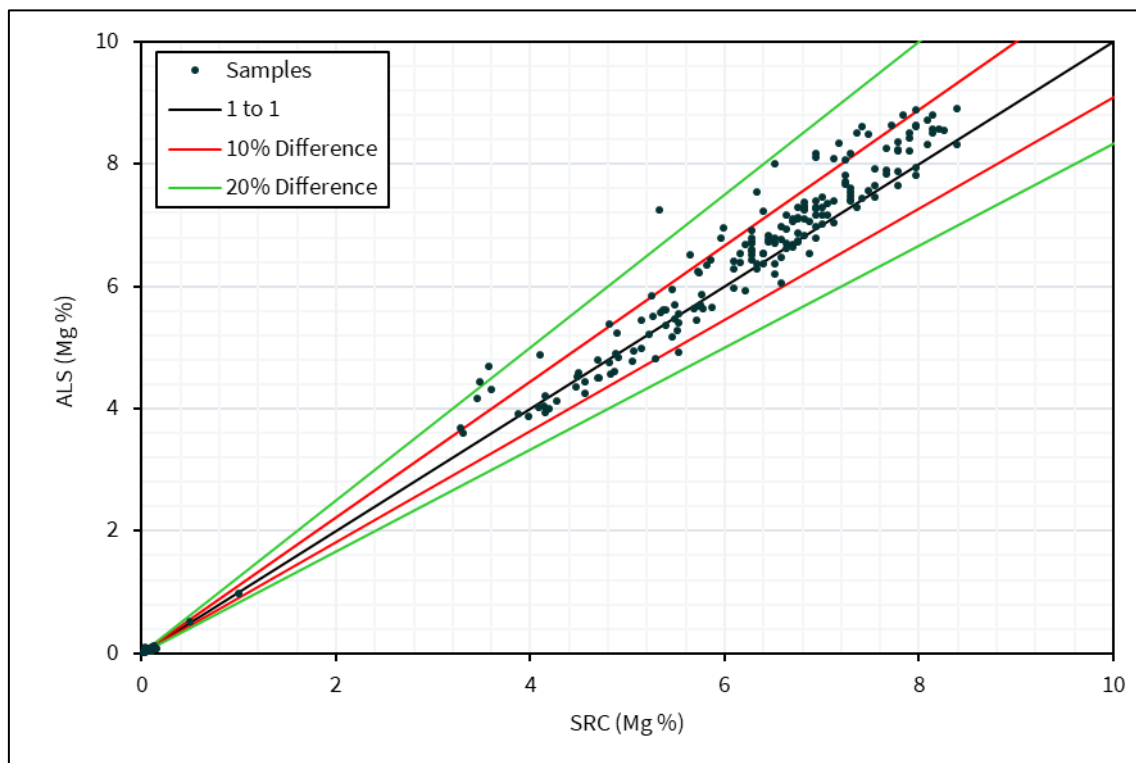


Figure 11.17: Correlation Plot of ALS vs SRC Sodium Results for Hole Ba-003

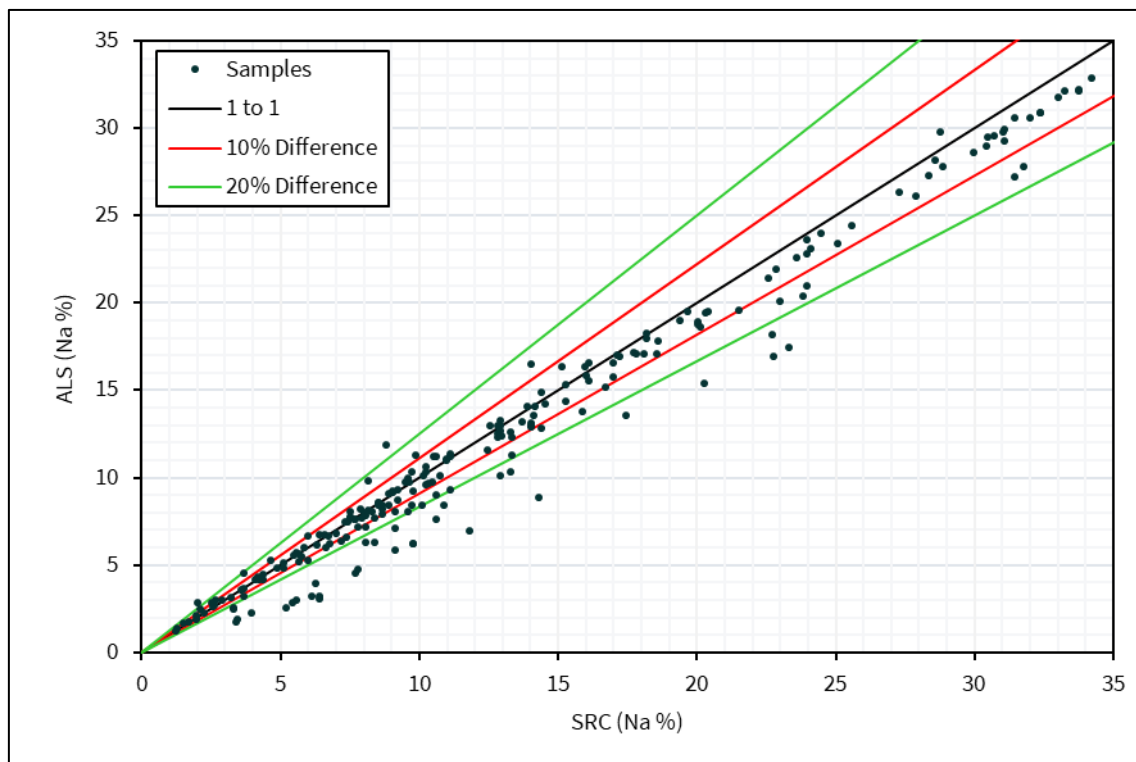


Figure 11.18: Correlation Plot of ALS vs SRC Sulphur Results for Hole Ba-003

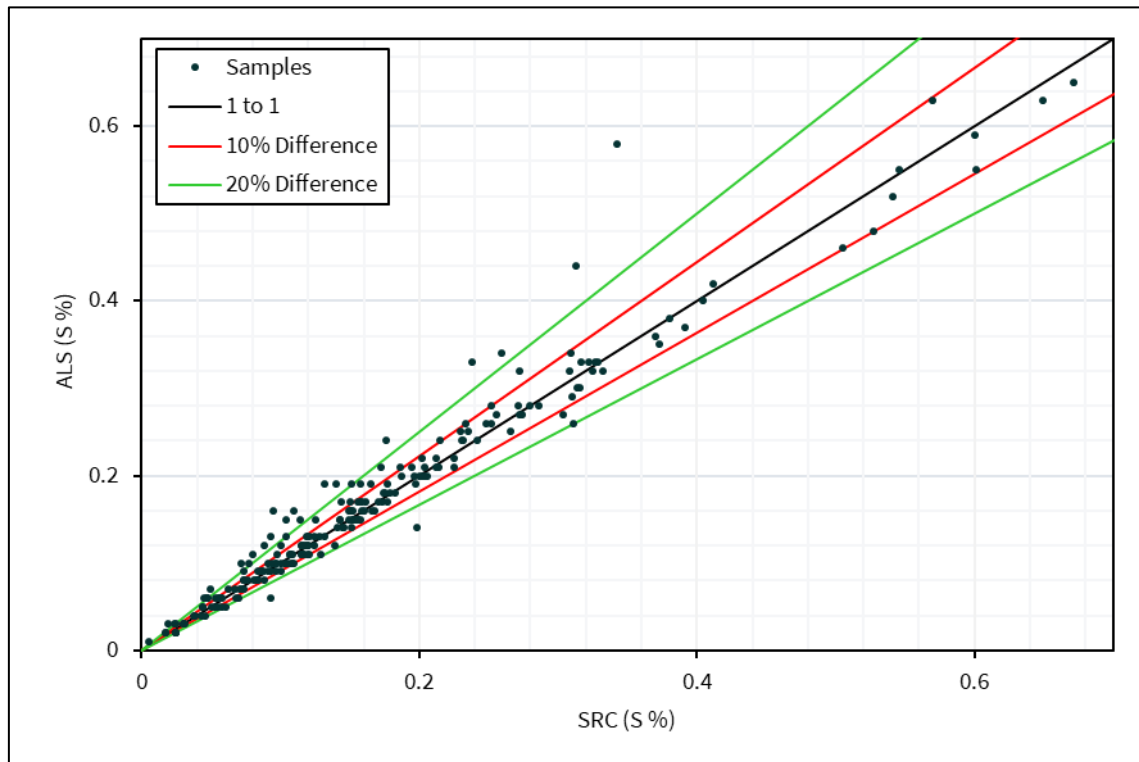


Table 11.3: Summary of ALS vs SRC Results for Hole Ba-003

Element	Parameters	ALS	SRC
Cl (%)	Mean	45.00	45.32
	Standard Deviation	4.49	5.61
	Correlation Coefficient	0.967	
	No. of Samples	218	
Ca (%)	Mean	0.28	0.26
	Standard Deviation	0.25	0.25
	Correlation Coefficient	0.985	
	No. of Samples	218	
K (%)	Mean	10.64	10.48
	Standard Deviation	2.59	2.73
	Correlation Coefficient	0.972	
	No. of Samples	218	
Mg (%)	Mean	5.60	5.37
	Standard Deviation	2.63	2.48
	Correlation Coefficient	0.990	
	No. of Samples	218	
Na (%)	Mean	12.25	13.07
	Standard Deviation	8.17	8.51
	Correlation Coefficient	0.988	
	No. of Samples	218	
S (%)	Mean	0.17	0.17
	Standard Deviation	0.12	0.12
	Correlation Coefficient	0.977	
	No. of Samples	218	

Precision plots were generated for all the duplicate samples, these plots present the precision of the sample pairs as respective percentages of the original grades (ALS in this case). The precision plots are presented in Figure 11.19 to Figure 11.24 and a table summarising the analytical errors is presented in Table 11.4.

Figure 11.19: Precision Plot of ALS vs K-UTEC Chlorine Results for Hole Ba-003

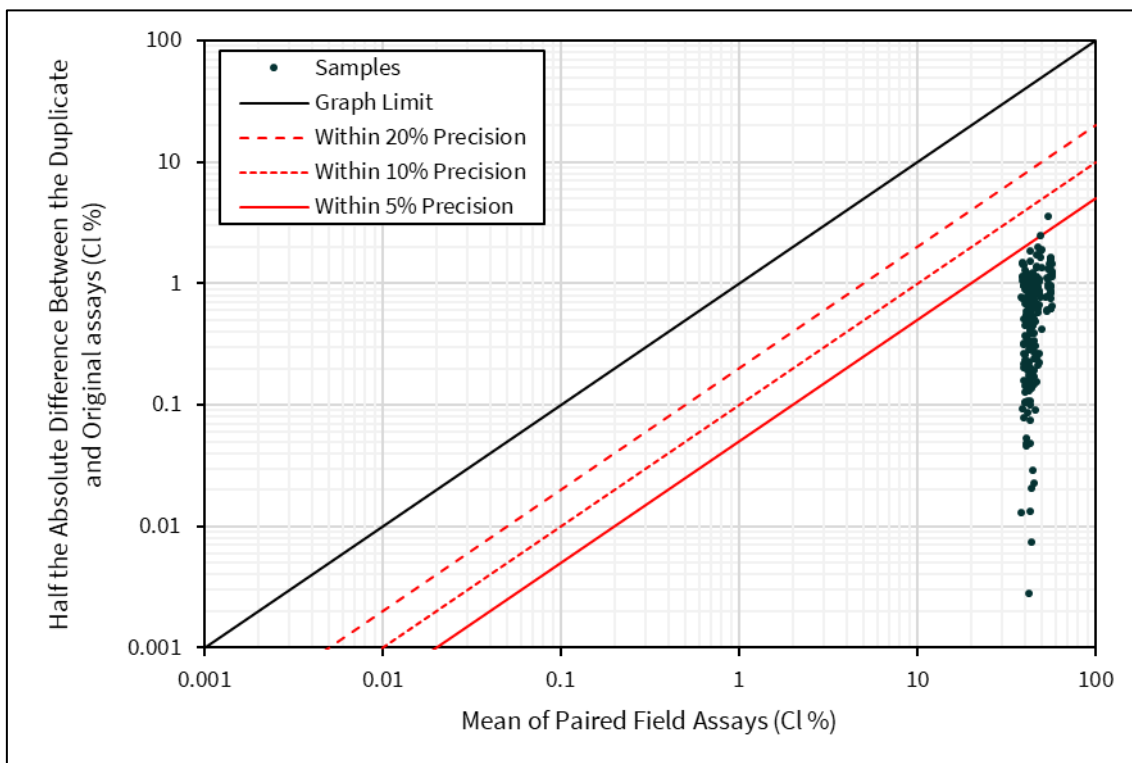


Figure 11.20: Precision Plot of ALS vs K-UTEC Calcium Results for Hole Ba-003

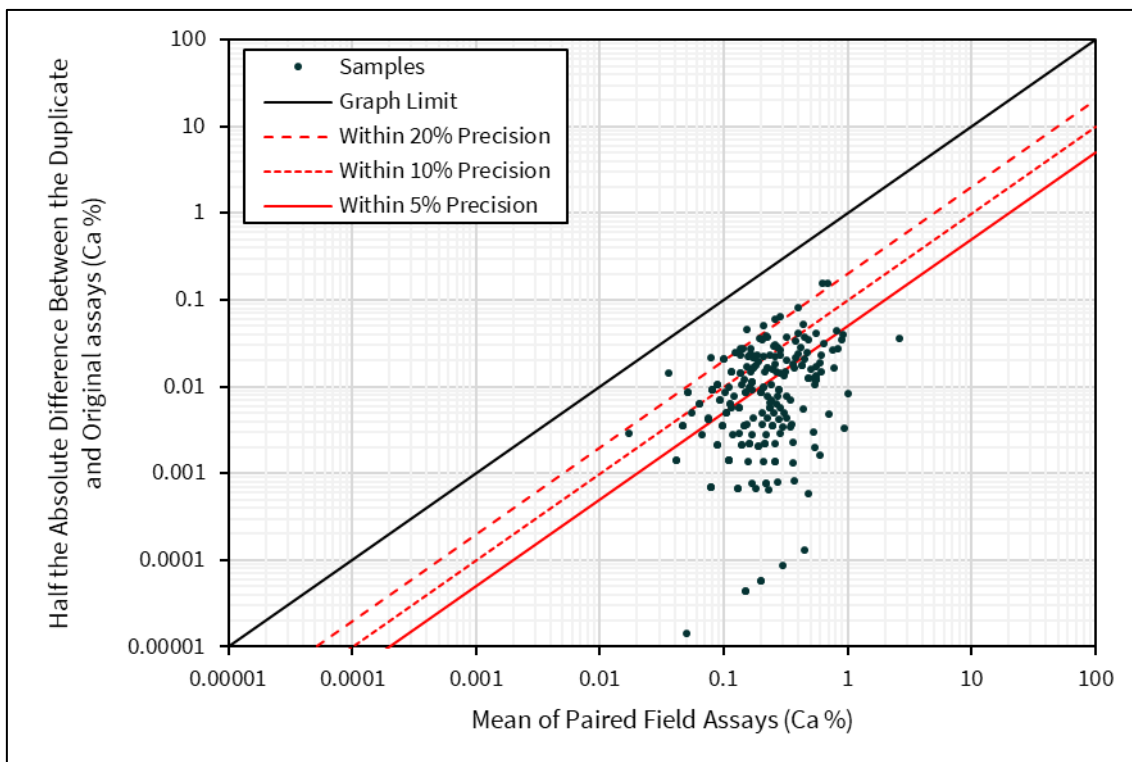


Figure 11.21: Precision Plot of ALS vs K-UTEC Potassium Results for Hole Ba-003

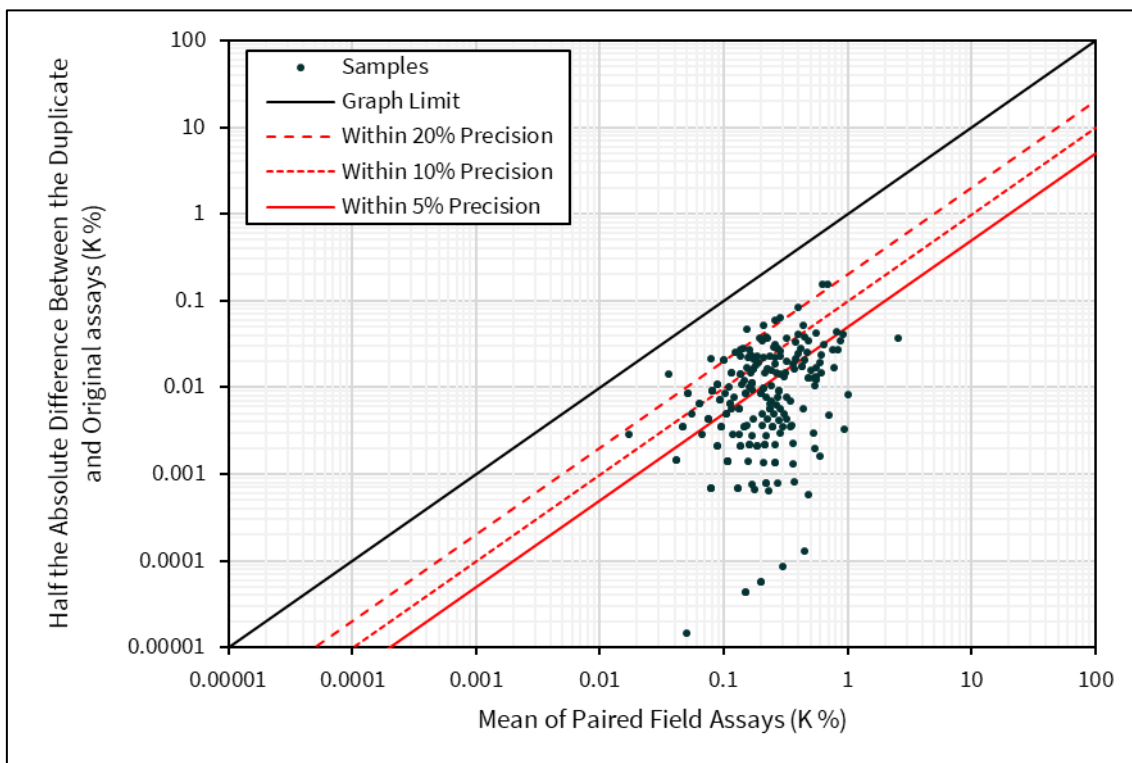


Figure 11.22: Precision Plot of ALS vs K-UTEC Magnesium Results for Hole Ba-003

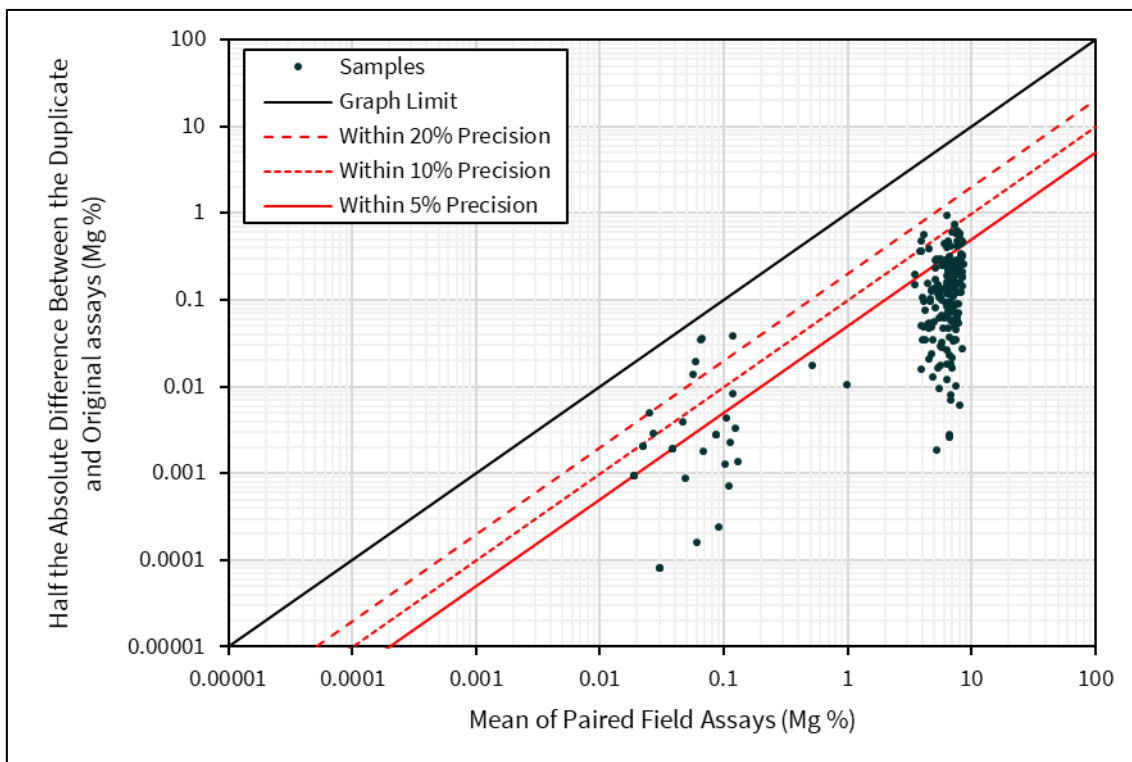


Figure 11.23: Precision Plot of ALS vs K-UTEC Sodium Results for Hole Ba-003

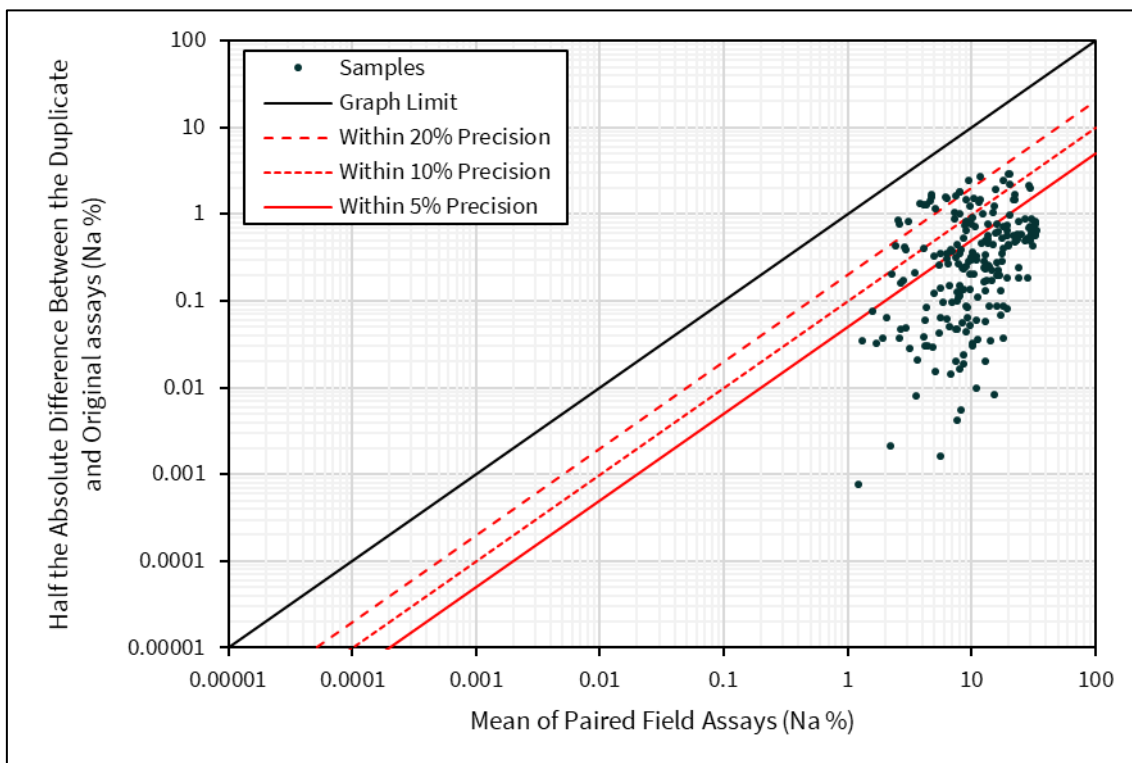


Figure 11.24: Precision Plot of ALS vs K-UTEC Sulphur Results for Hole Ba-003

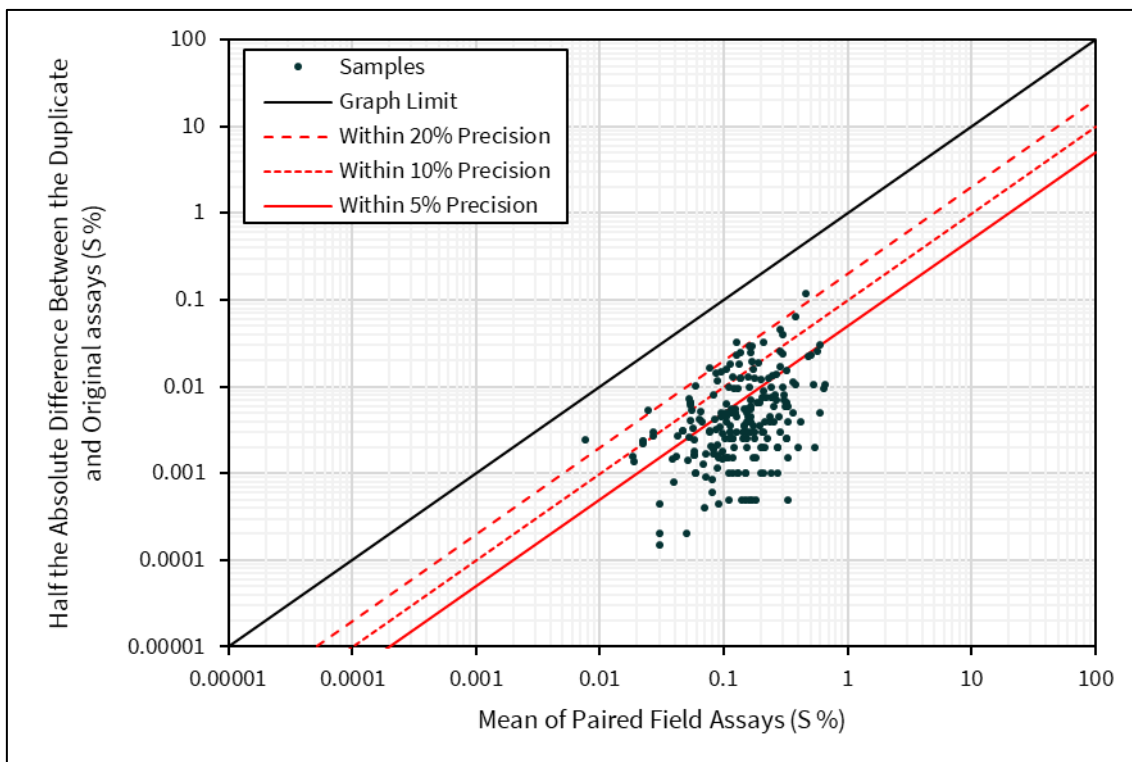


Table 11.4: Analytical Error of the ALS vs SRC Sample Pairs

Error	Cl (%)	Ca (%)	K (%)	Mg (%)	Na (%)	S (%)
Pairs with Analytical Errors Less than $\pm 20\%$	100.00	94.95	99.54	97.25	92.20	97.71
Pairs with Analytical Errors Less than $\pm 10\%$	100.00	77.98	95.87	94.95	84.86	85.78

Micon concludes that the results of the check samples between ALS and SRC demonstrate a good level of reproducibility, with all elements having less than 10% of pairs exhibiting $\pm 20\%$ analytical error (up to 20% of samples with more than $\pm 20\%$ analytical error would be deemed acceptable).

11.4.3.3 K-UTEC vs SRC

The comparison between the K-UTEC Laboratory and SRC Laboratory for chlorine, calcium, potassium, magnesium, sodium and sulphur samples are shown in Figure 11.25 to Figure 11.30 and summary statistics are presented in Table 11.5. In these figures the black line represents a 1:1 correlation between the results of the laboratories, the red line marks a 10% difference between the results of the laboratories and the green line marks a 20% difference between the results of the laboratories. With regards to calcium and sulphur the SRC Laboratory tends to slightly overestimate the contents of the sample when compared with the K-UTEC Laboratory. For magnesium the discrepancies are smaller with a slight tendency by the K-UTEC Laboratory compared to the SRC Laboratory to underestimate the sodium content at lower grades ($<6\%$).

Figure 11.25: Correlation Plot of K-UTEC vs SRC Chlorine Results

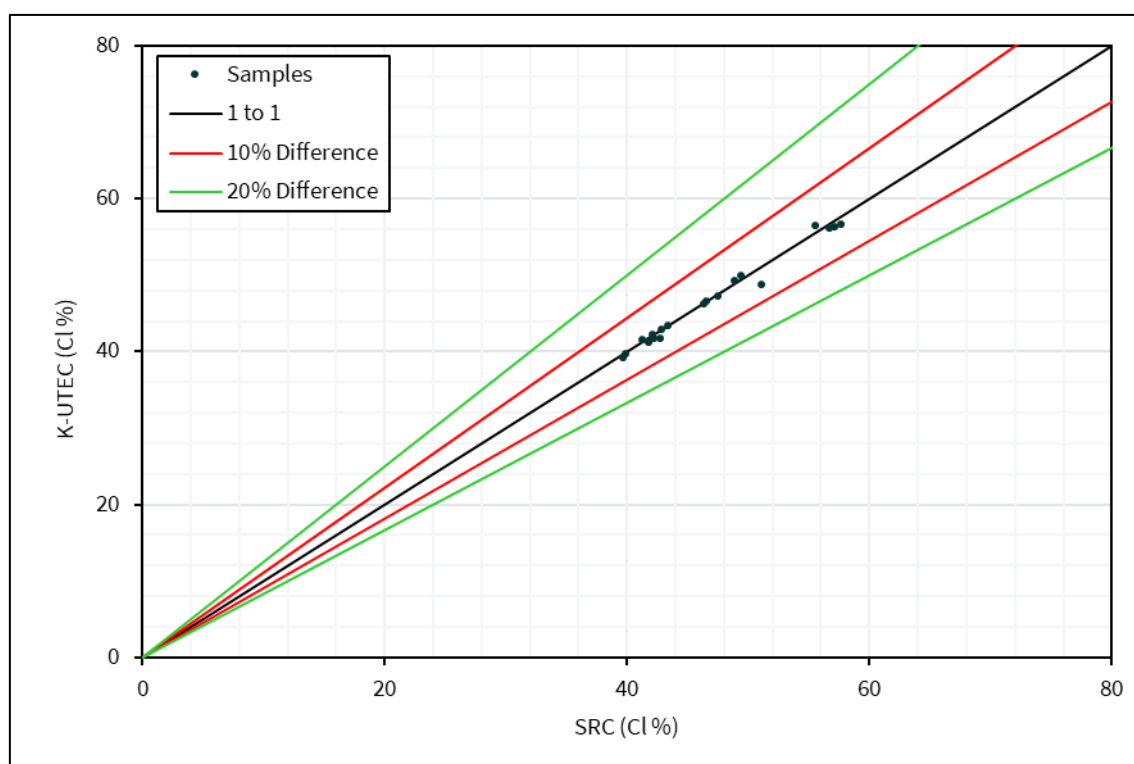


Figure 11.26: Correlation Plot of K-UTEC vs SRC Calcium Results

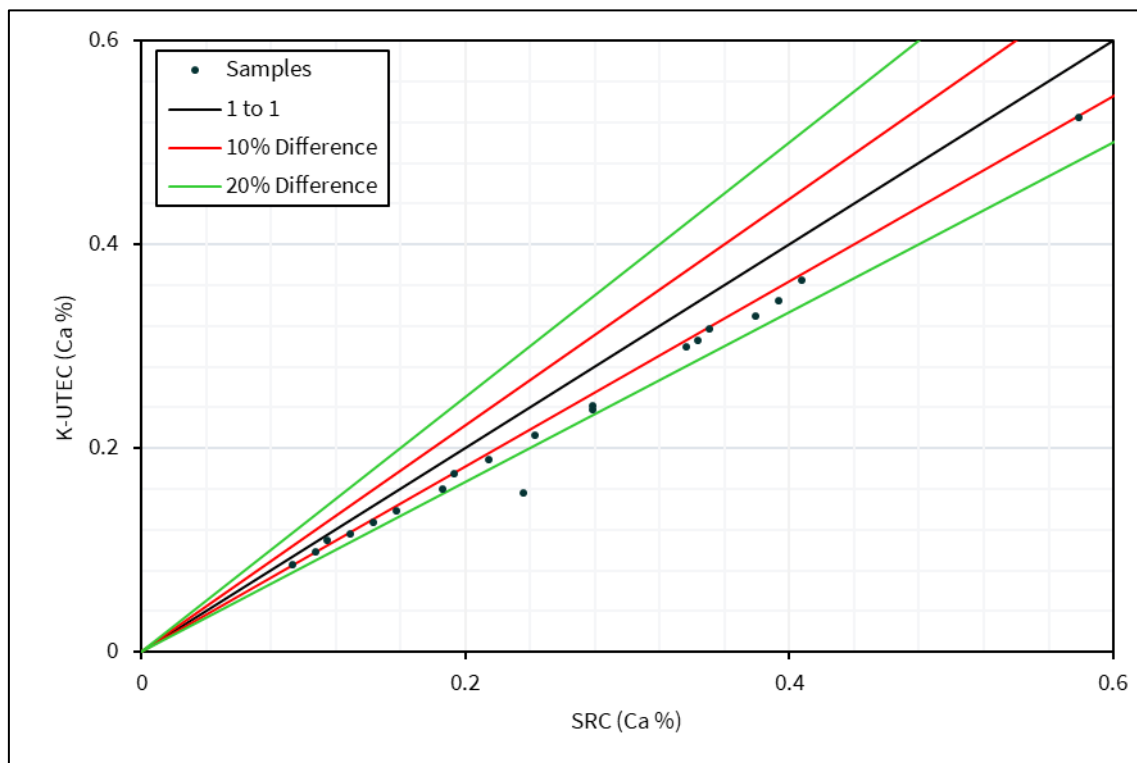


Figure 11.27: Correlation Plot of K-UTEC vs SRC Potassium Results

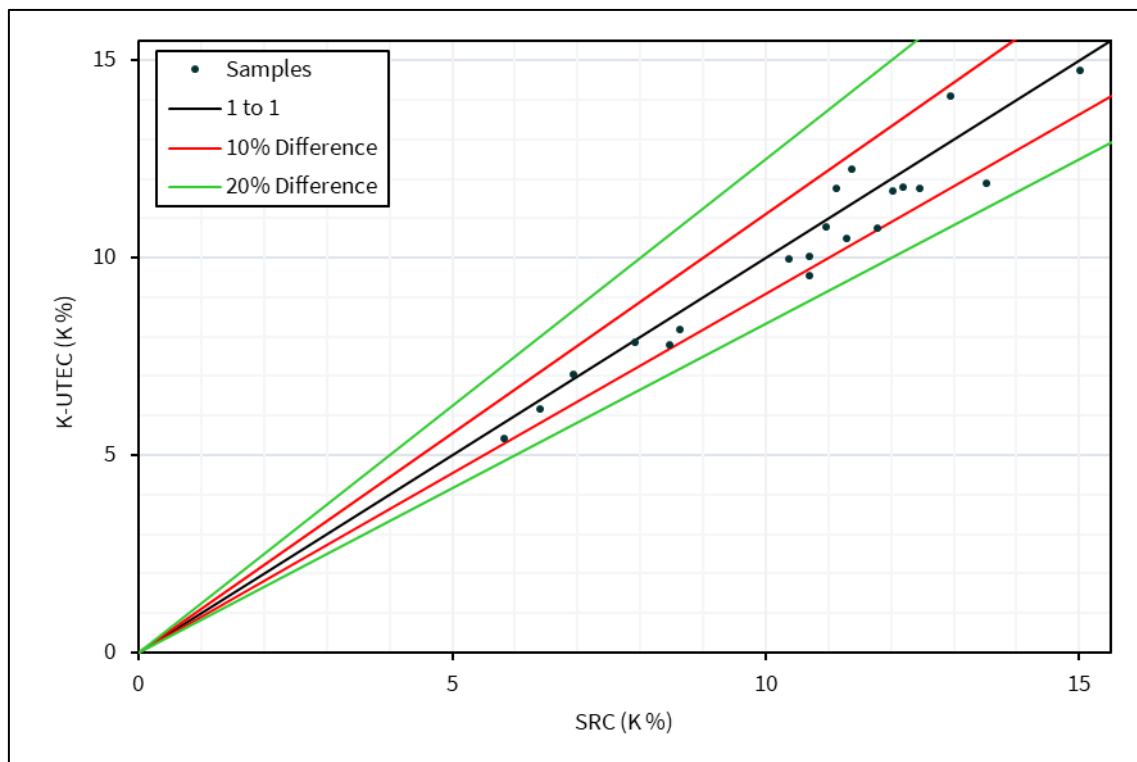


Figure 11.28: Correlation Plot of K-UTEC vs SRC Magnesium Results

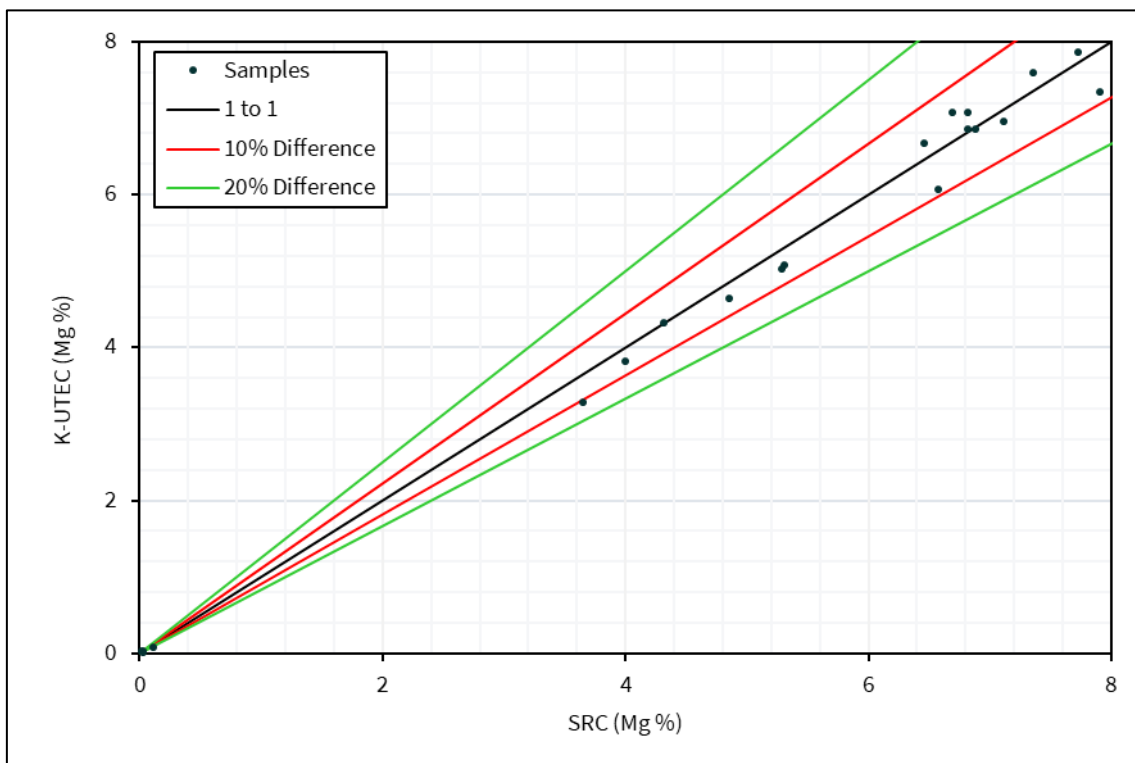


Figure 11.29: Correlation Plot of K-UTEC vs SRC Sodium Results

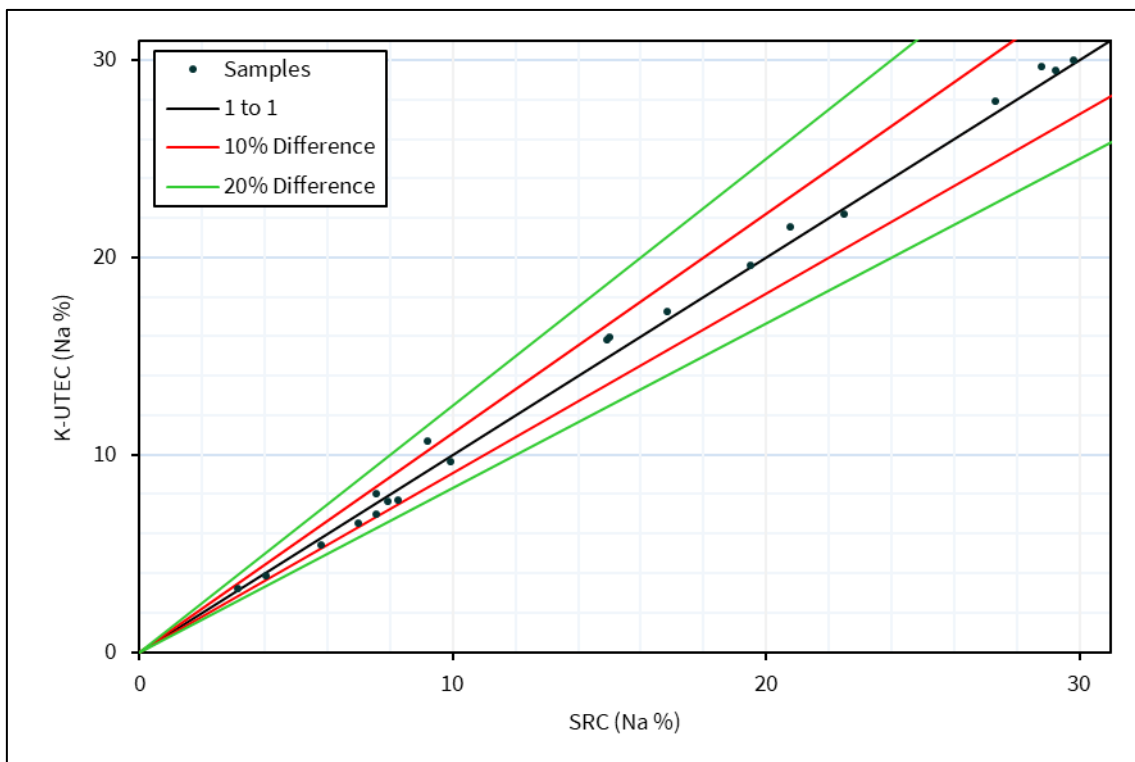


Figure 11.30: Correlation Plot of K-UTEC vs SRC Sulphur Results

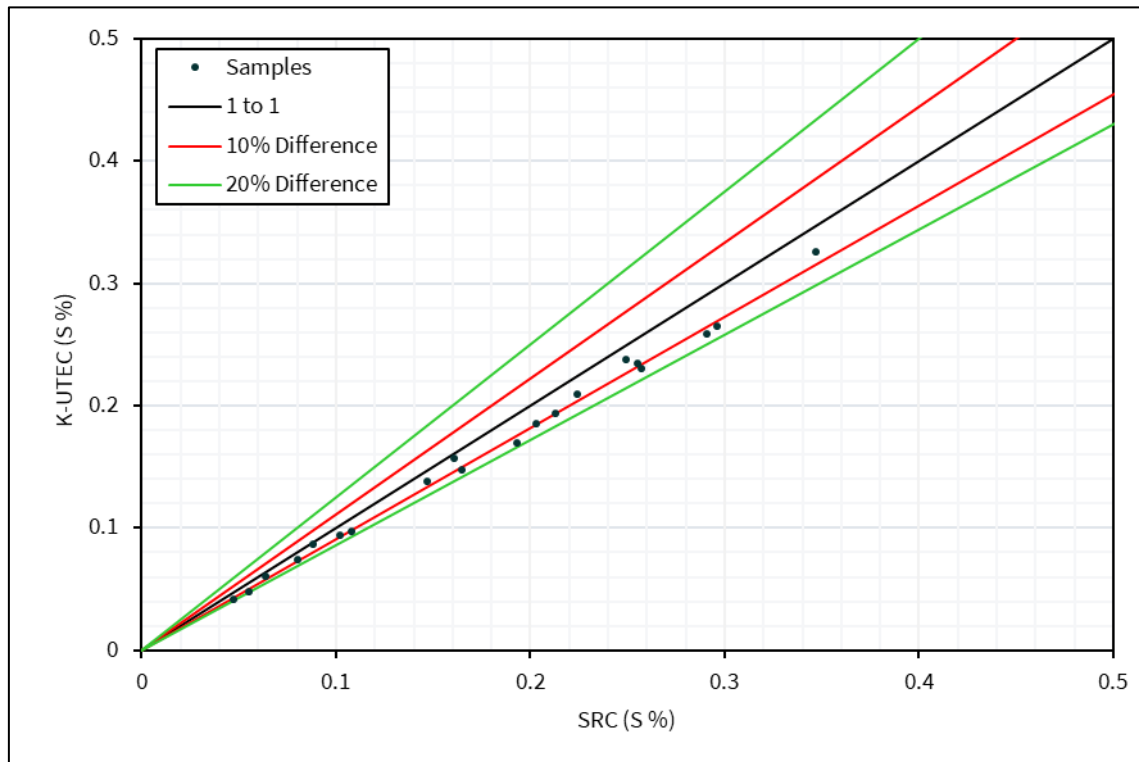


Table 11.5: Summary of K-UTEC vs SRC

Element	Parameters	K-UTEC	SRC
Cl (%)	Mean	46.46	46.71
	Standard Deviation	5.81	5.89
	Correlation Coefficient	0.993	
	No. of Samples	20	
Ca (%)	Mean	0.23	0.26
	Standard Deviation	0.11	0.12
	Correlation Coefficient	0.994	
	No. of Samples	20	
K (%)	Mean	10.20	10.53
	Standard Deviation	2.43	2.39
	Correlation Coefficient	0.964	
	No. of Samples	20	
Mg (%)	Mean	4.84	4.90
	Standard Deviation	2.71	2.69
	Correlation Coefficient	0.996	
	No. of Samples	20	
Na (%)	Mean	14.96	14.75
	Standard Deviation	9.04	8.81
	Correlation Coefficient	0.998	
	No. of Samples	20	
S (%)	Mean	0.16	0.18
	Standard Deviation	0.08	0.09
	Correlation Coefficient	0.998	
	No. of Samples	20	

Precision plots were generated for all the duplicate samples, these plots present the precision of the sample pairs as respective percentages of the original grades (SRC in this case). The precision plots are presented in Figure 11.31 to Figure 11.36 and a table summarising the analytical errors is presented in Table 11.6.

Figure 11.31: Precision Plot of SRC vs K-UTEC Chlorine Results

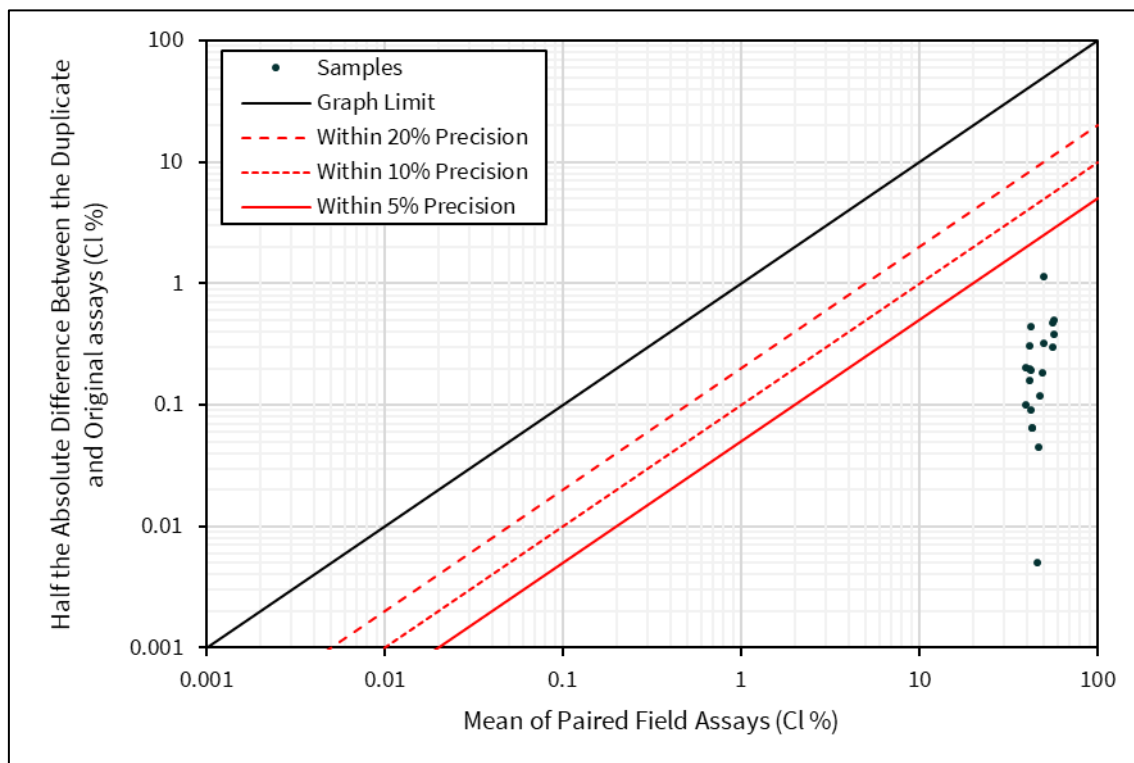


Figure 11.32: Precision Plot of SRC vs K-UTEC Calcium Results

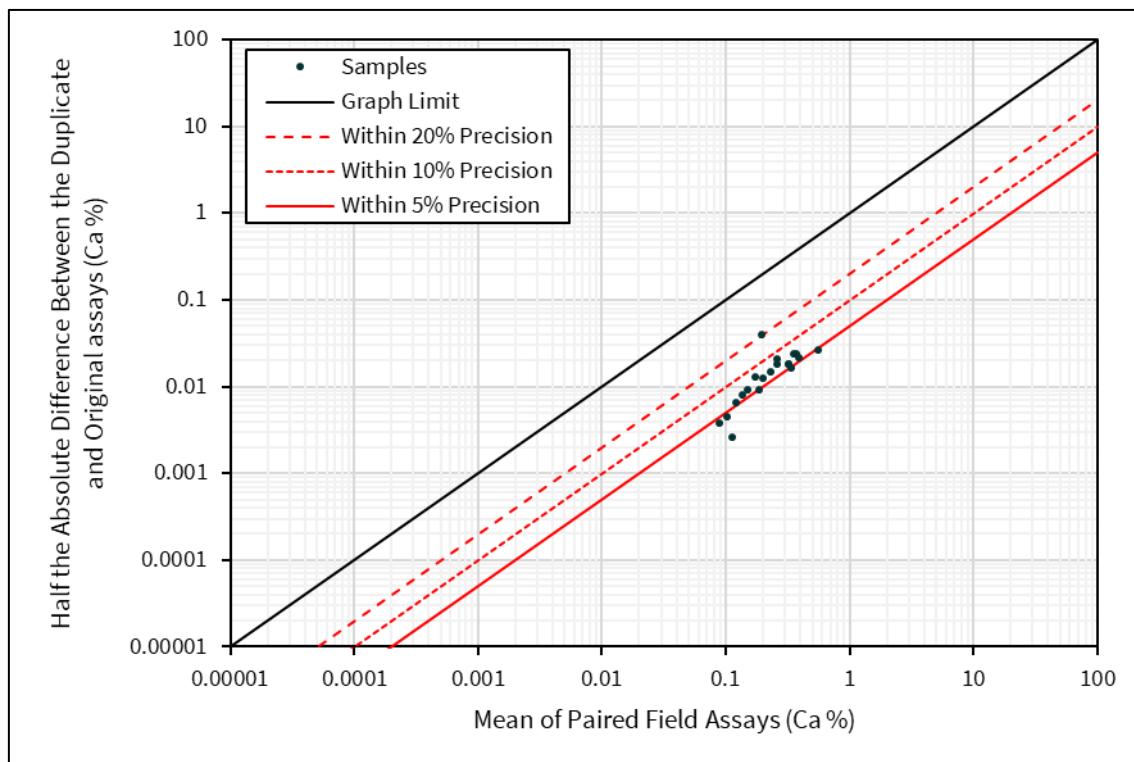


Figure 11.33: Precision Plot of SRC vs K-UTEC Potassium Results

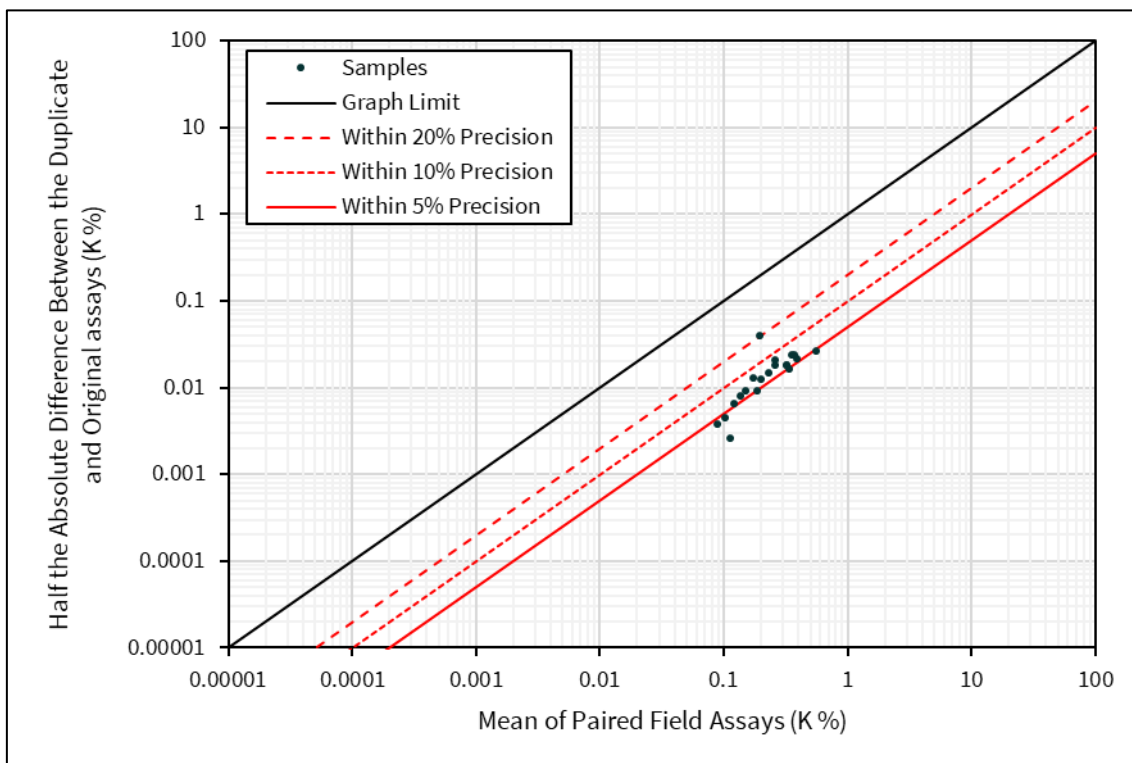


Figure 11.34: Precision Plot of SRC vs K-UTEC Magnesium Results

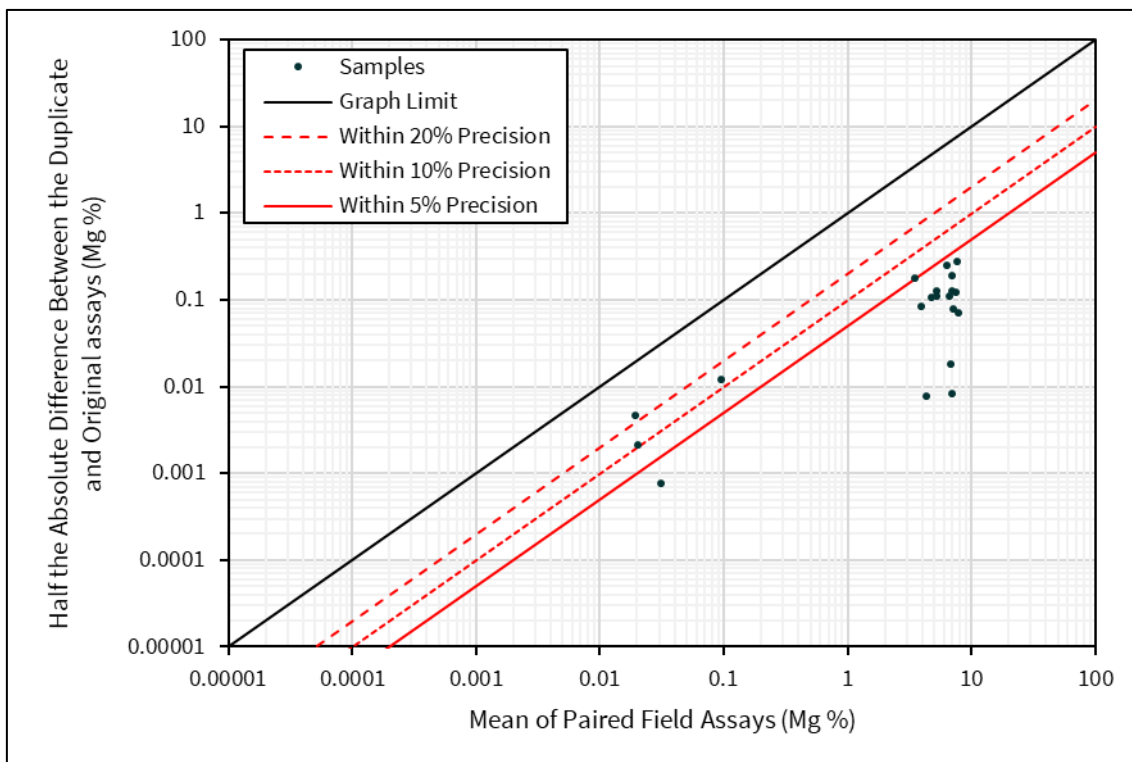


Figure 11.35: Precision Plot of SRC vs K-UTEC Sodium Results

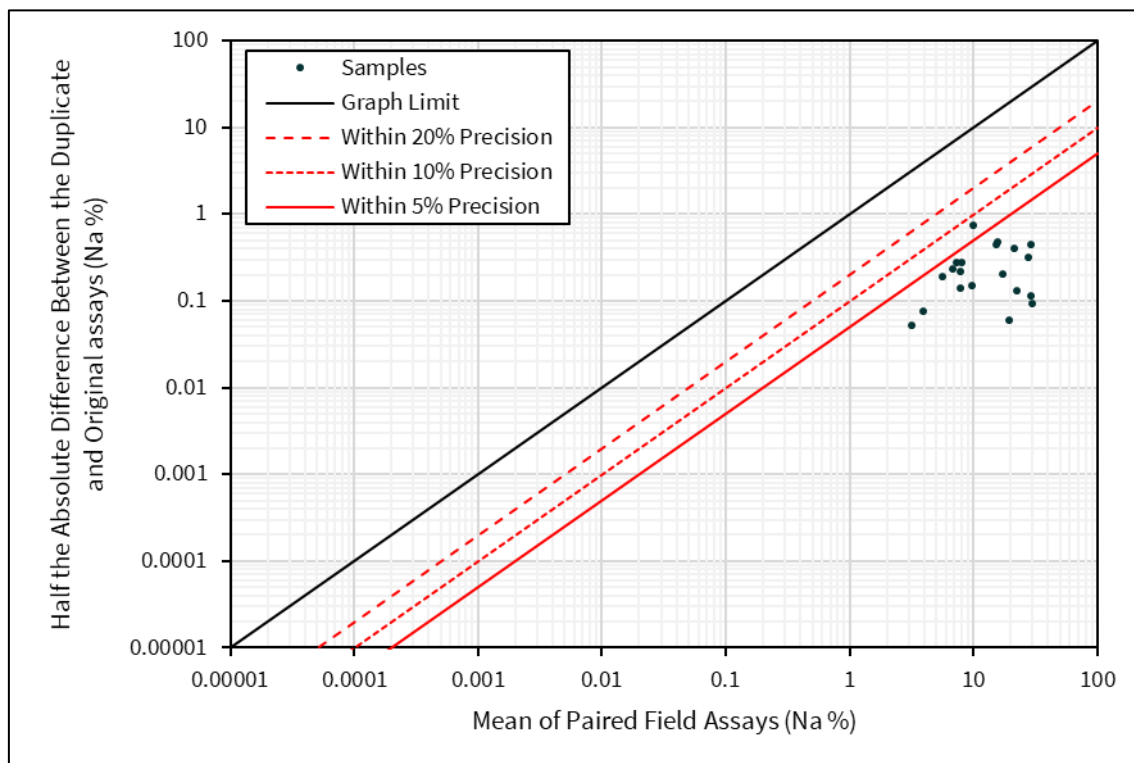


Figure 11.36: Precision Plot of SRC vs K-UTEC Sulphur Results

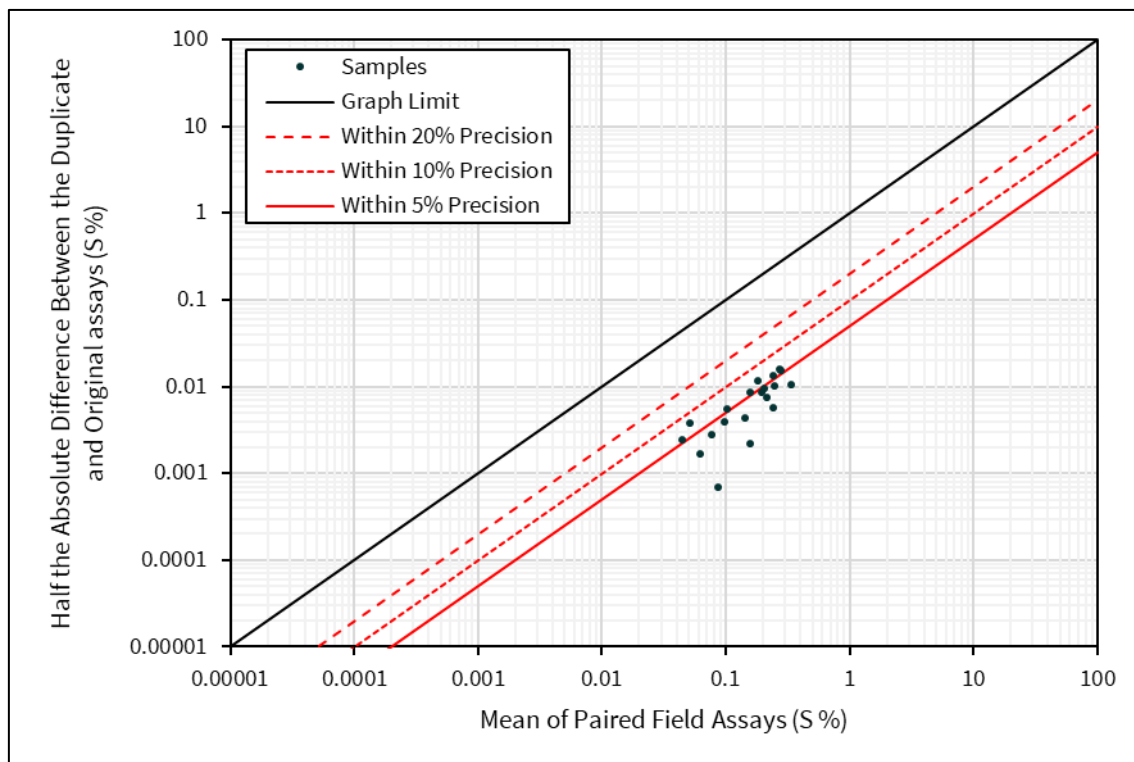


Table 11.6: Analytical Error of the SRC vs K-UTEC Sample Pairs

Error	Cl (%)	Ca (%)	K (%)	Mg (%)	Na (%)	S (%)
Pairs with Analytical Errors Less than $\pm 20\%$	100.00	95.00	100.00	95.00	100.00	100.00
Pairs with Analytical Errors Less than $\pm 10\%$	100.00	95.00	100.00	85.00	100.00	100.00

Micon concludes that the results of the check samples between SRC and K-UTEC demonstrate a good level of reproducibility, with all elements having less than 5% of pairs exhibiting $\pm 20\%$ analytical error (up to 20% of samples with more than $\pm 20\%$ analytical error would be deemed acceptable).

11.4.4 SRC QA/QC

As well as the round robin/check results mentioned above, Micon received QA/QC data for SRC which included data on standards and analytical duplicates. No blank data was provided for any of the three laboratories and no standards or duplicates have been provided for ALS or K-UTEC.

In total 231 unknown assay samples were submitted to SRC. Alongside the unknown assay samples there were 7 analytical duplicates and 14 standards which were submitted for a full suite of analysis of 51 elements and compounds by Mass Spectrometry (MS) and Inductively Coupled Plasma Spectroscopy (ICP). No blank samples were submitted. For QA/QC analysis a subset of the 51 elements and compounds which Micon deems relevant to Potash has been selected which consists of Cl, CaO, K₂O, MgO, Na₂O, S and Insolubles. The percentages of duplicates, standards and blanks compared to the total number of unknown samples are presented in Table 11.7.

Table 11.7: SRC Quality Control Samples Summary

Sample Type	Sample No.	Percentage of Total No. Samples (%)
Samples	231	-
Duplicates	7	2.78
Standards	14	5.56
Blanks	0	-
Total No. of Samples	252	-

The total number of duplicates, standards and blanks make up 2.78%, 5.56% and 0.00% of the total number of unknown samples, respectively. Of these values, the only one which exceeds the industry standard of 5% of the total samples submitted is the standards at 5.56% with the duplicates and blanks falling well short of this. To reach the accepted industry standard of 5.00%, each sample type would require a minimum of 14 samples to be submitted, based on the number of unknown assays submitted.

11.4.4.1 Duplicates

Duplicates are samples that are taken from and are representative of the same population, to assess any variance caused by sampling or analysis. The duplicate samples submitted for analysis at the

SRC Laboratory are analytical duplicates, as opposed to field duplicates. Summary statistics for the analytical duplicates are presented in Table 11.8.

Table 11.8: Summary of Analytical Duplicates

Element	Parameters	Original	Duplicate
Cl (%)	Mean	46.20	46.34
	Standard Deviation	4.37	4.28
	Correlation Coefficient	0.997	
	No. of Samples	7	
CaO (%)	Mean	0.25	0.25
	Standard Deviation	0.11	0.12
	Correlation Coefficient	0.999	
	No. of Samples	7	
K ₂ O (%)	Mean	12.74	12.85
	Standard Deviation	4.22	4.25
	Correlation Coefficient	0.999	
	No. of Samples	7	
MgO (%)	Mean	8.30	8.31
	Standard Deviation	3.42	3.43
	Correlation Coefficient	1.000	
	No. of Samples	7	
Na ₂ O (%)	Mean	19.24	19.18
	Standard Deviation	7.68	7.67
	Correlation Coefficient	1.000	
	No. of Samples	7	
S (ppm)	Mean	1174	1172
	Standard Deviation	601	599
	Correlation Coefficient	1.000	
	No. of Samples	7	
Insolubles (%)	Mean	0.86	0.83
	Standard Deviation	0.31	0.33
	Correlation Coefficient	0.977	
	No. of Samples	7	

The results of the analytical duplicates show a strong convergence for all seven elements, with correlation coefficients ranging from 0.977 to 1.000.

Correlation plots were generated for the field duplicates to assess the relationship between the original assays and the repeat assay results and are presented in Figure 11.37 to Figure 11.43.

Figure 11.37: Correlation Plot of Original and Analytical Duplicate Chlorine Samples

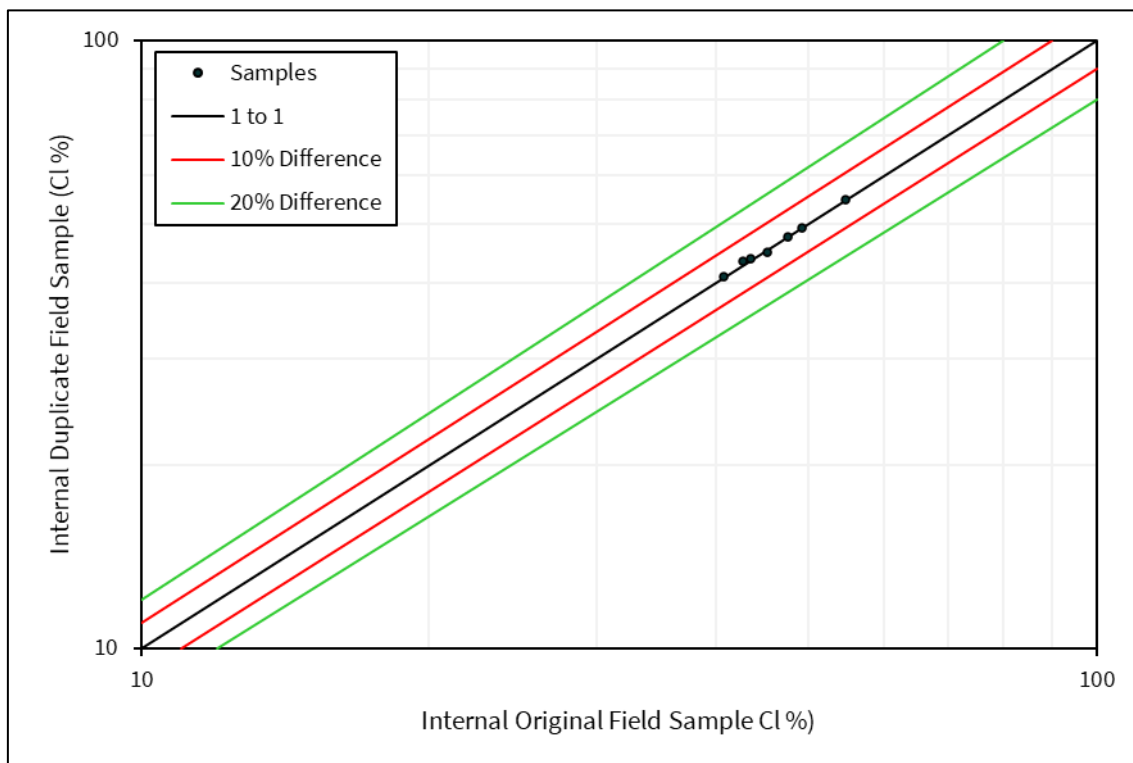


Figure 11.38: Correlation Plot of Original and Analytical Duplicate Calcium Oxide Samples

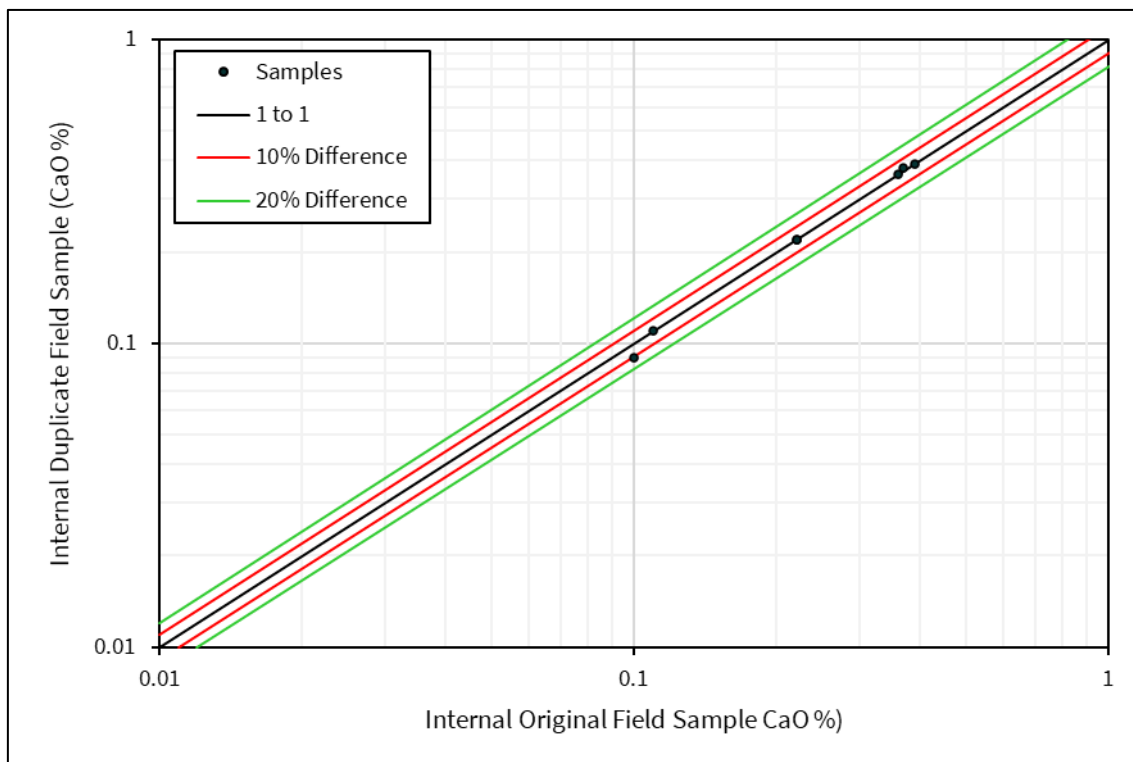


Figure 11.39: Correlation Plot of Original and Analytical Duplicate Potassium Oxide Samples

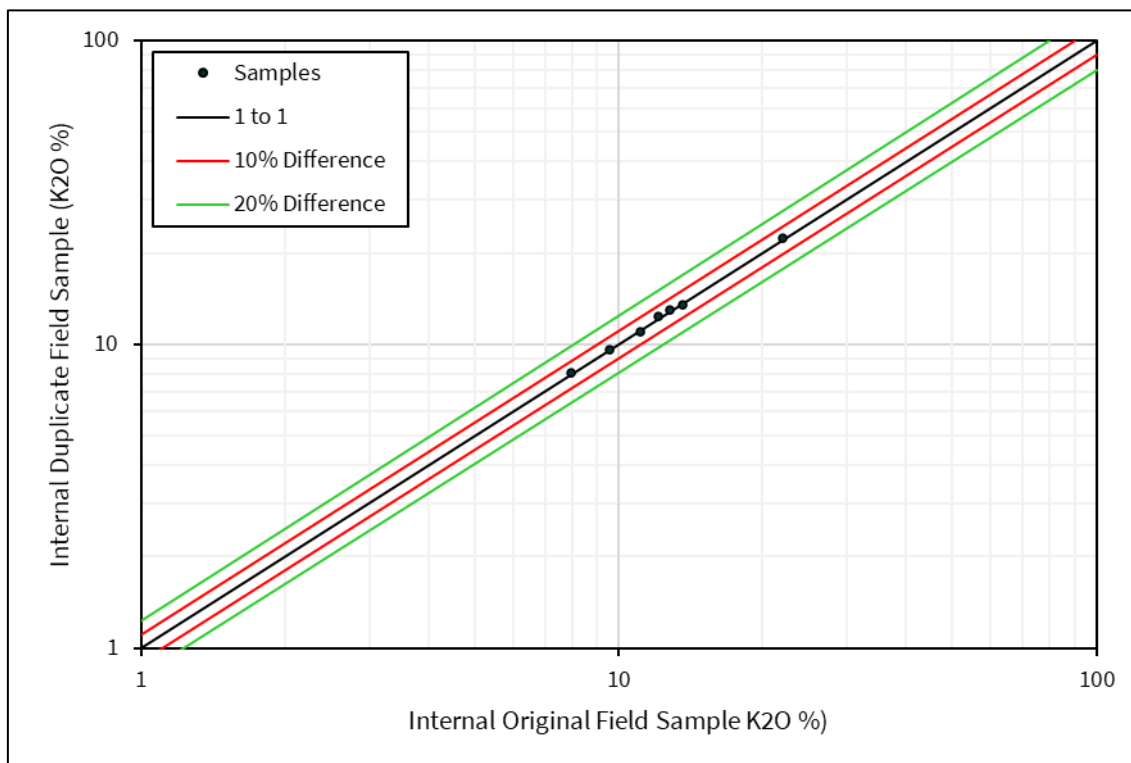


Figure 11.40: Correlation Plot of Original and Analytical Duplicate Magnesium Oxide Samples

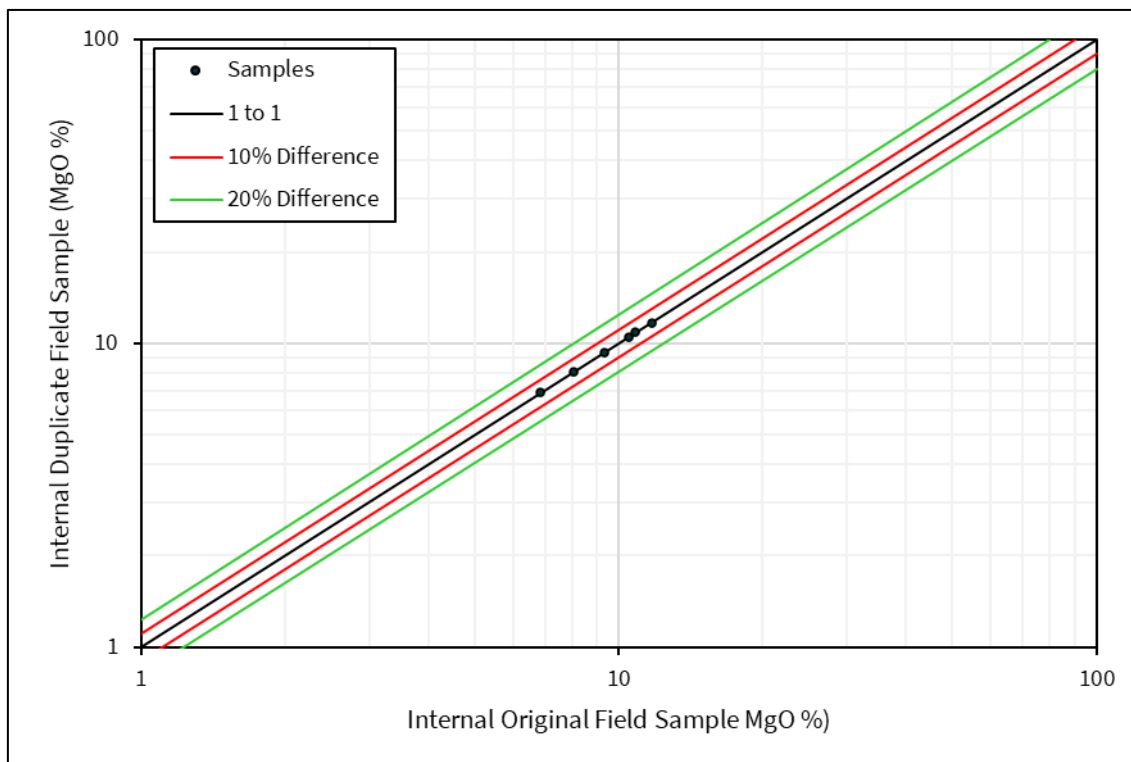


Figure 11.41: Correlation Plot of Original and Analytical Duplicate Sodium Oxide Samples

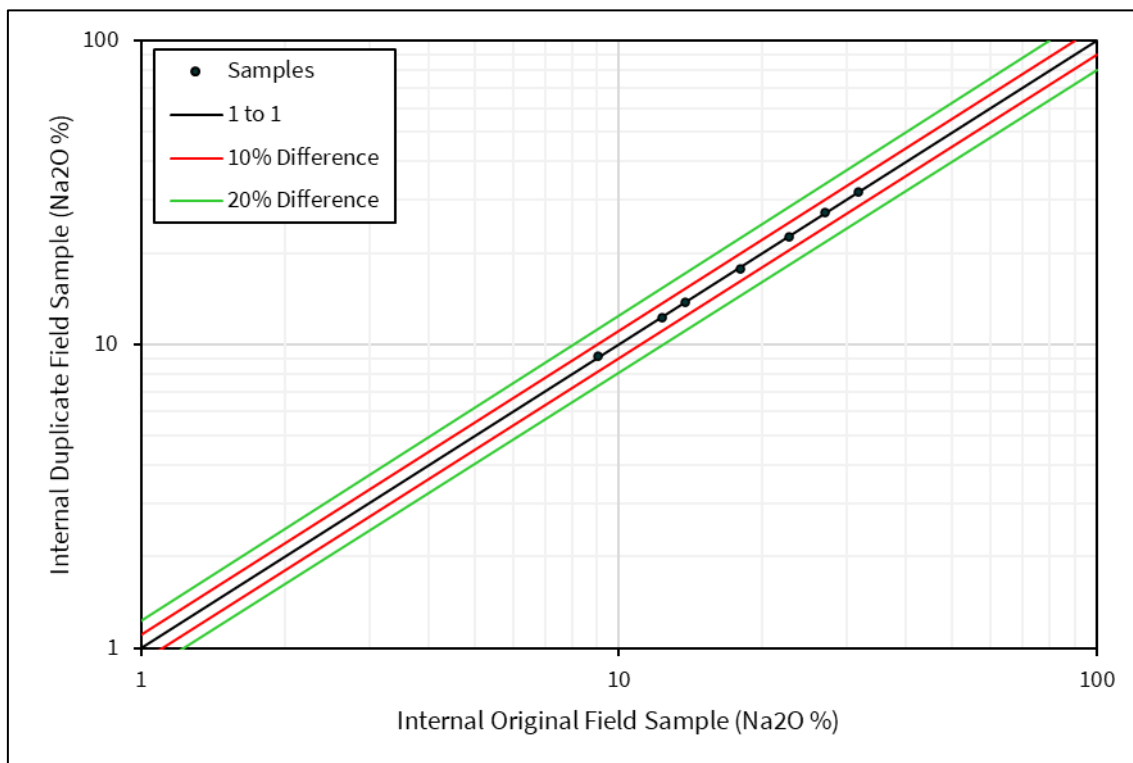


Figure 11.42: Correlation Plot of Original and Analytical Duplicate Sulphur Samples

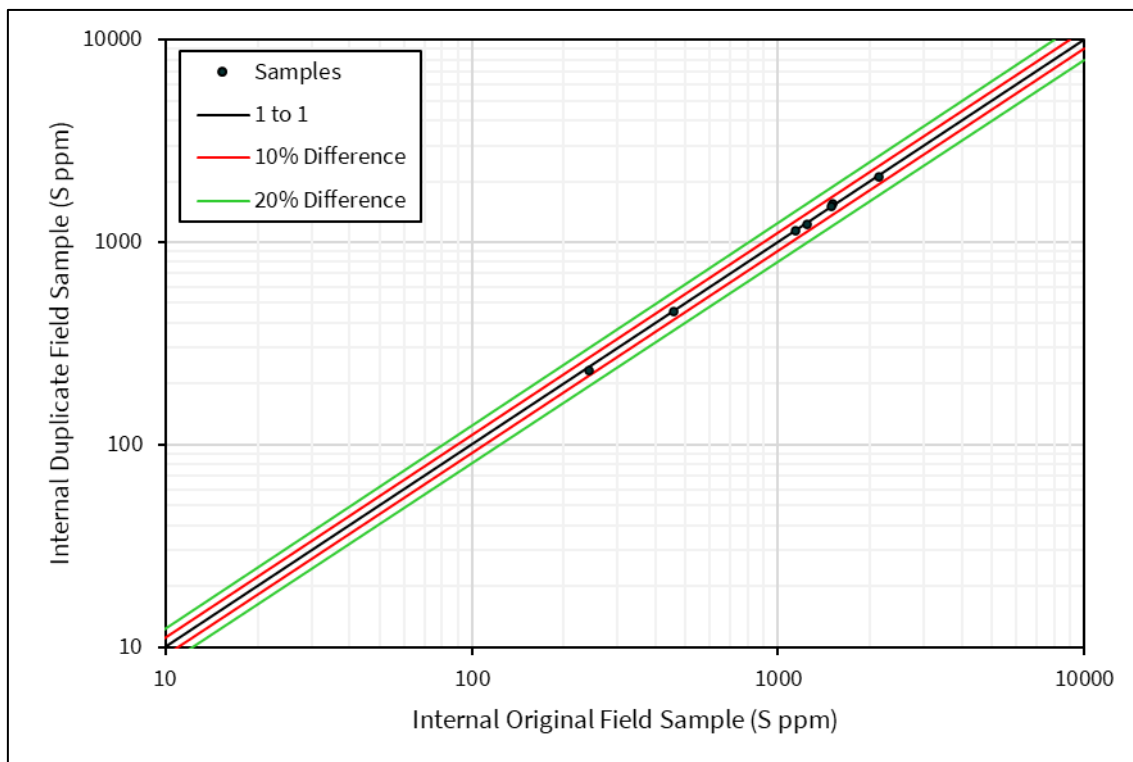
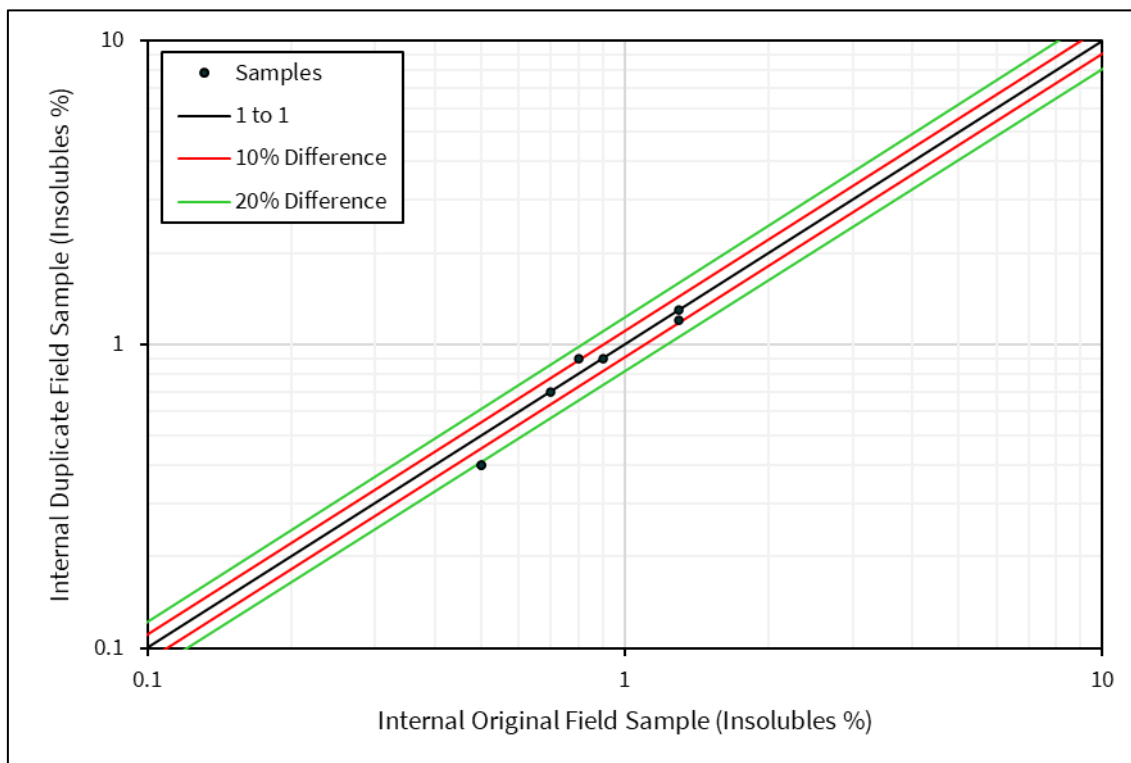


Figure 11.43: Correlation Plot of Original and Analytical Duplicate Insolubles Samples



The correlation plots show five correlation lines; the central black line is the 1:1 line, the red lines denote $\pm 10\%$ difference between sample pairs and the green lines denote $\pm 20\%$ difference. The $\pm 20\%$ limits indicate the acceptable range of analytical error for assays derived from unknown samples.

The correlation graphs for the duplicates show a consistent correlation between the duplicate samples for all elements, with no samples plotting outside of the 20% difference limits. This suggests that there is very little variance or error caused by the laboratory sampling or analysis methods.

Precision plots were generated for all the duplicate samples, these plots present the precision of the sample pairs as respective percentages of the original grades. The precision plots are presented in Figure 11.44 to Figure 11.50 and a table summarising the analytical errors is presented in Table 11.9.

Figure 11.44: Precision Plot of Original and Analytical Duplicate Chlorine Samples

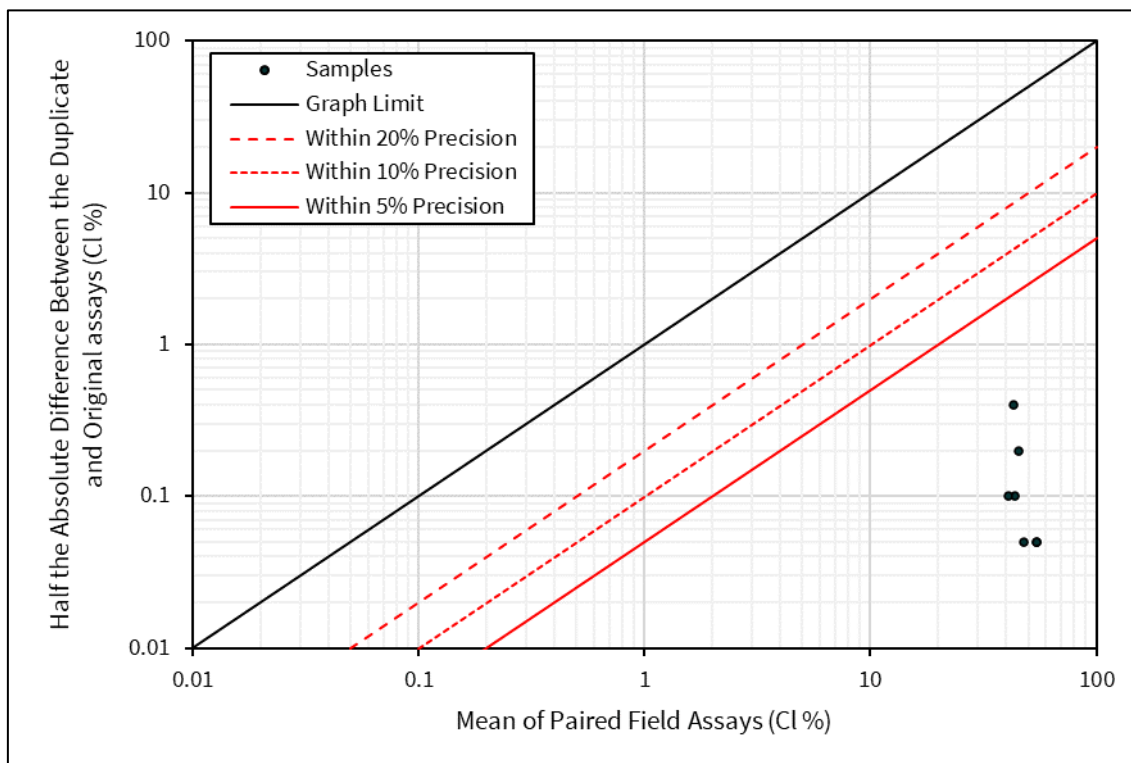


Figure 11.45: Precision Plot of Original and Analytical Duplicate Calcium Oxide Samples

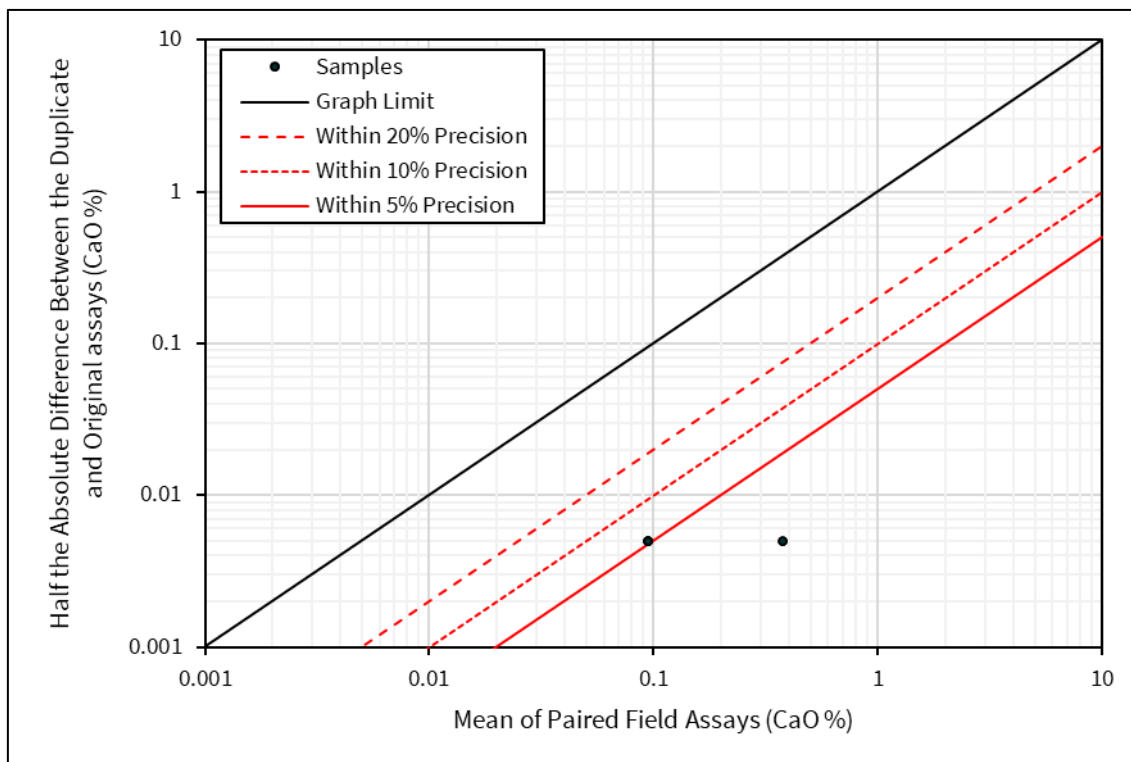


Figure 11.46: Precision Plot of Original and Analytical Duplicate Potassium Oxide Samples

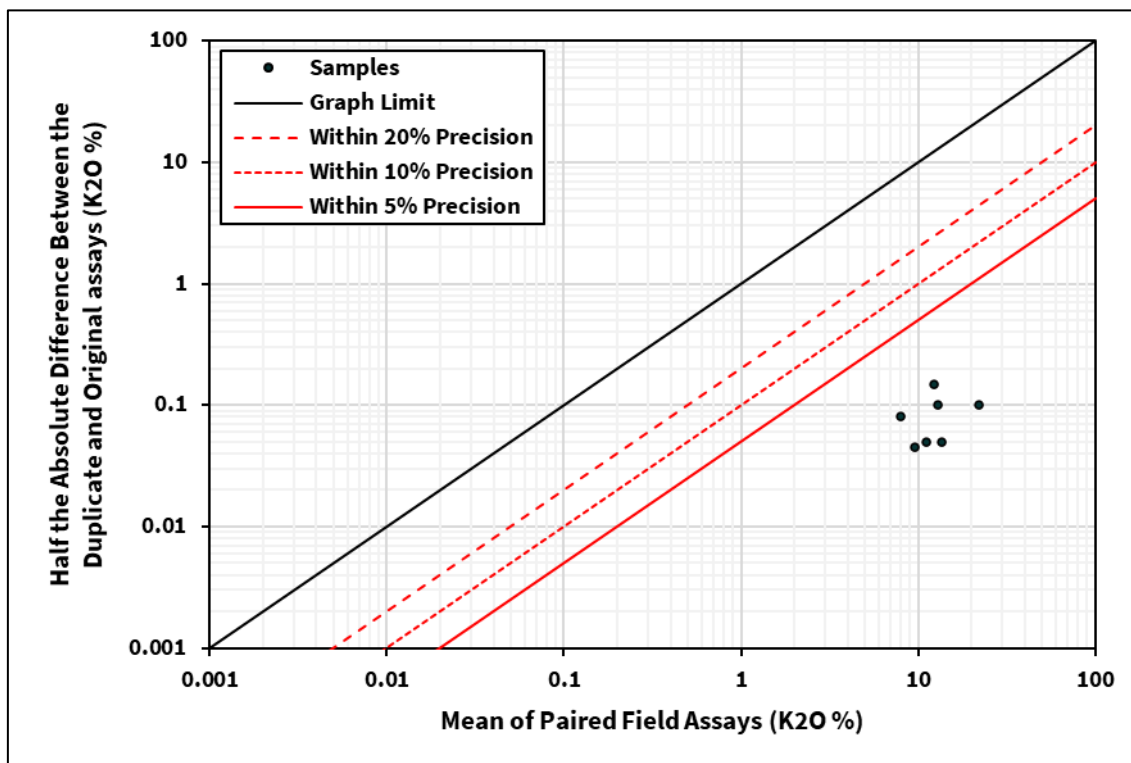


Figure 11.48: Precision Plot of Original and Analytical Duplicate Sodium Oxide Samples

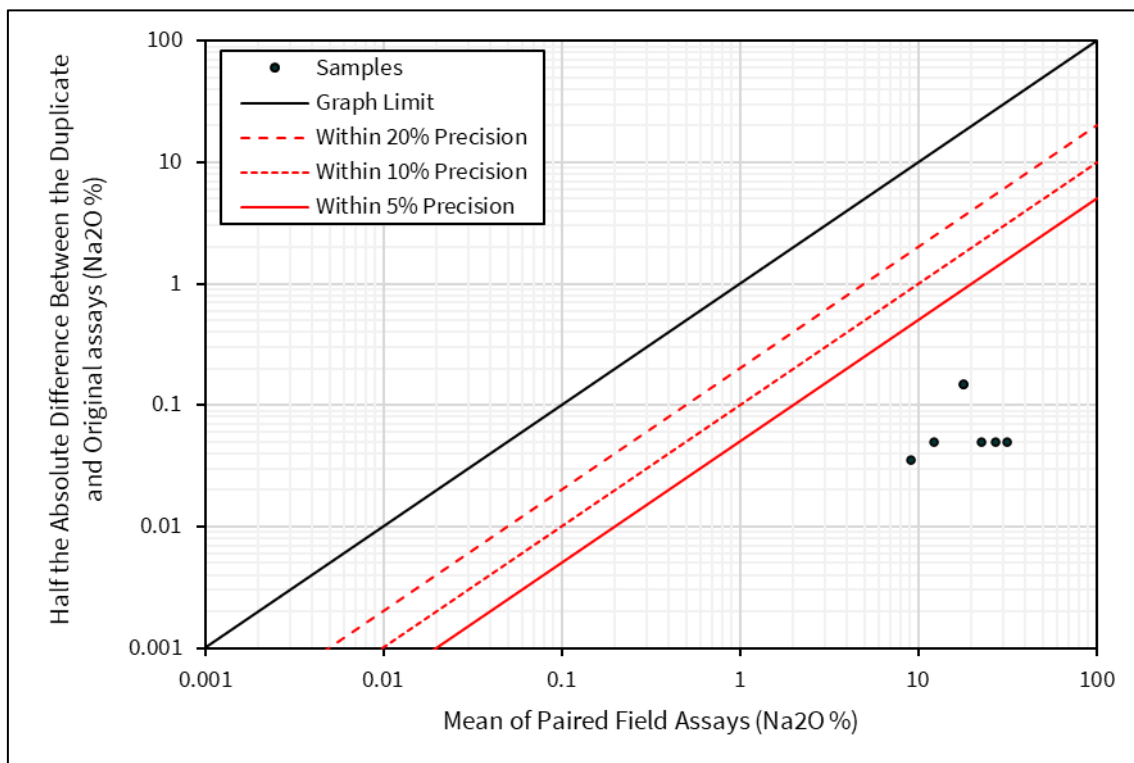


Figure 11.49: Precision Plot of Original and Analytical Duplicate Sulphur Samples

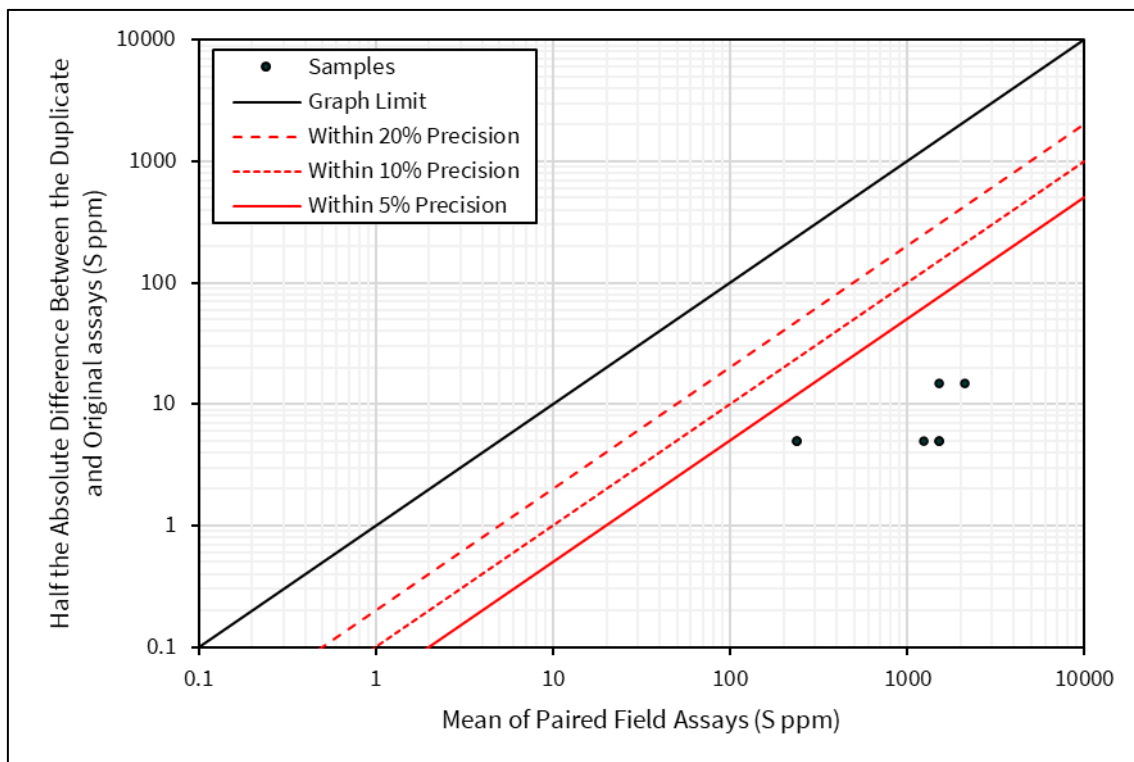


Figure 11.50: Precision Plot of Original and Analytical Duplicate Sodium Oxide Samples

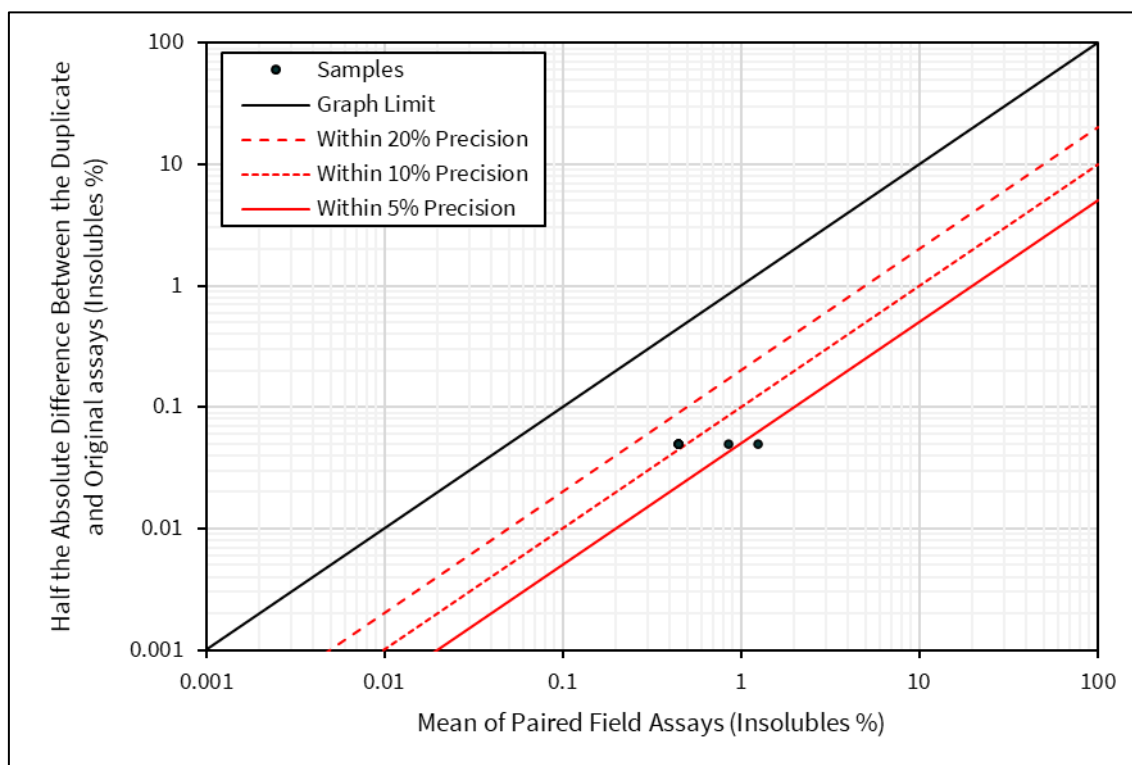


Table 11.9: Analytical Error of the Original Assays to the Mean of Assay Pairs

Error	Cl (%)	CaO (%)	K ₂ O (%)	MgO (%)	Na ₂ O (%)	S (%)	Insolubles (%)
Pairs with Analytical Errors Less than $\pm 20\%$	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Pairs with Analytical Errors Less than $\pm 10\%$	100.00	100.00	100.00	100.00	100.00	100.00	71.43

Micon concludes that the results of the duplicate quality control assays for all elements demonstrate a good level of reproducibility, with 100% of results having less than $\pm 20\%$ analytical error (up to 20% of samples with more than $\pm 20\%$ analytical error would be deemed acceptable) and the Insolubles having 71.43% of results with less than $\pm 10\%$ analytical error.

11.4.4.2 Standards

The standards submitted for analysis at the SRC Laboratory are presented in Table 11.10.

Table 11.10: SRC Standards

Standard	Element	No. of Samples
POT003B	Cl	7
	CaO	7
	K ₂ O	7
	MgO	7
	Na ₂ O	7
	S	7
	Insolubles	7
POT004B	Cl	7
	CaO	7
	K ₂ O	7
	MgO	7
	Na ₂ O	7
	S	7
	Insolubles	7

Typically, Performance Gates (a Performance Gate is a control value specified as a Standard Deviation of the Certified Value) would be used to assess the performance of the analysed standards, but no standard deviation is supplied for any of the seven elements and compounds analysed for either standard used. Because of the lack of standard deviations, gates of $\pm 10\%$ and $\pm 20\%$ of the expected value are used instead. The expected value of the standards and the percentage difference performance gates are shown in Table 11.11.

Table 11.11 Summary of Standards

Standard	Element	Expected Value	Performance Gates (Relative Percentage)			
			+10%	-10%	+20%	-20%
POT003B	Cl (%)	51.5	56.7	46.4	61.8	41.2
	CaO (%)	0.36	0.40	0.32	0.43	0.29
	K ₂ O (%)	18.9	20.8	17.0	22.7	15.1
	MgO (%)	1.55	1.71	1.40	1.86	1.24
	Na ₂ O (%)	30.3	33.3	27.3	36.4	24.2
	S (ppm)	1,764	1,940	1,588	2,117	1,411
	Insolubles (%)	4.6	5.1	4.1	5.5	3.7
POT004B	Cl (%)	51.4	56.5	46.3	61.7	41.1
	CaO (%)	0.21	0.23	0.19	0.25	0.17
	K ₂ O (%)	36.4	40.0	32.8	43.7	29.1
	MgO (%)	0.11	0.12	0.10	0.13	0.09
	Na ₂ O (%)	20.4	22.4	18.4	24.5	16.3
	S (ppm)	1,052	1,157	947	1,262	842
	Insolubles (%)	2.1	2.3	1.9	2.5	1.7

The assay values for the internal standard samples returned by the SRC laboratory were compared with the expected assay values by plotting the assay values against the expected value of the material and the 10% and 20% relative percentage gates discussed above. There is no industry standard for this analysis and it is presented only to help quantify the deviations from the certified value.

The standard plots are presented in Figure 11.51 to Figure 11.57 and a summary table of the analysis is shown in Table 11.12.

Figure 11.51: Chlorine Standards POT003B and POT004B

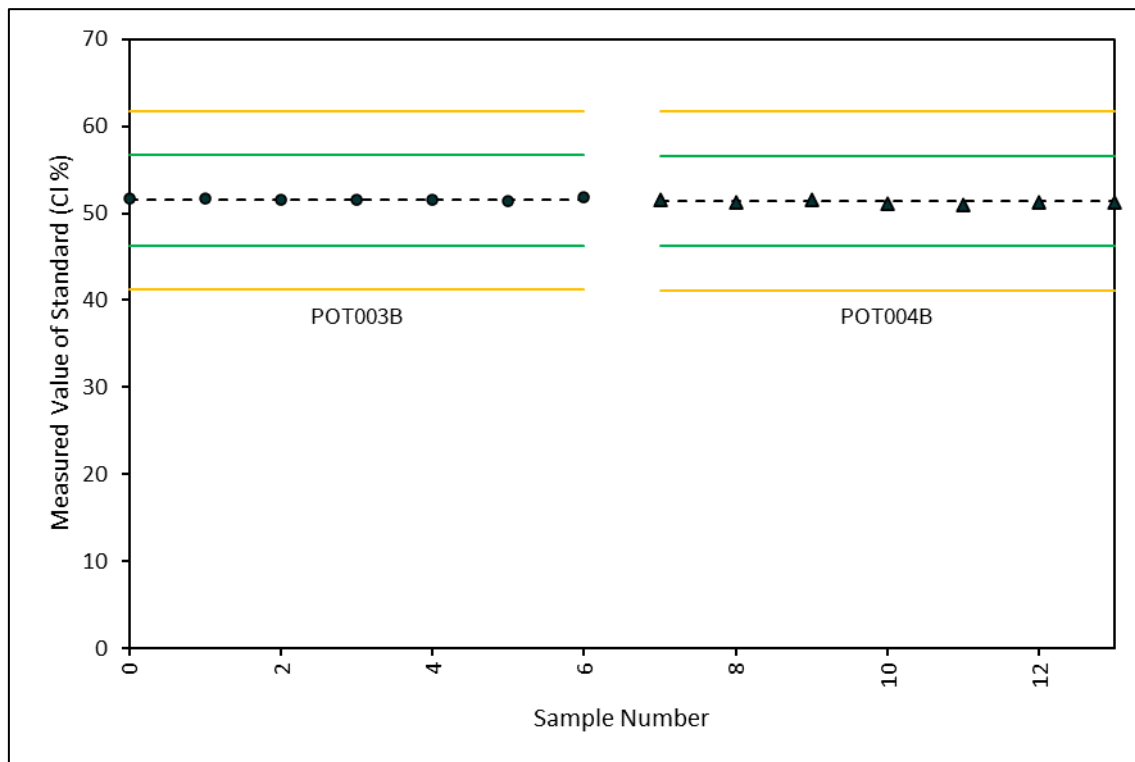


Figure 11.52: Calcium Oxide Standards POT003B and POT004B

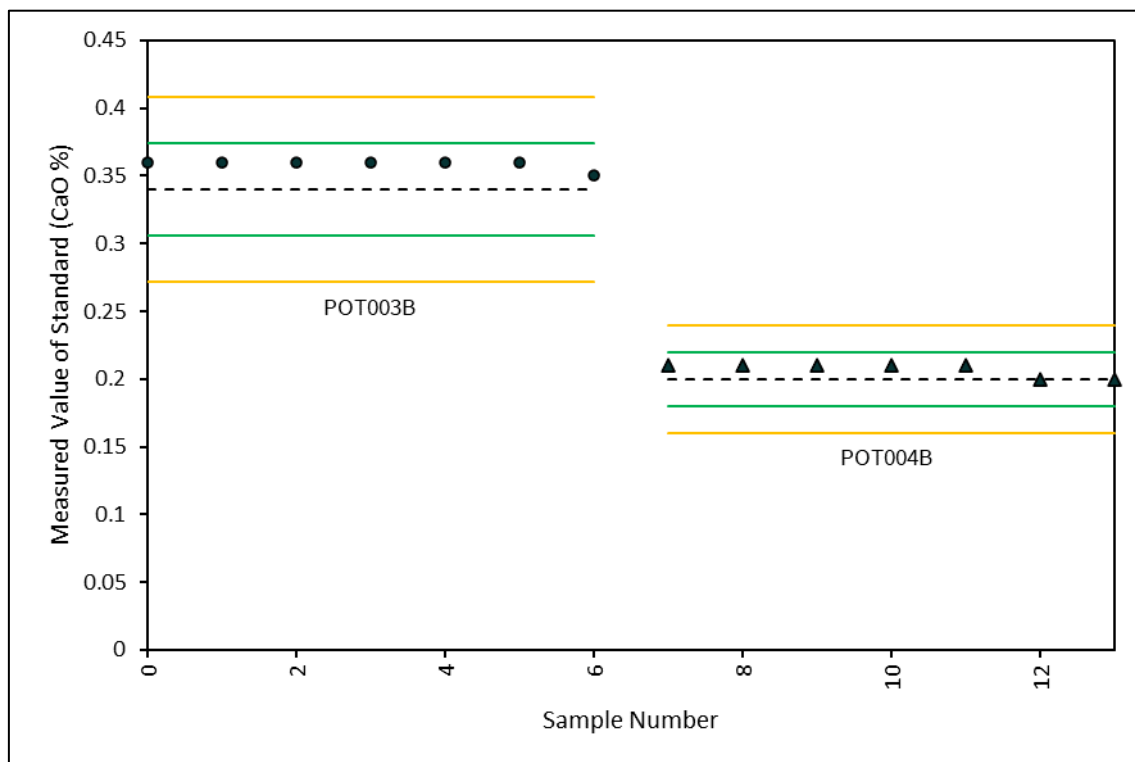


Figure 11.53: Potassium Oxide Standards POT003B and POT004B

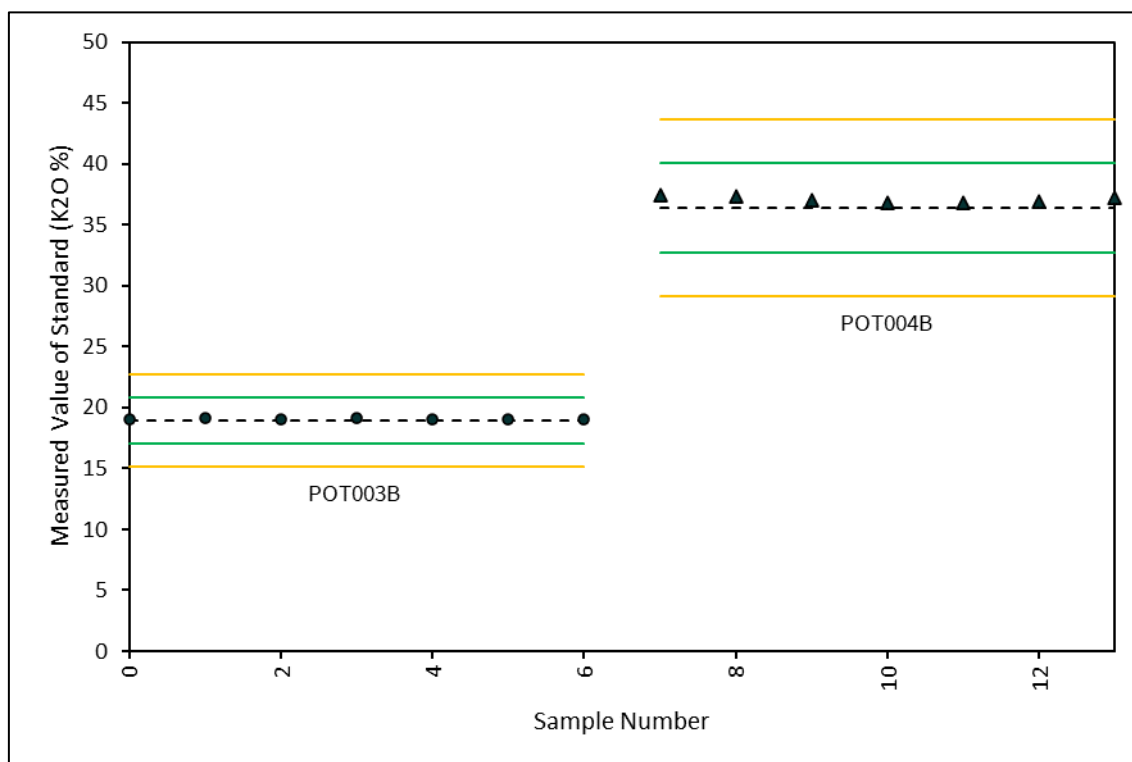


Figure 11.54: Magnesium Oxide Standards POT003B and POT004B

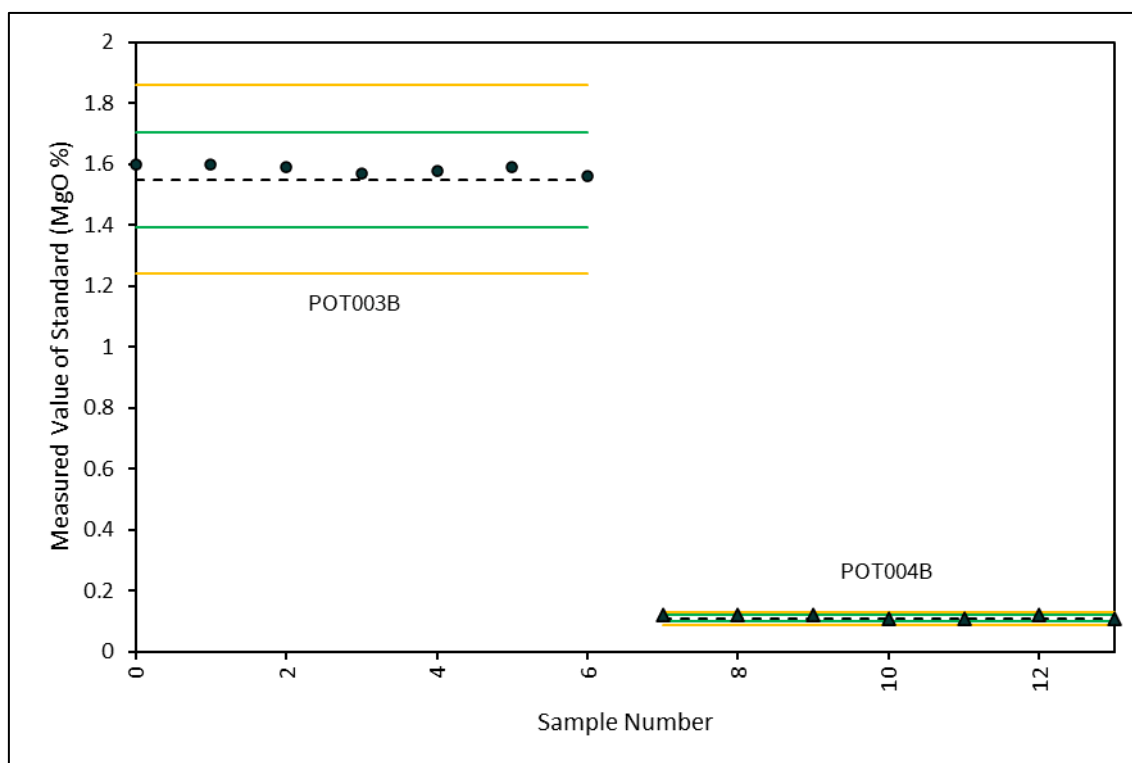


Figure 11.55: Sodium Oxide Standards POT003B and POT004B

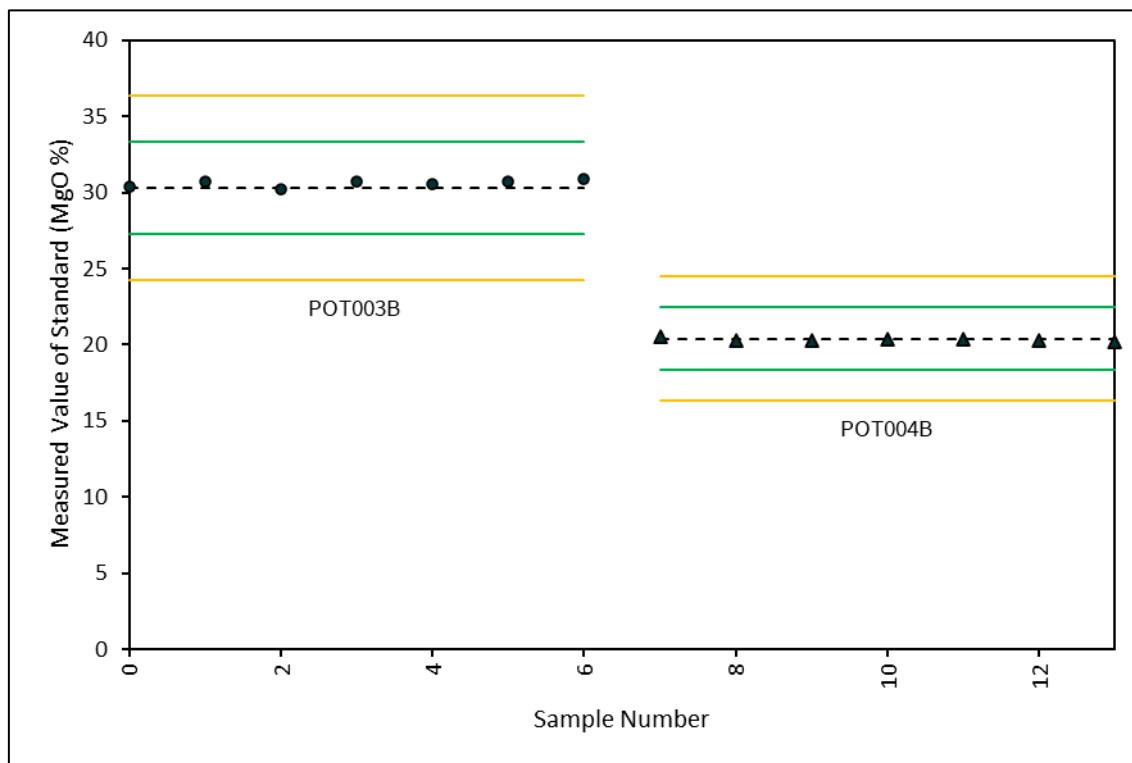


Figure 11.56: Sulphur Standards POT003B and POT004B

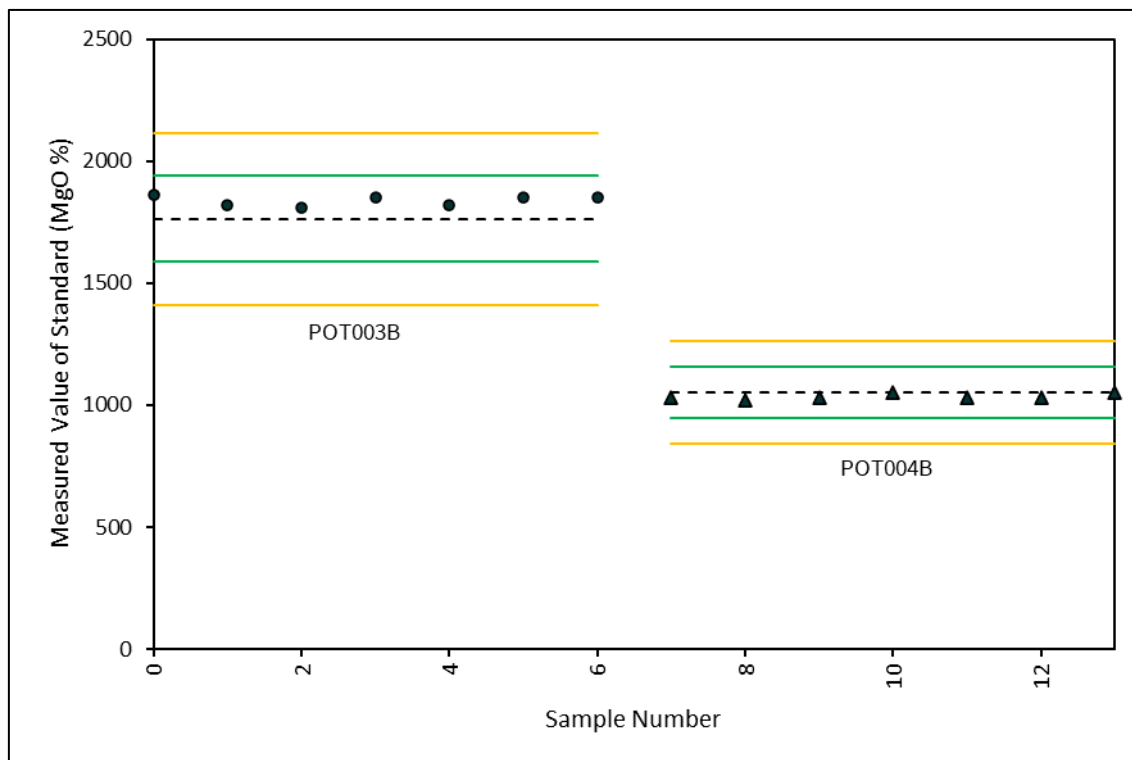


Figure 11.57: Insolubles Standards POT003B and POT004B

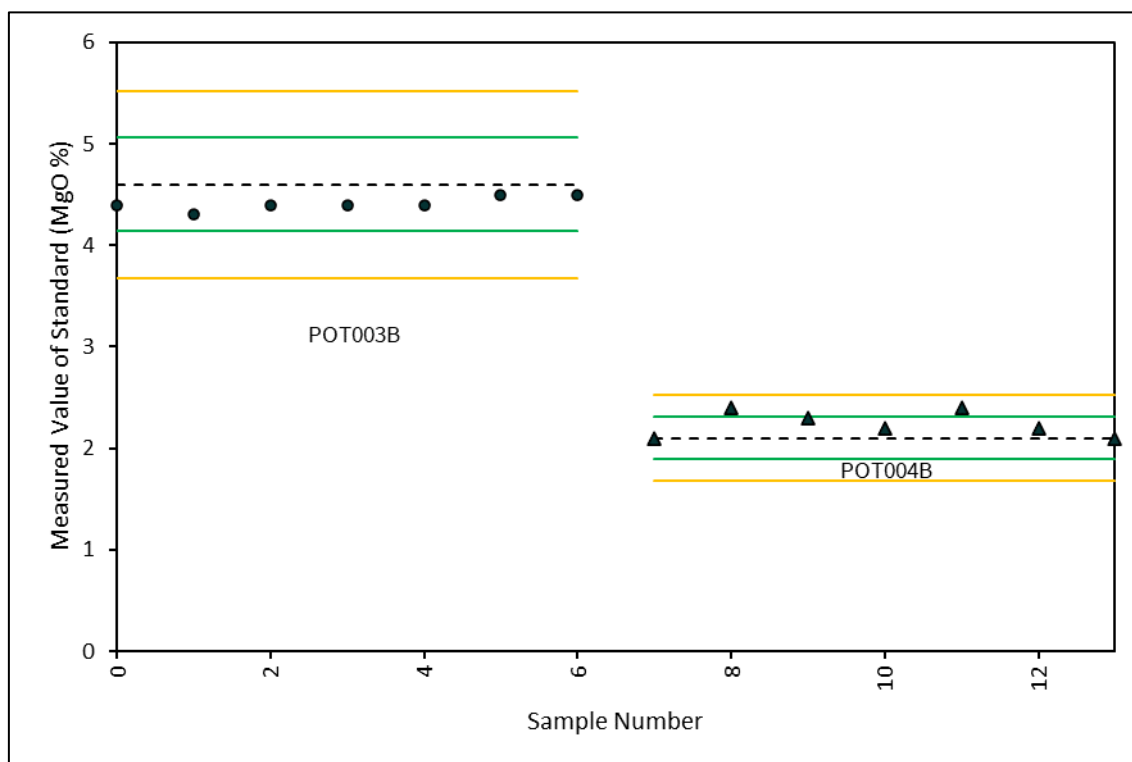


Table 11.12: Summary of Standards Results

Standard	Element	Expected Value	No. of Data Points	Points Outside $\pm 10\%$	Percentage of Points Outside $\pm 10\%$ (%)	Points Outside $\pm 20\%$	Percentage of Points Outside $\pm 20\%$ (%)
POT003B	Cl (%)	51.5	7	0	0.00	0	0.00
	CaO (%)	0.36	7	0	0.00	0	0.00
	K ₂ O (%)	18.9	7	0	0.00	0	0.00
	MgO (%)	1.55	7	0	0.00	0	0.00
	Na ₂ O (%)	30.3	7	0	0.00	0	0.00
	S (ppm)	1,764	7	0	0.00	0	0.00
	Insolubles (%)	4.6	7	0	0.00	0	0.00
POT004B	Cl (%)	51.4	7	0	0.00	0	0.00
	CaO (%)	0.21	7	0	0.00	0	0.00
	K ₂ O (%)	36.4	7	0	0.00	0	0.00
	MgO (%)	0.11	7	0	0.00	0	0.00
	Na ₂ O (%)	20.4	7	0	0.00	0	0.00
	S (ppm)	1,052	7	0	0.00	0	0.00
	Insolubles (%)	2.1	7	2	28.57	0	0.00

All the elements analysed, for both standards, have 100% of their samples within $\pm 10\%$ of the expected value except for the Insolubles for POT004B where 28.57% fall outside of the $\pm 10\%$ performance gate. As stated previously, there is no industry standard for percentage deviation from a certified value, but Micon would aim for less than 10% of samples to fall outside of a deviation of 10% from the certified value.

Micon deems the results of the standards to be acceptable for all analyses except for the Insolubles for POT004B. Micon suggests these samples are reanalysed to rule out errors in the laboratory analysis methods.

11.4.4.3 Blanks

No blanks samples were submitted to the SRC Laboratory.

11.5 CONCLUSIONS

The laboratories used for sample analysis have established internal QA/QC procedures, as outlined in Sections 11.4.1 and 11.4.2, but the extent of QA/QC samples submitted to these laboratories by Millennial/previous owners of the Project is somewhat limited. Of the three laboratories used for sample analysis, only SRC had QA/QC samples submitted. No blanks were submitted, and the number of duplicates submitted does not satisfy the typically accepted minimum industry standard of 5% of total samples submitted.

The results of the check/round robin samples between the three laboratories show incredibly strong correlations, with high levels of precision and very low levels of error far below typically accepted industry thresholds.

Because of these strong correlations between laboratories and the internal QA/QC procedures of each of them, Micon believes that the dataset can be considered robust and adequate for resource estimation purposes. Micon strongly recommends that in future analyses are kept to one laboratory if possible, and 5% of the total number of assays submitted is submitted as duplicate, standard and blank samples with regular monitoring of these results to observe and rectify any possible issues should they arise.

12.0 DATA VERIFICATION

Micon completed a site visit in November 2023. During Micon's site visit the Micon Team verified the location of Millennial drill holes Ba-002 and Ba-001. The exploration camp was visited where the historical drill core was logged and photographed.

ERCOSPLAN completed a site visit to the Banio Project in October 2022 and on 16th October 2022 examined core material from Ba-003 and Ba-001. The review confirmed that the core pictures provided by Mayumba Potasse are of actual cores from the drill holes and that sampling had taken place as shown on the sample protocols. The actual location of drill hole Ba-002 was verified by ERCOSPLAN in the field. In addition spot checks were made to verify that the Excel files with the analytical results conformed to the analysis protocols.

For drill holes Ba-002 and Ba-003 ERCOSPLAN completed a qualitative comparison between estimated mineralogy from assays and the natural gamma ray logs. These comparisons showed that there is a reasonable correspondence between thickness and mineral grade for potash seams from the assay and width and intensity of the natural gamma peaks. The presence of high grade carnallite seams at these depth intervals has been confirmed by ERCOSPLAN.

13.0 MINERAL PROCESSING AND METALLURGICAL TESTING

The Banio Project is at an early stage of exploration and no mineral processing has been completed on the Project at this time. For a description of the proposed recovery methods and processing route see Section 17.0.

13.1 METALLURGICAL TESTING

Within the context of this Project, solution mining and subsequent brine processing are not metallurgical processes in the strictest sense. Once the solvent has dissolved the salts present within the cavern and the brines are delivered to the processing plant, it becomes a chemical engineering exercise whose outputs are dictated by known principles of salt chemistry. These are completely predictable and require no re-invention.

The principal driver for the mining process is the dissolution rate within the cavern and the steady-state brine composition that will be reached. The driving force for mass transfer of salts from solid to liquid phase will be dictated by numerous factors such as the difference in concentration of the solvent and solid rock, the temperature, the degree of agitation caused by the inflow of solvent and so forth.

A tried and tested means of approximating the rate of mass transfer is by simple dissolution tests using drill cores from the resource area. A simple dissolution test apparatus is shown in schematic form in Figure 13.1.

The dissolution testwork involves the exposure of a drill core to a synthetic solvent solution, whereupon the dissolution characteristics are measured as a function of time. The change in the core mass and the increase in density of the solution are measured simultaneously during the test period.

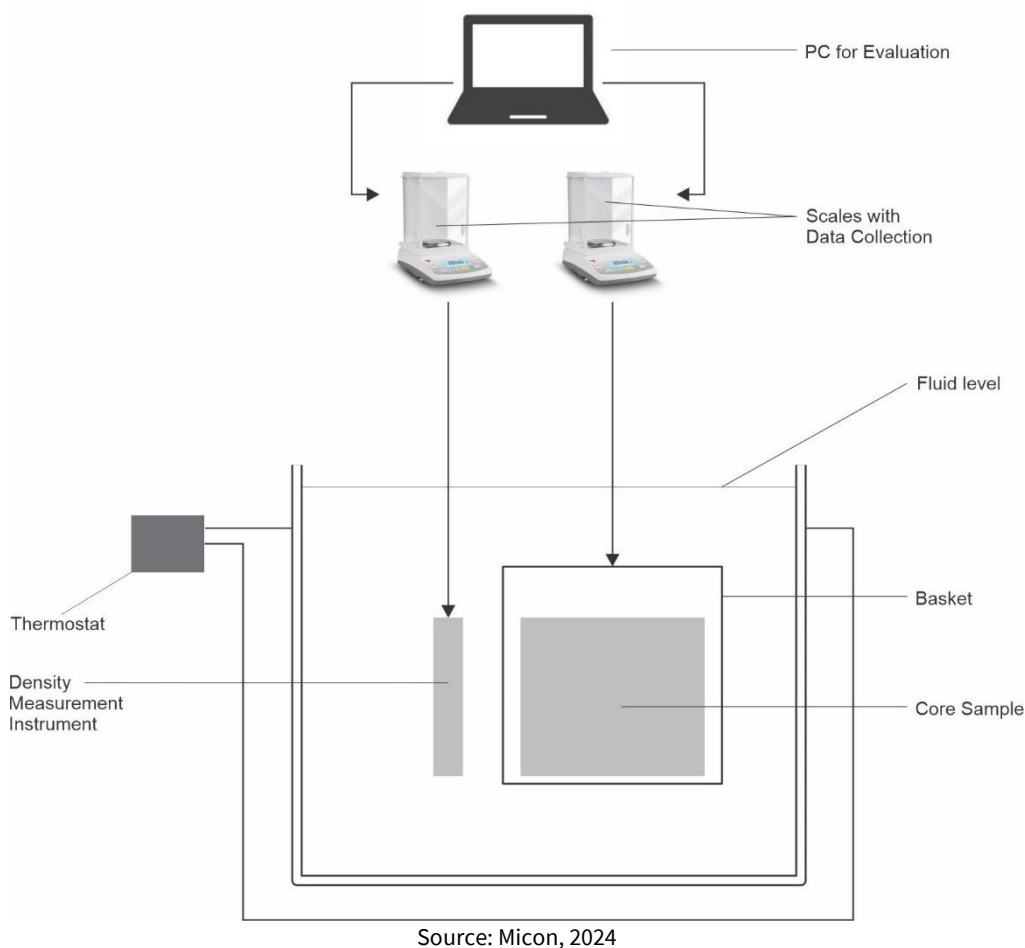
The density of the solution increases as dissolution progresses, and the weight of the density reference block decreases apparently because the buoyancy of the liquid rises.

The dissolution test is deemed complete when one of the following occurs:

- After a predetermined time;
- When the drilling core is completely dissolved; and,
- When no change in mass is recorded.

The dissolution rate of the selected cores can be tested according to the exposed dissolution surface. For this purpose, the samples are selectively coated with epoxy resin. The horizontal attack is evaluated with the non-coated front side samples, and the vertical attack can be evaluated with the non-coated bottom side samples.

Figure 13.1: Schematic of Dissolution Test Apparatus for Solution Mining



Of equal importance to the dissolution rate of the core is the composition of the final brine that will exit the cavern. Once this is known, the performance of the evaporators and crystallisers can be predicted using manufacturer forecasting models. Likewise, the performance of the debrining centrifuges and product dryers can be predicted once the mass flow and crystal size distribution is provided by the crystalliser package provider. Finally, the performance of the compactors (to manufacture granular potash) can be forecast from the mass flow, temperature and particle size distribution of the standard MOP feed.

It is well known that the presence of MgCl_2 within the leach brine will have an impact on the solubility of the respective Na and K salts within the evaporation and crystallisation environments. In highly carnallitic solutions, it may be required to decompose a synthetic carnallite produced in a later process step in a decomposition evaporator.

It is therefore recommended that further metallurgical testing required to upgrade to the feasibility stage includes dissolution rate testing, and testwork to determine if there is a requirement for a decomposition evaporator to reduce the negative effect of MgCl_2 -rich brines on Na and K solubility. The remaining processing parameters are well-documented and can be forecast with accuracy.

14.0 MINERAL RESOURCE ESTIMATES

14.1 INTRODUCTION

Millennial requested ERCOSPLAN to complete an NI 43-101 compliant Mineral Resource Estimate (MRE) for the Banio Potash Project. The results of the MRE were reported by ERCOSPLAN in the technical report, titled “Technical Report Initial Mineral Resource Estimate for the North Target of the Banio Potash Project, Mayumba Permit, Republic of Gabon, for Millennial Potash Corp., 20th February 2024, Effective Date 7th November 2023”. Mineral Resources and Mineral Reserves are reported in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014) and were prepared using the CIM guidelines for reporting Mineral Resources and Mineral Reserves.

It is the opinion of ERCOSPLAN that historical drilling and subsequent exploration drilling in 2023 by Millennial confirm that drill holes Ba-001 to Ba-003 contain carnallite and sylvinite seams within the evaporite Cycles II to VIII of the Loume evaporites and Mineral Resources can be estimated for the Banio Project.

The information presented in this Section is summarised from the ERCOSPLAN Technical Report. The ERCOSPLAN Technical Report was prepared by Dr. Sebastiaan van der Klauw of ERCOSPLAN. The Mineral Resources have been reviewed by Mrs. Liz de Klerk of Micon. Mrs. de Klerk has sufficient experience which is relevant to the style of exploration, mineralisation and type of deposit under consideration and to the activity which she is undertaking to qualify as a QP under the terms of NI 43-101.

14.2 ASSUMPTIONS

In determining the potential extent, grade, and volume of the potash Mineral Resource for the Banio Project, the QP was guided by commonly used exploration principles, sampling techniques, and the CIM guidelines for reporting Mineral Resources and Mineral Reserves. As part of this, the following assumptions were made:

- The thickness of mineralised carnallite and sylvinite seams was determined from the core drilling description combined with the geophysical logging. The grade of mineralised intervals was determined by the assaying of core samples;
- As described in the CIM standards (CIM, 2014), potash deposits typically display consistency of grade and thickness over large areas and it is important to define areas, where the potash mineralisation is absent;
- The extent of the potash mineralisation and the continuity between drill holes can be determined by subsurface mapping correlating drill hole data using seismic investigations; and,
- A Radius of Influence (ROI) was defined around each drill hole. The size of the ROI depends on the Mineral Resource category and the confidence in the continuity of the deposit.

14.3 DRILL HOLE DATA

The evaluation of the Mineral Resources used geological and assay data from historic drill holes Ba-001, Ba-002, Ba-003 and the recently drilled extension to Ba-002. The drilling, sample preparation, security, and analysis are described in Section 10.0 and Section 11.0.

14.4 GEOLOGICAL MODEL

The geological model of Banio Potash mineralisation identified 16 carnallite seams and three sylvinite seams in drill holes Ba-002 and Ba-003. Each of the seams identified meets the required thickness and grade to be considered potentially suitable for solution mining. This is considered the most appropriate mining method to sustain an economic operation at the Banio Project. To be considered as potentially mineable via solution mining the following cut-off parameters were applied to the carnallite and sylvinite seams:

- Carnallite: seam thickness had to be >2.5 m when single, and >1.25 m when other seams are present within a 5 m vertical distance, and carnallite content >47%; and,
- Sylvinite: seam thickness had to be >2 m and the sylvite content >16%. Combined sylvite/carnallite seams (e.g. Cycle VIII Seam 4 in Ba-003, Cycle VII Seam 14 in Ba-002) have been considered as separate seams.

The KCl assay results for the cored holes located within the Mineral Resource boundaries are presented in Figure 14.1. The composite carnallite and sylvinite seam data is shown in Table 14.1 that was used in the MRE.

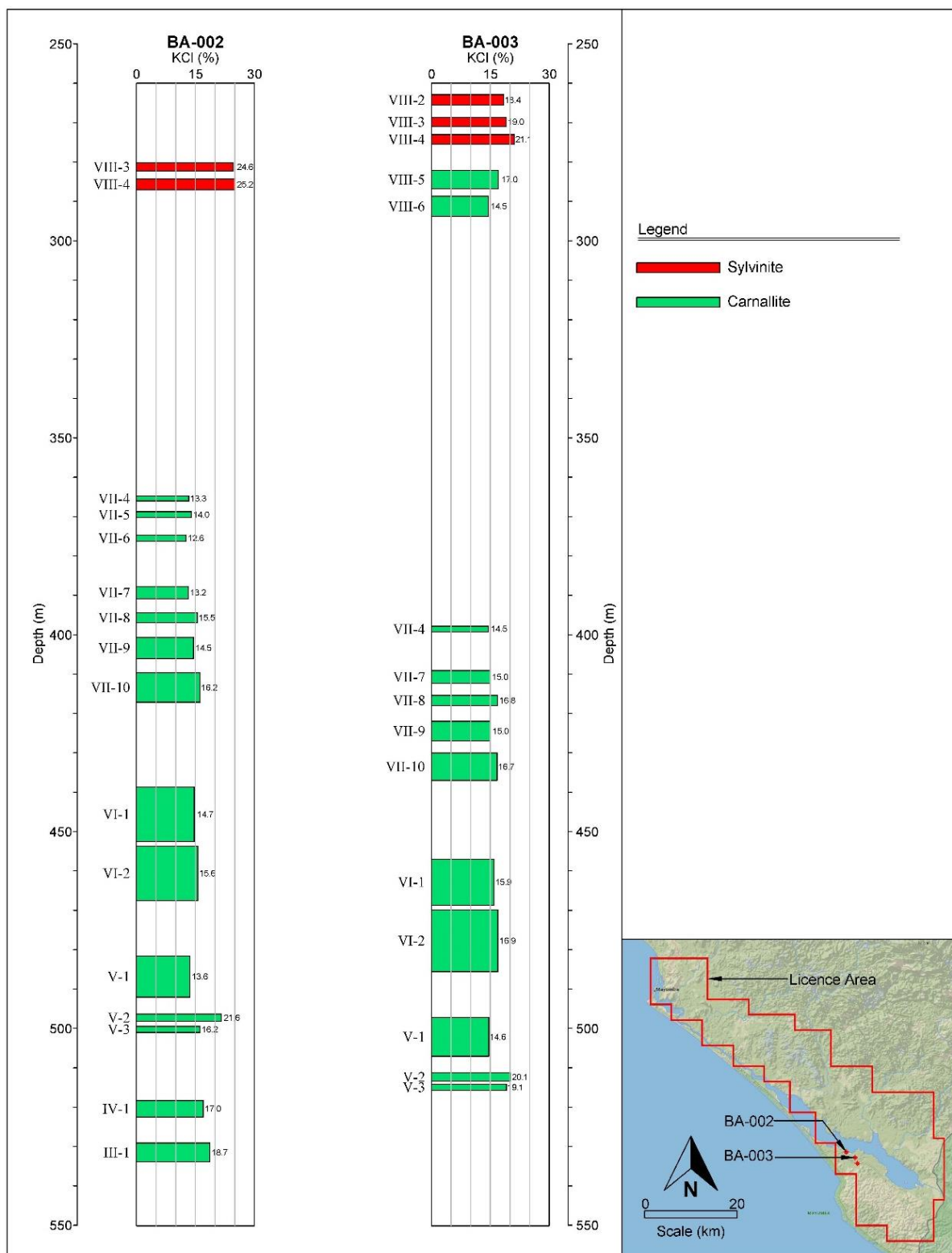
The flat-lying nature of the Congo Basin, confirmed in the Project area by results from extensive seismic studies coupled with drill hole geological information, allows for extrapolation of the various cycles and seams over significant distances. The results confirm the continuity of potash seams over 2,260 m based solely on drill holes Ba-002, BATC-1 and Ba-003. Note that the potash cycles in BATC-1 are interpreted from downhole gamma-ray logs and geological logging and that no assays are available, and that Ba-001 was not drilled deep enough to intersect the full potash stratigraphy.

The seams are therefore modelled as near horizontal and are offset by a normal and a reverse fault. They can either be considered as either homogeneous or inhomogeneous in nature, with inhomogeneous seams containing interbedded carnallite and rock salt layers. The thickness of inhomogeneous layers is dependent on the amount of dilution included when assigning the seam boundaries based on the cut-offs.

For the homogeneous seams there is some variation in thickness and grade between drill holes, this may reflect trends in grade or thickness, but with only two drill holes this cannot be confirmed until further data becomes available.

The grade and thickness of inhomogeneous seams in Cycle VIII (Table 14.1) cannot be correlated between the two drill holes due to the different intensity and stratigraphic penetration depth of the transformation reaction carnallite to sylvite. Some parts of inhomogeneous Seams 8 to 13 in Cycle VII are considered mineable in Ba-002, but do not make the grade or thickness to be considered mineable in Ba-003. This also may reflect trends in grade or thickness, but with only two drill holes this cannot be confirmed until further data becomes available.

Figure 14.1: KCl Assay Results for the Cored Holes Located within the Mineral Resource Boundaries



1128-02 Micon[Depth vs Percent KCL_BA-002_BA-003.dwg]r(11-20-2023)

Source: Agapito (2023)

Table 14.1: Composite Carnallite and Sylvinite Seam Data Used in the MRE

Cycle	Seam	Ba-002					Ba-003				
		From (m)	To (m)	Thickness (m)	KCl (%)	Mineralogy	From (m)	To (m)	Thickness (m)	KCl (%)	Mineralogy
VIII	4a	NA	NA	NA	NA	NA	262.89	265.59	2.7	18.4	Sylvinite
VIII	4b	NA	NA	NA	NA	NA	268.68	270.99	2.3	19.0	Sylvinite
VIII	4c	NA	NA	NA	NA	NA	273.03	275.48	2.5	21.1	Sylvinite
VIII	3	280.2	282.3	2.1	24.6	Sylvinite	282.16	286.79	4.6	17.0	Carnallite
VIII	2	284.4	287.1	2.7	25.2	Sylvinite	288.7	293.81	5.1	14.5	Carnallite
VII	10	364.77	366.04	1.3	13.4	Carnallite	NA	NA	NA	NA	Carnallite
VII	9	368.79	370.29	1.5	14.0	Carnallite	NA	NA	NA	NA	Carnallite
VII	8	374.69	376.24	1.6	12.6	Carnallite	397.84	399.25	1.4	14.5	Carnallite
VII	6 - 7	387.76	390.86	3.1	13.2	Carnallite	409.09	412.35	3.3	15.0	Carnallite
VII	5	394.41	396.96	2.6	15.5	Carnallite	415.39	418.03	2.6	16.8	Carnallite
VII	3 - 4	400.71	406.06	5.4	14.6	Carnallite	421.98	427.00	5.0	15.0	Carnallite
VII	1 - 2	409.66	417.16	7.5	16.2	Carnallite	430.02	437.01	7.0	16.7	Carnallite
VI	6 - 11	438.71	452.52	13.8	14.7	Carnallite	456.98	468.75	11.8	15.9	Carnallite
VI	2 - 5	453.72	467.52	13.8	15.6	Carnallite	469.88	485.60	15.7	16.9	Carnallite
V	5 - 9	481.80	491.85	10.1	13.6	Carnallite	497.18	507.06	9.8	14.6	Carnallite
V	3	496.35	498.25	1.9	21.6	Carnallite	511.23	513.45	2.2	20.1	Carnallite
V	2	499.50	501.05	1.6	16.2	Carnallite	514.2	515.75	1.6	19.1	Carnallite
IV	1	518.34	522.5	4.2	17.1	Carnallite	NA	NA	NA	NA	Carnallite
III	1	529.14	533.9	4.8	18.7	Carnallite	NA	NA	NA	NA	Carnallite

The extrapolation and interpolation of thickness and grade with only two data points is not considered suitable for the MRE due to the number of data points. As such, the geological model was simplified, and for the northern area of the MRE the thickness and grade of potash seams was determined from drill hole Ba-002 intercepts, and in the southern area from Ba-003 intercepts. The actual extent of the areas will be defined over the ROI.

Evaluation of the available drill hole data suggests that no faults are present between the drill holes Ba-002, Ba-003 and Ba-001, but the boundary faults of the uplifted block are relatively close. The approximate location of this fault is known and has been accounted for in the MRE (see Section 14.5). Within the Banio Project and in the vicinity of the faults there are no surface indications of dissolution structures.

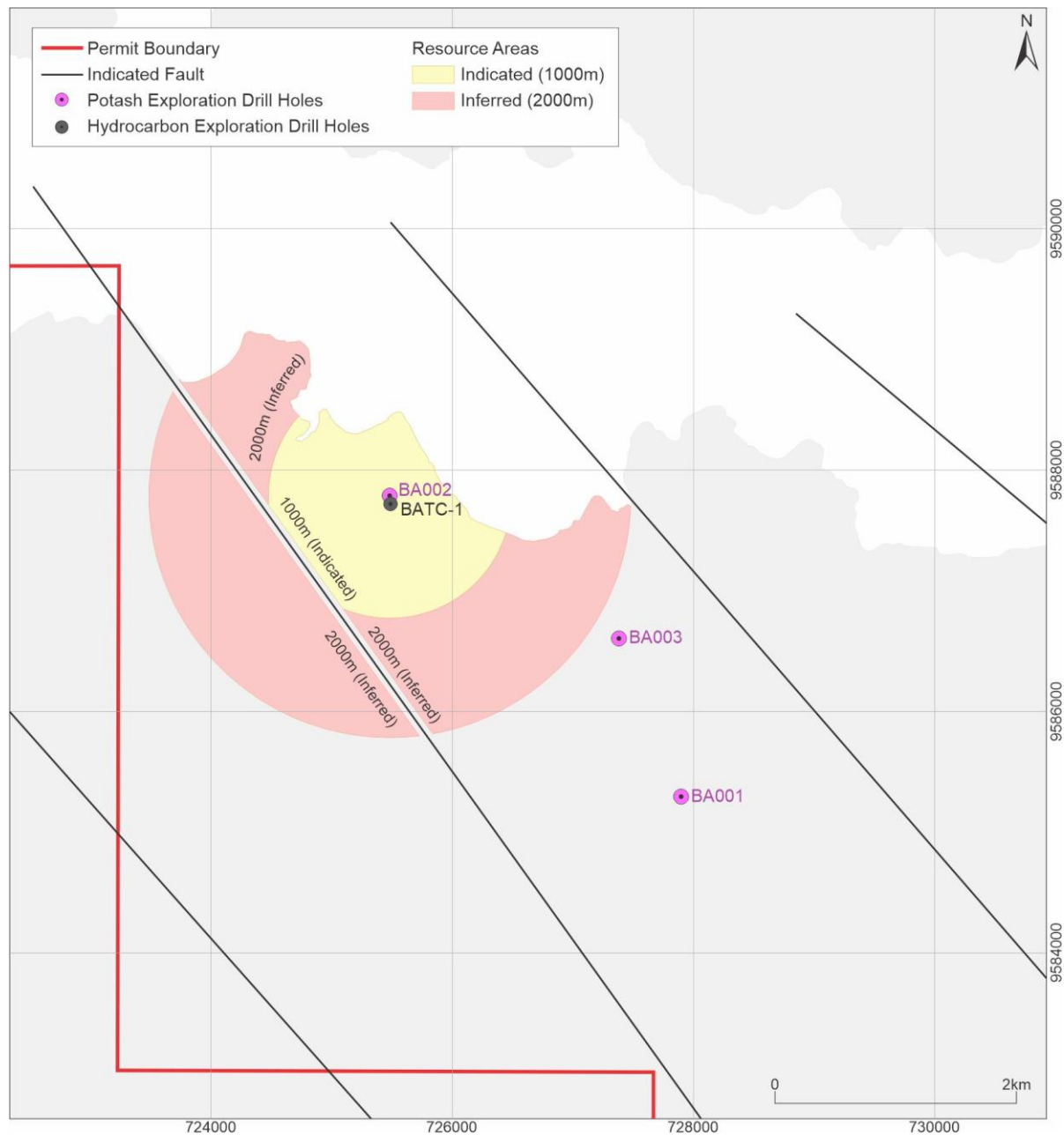
14.5 ESTIMATION METHOD

In calculating the Mineral Resource tonnages, the following methodology was completed (Mineral Resources are given as mineralisation in situ):

- Around each drill hole, an ROI was defined and by intersection of these ROI's, polygons around drill holes were constructed;
- Each polygon was clipped by the coast of the Banio Lagoon and restricted to only onshore areas within the Mayumba Permit. The volume for each potash seam was calculated by multiplying the clipped polygon area with the thickness of the potash seam;
- The carnallite tonnage was calculated by multiplying the volume assigned to each seam with a carnallite tonnage factor (density). The density for each seam was determined individually from the relative abundance of the salt minerals in the carnallite seam and varies from between 1.67 g/cm³ for high grade carnallite and 1.92 g/cm³ for low grade carnallite seams. For sylvinite seams, a sylvinite tonnage factor was similarly determined. Based on sylvite grade, the density varied between 2.11 g/cm³ and 2.14 g/cm³; and,
- The KCl grade of each seam was calculated from a weighted average grade of drill holes sample results collected from the individual seams.

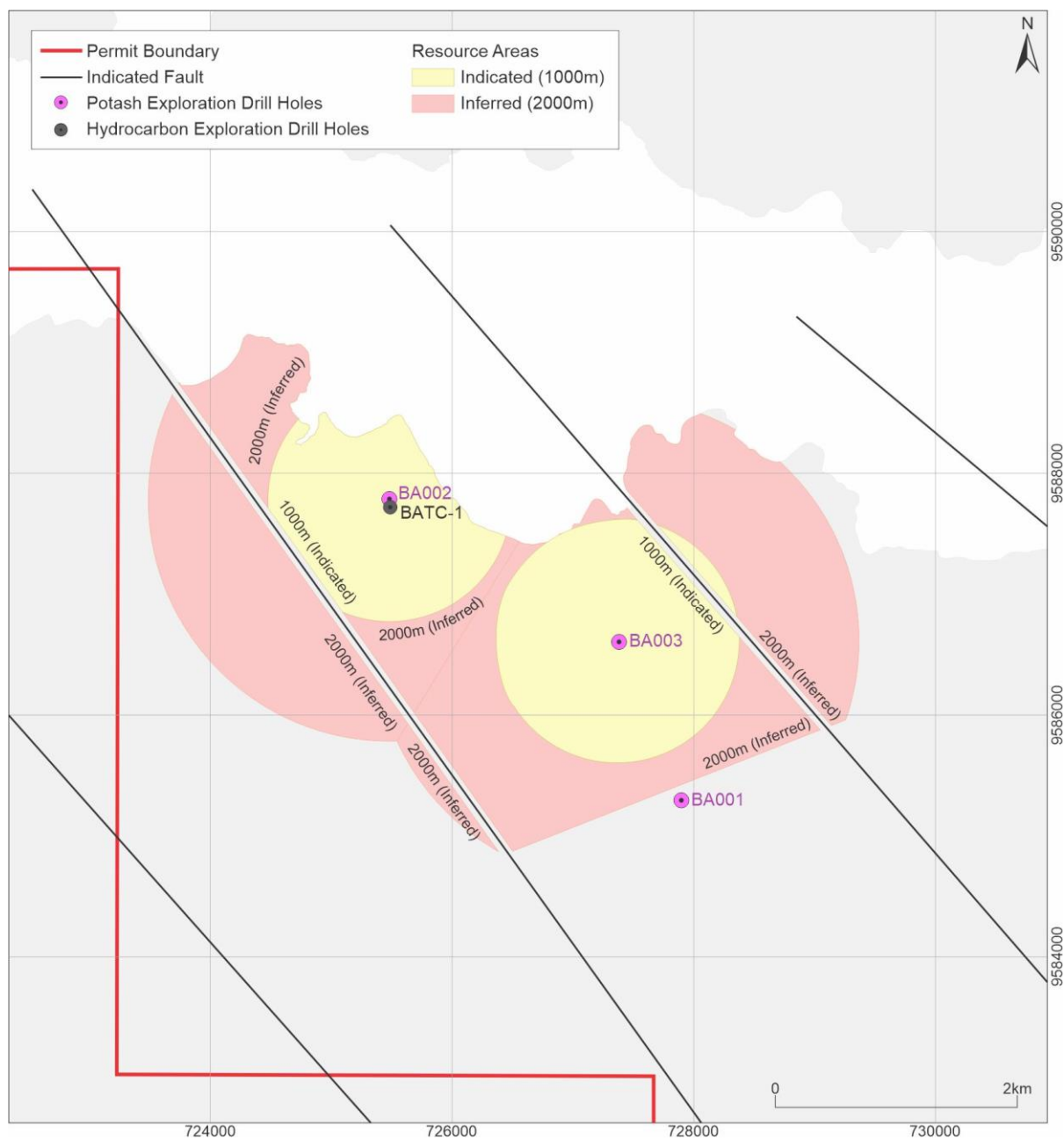
The MRE classifies the carnallite and sylvinite mineralisation as Indicated and Inferred Mineral Resources as defined by NI 43-101. This reflects the level of confidence in the extent and grade of both the carnallite and sylvinite bodies. There is insufficient drilling and assaying completed on the Project at this time for Measured Mineral Resources to have been defined. Plan maps of the ROI for the different seams are shown in Figure 14.2 to Figure 14.5.

Figure 14.2: ROI around Drill Holes showing Areas for Inferred and Indicated Mineral Resources for the Cycle III to IV Carnallite Mineralisation



Source: Micon, modified ERCOSPLAN (2023)

Figure 14.3: ROI around Drill Holes showing Areas for Inferred and Indicated Mineral Resources for the Cycle V to VII Carnallite Mineralisation



Source: Micon, modified ERCOSPLAN (2023)

Figure 14.4: ROI around Drill Holes showing Areas for Inferred and Indicated Mineral Resources for the Cycle VIII Carnallite Mineralisation

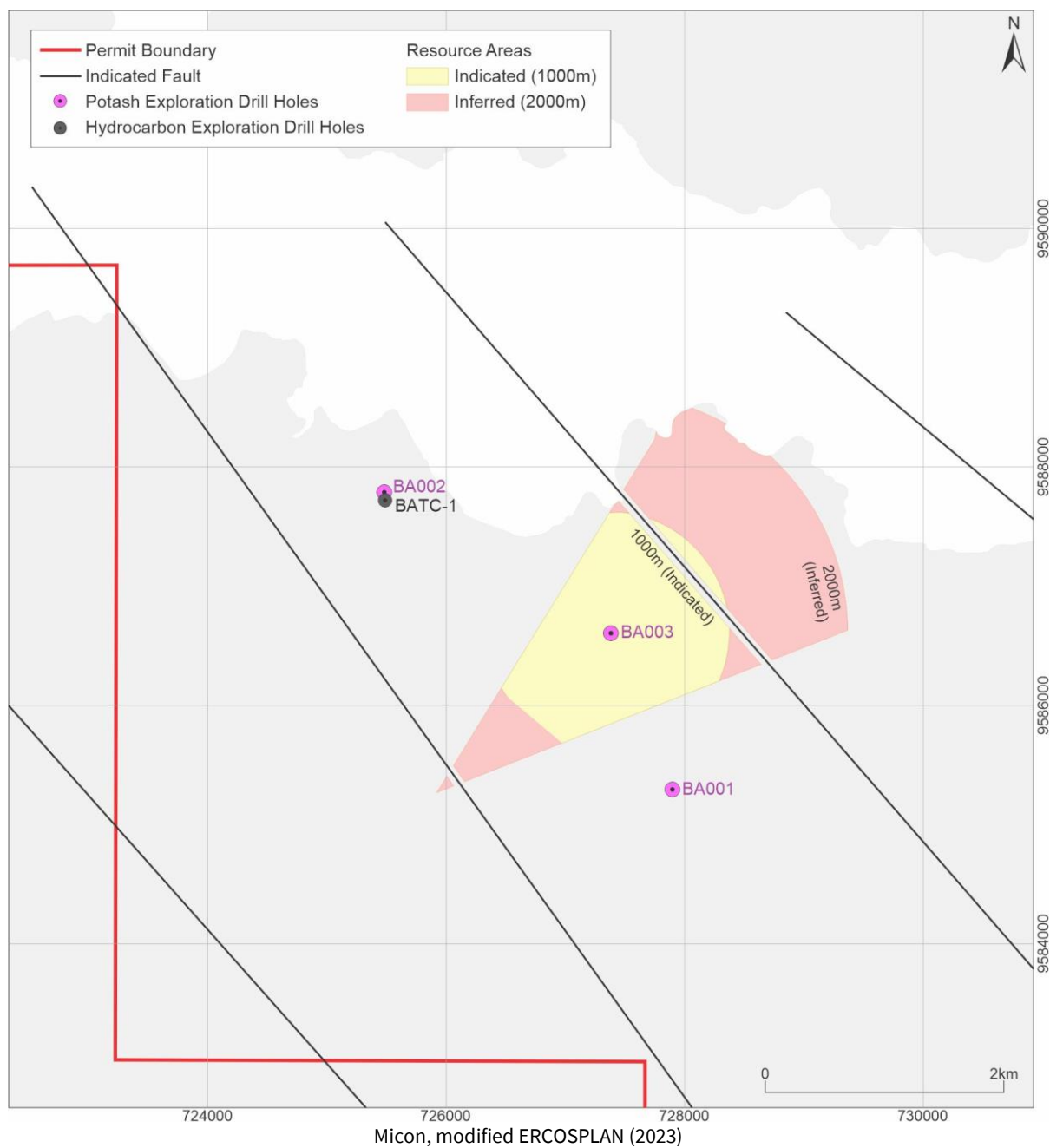
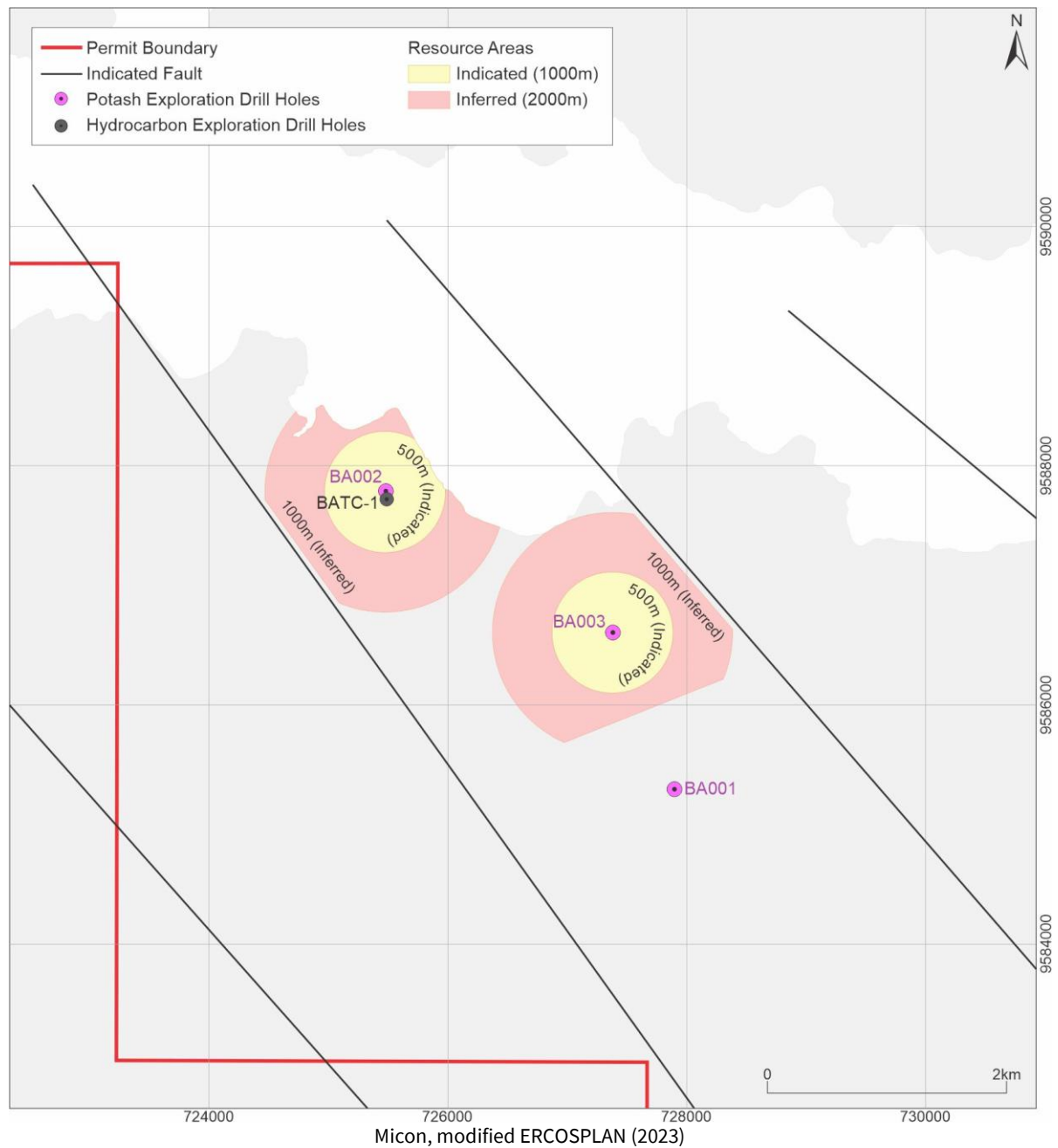


Figure 14.5: ROI around Drill Holes showing Areas for Inferred and Indicated Mineral Resources for the Cycle VIII Sylvite Mineralisation



The criteria used in the MRE to define the extension of mineralisation from each drill hole for carnallite Indicated and Inferred Mineral Resources is as follows:

- Indicated Mineral Resources occur within a radius of 1,000 m of a drill hole, as long as the seismic survey results show no significant change in thickness of the overall salt section. The ROI for Indicated Mineral Resources is not extended beyond the position of faults interpreted from the seismic survey sections; and,
- Inferred Mineral Resources occur within a radius of 2,000 m of a drill hole, minus the Indicated resources within this area. Considering that for Inferred Mineral Resources the continuity of grade and thickness only have to be implied, the ROI for this category is predicted to extend into the fault bounded downthrown block that has been interpreted from the seismic sections.

Although only two drill holes have adequate information to define the Mineral Resources, the ROI's for Indicated Mineral Resources for carnallite seams has been taken as 1,000 m and for Inferred Mineral Resources as 2,000 m, because of the stratigraphic continuity of the seams. The seams can be correlated over a distance of more than 15 km with the Banio drill holes to the southeast, and more than 50 km to the south in the ROC. The ROI's have been limited, because the grade continuity over these larger distances has not yet been proven.

The ROI for Inferred Mineral Resources is extended beyond interpreted normal or reverse faults in the downthrown block, because these faults are interpreted to have been active during deposition of the carnallite. A potential negative influence of these faults on the carnallite mineralisation has been accounted for by a 100 m wide barrier along the faults. This also accounts for uncertainty in position of the faults interpreted from the seismic data and the changing position of the faults with depth due to dip of the fault plane.

Similarly, the MRE utilises the following criteria to estimate the extension of the sylvinite Indicated and Inferred Mineral Resources from a drill hole:

- Indicated Mineral Resources occur within a radius of 500 m of a drill hole, as long as the seismic survey results show no significant change in thickness of the overall salt section; and,
- Inferred Mineral Resources occur within a radius of 1,000 m of a drill hole, minus the Indicated Mineral Resources within this area.

The ROI for Indicated and Inferred Mineral Resources is significantly smaller than the Area of Influence (AOI) that Kore used for the estimation of sylvite Indicated and Inferred Mineral Resources at their Kola Project (SRK et al., 2012), reflecting that compared to the Kola project, only limited drill hole and seismic information is available.

Since the extent of the sylvite mineralisation is secondary and mainly structurally controlled, the ROIs for the sylvinite mineralisation are not extended beyond faults interpreted from the seismic survey sections. Minor uncertainty remains regarding the exact position of the faults interpreted from the seismic sections and consequently a 100 m wide barrier with no Mineral Resources is defined along the interpreted fault. This also accounts for uncertainty in position of the faults interpreted from the seismic data and the changing position of the faults with depth due to dip of the fault plane.

The ROI for carnallite and sylvite mineralisation in Cycle VIII around Ba-003 are truncated at equal distances between drill holes Ba-003 and Ba-001. This is because potash bearing rocks of Cycle VIII were not intercepted in Ba-001 (Figure 14.4 and Figure 14.5). From the available drill hole data the dip of the sylvite-carnallite mineralisation transformation boundary is much greater than the dip of the near horizontal seams. The stratigraphic position of the sylvite-carnallite mineralisation transformation boundary in Ba-002 is much lower than in Ba-003, and the extrapolated sylvite-carnallite mineralisation transformation boundary will cross cut the seams much closer to drill hole Ba-003. Lacking further data about the orientation of this boundary, it has been interpreted to be oriented perpendicular to the line connecting both wells (Figure 14.4). On the Ba-002 side of this boundary it cannot be excluded that sylvite instead of carnallite is present, so the Ba-003 polygon for carnallite mineralisation in the Ba-002 direction ends at this boundary. Without further evidence, it cannot be assumed that beyond this boundary the same seams are present as sylvite seams.

The ROI for carnallite mineralisation in Cycle V to VII are truncated close to Ba-001 because it cannot be proven without further drilling, that the original interpretation of the intersection of a major fault in Ba-001 is correct (Figure 14.3).

14.6 MINERAL RESOURCE STATEMENT

The 2024 MRE was prepared by Dr. Sebastiaan van der Klauw of ERCOSPLAN. The Mineral Resources have been reviewed by Mrs. Liz de Klerk of Micon. Mrs. de Klerk has sufficient experience which is relevant to the style of exploration, mineralisation and type of deposit under consideration and to the activity which she is undertaking to qualify as a QP under the terms of NI 43-101.

It is the opinion of the author that the potash seams identified in the Banio Project have the potential for economical extraction using the solution mining method and a saleable product can be produced by processing the brine from solution mining. The production of MOP and other products by DEUSA International GmbH (DEUSA) in Germany since 1989 at its carnallite deposit demonstrates that commercial recovery of potash from carnallite using solution mining and brine processing is possible. The DEUSA mines from a deposit with a similar depth as the carnallite from Cycles III to VIII at the Banio Project. Compared to the Banio Project it has a lower overall deposit thickness, comparable average carnallite grades, but a higher sulphate mineral content which is problematic for the solution mining operation. Therefore, there exists a reasonable prospect for eventual economic extraction of the carnallite from the evaporite Cycles II to VIII of the Loume evaporites in the current focus area of the Banio Project. The modelled potash seams constitute a Mineral Resource as defined by NI 43-101.

The Mineral Resources have been classified according to the methods described in Section 14.5. Mineral Resources are reported as in-situ material, without any deductions for potential mining and processing recoveries.

The resulting Indicated and Inferred Mineral Resources for the Banio Project are presented in Table 14.2 and Table 14.3.

**Table 14.2: Indicated Mineral Resources for the Banio Project
(Effective Date of 7th November 2023)**

Mineralogy	Drill Hole	Evaporation Cycle	Tonnage (Mt)	Grade (KCl)	Tonnage (Mt KCl)
Sylvinitite	Ba-002	VIII	7.73	24.9	1.93
	Ba-003	VIII	12.38	19.5	2.41
	Total		20.12	21.6	4.34
Carnallitite	Ba-003	VIII	37.02	15.7	5.79
	Ba-002	VII	88.69	14.8	13.11
	Ba-003	VII	102.9	15.8	16.26
	Ba-002	VI	105.72	15.1	16.01
	Ba-003	VI	144.78	16.5	23.81
	Ba-002	V	51.72	15	7.73
	Ba-003	V	72.12	15.9	11.5
	Ba-002	IV	15.79	17.1	2.69
	Ba-002	III	17.76	18.7	3.33
	Total		636.53	15.8	100.23

Notes:

1. Tonnage is for in-situ resources with no discount for recovery as mining and processing methods are to be finalised. Potash deposits have been mined by underground, open pit and solution mining methods.
2. The numbers for tonnage and average KCl % are rounded figures.
3. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. The estimates of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, sociopolitical, marketing, or other relevant issues.
4. Densities used in resource calculations are 2.11 g/cm³ to 2.14 g/cm³ for sylvinitite and 1.67 g/cm³ to 1.92 g/cm³ for carnallitite.

**Table 14.3: Inferred Mineral Resources for the Banio Project
(Effective Date of 7th November 2023)**

Mineralogy	Drill Hole	Evaporation Cycle	Tonnage (Mt)	Grade (KCl)	Tonnage (Mt KCl)
Sylvinite	Ba-002	VIII	13.94	24.9	3.47
	Ba-003	VIII	29.85	19.5	5.81
	Total		43.79	21.2	9.28
Carnallitite	Ba-003	VIII	43.16	15.7	6.76
	Ba-002	VII	160.76	14.8	23.76
	Ba-003	VII	173.82	15.8	27.46
	Ba-002	VI	191.64	15.1	29.02
	Ba-003	VI	244.57	16.5	40.22
	Ba-002	V	93.74	15	14.01
	Ba-003	V	121.83	15.9	19.42
	Ba-002	IV	40.39	17.1	6.88
	BA-002	III	45.42	18.7	8.51
	Total		1,115.35	15.8	176.04

Notes:

1. Tonnage is for in-situ resources with no discount for recovery as mining and processing methods are to be finalised. Potash deposits have been mined by underground, open pit and solution mining methods.
2. The numbers for tonnage and average KCl % are rounded figures.
3. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. The estimates of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, sociopolitical, marketing, or other relevant issues.
4. The quantity and grade of reported Inferred Mineral 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 and it is uncertain if further exploration will result in upgrading them to an Indicated or Measured mineral resource category.
5. Densities used in resource calculations are 2.11 g/cm³ to 2.14 g/cm³ for sylvinitite and 1.67 g/cm³ to 1.92 g/cm³ for carnallitite.

14.6.1 Factors that Could Influence the Mineral Resource Estimate

The estimate presented here is based only on the confirmed thickness and grade of two drill holes over the mineralised sequence. As such, conservative ROI's for Indicated and Inferred Mineral Resources have been selected, when compared to other projects in the same basin. The planned extension of drill hole Ba-001 and the new drill hole Ba-004 will allow the continuity of thickness and grade that is expected, based on geophysical correlations, to be confirmed. This would allow the qualified person to increase the ROI for both Mineral Resource categories and also to increase the level of confidence in the data to estimate Measured Mineral Resources.

The estimate of Mineral Resources requires that the QP sees a reasonable prospect of economic extraction of the material. Since there is no known potash operation where solution mining takes place offshore, it has been conservatively assumed that within the area of the shallow Banio Lagoon there is no reasonable prospect of economic extraction of the deposit. With a feasible preliminary economic assessment for a solution mining operation of caverns in the lagoon it would be possible to add at least part of the lagoon area to the Indicated and Inferred Mineral Resources.

The estimate of the carnallite Mineral Resources has been based on the assumption that the carnallitite will be mined by solution mining in caverns that may extend over several thinner seams. If an alternative solution mining method is selected, it may not be possible to economically mine relatively thin and low grade carnallitite seams and the boundary condition for thickness for solution mining might need to be adapted from >1.25 m to >2.5 m. This would reduce the tonnage of carnallitite Mineral Resources in both the Indicated and the Inferred categories by approximately 10% at the same time increasing the overall grade of the remaining Mineral Resources.

15.0 MINERAL RESERVE ESTIMATES

This section, which forms part of the NI 43-101 reporting requirements for advanced projects or properties, is not relevant to this Technical Report as the Banio Project is at an early stage of exploration.

16.0 MINING METHODS

The proposed mining method for extraction of potash from the Banio Project is through solution mining, as discussed in the following sections.

16.1 SOLUTION MINING OVERVIEW

Solution mining is one of the most effective means of exploiting an underground potash resource at a reduced scale, and the method is proven across other operations globally. Potash solution mining is currently being conducted in Canada, the USA, and Germany. Multiple potash solution mining projects are in the planning stages in Canada, the USA, Argentina, the Republic of Congo, and Ethiopia. Table 16.1 lists most of the current and planned potash solution mining operations in the world and the solution mining method that is being employed or planned.

Table 16.1: List of Operating and Planned Potash Solution Mining Operations

Mine or Project	Location	Status	Method	Dissolution
Mosaic's Belle Plaine	Saskatchewan, Canada	Operating	Dual well	Non-selective and selective
K+S Bethune	Saskatchewan, Canada	Operating	Dual well	Non-selective and selective
Western Potash	Saskatchewan, Canada	Operating	Horizontal cavern	Selective
Intrepid Potash	Utah, USA	Operating	Multilateral horizontal cavern	Selective
Encanto Potash	Saskatchewan, Canada	Planned	Dual well	Non-selective and selective
Yancoal Canada Resources	Saskatchewan, Canada	Planned	Dual well	Non-selective and selective
CanPacific Potash	Saskatchewan, Canada	Pilot	Horizontal cavern	Selective
Canada Golden Fortune Potash Corp	Saskatchewan, Canada	On hold	Horizontal cavern	Selective
Gensource Potash	Saskatchewan, Canada	Planned	Multilateral horizontal cavern	Selective
Buffalo Potash Corp	Saskatchewan, Canada	Planned	Horizontal cavern	Selective
PADCOM	Manitoba, Canada	Planned	Horizontal cavern	Selective
Michigan Potash	Michigan, USA	Planned	Dual well	Non-selective and selective
Pinnacle Potash	Utah, USA	Planned	Single well	Non-selective and selective
DEUSA International	Germany	Operating	Closely spaced dual well	Non-selective
Potasio Rio Colorado	Mendoza, Argentina	On hold	Dual well	Non-selective
Kanga Potash	Republic of Congo	Planned	Single well	Non-selective
Kore Potash Dougou Extension	Republic of Congo	Planned	Single well	Selective
Yara	Ethiopia	Planned	Single well	Non-selective
Circum Minerals	Ethiopia	Planned	Single well	Non-selective
Allana Potash	Ethiopia	On hold	Single well	Non-selective
Karnalyte Resources	Saskatchewan, Canada	Planned	Dual well	Non-selective

Most of the potash solution mining operations are located in Canada, as indicated in Table 16.1. Currently, there are three active solution mining projects in Canada, with another eight being planned or on hold. Two main solution mining methods are used or planned for these projects: the dual-well vertical cavern method with both non-selective and selective mining, and the horizontal cavern method with selective mining.

The two solution mining methods were chosen for potash projects in Canada because of the high potash grades and thicknesses of the deposits, as well as their excellent horizontal continuity. The selective mining method with a horizontal cavern is typically used for smaller operations, while the dual-well vertical cavern method is used for larger operations.

In the USA, there are three potash solution mining operations. Intrepid Potash in Moab, Utah, uses the pitchfork-type multilateral horizontal cavern for selective mining of sylvinite due to the deposit's thinness. The other two projects are still in the planning stage and will use the single-well and dual-well vertical cavern solution mining methods.

Several solution mining projects in Africa are in the planning stage, close to Millennial's Banio Potash Project. These projects are mostly small operations using the single-well vertical cavern solution mining method due to the complex geology of the deposits. There is also one carnallite solution mining project in Germany and one sylvinite solution mining project in Argentina, both using the dual-well vertical cavern solution mining method.

16.2 SOLUTION MINING METHOD

Solution mining has been proven as an efficient way of exploiting underground potash resources, particularly for mining large deposits. Different solution mining methods, such as non-selective solution mining, selective solution mining, vertical cavern mining, horizontal cavern mining, single- and multiple-well mining, are used for various existing and planned potash solution mining operations. However, selecting the right solution mining method for a new project can be a critical and difficult task. The main objectives of solution mining method selection are to maximize project economics and ensure maximum recovery of mineral resources.

Selecting an appropriate solution mining method is a complex task that requires consideration of various technical, economic, political, social, and historical factors. The method chosen should be technically feasible for the deposit geometry and ground conditions, while also being cost-effective. Usually, there are two or more feasible solution mining methods for a project, and each method may entail some inherent problems. The optimal method is one that offers the fewest problems.

Adopting the same solution mining method as a neighbouring operation is not always appropriate. However, it's possible to learn from comparing mining plans of existing operations in the district or similar deposits. Every deposit is unique and has its own properties. Therefore, engineering judgement has a significant impact on the decision-making process in such versatile mining projects. Although experience and engineering judgement are crucial, differences in the characteristics of each deposit can usually be perceived only through a detailed analysis of the available data. It's the responsibility of the geologist and engineer to work together to ensure that all factors are considered in the solution mining method selection process.

The Banio Project encompasses a rare potash deposit that features both sylvinite and carnallite seams, which are spread across a depth range of 230 m to over 500 m. The nature of the deposit's

structure, geological composition, extent, and distribution must be considered when selecting the solution mining technique for the Project.

16.2.1 Solution Mining Method Trade-Offs

The factors that should be considered for solution mining method selection include geological requirements, drilling and operation, production and resource recovery, capital expenditures (CAPEX) and operating expenses (OPEX), and the risks associated with these solution mining methodologies. For Millennial's Banio Project, a series of comparisons and selection of the optimal solution mining method are discussed in this section.

16.2.1.1 Non-Selective Mining Versus Selective Mining

Sylvinite resources, consisting of KCl and NaCl, are mined through two different methods: non-selective solution mining and selective dissolution. In non-selective solution mining, water or unsaturated brine is used to dissolve both NaCl and KCl in the potash zone. The resulting brine is then evaporated and crystallised to precipitate NaCl and KCl. However, in cases where NaCl cannot be marketed, it is stored on the surface as a tailings waste.

On the other hand, selective dissolution uses an injection fluid that is near NaCl saturation. This fluid only dissolves KCl crystals in the potash zone. The resulting brine is then processed through selective mining, which involves cooling crystallisation or cracking ponds to precipitate KCl from the solution mining production brine.

For carnallite resources containing KCl, NaCl, and $MgCl_2$, the non-selective solution mining process is like that used for sylvinite resources. This involves using water or unsaturated brine to dissolve KCl, NaCl, and $MgCl_2$ in the potash zone. However, if the brine has a high magnesium content, it will significantly impact its ability to dissolve KCl. Hence, selective mining with $MgCl_2$ saturated brine is not feasible. Therefore, non-selective solution mining is the method chosen for the carnallite deposit at the Banio Project.

16.2.1.2 Vertical Cavern Versus Horizontal Cavern

Horizontal caverns are longer than vertical ones, which means that the requirements for continuous high-grade and thick potash beds are even higher. Potash beds that have collapse zones, mounds, or high tachyhydrite zones can be harmful to horizontal-cavern solution mining. A blanket is generally not used for horizontal-cavern solution mining. To prevent rapid vertical growth of the cavern into the aquifers above the mining horizon, selective mining is the preferred method for horizontal caverns.

Vertical caverns are easier to drill than horizontal ones. One of the biggest challenges of drilling horizontal caverns is maintaining drilling inside the potash beds. Since selective mining is used for horizontal caverns, which requires high potash grades, it is critical that the cavern's horizontal section is drilled in the high-grade potash. While multiple geophysical and geo-steering techniques have been used for drilling the caverns used by Intrepid, only about 30% of the horizontal drilling stayed within the potash beds.

The vertical cavern solution-mining process involves cavern development, non-selective mining, and/or selective mining. A blanket is used to control the vertical growth of the cavern and expand cavern growth horizontally. During non-selective mining, perforations are used to move the

injection location. Cavern growth and shape are measured with sonar surveys during mining operations.

In the typical horizontal cavern solution-mining process, shown in Figure 16.1, the process is more complex compared to the vertical cavern method. It involves cavern development and selective mining. During the cavern development stage, raw water is injected to create more cavern surface contact area for dissolution. With the help of raw-water dissolution, the cavern grows upward at a faster pace. As no blanket is used in a horizontal cavern, it becomes challenging to control the timing for raw-water injection at each planned injection location. The raw-water injection location pullback requires several plug and perforation operations.

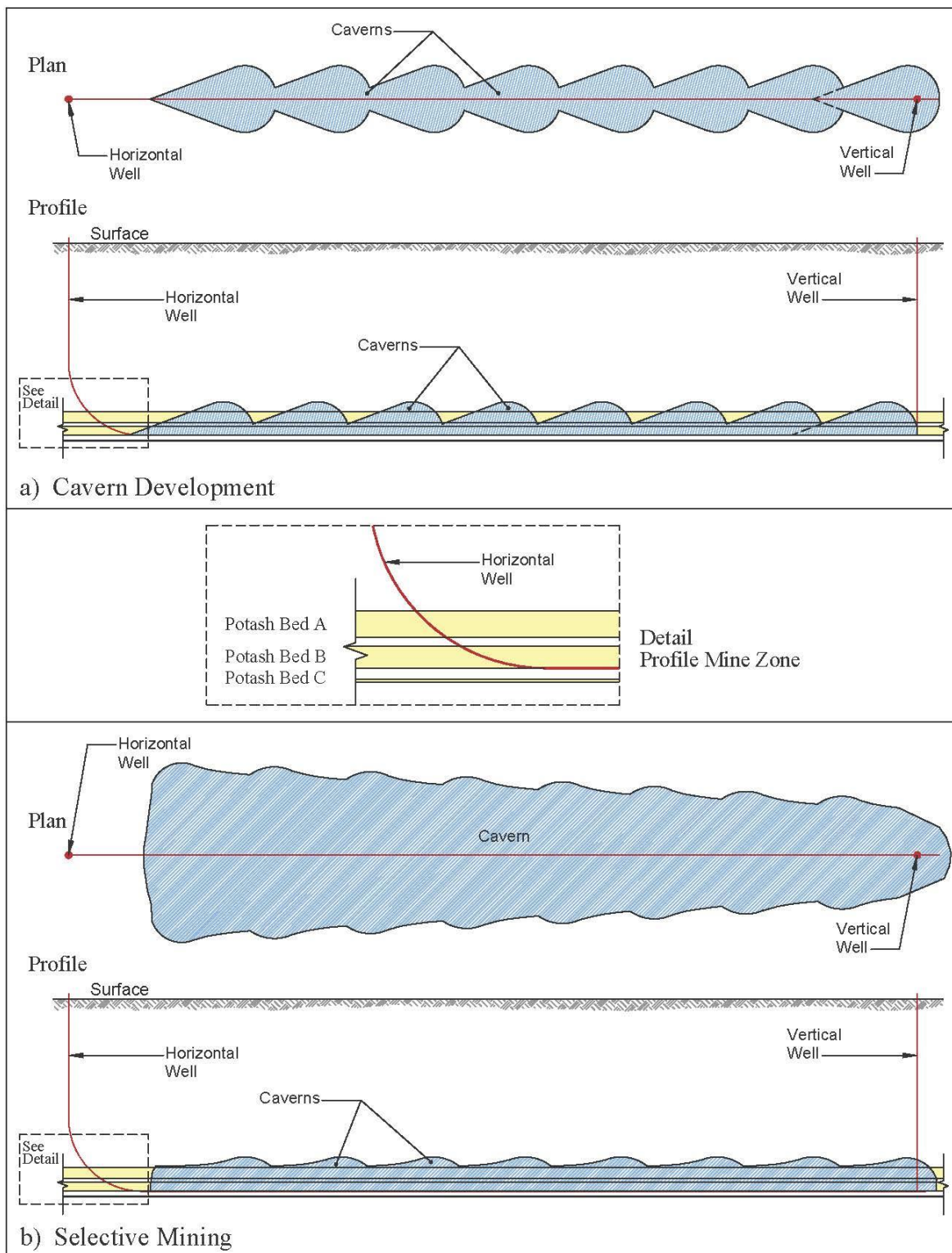
After cavern development, solution mining is initiated by injecting NaCl-saturated brine for selective dissolution of KCl. For single horizontal caverns, the cavern shape will be irregular, being larger at the injection points (both ends) and smaller at the centre of the cavern. A slant well or vertical well may be needed, which is drilled from the surface into the middle section of the cavern.

This well can be used as injection for increased resource recovery at the centre of the cavern. For multilateral horizontal caverns (a pitchfork array of injection wells that connect to an orthogonal horizontal well that carries the produced brine to a production well), there are multiple flow paths from the injection well to the recovery well, making it very hard to control the injection flow distribution over the different flow paths. Short-circuiting may occur when one flow path dissolves faster than others, and cavern productivity is significantly impacted.

Horizontal-cavern solution mining has a much smaller cavern roof span than vertical caverns, making cavern roof collapse and rubblized solution mining less likely. It is hard to measure the cavern shape for horizontal caverns. Although sonar surveys can be performed inside the horizontal injection tubing, because undissolved and precipitated salt are deposited on the tubing, it is impossible to measure the cavern shape accurately.

Table 16.2 lists the risks associated with the horizontal and vertical cavern solution-mining method. For the Banio Potash deposit, the vertical cavern method is selected due to its simplicity in drilling and operation and its flexibility to deal with the complicated geology of the deposit. The dip and the variability of the dip of the beds restrict the performance of horizontal wells.

Figure 16.1: Typical Horizontal-Cavern Solution Mining



984-02 Kore [Kore Horizontal Caverns_BQ-rjl.dwg Layout: a and b].rjl(9-6-2022)

Source: Agapito (2023)

Table 16.2: Risks Associated with Vertical and Horizontal Cavern Solution Mining Methods

Risk Type	Horizontal Cavern Wells	Risk Level	Vertical Cavern Wells	Risk Level
Geological	Potash bed thickness and grades are insufficient to support selective mining, resulting in low brine quality and production rate. May require additional caverns to be drilled to support target production.	Medium	A blanket may be used with vertical wells that can increase the cavern roof span, and rubblized mining can be used to increase contact area and brine grade. Effectiveness of this needs to be proved.	Medium
Drilling	Drill into halite zone below or above potash bed, resulting in resource loss.	High	Depth of the injection point may be easily altered after drilling of a vertical well.	Low
Operational	No blanket, risk of cavern growth to the aquifer above the salt zone in the cavern development stage, resulting in cavern leakage. Early Electric Submersible Pumps (ESP) installation to reduce cavern pressure and leakage may be needed.	Low	A blanket may be used with a vertical well which stop cavern from growing vertically.	Low
	Higher risk of uncontrolled cavern roof collapse that damages injection tubing, causing blockages in the horizontal tubing, and therefore reducing access to the resource. May need to redrill the horizontal section, or drill another well to connect to the cavern.	Medium	No horizontal tubing installed for vertical caverns.	Low
	No good way to accurately characterise cavern shape during mining.	Medium	A sonar may be run in a vertical well.	Low
Mining	Dissolution rate for selective mining is very small; the brine quality and production rate may be low. May require additional caverns to be drilled to support target production.	High	Low dissolution rate is also a high risk for vertical caverns with selective mining.	High
	Selective mining only occurs at cavern wall; salt blinding slows cavern growth resulting in short cavern life. Caverns need to be replaced more frequently to support target production.	Medium	Salt blinding is also a high risk for vertical caverns with selective mining.	Medium
	Cavern development in potash bed, high resource loss.	Low	Easy to move initial development to below potash bed.	Low
	Temperature loss is too high such that cavern cannot maintain expected temperature, resulting in low brine quality. More initial caverns may be drilled to support target production.	Medium	Temperature loss for vertical cavern is less than horizontal cavern.	Low
	Difficulty in mining through low-grade interbeds, resulting in low brine grade.	Medium	Hydraulic pressure can be used to push down the salt interbeds.	Medium

16.2.1.3 Single Well Versus Dual Well

In Canada, dual-well solution mining designs are commonly used for solution mining of potash due to its flat deposit form and simple geology. On the other hand, single well vertical cavern design is more flexible in mining design and causes less resource losses. For the Banio Project, single well vertical cavern method is chosen because of the geological conditions as mentioned in the previous sections. As seen in Table 16.1, the single-well design is used or is also planned in five other potash projects.

The advantages of the single-well design at the Banio site are:

- Straightforward well completion and equipping are easier due to fewer valves;
- Lower Mineral Resource loss is expected due to the dip of the potash beds;
- The extraction ratio will improve as more circular caverns can be placed tightly along the irregular Mineral Resource boundary;
- The extraction ratio will also improve because of the higher density of caverns (packing factor);
- There are operational advantages because single-well cavern development takes less time than for the dual-well caverns; and,
- There is an advantage of production brine being heated by injection brine, which reduces the possibility of precipitation and blockages and eliminates the need for a dilution string.

The disadvantages of the method are as follows:

- Heat exchange between the injection fluid and the production brine which travels up and down in the same drill hole; and,
- Some of the injection brine bypasses the cavern and goes directly to production brine without dissolving KCl.

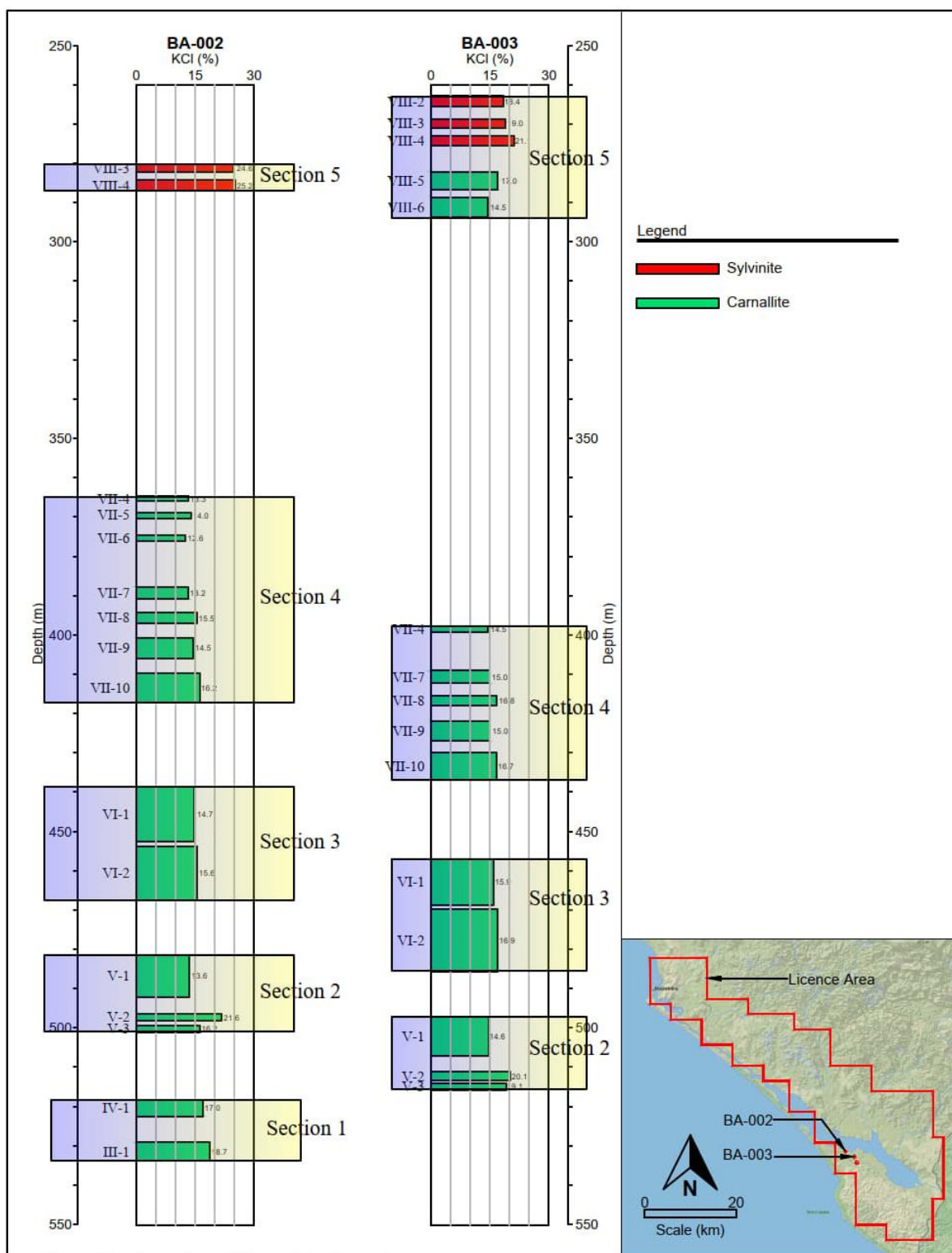
16.2.2 Banio Solution Mining Method Description

The Banio solution mining method utilises one well per cavern, drilled to a vertical depth of approximately 530 m for the Ba-002 areas and approximately 550 m for Ba-003 areas is planned. Surface casing will be installed to the top of the salt at about 220 m, then an intermediate casing will be installed to the base of the lowest targeted carnallite bed, and an open hole extended to the total depth (TD) of the well.

To mine multiple carnallite and sylvinite seams using the single well vertical cavern method at the Banio Project, the seams are grouped to a few sections based on the interbed thicknesses between the seams. Figure 16.2 shows the mining sections for each well.

For the solution mining of each section, the solution-mining method is divided into three phases: (1) sump development, (2) roof development, and (3) continuous mining. Once the last section of the well is mined, cavern closure is performed. Figure 16.3 to Figure 16.11 schematically depict the development of the cavern assuming a blanket is used.

Figure 16.2: Solution Mining Sections of Each Well



1128-02 Micon[Depth vs Percent KCl_BA-002_BA-003.dwg](11-20-2023)

Source: Agapito (2023)

16.2.2.1 Sump Development

The first mining process is to create a sump below the lowest targeted carnallite bed. The vertical growth of the sump is controlled by the oil (or nitrogen gas) blanket. The sump is developed by injecting ambient-temperature water and dissolving the NaCl immediately below the targeted seam. Figure 16.3 illustrates sump development of a single well vertical cavern.

The general shape of the solution-mining sump within the salt layer beneath the carnallite is an inverted cone, with the point of the cone at the bottom of the well and the wide portion of the cone extending upward. The top of the sump at the base of the carnallite seam (the wide portion of the cone) is controlled by the blanket, forcing the flow outward rather than upward. The blanket can be a low-density immiscible liquid such as oil or a gas (oil is preferred). The blanket forms a layer on top of the solvent and protects the roof from dissolving. Any injected solvent will then flow laterally below the blanket to the radial extent of the sump.

Each individual well is planned to have a 5 m deep sump developed beneath the carnallite seam. The sump is designed to accommodate the undissolved NaCl and insolubles that remain within the cavern. It is estimated that sump development will require about 60 days.

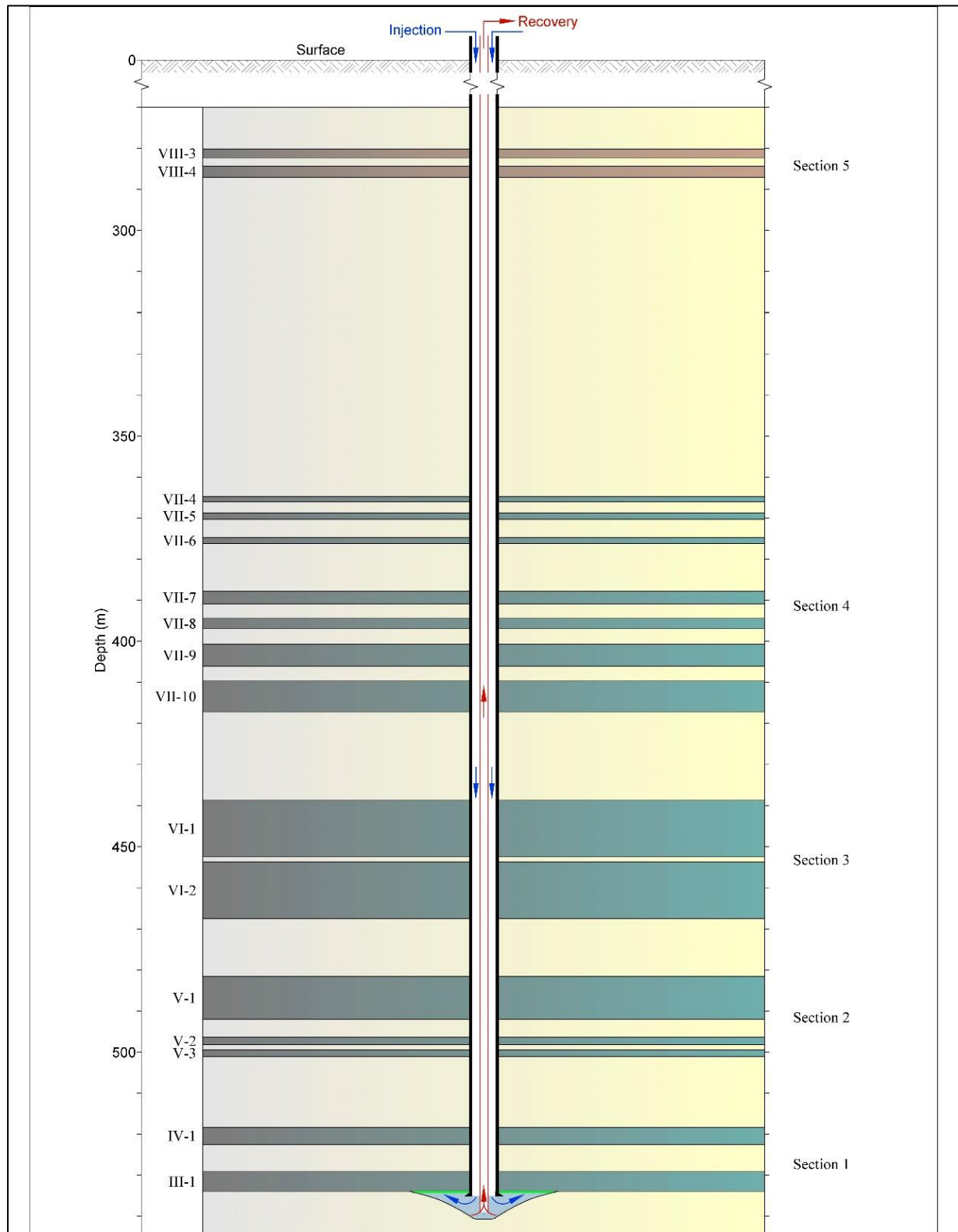
The sump is developed by pumping water at a rate of approximately 25 m³/h through the annulus of the well and recovering partially saturated brine through the tubing in the well located towards the bottom of the sump. The size of the sump is determined by calculating the volume of salt removed from the well and the position of the tubing in relationship to the bottom of the carnallite zone.

16.2.2.2 Cavern Roof Development

Upon successful development of the sump, roof development begins. Ambient-temperature water is injected at a rate of 25 m³/h at the top of the sump through the injection annulus, and partially saturated brine is recovered through the production tubing. The blanket is maintained during roof development to promote outward cavern growth and prevent upward growth.

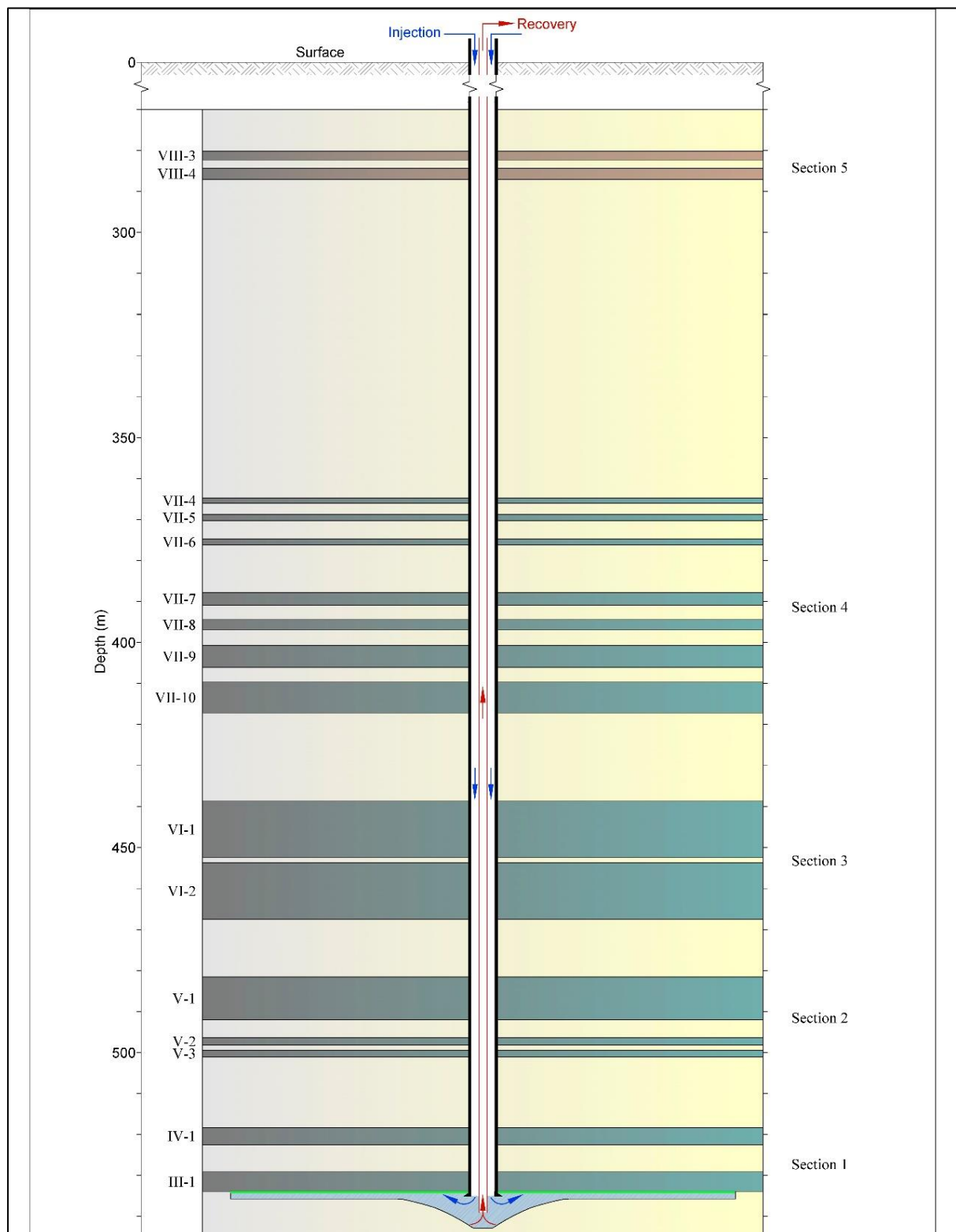
The roof is developed until approximately 70% to 80% of the designed cavern roof area is established. It is estimated that this phase will require 80 to 100 days for completion, based on the estimated dissolution rate and from operating experience. Figure 16.4 illustrates roof development for a Single Well Vertical Cavern.

Figure 16.3: Initial Sump Development of a Single Well Vertical Cavern



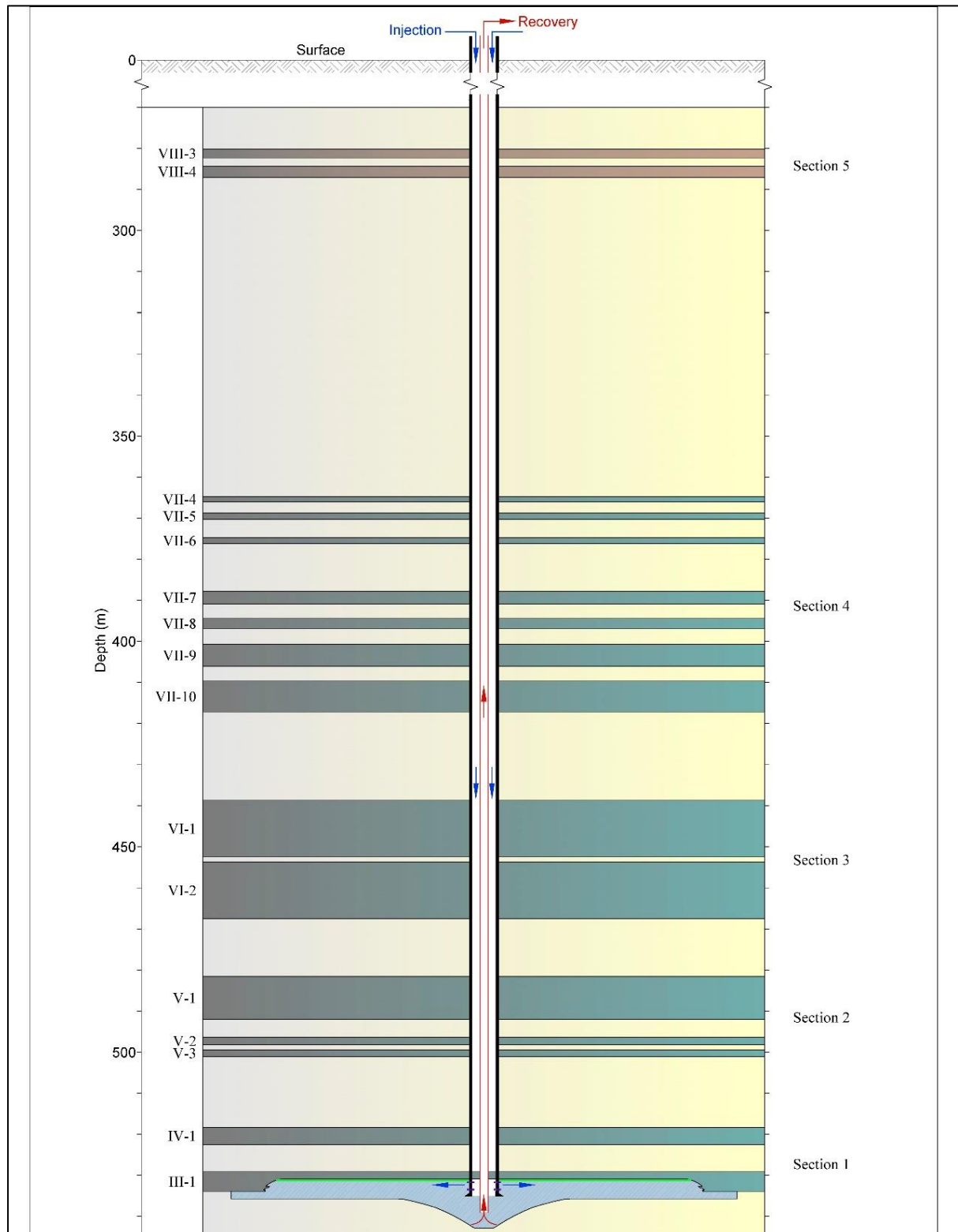
Source: Agapito (2023)

Figure 16.4: Initial Roof Development of a Single Well Vertical Cavern



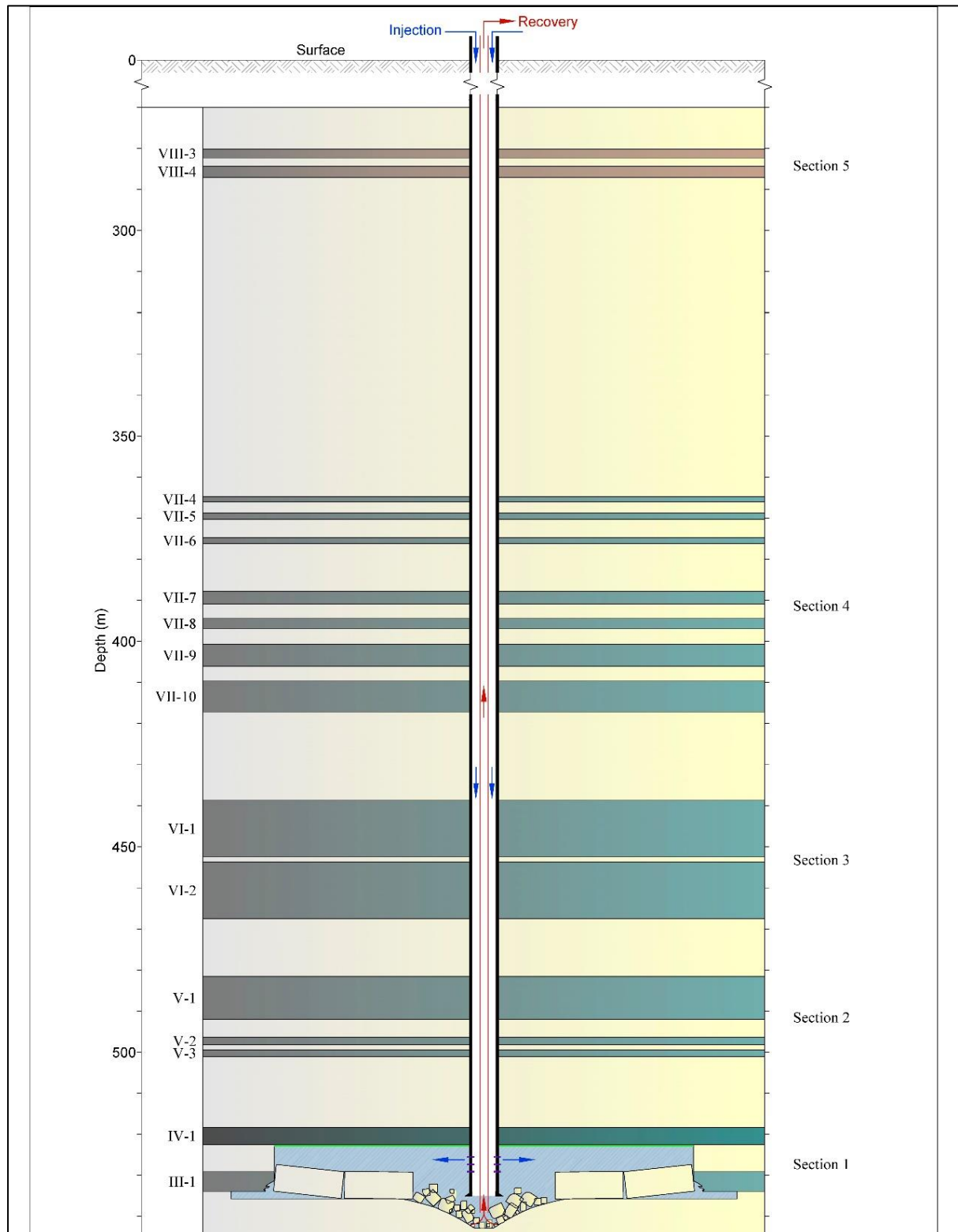
Source: Agapito (2023)

Figure 16.5: Solution Mining of Lower Seam in Section 1 in a Single Well Vertical Cavern



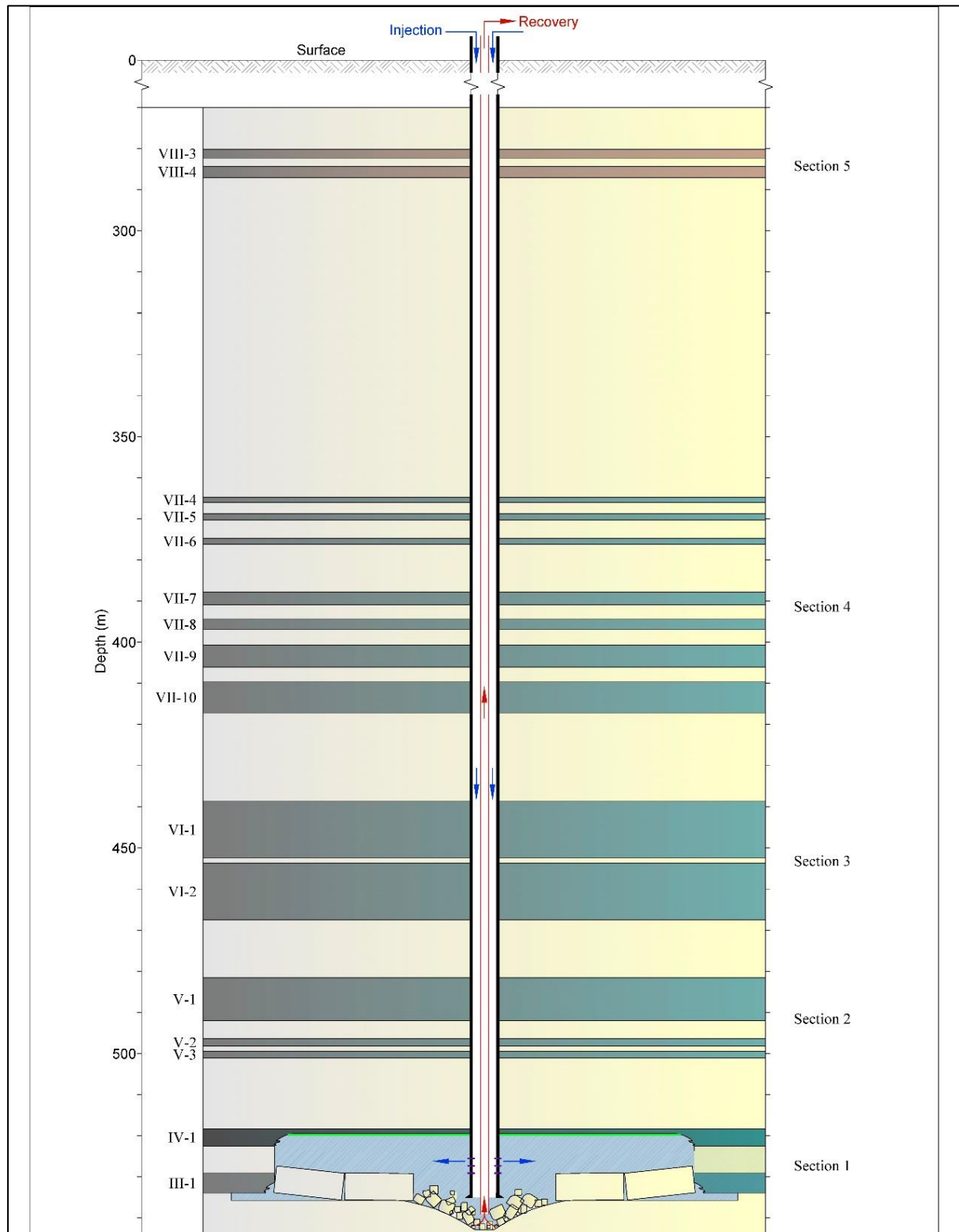
Source: Agapito (2023)

Figure 16.6: Rubblizing Salt Interbed in Section 1 in a Single Well Vertical Cavern



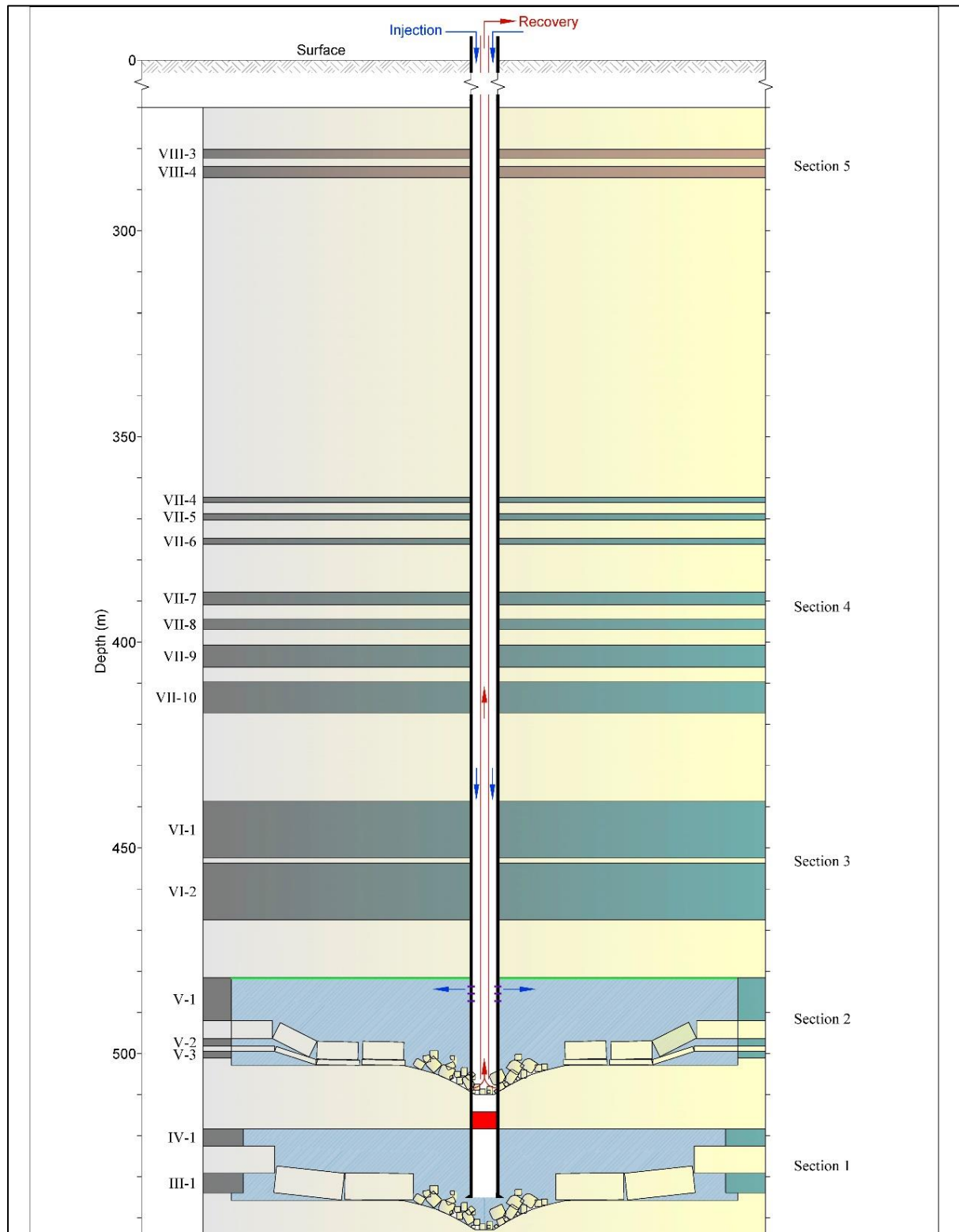
Source: Agapito (2023)

Figure 16.7: Solution Mining of Upper Seam in Section 1 in a Single Well Vertical Cavern



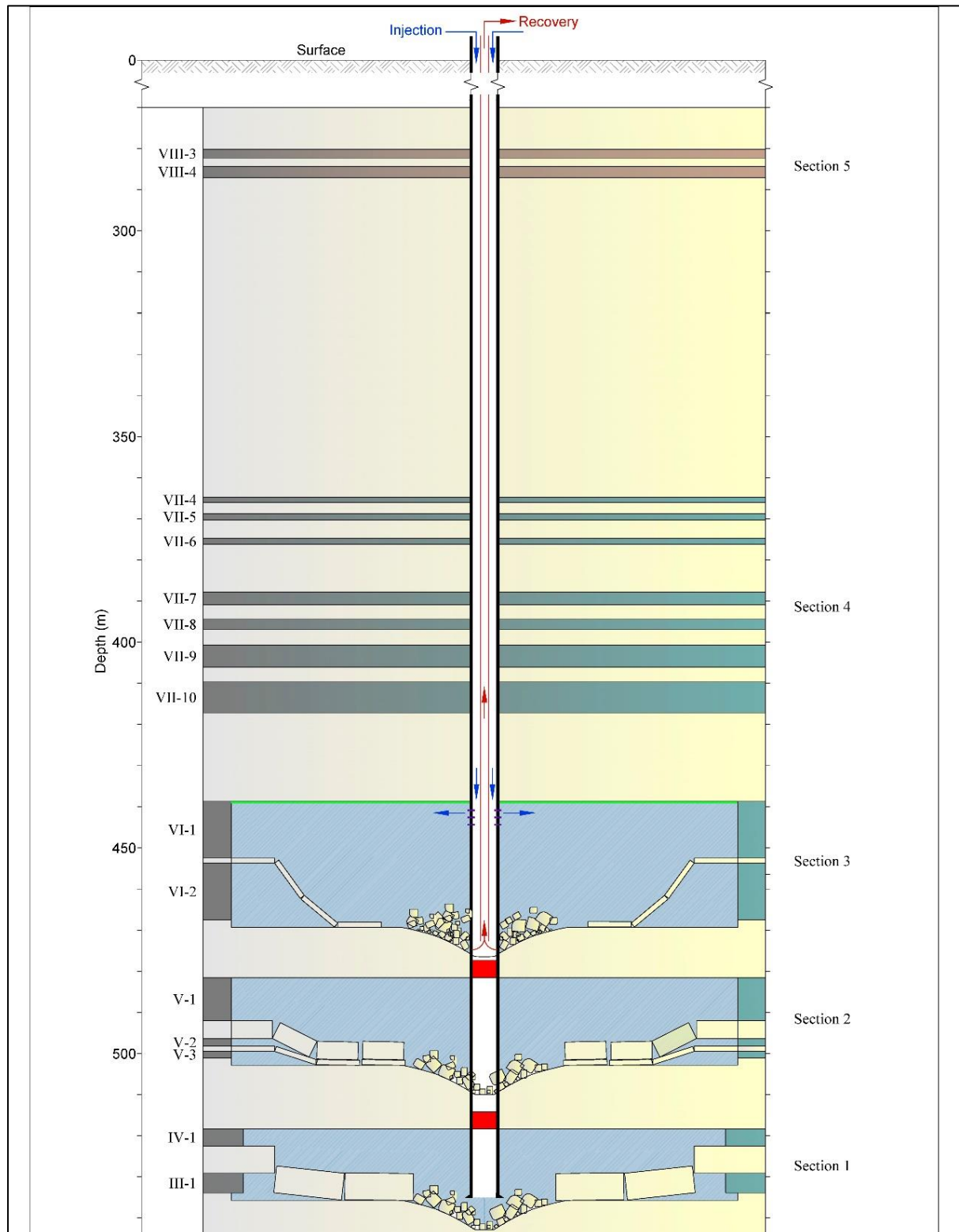
Source: Agapito (2023)

Figure 16.8: Solution Mining of Section 2



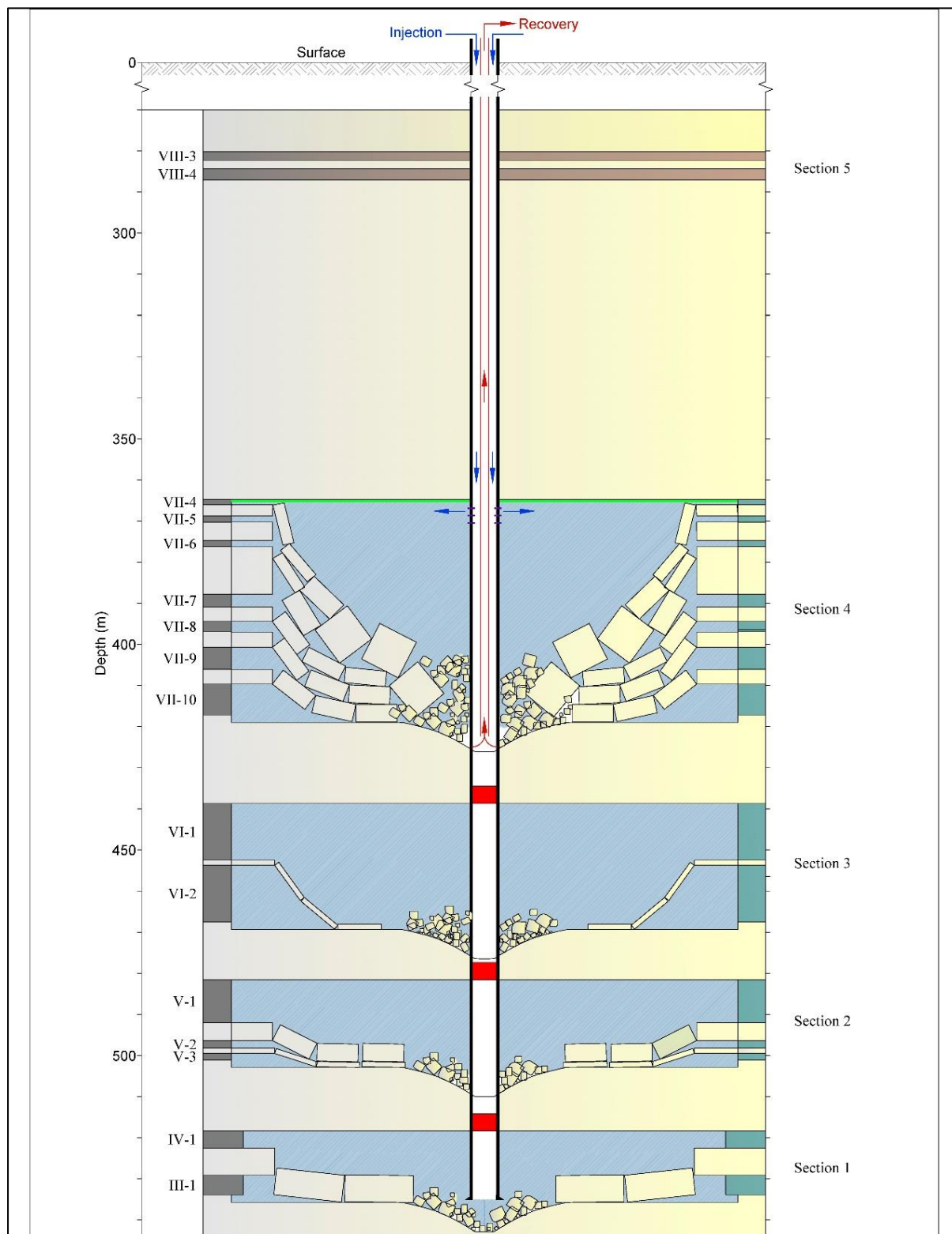
Source: Agapito (2023)

Figure 16.9: Solution Mining of Section 3



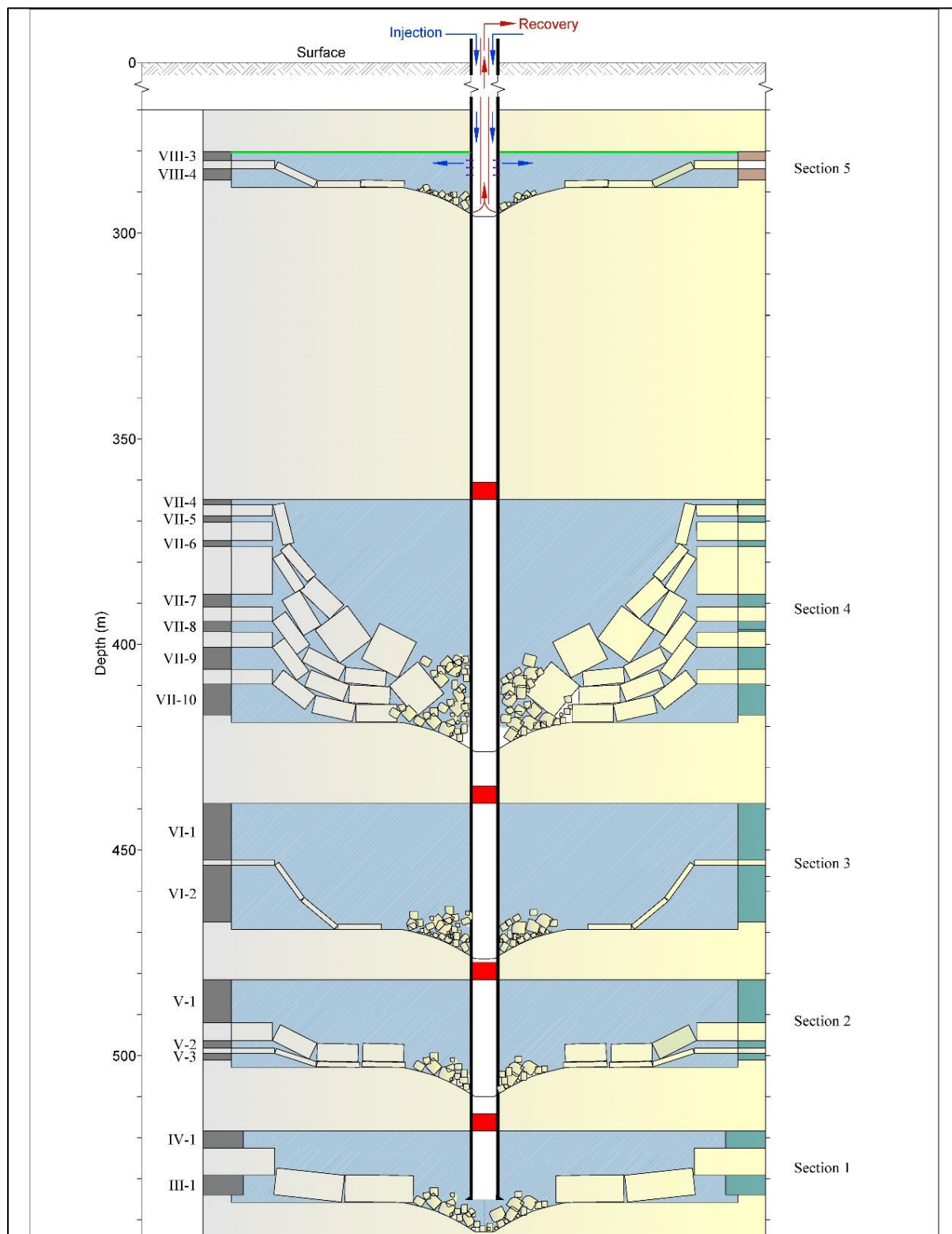
Source: Agapito (2023)

Figure 16.10: Solution Mining of Section 4



Source: Agapito (2023)

Figure 16.11: Solution Mining of Section 5



Source: Agapito (2023)

16.2.2.3 Cavern Solution Mining

For continuous solution mining the solvent from the Banio Lagoon is injected into the annulus and through the perforations to dissolve the potash minerals. The production tubing retrieves production fluid from the lower portion of the cavern. Each mining seam is divided into several mining cuts, which are solution mined successively. The mining cut thickness is determined as a function of composition and surface area of the successive carnallite cuts and is selected to achieve a reasonable KCl concentration in the brine at high flow rates to minimise the number of caverns that need to be operated in parallel.

The brine injection rate is a function of exposed roof area. The injection rate is expected to average approximately 25 m³/h over the life of the continuous mining phase. Since the solvent has a lower density than the brine resulting from deposit rock dissolution, the cavern generated by solvent injection will tend to develop upward instead of laterally outward as required in the mining cut concept. Thus, a blanket is required to prevent this upward development, and to create lateral cavern growth.

It is estimated that each cavern will produce approximately 19,008 t/a and 14,256 t of KCl with hot mining and cold mining, respectively. The plan is to operate each well in solution-mining mode until the cavern roof area reaches a radius of approximately 50 m, or 7,854 m². Production continues until the KCl brine grade declines below a concentration of 60 g/L. Figure 16.5 illustrates solution mining of the lower seam for the first Section.

When the mining cuts go up to the halite interbeds inside a solution mining section, KCl concentrations will fall to an uneconomic level. Two options are available for dealing with the salt interbeds. For a reasonable sized cavern, solution mining through the salt interbeds may be easier if the thickness of the salt interbed is less than 3 m. For a thicker salt interbed, hydraulic pressure will be exerted at the top of the salt interbed, separating the carnallite or sylvinite seams and causing the cavern roof to fall out.

Perforations would be extended to the top of the interbed halite to allow pressurisation to the interbed to trigger collapse of the salt interbed. Solution mining would then progress in the seam above the interbed. This process would be repeated to recover other seams that are separated by salt interbeds in each section. Figure 16.6 and Figure 16.7 illustrate the rubblizing of the salt interbed and the solution mining of the upper seam in Section 1.

16.2.2.4 Cavern Solution Mining in Upper Sections

As the KCl brine grade for the initial section declines to an uneconomic level, it is planned that production will move to the overlying sections. A plug will be set in the production well between the existing and the next cavern section to minimise potential interaction between the vertically stacked caverns. For the solution mining of a new section, the sump and roof development will be conducted similarly as for the initial section and as shown in Figure 16.8. Mining of the upper beds will be sequential with intermediate perforations and use an oil blanket. This requires that the casing is perforated, utilising a perforation tool, from the bottom of the sump to the bottom of the mining seam. The production string is located at the bottom of the sump. Once the sump has been developed, roof development at the base of the mining seam can be extended. Figure 16.9, Figure 16.10, Figure 16.11, and Figure 16.12 illustrate solution mining in Section 2, Section 3, Section 4, and Section 5, respectively.

The cavern will then be operated in continuous mode for as long as possible. Near the end of the continuous phase, the injection flow into the cavern will be slowed to a rate that sustains KCl concentration. As flow rates drop, at some point it may not be possible to maintain the desired cavern temperature when hot mining and brine grade may decline as the cavern cools. At this time, the cavern can be closed.

16.2.2.5 Cavern Closure

Upon completion of mining, the injection tubing can be removed from the wells, and cement plugs can be inserted in the intermediate casings above the solution mining cavern. The plugging procedure includes:

1. Depressurisation of the wells and cavern.
2. Install appropriate blow-out prevention (BOP) equipment at the well head.
3. Remove tubing from the wells.
4. Install a wireline or tubing bridge plug at a depth of approximately 500 m.
5. Fill the 177.8 mm casing above the bridge plug to the surface with Class G cement.
6. Cut down the surface and intermediate casings to approximately 2 m below ground level.
7. Seal-weld a steel cap to the top intermediate casing of each well.
8. Place a permanent marker identifying the operator's name and well number.
9. Salvage surface piping and instrumentation for reuse.
10. Restore the surface location according to the standards of the reclamation plan.

16.3 SOLUTION MINING DETAILED DESIGN

16.3.1 Cavern and Pillar Dimensions

The design for the single-well caverns is based on a radius of 50 m, with cavern centres spaced 210 m apart. This layout results in an aerial extraction ratio of 21%. Based on Agapito's experience on other similar potash solution mining projects, the designed caverns for the Banio Project in this study are expected to be stable, but some yielding of pillars may occur. However, no adverse consequences are expected as a result. Detailed numerical modelling of single-well cavern deformations and surface subsidence should be conducted in the next phase of the study.

At the Banio Project area, there has been no site-specific groundwater or aquifer investigations undertaken to date. As water will be drawn from the Banio Lagoon, a water table monitoring system is recommended to meet environmental and regulatory requirements, including understanding potential impacts on community water sources.

No significant issues or risks to the Banio Project associated with the overlying aquifers are expected. If connection is made to the overlying aquifer(s) during operations, leakage from caverns into overlying groundwater will be detected. If the leakage is significant, a submersible pump can be used to lower the pressure in the cavern to minimise the leakage.

16.3.2 Solution-Mining Cavern Assumptions and Placement

Table 16.3 lists the solution-mining assumptions. Figure 14.2, Figure 14.3, Figure 14.4, and Figure 14.5 show the boundaries of the mine plans based on the ROI from the cored drill holes and the geological model. Using the boundaries and maps, the following steps were completed to layout the solution-mining caverns within the mine plan boundary:

- Caverns with a radius of 50 m and with spacing between cavern centres of 210 m were specified;
- A spreadsheet was created to tabulate the assigned parameters for each cavern;
- From the spreadsheet, the cavern tonnages and losses were calculated; and,
- A cavern recovery factor was assigned and using these parameters, the total producible tonnes of KCl per cavern was estimated.

Table 16.3: Solution Mining Parameters and Assumptions for the Banio Project

Item	Unit	Value
Cavern Layout Pattern	m	Hexagonal
Cavern Radius	m	50
Pillar Width	m	110
Cavern Footprint Area	m ²	7,854
Areal Extraction Ratio	%	21
Sump Height	m	5
Sump Radius	m	20
Undercut Height	m	2
Sump and Undercut Volume	m ³	13,090
Ba-002 Cavern Top Depth	m	262.9
Ba-002 Cavern Bottom Depth	m	533.9
Ba-002 Cavern Nominal Height	m	271
Ba-002 Cavern Mining Height	m	94.38
Ba-002 Cavern Nominal Volume	m ³	2,128,429
Ba-002 Cavern Mining Volume	m ³	741,259
Ba-003 Cavern Top Depth	m	237.84
Ba-003 Cavern Bottom Depth	m	515.75
Ba-003 Cavern Nominal Height	m	277.91
Ba-003 Cavern Mining Height	m	84.23
Ba-003 Cavern Nominal Volume	m ³	2,182,700
Ba-003 Cavern Mining Volume	m ³	661,541

The following are the criteria used in the wellfield cavern layout:

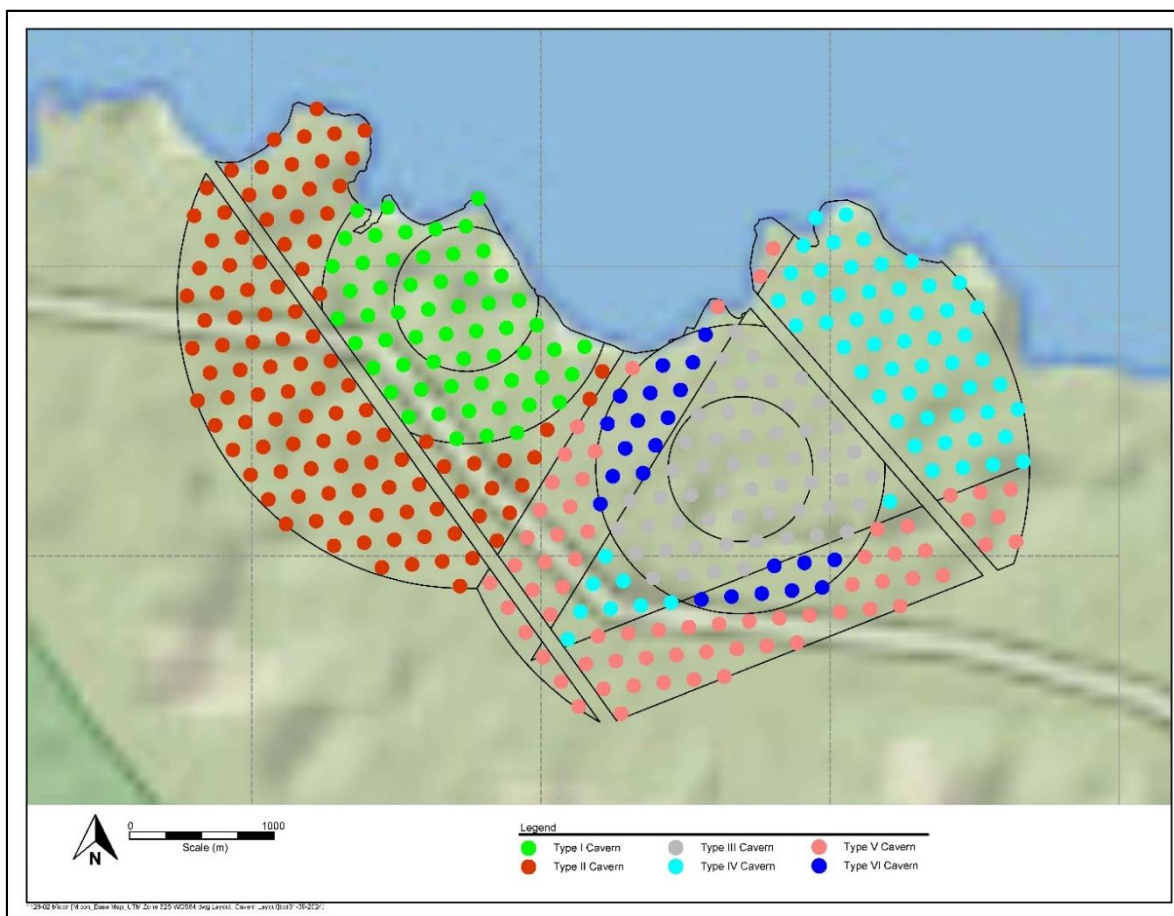
1. Single-well vertical caverns are planned for the Banio Project solution mining. The cavern used for the layout has a radius of 50 m and pillar width of 110 m.
2. The wellfield cavern layout was generated in the Indicated and Inferred Mineral Resource areas. The ROIs for the Indicated Resource areas are 500 m for the sylvinite and 1,000 m for the carnallite, and for the Inferred Resource areas 1,000 m for the sylvinite and 2,000 m for the carnallite.
3. The proposed plant site is located approximately 60 km away from the wellfield boundary. There is no impact of potential surface subsidence at the plant. There are no towns/villages within the proposed mining area.
4. The single-well vertical-cavern method was chosen for this Project.
5. Thickness cut-offs and KCl grade cut-offs were not applied.
6. The high tachyhydrite seams were excluded in this mine plan.
7. The current cavern layout does not consider surface roads, highways, and water bodies. If this is a constraint for the well surface locations, directional drilling can be used to access the designated cavern location from accessible surface locations.

Figure 16.12 shows the cavern layout in the Indicated and Inferred Mineral Resources for the Banio Project. There are six types of cavern:

- Type I caverns mine the Cycle III-IV carnallite, Cycle V-VII carnallite, and Cycle VIII sylvinite.
- Type II caverns mine the Cycle III-IV carnallite, and Cycle V-VII carnallite.
- Type III caverns mine the Cycle V-VII carnallite, Cycle VIII carnallite, and Cycle VIII sylvinite.
- Type IV caverns mine the Cycle V-VII carnallite and Cycle VIII carnallite.
- Type V caverns mine the Cycle V-VII carnallite.
- Type VI caverns mine the Cycle V-VII carnallite and Cycle VIII sylvinite.

There are 58 Type I caverns, 107 Type II caverns, 55 Type III caverns, 61 Type IV caverns, 67 Type V caverns, and 22 Type VI caverns. The total number of caverns to be mined is 370.

Figure 16.12: Wellfield Cavern Layout for the Banio Project



Source: Agapito (2023)

16.3.3 Cavern Temperature and Brine Grade Assessment

Employing heated injection solvent during solution mining increases the dissolution rates and allows for a more concentrated production brine, thereby improving mining efficiency and lowering processing costs. On the other hand, higher injection temperatures increase costs, and by heating the rock mass surrounding the cavern, accelerate creep deformation.

To optimise solution mining design, the heat transfer and temperature profile along the wells and cavern walls should be studied in detail. Heat transfer in the solution mining process includes heat transfer from solvent/brine to the formation rock through the well casing, heat transfer from cavern brine to the formation rock, heat loss/gain due to dissolution of minerals, and heat exchange between solvent and brine for coaxial injection-recovery design.

For the Banio Potash Project, both hot mining and cold mining options are evaluated. For the hot mining option, the Project will need to heat the solvent before injecting into the cavern which requires additional capital investment on the heating system. However, due to the long distance between the processing plant and the wellfield, the hot mining option may have very high costs due to the temperature loss along the pipelines. An alternative option is to heat the solvent at the wellfield location, however, this option requires significant infrastructure on the wellfield. For this reason, it is decided that cold mining will be used for the initial caverns and switch to hot mining after the completion of the initial caverns.

For cold mining, it is assumed that ambient temperature solvent will be injected into the cavern and the cavern brine will be maintained at 32.5°C. For hot solvent mining, it is proposed that the injection solvent temperature is 80°C. With a cavern located at approximately 500 m in depth in the area, the expected temperature drop in the hot injection fluid is estimated to be between 10°C and 20°C with resulting brine temperatures in the cavern between 60°C to 70°C. With this elevated temperature, the KCl content in production brine will be much higher than the case with cold solvent injection.

The composition of the production brine coming from a cavern depends on the mineralogy of the rock dissolved in the cavern, dissolution behaviour of the rock, shape of the cavern (available dissolution surface), composition and flow rate of solvent as well as the temperature of solvent. These factors are not independent but influence each other nonlinearly. To understand the impacts of these factors on the brine composition, dissolution tests on core samples should be conducted. For the Banio Project, the dissolution tests have not been conducted at this stage, Agapito's internal dissolution test database and brine grade estimation model were used to estimate the brine composition for the Project. The estimated overall average brine composition over the two boreholes is given in Table 16.4. Although the brine composition from a single cavern differs from the average provided in Table 16.4, the processing plant will be fed by a number of caverns at different development stages, and the production brine is a mixture of these brines.

Table 16.5 shows the estimated overall average brine composition over the two boreholes for the cold mining option. As shown in Table 16.4 and Table 16.5, the KCl concentration with cold mining is approximately 25% lower than the hot mining option.

16.3.4 Well Completion Design

For solution mining, the deposit is accessed by drill holes. The single well cavern method has been selected for the Banio Project. The operations with the single well cavern method include three pathways from surface to cavern:

- Solvent flow from surface to the cavern;
- Brine flow from the cavern to surface; and,
- Blanket material flow in both directions. For a single well cavern, this requires an inner and an outer string.

The well structure design is shown in Figure 16.13. Basic well construction and completion specifications are listed below:

1. Drill a 508.0 mm (20-inch) diameter conductor hole and cement 406.4 mm (16-inch) conductor casing to a minimum of 20 m, or as deep as required to obtain a competent casing shoe. Note, conductor casing may be set in advance by a separate contractor or during spudding. Conductor can also be driven in place to reduce cost.
2. Drill a 374.7 mm (14¾-inch) diameter surface hole.
3. Install 298.5 mm (11¾-inch) diameter surface casing.
4. Drill a 269.9 mm (10⅝-inch) diameter intermediate (main) hole.
5. Install 219.1 mm (8⅝-inch) diameter production casing.
6. Install 139.7 mm (5½-inch) diameter leach string.
7. Install 88.9 mm (3½-inch) diameter recovery string.

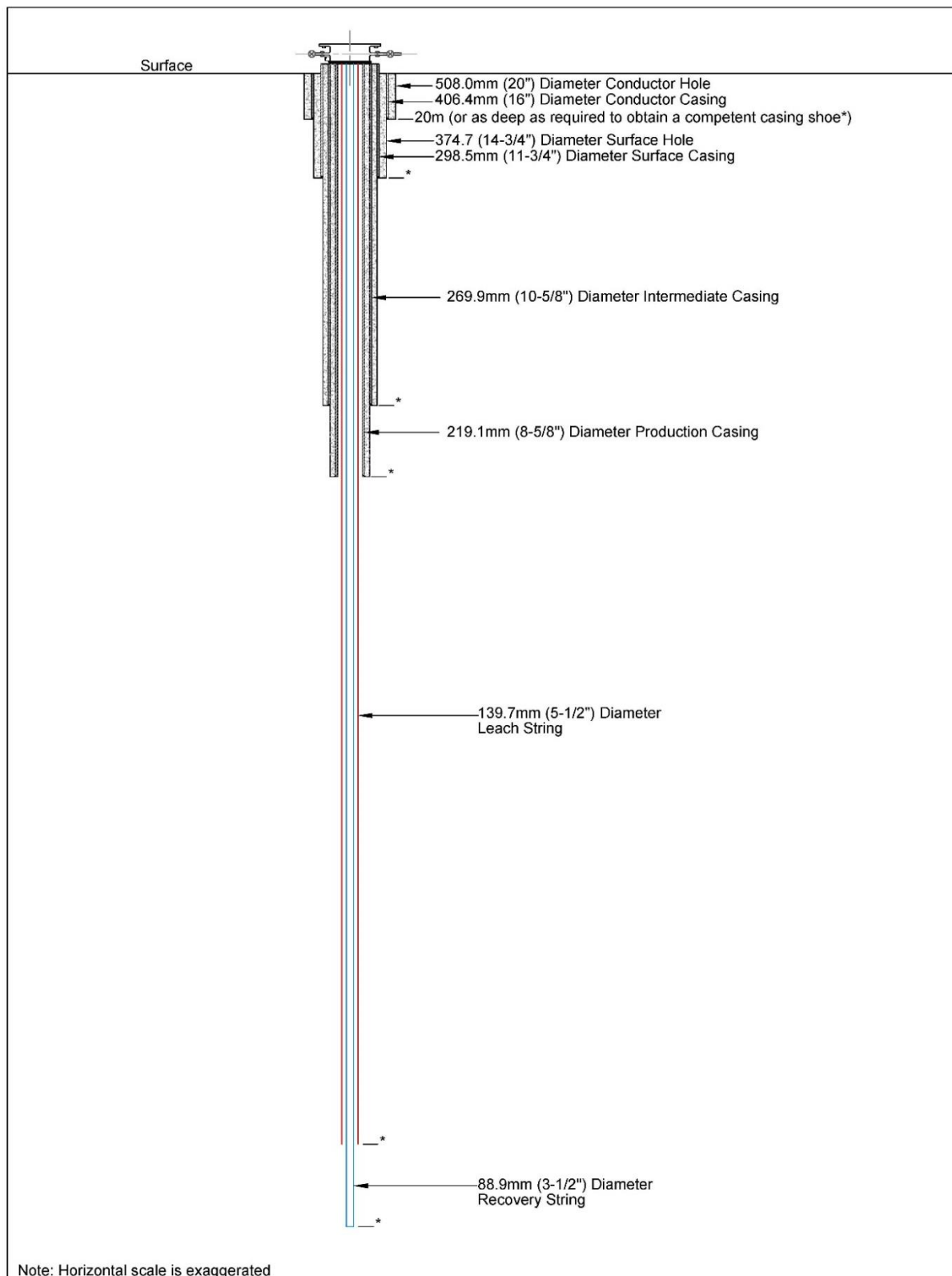
Table 16.4: Average Brine Composition Estimation for Each Seam for Hot Mining

Seam Information						Brine Composition					
BH ID	Cycle No.	Cycle Seam No.	From (m)	To (m)	Thickness (m)	CaSO ₄ (g/L)	MgSO ₄ (g/L)	CaCl ₂ (g/L)	MgCl ₂ (g/L)	KCl (g/L)	NaCl (g/L)
Ba-002	VIII	VIII_3	280.2	282.3	2.1	0.96	1.58	0.00	2.12	137.79	252.43
Ba-002	VIII	VIII_4	284.35	287.05	2.7	1.29	1.21	0.00	1.40	141.17	252.79
Ba-002	VII	VII_4	364.79	366.04	1.25	0.80	0.00	0.54	115.58	95.01	139.79
Ba-002	VII	VII_5	368.79	370.29	1.5	0.72	0.00	0.32	124.23	99.32	127.69
Ba-002	VII	VII_6	374.69	376.24	1.55	0.94	0.00	0.47	110.98	89.98	147.17
Ba-002	VII	VII_7	387.76	390.86	3.1	1.21	0.00	4.91	108.28	94.25	141.89
Ba-002	VII	VII_8	394.41	396.96	2.55	0.94	0.00	6.59	123.70	110.76	104.37
Ba-002	VII	VII_9	400.71	406.06	5.35	1.40	0.00	3.52	119.49	103.35	129.14
Ba-002	VII	VII_10	409.66	417.16	7.5	0.96	2.07	0.00	152.77	114.85	99.83
Ba-002	VI	VI_1	438.71	452.52	13.81	2.51	0.00	1.96	140.80	104.27	110.35
Ba-002	VI	VI_2	453.72	467.52	13.8	1.99	1.34	0.00	155.85	110.41	98.37
Ba-002	V	V_1	481.8	491.85	10.05	2.13	0.90	0.00	138.78	96.63	119.48
Ba-002	V	V_2	496.35	498.25	1.9	0.69	0.00	0.68	201.40	151.01	45.28
Ba-002	V	V_3	499.5	501.05	1.55	1.52	0.00	3.00	152.30	114.46	99.37
Ba-002	IV	IV_1	518.34	522.5	4.16	6.47	0.00	5.65	166.25	120.89	63.06
Ba-002	III	III_1	529.14	533.9	4.76	4.70	0.00	8.73	180.72	132.53	42.20
Ba-003	VIII	VIII_Sylvinitite 2	262.89	265.59	2.7	1.01	0.00	0.20	1.89	103.57	274.31
Ba-003	VIII	VIII_Sylvinitite 3	268.68	270.99	2.31	0.98	0.00	0.17	0.61	106.93	274.95
Ba-003	VIII	VIII_Sylvinitite 4	273.03	275.48	2.45	1.09	0.00	0.15	5.42	118.85	260.52
Ba-003	VIII	VIII_Carnallitite 5	282.16	286.79	4.63	0.94	0.16	0.00	149.65	119.97	102.72
Ba-003	VIII	VIII_Carnallitite 6	288.7	293.81	5.11	1.10	0.00	0.22	130.72	102.70	126.92
Ba-003	VII	VII_Carnallitite 4	397.84	399.25	1.41	1.38	0.00	0.87	125.46	103.33	124.95
Ba-003	VII	VII_Carnallitite 7	409.09	412.35	3.26	1.09	0.00	0.37	132.07	106.22	124.20
Ba-003	VII	VII_Carnallitite 8	415.39	418.03	2.64	0.99	0.00	0.28	147.14	118.44	104.60
Ba-003	VII	VII_Carnallitite 9	421.98	427	5.02	1.40	0.00	0.35	132.26	106.47	122.37
Ba-003	VII	VII_Carnallitite 10	430.02	437.01	6.99	1.51	0.00	0.31	147.69	117.76	104.05
Ba-003	VI	VI_Carnallitite 1	456.98	468.75	11.77	2.23	0.00	2.10	143.14	112.33	106.37
Ba-003	VI	VI_Carnallitite 2	469.88	485.6	15.72	1.99	0.00	1.89	154.39	119.60	89.84
Ba-003	V	V_Carnallitite 1	497.24	507.06	9.82	2.47	0.00	2.65	134.39	103.41	119.30
Ba-003	V	V_Carnallitite 2	511.23	513.45	2.22	0.81	0.00	0.64	179.22	141.73	60.13
Ba-003	V	V_Carnallitite 3	514.2	515.75	1.55	1.27	0.00	1.15	169.53	134.53	73.32

Table 16.5: Average Brine Composition Estimation for Each Seam for Cold Mining

Seam Information						Brine Composition					
BH ID	Cycle No.	Cycle Seam No.	From (m)	To (m)	Thickness (m)	CaSO ₄ (g/L)	MgSO ₄ (g/L)	CaCl ₂ (g/L)	MgCl ₂ (g/L)	KCl (g/L)	NaCl (g/L)
Ba-002	VIII	VIII_3	280.2	282.3	2.1	0.71	1.18	0.00	1.58	115.34	263.07
Ba-002	VIII	VIII_4	284.35	287.05	2.7	0.96	0.90	0.00	1.05	118.19	263.48
Ba-002	VII	VII_4	364.79	366.04	1.25	0.59	0.00	0.40	85.58	70.35	198.67
Ba-002	VII	VII_5	368.79	370.29	1.5	0.53	0.00	0.24	92.22	73.73	181.94
Ba-002	VII	VII_6	374.69	376.24	1.55	0.70	0.00	0.35	82.03	66.51	208.80
Ba-002	VII	VII_7	387.76	390.86	3.1	0.90	0.00	3.63	80.13	69.75	201.54
Ba-002	VII	VII_8	394.41	396.96	2.55	0.70	0.00	4.91	92.23	82.57	149.36
Ba-002	VII	VII_9	400.71	406.06	5.35	1.04	0.00	2.61	88.70	76.72	184.02
Ba-002	VII	VII_10	409.66	417.16	7.5	0.71	1.55	0.00	114.22	85.87	143.27
Ba-002	VI	VI_1	438.71	452.52	13.81	1.87	0.00	1.46	104.95	77.73	157.89
Ba-002	VI	VI_2	453.72	467.52	13.8	1.49	1.00	0.00	116.54	82.56	141.19
Ba-002	V	V_1	481.8	491.85	10.05	1.59	0.67	0.00	103.24	71.88	170.60
Ba-002	V	V_2	496.35	498.25	1.9	0.53	0.00	0.52	152.67	114.47	65.89
Ba-002	V	V_3	499.5	501.05	1.55	1.13	0.00	2.24	113.88	85.59	142.63
Ba-002	IV	IV_1	518.34	522.5	4.16	4.87	0.00	4.25	125.19	91.03	91.14
Ba-002	III	III_1	529.14	533.9	4.76	3.56	0.00	6.60	136.75	100.28	61.29
Ba-003	VIII	VIII_Sylvinitite 2	262.89	265.59	2.7	0.75	0.00	0.15	1.41	86.51	285.27
Ba-003	VIII	VIII_Sylvinitite 3	268.68	270.99	2.31	0.73	0.00	0.12	0.45	89.32	285.95
Ba-003	VIII	VIII_Sylvinitite 4	273.03	275.48	2.45	0.81	0.00	0.11	4.03	99.39	271.25
Ba-003	VIII	VIII_Carnallitite 5	282.16	286.79	4.63	0.70	0.12	0.00	111.85	89.66	147.36
Ba-003	VIII	VIII_Carnallitite 6	288.7	293.81	5.11	0.82	0.00	0.16	97.12	76.30	181.00
Ba-003	VII	VII_Carnallitite 4	397.84	399.25	1.41	1.03	0.00	0.64	93.21	76.77	178.19
Ba-003	VII	VII_Carnallitite 7	409.09	412.35	3.26	0.81	0.00	0.28	98.20	78.98	177.26
Ba-003	VII	VII_Carnallitite 8	415.39	418.03	2.64	0.74	0.00	0.21	109.91	88.48	149.99
Ba-003	VII	VII_Carnallitite 9	421.98	427	5.02	1.04	0.00	0.26	98.37	79.19	174.69
Ba-003	VII	VII_Carnallitite 10	430.02	437.01	6.99	1.13	0.00	0.23	110.33	87.98	149.21
Ba-003	VI	VI_Carnallitite 1	456.98	468.75	11.77	1.66	0.00	1.57	106.84	83.84	152.40
Ba-003	VI	VI_Carnallitite 2	469.88	485.6	15.72	1.49	0.00	1.42	115.65	89.59	129.18
Ba-003	V	V_Carnallitite 1	497.24	507.06	9.82	1.84	0.00	1.97	100.01	76.95	170.41
Ba-003	V	V_Carnallitite 2	511.23	513.45	2.22	0.61	0.00	0.48	135.25	106.96	87.10
Ba-003	V	V_Carnallitite 3	514.2	515.75	1.55	0.96	0.00	0.86	127.55	101.22	105.88

Figure 16.13: Well Schematics for the Production Wells for the Banio Project



1128-02 Micon[Micon Profile Casing.dwg Layout: Casing Diagram]rjl (11-30-2023)

Source: Agapito (2023)

16.3.5 Surface Subsidence Analysis

Proposed solution mining at the Banio Project site will be conducted at a depth of cover of approximately 300 m to 500 m with an aerial extraction ratio of 21%. To minimise ground disturbance and slow surface subsidence, solution brine will be left in the caverns after mining is complete. Therefore, subsidence at the Project site is expected to be gradual and non-disruptive. Sinkholes and/or other forms of disruptive subsidence are not expected because of the planned cavern depth, limited vertical extent of mining, low extraction ratio, and favourable overlying stratigraphy. Subsidence will develop over mined caverns concurrently with mining and will continue post-mining as the caverns continue to close due to salt creep of the pillars, the salt interburden, and the surrounding salt strata. The ultimate (long-term) subsidence will not occur until many years after mining is complete.

For trough-type subsidence that is most likely to occur at the Project site, vertical ground depression alone causes little structural damage. It is usually the ground slopes and strains at the edges of the subsidence trough that cause damage to surface structures and natural surface features. Published criteria for angular distortion and strain thresholds for subsidence-induced damage are listed in Table 16.6.

Table 16.6: Published Damage Threshold Strains for Various Surface Features

Feature	Damage Severity Level	Threshold Strain (absolute value)	Slope (%)
Building – Brick and Masonry	Cosmetic ¹	0.0005	0.1
	Functional ¹	0.0015	0.2
Building – Wood Frame	Cosmetic ¹	0.001	0.15
Paved Roads	Cosmetic ¹	0.001	0.5
Groundwater Aquifers	Severe ¹	0.005	-
Buried Pipelines	Wrinkling ²	0.0023 ³	0.4
Ponds (without liner)	Severe ¹	0.005	-

Source: Singh (1992).

Notes:

1. Cosmetic damage is that which requires repairs for aesthetic purposes, but maintains function. Functional damage implies that the feature ceases to function as intended. Severe aquifer or pond damage implies partial or complete loss of water. Failure of pipelines means failure of couplings or pipe rupture.
2. Wrinkling is less severe than pipe buckling or collapse (failure).
3. Minimum threshold limit for wrinkling for pipes with diameters ranging from 21.84 cm (8.6 inches) to 106.7 cm (42 inches) (Kiefner, 1986).

The amount of surface subsidence at the Project site will be a function of the mine layout, depth of cover, aerial extraction ratio, mining height, the creep rate of the salt layers, cavern temperature, and brine pressure, etc. For this analysis it is assumed that a cavern would eventually close after solution mining is complete.

An empirical method is used to assess the ultimate subsidence over the planned mine site. Of the empirical methods, the influence function method is applicable to complex mine layouts and is available in many computer programs. The principle of this method is based on the extraction of infinitesimal elements of area. Subsidence at any point on the surface is obtained from the sum of the influence of each extracted element through superposition. A commercially available influence function code, Surface Deformation Prediction Software (SDPS) (Agioutantis & Karmis, 2005) is used in the subsidence estimation.

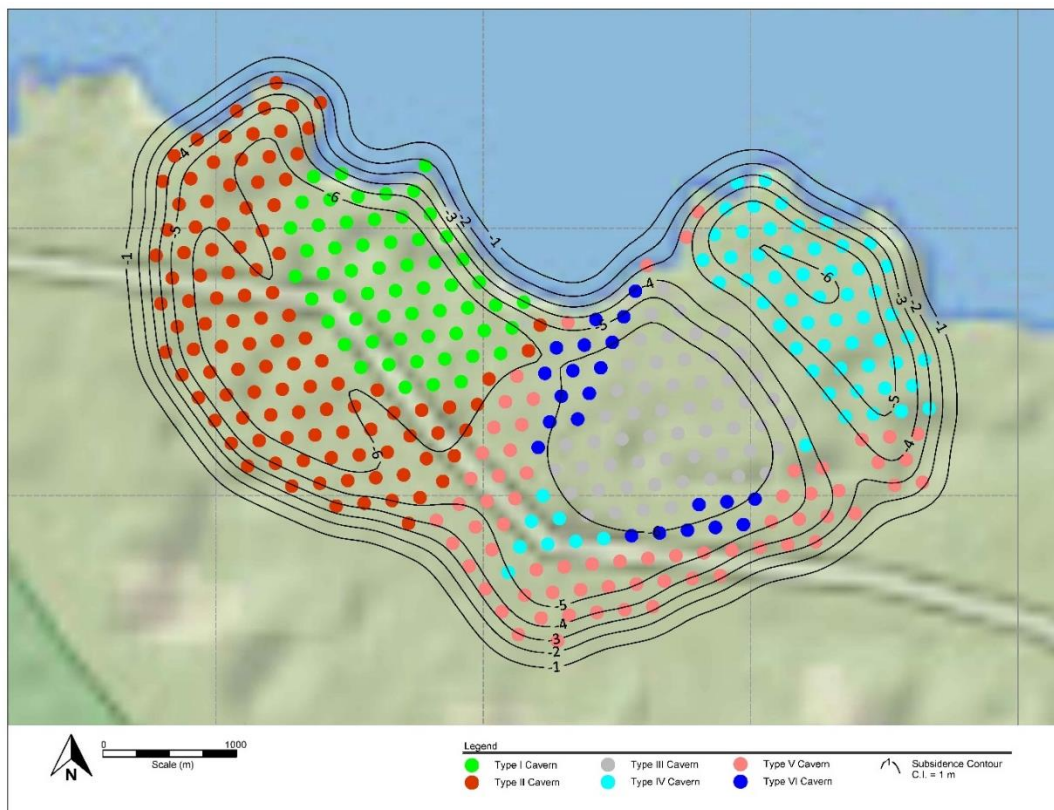
The cavern layout design was discussed in Section 16.3 of this Report. The ultimate subsidence prediction is based on the cavern layout design shown in Figure 16.16. The assumptions and inputs used in the subsidence model are as follows:

- A cavern would eventually close after solution mining is complete. The maximum cavern closure is assumed to be the effective mining height in a cavern. The maximum closure within the deposit after mining the carnallite/sylvinite beds is estimated as the sum of the bed thicknesses minus the thickness of undissolved minerals and insolubles within the beds. Individual caverns with various effective cavern heights are modelled;
- The angle of draw is assumed to be 45°. The angle of draw is the angle between the vertical line at a mining panel edge and the line connecting the panel edge and the edge of the movement basin when the mined-out spoil has reached a critical size (Peng, 1992). For a specific mine, usually this value is determined by fitting a calculated subsidence profile to a measured subsidence profile. However, for a greenfield project, this is not possible. The published angle of draw values for conventional underground potash mines in Saskatchewan range from 28.5° (Mraz & Gendzwill, 1986) up to 44° (Steed, et al., 1985). A small angle of draw implies that sinkhole-type subsidence is likely. Due to the large depth of cover of the caverns, a trough-type subsidence with a large angle of draw is expected;
- A variable depth of cover is modelled in the subsidence analysis. The elevations of ground surface and mining seams are provided by Micon; and,
- A horizontal-to-vertical displacement ratio of 0.35 is used in the subsidence model to define the magnitude of horizontal strain based on the vertical subsidence. A ratio of 0.17 to 0.30 is usually used for coal and conventionally mined trona mines. This coefficient is positively proportional to the predicted horizontal strains and can be empirically estimated by the average ratio of measured strain and curvature over a set of surface points. Since direct measurement is not possible in this case, a large value of 0.35 for this coefficient is used in order to be conservative.

Results of the ultimate surface subsidence contours are presented for the preliminary mine plan in Figure 16.14. The maximum predicted ultimate subsidence for the preliminary mine plan is approximately 6.7 m.

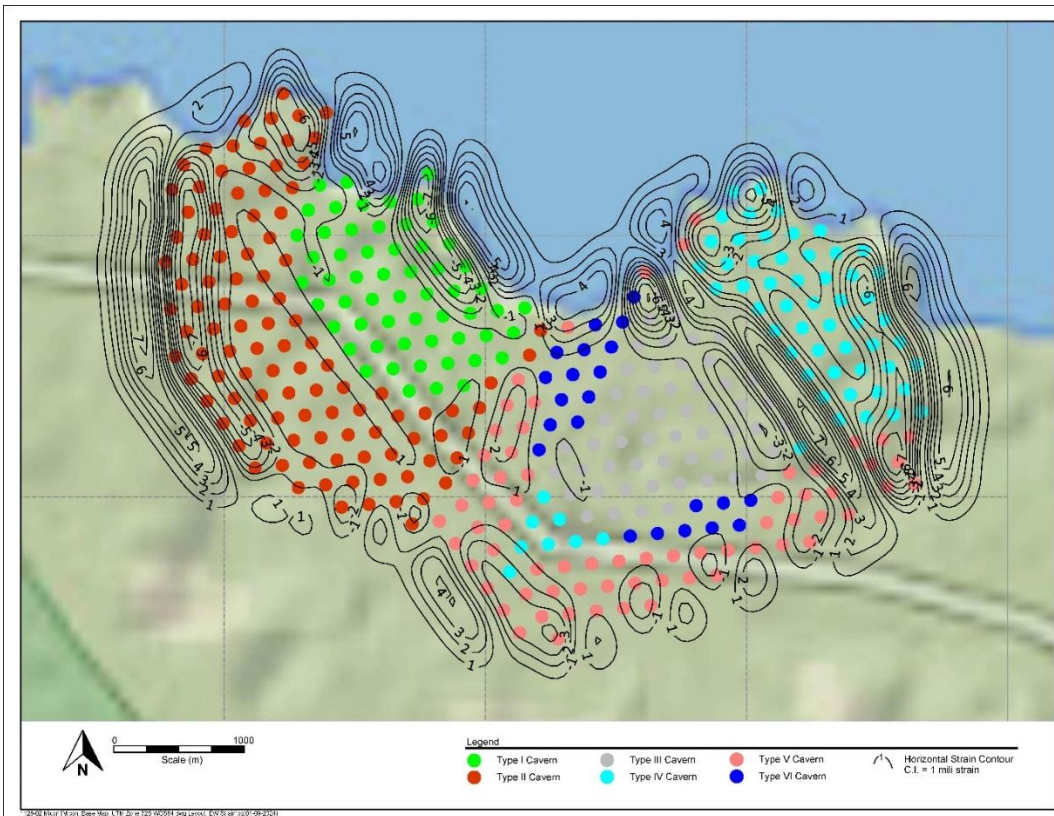
The ultimate horizontal strain contours in the x and y directions for the preliminary mine plan are presented in Figure 16.15 and Figure 16.16. The maximum horizontal strains in the east-west direction are 8.1×10^{-3} and -7.4×10^{-3} for tensile and compressive strains, respectively. The maximum horizontal strains in the north-south direction are 8.5×10^{-3} and -7.4×10^{-3} for tensile and compressive strains, respectively.

Figure 16.14: Predicted Ultimate Surface Subsidence at Banio Project



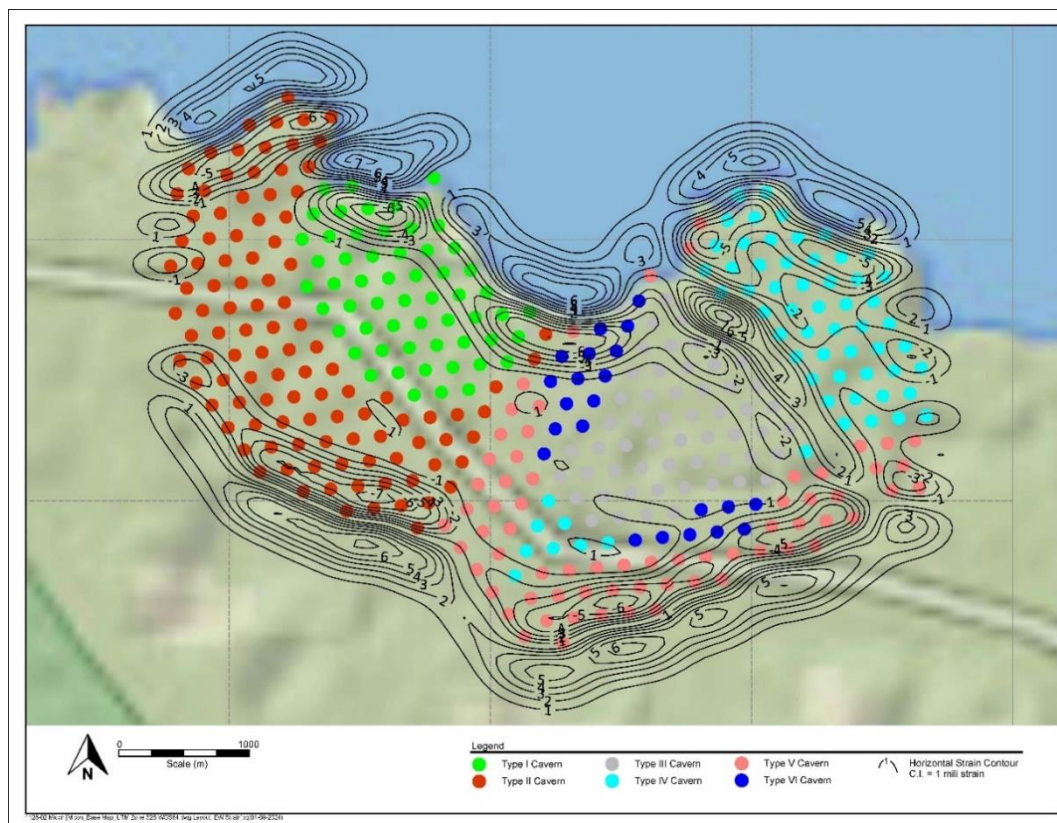
Source: Agapito (2023)

Figure 16.15: Predicted Ultimate Horizontal Strain in East-West Direction at Banio Project



Source: Agapito (2023)

Figure 16.16: Predicted Ultimate Horizontal Strain in North-South Direction at Banio Project



Source: Agapito (2023)

16.4 LOM PRODUCTION SCHEDULE

The LoM production schedule was developed to plan drilling, development, and production mining stages for each cavern in the current mine plan so that a MOP (K62) product could be maintained at the target rate during steady-state mining operations. Three case scenarios of production schedule were developed for the three target production rate options, i.e. 400 kt/a, 600 kt/a, and 800 kt/a, which result in a LoM expectancy of 112, 79 and 56 years, respectively.

Cavern production at the Project site was scheduled daily using Agapito's computer-aided solution-mining-design program (SMCD) based on the cavern layout and mining parameters defined in previous sections. Mass balance was calculated to estimate daily solvent, brine volumes, and water requirements for cavern development, primary mining, and secondary mining, respectively, for the entire wellfield.

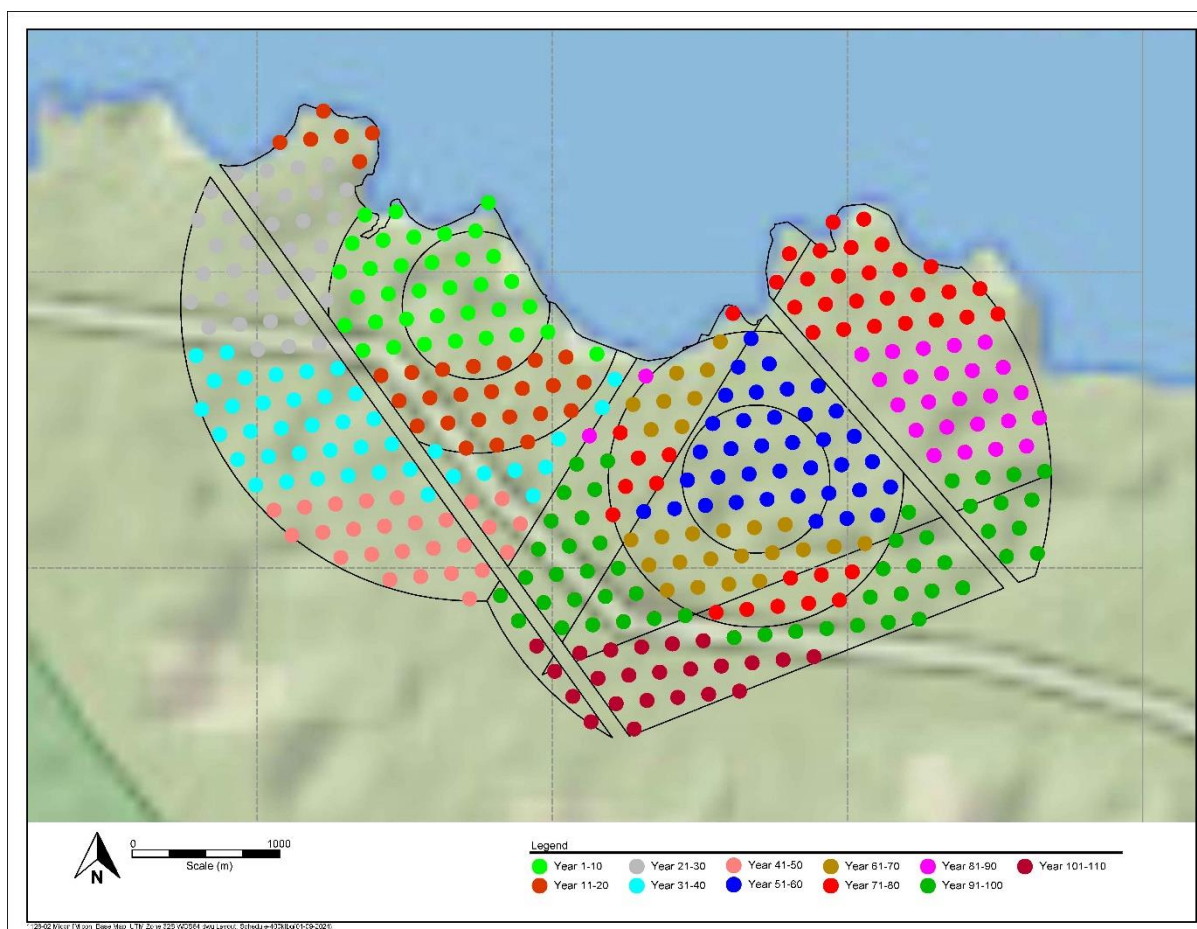
16.4.1 Cavern Data

A database containing 370 caverns with 47.7 Mt of recoverable KCl within the Indicated and Inferred Mineral Resource boundary was prepared using SMCD, a program written by Agapito to assist with solution mining cavern design. The cavern database stores cavern information such as cavern locations, mining horizons, mining heights, mineral grades, recoverable KCl tonnages, etc. Mining was planned to start from the northwest section of the mine boundary, then migrate to the middle section, and be completed at the south end.

16.4.2 Option 1 - Production Scheduling (400 kt/a)

Figure 16.17 shows the cavern solution mining sequence from the start to the end of the LoM for Option 1 with a target production rate of 400 kt/a. As shown in Figure 16.17, the initial 35 caverns will be drilled and developed in Year 1. Wellfield production will ramp-up to target production rate at the end of Year 2. Cavern replacement starts from Year 12 with 26 caverns added. Depending on the individual cavern lives and the schedule, 0 to 15 caverns will be replaced each year from Year 13 to Year 105. After Year 105, no new caverns will be added, and the production will ramp down to the end of LoM at Year 112.

Figure 16.17: Option 1 - Wellfield Cavern Solution Mining Sequence for the Banio Project



Source: Agapito (2023)

Figure 16.18 shows the injection solvent, production brine and disposal brine volumes over the LoM. As cold mining is planned for the initial caverns, the required injection solvent volume is larger than hot mining. Approximately 4.4 M m³ solvent is needed for Year 1, and approximately 6.5 M m³ solvent is needed for Year 2 through Year 12. With hot mining caverns started, the required solvent volume reduced to approximately 5.1 M m³ at Year 13 and maintains at this level until Year 105. After Year 105, the required solvent volume reduces to zero with the ramp down schedule. The production brine volume is approximately 1.5 M m³ for Year 1. During the initial cold mining stage, the production brine volume ranges from 3.6 M m³ to 5.8 M m³. At the hot mining stage, the production brine volume ranges from 3.3 M m³ to 4.3 M m³. The disposal brine volume is approximately 1.9 M m³ for the initial 4 schedule years and is approximately 1.1 M m³ from Year 5 to Year 105. No disposal brine is anticipated from Year 105 to the end of LoM at Year 112.

Figure 16.18: Option 1 - Injection Solvent, Production Brine and Disposal Brine Volumes Over the LoM

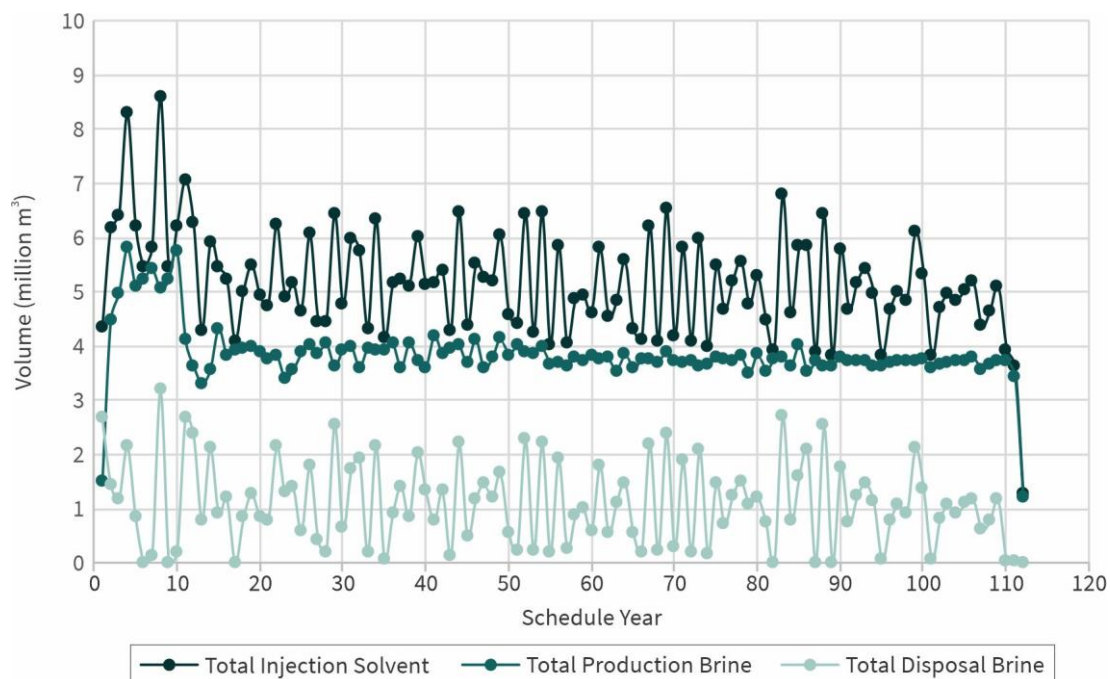


Figure 16.19 shows the wellfield average brine concentrations feeding to the plant over the LoM. During the initial cold mining stage, the NaCl concentration is up to more than 250 g/L, the KCl concentration is approximately 80 g/L, and the MgCl₂ concentration is in the range of 100 g/L to 140 g/L. During the hot mining stage, the KCl concentration increases to approximately 113 g/L, the MgCl₂ and NaCl concentrations are in the range of 100 g/L to 140 g/L. The production brine also contains very small amounts of CaSO₄, MgSO₄, and CaCl₂, they are mainly in the range of 0 g/L to 3 g/L, which has very minimal impact on the brine.

Figure 16.20 shows the wellfield salt production over the LoM. The KCl produced from the wellfield caverns is 151,000 t in Year 1 and maintains approximately 422,000 t/a during the steady mining stage. The annual NaCl production is up to approximately 1.1 Mt during the cold mining stage, and reduces to approximately 418,000 t during the hot mining stage. The annual MgCl₂ production averages approximately 530,000 t during the steady mining period. The CaSO₄, MgSO₄, and CaCl₂ production tonnages are mainly less than 10,000 t over the 112 year LoM.

Figure 16.19: Option 1 - Average Brine Concentrations Over the LoM

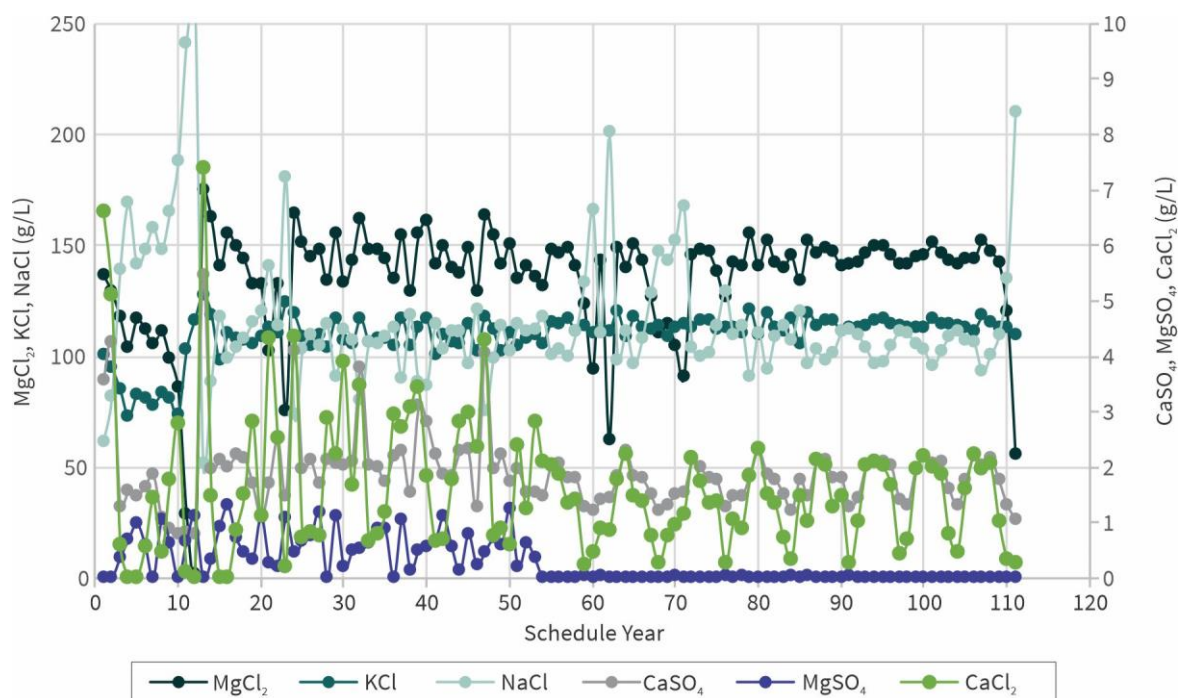
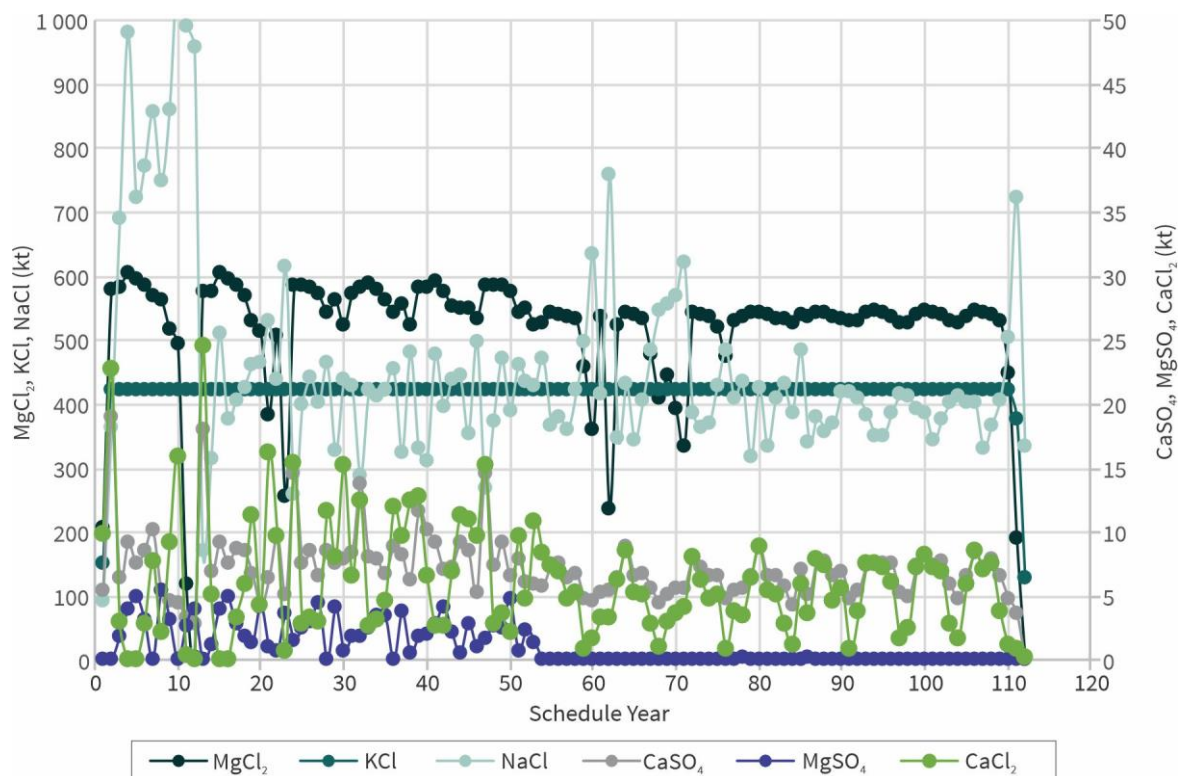


Figure 16.20: Option 1 - Wellfield Salt Production Over the LoM



16.4.3 Option 2 - Production Scheduling (600 kt/a)

Figure 16.21 shows the cavern solution mining sequence from the start to the end of the LoM for Option 2 with a target production rate of 600 kt/a. As shown in Figure 16.21, the initial 50 caverns

will be drilled and developed in Year 1 and Year 2. Wellfield production will ramp-up to the target production rate at the end of Year 2. Cavern replacement starts from Year 12 with two caverns added. Depending on the individual cavern lives and the schedule, 0 to 36 caverns will be replaced each year from Year 13 to Year 72. After Year 72, no new caverns will be added, and the production will ramp down to the end of LoM at Year 79.

Figure 16.21: Option 2 - Wellfield Cavern Solution Mining Sequence for the Banio Project

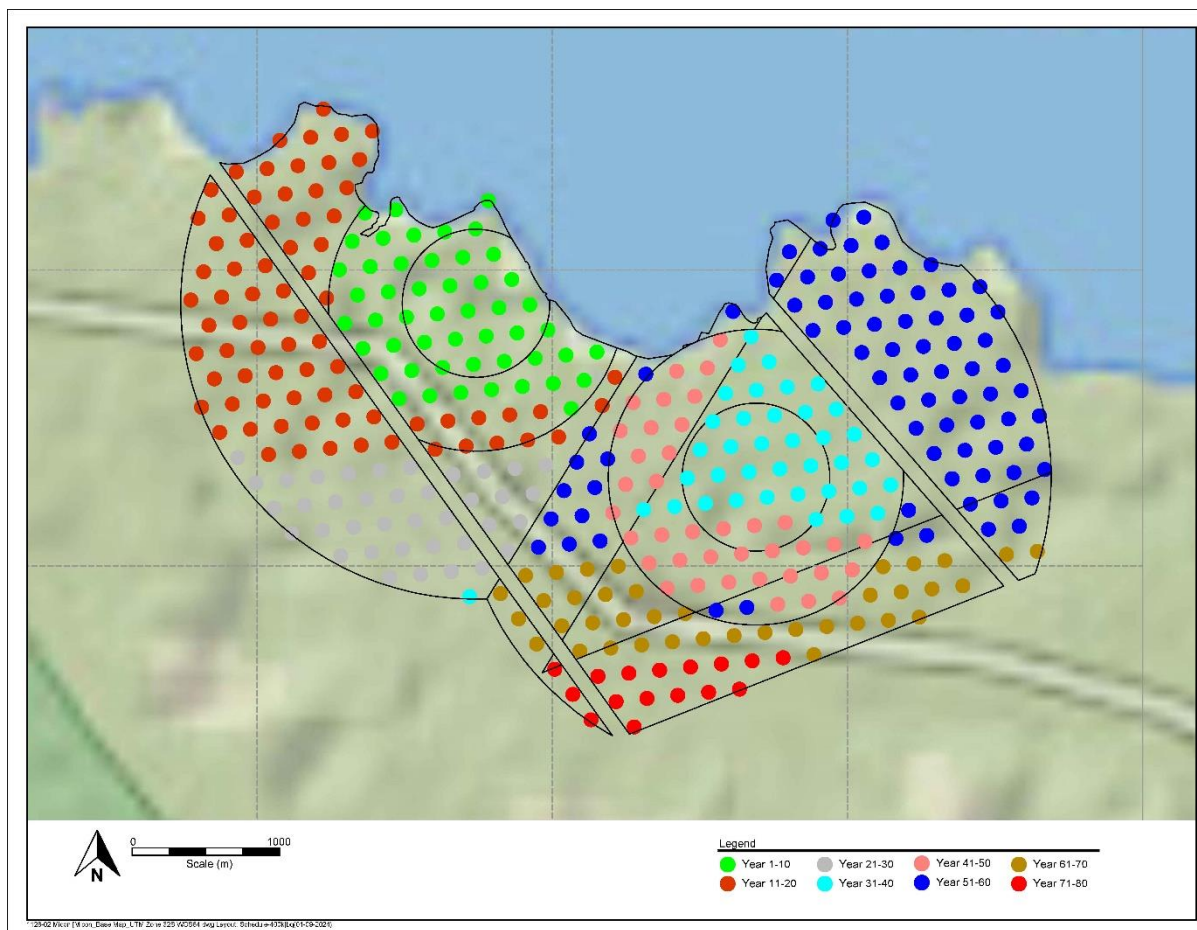


Figure 16.22 shows the injection solvent, production brine and disposal brine volumes over the LoM. As cold mining is planned for the initial caverns, the required injection solvent volume is larger than hot mining. Approximately 4.7 M m^3 solvent is needed for Year 1, and approximately 10 M m^3 of solvent is needed for Year 2 through to Year 12. With hot mining caverns started, the required solvent volume will reduce to approximately 7.6 M m^3 at Year 12 and maintains at this level until Year 72. After Year 72, the required solvent volume reduces to zero with the ramp down schedule. The production brine volume is approximately 1.5 M m^3 for Year 1. During the initial cold mining stage, the production brine volume ranges from 6.6 M m^3 to 9.6 M m^3 . At the hot mining stage, the production brine volume ranges from 5.0 M m^3 to 6.4 M m^3 . The disposal brine volume is approximately 2.6 M m^3 for the initial four schedule years and is approximately 1.9 M m^3 from Year 5 to Year 72. No disposal brine is anticipated from Year 73 to the end of the LoM at Year 79.

Figure 16.22: Option 2 - Injection Solvent, Production Brine and Disposal Brine Volumes Over the LoM

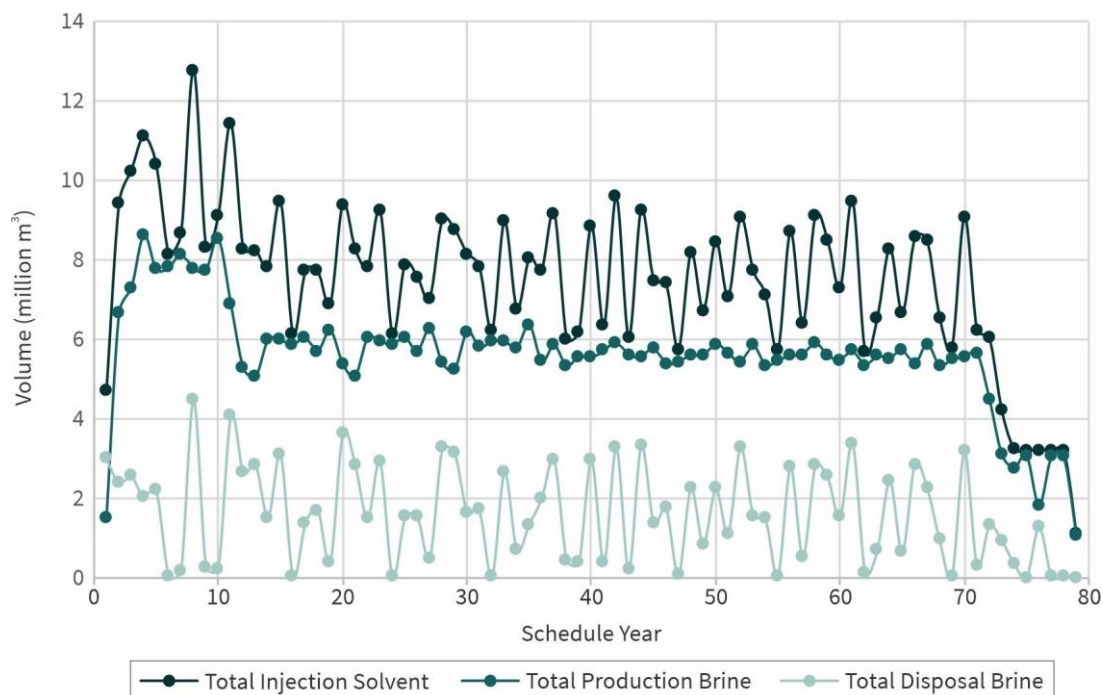


Figure 16.23 shows the wellfield average brine concentrations feeding to the plant over the LoM. During the initial cold mining stage, the NaCl concentration is up to more than 200 g/L, the KCl concentration is approximately 80 g/L, and the MgCl₂ concentration is in the range of 100 g/L to 140 g/L. During the hot mining stage, the KCl concentration increases to approximately 113 g/L, the MgCl₂ and NaCl concentrations are in the range of 100 g/L to 140 g/L. The production brine also contains very small amounts of CaSO₄, MgSO₄, and CaCl₂, they are mainly in the range of 0 g/L to 3 g/L, which has a very minimal impact on the brine.

Figure 16.24 shows the wellfield salt production over the LoM. The KCl produced from the wellfield caverns is 151,000 t in Year 1 and maintains approximately 633,000 t/a during the steady mining stage. The annual NaCl production is up to approximately 1.6 Mt during the cold mining stage, and reduces to approximately 600,000 t during the hot mining stage. The annual MgCl₂ production averages approximately 795,000 t during the steady mining period. The CaSO₄, MgSO₄, and CaCl₂ production tonnages are mainly less than 15,000 t over the 79 year LoM.

Figure 16.23: Option 2 - Average Brine Concentrations Over the LoM

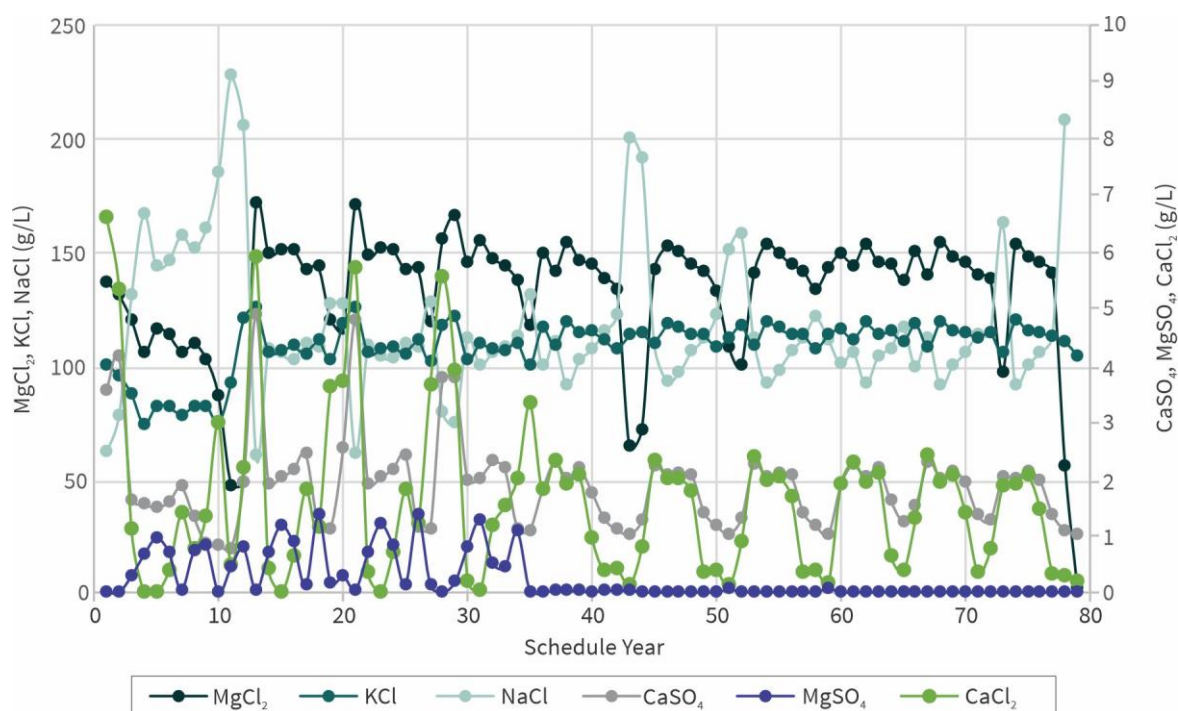
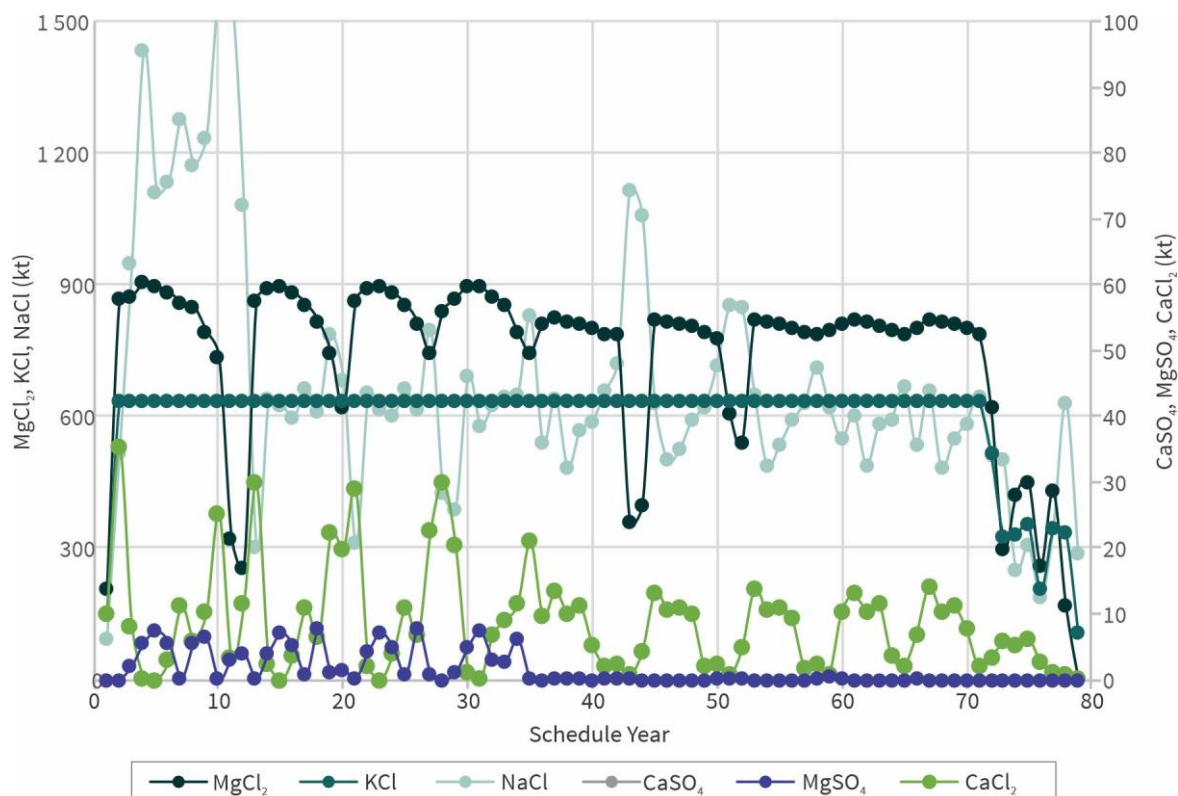


Figure 16.24: Option 2 - Wellfield Salt Production Over the LoM



16.4.4 Option 3 - Production Scheduling (800 kt/a)

Figure 16.25 shows the cavern solution mining sequence from the start to the end of the LoM for Option 3 with a target production rate of 800 kt/a. As shown in Figure 16.25, the initial 68 caverns will be drilled and developed in Year 1 and Year 2. Wellfield production will ramp-up to the target production rate at the end of Year 2. Cavern replacement starts from Year 9 with one cavern added. Depending on the individual cavern lives and the schedule, 0 to 36 caverns will be replaced each year from Year 10 to Year 51. After Year 51, no new caverns will be added, and the production will ramp down to the end of LoM at Year 56.

Figure 16.25: Option 3 - Wellfield Cavern Solution Mining Sequence for the Banio Project

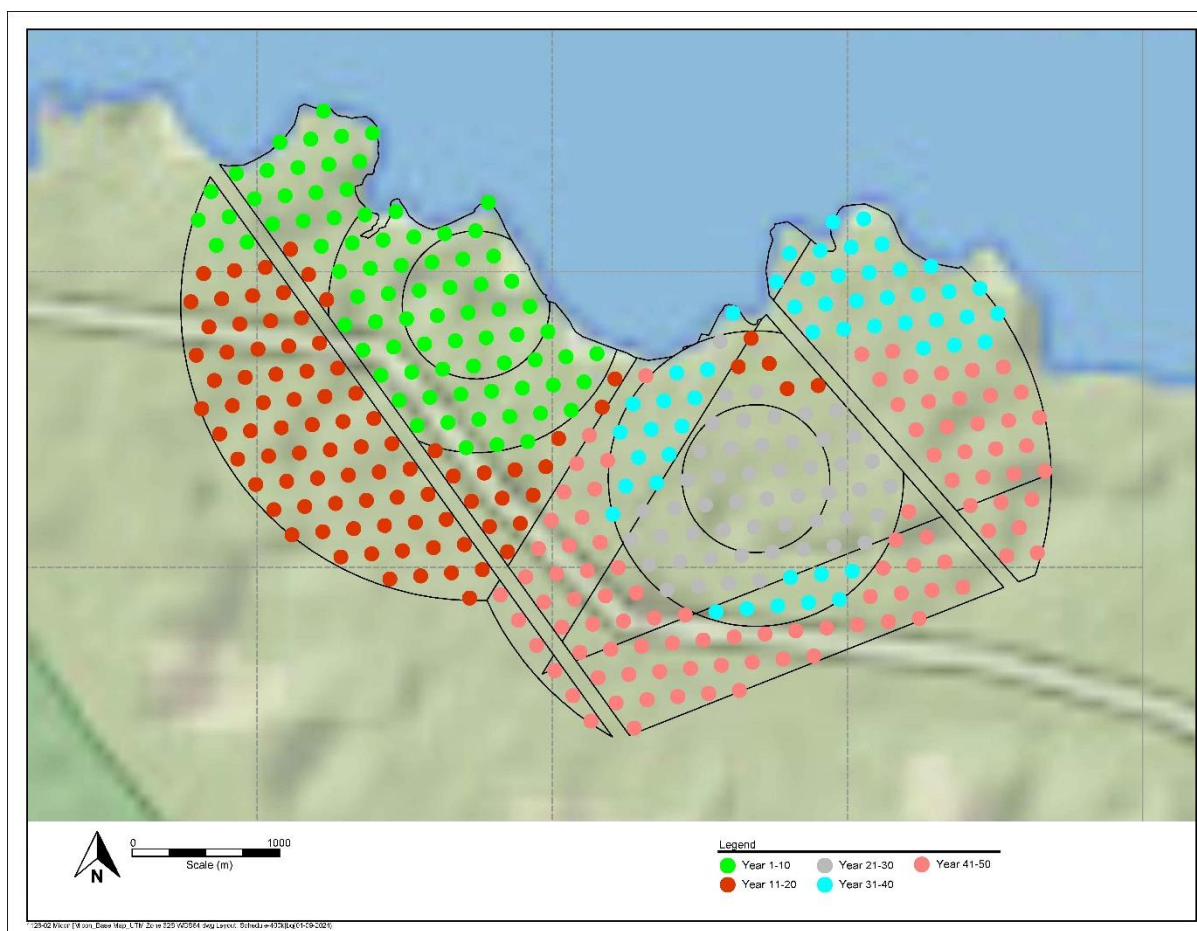


Figure 16.26 shows the injection solvent, production brine and disposal brine volumes over the LoM. As cold mining is planned for the initial caverns, the required injection solvent volume is larger than for hot mining. Approximately 4.7 M m³ solvent is needed for Year 1, and approximately 13.4 M m³ of solvent is needed for Year 2 through to Year 9. With hot mining caverns started, the required solvent volume will reduce to approximately 10 M m³ at Year 12 and maintains at this level until Year 51. After Year 51, the required solvent volume reduces to zero with the ramp down schedule. The production brine volume is approximately 1.5 M m³ for Year 1. During the initial cold mining stage, the production brine volume ranges from 8.3 M m³ to 11.4 M m³. At the hot mining stage, the production brine volume ranges from 7.0 M m³ to 8.2 M m³. The disposal brine volume is approximately 3.3 M m³ for the initial four schedule years and is approximately 2.1 M m³ from Year 5 to Year 51. No disposal brine is anticipated from Year 51 to the end of the LoM at Year 56.

Figure 16.26: Option 3 - Injection Solvent, Production Brine and Disposal Brine Volumes Over the LoM

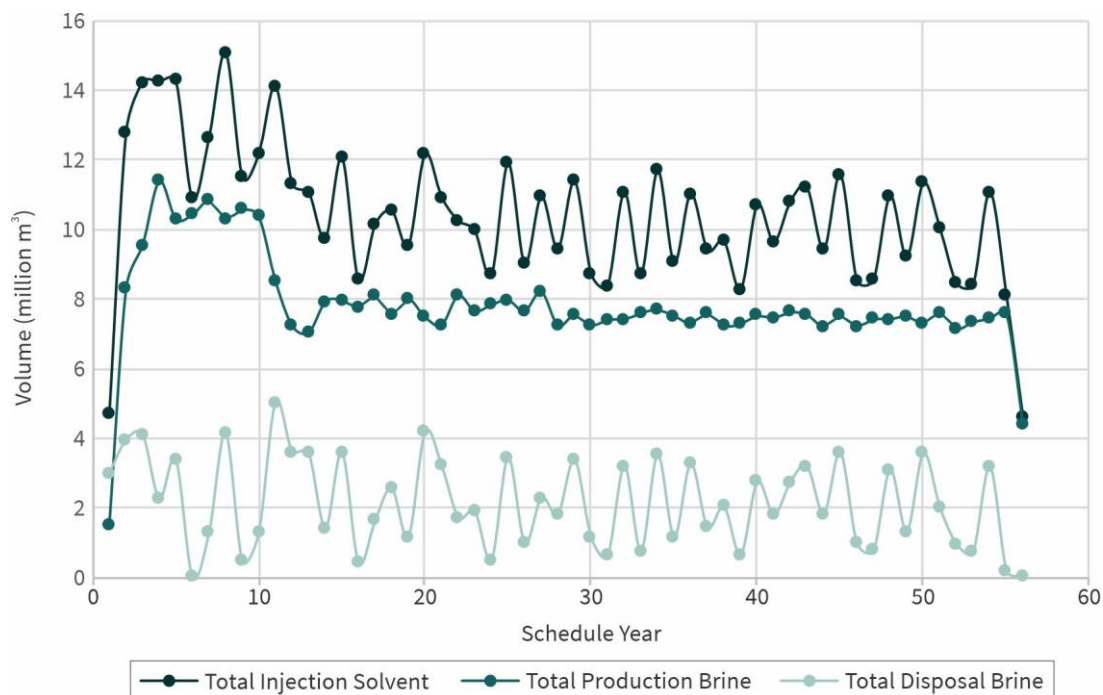


Figure 16.27 shows the wellfield average brine concentrations feeding to the plant over the LoM. During the initial cold mining stage, the NaCl concentration is up to 190 g/L, the KCl concentration is approximately 80 g/L, and the MgCl₂ concentration is in the range of 100 g/L to 140 g/L. During the hot mining stage, the KCl concentration increases to approximately 113 g/L, the MgCl₂ and NaCl concentrations are in the range of 100 g/L to 140 g/L. The production brine also contains very small amounts of CaSO₄, MgSO₄, and CaCl₂, they are mainly in the range of 0 g/L to 3 g/L, which has a very minimal impact on the brine.

Figure 16.28 shows the wellfield salt production over the LoM. The KCl produced from the wellfield caverns is 151,000 t in Year 1 and maintains approximately 844,000 t/a during the steady mining stage. The annual NaCl production is up to approximately 1.9 Mt during the cold mining stage, and reduces to approximately 830,000 t during the hot mining stage. The annual MgCl₂ production averages approximately 1.1 Mt during the steady mining period. The CaSO₄, MgSO₄, and CaCl₂ production tonnages are mainly less than 20,000 t over the 56 year LoM.

Figure 16.27: Option 3 - Average Brine Concentrations Over the LoM

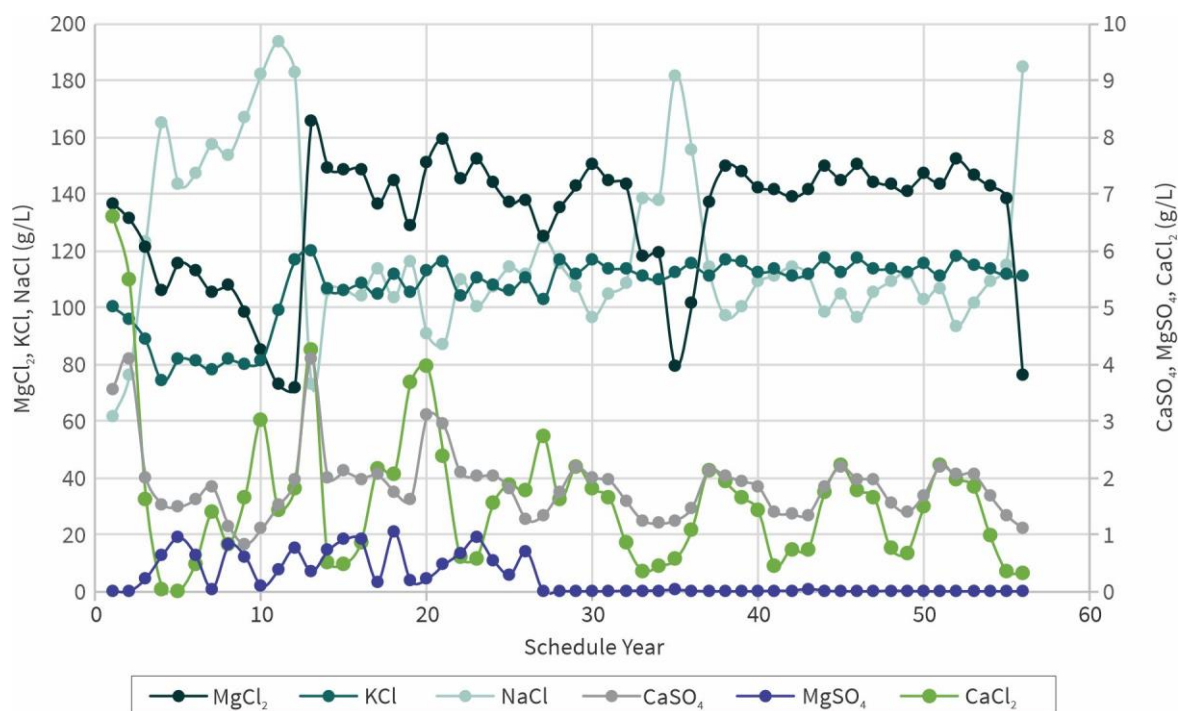
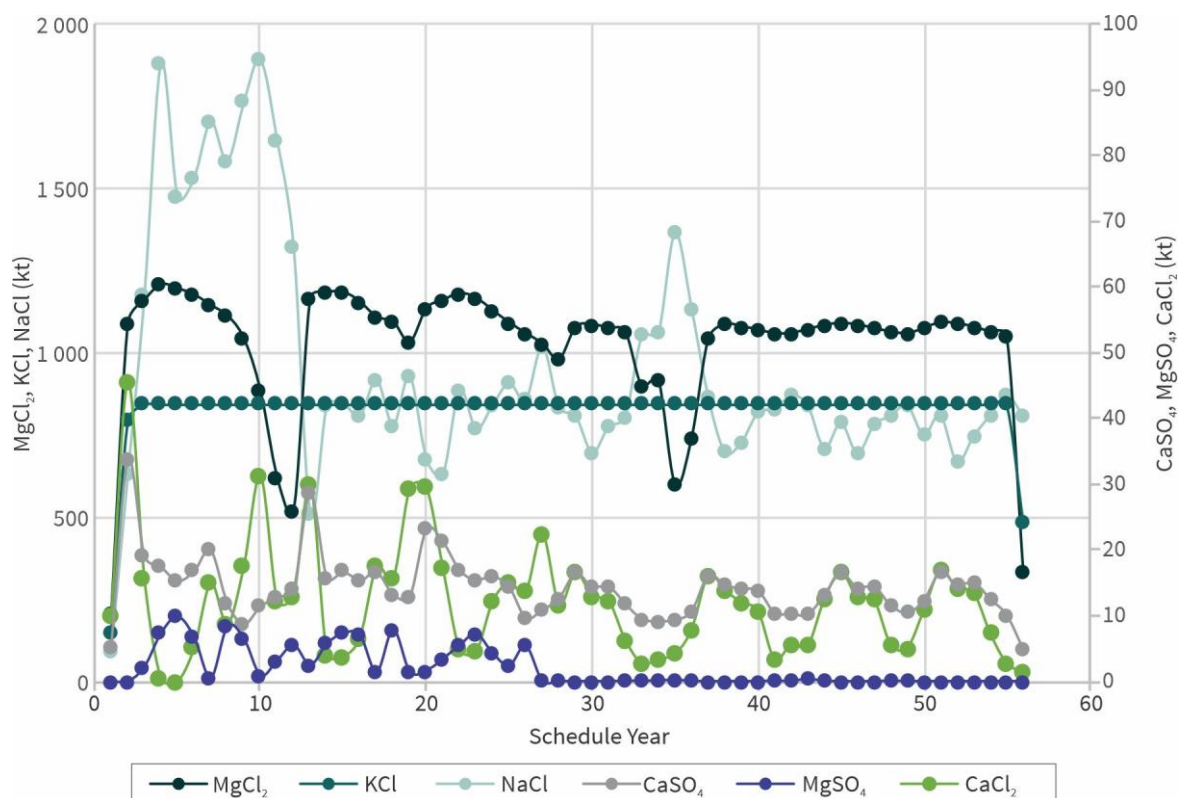


Figure 16.28: Option 3 - Wellfield Salt Production Over the LoM



17.0 RECOVERY METHODS

17.1 INTRODUCTION

The argument has been made in Section 16.0 for the use of solution mining in the extraction of potash-rich brines from the Banio Project wellfield, as opposed to conventional underground mining, therefore this section will focus on the processing requirements to recover saleable KCl solids from the brines together with a solid NaCl by-product.

In keeping with the requirements of Millennial, a suitable processing regime is proposed for the production of 400 kt/a, 600 kt/a and 800 kt/a MOP (K60 grade) respectively from the brines, the majority of the product being in the form of 2 mm to 4 mm granular solids, but with the capability to bypass the compaction stage and offer a standard-grade product for reasons described elsewhere (see Section 19.0 Market Studies and Contracts).

As will be demonstrated during the description of the process flowsheet, the opportunity arises to produce an industrial-grade vacuum salt containing a minimum of 99.0% NaCl from the wellfield brines which would otherwise be disposed as a waste brine ("Bittern").

The processing flowsheet recommended in this PEA is therefore designed to produce MOP with a guaranteed purity of 95% KCl (K60) with a maximum of 5% impurities, most of which is NaCl. All dissolved sodium chloride would be obtained as a high-grade crystalline crop with a guaranteed purity of >99% NaCl.

17.2 DETAILED DESCRIPTION OF THE PROPOSED PROCESS ROUTE

17.2.1 Advantages and Principal of the Selected Process Route

The proposed process route for the Banio Project avoids the disadvantages of conventional hot leaching or flotation and increases recoveries of the components of the Run of Mine (RoM) brines. The advantages of the procedure are as follows:

- The process can cope with wide variations in feed composition;
- Most components of the brines can be extracted and sold as products;
- The waste product is a harmless magnesium chloride brine;
- The waste product is in liquid form and can be discharged to sea;
- No reagents and other chemicals are contained in the waste products;
- The process can be highly automated;
- Simple process route requires a lower number of skilled employees; and,
- The process maximises the advantage of having a cheap source of natural gas.

The proposed processing route requires loaded brines directly from the wellfield, or via an intermediate storage tank/clarifier, and the following auxiliary materials and resources:

- Fresh demineralised water: From resources close to the MOP plant, industrial mains supply, wells or river;
- Vapour condensate: Recycled from the water evaporation processes;
- Steam condensate: From live steam for heating operations; and,
- Natural gas for power generation, steam raising and product drying.

All water (condensate) will be collected and re-used in the process facility. Water losses have to be balanced by an external supply of demineralised fresh water, therefore recycling condensates will reduce the amount of fresh water to be treated.

Energy supplied to the process are from the following sources:

- Live steam: Coming as 6 bar steam from a steam generator unit, powered by waste heat from the power station and supplemented by natural gas flame;
- Natural gas: Coming from the under construction gas network, used for steam generation and for direct heating in product drying; and,
- Electricity: Coming from the power station (dual-fuel engine or gas-turbine, combined with steam generation) produced from natural gas.

The proposed outputs from the wellfield for the three production scenarios are given in Table 17.1.

**Table 17.1: Proposed Output from the Wellfield for Production Scenarios
(400 kt/a, 600 kt/a, 800 kt/a)**

Scenario Output (MOP kt/a)	Production Brine (peak) (M m ³ /a)	Peak Year	Contained (KCl kt/a)	Contained (in peak year) (NaCl kt/a)
400	5.8	5	422	980
600	7.8	9	633	1,173
800	11.4	4	844	1,880

The selected and proposed process flowsheet procedure has the following process steps:

- Dissolution of carnallite, sylvinitite and halite within the brine wells;
- Displacement of loaded brines from the wells to a common collection tank;
- Pumping the brines to the Process Plant Site;
- Receipt of brines into a storage tank/clarifier;
- Heating of brines with steam followed by evaporation;
- Precipitation of purified NaCl solids from evaporators;
- Transfer of brines to a cooling crystalliser circuit;
- Precipitation of KCl solids;

- Debrining and drying of KCl and NaCl solids;
- Compaction of KCl solids, flake crushing and screening;
- Granule post-treatment glazing and oiling;
- Transport of products to storage warehouse;
- Transfer to port as required; and,
- Disposal of waste bittern and clarifier tank sediment to sea.

A simplified flowsheet following the process description is illustrated in Figure 17.1. It should be noted that the flowsheet is the same for all three production scenarios, only that the mass balances and number of production units for each will differ.

17.2.2 Detailed Description of Process

The description in this section covers all the production rates: 400 kt/a, 600 kt/a, 800 kt/a.

17.2.2.1 Fresh Water Extraction, Filtration and Injection

Freshwater is abstracted from the Banio Lagoon via a floating pontoon which is equipped with submersible pumps. The pontoon is connected to land by means of a floating walkway which also carries the freshwater delivery pipeline and the electricity supply cable. On the delivery side of the pumps are mesh strainers to prevent the ingress of any large unwanted solids.

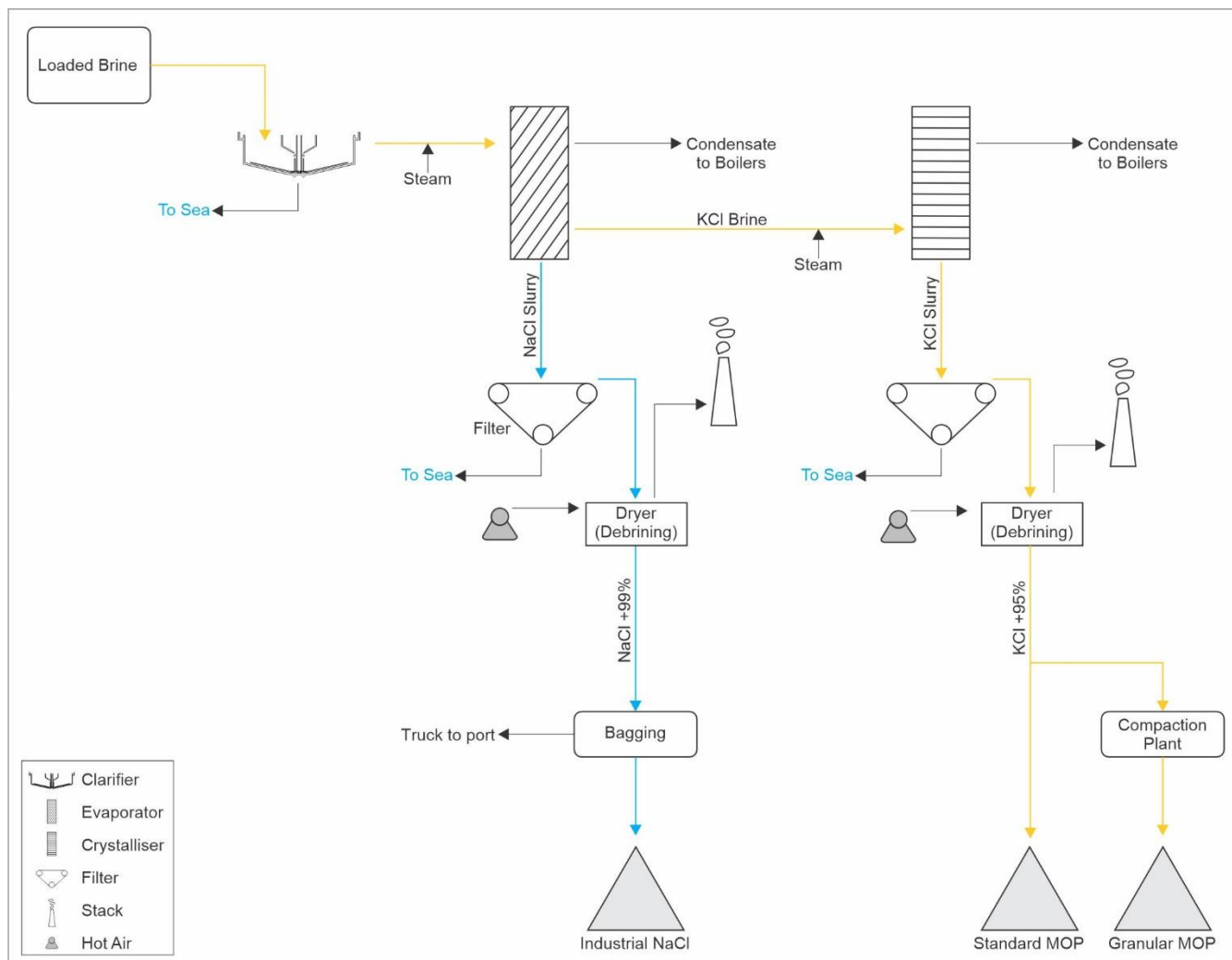
The pipeline delivers the required volume of water to a sand-filtration system whose purpose is to remove unwanted suspended solids which are mostly organic in nature. The sand filtration system can be backwashed into the lagoon periodically as indicated by pressure gauges.

Filtered freshwater, now known as “solvent”, flows into a wellfield feed tank from where high-pressure, positive displacement pumps distribute the liquid to the wellfield caverns (Figure 17.2).

The pressurized solvent flows into each cavern through one annulus of the drill string and loaded brine flows in the opposite direction, upwards out of the cavern, using the pressure supplied by the solvent entering the system. The loaded brine subsequently flows overland to a brine collector tank along with all other loaded brines from the adjacent caverns. A more detailed description of cavern operation is given in Section 16.2.2.

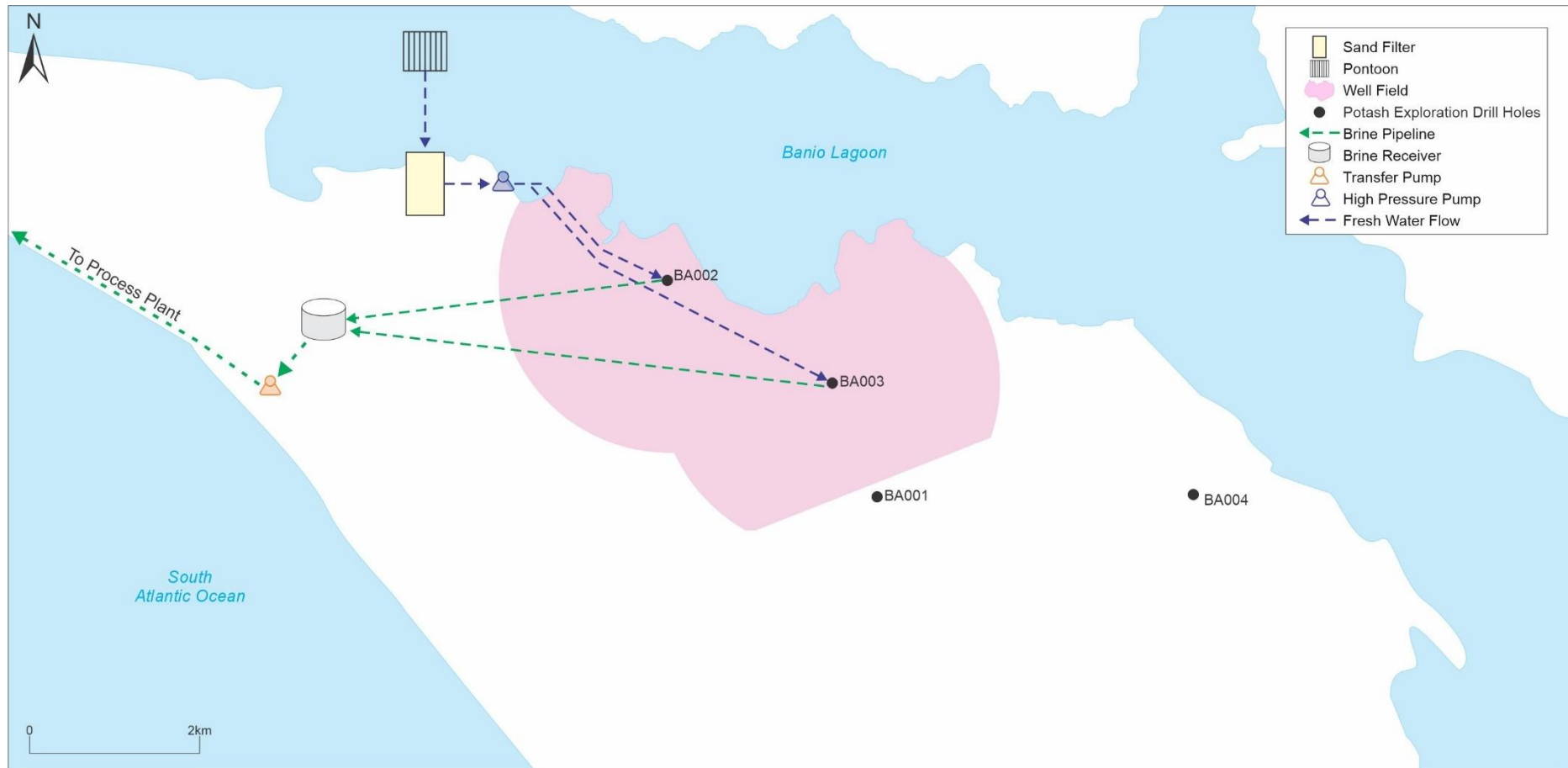
Finally, the loaded brine is transported by an overland pipeline to the process facility using centrifugal pumps located at the outlet of the brine collector tank.

Figure 17.1: Simplified Flowsheet for the Proposed Process Description



Source: Micon, 2024

Figure 17.2: Schematic Fresh Water Extraction and Wellfield Infrastructure



Source: Micon, 2024

17.2.2.2 Potash Process Plant

Loaded brine from the wellfield is received into a large-diameter brine collector tank which offers relatively quiescent conditions for the settling of any fine, insoluble solids which originated in the wellfield caverns.

Clarified brine is pumped from this tank through a series of heat exchangers which preheat the brine using waste heat from the cooling crystallisers and other sources. The brine temperature is further elevated by live steam injection prior to its introduction to a set of evaporators in parallel. The brines are separated into streams of approximately 500 m³/h, the total number of streams is dependent on the production scenario.

The evaporation process takes place in vessels which can evaporate approximately 200 t/h water and crystallise approximately 65 t/h NaCl. Evaporation can be conducted using mechanical vapour compression or by steam ejectors, the choice would be made at the detailed design stage in conjunction with the supplier of the evaporation package. The evaporated water leaves the vessel at the top whereas the precipitated NaCl slurry and concentrated KCl liquid are extracted continuously at the bottom by variable-speed pumps. Heat from the condensate is transferred to the incoming brine via heat exchangers, the condensed liquid is then recycled to the steam-generation boilers within the power station.

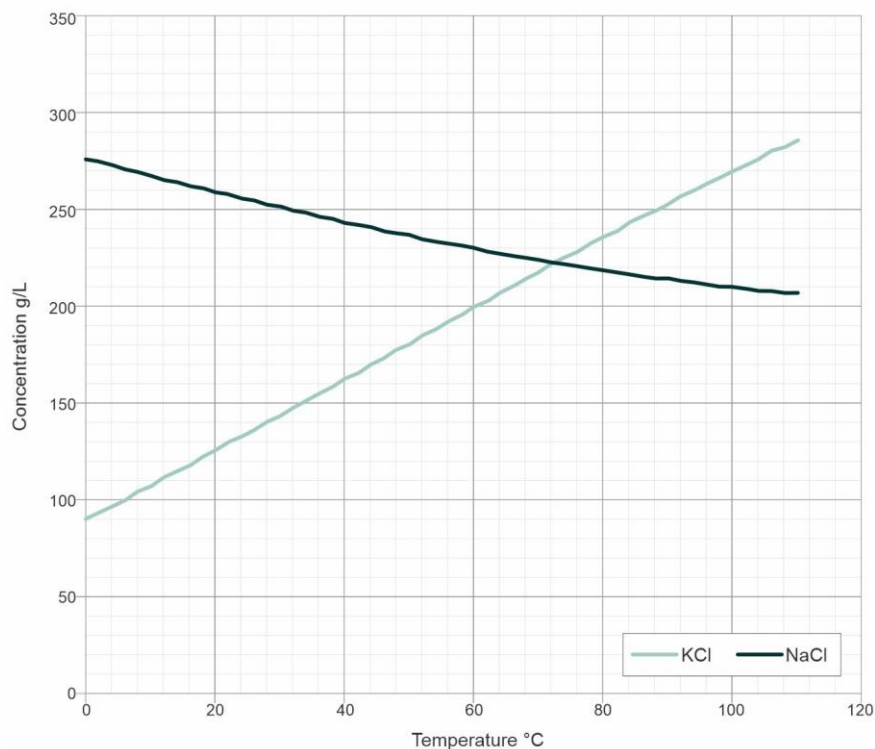
The NaCl slurry is debrined in solid-bowl decanter centrifuges, the resultant damp solids are dried in a gas-fired, fluidized bed dryer and delivered by conveyor to the product storage warehouse. An application of an anti-caking agent may be added at this stage. The centrate from the centrifuges rejoins the KCl-rich liquid stream from the evaporators in order to maintain a high KCl recovery.

The KCl-rich streams are transferred to the cooling crystalliser plant and cooled in stages through several vessels from approximately 70°C (minimum 60°C) to approximately 25°C (minimum 20°C). This process utilises the fact that KCl becomes less soluble within this temperature range as the liquid cools, whereas NaCl remains in solution (Figure 17.3). Despite the decreasing temperature, the liquid is kept boiling as it passes through the crystalliser train (Figure 17.4) because the vacuum pressure increases accordingly. Vacuum can be applied to these vessels using vacuum pumps or steam ejectors. A KCl slurry is extracted from the bottom of each crystalliser which is pumped to the next stage.

The KCl slurry is debrined using solid-bowl decanter centrifuges, the centrate from which is recycled to maintain metallurgical recovery. The damp solids (5% to 6% moisture) are fed to a gas-fired fluidized bed dryer, the input air to which can be preheated using power station offgas.

Hot MOP exits the dryer at approximately 140°C and is transported by bucket-elevator to the top of the compaction plant for near-immediate compaction (before cooling takes place) or is diverted onto a conveyor for delivery to the product storage warehouse as standard MOP (Figure 17.5). An application of anti-caking agent may be made at this stage prior to storage.

Figure 17.3: Simplistic View of the Relative Solubilities of KCl and NaCl Illustrating the Relationship Between Solubility and Temperature



Source: Micon, modified from Garrett (1996)

Figure 17.4: A Train of Cooling Crystallisers



Source: Uralkali (2009)

Figure 17.5: Recrystallised Standard Potash in Transit

Source: Uralkali (2009)

Market studies (Section 19.0) together with Millennial's requirements indicate that there is a high demand for granular MOP. Such granules are produced from standard grade potash by hot compaction through roller presses. Approximately 90% of the total MOP production will be sold as granular fertilizer and about 10% of the MOP can be sold in standard quality as dust free KCl with a 0.1 mm to 0.8 mm grain size. The compaction plant is sized accordingly to permit the total compaction of all production from the crystalliser plant, however in reality, standard potash is always available for sale due to the screening of granular products (which produces fines) and during the periods when the compaction system is unavailable.

17.2.2.3 Products

The intended products from the process plant are saleable grade K60 MOP in both standard and granular form together with a saleable grade industrial vacuum salt containing a minimum of 99% NaCl which is suitable for a variety of chemical applications such as the chlor-alkali process. The minimum MOP specification for sale is 60% K₂O which equates to 95% KCl, the remaining impurities are usually NaCl and insolubles such as gypsum and clay.

The exact ratio of sylvinite:carналitite:halite which will be dissolved in the wellfield caverns and hence the final brine composition for each of the production scenarios will only be finalised at the feasibility study stage when Mineral Resources are converted to Mineral Reserves in keeping with an optimised mine plan.

For the purposes of this preliminary assessment, however, a conservative assumption has been made which states that one tonne of NaCl shall be produced for each tonne of MOP. This is conservative because both carnallitite and sylvinite contain high proportions of NaCl, therefore there will always be an excess of NaCl. This assumption is supported by the preliminary LoM plan provided in Section 16.4.

In terms of the ratio of standard to granular MOP produced, this is entirely dependent on market conditions and the process plant will have the flexibility to produce these products in varying quantities. The nominal 100 t/h compactor depicted in Figure 17.6 is capable of producing 40 t/h granular MOP (the balance of 60 t/h is recycled within the system) which translates to approximately 300 kt/a with an overall availability of 85%.

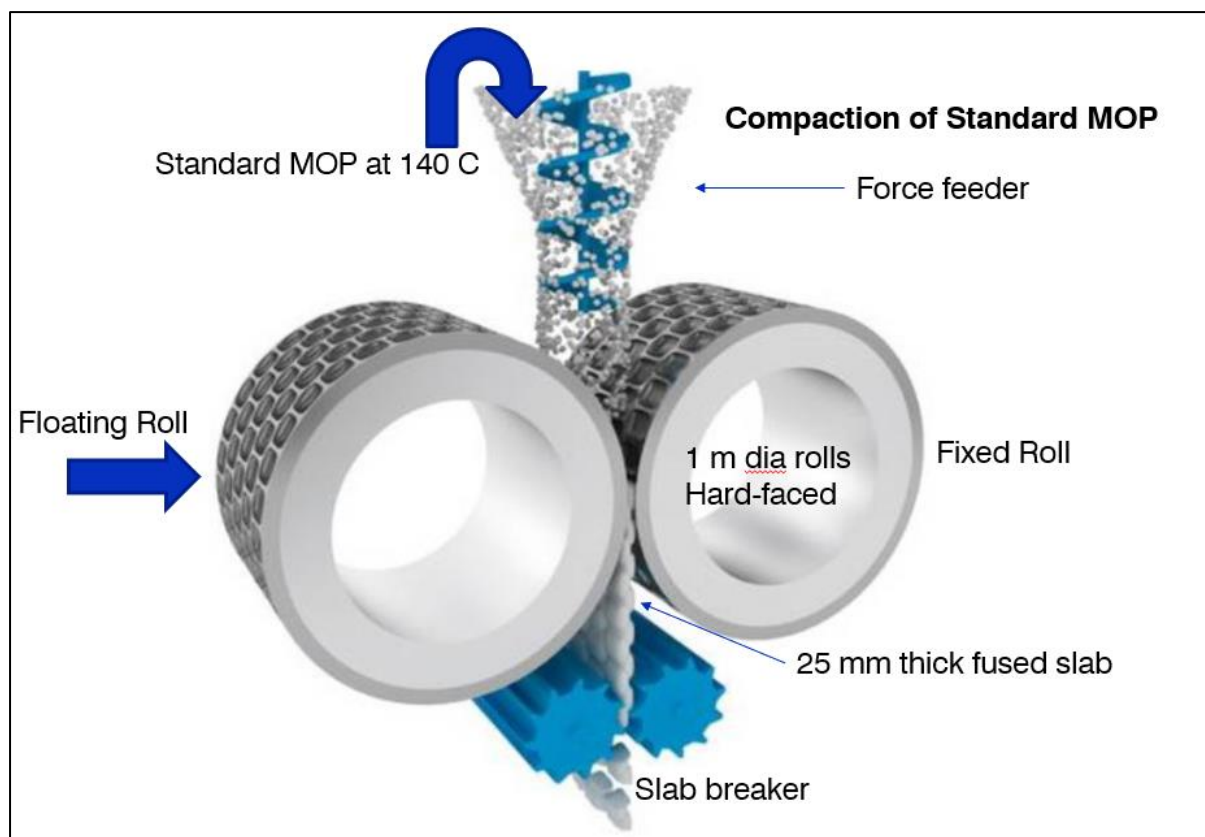
As this compactor is the industry-standard size, it is proposed to allow for two or three compactors which gives rise to the final table of products as shown in Table 17.2.

Table 17.2: Number of Compactors and Resulting Compaction Capacity for the Production Scenarios (400 kt/a, 600 kt/a, 800 kt/a)

Scenario Output (MOP kt/a)	NaCl (kt/a)	No. of Compactors	Granular Capacity (MOP kt/a)	Standard (MOP kt/a)
400	5.8	2	422	980
600	7.8	2	633	1,173
800	11.4	3	844	1,880

Therefore, it can be observed that there is an excess of compaction capacity in the 400 kt/a and 800 kt/a scenarios, but none in the 600 kt/a scenario. The capital efficiency for the 600 kt/a scenario will therefore be highest, however the risk of underproducing to target is greater.

Figure 17.6: Principles of Potash Compaction



Source: Gilchrist Mining Ltd (2023)

Broken slab crushed and screened to recover 2 mm to 4 mm granules, over and under sized material returns to crusher and compactor, respectively. Typical yield 40% i.e. 40 t/h compactor feed will make 40 t/h granules.

Figure 17.7 illustrates recrystallised (white) standard potash and compacted granular MOP. Recrystallised standard potash contains a minimum of 60% K_2O , typically 100% <2 mm, 50% >0.6 mm. Compacted granular MOP also contains a minimum of 60% K_2O and 87% to 90% in the 2 mm to 4 mm range with less than 2% less than 1 mm.

Figure 17.7: Recrystallised (white) Standard Potash (left) Compacted Granular MOP (right)



Source: Uralkali (2009)

17.2.2.4 Product Storage

The produced MOP is stored before shipping in a covered shed with a capacity of at least one month's production. The shed will be split to cater for a standard potash pile and a granular pile. These can be delivered to the store by a common overhead conveyor which is run to empty between production campaigns. The two storage areas will be separated by concrete Stelcon walls at the base and have plastic suspended curtaining to prevent dust transfer between the piles.

Potash will be placed onto the piles using a proprietary “Cleveland Cascades” chute (Figure 17.8) which is industry-standard for facilitating gentle placement and so preventing granule damage.

Figure 17.8: Cleveland Cascades Chute Loading from an Overhead Conveyor into a Ship Hold



Source: Cleveland Cascades (UK) Ltd (<https://clevelandcascades.co.uk/> 2023)

Potash storage warehouses are commonly fabricated from timber in order to prevent corrosion of the structure. The base of the store is smooth concrete and smooth-bucket loaders are used to recover potash from the piles and deliver it onto a conveyor for onward transportation to a ship-loader (Figure 17.9). Granular potash is often re-screened at this point to remove particles less than 1 mm which are not desired by the customer and a light mineral oil is often applied to reduce inter-particle friction during transportation. Screenings (<1 mm) may be re-combined with the standard potash. The ship-loader will also be equipped with a Cleveland Cascades chute.

Figure 17.9: Inside a Typical Potash Storage Warehouse



Source: Uralkali (2009)

Sales contracts of the Cost and Freight (CFR) type are preferred by the potash producer as the latter charters the vessel and has the ability to dictate the LayCan terms, demurrage and despatch rates. This also allows the producer to manage the capacity of the storage warehouse effectively.

Vacuum salt produced by the process plant may be bagged directly upon production and will not therefore require the same bulk handling requirements as for MOP. Bagging would be conducted in accordance with customer requirements, most likely 1 t woven polythene bags which can be placed on pallets and shrink-wrapped or put into 40 ft containers.

17.2.3 Process Alternatives

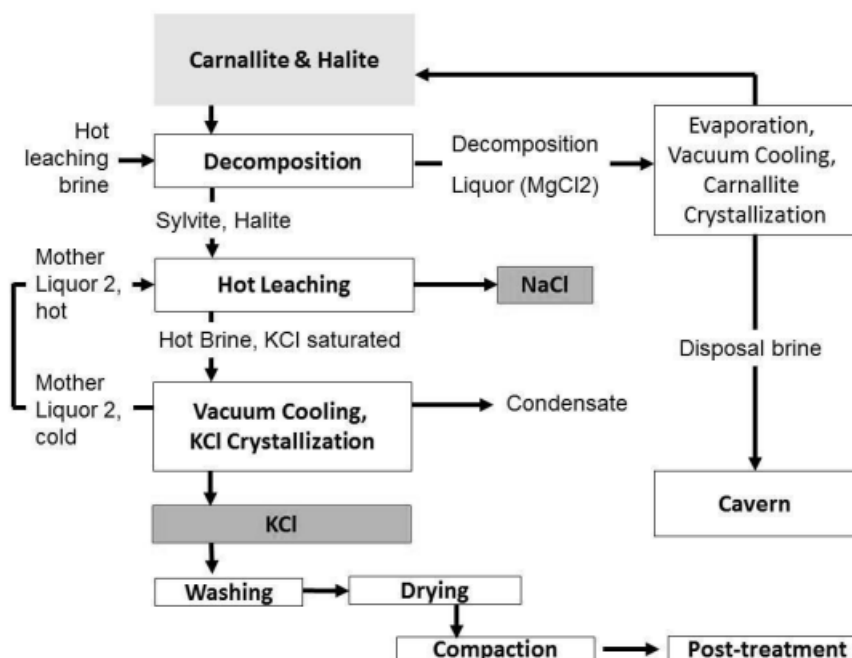
The process route described in Section 17.2 comprises a combination of evaporation and crystallisation to recover both NaCl and KCl solids. The capital and operating costs of this process route are derived from the intended capacity of each process option (400 kt/a, 600 kt/a or 800 kt/a) using factored capital costs from similar operations and supplemented by Micon's database. Micon is satisfied that both the conceptual process route and costing approach are well within the parameters of the level of definition required by a PEA.

The requirement for metallurgical testing is described in Section 13. The dissolving of carnallitic cores from the deposit under controlled conditions will indicate, amongst other things, the final composition of the brine which is to be leached from the caverns.

At the later feasibility stage, whether PFS or DFS, Millennial will seek to engage, directly or indirectly through an engineering contractor, with a specialist evaporation and crystallisation provider who will consider the final leach brine composition in presenting a process solution.

It is well known that the presence of $MgCl_2$ within the leach brine will have an impact on the solubility of the respective Na and K salts within the evaporation and crystallisation environments. In highly carnallitic solutions, it may be required to decompose a synthetic carnallite produced in a later process step in a decomposition evaporator. The decomposition process leads to the crystallisation of a KCl/NaCl mixture and the formation of $MgCl_2$ brine. The synthetic carnallite, intermixed with some NaCl coming from the evaporation and crystallisation unit, must be fed back into a counter-current stream. The principal flowsheet for this is shown in Figure 17.10.

Figure 17.10: Modification to Proposed Flowsheet for Highly Carnallitic Environments



Source: K-UTEC AG Salt Technologies, 2013

The requirement to provide a decomposition evaporator followed by a hot leaching tank will be determined during consultation with the selected process engineering provider during future work phases. Additional capital and operating costs associated with these are expected to be well within the level of definition already provided by this study.

18.0 PROJECT INFRASTRUCTURE

18.1 INTRODUCTION

The Banio Project infrastructure comprises the process plant and stockpiles, road and rail accesses, tailings management areas, and various utilities. The various facilities are described in this section and where relevant are elaborated on in Section 21.4.

18.2 PLANT SITE

The proposed processing plant site will be situated partway between the proposed mine site and the Mayumba Deep-Water Port, occupying a ± 60 km² clearing which is just south of the Mayumba Airstrip. By road, the proposed location for the process plant is approximately 50 km northwest of the proposed mine site and 6 km southeast of the proposed Deep-Water Port (Figure 18.1).

Figure 18.1: Banio Project Process Plant Related Infrastructure



Source: Micon, 2024

18.3 TAILING MANAGEMENT AREA

There is no proposed tailing management area for the Project as it is currently anticipated that all waste is either discharged into the ocean or backfilled into the depleted caverns.

18.4 LAND BASED TRANSPORT

Land based transport between the proposed Mayumba Deep-Water Port, processing plant and mine site would occur along the ~60 km stretch of pre-existing road which runs south from Mayumba to the proposed industrial area and mine site. The existing road would require significant upgrades to accommodate the transportation needs of the Project, as it is currently no more than an earthen track which is prone to inundation by vegetation and flooding. A capital cost estimate of US\$15 million was generated using a factor provided by the African Development Bank Group (ADB) for estimation of road costs in African environments. The proposed upgraded road would consist of a compacted laterite base (a local source is available) and asphalt surface, with culverts and drainage channels as required. As well as transport via road, brine would be transported from the proposed mine site to the process plant via two 500 mm diameter HDPE pipelines which would run alongside the previously described road (Figure 18.2). One pipeline will transport the development brine flow that will not be processed at the plant and the other pipeline will transport the higher-grade production brine.

18.5 MARINE FACILITIES

Two possibilities are under consideration for the export of products from the proposed mine as described elsewhere. The preferred option is the “Mayumba Deep-Water Port” option which offers significant logistic and cost advantages over the shallow-water alternative which requires the placement of product onto barges for subsequent trans-shipment at sea onto ocean-going vessels (Figure 18.3).

The port will be equipped with a 1,000 t/h ship-loader which can travel the quayside along the length of the vessel and direct the loading conveyor extension over the required hold. The ship-loader and delivery conveyors are operated by a company employee placed next to the open hold using a remote controller.

18.6 WATER SUPPLY AND BRINE DISPOSAL

Freshwater is to be extracted from the Banio Lagoon via a floating pontoon which is equipped with submersible centrifugal pumps. The pontoon will be connected to land by means of a floating walkway which will also carry the freshwater delivery pipeline and the electricity supply cable. On the delivery side of the pumps are mesh strainers to prevent the ingress of any large unwanted solids.

Raw water will be delivered to a shore-based sand filtration system which will automatically backwash to the Banio Lagoon once the filter pressure increases to a pre-determined level. The sand filtration system will remove suspended solids greater than 50 µm in diameter, filtered water will subsequently enter the suction ports of a set of high-pressure, multi-stage centrifugal pumps for delivery to the wellfield caverns at a wellhead pressure of 4 MPa.

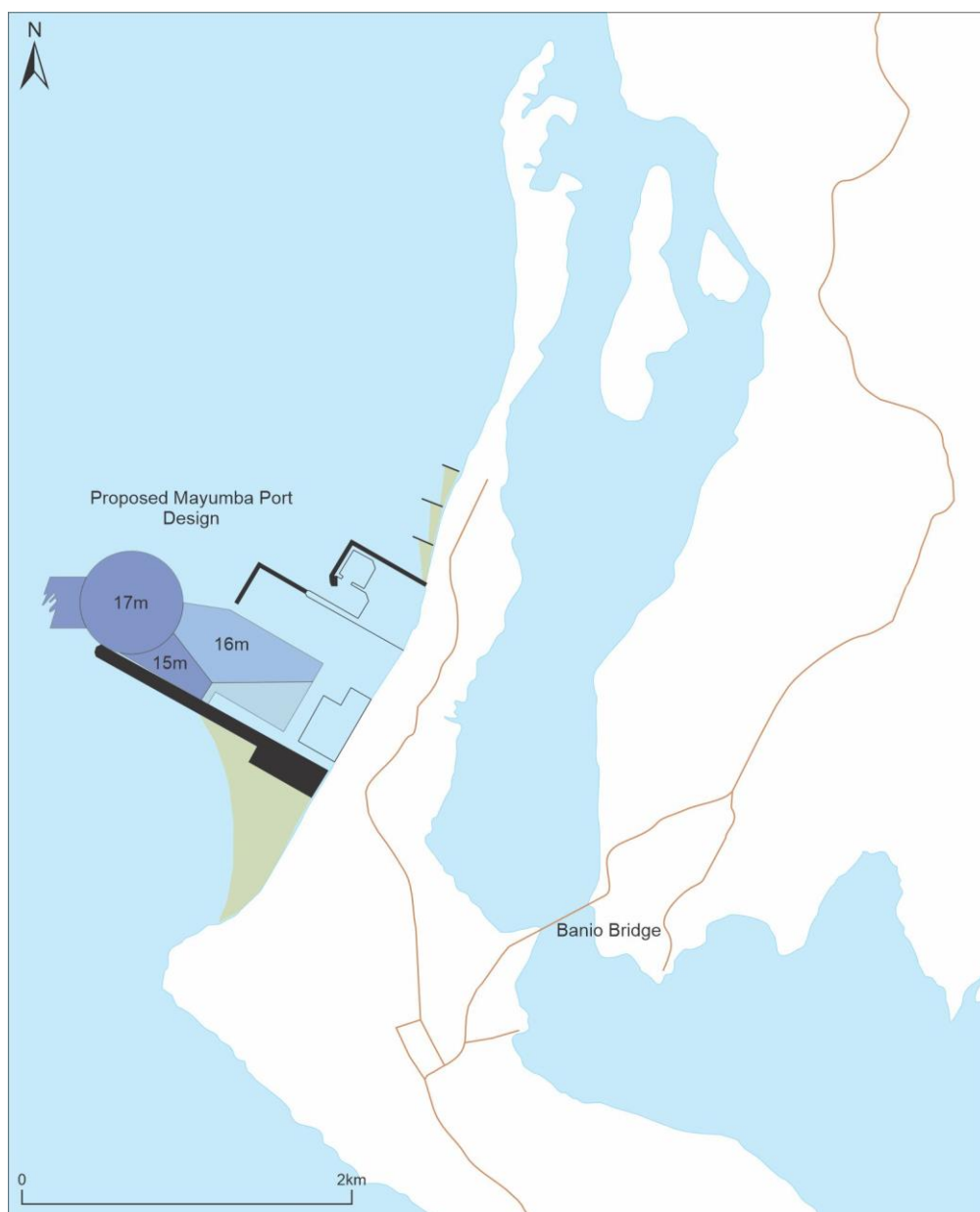
Brine will be disposed of from the process site via a discharge pipe directly into the ocean, but as outlined in the process flow sheet (Figure 17.1) this need for brine disposal may be reduced through production of an industrial-grade vacuum salt ($\geq 95.0\%$ NaCl). The pipe used for the discharge of brine would be the second of the two previously mentioned 500 mm HDPE pipelines.

Figure 18.2: Proposed Banio Project Infrastructure Overview



Source: Micon, 2024

Figure 18.3: Proposed Mayumba Port Location



Source: Micon, 2024

18.7 POWER SUPPLY

The principal source of power to the Project would be from a dedicated gas-fired power station which would utilise the local natural gas supply. Natural gas will be delivered via a pipeline from the current offshore rigs to the Mayumba area, where it will be refined and made available for onward delivery. The exact location of the shore-based refining plant is unknown, however it is assumed for the purposes of this study that the gas can be delivered to the Project's dedicated power station at the proposed industrial site. The inclusion of a dedicated power station will permit the Project a closer control of reliable power, ensuring a constant supply of "clean" electrical power. It's close proximity to the process plant will simultaneously permit the ducting of hot exhaust gas to the dryers which will benefit operating costs and has environmental advantages.

The combined heat and power plant (CHP) size has been calculated for each of the three options. The 400 kt/a option requires a 15 MW plant, the 600 kt/a option requires a 20 MW plant, and the 800 kt/a option requires a 30 MW plant. The breakdown between mining, plant and G&A has also been estimated. Although each option has a slightly different distribution, on average, the plant is approximately 75% of the power requirement, mining requires 15% of power requirement, and G&A, including port and camp etc. requiring the remaining 10% of power.

Table 18.1: Assumed CHP Plant Size for Each Different Option

Production Scenarios (kt/a)	Assumed CHP Size (MW)
400	15
600	20
800	30

19.0 MARKET STUDIES AND CONTRACTS

No material contracts are in place or under negotiation.

The information outlined in this section is based on publicly available information and market research reports delivered to Millennial by Argus Media Ltd. (Argus).

19.1 GLOBAL POTASH MARKET OVERVIEW

19.1.1 Potash Ores and World Reserves

Potash is a term used to describe different potassium salts used in agriculture and industry. The most common salts are potassium chloride, potassium sulphate, potassium-magnesium sulphate, and potassium nitrate. These salts are measured as the oxide of potassium (K_2O) since potassium is the element of interest. Potash resources are generally reported in metric tonnes of K_2O or equivalent metric tonnes of MOP, which is KCl (Mansanti, 2019).

Potassium salts are found in underground deposits formed by the evaporation of ancient saltwater bodies, inland drainage basins, and shallow sea lagoons. The natural brines of some lakes in arid and semi-arid regions of the continents are also significant sources of potash (Mansanti, 2019).

The most common naturally occurring potash mineral salts are carnallite ($MgCl_2 \cdot KCl \cdot 6H_2O$) and sylvite (KCl), with sylvite being the most economically important. Sylvinite ($KCl + NaCl$), a mixture of sylvite and halite, is the highest-grade ore source. Carnallite, when present in a sylvinite ore, is considered a contaminant. Carnallite ($MgCl_2 \cdot KCl \cdot 6H_2O + NaCl$), a mixture of carnallite and halite, is another important type of ore. (Mansanti, 2019; Warren, 2016).

Sylvinite ores are known for being relatively abundant and are the preferred ore for their high potassium chloride (KCl) content and lower processing costs. The high production rates from Canada, Russia, and Belarus are predominantly from such ores (Mansanti, 2019). The highest sylvinite ore grade is found in Canada, where Saskatchewan deposits contain approximately 40% KCl, while in other regions, ore extracted contains around 15% to 25% KCl (Argus, 2023). On the other hand, carnallite ores are less abundant than sylvinite ores, contain less K_2O , and are more challenging to beneficiate (Mansanti, 2019).

The estimated global potash reserves for the year 2022, according to the U.S. Geological Survey, are approximately 3,300 Mt K_2O equivalent. Most of these reserves are located in Canada (1,100 Mt), Belarus (750 Mt), and Russia (400 Mt). The estimated total resources of potash worldwide is approximately 250 billion tonnes (Jasinski, 2023).

19.1.2 Potash Products and Their Uses

Potash is mainly used as a source of soluble potassium in fertilisers. Potassium is one of the three primary nutrients that plants need to grow, alongside soluble phosphorus and nitrogen. The fertiliser industry uses over 90% to 95% of the produced potash. The remaining amount is used by the chemical industry to manufacture soaps and detergents, glass, ceramics, synthetic rubber, and various other industrial chemicals (Mansanti, 2019; Warren, 2016).

Retailers sell potash, or potash blended with other fertilizers, in dry or liquid form. The primary products of the potash industry are MOP, Sulphate of Potash (SOP), and sulphate of potassium magnesia (SOPM). MOP is the most widely used type of potash, constituting over 90% of the global

market. MOP fertilizer should have a minimum of 60% K₂O content. The final products are compatible with current agricultural products, such as granular, standard (unprocessed form), fine standard, and soluble (fine white product for liquid application) grades. Granular potash dominates the market. (Mansanti, 2019; Warren, 2016).

SOP and SOPM account for approximately 5% of the total fertilizer usage. These fertilizers are necessary for more delicate crops that may be affected by high levels of chloride. SOP must have a minimum of 50% K₂O, while SOPM must have a minimum of 19% K₂O content. They are available in granular, standard, and fine standard grades for the agricultural sector (Mansanti, 2019; Warren, 2016).

19.1.3 World Capacity, Production and Supply Outlook

Argus (2023) offers a comprehensive analysis of global potash supply by providing detailed information on capacity, production, and supply outlook. They provide nameplate capacity data for potash mines, and achievable production figures based on their calculation of how much a MOP mine can produce in a year. For SOP, they provide nameplate capacity only.

In 2023, the global MOP installed capacity was approximately 99 Mt, with Canada, Russia, and Belarus being the three major countries that dominate two-thirds of the global supply. Despite growing diversification in MOP supply over the past decade, the top ten producing countries still account for over 95% of global capacity.

The global achievable production of MOP is 81 Mt and Canada, Russia, and Belarus together account for two-thirds of it. The 10 largest MOP producers, including Nutrien in Canada, Belaruskali in Belarus, and Uralkali in Russia, are responsible for more than 90% of achievable production. Among these, Nutrien accounts for 18%, Belaruskali accounts for 17%, and Uralkali accounts for 13% of global production capacity.

China is the leading global producer of SOP, both as primary and secondary producer, with a production capacity of 7.7 Mt in 2023, which is about two-thirds of the total capacity of 11.9 Mt. China has been the main region for the expansion of SOP production, particularly in the secondary sector. However, due to the unsustainable growth rates, some facilities have been closed in recent years.

Argus (2023) provides a forecast for MOP and SOP production capacities based on their evaluation of the industry's project pipeline. The projects are categorised into four groups with decreasing levels of confidence: Firm, Probable, Possible, and Speculative (Figure 19.1). Their estimated installed capacity for MOP from 2023 to 2037 increases and averages around 105 Mt/a (Figure 19.2), and achievable production averages about 90 Mt. The total SOP installed capacity increases and averages about 12.4 Mt/a.

19.1.4 Demand Outlook

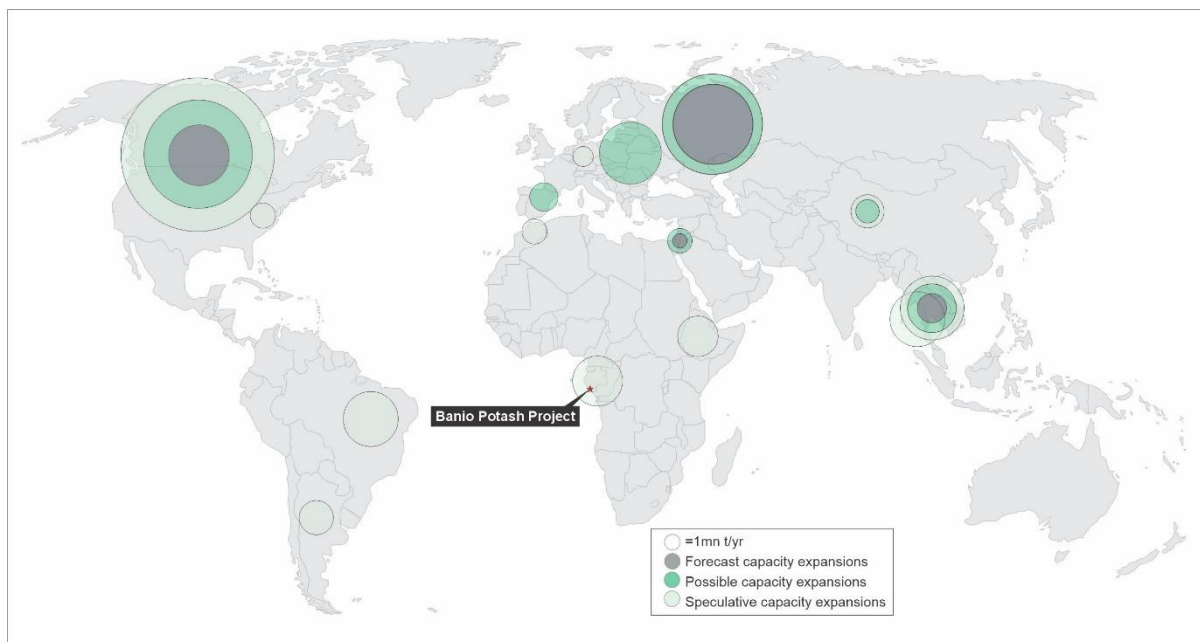
The demand for potash is primarily fueled by the need for fertilizers in agriculture, which helps to supply food to the growing global population. This demand can be attributed to several factors such as the increasing global population, rising crop yield requirements, changing dietary patterns, and soil depletion.

The Argus (2023) report bases its long-term expectations for potash demand on the long-term expectations for the agricultural sector. They forecast an increase in MOP demand to 77.7 Mt in 2027 and 86.4 Mt in 2037, versus the predicted 95 Mt of achievable production in 2037 (Figure 19.2).

Regional distribution of the MOP demand growth is dominated by South Asia (driven by India), southeast Asia (Indonesia and Malaysia), Latin America (Brazil) and China in northeast Asia (Figure 19.3).

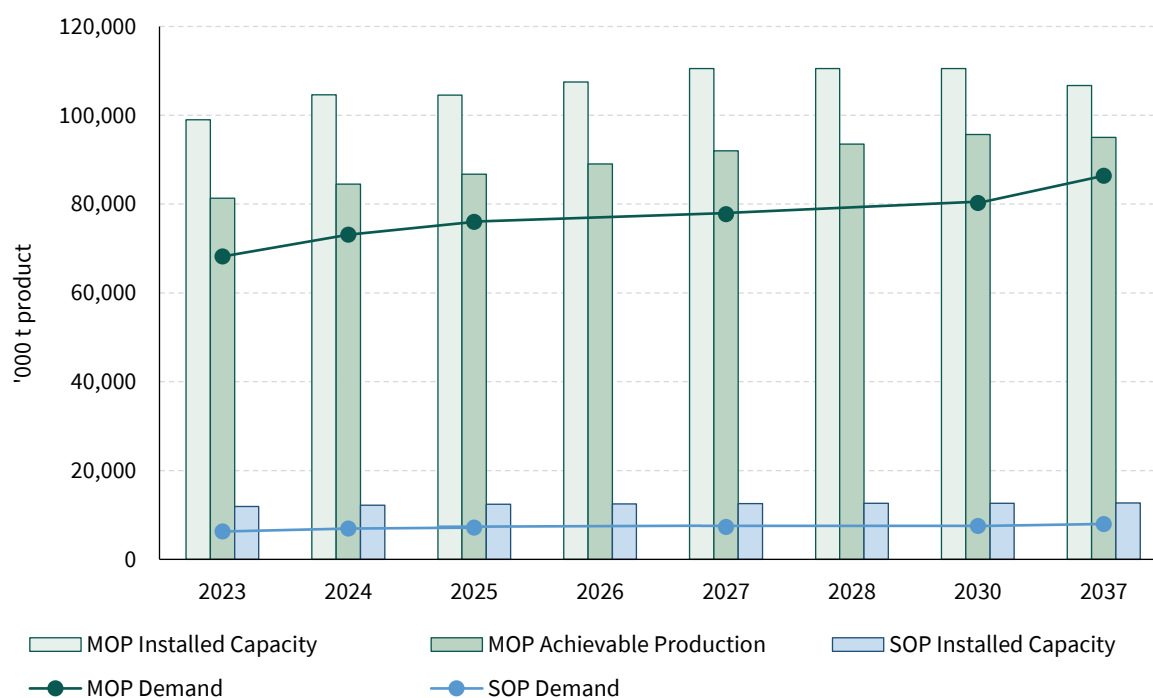
SOP demand is forecast to increase to 7.3 Mt in 2027 and 8.0 Mt in 2037, versus the 12.7 Mt of nameplate capacity by 2036.

Figure 19.1: Global MOP Capacity Expansions



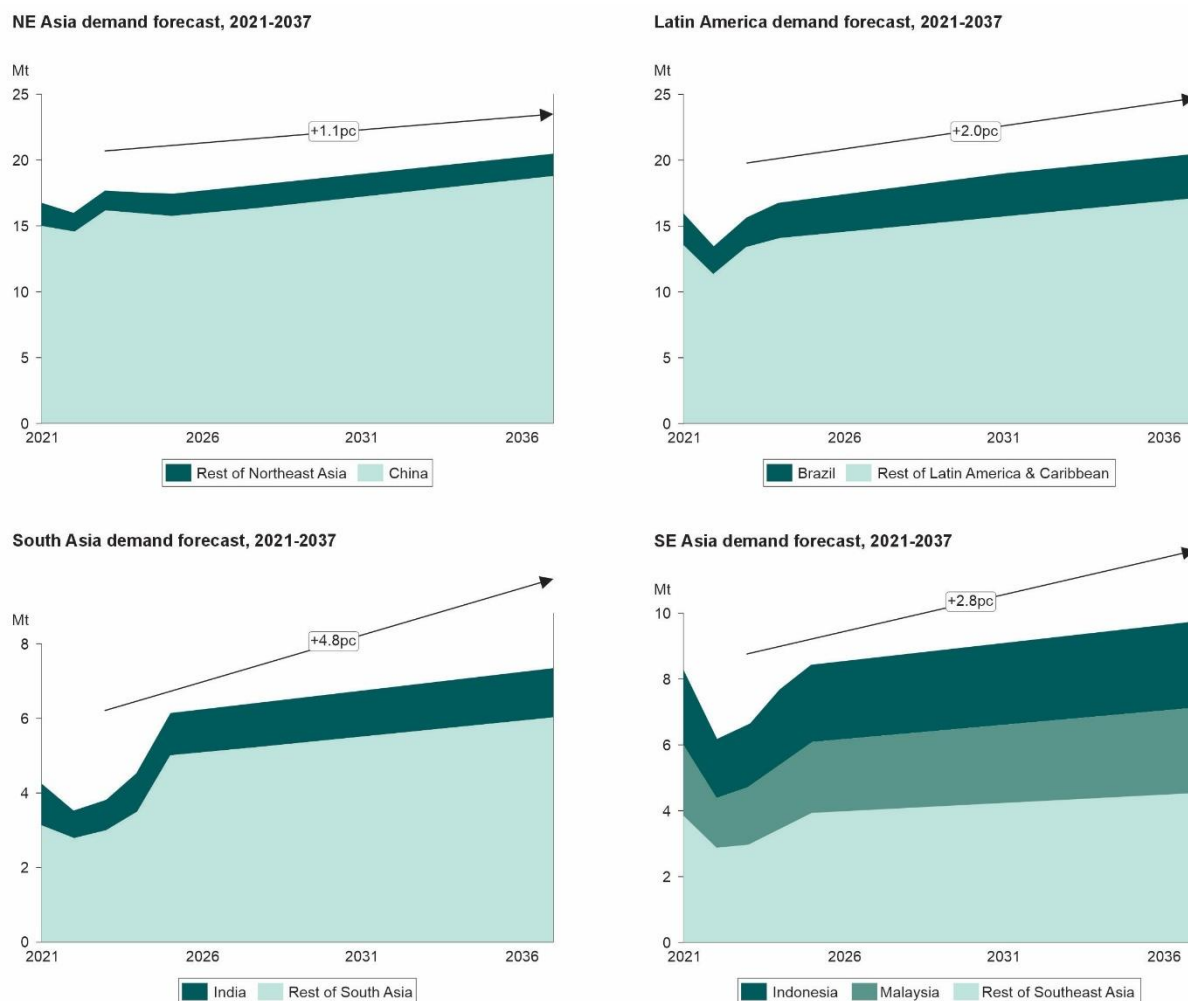
Source: Micon, modified from Argus (2023).

Figure 19.2: Global Totals of MOP and SOP Installed Capacity, Achievable Production and Demand



Source: Created from data provided by Argus (2023).

Figure 19.3: MOP Demand Forecast by Region



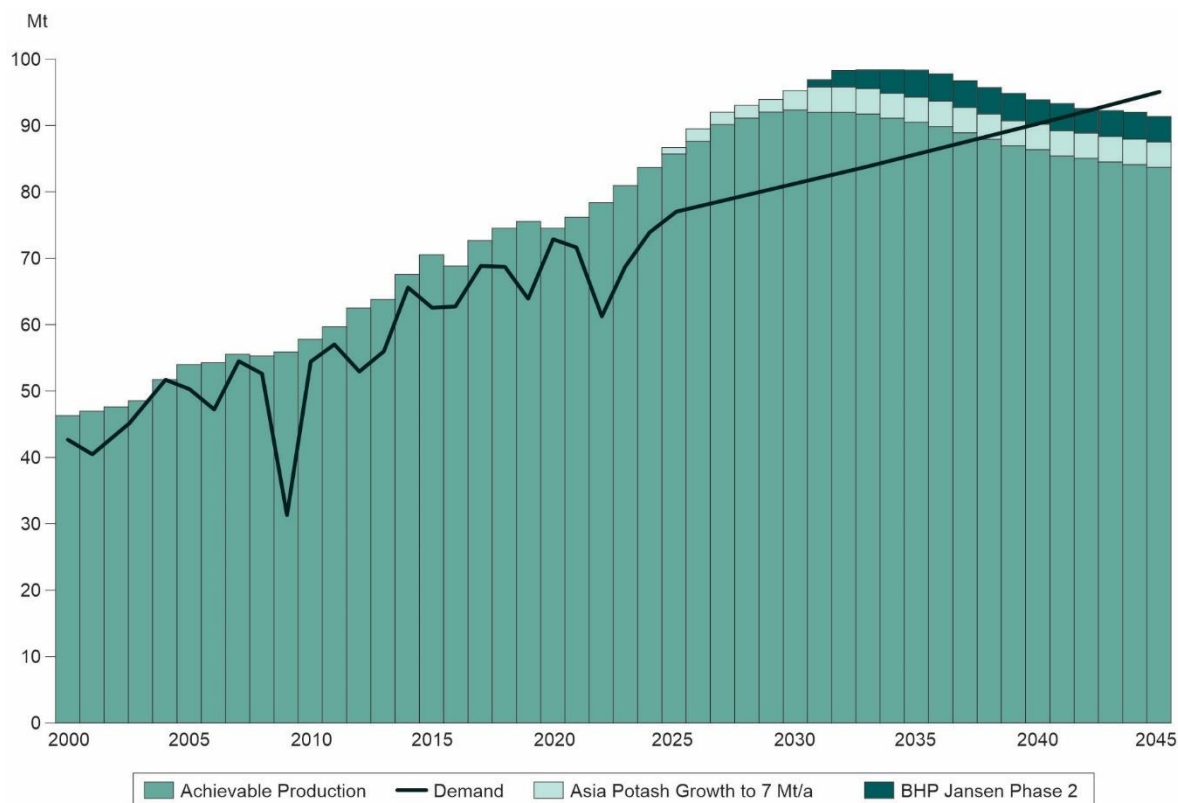
Source: Micon, modified from Argus (2023).

19.1.5 Supply and Demand Gap Analysis

Argus (2023) modelled the supply and demand gap up to 2045, considering the achievable production, mine closures and major projects commencing, results in oversupply until the year 2043 (Figure 19.4). It's worth noting that the impact of the disruptive sanctions on Russia and Belarus on MOP supply has not been taken into account, assuming that in the medium-term, Russia and Belarus will overcome the logistical issues posed by sanctions, and their capacity will return to historic levels on the traded market.

The same considerations are taken into account when predicting the SOP supply and demand gap, namely incorporating nameplate capacity with supply loss with a closure rate based on historical asset loss, a supply gap emerges in the mid to late-20s.

Figure 19.4: Global MOP Supply Gap, Achievable Production Basis with Second Phase of BHP Jansen and Further Development in Laos



Source: Micon, modified from Argus (2023).

It's worth noting that there is a significant difference between MOP and SOP. Although MOP supply is limited to a few countries, it is traded worldwide from these countries. On the other hand, more than 50% of the world's SOP capacity is in China, but not all of it is usable for trading purposes. Depending on the Chinese government's stance, China might be entirely excluded from the global market. If we exclude both Chinese supply and demand, projections reveal that demand will surpass supply by 2026 to 2027 without additional investment.

19.1.6 Price Controls and Outlook

Argus (2023) note the cost of MOP is mainly determined by the balance between its supply and demand. The prices of MOP are highly influenced by its affordability in the agricultural sector. The oligopoly of MOP suppliers is dominated by Canada, Russia, and Belarus. As a result, suppliers have some control over setting the prices of MOP, instead of relying on the market to determine prices. Thus, the prices of MOP are usually higher than the cash costs of the highest-cost producers.

Many of the major countries that consume a lot of products rely heavily, if not completely, on imports from overseas. Typically, these markets purchase products from a variety of suppliers, mainly because there are few cases where one supplier has a unique geographical or cost advantage. However, a notable exception is the US, which gets most of its supply from cross-border imports from Canada.

Most markets do business using spot trading, at current market prices. Although, some customers may form long-term relationships with a particular producer for future business. Global MOP prices

usually move together, as suppliers can shift shipments to whichever market offers the highest returns at a given time. This is due to the arbitrage between markets.

Since 2021, the MOP market has experienced an unusual period of separation and volatility, resulting in the development and decline of arbitrages (Figure 19.5). In the mid-2021, prices started to rise in the US and Brazil due to low fertilizer stocks in these countries, coupled with high affordability and demand, as well as the beginning of buying windows for seasonal demand. After a few months, these price increases led to upward trends in other regions as seasonal demand emerged in each market.

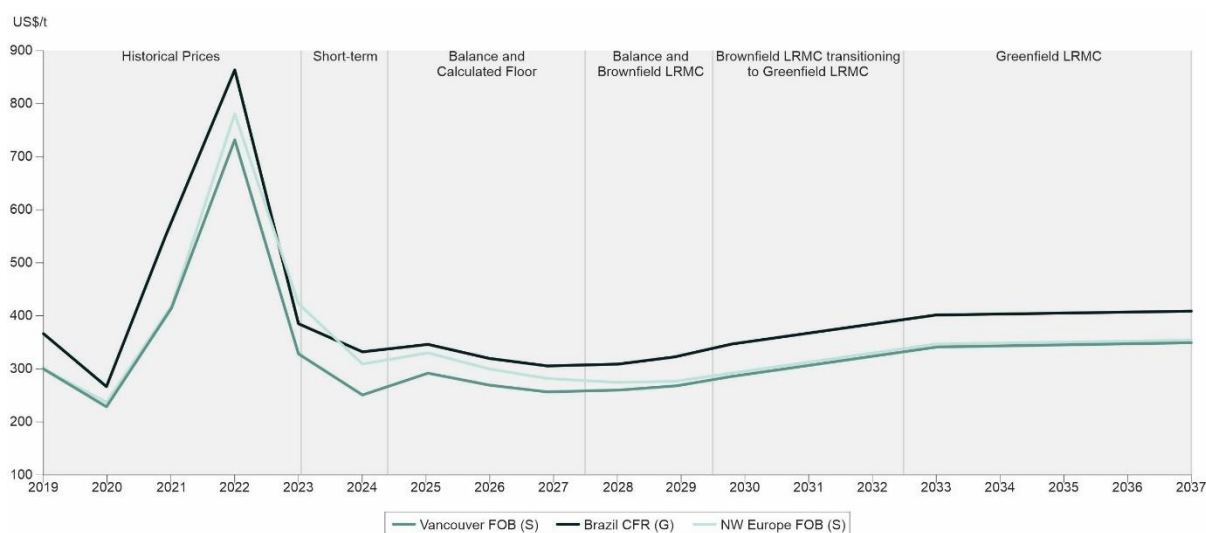
In 2022, the year started with a decrease in discount after China and India agreed on new contract prices in February. However, following Russia's invasion of Ukraine, spot market prices increased again, causing them to be out of sync with contract markets.

Moving on to 2023, the Brazilian and US markets are mostly in sync, with southeast Asian prices reaching the same level by mid-year. The European market, on the other hand, continues to trade at a premium due to a limited supply of available options. The difference between contract and spot markets has also largely diminished after new agreements made in the past year.

The Argus (2023) report provides short-term (1 month to 18 months), medium-term (1.5 years to 7 years) and long-term (up to 2037 (~15 years)) price forecasts. In the short term, prices are expected to remain stable in 2024 as demand from 2022 and 2023 should return to the market due to improved affordability resulting from lower fertilizer prices.

In the medium term, MOP prices will struggle to rise due to supply constraints from the Former Soviet Union (FSU) producers being removed or trade finding mechanisms to operate under sanctions. In the long term, prices are expected to be stable or gradually rise, following the trend of the Argus (2023) long-run marginal cost (LRMC) model.

Figure 19.5: Long-Term MOP Price Forecast, 2019-2037 (Real, 2022)



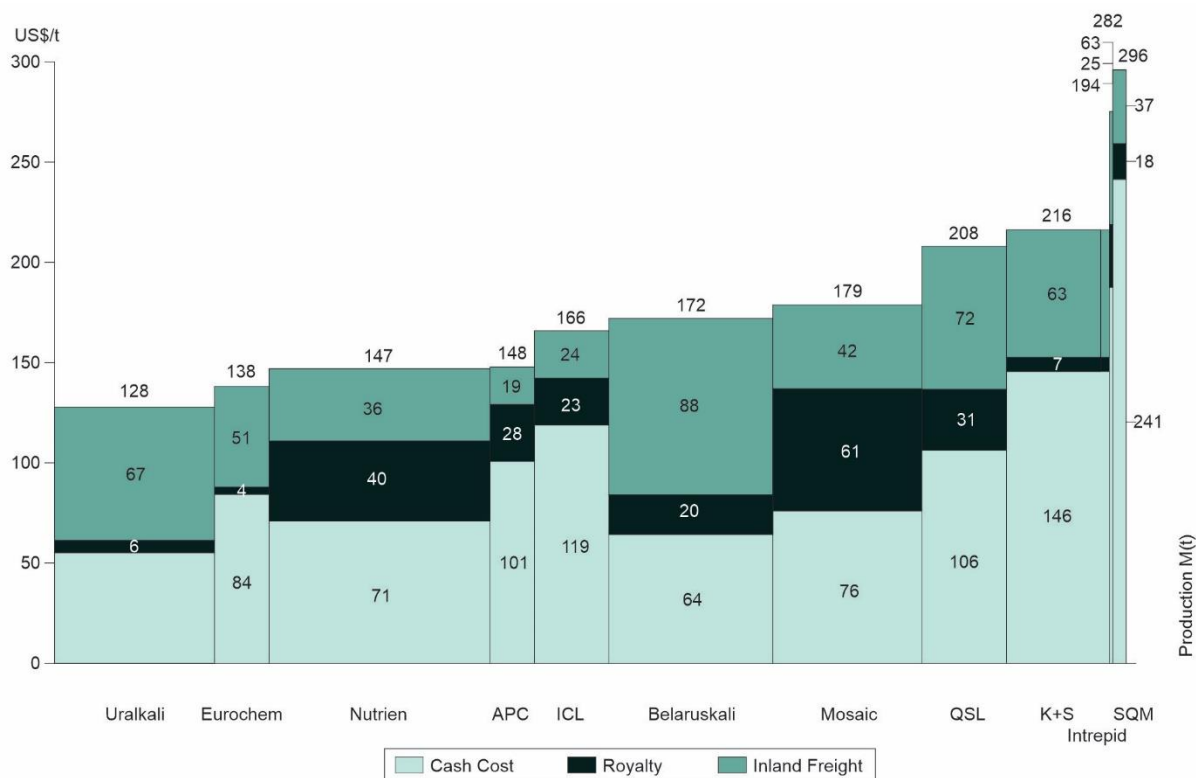
Source: Micon, modified from Argus (2023).

19.1.7 Cost Curves

The Argus (2023) MOP cash cost curve for 2023 shows a decrease in cash cost from 2022 due to the decline in energy prices, resulting in lower royalty payments (Figure 19.6). However, for 2024, there

may only be a slight decrease in costs as high gas inventories and mild weather have increased the probability of energy prices trending lower. Unfortunately, other costs are expected to rise due to the wider inflationary environment, which will offset the benefits of falling energy prices and lower royalties.

Figure 19.6: MOP FOB Cost Curve, 2023



Source: Micon, modified from Argus (2023).

19.2 THE OPPORTUNITY FOR THE BANIO PROJECT

Regional and international demand (Figure 19.3), regional price premiums (Figure 19.5), geographic location, export shipping routes (Figure 19.7), and associated freight costs drive the Banio Project's target market. As a result, the MOP produced from the Banio Project is planned to be exported and sold to the Brazilian market. However, it is worth considering the African potash market as an alternative option. Further details on both markets are provided in Section 19.2.1 and Section 19.2.2.

19.2.1 Brazil Potash Market

Argus (2023) highlight Brazil as the country with the most pressing need for potash. Brazil is one of the biggest importers of MOP (potash) in the world, and it is predicted that the demand for imports will increase in the future (Figure 19.3 and Figure 19.8). To supply potash to Brazil, long sea voyages are generally required, with only small quantities being imported from Chile and Bolivia. The next nearest suppliers are located over 3,500 miles away in western Europe.

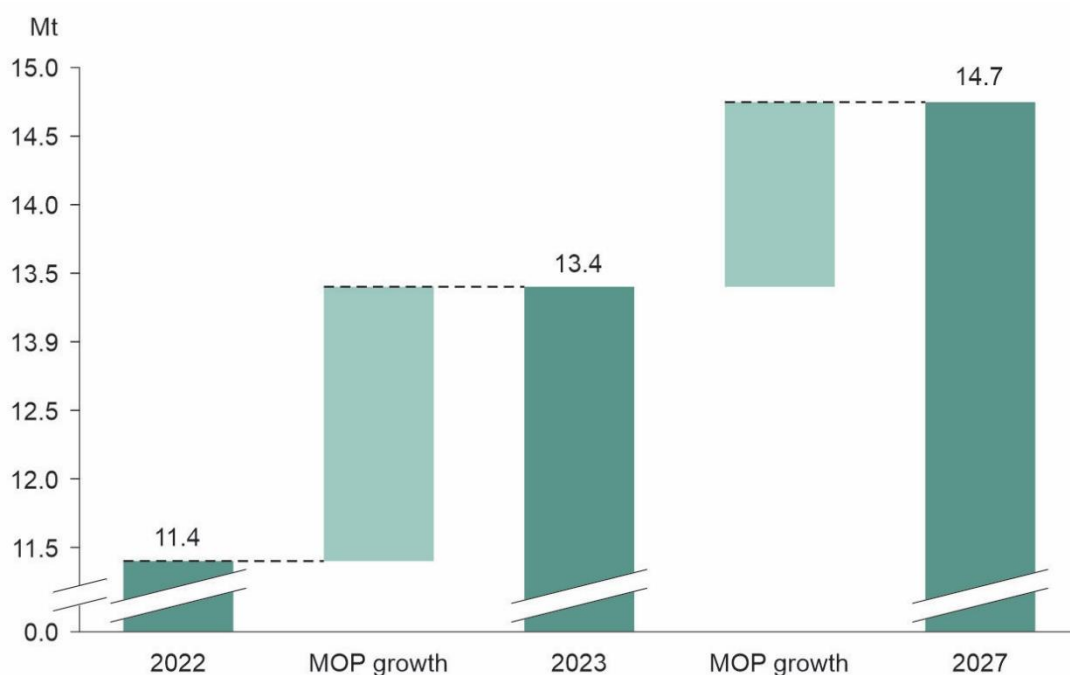
Despite the clear requirement for MOP, no production has emerged yet in Brazil. The only operating mine is also close to the end of its life. Proposals for new mines are still in their early stages, and are facing various challenges such as high capital costs, investment risks, high energy costs, environmental concerns, and internal infrastructure issues.

Figure 19.7: Export Shipping Routes from the Banio Potash Project



Source: Micon, 2024

Figure 19.8: Brazil MOP Demand Growth



19.2.2 African Potash market

Fertilizer usage in Africa is characterised by extremely low application rates. Although this factor provides exceptional demand growth potential, it has not yet resulted in any significant progress towards higher fertilizer use in the region.

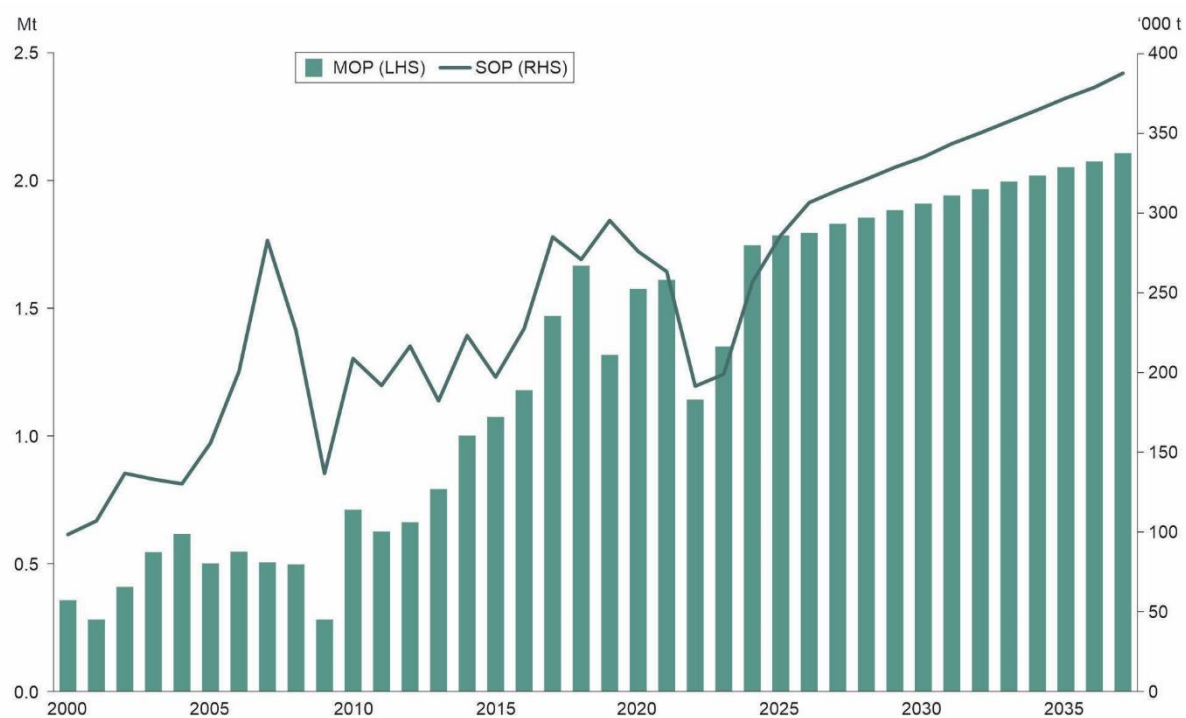
South Africa has traditionally been responsible for almost all of the region's consumption, but other countries like Nigeria and Egypt have seen an increase in demand in the past two decades. Meanwhile, South African consumption has grown at a far slower pace.

According to Argus (2023), demand growth for the remainder of the forecast is predicted to be 1.5% per year until 2037 (Figure 19.9). However, recent declines due to the Covid-19 pandemic and falling affordability have demonstrated the vulnerability of this potential growth. Some potassium demand growth will be met by growing NPK consumption, with large fertilizer producers such as OCP and Uralchem having invested in downstream distribution in the continent.

Despite the forecast demand growth, Africa currently has limited potash production and it is unlikely that this will change in the near future. The continent has very few economically viable sources of potash, and there are no commercial operations in place to develop the ones that do exist. Due to unpredictable operating conditions, investment in African projects has been difficult to attract.

The majority of potassium fertilizer production in Africa is concentrated in Egypt, where the largest producer of SOP is Evergrow. Evergrow uses the Mannheim process to produce a range of fertilizer specialties at two locations near Cairo - Giza and Sadat City. The company started producing SOP in 2015 and has since then expanded its annual production capacity to 360,000 t.

Figure 19.9: Africa MOP and SOP Demand Forecast



Source: Micon, modified from Argus (2023).

20.0 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

This section provides an overview of the environmental and social conditions at the Banio Project provided by ESS Sustainability to Millennial, it explains the environmental permitting status, and provides a summary and comment on how environmental, social and safety issues are managed by Millennial. Potential risk and technical issues relating to site facilities are outlined. Recommendations for potential future improvements are provided.

20.1 REGULATORY FRAMEWORK AND PERMITTING

The main government agencies that will be involved with the Banio Project are as follows:

- Ministry of Mines;
 - General Directorate of Studies and Laboratories (Direction Générale des Etudes et Laboratoires - DGEL);
- Ministry of Environment, Water and Forests, Responsible for the Preservation of the Environment, Climate and Human-Wildlife Conflict;
 - General Directorate of Environment and Protection of Nature (Direction Generale de l'Environnement et de la Protection de la Nature - DGEPN);
 - General Directorate of Forests (Direction Generale des Forets - DGF);
 - General Directorate of Wildlife and Protected Areas (Direction Generale de la Faune et des Aires Protégées - DGFAP);
 - General Directorate of Aquatic Ecosystems (Direction Générale des Equosysttemes Aquatiques - DGEA); and,
 - National Agency for National Parks (Agence Nationale des Parcs Nationaux - ANPN).

The Key Gabonese laws, regulations and policies that are related to Health, Safety, Environment and Communities (HSEC) issues concerning mining activities and are relevant to the Banio Project are as follows:

- *Law n°03/91* Constitution of Gabon (and subsequent amendments and revisions), 26th March 1991;
- *Law n°037/2018* regulating of the mining sector (Mining Code), 11th June 2019;
- *Law n°007/2014* Environmental Protection (Environmental Code), 1st August 2014;
- *Law n°16/93*, Gabon Guidelines for Environmental and Social Impact Assessment (ESIA), 26th August 1993;
- *Decree n°539/PR/MEFEPEPN*, Environmental Impact Assessment, 15th July 2005;
- *Decree n°543/PR/MEFEPEPN* relating to the legal regime applicable to classified installations, 15th July 2001;
- *Ministerial Order n°2/PM/MEPNRT*, 14th April 2006;
- *Decree n°3/PM/MEPNRT* control modalities of classified installations, 14th April 2006;
- *Law n°002/2014* regarding sustainable development, 1st August 2014;

- *Law n°00198/MRS/E/PN/CENAP* relating to the protection of water, 28th June 1979;
- *Decree n°542/PR/MEFEPEPN* relating to the dumping of substances in surface water or in the marine environment, 15th July 2005;
- *Law n°653/PR/MTEPN* relating to regulating spills of products in the environment, 21st May 2003;
- *Law n°16/01* relating to the forest code, 31st December 2001;
- *Decree n°541/PR/MEFEPEPN* relating to waste management, 15th July 2005;
- *Decree n°000451/PR/MEFEPEPN* regulating waste disposal, 15th July 2005
- *Decree n°00653/PR/MTEPN* on the preparedness and response to oil pollution, 21st May 2003;
- *Law n°3/2007*, related to the National Parks and the creation of the National Parks Agency, 27th August 2007;
- *Law n°015/2005*, Fishing and Aquaculture Code, 8th August 2005;
- *Decree n°189/PR/MEFCR* relating to the protection of wildlife, 4th March 1987;
- *Law n°03/94*, Labour Code, 21st November 1994, revised by *Law n°12/2000*, 10th December 2000;
- *Law n°28/2016*, Social Protection Code, 6th February 2017;

Millennial is committed to developing and managing the Banio Project in a manner consistent with best international industry practice and national legislation with a focus on sustainable development, minimisation of environmental and socio-economic risks, and obtaining a social licence to operate from the Project's communities and the host country.

To achieve this, the Project will strive to apply the "Applicable Standards" usually applied by international financial institutions, in addition to national legislation. These International Environmental and Social Standards, safeguards and guidelines are:

- Equator Principles (EP);
- International Finance Corporation (IFC) Performance Standards;
- The World Bank (General Environment, Health and Safety (EHS) Guidelines and EHS Guidelines on Mining); and,
- International Labour Organisation (ILO) Conventions for Freedom of Association and Protection of the Right to Organise.

20.2 ESIA REQUIREMENTS IN THE GABONESE REPUBLIC

20.2.1 Overview

Since the adoption of *Law n°16/93* dated 26th August 1993, Gabonese Republic has adopted several legislative and regulatory texts establishing an ESIA procedure prior to the implementation of any economic development project.

This is a powerful environmental management tool, whose fundamental principles, set out in *Decree n°539/PR/MEFEPEPN* dated 15th July 2005, enable the assessment of a project's impact on the

environment and, consequently, to limit their harmful effects through appropriate mitigation measures set out in the environmental and social management plan. An ESIA is mandatory where proposed projects or activities are likely to cause significant environmental effects (*Law n°16/93*). According to the guidelines from *Law n°16/93*, mining projects are listed in List A of the regulations as projects that require a mandatory EIA to be conducted before commencing with project activities. *Decree n°539/PR/MEFEPEPN* includes 17 categories of works that are subject to an ESIA.

The purpose of an ESIA is to evaluate the environmental implications (negative and positive) of carrying out a development project. The need for an ESIA depends on the scope of the project. All projects have repercussions on the environment, but not all projects are subject to detailed impact studies.

The General Directorate for Environment (Direction Generale de l'Environnement et de la Protection de la Nature - DGEPN) is the responsible authority for development and enforcement of environmental policy and legislation. The administrative procedure required by the DGEPN is listed in the procedure manual for the EIA (*Law n°007/2014* Appendix 1). This manual indicates how the promoter must proceed to obtain authorisation from the Environment Administration, as outlined in Section 6 of the manual. The procedures for issuing approval for carrying out environmental impact studies are regulated by *Order n°2/PM/MEPNRT* of 14th April 2006.

Decree n°543/PR/MEFEPEPN relates to classified installations and requires that an EIA must be undertaken for any developments that have the potential for environmental impacts.

The Gabonese Environmental Code, *Law n°007/14* outlines provisions regarding the protection of the environment in Gabon. The Code aims to promote protection and sustainable use of natural resources, reduce pollution and environmental nuisance, and improve and preserve living conditions.

The need for an ESIA depends on the scope of the project. Not all projects are subject to impact studies. *Decree n°539/PR/MEFEPEPN* outlines the regulatory requirements for undertaking an ESIA; the process, obligations and penalties. It also sets out the requirements for assessing impacts on the natural and human environments. The procedure required by the DGEPN is listed in the procedure manual for EIA (*Law n°007/2014* Appendix 1).

The *Decree n°539/PR/MEFEPEPN* also specifies that any project subject to ESIA requirements cannot be licensed and implemented until a satisfactory ESIA study has been completed and the project has been approved by the DGEPN. Project developers are required to implement any terms and conditions which the DGEPN may attach to his approval.

This procedure manual indicates how the company must proceed to obtain authorisation from the Environment Administration with the following steps:

- **Submission of the project notice to the DGEPN:** this corresponds to the presentation by the promoter to the DGEPN of general information on its project;
- **Site visit:** visit to the project site organised by the promoter and at his expense (*n°539/PR/MEFEPEPN* Article 2). The committee, within one month, must provide the promoter with a technical approval sheet which determines whether a study or an environmental impact notice is required for the project;

- **Drafting and submission of the Terms of Reference (ToR) to the DGEPN:** before carrying out the impact study, the promoter is required to draft the ToR which will serve as the basis for the study and submit them to the DGEPN for validation;
- **ToR scoping meeting:** a scoping meeting is organised at the DGEPN premises to assess the scope of the study to be carried out. The technical departments relevant to the project are required to take part;
- **Completion of the ESIA and public consultations:** the promoter carries out the impact study in accordance with the framework of the ToRs validated by the DGEPN. It is required to organise public consultations in order to gather the opinions of stakeholders (Ministries, Non-Governmental Organisations (NGOs), Institutions for research and preservation of the Environment, etc.) on the project. The minutes of the said consultations must be annexed to the final report of the impact study;
- **Submission of the ESIA report:** the promoter must send 15 copies of the impact study to the Minister of the Environment, in accordance with *n°539/PR/MEFEPEPN* Article 5;
- **Press release and opinion of the DGEPN:** After the submission of copies of the final report, the promoter publishes, for three days in a Gabonese daily publication, a press release calling for consultation of the study submitted to the DGEPN. The DGEPN then examines the impact study report and the minutes of the public consultations, and issues a reasoned technical opinion on the study.
- **Decision of the DGEPN:** After the technical opinion, the competent authority issues a certificate of conformity equivalent to a decision of approval in accordance with Article 5 Paragraph 2 of *n°539/PR/MEFEPEPN*.

The procedures for issuing approval for carrying out environmental impact studies are regulated by *Order n°2/PM/MEPNRT* dated 14th April 2006.

20.2.2 Roles and Responsibilities under Gabonese Law

20.2.2.1 Project Proponent

The responsibility for carrying out the ESIA lies with the promoter and/or petitioner. An ESIA shall be undertaken by an independent third party (consulting company). Project ESIA's must be completed in accordance with the corresponding sectoral Directive. ESIA's must be designed and prepared according to a scientific method, so as to identify and assess the consequences of the project on the quality of the environment. The project proponent is responsible for organising public consultations with the affected population during the development of an ESIA.

20.2.2.2 Consulting Company

This is an institution that can provide the required qualified professional working group, has demonstrated its ability to undertake the ESIA, and meets the requirements specified under the relevant laws. There is no specific requirement within *Decree n°539/PR/MEFEPEPN* for the consulting firm to be registered or accredited with the DGEPN or the Ministry of Water, Forests and the Environment.

The key responsibilities of the Consulting Company include:

- Having expertise in ESIA and management in accordance with the nature of the proposed activity and the legal requirements;
- Make available an interdisciplinary team, having solid technical skills and legal know-how, as well as local knowledge;
- Manage the participation of interested and affected parties in an acceptable manner;
- Have the facility to produce readable reports that are thorough and informative; and,
- Declare and ensure at all times that they have no vested interest in the proposed activity and observe all ethical values of the calling.

20.2.2.3 Licensing Agency

The environmental analysis is carried out by the DGEPN. It is the government agency that receives and validates the ESIA's ToR and report.

After submitting copies of the final report, the proponent publishes, for three days in a Gabonese daily, a press release calling for consultation of the study submitted to the DGEPN.

The DGEPN then examines the content of the ESIA's report and the minutes of the public consultations, and issues a reasoned technical opinion on the study.

The DGEPN issues a certificate of conformity which is a decision of approval in accordance with Paragraph 2 Article 5 of *n°539/PR/MEFEPEPN*.

20.2.2.4 Considerations in Determining Impact

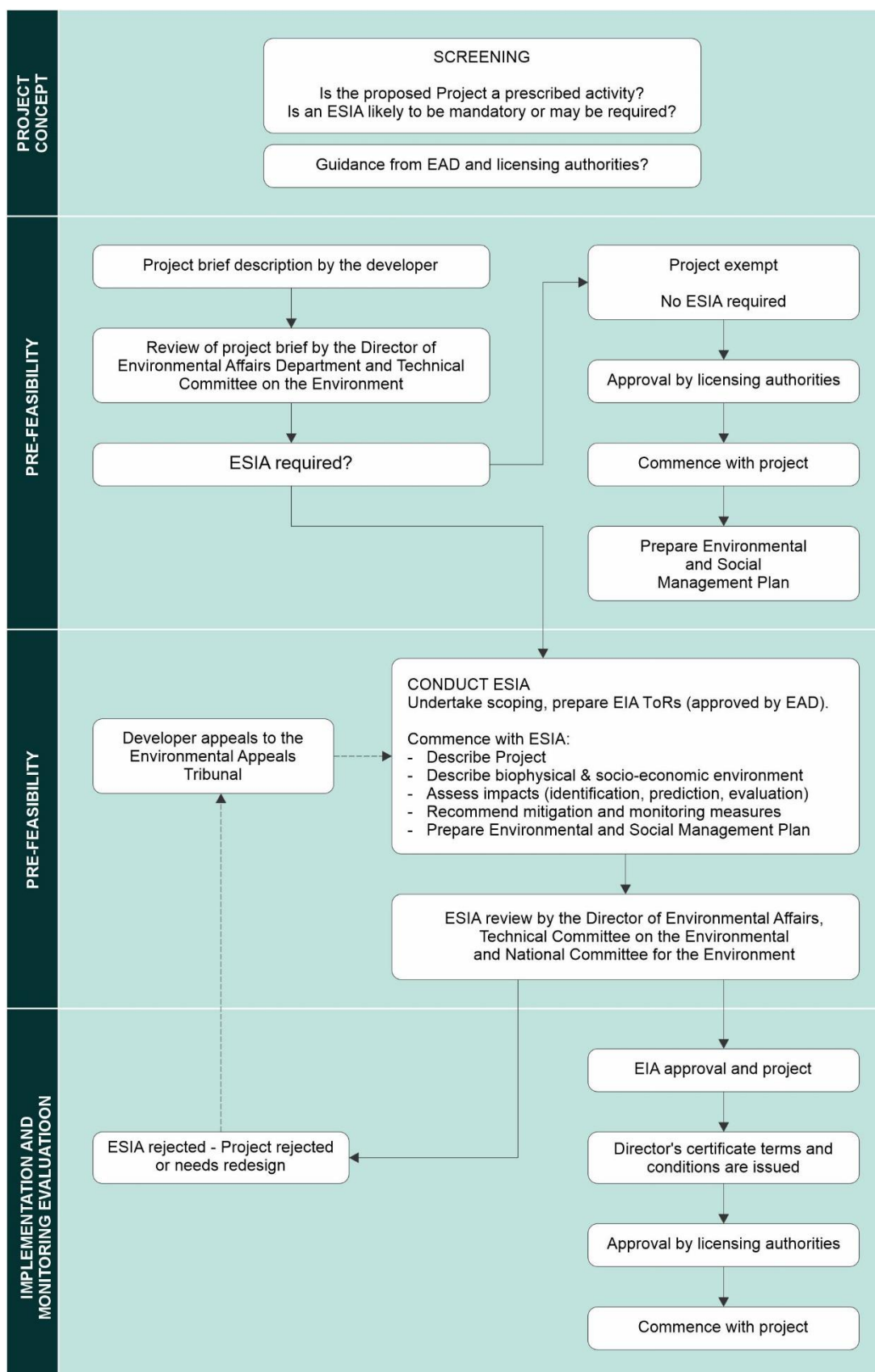
The impact of the project shall be assessed on the basis of the size, location, nature, cumulative effect with other concurrent impacts or phenomena, trans-regional effect, duration, reversibility or irreversibility or other related effects of the Project.

Millennial must ensure that the ESIA is carried out in consultation with the communities that could be affected in any area of the project: the local authorities will ensure that communities likely to be affected have been consulted and their views incorporated in the ESIA report.

20.2.2.5 ESIA Process

The approach employed in conducting an ESIA is outlined in Figure 20.1. This approach is detailed in the EIA Guidelines (1993) and ensures that potential and associated impacts are scoped into the Project Brief that is approved by the DGEPN.

Figure 20.1: ESIA Approach and Project Milestones



20.3 ENVIRONMENTAL AND SOCIAL CONTEXT

20.3.1 Project Setting

The Banio Project Licence area is bordered in the north by the Moukalaba-Doudou National Park, in the southwest by the Mayumba National Park and the Atlantic Ocean, in the south by the Gabonese / Congo border, and to the east by the Mayombe mountain chain.

The topography of the Project site exhibits contrasting features. It is characterised by the low-lying coastal plain, which transitions quickly to the elevation of the Mayombe mountain range. The area has a very dense hydrographic network composed of rivers such as the Djoungou, Dounvou, Loutsieni, Louzibi and Ouzibi Rivers and the Banio Lagoon (Figure 20.2).

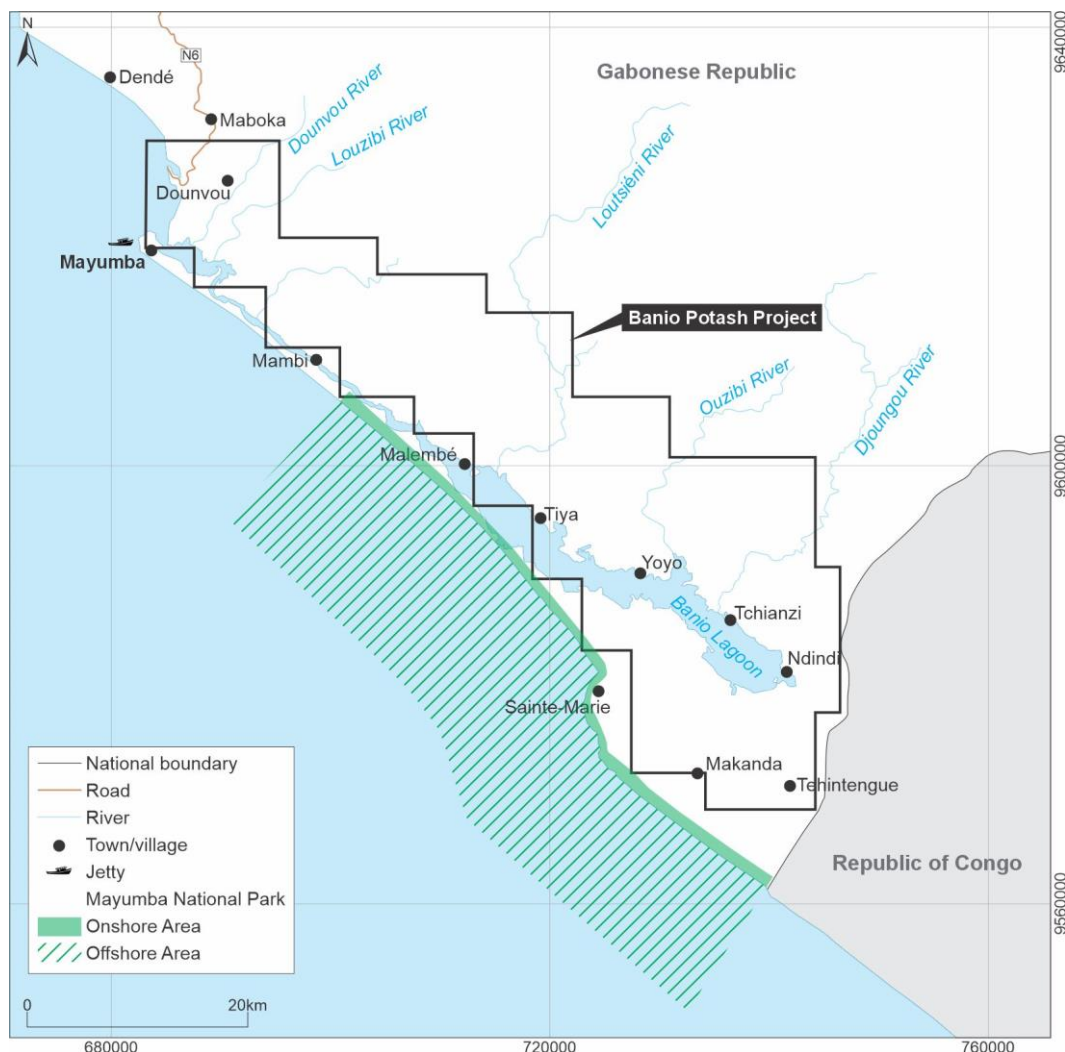
20.3.2 Flora and Fauna

The area has a diverse range of flora and fauna. The vegetation in the area is composed of the following mosaic vegetation; evergreen forest, savannah, flooded forest, secondary forest and mangroves. The savannah areas are protected in the Mayumba National Park and the Moukalaba-Doudou National Park. Flooded forests can be found in the Mayumba National Park, as it covers diverse ecosystems, such as rainforests, savannahs, freshwater lagoons, and coastal habitats. Secondary and naturally regenerated forests can be found in the vicinity of the Banio Project area and are the results of logging by local communities for firewood. Mayumba is not a region with industrial logging. Mangroves are widespread along the coastline and present also in the Mayumba National Park which borders the Project area to the southwest (Figure 20.2).

The area's hydrography and vegetation provide habitats for different varieties of terrestrial fauna. Most of the fauna in the Gabonese habitat is listed in the red list of International Union for Conservation of Nature (IUCN). The list of various animals in and around the licence area is as follows: elephant, African buffalo, leopard, gorilla, antelope, crocodile, hippopotamus, chimpanzee, several monkey species and leatherback turtle.

The coastal zone shelters coastal fauna and flora. The Gabonese Republic hosts the world's largest leatherback turtle nesting zone. Located west of the Project area, the nesting zone is approximately 60 km in length. The mangrove shelters juvenile marine species such as fishes, shrimp etc. The coastal reefs are the habitat of invertebrates that are food for olive ridley sea turtles. Humpback whales are nursing their young in the Gabonese sea before migrating south.

Figure 20.2: Banio Project Licence Area



Source: Micon, 2024

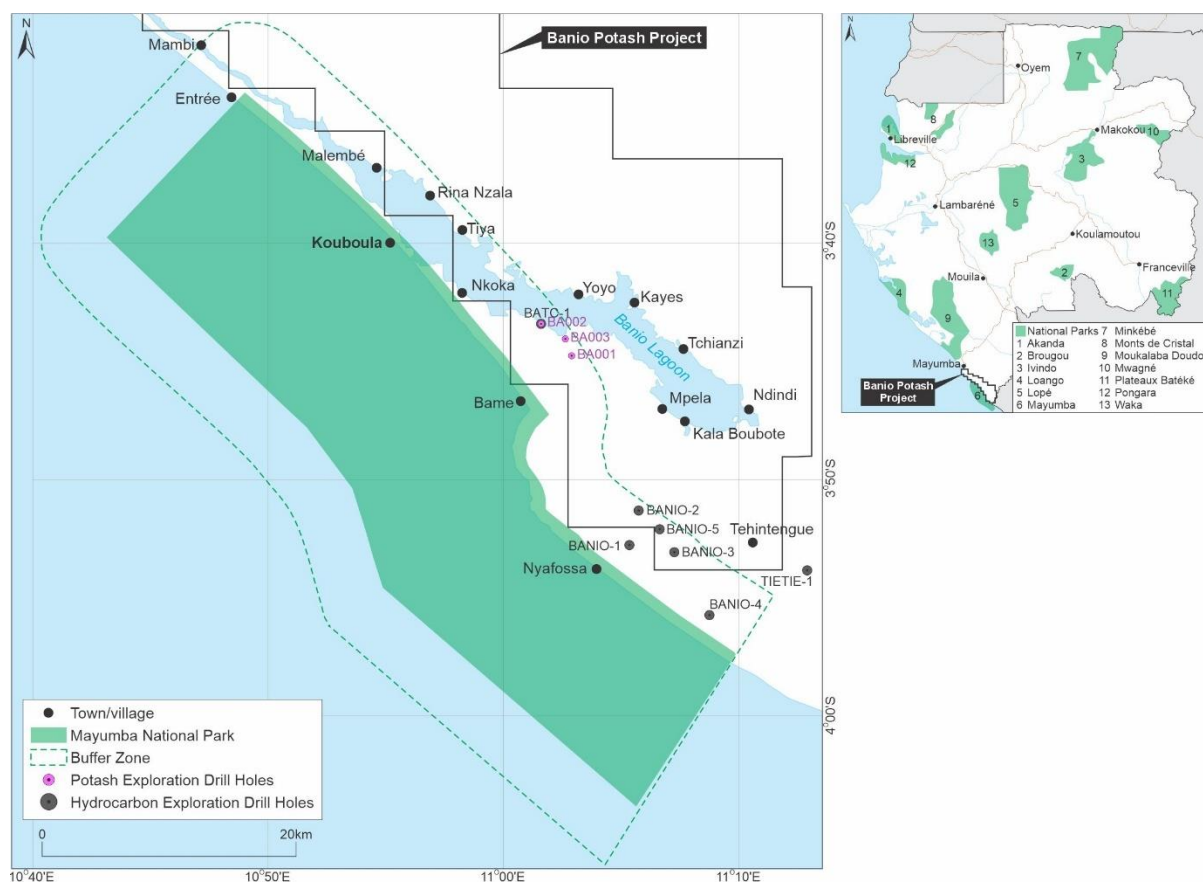
20.3.3 Mayumba National Park

The Mayumba Maritime National Park is located between Mayumba and the Congo border, it is a Gabonese protected area. The park was created in 2002 and it is the Gabonese Republic's first marine park. The park is protecting both the coastal area and marine habitats (Figure 20.3).

The park is comprised of a sea coastal area, a thin tongue of beach dunes, savannah and rain forest. The offshore area of coastal sea is 15 km by 60 km and the onshore area of beach and dunes is 1 km by 60 km. The onshore area of the park shelters 60 km of leatherback turtle nesting beaches, coastal vegetation and terrestrial animals. The offshore area protects marine habitats for dolphins, sharks and migrating humpback whales.

The vicinity of the Project to the Mayumba National Park, composed of terrestrial and marine protected areas, could present a potential risk to the park. The potentially affected area will be identified when the feasibility study and the EIA will be completed.

Figure 20.3: Mayumba National Park and Banio Project Area



20.3.4 Social Context

20.3.4.1 Population and Housing

The population density in the Project area will be relatively low as the national density is approximately 8.7 inhabitants per km². Three main ethnic groups are present in the Project area and cohabit regularly, these ethnic groups are: the Punu, the Loumbou and the Vili. The position of village chiefs is held by both women and men, but currently there are only two women out of ten chiefs.

The analysis of the built environment in the Project area, completed by ESS Sustainability, highlights the relatively low level of development in rural areas of the Gabonese Republic, particularly in the area targeted by the Project. Land use is minimal even along the roads and rivers. The predominant construction and housing patterns consist of rudimentary materials with limited use of modern and sustainable materials.

It was observed that elderly individuals mainly populate the villages. The lack of employment opportunities and high school dropout rates have led to significant rural-urban migration in the Project area. As a result, young people are concentrated in Mayumba, the urban centre, seeking education and employment opportunities. In the Project area, the economic structure is weak and almost non-existent.

The nearby communities include the following settlements: Mayumba, Mambi, Mallembé, Tiya, Yoyo, Nkoka, Mpola, Tchianzi, Kala Bouboté, and Ndindi (Figure 20.3).

20.3.4.2 Economic Activities

The majority of the population in the Project area derive their livelihood from agriculture, fishing livestock and hunting. The slash and burn agricultural system is practised for the cultivation of cassava, taros, macabo, yams, cucumber, plantains and sweet potatoes. Access to land is easy for the population.

The water network and the village's proximity to rivers make fishing a key activity for the community in the Project area. People of both genders in the area engage in fishing using different techniques. They typically catch a variety of fish species such as machoiron, mullet, sardine, sea bass, captain, and shrimp and oysters.

Hunting is the third economic activity practised after agriculture and fishing. Techniques used for hunting are trapping and rifle hunting. Porcupine, gazelle antelope, partridge, pigeon and python are the usual animals caught by the hunters.

Livestock farming is mainly practised for a social function. It provides social participation during mourning events, weddings, etc. The main livestock kept are poultry (primarily chickens and ducks), and ruminants (mainly sheep).

20.3.4.3 Health

The Mayumba Health Centre has limited resources and capacity to handle health issues. National health care access was approximately 53.7% in 2021. The health facilities are faced with issues of medicine procurement, human resources, and specialised services. In addition to this, the population often does not have the financial resources to pay for treatment. Consequently, traditional medicine is widely used by the community.

The Gabonese Republic is situated within the tropics where it experiences a tropical climate of two rainy seasons and dry seasons, respectively. The area records an average annual temperature of 26°C with a relative humidity of more than 80%. This weather condition favours the breeding of mosquitoes and multiplication of plasmodium parasites (Babajide et al., 2015). Malaria has been a major health challenge for the Gabonese Republic over the years due to its prevalence. It is the major cause of death of children between the ages of zero and five years old and pregnant women in the country. A study carried out by the Parasitology Department of University of Health Sciences (Département de Parasitologie de l'Université des Sciences de la Santé) in 2011 indicated a high prevalence of the disease in adults. The rate of mortality due to malaria is estimated at 68.4 per 100,000 population.

According to the national data on malaria presented during the quarter one of the African Leaders Malaria Alliance (ALMA 2023) Quarterly Report, the annual reported number of malaria cases in the Gabonese Republic in 2021 was 141,195 with 244 deaths. This data shows an increase in the number of malaria cases and deaths recorded in 2020 (127,500 cases of malaria with 224 deaths) (ALMA 2022).

Three species of plasmodium parasites are major causes of malaria in Gabon, namely *Plasmodium falciparum*, *Plasmodium malariae* and *Plasmodium ovale*. The *P. falciparum* is the most common species identified in 96.4% of positive smears completed during testing. This plasmodium species exhibits severe forms of malaria when contracted.

Efforts to eradicate have been difficult due to insufficient resources and evolutionary resistance of mosquitoes and plasmodium parasites to insecticides and medications, respectively. However, the Gabonese Republic seeks to reinforce its national programmes and services to fight against malaria.

Other major public health concerns are diarrhoea due to lack of hygiene and respiratory infections.

20.3.4.4 Goods and Services Accessibility

Generally, the Mayumba population has access to electricity, which the Gabon Energy and Water Company provides. In 2019, the national electricity cover in Gabon was 90.7%. The urban area was covered at 98.3% and the rural area at 24.2%. As the Project area is located in a rural area, which does not have access to electricity, most of the communities in the Project area use generators or storm-lamps.

Clean water is provided by public water networks or by a hydraulic pump systems. However, pump maintenance is not regularly undertaken, resulting in pump breakdowns and villagers having to obtain water from nearby watercourses.

20.4 ENVIRONMENTAL AND SOCIAL MANAGEMENT

20.4.1 Key Risks and Mitigation Measures

An identification and an assessment of the potential environmental and social impacts of the Project activities was undertaken and is summarised in Table 20.1. In March 2017, the Gabonese consulting firm Bureau d'Ingénierie, de Conseil et d'Expertise (B.I.C.E) conducted the assessment on behalf of Plymouth to produce an Environmental Impact Notice (French: Notice d'impact Environnemental or NIE). These impacts will be further refined as part of ESIA studies.

Table 20.1: Risks and Opportunities of the Banio Project

No.	Potential Impacts	Level	Expected Mitigation Measures
1	Disturbance of the physical properties of the soil	Low	• Monitor soil quality periodically
2	Soil and subsoil pollution by hydrocarbons, waste oils and other lubricants	Moderate	• Ensure mining equipment is well maintained • Avoid any contact of contamination (e.g. oil, fuel) with soil and/or sand • Minimise types and use of hazardous materials / wastes by design • Recuperate any spills and treat contaminated soils in a dedicated facility • Ensure adequate treatment of waters used on the project site • Monitor water quality (e.g. from processing, wastewater)
3	Imbalance of soil microbiological activity	Low	• Monitor the soil quality periodically • Avoid soil contamination
4	Water erosion	Low	• Protect the watershed by planting trees, implementing contours or by installing gabions.
5	Soil pollution by solid waste	Low	• Establish a waste management plan • Deposit waste in project landfill
6	Water pollution	Moderate	• Ensure exploration & mining equipment is well maintained • Avoid any contact of contamination (e.g. oil, fuel) with soil / sand • Minimise types and use of hazardous materials / wastes by design • Recuperate any spills and treat contaminated soils in dedicated facility • Ensure adequate treatment of waters used on the mine site • Monitor water quality (e.g. from process, wastewater) • Establish a wastewater management plan • Implement zero discharge to the Mayumba National Park and its buffer zone
7	Disturbance of the water flow regime	Low	• Avoid existing waterways and channels • Monitor and control water usage to avoid altering or negatively impacting watershed and water inflows
8	Altered air quality	Moderate	• Monitor and manage the air quality onsite and in the project vicinity • Identify different sources / types of emissions, and implement measures to avoid, mitigate and compensate
9	Changing the aesthetics of the natural landscape	Low	• Minimise land clearance • Monitor the landscape evolution periodically. • Engage qualified persons for the monitoring
10	Fragilisation by fragmentation of vegetation cover	Low	• Minimise land clearance • Undertake tree planting programme
11	Loss of vegetation cover	Moderate	• Minimise land clearance • Undertake tree planting programme • Minimise cut trees with a chainsaw • Adopt cutting practices that allow the natural regeneration of the forest

No.	Potential Impacts	Level	Expected Mitigation Measures
			• Reduce tree felling to the limit of what is possible • Do not cut trees larger than 10 cm in diameter • Avoid clearing land when it is not strictly necessary • Raise awareness among community and workers about the importance and role of trees • Recover all felled timber in order to build engineering structures (bridge in particular) • Work with the Conservator of Mayumba National Park • Prohibit the taking of plants
12	Modification of animal behaviour	High	• Monitor animal behaviour periodically • Engage qualified persons for the monitoring • Equip light sources with lampshades to direct light to the ground; • Limit as much as possible the noise coming from the generators, by the use of the latest generation equipment • Use the bare necessities of light sources and animal friendly lighting • Use the right amount of light by choosing a lamp power that meets the real needs • Turn on light sources as late as possible in the evening and turn them off as soon as possible • Limit the use of horns • Do not use a flash when taking pictures of animals • Minimise maintenance at night of equipment and other equipment that will produce noise likely to disturb animals and remove them from their usual habitats • Undertake the strict necessary work at night • Search for options to minimise impact from drilling operations on the local flora and fauna • Limit night travel to what is strictly necessary.
13	Destruction of wildlife habitat	Moderate	• Monitor the evolution of the wildlife habitat • Collaborate with Mayumba National Park • Engaged qualified persons for the monitoring • Undertake measures to address the impact • Limit the areas to be opened to a strict minimum; • Develop internal regulations that must prohibit any slaughter of animals and any transport of animal remains; • Prohibit the destruction of the mangrove, a spawning ground and nursery for several aquatic species. • Implement zero discharge to the Mayumba National Park and its buffer zone
14	Disruption of the vegetative cycle	Low	• Monitor the evolution of species in the areas • Collaborate with Mayumba National Park • Engaged qualified persons for the monitoring
15	Workers' exposure to accidents and heavy work	Low	• Identify the potential risk and hazard • Establish an effective induction • Provide Personal Protective equipment to each employee
16	Risk of contracting diseases	Moderate	• Raising awareness of disease contamination • Implement a health centre on the Project site • Provide medicines to the employees.

No.	Potential Impacts	Level	Expected Mitigation Measures
			• Avoid breeding areas of parasites (stagnant water, market gardening, ponds and others); • Cover all containers, located within the base life, containing water; • Use insecticides and insecticide-treated mosquito nets in the living area; • Have a first aid medical kit; • Use only bottled or mineral water as drinking water; • Provide domestic water analysed at the base; • Ensure the implementation of the waste management plan.
17	Job creation	High	• Maximise employment in local communities • Provide training to local communities to maximise their employability
18	Risks of social conflicts	Low	• Establish a code of conduct and ethic for the mine employee • Implement a grievance mechanism system • Consult frequently and collaboratively with all stakeholder to ensure win-win solutions whenever possible • Maximise the employment and training of Gabonese, with priority given to the host communities
19	Public Safety Risks	Low	• Sensitise the community about the risk and safety measures • Fencing the site
20	Noise pollution, vibrations	Moderate	• Monitor noise and vibration in several areas around the site • Address measures to minimise the noise and the vibration • Implement a grievance mechanism system • Equip workers with PPE ; • Set up safety barriers in populated areas; • Search for options to minimise noise and vibration during drilling operations • Inform the neighbourhood before the start of the work. • Compensate any negative impact
21	Improved quality of life through job supply and human presence	High	• Comply with any relevant legislation and standards relating to working conditions • Pay a living wage • Provide health and social coverage • Promote a healthy and safe working environment • Aspire to improve gender balance when hiring employees
22	Improvement of the quality of life through the sale and exchange of goods.	High	• Provide goods and services locally • Fairtrade with the suppliers and contractors • Support small businesses by consuming the products available in the markets
23	Increasing prevalence of STIs/HIV-AIDS	Moderate	• Sensitise workers about the transmission of STIs/HIV-AIDS • Distribute condoms when leaving the base life.
24	Facilitation of hunting activities	Moderate	• Raising awareness among the populations of the site and surroundings on hunting activities
25	Poaching risks	High	• Prohibit hunting on the project site during the exploration campaign

No.	Potential Impacts	Level	Expected Mitigation Measures
			• Raise awareness among site staff and populations about the effects and consequences of poaching • Regularly supply the base, in order to avoid food shortages • Apply the Company's environmental procedure highlighting the prohibition of hunting, transporting and consuming game. Sanctions will be imposed to those who will not comply with the procedure • Set up a monitoring committee and, if necessary, report the presence of poachers to the Conservator of Mayumba National Park.
26	End of staff employment contract	Moderate	• Provide employment certificates to employees at the end of their contract in order to facilitate their professional reintegration • Support community-based private initiatives.
27	Loss of income for all categories of populations involved	Moderate	• Establish a stakeholder engagement • Compensate affected people
28	Regulatory incompliance with environmental, social and other related issues	Moderate	• Legislation Register • Monitor closely the implementation of the register • Continuously improve Millennial management systems, its team and its actions to ensure a profitable Project for the Company shareholders while delivering on the above commitments.

20.5 HEALTH, SAFETY, ENVIRONMENT AND COMMUNITIES (HSEC) TEAM

20.5.1 Team and Resourcing

In order to proactively address the environmental, social, and governance (ESG) risks to the Project and ensure its compliance with the Applicable Standards, Millennial has enlisted the support of ESS, which has dedicated teams of experienced Health, Safety, Environment and Communities (HSEC) specialists in the mining sector across Africa.

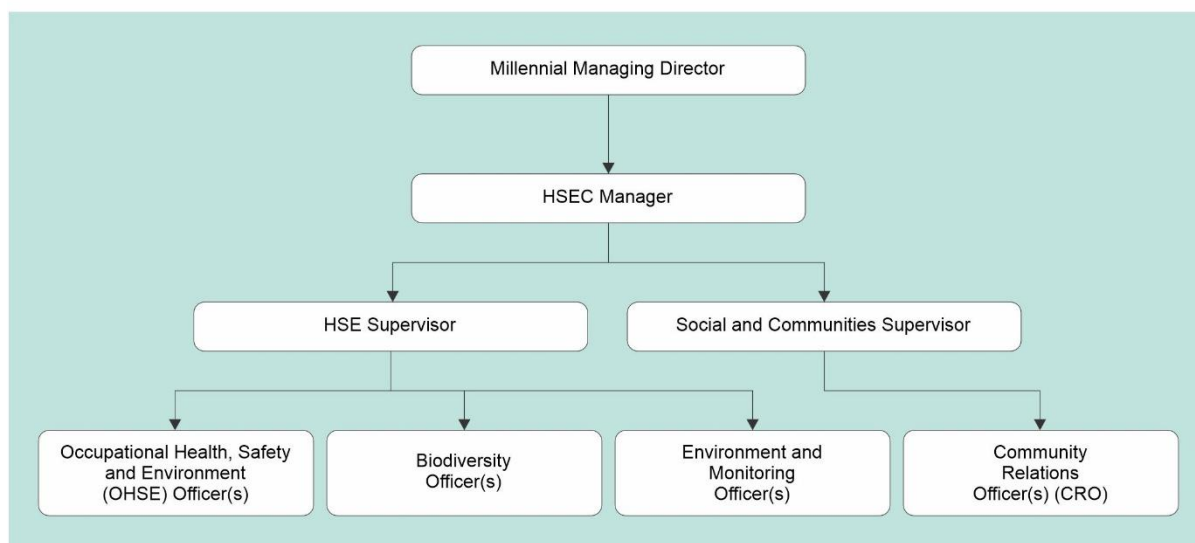
ESS Sustainability will implement an HSEC team for Millennial responsible for managing ESG and sustainability considerations and ensuring implementation of these issues at each Project lifecycle stage. The team will have the capacity, including management support, resources and budget, to effectively manage risks and impacts associated with the Project.

The HSEC team will vary over time, with the HSEC Manager role being the main responsible person throughout the Project lifetime.

The HSEC Manager in line with key international standards (i.e. ISO 14001, ISO 45001 etc.), will report directly to the most senior Millennial Director and work with all other departments to ensure the Project's compliance with the Health, Safety, Environment and Communities Management System (HSECMS) requirements.

Over time and at its maximum operational extent, the team is likely to comprise the following roles detailed in Figure 20.4.

Figure 20.4: HSEC Team Structure



Key responsibilities of the HSEC team include:

- Develop and implement an HSECMS and associated documentation to ensure that the ESG and sustainability engagements are clearly defined, and the path to achieving them is transparently set out;
- Liaising with Government, financiers and other key stakeholders on ESG and sustainability issues to safeguard the Company's interests as well as those of society and the environment; and,
- Undertake regular auditing and monitoring to ensure the achievement of the HSECMS requirements and regular and transparent reporting, including national reporting to the regulatory agencies of the Gabonese Republic.

20.5.1.1 Monitoring

The Project HSECMS will ensure that HSEC aspects and impacts are monitored in a documented and controlled manner. Data will be collected regularly for various HSEC risks inherent in the Project activities and reported daily, weekly and monthly by the HSEC manager.

Table 20.2 demonstrates the monitoring activities to be undertaken by the HSEC team.

Table 20.2: Monitoring Activities to be Undertaken by the HSEC Team

Occupational Health & Safety Environment	Community Health & Safety	Environment & Biodiversity	Communities and Stakeholders
• Training, awareness and competence • Audits • Injuries • Incidents • Near-Misses • COVID-19 Cases	• Communicable disease • Traffic related risks and impacts • Other Project related safety, security incidents	• GHG emissions • Air emission (in particular dust) • Noise emissions • Waste water emissions • Water quality and flows • Waste production • Hazardous materials management • Soil management • Water and/or energy resources management • Biodiversity management	• Stakeholder engagement • Community development • Community consultations • Grievances

20.5.1.2 Reporting

The HSEC team will ensure that transparent, regular reporting is undertaken both within Millennial and to key stakeholders, in line with national and international requirements. Specifically in the following points:

- Report to the Project key stakeholders and interested parties on the ESG and sustainability performance regularly, in line with the World Economic Forum (WEF) Framework and the Global Reporting Initiative (GRI). The WEF ESG metrics are designed to be transparent, addressing the concerns and issues relevant to Project stakeholders. Millennial will ensure that all relevant aspects of the ESG performance are addressed, the ESG aspects significance being evaluated beforehand through an adequate materiality assessment;
- Prepare and disclose an annual monitoring report that outlines the annual ESG and sustainability performance against the Reference Framework;
- Report to the Project key stakeholders and interested parties on its general experience and progress towards implementing the ESMS and ESG commitments quarterly and annually; and,
- Provide regular and timely reporting to relevant regulatory agencies of Gabon.

20.6 MANAGEMENT SYSTEM

Millennial will continually assess, monitor and improve its environmental performance by implementation of an HSECMS, which outlines the organisation's strategies and tools to manage different aspects of the environmental performance.

Once the Project enters construction and eventually operations, the following documents are expected to comprise Millennial's HSECMS:

- Strategic Documents
 - ESG and Sustainability Strategy; and,
 - Community Investment Strategy.

- Policies
 - HSEC Policy;
 - Security Policy;
 - Human Resources Policy;
 - Supply Chain and Procurement Policy;
 - Anti-Corruption and Bribery Policy;
 - Child Labour and Forced Labour Policy;
 - Professional Ethics Policy;
 - Drugs and Alcohol Policy and,
 - Whistleblower Policy.
- Procedures
 - HSEC Screening;
 - Incident Investigation;
 - Occupational Health and Safety Risk Assessment;
 - Task-Specific Hazard Assessments;
 - Recruitment Procedure;
 - Permit to Work;
 - Simultaneous Operations Procedure;
 - Supply Chain Due Diligence;
 - Chance Find; and,
 - Site Visit Procedure (part of Workers Accommodation Plan).
- SOPs
 - PPE;
 - Heat Stress;
 - Hazmat Management;
 - Confined Space;
 - Stacking of Items;
 - Hot Work;
 - Lockout/Tagout (LOTO);
 - Work at Height;
 - Excavations;
 - Safe Lifting;
 - Scaffolding;
 - Concrete Work;
 - Explosives;
 - Pilling; and,
 - Fumigation.
- Management Plans
 - HSEC Management Guidelines;
 - Emergency Preparedness and Response Plan;

- Occupational Health and Safety Management Plan;
- Security Management Plan;
- Traffic, Transport and Safety Management Plan;
- Contractor Management Plan;
- Community Development Plan;
- Community Health and Safety Management Plan;
- Local Content Plan;
- Stakeholder Engagement Plan;
- Communication Plan;
- Influx Management Plan;
- External Stakeholders' Grievance Redress Mechanism;
- Workers Grievance Redress Mechanism;
- Workers Accommodation Management Plan;
- Malaria Management Plan;
- Hazardous Materials Management Plan;
- Waste Management Plan;
- Water Resources Management Plan;
- Air Quality, Noise and Vibration Management Plan;
- Environmental Monitoring Plan;
- Resource Use and Energy Efficiency Management Plan;
- Biodiversity Action Plan;
- Cultural Heritage and Archaeology Management Plan;
- Construction HSEC Management Guidelines;
- Commissioning and Oversight of Security Management Plan;
- Communicable Diseases Management Plan;
- Management of Change;
- Livelihood Restoration Plan;
- Mine Reclamation and Closure Plan; and,
- Pest Management Plan.
- Key Procedures, Permits and Conformance Documents
 - HR Manual including Key Policies;
 - HSECMS Manual;
 - HSECMS Framework;
 - Company Compliance Declaration;
 - Induction;
 - Security Code of Conduct;
 - Personal Protective Equipment Register;
 - Job Safety Analysis Form;
 - Permit to Work Forms;
- Other Key Documents

- Legal Register;
- Stakeholders Database and Matrix;
- Commitments Register; and,
- ESG Register.

20.7 CONCLUSIONS AND RECOMMENDATIONS

The EIA, completed by Plymouth and accepted by the Gabonese Government in 2017, remains in effect allowing the current planned exploration activities to continue on the Project.

For drilling further south on the Banio Project area Millennial may need a new EIA study to be completed and approved by the DGEPN. Therefore the next step will be for Millennial to engage an independent Environmental Consultancy company to assess whether a new EIA study is required (see Section 20.2.2.2 and 20.2.2.5).

Millennial must ensure that if an EIA is required that it is carried out in consultation with the communities that could be affected in any area of the Project. The local authorities will ensure that communities likely to be affected have been consulted and their views incorporated into the EIA report.

21.0 CAPITAL AND OPERATING COSTS

21.1 INTRODUCTION

As discussed in Section 16.0 of this Report, mine plans were developed for three different production rate options. Capital and operating costs have also been estimated for these three mine plans.

21.2 MINING

21.2.1 Capital Costs

21.2.1.1 Capital Cost Estimation Basis

Solution mining with vertical caverns is the presumed mining method for extracting the potash at the Banio Project. Mining costs are limited to the elements of the wellfield, including all capital and operating costs for well pads and wellfield pipelines connected to the main pipelines that transport brine from the wellfield to the processing plant. Subsurface activities include well drilling, casing, and cementing as well as workover operations consisting of perforating, downhole geophysical logging, submersible pump installation and maintenance, sonar surveys, and oil blanket injection. Costs were estimated in United States (US) dollars. Well pad costs assume that a well pad will consist of compacted gravel and will service a single cavern.

The main pipelines from the wellfield to the planned processing plant are not included in this wellfield capital costs. Only the wellfield pipelines that connect the initial wells to the main pipelines are included in this wellfield capital costs. The wellfield pipeline extensions that will be required as production progresses are considered in sustaining capital.

The cost data for the estimates consist of vendor quotes for the various operations - drilling, coring, casing supply and installation, casing cementing, downhole logging, perforating, submersible pump supply and installation, and casing cutting - required for construction and operation of the wells used to access the production caverns. These quotes were obtained from Agapito's database of recent vendor costs compiled for feasibility studies (FSs) and prefeasibility studies (PFSs) prepared for several solution mining projects in North America and Africa. The cavern replacement rate used to define the annual sustaining capital cost requirements was defined by the LoM Plan cavern schedule developed by Agapito and discussed in Section 16.0 of this Report.

The estimate corresponds to an Association for the Advancement of Cost Engineering (AACE) International Class 5 estimate (AACE International, 2020) with an expected accuracy range of +/- 30% (costs are rarely significantly underestimated, except in special circumstances such as a severe recession when vendors are hungry for work).

21.2.1.2 Production Well Capital Cost Estimate

Capital costs for solution mining in the subsurface consist of the costs to construct the wells for the initial caverns. Based on the LoM Plan, on average of 35, 50, and 68 caverns are required in simultaneous production to meet the production targets of 400 kt/a, 600 kt/a, and 800 kt/a MOP for solution mining, respectively. Capital costs to construct injection and production (extraction) wells include costs for the following items:

- Drilling and casing installation;
- Casing and tubing supply;
- Casing cementing;
- Sample coring (one well of every 10);
- Downhole geophysical logging;
- Drilling mud; and,
- Rentals, supplies, and consumables.

Agapito has an in-house cost database containing direct quotations obtained for all the above items from multiple vendors for other solution mining projects between 2010 and 2023. The vendors were asked to provide unit prices for major line items such as daily equipment rentals and hourly crew costs. Because well construction uses oilfield service companies, unit prices are heavily dependent on the level of activity in the oil and gas industry. If activity in the oil industry picks up significantly, prices for some items, notably casings and drill rig day rates, could increase substantially.

21.2.1.3 General Drilling Contractor

General drilling contractor unit costs were based on data collected by Agapito between 2010 and 2023 for projects in North America and Africa. Costs for one well are presented in Table 21.1.

Assuming 10 days (uncored) to 11 days (cored) per well and allowing for moving, each rig can drill approximately two wells per month; therefore, the initial wells will be completed in one or two years by two rigs. Depending on their maintenance history, the rig may require demobilisation back to the Contractor's shop for inspection and maintenance during the drilling campaign. Thus, Agapito assumes that 2, 3, and 4 mobilisations and demobilisations are required for drilling the initial production wells for the options with 400 kt/a, 600 kt/a, and 800 kt/a MOP, respectively.

Table 21.1: General Drilling Contractor Costs for One Well

Item	Unit	Unit Price (US\$)	Units per Well	Cost per Well (US\$)
Crew Size	man	-	11	-
Day Rate, Operating	day	20,000	10	200,000
Day Rate, Moving, Rigging Up, Tearing Out	day	20,000	0.167	3,340
Subsist	man-day	140	112	15,657
Loader	day	556	10	5,560
Boiler (assume 50% utility)	hour	76	240	18,240
Crew Vehicle	day	415	10	4,150
Well Permit Review	well	1,000	1	1,000
Total				247,947

Driller mobilisation and demobilisation costs depend on the distance between the site and an available rig. Because the wells are relatively shallow, Agapito assumed that a truck-mounted rig such as a Schramm T685WS would be used. Other required support equipment would include mud mixers, shale shakers, a drill pipe trailer, a flat-bed truck for pallets of mud and cement sacks, a utility truck and a trailer for the mud logger and core storage. Because the identity of the drilling contractor and its drills are currently unknown, mobilisation to the site was assumed at a cost of US\$20,000. The mobilisation and demobilisation costs are assumed to be the same or US\$40,000 for both.

21.2.1.4 Casing and Tubing Material

Agapito's cost database contains data from casing and tubing suppliers in the US and Canada covering the period from 2010 to present. Casing and tubing costs are presented in Table 21.2.

Table 21.2: Casing and Tubing Supply Costs

Item	Unit	Unit Price (US\$)	Average Units per Well	Cost per Well (US\$)
Conductor: 406.4 mm, 111.6 kg/m, J-55, ST+C	m	185.00	16	2,960.00
Surface Casing: 298.5 mm, 69.9 kg/m, J-55, ST+C	m	115.00	100	11,500.00
Intermediate Casing: 269.9 mm, 60.3 kg/m, J55, ST+C	m	93.00	200	18,600.00
Production Casing: 219.0 mm, 35.7 kg/m, K55, ST+C	m	55.00	280	15,400.00
Leaching String: 139.7 mm, 25.3 kg/m, K-55, LT+C	m	32.00	530	16,960.00
Tubing: 88.9 mm, 11.5 kg/m, EU T&C	m	27.00	530	14,310.00
Total				79,730.00

Note: ST+C = short threaded and coupled; LT+C = long threaded and coupled

21.2.1.5 Casing Cementing

For casing cementing, Agapito's database includes quotes for both conventional and lightweight cements. The cost for conventional cement, which is typically significantly cheaper than ultra-lightweight cement, is presented in Table 21.3.

Table 21.3: Well Casing Cement Cost

Item	Unit	Unit Price (US\$)	Units per Well	Cost per Well (US\$)
Conductor				
Pumping Services	Well	720.00	1	720
Handling and Delivery	Sack	16.24	41	666
Surface Mix + Additives	Sack	16.00	41	656
Wooden Cementing Plug	Each	162.00	1	162
Sub-Total				2,204
Surface Casing				
Pumping Services	Well	720.00	1	720
Handling and Delivery	Sack	16.24	141	2,289
Surface Mix + Additives	Sack	16.00	141	2,256
Wooden Cementing Plug	Each	162.00	1	162
Sub-Total				5,427
Intermediate Casing				
Pumping Services	Well	720.00	1	\$720
Handling and Delivery	Sack	16.24	271	4,400
Surface Mix + Additives	Sack	16.00	271	4,336
Wooden Cementing Plug	Each	162.00	1	162
Sub-Total				9,618
Production Casing				
Pumping Services	Well	720.00	1	720
Handling and Delivery	Sack	16.90	128	2,163
Lead: Lite Mix + Additives	Sack	33.42	128	4,277
Rubber Drillable Top Cementing Plug	Each	162.00	1	162
Rubber Drillable Bottom Cementing Plug	Each	162.00	1	162
Sub-Total				7,484
Total				24,734

21.2.1.6 Coring

Agapito's database includes quotes for both conventional coring and wireline coring. As shown in Table 21.4, wireline coring is faster, but slightly more expensive if the day rates for the drill rig are not considered. However, when the day rates for the drill rig for the extra day required for conventional coring (compared to coring with a wireline and then reaming) are included as in Table 21.4, wireline coring becomes not only faster but economical as well.

Table 21.4: Well Coring Costs

Item	Unit	Conventional Core Barrel			Wireline Core Barrel		
		Unit Price (US\$)	Units per Well	Cost per Well (US\$)	Unit Price (US\$)	Units per Well	Cost per Well (US\$)
Coring time per well	day	-	1.25	-	-	0.62	-
Cost per metre cored plus cutter replacement and core box supply	m	231.00	300	69,300	281.60	300	84,480
Core supervisor day rate plus subsistence rate (two shifts)	day	3,650.00	2	7,300	7,500.00	1	7,500
Coring jar rental	well	2,400.00	1	2,400	-	-	-
Accessory package (pup joints, crossover subs, core barrel inspection)	well	880.00	1	880	-	-	-
Additional drilling rig time	day	20,000.00	0.89	17,857	20,000.00	0.26	5,257
Fixed mobilisation	well	3,450.00	1	3,450	5,175.00	1	5,175
Total				101,187	-		102,412

21.2.1.7 Downhole Geophysical Logging

For downhole geophysical logging, Agapito's database includes quotations for open- and cased-hole logging. Costs for open-hole logging are presented in Table 21.5; costs for cased-hole logging are presented in Table 21.6. Operating costs include an allowance for cased-hole logging events associated with perforating at each operating cavern.

Table 21.5: Open Hole Downhole Geophysical Logging

Item	Unit	Unit Price (US\$)	Units per Well Run 1	Cost per Well Run 1 (US\$)	Units per Well Run 2	Cost per Well Run 2 (US\$)
Service and Setup	each	995.00	1	995.00	1	995.00
One-way Travel	hour	400.00	1	400.00	1	400.00
Open-Hole Logging						
Array Induction Resistivity (depth)	m	0.84	280	236.58	530	447.81
Array Induction Resistivity (operation)	m	0.84	280	236.58	530	447.81
Density (depth)	m	0.94	280	261.92	530	495.78
Density (operation)	m	0.94	280	261.92	530	495.78
Neutron (depth)	m	0.74	280	208.41	530	394.50
Neutron (operation)	m	0.74	280	208.41	530	394.50
Gamma Ray (depth)	m	0.23	280	64.68	530	122.43
Gamma Ray (operation)	m	0.23	280	64.68	530	122.43
Sonic (depth)	m	0.79	280	222.49	530	421.15
Sonic (operation)	m	0.89	280	247.84	530	469.13
Caliper (depth)	m	0.14	280	39.43	530	74.63
Caliper (operation)	m	0.13	280	36.96	530	69.96
Borehole Volume Integration (operation)	m	0.20	280	55.44	530	104.94
Data Bundle True Vertical Depth (TVD)	each	400.00	0	0.00	1	400.00
TVD Log	each	250.00	0	0.00	3	750.00
Data Bundle Measured Depth	each	600.00	1	600.00	1	600.00
Total Open Hole				4,140	-	7,206

Table 21.6: Cased Hole Downhole Geophysical Logging

Item	Unit	Unit Price (US\$)	Units per Well	Cost per Well (US\$)
CBL (depth)	m	1.38	530	730.35
CBL (operation)	m	1.39	530	734.58
CBL (operation) base charge (first 200 m)	each	665.00	1	665.00
Pressure Control Packoff (CBL)	day	210.00	1	210.00
Wireline Unit Travel Time (CBL)	hour	185.00	1	185.00
Standard Environment	day	348.25	1	348.25
PC-MD Data Bundle	each	200.00	1	200.00
Total				3,073.18

Note: CBL = cement bond log

21.2.1.8 Drilling Fluid (Mud)

For drilling fluids, it is assumed that conventional bentonite drilling mud will be adequate. For most evaporites, drilling through the salt zone requires either mud saturated with the ions that would dissolve or an invert (oil-based) mud. Because of environmental regulations concerning disposal of mud and cuttings, invert muds are not commonly used. Costs for drilling muds for a single well are presented in Table 21.7.

Table 21.7: Open Hole Drilling Mud Capital Cost

Item	Unit	Unit Price (US\$)	Units per Well	Cost per Well (US\$)
Conductor Hole Drilling Fluids	m	5.16	16	83
Surface Hole Drilling Fluids	m	5.16	100	516
Intermediate Hole Drilling Fluids	m	5.16	200	1,033
Production Hole Drilling Fluids	m	10.56	280	2,957
Environmental Fee	well	150.00	1	150
Hauling Cuttings Away	hr	155.00	12	1,860
Trucking	hr	160.00	5	800
Total				7,399

21.2.1.9 Equipment Rental, Supplies and Services

Equipment rentals, miscellaneous services, and consumables are minor cost items and, in aggregate, represent less than 20% of the total cost of a well. Equipment rentals for drilling operations consist of the following:

- Matting;
- Camp;
- Camp light plant;
- Bins;
- Centrifuge;
- Forklift;

- Track hoe;
- Vacuum trucks;
- Water truck; and,
- Potable water (for the camp).

Items included in supplies may include:

- Fuel;
- Conductor hole;
- Casing bowls/wellhead;
- Cuttings disposal (tipping fees);
- Casing shoes;
- Casing tools (centralizers, float collars, shoes, and injection packers);
- Welding;
- Power casing tongs;
- Fishing tools;
- Extra fuel storage; and,
- Extra water storage.

Note that cuttings disposal is often included in quotations from drilling mud suppliers. Similarly, costs for casing shoes and casing tools are often, but not always, included with the quotes from the general drilling contractor or the cementing contractor. Thus, the estimator must be careful not to double- or triple-charge these items. Miscellaneous services include:

- Analytical services;
- Steam cleaning;
- Welding;
- Programming;
- Coordinator;
- Trucking; and,
- Safety programme.

The estimated costs for these items were based on Agapito's database and are presented in Table 21.8.

Table 21.8: Capital Costs for Bits, Equipment Rentals, Supplies and Miscellaneous Services

Item	Unit	Cost per Well (US\$)
Bits	well	40,300
Equipment Rentals	well	20,388
Fuel	well	15,760
Services and Supplies	well	64,300
Total		140,748

21.2.1.10 Electric Submersible Pumps (ESPs)

For the Banio Project, it will likely be necessary to provide artificial lift to the production string to bring the produced brine to the surface and the plant. Given the maximum anticipated flow rate and brine density, and the customary placement of the pump at a depth of approximately half the maximum depth of the cavern, the average power requirement for a pump will be approximately 22 kW. The capital costs for an ESP are presented in Table 21.9. The main reason for the elevated cost is the need for specialty metal construction to minimise corrosion.

Table 21.9: ESPs Capital Cost

Item	Price per Unit (US\$)
Pump, Head, Discharge Head, Seals, Motor, Sensors and Surface Unit, Cables and Connectors	85,183
Variable Speed Drive	29,925
Corrosion Protection and Miscellaneous	8,482
Total	123,590

21.2.1.11 Well Pad and Access Road Capital Cost Estimate

Each well will have its own well pad. The well pad will be approximately 7 m². The access road to the well pad should be constructed to allow the drilling rig and other equipment to move in and move out. It is planned that the well pad and access road will be constructed with compacted gravel. It is estimated that the total cost of well pad and access road is US\$153,163 per well.

21.2.1.12 Wellhead, Instrumentation and Electrical Capital Cost Estimate

The wellhead is located on the surface of the production well, which provides structure and a pressure bearing interface for drilling and production equipment. The main purpose of using the wellhead is to provide a pendant point and pressure seal for casing string from hole bottom to surface pressure control equipment. After the installation of the wellhead, instrumentation and electrical work on the wellhead will be completed for the well to provide power and data monitoring for the solution mining operation. It is estimated that the total cost of the wellhead is US\$77,160 per well and the total cost of instrumentation and electrical is US\$89,510 per well.

21.2.1.13 Wellfield Piping Capital Cost Estimate

Wellfield piping is also required for the supply of solvent for injection, production brine and waste brine transportation, and fluid for the blanket to limit vertical growth. Both injection solvent and brine production pipelines will be using a 304.8 mm diameter pipe. The per metre costs for 304.8 mm Schedule-40 high-density polypropylene (HDPE) pipe is US\$90.65 per metre including the costs for couplings. The solvent injection and production pipeline will need insulation and corrosion protection which adds approximately US\$32 per metre of pipe. The estimated installation time is 1.5 man-hour/m for 304.8 mm diameter pipe. The hourly man-hour cost for pipeline installation is assumed to be US\$68.08. Extensions to the pipelines as mining progresses are considered as sustaining capital.

Volumes for the oil blanket will be small initially but will increase as the caverns are enlarged. At full diameter, the flow rate oil reinjection should be such that the blanket can be completely replaced after cavern recompression (after a workover) in a couple of hours. Given a maximum diameter of 50 m, the maximum total oil volume to be replaced is 78.54 m³. In the well, the blanket will be injected through the annulus between the casing and tubing. An 80 m³ holding tank costing approximately US\$5,000 will be required at each well to collect the oil that flows back when the well is depressurised as well as a pump, which costs approximately US\$2,250, to reinstall before restarting operations. The wellfield piping and oil blanket capital costs are for each of the considered options (400 kt/a, 600 kt/a and 800 kt/a) are presented in Table 21.10, Table 21.11 and Table 21.12, respectively.

Table 21.10: Option 1 (400 kt/a) - Wellfield Piping and Oil Blanket Capital Cost

Item	Diameter (mm)	No. of Items	Length (m)	Material Unit Price (US\$/m)	Material Cost (US\$)	Installation Unit Price (US\$/man-hour)	Installation Time (hr/m)	Pipe Installation Cost (US\$)	Total Capital Cost (US\$)
Production Brine Pipeline	304.80	1	9,576	123	1,174,535	68.08	1.5	977,901	2,152,436
Injection Brine Pipeline	304.80	1	9,576	123	1,174,535	68.08	1.5	977,901	2,152,436
Waste Brine Pipeline	304.80	1	9,576	91	868,103	68.08	1.5	977,901	1,846,004
Oil Blanket Pipeline	36.75	1	3,429	17	57,168	68.08	0.3	70,034	127,202
Sub-Total Pipelines				353	3,274,340	-	-	3,003,737	6,278,078
Oil Blanket Storage Tank	-	35	1	5,000	175,000	-	-	-	175,000
Oil Pump	-	35	1	2,250	78,750	-	-	-	78,750
Total					3,528,090	-	-	3,003,737	6,531,828

Table 21.11: Option 2(600 kt/a) - Wellfield Piping and Oil Blanket Capital Cost

Item	Diameter (mm)	No. of Items	Length (m)	Material Unit Price (US\$/m)	Material Cost (US\$)	Installation Unit Price (US\$/man-hour)	Installation Time (hr/m)	Pipe Installation Cost (US\$)	Total Capital Cost (US\$)
Production Brine Pipeline	304.80	1	13,430	123	1,647,219	68.08	1.5	1,371,451	3,018,670
Injection Brine Pipeline	304.80	1	13,430	123	1,647,219	68.08	1.5	1,371,451	3,018,670
Waste Brine Pipeline	304.80	1	13,430	91	1,217,465	68.08	1.5	1,371,451	2,588,916
Oil Blanket Pipeline	36.75	1	7,132	17	118,905	68.08	0.3	145,664	264,569
Sub-Total Pipelines				353	4,630,807	-	-	4,260,017	8,890,825
Oil Blanket Storage Tank	-	50	1	5,000	250,000	-	-	-	250,000
Oil Pump	-	50	1	2,250	112,500	-	-	-	112,500
Total					4,993,307	-	-	4,260,017	9,253,325

Table 21.12: Option 3 (800 kt/a) - Wellfield Piping and Oil Blanket Capital Cost

Item	Diameter (mm)	No. of Items	Length (m)	Material Unit Price (US\$/m)	Material Cost (US\$)	Installation Unit Price (US\$/man-hour)	Installation Time (hr/m)	Pipe Installation Cost (US\$)	Total Capital Cost (US\$)
Production Brine Pipeline	304.80	1	18,392	123	2,255,836	68.08	1.5	1,878,177	4,134,014
Injection Brine Pipeline	304.80	1	18,392	123	2,255,836	68.08	1.5	1,878,177	4,134,014
Waste Brine Pipeline	304.80	1	18,392	91	1,667,296	68.08	1.5	1,878,177	3,545,474
Oil Blanket Pipeline	36.75	1	9,317	17	155,333	68.08	0.3	190,290	345,623
Sub-Total Pipelines				353	6,334,301	-	-	5,824,823	12,159,124
Oil Blanket Storage Tank	-	68	1	5,000	340,000	-	-	-	340,000
Oil Pump	-	68	1	2,250	153,000	-	-	-	153,000
Total					6,827,301	-	-	5,824,823	12,652,124

21.2.1.14 Capital Cost Summary

The total capital costs for the initial wells as the well pads and piping from the wellfield to the main pipeline are summarised in Table 21.13. Mobilisation and demobilisation costs were estimated by assuming that two drilling rigs will meet the drilling and development schedule. Costs are stated without any added contingencies.

Table 21.13: Total Wellfield Capital Costs

Item	Cost for One Well (US\$)	Cost for Initial Well 400 kt/a (US\$)	Cost for Initial Well 600 kt/a (US\$)	Cost for Initial Well 800 kt/a (US\$)
Number of Initial Wells	-	35	50	68
Drilling Licence and Agency Review	1,000	35,000	50,000	68,000
Drilling	247,947	8,748,151	12,497,359	16,996,408
Casing	79,730	2,790,550	3,986,500	5,421,640
Cementing	24,734	865,688	1,236,697	1,681,908
Coring*	102,412	358,443	512,061	696,403
Open-Hole Logging, Intermediate Casing point	4,140	144,912	207,018	281,544
Open-Hole Logging, Total Depth	7,206	252,205	360,292	489,997
Cased Hole Logging	3,073	107,561	153,659	208,976
Gyro Survey	-	0	0	0
Mud Programme	7,399	258,972	369,959	503,145
Bits, Rentals, Supplies and Fuel and Miscellaneous	140,748	4,926,180	7,037,400	9,570,864
Electric Submersible Pumps (ESPs)	123,590	4,325,650	6,179,500	8,404,120
Sub-Total	741,980	22,813,311	32,590,445	44,323,005
Mobilisation and Demobilisation	-	120,000	160,000	200,000
Drilling Manager	-	500,000	750,000	1,000,000
Drilling Engineer	-	400,000	600,000	800,000
Well Geologist	-	350,000	525,000	700,000
Well Pad and Access Road Costs	153,163	5,360,712	7,658,160	10,415,098
Wellhead	77,160	2,700,600	3,858,000	5,246,880
Instrumentation and Electrical	89,510	3,132,850	4,475,500	6,086,680
Wellfield Pumping	-	6,531,828	9,253,325	12,652,124
Total Direct Wellfield Capital Costs		41,909,301	59,870,429	81,423,787

Note: *It is assumed that only one well in every 10 will be cored. Cost per well includes extra time for the general drilling contractor.

21.2.1.15 Deferred, Sustaining and Replacement Capital

Wellfield deferred, sustaining, and replacement capital are the costs for replacing caverns every year. These costs include the expenses for drilling, casing, and developing the wells as well as costs for well pads and modifications to the wellfield pipelines. Costs will also be incurred for moving the oil blanket tanks; however, such costs are relatively small. The number of wells to be replaced each year is presented in Table 21.14 for the three options.

Table 21.14: Wellfield Annual Sustaining Capital Costs for the First 30 Years

Year	Option 1 (400 kt/a)							Option 2 (600 kt/a)							Option 3 (800 kt/a)						
	No. of Cavern Replaced	Production Well (US\$)	Rig Mob/ Demob (US\$)	Well Pads for Replacement Caverns (US\$)	Wellfield Extension Pipelines (US\$)	Plugging and Abandonment (US\$)	Annual Wellfield Sustaining Capital Cost (US\$)	No. of Cavern Replaced	Production Well (US\$)	Rig Mob/ Demob (US\$)	Well Pads for Replacement Caverns (US\$)	Wellfield Extension Pipelines (US\$)	Plugging and Abandonment (US\$)	Annual Wellfield Sustaining Capital Cost (US\$)	No. of Cavern Replaced	Production Well (US\$)	Rig Mob/ Demob (US\$)	Well Pads for Replacement Caverns (US\$)	Wellfield Extension Pipelines (US\$)	Plugging and Abandonment (US\$)	Annual Wellfield Sustaining Capital Cost (US\$)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	741,980	40,000	153,163	68,210	0	1,003,353
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	8,903,758	40,000	1,837,958	818,525	0	11,600,241
11	0	0	0	0	0	0	0	2	1,483,960	40,000	306,326	136,421	0	1,966,707	2	1,483,960	40,000	306,326	136,421	0	1,966,707
12	26	19,291,475	40,000	3,982,243	1,773,470	0	25,087,189	36	26,711,274	40,000	5,513,875	2,455,574	0	34,720,723	36	26,711,274	40,000	5,513,875	2,455,574	0	34,720,723
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	5,193,859	40,000	1,072,142	477,473	0	6,783,474
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	4,451,879	40,000	918,979	409,262	0	5,820,121
19	0	0	0	0	0	0	0	4	2,967,919	40,000	612,653	272,842	0	3,893,414	12	8,903,758	40,000	1,837,958	818,525	0	11,600,241
20	3	2,225,939	40,000	459,490	204,631	0	2,930,060	34	25,227,314	40,000	5,207,549	2,319,154	0	32,794,016	26	19,291,475	40,000	3,982,243	1,773,470	0	25,087,189
21	8	5,935,839	40,000	1,225,306	545,683	0	7,746,827	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	15	11,129,697	40,000	2,297,448	1,023,156	0	14,490,301	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	5,193,859	40,000	1,072,142	477,473	0	6,783,474
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	4,451,879	40,000	918,979	409,262	0	5,820,121
27	0	0	0	0	0	0	0	13	9,645,738	40,000	1,991,122	886,735	0	12,563,594	21	15,581,576	40,000	3,216,427	1,432,418	0	20,270,422
28	3	2,225,939	40,000	459,490	204,631	0	2,930,060	25	18,549,496	40,000	3,829,080	1,705,260	0	24,123,836	12	8,903,758	40,000	1,837,958	818,525	0	11,600,241
29	8	5,935,839	40,000	1,225,306	545,683	0	7,746,827	0	0	0	0	0	0	0	5	3,709,899	40,000	765,816	341,052	0	4,856,767
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Provided that a rig can drill approximately two wells of the required average depth per month, or approximately 20 wells per year, one or two rigs are needed to drill the necessary wells the year that replacement caverns are needed. However, depending on rig availability and maintenance requirements, two to four mobs and demobs may be required at an estimated cost of US\$40,000 for each mob and demob cycle. (Note that at least one mob/demob of the rig would be to go back to the Contractor's shop for annual inspection and maintenance.) The average annual sustaining capital costs for the wellfield are presented in Table 21.14. The unit costs used for sustaining cost estimate were obtained from Table 21.13 that presents the total capital cost estimate.

21.2.2 Operating Costs

21.2.2.1 Operating Cost Estimation Basis

For the purposes of the present exercise, operating costs were based on average cavern dimensions. The annual operating cost for the wellfield (subsurface) consists of the labour, equipment, and supplies required to operate and maintain the production wells and caverns. The operations that contribute to these costs include:

- Addition of diesel to the oil blanket;
- Depressurization of the well for workovers and storage of the collected oil;
- Workovers for perforation of new cuts;
- Workovers for routine well and casing maintenance;
- Workovers for installation and removal of Electrical Submersible Pump System ESPs;
- Sonar surveys to verify cavern size and shape; and,
- Cutting and removal of casing or stuck tubing.

Most of the above items are routine and would be performed on a scheduled basis. Oil can be stored in movable, fiberglass-reinforced plastic storage tanks located at the well pads. These tanks and the pumps to supply the oil to the injection wells are relatively small cost items that have been included in the Capital Cost. ESPs would be used to provide a pressure boost in the production well because of the need to minimise the solvent injection pressure to prevent hydrofracking.

The cutting of casing or stuck tubing is not a regular operation, but will be required for the recommended annual sonar survey of the caverns. Workovers for perforating and addition of oil blanket pertain to the solution mining of all the cycles.

Subsurface wellfield operating costs are subdivided into costs for labour, equipment, materials, and supplies. Equipment costs include hourly operating costs for well equipment as well as any costs for supply of water and electric power to the wells by public utilities. Costs for materials include allowances for diesel oil for the cavern blanket during primary mining and replacement costs for damaged casings and tubulars. Costs for supplies include costs for small hand tools, personal protective equipment provided by the company, and small hardware used in normal production and maintenance operations.

It is further assumed that operations are performed on a 24-hour per day, 7-day per week basis over a total of 8,000 h/a. Workover rigs were assumed to be contractor-supplied and operated on a

12-h/d, single-shift basis. The hourly cost of a workover rig in Agapito's database ranges from US\$500/h to US\$1,000/h; for this estimate, Agapito used a median value of US\$750/h including crew labour and subsistence.

Costs for perforating, post-perforating cased-hole logging, and casing cutting were obtained from Agapito's database. Estimated costs for cased-hole downhole geophysical logging to confirm cementing effectiveness were presented in the CAPEX estimation. However, cased-hole downhole logs are required each time a well is perforated to check that the fractures through the casing and cement were successful.

21.2.2.2 Operating Cost Estimation

Wellfield Labour Cost

Labour rates were based on an average full-time employee cost of US\$75 thousand used in planning studies as discussed in the CAPEX estimation section above and modified in the case of supervisory personnel.

Oil Blanket Cost

Immiscible fluid blankets are used to control and inhibit upward advancement of the dissolution front. Gas or liquid blankets can be used for this purpose; however, liquid blankets are generally more effective. Diesel is the most common liquid blanket; however, refinery condensate can also be used and costs significantly less than diesel. To be effective, the blanket needs to be 10 mm thick. Over the life of a cavern, it will be necessary to replace about 80% of the blanket volume. For a 50 m radius cavern, the volume of oil required for a blanket is 78.54 m³ of fluid. Assuming the wholesale diesel price of US\$1.00/L, the cost per cavern for oil blanket addition is US\$78,540.

Perforating Cased Hole Logging Cost

Perforating is required to initiate production from each lift in the cavern except the lowest, which will be uncased. Two wells can be perforated or logged in a 12-hour day. It is customary to wait three days after perforating to confirm with cased-hole logging that the fracture was successful. Costs for perforating and subsequent cased-hole logging are presented in Table 21.15. To obtain the total costs for logging and perforating, Agapito assumed one perforating event per operating cavern per year. This perforating frequency was based on the assumed production schedule and cavern lives.

Routine Well Maintenance Activities

Costs for well maintenance assumed that a workover rig is required for 12 hours per maintenance event and that ten maintenance events are required per year per cavern based on experience at other potash solution mines. Experience at potash solution mining operations has shown that approximately 10% of the casings and tubings will require replacement at approximately 3-year intervals. The estimated routine well maintenance costs are US\$54,405 per cavern per year.

Table 21.15: Annual Perforating and Related Cased Hole Logging Cost per Well Event

Item	Unit	Unit Price (US\$)	Quantity per Event	Single Event Cost (US\$)
E-Line Equipment				
Nitrogen Purge	day	128.99	2	257.98
Pressure Control Equipment	well per day	585.00	2	1,170.00
Safety/Environmental Compliance	well per day	195.00	2	390.00
Support Pickup	day	442.26	2	884.52
Mast Unit - Travel	hour	195.00	4	780.00
E-Line Setup Service	well per day	85.00	2	1,170.00
Sub-Total E-Line Equipment				4,652.50
Perf Charge Carriers				
4-inch (101-mm) expendable ERHSC 21-ft (6-m)	each	1,348.54	1	1,348.54
Perforating Depth Charge	m	0.39	530	206.70
Shaped Charges	each	28.08	40	1,123.20
Minimum Well Charge (1-m)	well	524.16	1	524.16
Sub-Total for Perforating				3,202.60
Pulsed-Neutron Cased-Hole Logging				
Pulsed Neutron (PNN) Analysis	each	1,920.00	1	1,920.00
Depth Charge	m/run	1.12	530	593.60
Operation Charge	well/day	1,755.00	1	1,755.00
Sub-Total PNN Logging				4,268.60
Total per Well per Event				12,123.70

Submersible Pump Operation and Maintenance

The submersible pumps used to assist in pumping the production brine to the plant will require routine service to ensure that they are operating properly. This maintenance can be performed in conjunction with other well maintenance activities. Apart from maintenance, pump operating costs consist of power cost and costs for pump removal from completed caverns and installation in replacement caverns. Power costs for large industrial users in the area are US\$0.206 per kWh for power delivered to site. The average ESP power requirement is 22 kW, which results in 176,000 kWh/a per cavern for an annual power cost per cavern of US\$36,256.

Casing Cutting and Sonar Surveys

Cutting and removal of within-cavern casing is necessary to perform a sonar survey. Mechanical cutting was attempted on a project of Agapito's and found unsatisfactory as much more hydraulic pressure was required than could be supplied by the rig pumps. Agapito has cost estimates for casing cutting using electric and jet cutter options. The jet cutting option was chosen due to its significantly lower cost and is presented in Table 21.16.

Table 21.16: Case Cutting Cost per Well

Item	Unit	Unit Price (US\$)	Units per Well	Single Event Cost (US\$)
Depth	-	-	530	-
Common Pressure-Control Equipment	Well per day	585.00	1	585.00
Safety/Environmental Compliance	Well per day	195.00	1	195.00
Support Pickup	Day	655.20	1	655.20
Mast Unit travel	Hour	195.00	2	390.00
Setup Service	Well per day	585.00	1	585.00
Electric Line Pipe Recovery, Jet Cutter				
Cut Casing Recovery	m	0.75	530	397.50
7-Inch Jet Cutter	Each	2,000.00	1	2,000.00
Total per Well				4,807.70

The sonar cost is based on Agapito's experience with sonar in pilot caverns. Because casing cutting and sonar can be performed as a single sequential operation, no mobilisation/demobilisation was included for the casing cutting associated with the sonar survey. A single mobilisation/demobilisation cost was included for the sonar as all caverns could be done in a single visit. Although the sonar survey can be run from tubing that has been run up above the bottom of the production casing, use of the jet cutter will require removal of the ESP and tubing using a workover rig. Sonar survey costs per cavern are presented in Table 21.17.

Table 21.17: Sonar Survey Cost per Cavern

Item	Unit	Unit Price (US\$)	Units per Well	Cost per Well (US\$)
Common Pressure-Control Equipment	Well per day	516.00	1	516.00
Blowout Preventer (BOP)	Well per day	600.00	0	0.00
E-Line Setup Service	Well per day	640.00	1	640.00
2⅞" Explorer Tool—gamma ray, casing collar locator (CCL), caliper	m	0.99	530	524.70
2⅞" Sonar Tool	m	0.99	530	524.70
Additional Logging Time	hr	512.00	1	512.00
Environmental Surcharge	cavern	87.00	1	87.00
Nitrogen Skid and Manifold	well	100.00	1	100.00
Crew Truck	day	420.00	1	420.00
Monitors	cavern	150.00	1	150.00
Sonar	cavern	15,000.00	1	15,000.00
Versa-Line	m	1.33	530	704.90
Specialist	man-day	2,250.00	1	2,250.00
Processing and Final Report	cavern	1,450.00	1	1,450.00
Total per Measuring Event				22,879.30
Mobilisation and Demobilisation	hr	296.85	4	1,187.40

Operating Cost Summary

The annual wellfield OPEX for the Banio Project includes costs for:

- Wellfield labour. The assumed crew sizes are 21, 31, and 49 full-time employees for the options of 400 kt/a, 600 kt/a, and 800 kt/a, respectively;
- Electrical power for wellfield injection, pipeline booster, and submersible pumps. The assumed power rate is US\$0.206 kWh;
- Routine electrical and mechanical maintenance and materials supply is assumed to cost annually 1% of the direct and indirect CAPEX;
- Workover rig and crew to raise and lower well tubing, replace damaged tubing, squeeze-cement voids in casing cement, and assist with periodic downhole surveys, etc. as required at a cost of US\$750/h for the rig and crew; and,
- Wireline truck and crew if used in lieu of a workover rig.

All options assume 8,000 h/a representing a year-round, 7 days per week operation less annual maintenance shutdown time and statutory holidays. Table 21.18 shows the wellfield OPEX for the three production rate options. The initial wellfield OPEX are approximately US\$5.8 million, US\$8.6 million, and US\$12 million for the 400 kt/a, 600 kt/a, and 800 kt/a options, respectively.

Estimated annual wellfield operating costs without escalation for inflation or wage increases, are presented in Table 21.18.

Table 21.18: Summary of Mining OPEX Costs

Item	Unit	Unit Cost (US\$)	Option 1 (400 kt/a)		Option 2 (600 kt/a)		Option 3 (800 kt/a)	
			No. of Units	Annual Cost (US\$)	No. of Units	Annual Cost (US\$)	No. of Units	Annual Cost (US\$)
Number of simultaneous caverns for mining including spares			35	-	50	-	68	-
Personnel Cost								
Superintendent Wellfield Operations	man-year	125,000	1	125,000	1	125,000	1	125,000
Production Engineer	man-year	100,000	1	100,000	2	200,000	2	200,000
Wellfield Engineer	man-year	85,000	2	170,000	3	255,000	5	425,000
Project Geologist	man-year	100,000	1	100,000	1	100,000	2	200,000
Geologist	man-year	65,000	1	65,000	2	130,000	2	130,000
Workover Supervisor	man-year	100,000	1	100,000	2	200,000	2	200,000
Wellfield Operator	man-year	60,000	8	480,000	12	720,000	16	960,000
Wellfield Electricians and Mechanics	man-year	70,000	2	140,000	3	210,000	4	280,000
Wellfield Labourers	man-year	50,000	4	200,000	6	300,000	8	400,000
Total Labour			21	1,480,000	32	2,240,000	42	2,920,000
Materials and Services								
Perforating and Cased-Hole Logging	cavern/year	12,124	35	424,330	50	606,185	68	824,412
Cased-Hole CBL for Perforating	cavern/year	6,693	35	234,268	50	334,668	68	455,149
Electric Submersible Pumps	cavern/year	36,256	18	652,608	26	942,656	35	1,268,960
Well Maintenance	cavern/year	54,405	35	1,904,175	50	2,720,250	68	3,699,540
Oil Blanket	cavern/year	3,927	35	137,445	50	196,350	68	267,036
Total Materials and Services				3,352,825		4,800,109		6,515,096
Annual Sonar Survey	cavern/year	22,879	35	800,776	50	1,143,965	68	1,555,792
Casing Cutting for Sonar	cavern/year	4,808	35	168,270	50	240,385	68	326,924
Total Wellfield Operating Cost				5,801,870		8,424,459		11,317,812
Yearly MOP production	tonnes			400,000		600,000		800,000
Wellfield Direct Operating Cost/t	per tonne MOP			14.50		14.04		14.15

21.3 PROCESSING CAPEX AND OPEX

21.3.1 CAPEX Basis

Depending on the source of reference there are several different methods in use for estimation of CAPEX of processing plants. The most common method for cost estimation of PEA's is the mass approach. This concept uses the most important cost factors like control circuits, pipes, required area and other variables for the calculation of the costs of the plant. With this information, a cost calculation can be made if a similar plant can serve as a reference.

Micon is in possession of a cost estimation for a process plant utilising the same process flowsheet as proposed herein which was compiled within the past 12 months. Micon is satisfied as to the validity of utilising the previous cost estimate for this study, however it has been necessary to adjust the costs in accordance with a recognised methodology in order to align the costs with the process plant capacities required by this study.

The Rule of Six-tenths Approximate costs can be obtained if the cost of a similar item of different size or capacity is known. A rule of thumb developed over the years known as the rule of six-tenths

gives very satisfactory results when only an approximate cost within plus or minus 20% is required. An exhaustive search in conjunction with the development of this course left numerous authors with no indication of any single individual who developed this concept. One is forced to assume that the relationship naturally evolved in the public domain after large quantities of actual cost data were analysed retrospectively. The earliest mention of this concept was found in a reference accredited to a December 1947 Chemical Engineering magazine article by Roger Williams, Jr. entitled “Six-tenths Factor Aids in Approximating Costs”. At any rate, the following equation expresses the rule of six- tenths:

$$C_a \approx C_b \times (S_a/S_b)^{0.6}$$

Where C_b = the approximate cost (US\$) of equipment having size S_b (cfm, Hp, ft², etc.)
 C_a = is the known cost (US\$) of equipment having corresponding size S_a (same units as S_b), and
 S_b/S_a is the ratio known as the size factor, dimensionless.

It is reported that this method gives a reasonable estimation of costs at the “order of magnitude” level provided that the size ratio S_b/S_a is not excessive. In the case of this study, cost data for the process plant were available for 500 kt/a MOP which, by the method above, were scaled back to 400 kt/a ($S_b/S_a = 0.8$) and scaled-up to 600 kt/a ($S_b/S_a = 1.2$) and 800 kt/a ($S_b/S_a = 1.6$), respectively.

The overall accuracy of the estimates used in this study are in line with the Class 4 definition as described below. The definitions are agreed by the AACE International Recommended Practice No. 18R 97 - Cost Estimate Classification System (AACE, 2020). A summary is given in Table 21.19.

Table 21.19: Overview of the Classification Matrix of Cost Estimation in the Process Industry

ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic			
	LEVEL OF PROJECT DEFINITION Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges [a]	PREPARATION EFFORT Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/ Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Notes: [a] The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.
[b] If the range index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

Source: AACE (2020)

Using the above methodology, the cost of the main elements of the process plant were calculated and are shown in Table 21.20.

Table 21.20: CAPEX Cost of Main Elements of Process Plant

Elements	Option 1 400 kt/a (US\$)	Option 2 600 kt/a (US\$)	Option 3 800 kt/a (US\$)
Loaded Brine Buffer Tank/Clarifier	6,560,172	8,367,005	9,943,362
Primary Evaporators	48,107,931	61,358,034	72,917,988
KCl and NaCl Debrining	13,120,345	16,734,009	19,886,724
NaCl Drying	7,653,535	9,761,505	11,600,589
Cooling Crystallisers	6,560,172	8,367,005	9,943,362
Centrifuges	1,312,034	1,673,401	1,988,672
KCl Dryers	7,653,535	9,761,505	11,600,589
Compaction	13,120,345	13,120,345	19,886,724
Plant Buildings and Infrastructure	13,120,345	16,734,009	19,886,724
Total	117,208,414	145,876,819	177,654,735

The values in Table 21.20 represent the total direct and indirect cost of the process elements, i.e. procurement of the major items plus transportation, insurance and installation cost. Note that the

cost of the compaction plant is the same for the 400 kt/a and 600 kt/a scenarios – this is due to the plant sizing considerations described earlier.

21.3.2 OPEX Basis

21.3.2.1 Maintenance

The third of the three major components to operating cost is maintenance. At the PEA level, this is normally calculated as a percentage of CAPEX, often 5%, however this can sometimes be misleading since not all the CAPEX is connected with the purchase of mechanical or electrical equipment.

It can be observed from the Banio Project's CAPEX requirement that a high proportion of the CAPEX is indeed associated with pumps and pipelines, roads, mobile plant, process plant, buildings and electrical equipment, therefore it was considered that a provisional value of 4% was appropriate. Clearly, a more detailed analysis will follow at feasibility study level.

The potash processing environment is extremely harsh. The majority of equipment is exposed to highly corrosive brines, often at elevated temperatures. Within this environment, materials selection for specific tasks is immensely important and care must be taken to avoid mixing metallic components where galvanic action will cause rapid deterioration of components.

While typical mineral processing plants suffer high levels of abrasion, a high proportion of maintenance time and cost on this Project will be to address the early deterioration of equipment caused by corrosion. It is therefore recommended that materials selection is given a high level of importance during the design and construction phases.

21.4 INFRASTRUCTURE AND G&A

21.4.1 CAPEX Basis

21.4.1.1 Port

Two possibilities are under consideration for the export of products from the proposed mine as described elsewhere. The preferred option is the “Mayumba Deep-Water Port” option (Figure 18.3) which offers significant logistic and cost advantages over the shallow-water alternative which requires the placement of product onto barges for subsequent trans-shipment at sea onto ocean-going vessels.

MOP in both granular and standard forms will be loaded as a bulk product into ocean-going vessels, most commonly the “Handymax” variety which have a capacity of 35 kt to 50 kt in four or five holds. This vessel requires a draft of 10 m to 12 m which is in keeping with the deep-water port conceptual design. Vessel turn-around is generally expected to be in the region of three days, therefore the required loading rate should be 800 t/h to 1,000 t/h allowing stoppage time for bad weather.

The loading cycle is typically initiated by a third-party hold inspection (to ensure hold cleanliness) followed by loading, during which time third-party samples of the product are collected. A record is kept of weather conditions during the time the hatches are open (rain and wind gauges are installed at the port) and a draft survey is conducted to permit an estimate of the product tonnage placed onto the vessel. The product delivered is also weighed using a conveyor-belt weigher and the two results documented.

The port will be equipped with a 1,000 t/h ship-loader which can travel the quayside along the length of the vessel and direct the loading conveyor extension over the required hold. The ship-loader and delivery conveyors are operated by a company employee placed next to the open hold using a remote controller.

In order to ensure that there is sufficient MOP available for the three-day loading period, Micon advises that a 40 kt (live capacity) storage warehouse is provided at the port. Delivery of MOP from the process plant site some 10 km away will be completed by truck and the product will be tipped into a receiving hopper. This will be connected to a conveyor system which will elevate the product to the inner roof of the storage warehouse, whereupon the potash will be tipped vertically through a Cleveland Cascades Chute onto a conical pile.

When required, product will be reclaimed from the warehouse using two front-end loaders (FEL's) working in tandem and tipping the product onto a conveyor leading to the finishing screens. These FEL's will have smooth-edged buckets to avoid ripping the warehouse floor and introducing concrete lumps to the product. Supporting pillars in the building will be protected with rubber tyres for the same reason.

Following reclamation from the warehouse, granular products will be re-screened at 1.5 mm to 2.0 mm in order to remove dust and fractured particles which would otherwise lead to customer complaints and possible rejection of the cargo. The screenings are combined with the standard potash or returned to the compaction plant. The dust-free product is then sprayed with a light mineral oil prior to its transfer to the ship-loader.

Industrial-grade vacuum salt will be delivered to a storage warehouse located at the process plant site and placed into bags which will be sized in accordance with customer requirements. The bags will be palletized and placed by forklift truck into 40 ft containers and delivered to the port for onward transportation.

21.4.1.2 Power Generation

The principal source of power to the Project will be natural gas which will be delivered via a pipeline from the current offshore rigs to the Mayumba area where it will be refined and made available for onward delivery. The exact location of the shore-based refining plant is unknown; however it is assumed for the purposes of this study that the gas can be delivered to the Project's dedicated power station at the proposed industrial site.

It is recommended that the Project builds and operates a dedicated power station which comprises gas turbines for the generation of electrical power. The exhaust gas from the turbines, which is regarded as high-grade due to its temperature and volume, will be used to supplement the heat required for steam-raising boilers and to preheat product dryer air.

The inclusion of a dedicated power station will permit the Project a closer control of reliable power, ensuring a constant supply of "clean" electrical power. Its close proximity to the process plant will simultaneously permit the ducting of hot exhaust gas to the dryers which will benefit operating costs and have environmental advantages.

The capital cost estimate for the 400 kt/a scenario is based upon the downscale of a previous 500 kt/a estimate using the method described earlier. The 600 kt/a and 800 kt/a estimates are simple linear multiples on the basis of US\$41.02 capital per tonne MOP. Separate estimates are provided for buildings and insulated ducting, respectively.

There exists a strong possibility that a third party may be interested in a long-term tolling agreement to build and operate the power station on the Project's behalf whereby the latter provides the natural gas at its own cost and pays the contractor to convert the gas to electrical power and hot air. This should be investigated further at the feasibility stage and could potentially result in CAPEX savings. Table 21.21 presents the assumed CHP Plant cost for each different option.

Table 21.21: Assumed CHP Plant Cost for Each Different Option

Production Scenarios (kt/a)	Assumed CHP Cost (US\$ million)
400	16
600	21
800	25

21.4.1.3 Access and Transportation

An access road connecting the Mayumba industrial area to the proposed mine site exists (Figure 18.1) however this is currently not more than an earthen track which is prone to flooding and inundation by vegetation. It is therefore necessary to allow for a significant upgrade of this roadway to permit daily use by Project personnel and the transportation of equipment and blanket diesel.

The proposed route is approximately 60 km long. The capital cost estimate of US\$15 million was generated using a factor provided by ADBG for estimation of road costs in African environments. The road will comprise a compacted laterite base (a local source is available) and have an asphalt surface. Culverts and drainage channels will be provided as required. The road cost is independent of the Project production capacity, i.e. the same value in all three cases.

It is proposed to install two 500 mm diameter HDPE pipelines along the roadside to cater for the transportation of brine from the wellfield to the processing plant. A single 500 mm line will be adequate for the 400 kt/a and 600 kt/a scenarios where the respective flow velocities will be 0.94 m/s and 1.26 m/s at the peak brine flowrates advised by Agapito. Assuming that the pipeline route, which follows the coastline, is essentially flat, the frictional head losses were calculated to be 57 m and 99 m water, respectively. A pumping station comprising centrifugal pumps in series was allowed for in the capital estimate using these parameters and the power requirement was estimated using an assumed pump efficiency of 40%.

It is proposed that the second 500 mm diameter pipeline is used in the first case as a spare, but also used occasionally for the disposal of NaCl brine to sea when new caverns are being undercut into underlying halite. These brines can therefore be co-disposed along with the bittern from the processing plant using the shared disposal outfall facility under a common environmental permit.

Transportation of the wellfield brine to the processing plant in the 800 kt/a case using a single 500 mm diameter pipeline is conducted at 1.84 m/s resulting in a 200 m head loss. This is achievable, but may be further optimised during the DFS design stage. It may be more energy efficient to utilise both pipelines in parallel for this scenario.

21.4.1.4 G&A CAPEX

An estimate of US\$1.5 million has been included to provide a first-world standard guesthouse for expatriate and senior, non-local Gabonese employees. This would comprise single bedrooms, kitchen, dining room, storage and lounge facilities.

Allowances have also been made for a small clinic at the processing plant site, with a paramedic stationed at the processing plant and one at the mine site on a 24/7 basis. A 4x4 ambulance is also provided.

Stores, general offices and an analytical laboratory have been provided for. The laboratory will be operated on a 24/7 basis and will analyse liquid and solid samples for the purposes of:

- Process control;
- Final product certification; and,
- Exploration cores.

Diesel blanket storage and an oil/water separator has been allowed for. This will be situated at the wellfield. Diesel will be delivered to the facilities by road tanker.

Fifteen double-cab utility vehicles have been allowed for. Some will be personally assigned (e.g. General Manager) whilst others will be assigned to the various departments for shared use. A workshop/garage is allowed for.

21.4.1.5 Owner's Costs

The "Owner's Cost" is a term used in project management to refer to the cost that includes land purchase, financing cost, owner's third party costs, engineering studies, permits, licences, training, recruitment and corporate costs. These are typically never less than 5% of the total capital cost, however they can be much higher if significant land purchases are required.

At the level of definition offered by a preliminary economic analysis, the owner's costs are not yet well-defined and allowances have to be made based on previous experience with similar projects.

The total owner's cost estimate for the Banio Project is currently US\$22.3 million and shown in Table 21.22.

Table 21.22: Estimated Project Owner's Costs

Item	Total (US\$)
FEED	1,000,000
Purchase of Land	500,000
Financing Costs	1,500,000
Legals	3,000,000
Community Support	300,000
Temporary Camp	1,000,000
Insurances	300,000
Permits	1,000,000
Owner's Team	4,500,000
Owner's Reserve/Contingency	3,000,000
Taxes & Duties	3,000,000
Recruitment Costs	1,200,000
First Fills/Strategic Spares	2,000,000
Total	22,300,000

It is believed that a Front-End Engineering Design (FEED) would be conducted post-DFS in order to provide further definition to the Project. An estimate of US\$1 million has been made for this study.

Millennial has advised that an allowance of US\$0.5 million should be made for the purchase of industrial land to site the processing plant and power station.

Financing and legal costs of US\$1.5 million have been estimated for the equity raise, provision of a financial advisory and the execution of loan covenants. This may vary depending on the number of lenders within the lender group.

Notwithstanding the Engineering, Procurement, and Construction (EPC) contractor providing accommodation and messing for his workforce, the Company will maintain its own site camp in order to accommodate the owner's team and company personnel.

The Owner's team will initially comprise a project director, financial/contracts manager and an engineer. As the Project progresses and the EPC contractor requires to consult with the Company on technical matters, the Owner's Team will grow to include additional engineers.

Recruitment costs will be incurred by the Owner's Team as the Project nears completion and an Operations Team is assembled.

First fills (lubricants/diesel inventory) are generally not included in an EPC contract and are carried by Owner's Costs. Strategic spares recommended by the original equipment manufacturers, (OEM's) and verified by the Owner's Team engineers are often ordered and paid for at the construction stage. An allowance has been made for this in the Owner's Costs.

21.4.2 OPEX Basis

21.4.2.1 Natural Gas

The Banio Project is highly reliant on energy for power generation, process heating and product drying. The sole source of primary energy to the Project is natural gas which is supplied from offshore rigs by pipeline and refined onshore by others. Cost estimation for the Project is based upon the provision of natural gas to the dedicated Banio power station and to the processing plant by others.

No gas supply agreement is currently in place and only early discussions have taken place in order to ensure its supply. The Government has assured the Company that natural gas will be provided from the offshore rigs in order to supply a proposed, Government-owned power station in the Mayumba area, however no supply agreement or indicative costing has yet been negotiated. The Company has indicated that US\$0.10 per Nm³ be provisionally used in the financial model, however the Project's sensitivity to energy cost should be noted. The current cost of natural gas, at date of this Report, is approximately US\$0.30 per Nm³, however this is artificially inflated by the Ukrainian emergency and would normally be lower. Micon considers it reasonable to assume that US\$0.10 per Nm³ is a good approximation for what is currently an unwanted by-product from the offshore rigs.

Natural gas will be used in several ways: firstly, it will power gas turbines within the power station in order to generate electrical power. Secondly, gas will also be used in steam-raising boilers for process heating and thirdly, in the crystallised product dryers. Although hot exhaust gas from the turbines will also be used in both the boilers and dryers, an auxiliary flame will also be required in each case.

Natural gas requirements were calculated based on the following factors utilised in other Micon potash projects namely:

- Power generation 300 Nm³ per MW generated;
- Steam raising 75 m³ per tonne steam; and,
- Product drying 20.53 Nm³ per tonne product at 5% moisture.

(Note: 1 t steam is defined by vaporisation of 1 t water and is equivalent to 0.725 MW)

Product drying gas volumes include for the drying of NaCl as well as MOP, hence the 400 kt/a MOP scenario includes for actual drying of 800 kt/a (400 kt/a MOP plus 400 kt/a NaCl) and henceforth for the remaining scenarios.

Total gas requirements were calculated for each of the production scenarios using the following:

- Steam required 1 t per 1 t MOP; and,
- Process electricity 0.2 MWh/t.

The total electrical power required for each production scenario is provide in Table 21.23.

Table 21.23: Electrical Power Calculated for Each Production Scenario

Scenario Option	Plant (MW)	Mining (MW)	Brine Transport (MW)	Port (MW)	Other (MW)	Total (MW)
400 kt/a	10.1	1.3	0.45	1.0	0.5	13.4
600 kt/a	15.2	1.7	0.93	1.0	0.5	19.4
800 kt/a	20.3	2.4	2.80	1.0	0.5	27.0

The total natural gas volumes and annual costs at US\$0.10 per Nm³ are shown in Table 21.24.

Table 21.24: Total Gas Volume and Calculated Cost for Unit Price of US\$0.1 per Nm³

Scenario Option	Gas Required (million Nm ³)	Total Cost (US\$ million)
400 kt/a	81.6	8.16
600 kt/a	120.5	12.05
800 kt/a	163.8	16.38

21.4.2.2 Labour

The total labour complement was calculated on the following assumptions:

- Senior management with the required experience specific to solution mining and potash production is not available in the country at this time;
- Skilled personnel who are educated to secondary and tertiary level are available in the country and will be utilised as far as possible;
- A “localisation” programme will be implemented which will progressively train and introduce Gabonese nationals into the positions initially occupied by expatriates; and,
- Where possible, the number of unskilled, local (100 km radius of Mayumba) employees will be maximised. The Company will remunerate at a level which is slightly above the Government minimum wage in order to maximise the benefit to the region.

The Paterson Grading System, developed at the University of Zimbabwe, was utilised for this study. The system is well-suited to the African environment and described an incumbent’s job level in accordance with the accountability and skill level required in each position (Table 21.25). At the highest level, a position may be described as “F-grade”, however this is reserved for Chairmen and CEO’s and is not relevant to this study. The Banio Project will comprise a range of levels from “E-Upper” which is the General Manager of the Project to “A” grade which represents cooks, cleaners, gardeners etc.

Salary ranges were subsequently assigned to each job grade. For the senior managers and expatriates, these were based on Micon’s experience with “Fly-In, Fly-Out” (FIFO) type projects. The probable Gabonese salaries, including the national minimum wage, were advised by the Client.

Table 21.25: Paterson Band Designations and Estimated Annual Salaries for Each

Band	Upper Band (US\$)	Lower Band (US\$)	Designation (US\$)
E Upper	300,000	400,000	Senior Executive
E Lower	300,000	250,000	Executive
D Upper	250,000	175,000	Senior Management
D Lower	150,000	100,000	Junior Management
C Upper	35,000	25,000	Supervisor
C Lower	15,000	11,000	Skilled Artisan
B upper	11,000	8,500	Senior Assistant
B Lower	8,500	4,500	Assistant
A	4,500	3,600	Unskilled

The next step was to divide the operation into Departments (e.g. Mining, Processing, Port etc) and support functions (Engineering, Finance, HR) and calculate what skills were required within each.

Finally, the probable number of incumbents required within each department was estimated and is finalised within the cash flow model.

The summary results are as follows :

Number of Expatriates	22
Number of Nationals	388
Total	410
Annual Salary Bill	US\$9,758,000
Cost per tonne MOP (400 kt/a)	US\$24.39
Cost per tonne MOP (600 kt/a)	US\$16.26
Cost per tonne MOP (800 kt/a)	US\$12.20

The above costs clearly demonstrate the scalability of the Project due to the fact that there is essentially no relationship between the Project output and the manpower required.

21.4.2.3 Other G&A OPEX

As described in Section 18.5, the port will be constructed and operated with a third party to whom the Banio Project will be required to pay a fee for its use. For bulk cargoes, this is normally calculated on a “per tonne” basis, however there may be scope to recover this from the end-user as part of the sale contract. Based on Micon’s experience, a nominal port fee of US\$2.00/t has been applied for the MOP. Salt will be bagged and containerised for export, the cost of loading the containers is deemed insignificant and therefore not included at this time. Any small cost associated with this would be passed onto the end-user.

It is proposed to use diesel fuel (gas oil) as the “blanket” within the operating caverns to control upward cavern development. Diesel will also be used as the common fuel for mobile plant and double-cabs, however the transition to electric vehicles will be required by law at some future time. An allowance of 0.3 L/t has been made at the unit cost of US\$1.00/L.

Bulk MOP and containerised salt will be transported to the port site (approximately 10 km) by contractor. An allowance of US\$2.00/t has been made for this.

Other costs include Social Projects (US\$0.5 million/a), Consulting of various types (US\$1.00 million/a), Legals (US\$1.00 million/a), and Marketing (US\$0.75 million/a to US\$1.25 million/a).

21.5 CAPEX AND OPEX SUMMARY

A summary of the CAPEX costs, split down to mining, processing, and G&A for the 400 kt/a, 600 kt/a 800 kt/a options are presented in Table 21.26.

Table 21.26: Initial CAPEX Summary Breakdown

Parameter	400 kt/a (US\$ 000’)	600 kt/a (US\$ 000’)	800 kt/a (US\$ 000’)
Mine	74,959	97,942	123,250
Processing	125,377	159,999	190,416
G&A	78,205	92,001	104,216
Contingency	41,781	52,136	62,198
Total	320,323	402,078	480,080

Contingency is 15% of the sub-total, which is a reasonable assumption for this level Preliminary Economic Assessment. Mining shows a low relative CAPEX as the methodology is in-situ solution mining. The main component is drilling the brine cavern. The majority of the cost is for the process plant. G&A CAPEX includes infrastructure, accessibility, port facilities, mine camp, owner costs level fees, detailed engineering etc.

A summary of operating costs is given in Table 21.27 for each production scenario.

Table 21.27: Summary of OPEX Costs

Item	Description	400 kt/a (US\$ million)	600 kt/a (US\$ million)	800 kt/a (US\$ million)
Natural Gas	Based on US\$0.10 per Nm ³	8.2	12.1	16.4
Maintenance	Based on 2% of mining CAPEX and 4% of processing and G&A CAPEX	9.9	12.3	15.0
Labour	410 Employees, all three scenarios	9.8	9.8	9.8
Consulting	Ongoing	1.0	1.0	1.0
Legal	Contract Drafting etc.	1.0	1.0	1.0
Marketing	MOP and Salt Products	0.8	1.0	1.3
Port Fees	Estimated US\$2.00/t	0.8	1.2	1.6
Product Trucking	Estimated US\$2.00/t	0.8	1.2	1.6
Social Costs	Sponsor Local Projects	0.5	0.5	0.5
Diesel	Estimated US\$1.00/L	0.1	0.2	0.2
Demin Water	For Steam Raising	0.2	0.3	0.4
Total OPEX US\$/a		33.0	40.5	48.7
Unit Cost US\$/t MOP		83	68	61

22.0 ECONOMIC ANALYSIS

22.1 BASIS OF ANALYSIS

The economic analysis has considered a base case production rate of 400 kt/a of MOP as well as two alternatives including larger 600 kt/a and 800 kt/a scenarios. Each case evaluates the necessary CAPEX and OPEX required to deliver the respective scenario. When analysing economic cases, one of the typical trade-offs is comparing the Net Present Value (NPV) or enhanced economic indicators as a result of economies of scale, with the ability of the owner to raise the necessary CAPEX to fund the Banio Project in the current market environment.

The 400 kt/a base case option requires the least CAPEX and has the slowest production rate, resulting in a 112-year LoM that concludes in 2137. The second option for 600 kt/a option has a LoM of 79 years, concluding in 2104, whilst the third and largest option for 800 kt/a has the highest production rate, requires the most amount of capital and investment but benefits from economies of scale. As this is the most aggressive production rate the LoM is 56 years concluding in 2081.

CAPEX and OPEX cost parameters have been based on benchmark data and are order-of-magnitude estimates with an accuracy of $\pm 30\%$.

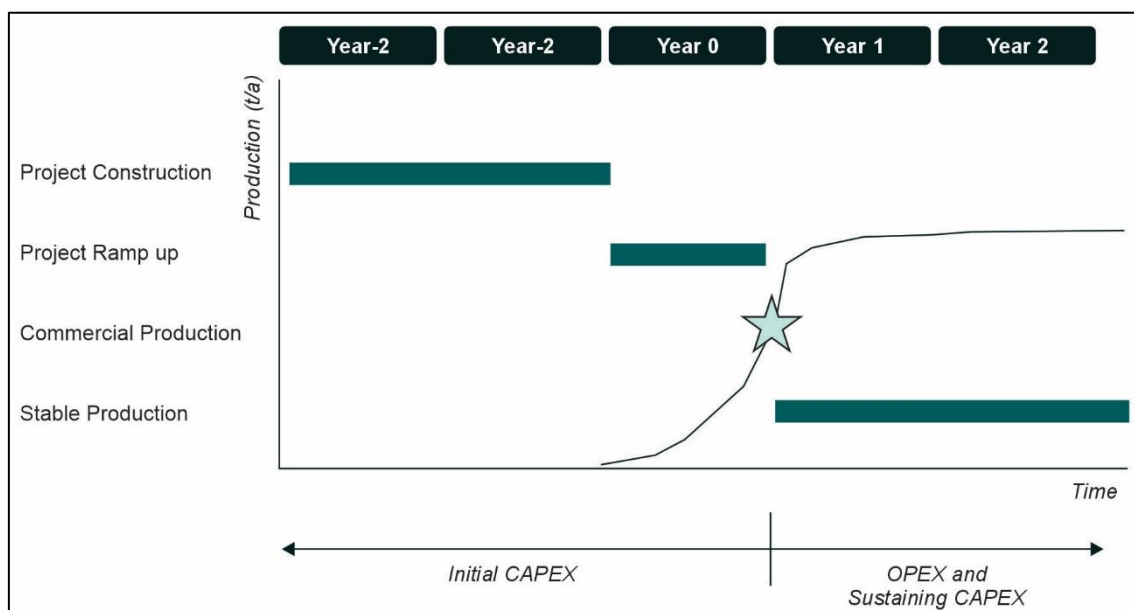
22.2 DCF MODEL ASSUMPTIONS

The following assumptions were made in the economic model:

- All values, both revenue and costs are in real terms, flat lined during the Project time frame, with no inflation. The cash flow is then discounted for the NPV calculation;
- The model assumes a two year construction phase followed by 1 year ramp-up production phase;
- Commercial production is taken as 60% of nameplate capacity and it is assumed that this occurs after a 12 month ramp-up period;
- Payback period is taken as the period to transition from cumulative cashflow negative to cumulative cashflow positive after the date of commercial production;
- As a consequence, Initial CAPEX is regarded as the first two years of construction in addition to the mine cavern construction and ramp-up period;
- Once production hits full capacity CAPEX turns into Sustaining CAPEX and OPEX begins. Everything previously being classed as “Initial CAPEX”;
- Although the mine life or LoM continues beyond a 25-year time frame in each of the cases, the NPV and internal rate of return (IRR) calculation only includes the first 25 years of the Project;
- All effects of stockpiles and lagging sales have been ignored and simplified to production equals sales; and,
- Brazil is the assumed market. The assumption is that Brazil would absorb the production, which de-risks this parameter in the assumption.

The conceptual Project time schedule is illustrated in Figure 22.1.

Figure 22.1: Conceptual Project Time Schedule

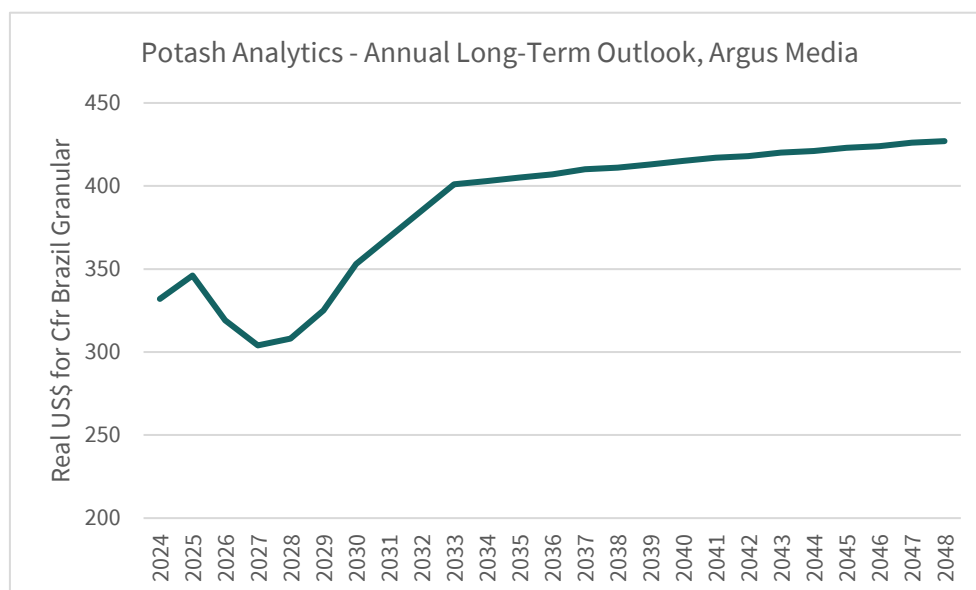


22.3 DCF MODEL INPUT PARAMETERS

The principal input parameters selected for the financial model with a list and discussion is provided below:

- 10% discount rate as this is representative of this level of PEA study and the risk involved in completing this Project;
- The average of the first 25-years of the real MOP price forecast for CFR Brazil Granular was used. This data was sourced from the Argus Potash Analytics: Annual Long-term Outlook, published in December 2023 (Figure 22.2);
- Micon used a fixed NaCl 99% salt price of US\$100/t CFR after discussions with Argus regarding forecasts, that at the time of writing, ranged between US\$100/t and US\$500/t container delivered;
- Micon used a freight rate of US\$22/t for the assumption price of shipping from Gabon to Brazil. This is conservative as the Argus report for costs from Hamburg to Brazil in 30 kt to 35 kt vessels is US\$23/t to US\$25/t which is 6,198 Nautical Miles vs. 4,474 Nautical Miles from the Gabonese Republic to Brazil;
- Micon has used a 7.5% Royalty to be paid to the Gabonese Government. The Royalty calculation the net revenue following deductions for the costs of sales and taxes etc. The possible range of royalty is 5% to 10% which can be negotiated; and,
- Micon has used a 30% Tax input. The base case government tax rate is 30% and will not be more than 35%.

Figure 22.2: MOP Price Forecast



Source: Micon, modified from Argus (2023).

The DCF model material input parameters are presented in Table 22.1.

Table 22.1: DCF Model Material Input Parameters

Input Parameters	Unit	Value
Project Commencement	Date	01/01/2024
Valuation Base Date	Date	01/01/2027
gMOP K60 Brazil (25-year average)	US\$/t	387
NaCl 99% CFR	US\$/t	100
Shipping Cost CFR to Brazil	US\$/t	22
Royalty	%	7.5%
Corporate Tax (CIT)	%	30%
Working Capital Retention	Days	30
Escalation Rate	%	5%
Contingency for CAPEX	%	15%
Plant Recovery	%	90%
Plant Product MOP Quality	%	95%
Discount Rate	%	10%
NPV calculation	Years	25

22.4 DCF MODEL ANALYSIS

The initial CAPEX ranges from US\$320 million for the base case, US\$402 million for the 600 kt/a Option 2 case and US\$480 million for the 800 kt/a Option 3 case.

The OPEX cost ranges from US\$83/t for the base case, US\$68/t for the 600 kt/a Option 2 case and US\$61/t for the 800 kt/a Option 3 case, as the higher production rate results in a lower denominator value for the unit rate calculation and economies of scale.

Revenue, earnings before interest, taxes, and amortization (EBITA) and all-in sustaining costs (AISC) and cash flow all increase with the higher production rate cases.

The payback period for the 400 kt/a case is 1.9 years, while the 600 kt/a case and the 800 kt/a case is 1.5 years and 1.4 years respectively from the date of commercial production.

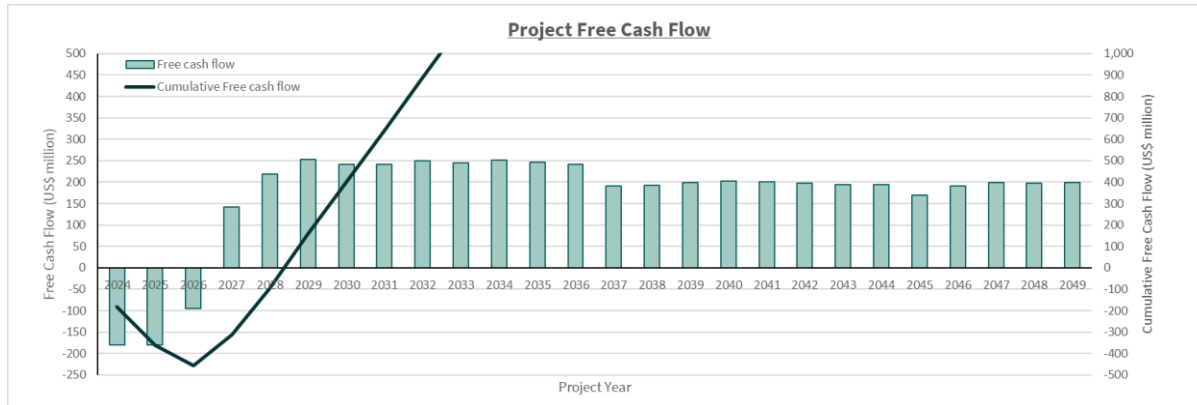
Post-Tax NPV is US\$440 million for the base case, US\$769 million for the 600 kt/a case and US\$1,071 million for the 800 kt/a case. Post-Tax IRR is 26% for the base case, 30% and 33% for the 600 kt/a case and 800 kt/a case, respectively.

Pre-Tax NPV is US\$721 million for the base case, US\$1,218 million for the 600 kt/a case and US\$1,680 million for the 800 kt/a case. Pre-Tax IRR is 33% for the base case, 38% and 41% for the 600 kt/a case and 800 kt/a case, respectively.

The cash flow is graphed in Figure 22.3 which shows free cash flow on a yearly basis and the cumulative (non-discounted) cashflow. As payback is calculated after plant commissioning, one can observe the cumulative free cash flow crossing the x-axis to break even or payback investment which is approximately 2 years for this 400 kt/a base case.

The DCF Model results for the Base Case Option 1 400 kt/a, and the Option 2 600 kt/a and Option 3 800 kt/a cases are presented in Table 22.2 and the cash flow for the Option 1 Base Case 400 kt/a is presented in Table 22.3.

Figure 22.3: Graph Showing Yearly and Cumulative Cashflow for 800 kt/a Base Case



Source: Micon, 2024

Table 22.2: DCF Model Results for Base Case 400 kt/a, and 600 kt/a and 800 kt/a Cases

Line Item	Unit	Option 1 (400 kt/a)	Option 2 (600 kt/a)	Option 3 (800 kt/a)
Max Production Rate MOP	t/a	422,222	633,333	844,444
Total MOP Production	kt	9,743	14,543	19,297
Total Revenue	US\$ million	5,147	7,612	10,036
Total Selling Cost	US\$ million	764	1,122	1,472
Net Revenue	US\$ million	4,383	6,490	8,564
Total Initial CAPEX	US\$ million	320	402	480
Capital Intensity (US\$/t MOP)	US\$/t	800	670	600
Total Sustaining CAPEX	US\$ million	92	143	180
Total CAPEX	US\$ million	413	545	660
Total OPEX	US\$ million	676	828	987
Mine OPEX LoM	US\$/t	17	13	11
Plant OPEX LoM	US\$/t	39	33	31
G&A OPEX LoM	US\$/t	27	21	19
Total OPEX LoM	US\$/t	83	68	61
EBITDA	US\$ million	3,524	5,450	7,335
AISC	US\$ million	1,687	2,264	2,849
Tax	US\$ million	-940	-1,488	-2,025
Free Cash Flow	US\$ million	2,132	3,382	4,599
Cumulative Free Cash Flow	US\$ million	1,776	2,800	3,808
Peak Funding Requirement	US\$ million	305	391	456
Payback Period	Years	1.9	1.5	1.4
Margin	%	68%	72%	73%
Pre-Tax Cashflow	US\$ million	2,561	4,045	5,500
Pre-Tax NPV	US\$ million	721	1,218	1,680
Pre-Tax IRR	%	33%	38%	41%
Post-Tax Cashflow	US\$ million	2,132	3,382	4,599
Post-Tax NPV	US\$ million	440	769	1,071
Post-Tax IRR	%	26.2%	30.2%	32.6%
Capital Efficiency	Ratio	2.1	2.4	2.6

Table 22.3: Cash Flow for Option 1 Base Case 800 kt/a

Cashflow Tab		Year	TOTAL	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051
Cashflow and Valuation	Start		01/01/2024	01/01/2025	01/01/2026	01/01/2027	01/01/2028	01/01/2029	01/01/2030	01/01/2031	01/01/2032	01/01/2033	01/01/2034	01/01/2035	01/01/2036	01/01/2037	01/01/2038	01/01/2039	01/01/2040	01/01/2041	01/01/2042	01/01/2043	01/01/2044	01/01/2045	01/01/2046	01/01/2047	01/01/2048	01/01/2049	01/01/2050	01/01/2051	
	End		31/12/2024	31/12/2025	31/12/2026	31/12/2027	31/12/2028	31/12/2029	31/12/2030	31/12/2031	31/12/2032	31/12/2033	31/12/2034	31/12/2035	31/12/2036	31/12/2037	31/12/2038	31/12/2039	31/12/2040	31/12/2041	31/12/2042	31/12/2043	31/12/2044	31/12/2045	31/12/2046	31/12/2047	31/12/2048	31/12/2049	31/12/2050	31/12/2051	
	Days		366	365	365	365	366	365	365	365	366	365	365	365	366	365	365	365	365	366	365	365	365	366	365	365	365	366	365	365	365
	Year No.		-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Product Production	Unit																														
MOP	kt	19,297.1	0	0	143	754	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
NaCl	kt	25,625.7	0	0	88	596	1,112	1,783	1,397	1,452	1,614	1,499	1,670	1,792	1,561	1,254	486	796	801	766	870	739	882	642	597	841	729	798	861	812	
Gross Revenue																															
MOP	MUS \$	7,473.4			55	292	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310
NaCl	MUS \$	2,562.6			9	60	111	178	140	145	161	150	167	179	156	125	49	80	80	77	87	74	88	64	60	84	73	80	86	81	
TOTAL	MUS \$	10,036.0			64	352	421	488	450	455	471	460	477	489	466	435	358	389	390	386	397	384	398	374	370	394	383	390	396	391	
Cost of Sales																															
Packaging and Bagging	MUS \$	7.7			0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Product Transport - Inland	MUS \$	0.0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Product Tranport CFR	MUS \$	846.9			5	30	42	57	48	50	53	51	54	57	52	45	28	35	35	34	37	34	37	32	31	36	34	35	37	35	
Royalties	MUS \$	400.0			3	17	20	23	21	21	22	21	22	23	22	20	17	19	19	18	19	18	19	18	18	19	18	19	19	19	
TOTAL	MUS \$	1254.6			8	47	62	80	70	71	76	73	77	80	74	66	46	54	54	53	56	53	56	50	49	55	52	54	56	54	
Capital Expenditure																															
Mining	MUS \$	123.2	0.0	0.0	101	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process Plant	MUS \$	190.4	95.2	95.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General Capital Expenditure	MUS \$	104.2	52.1	52.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sustaining Capex	MUS \$	179.9	0.0	0.0	0	2	4	4	4	4	4	4	5	16	6	42	4	4	4	11	10	16	31	4	4	4	4	4	11	10	
Contingency	MUS \$	62.2	31.1	31.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Capital Expenditure	MUS \$	659.9	178.4	178.4	101	24	4	4	4	4	4	4	5	16	6	42	4	4	4	4	11	10	16	31	4	4	4	4	4	11	10
Operating Costs																															
Mining	MUS \$	182.0			9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Processing	MUS \$	503.8			24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
General	MUS \$	301.2			14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Total	MUS \$	987.0			47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47
Free Cash Flow																															
Gross Revenue	MUS \$	10,036.0	0.0	0.0	64.3	351.6	421.0	488.1	449.5	455.0	471.2	459.8	476.9	489.0	465.9	435.2	358.5	389.4	389.9	386.5	396.8	383.7	398.0	374.0	369.5	393.9	382.7	389.6	395.9	391.0	
Cost of Sales (inc royalties)	MUS \$	1,471.8	0.0	0.0	8.2	46.9	62.3	79.9	69.8	71.3	75.5	72.5	77.0	80.2	74.1	66.0	45.9	54.0	54.2	53.2	56.0	52.5	56.3	50.0	48.8	55.2	52.3	54.1	55.7	54.4	
Net Revenue	MUS \$	8,564.1	0.0	0.0	56.0	304.7	358.7	408.1	379.7	383.7	395.7	387.3	399.9	408.8	391.8	369.1	312.6	335.4	335.8	333.2	340.9	331.2	341.7	324.1	320.7	338.7	330.5	335.5	340.2	336.6	
Operating Costs	MUS \$	1,175.0	0.0	0.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	
Total Cost Calculation	MUS \$	2,646.8	0.0	0.0	55.2	93.9	109.3	126.9	116.8	118.3	122.5	119.5	124.0	127.2	121.1	113.0	92.9	101.0	101.2	100.2	103.0	99.5	103.3	97.0	95.8	102.2	99.3	101.1	102.7	101.4	
EBITDA	MUS \$	7,335.2	-2.0	-2.0	7.0	255.7	309.7	359.1	330.7	334.7	346.7	338.3	350.9	359.8	342.8	320.1	263.6	286.4	286.8	284.2	291.9	282.2	292.7	275.1	271.7	289.7	281.5	286.5	291.2	287.6	
AISC	MUS \$	2,848.8	0.0	0.0	55.2	95.7	113.0	130.6	120.5	121.9	126.2	123.2	128.7	143.6	126.9	154.9	96.6	104.7	104.8	103.9	114.1	109.6	119.7	128.2	99.5	105.9	102.9	104.7	113.8	111.5	
Operating Cash Flow	MUS \$	7,335.2	-2.0	-2.0	7.0	255.7	309.7	359.1	330.7	334.7	346.7	338.3	350.9	359.8	342.8	320.1	263.6	286.4	286.8	284.2	291.9	282.2	292.7	275.1	271.7	289.7	281.5	286.5	291.2	287.6	
Free Cash Flow																															
Operating cash flow	MUS \$	7,335.2	-2.0	-2.0	7.0	255.7	309.7	359.1	330.7	334.7	346.7	338.3	350.9	359.8	342.8	320.1	263.6	286.4	286.8	284.2	291.9	282.2	292.7	275.1	271.7	289.7	281.5	286.5	291.2	287.6	
Tax	MUS \$	-2,025.0	0.0	0.0	0.0	-65.6	-81.7	-96.6	-88.0	-89.1	-92.6	-90.0	-93.7	-96.0	-97.9	-90.5	-73.5	-80.3	-80.4	-79.6	-81.7	-78.7	-81.5	-75.8	-78.0	-84.2	-81.7	-83.2	-84.5	-83.2	
Capex & Acquisition cost	MUS \$	-682.1	-178.4	-178.4	-100.7	-24.4	-3.7	-3.7	-3.7	-3.7	-3.7	-3.7	-4.7	-16.4	-5.8	-41.9	-3.7	-3.7	-3.7	-3.7	-11.1	-10.0	-16.4	-31.3	-3.7	-3.7	-3.7	-3.7	-11.1	-10.0	
WC movement	MUS \$	-28.7	-1.4		-23.6	-1.4	-5.7	-5.5	3.2	-0.5	-1.3	0.9	-1.4	-1.0	1.9	2.5	6.3	-2.5	0.0	0.3	-0.9	1.1	-1.2	2.0	0.4	-2.0	0.9	-0.6	-0.5	0.4	
Free cash flow	MUS \$	4,599.4	-180.4	-180.4	-95.1	142.1	218.6	253.4	242.2	241.5	249.1	245.5	251.1	246.5	241.0	190.3	192.7	199.8	202.6	201.2	198.2	194.6	193.6	170.0	190.4	199.8	197.0	199.1	195.1	194.7	
Cumulative Free cash flow	MUS \$	3,808	-180	-361	-456	-314	-95	158	400	642	891	1,136	1,388	1,634	1,875	2,065	2,258	2,458	2,660	2,862	3,060	3,254	3,448	3,618	3,808	4,008	4,205	4,404	4,599	4,794	
Peak Funding Requirement	MUS \$	456.0																													
Payback period	Years	1.4	0.00	0.00	0.00	0.00	0.00	1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Margin	%	73%	0%	0%	11%	73%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%
Real Project NPV																															
Pre-tax																															
Pre-tax Project Cash Flow	MUS \$	5499.8	-180.4	-180.4	-95.1	207.7	300.3	349.9	330.2	330.6	341.7	335.5	344.7	342.4	338.9	280.8	266.2	280.2	283.1	280.8	279.9	273.2	275.2	245.8	268.4	284.0	278.7	282.3	279.6	278.0	
Discounted FCF to Model Start Date	MUS \$	1680.1	-172.0	-156.4	-75.0	148.																									

22.5 SENSITIVITY ANALYSIS

The analysis shows that the most sensitive parameter of the inputs selected is the MOP Market price for both the NPV and IRR. As mentioned above the sales prices was taken from the Argus Forecast. The baseline values were taken from the report which forecast individual real-terms values per year from 2023 to 2048. The average of the first 25-years was used. This price was all modified by the sensitivity parameter to see their effect on NPV and NSR.

The next most sensitive parameter is the CAPEX on both NPV and IRR. The CAPEX has a negative trend, showing that in increase in CAPEX decreased NPV and IRR. The CAPEX contingency is 15%, so a -15% variation of CAPEX would represent no contingency of the Project and for example an increase of the IRR from 32% to 36% as seen in Figure 22.4 and Figure 22.5.

Figure 22.4: Base Case Scenario 800 kt/a Post-Tax NPV Sensitivity Analysis

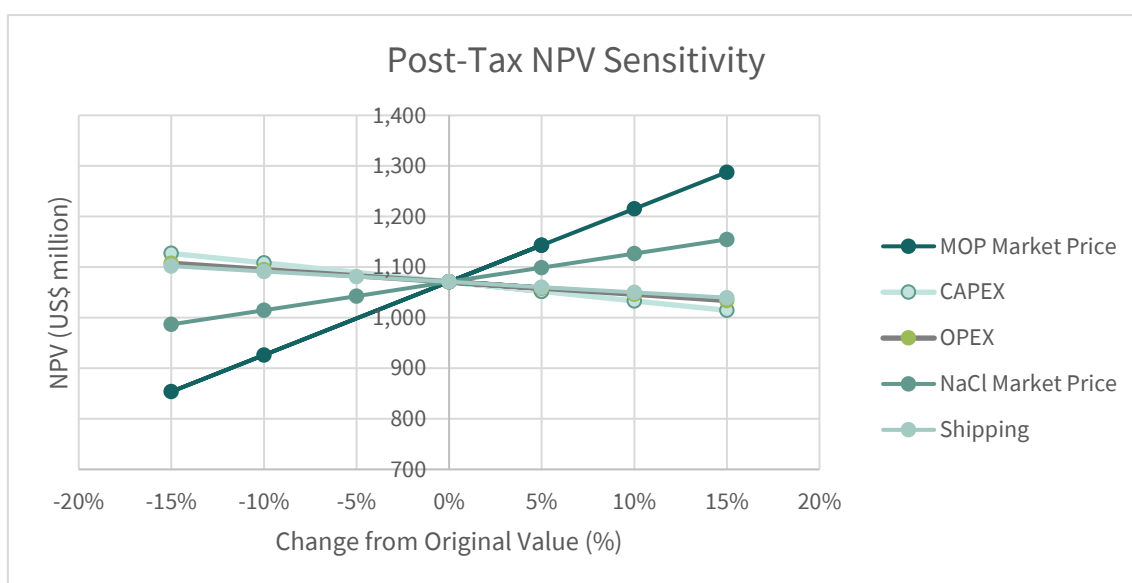
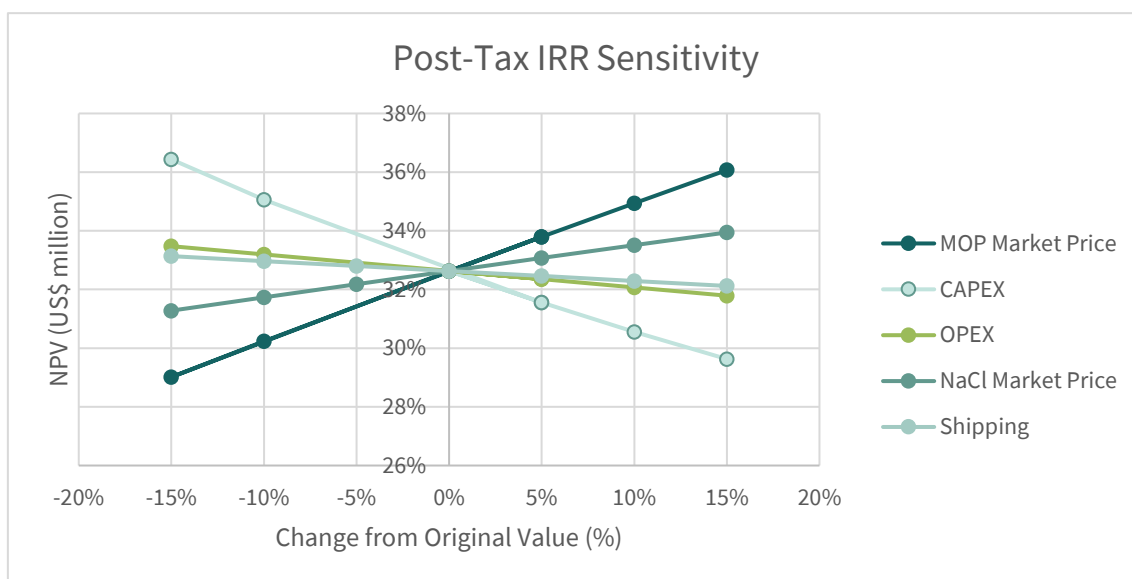


Figure 22.5: Base Case Scenario 800 kt/a Post-Tax IRR Sensitivity Analysis



The NaCl market price has an effect on NPV, but less so on IRR. This is because IRR is more sensitive to cashflow in the early years, resulting in CAPEX, and more specifically, initial CAPEX during the early years affecting the IRR.

Further sensitivity analysis has been completed to illustrate the effect of the discount rate and the government royalty which can only vary between 5% and 10%. A discount rate of 5% results in a Post-Tax NPV of approximately US\$2 billion and using a discount rate of 15% would result in an NPV of US\$512 million.

These two sensitivities, discount rate (Figure 22.6) and Royalty (Figure 22.7) have been analysed separately to the common above analysis as discount rate has a non-linear, exponential, extreme effect, and the royalty paid to the Gabonese Government can only range between 5% and 10%.

Figure 22.6: Sensitivity Graph Showing NPV with Different Discount Rates Pre-Tax and Post-Tax

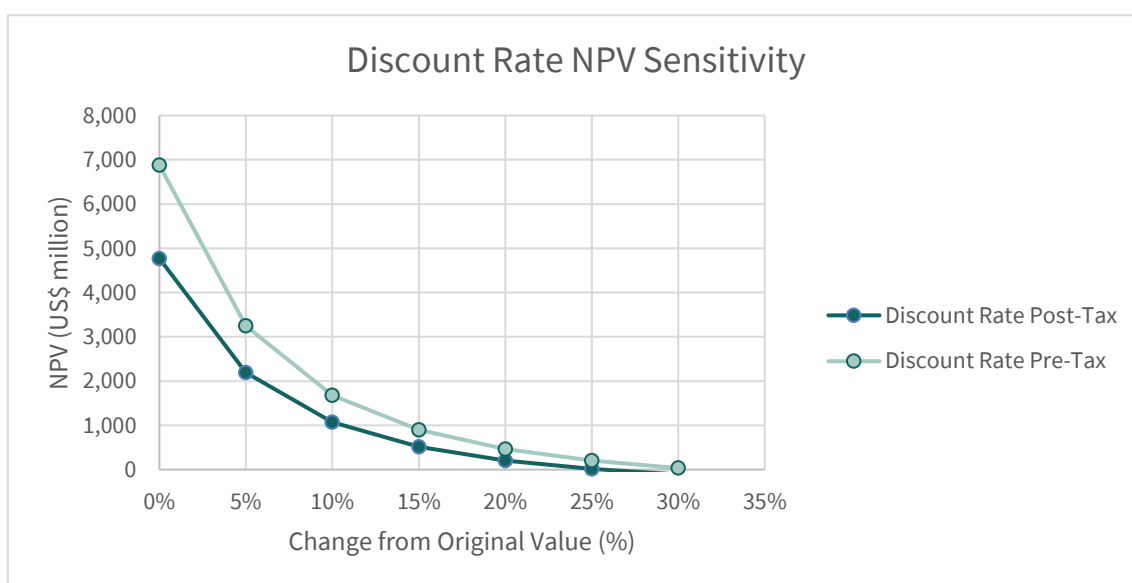
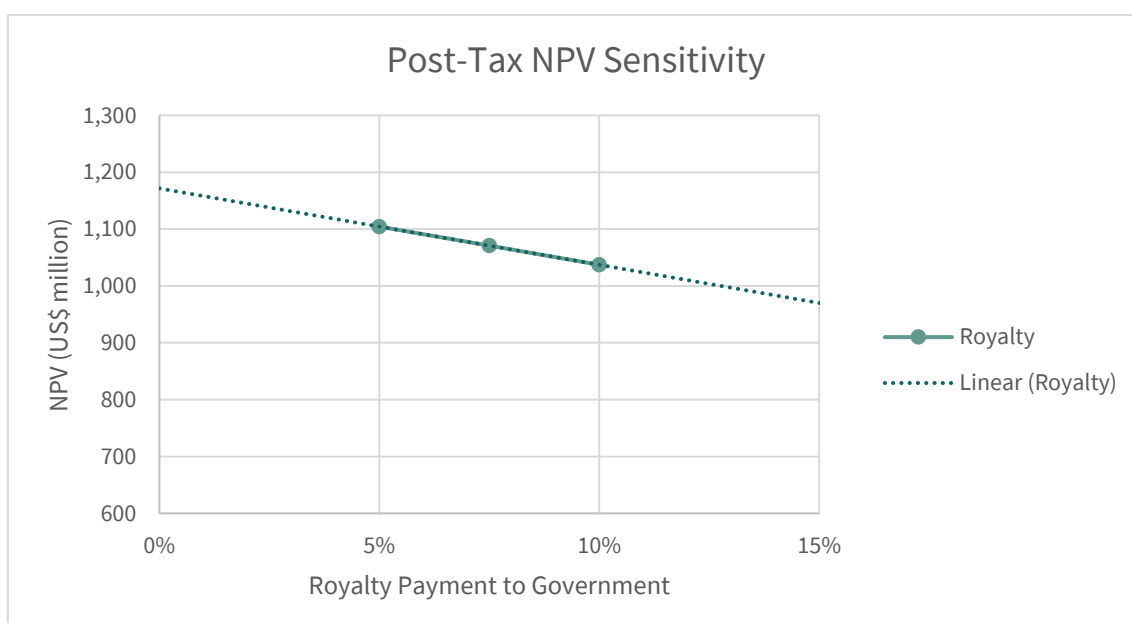


Figure 22.7: Post-Tax Royalty Sensitivity on NPV Analysis of Base Case Scenario 800 kt/a



22.6 RECOMMENDATIONS FOR THE DCF MODEL

As the sensitivity analysis shows that MOP and salt prices are two of the three most sensitive parameters to both NPV and IRR consequently a detailed market price study is required. Argus provided forecasts for this study, but more detail is required including the potential price for selling the product locally to the African continent, as opposed to the conservative sale only to Brazil. A detailed market study would include the potential price for MOP and Industrial vacuum salt in Africa, the preferred MOP and salt product presentation, preferred packaging, (bulk in ship's hull, containers, super sacks, 50 kg, or 25 kg sacks) and a shipping or freight cost.

In the next stage of the Project, the definite feasibility study detailed engineering is required for the CAPEX items to obtain fabricators quotes for equipment and increase the confidence in initial and sustaining CAPEX in the financial model. Updated CAPEX quotes will eliminate the need for escalation in the financial model.

Further definition of the Project timeline is also recommended and required to define the date of commercial production through the mill. A timeline required to take into account, permitting, funding, construction, ramp-up, commissioning and steady-state production.

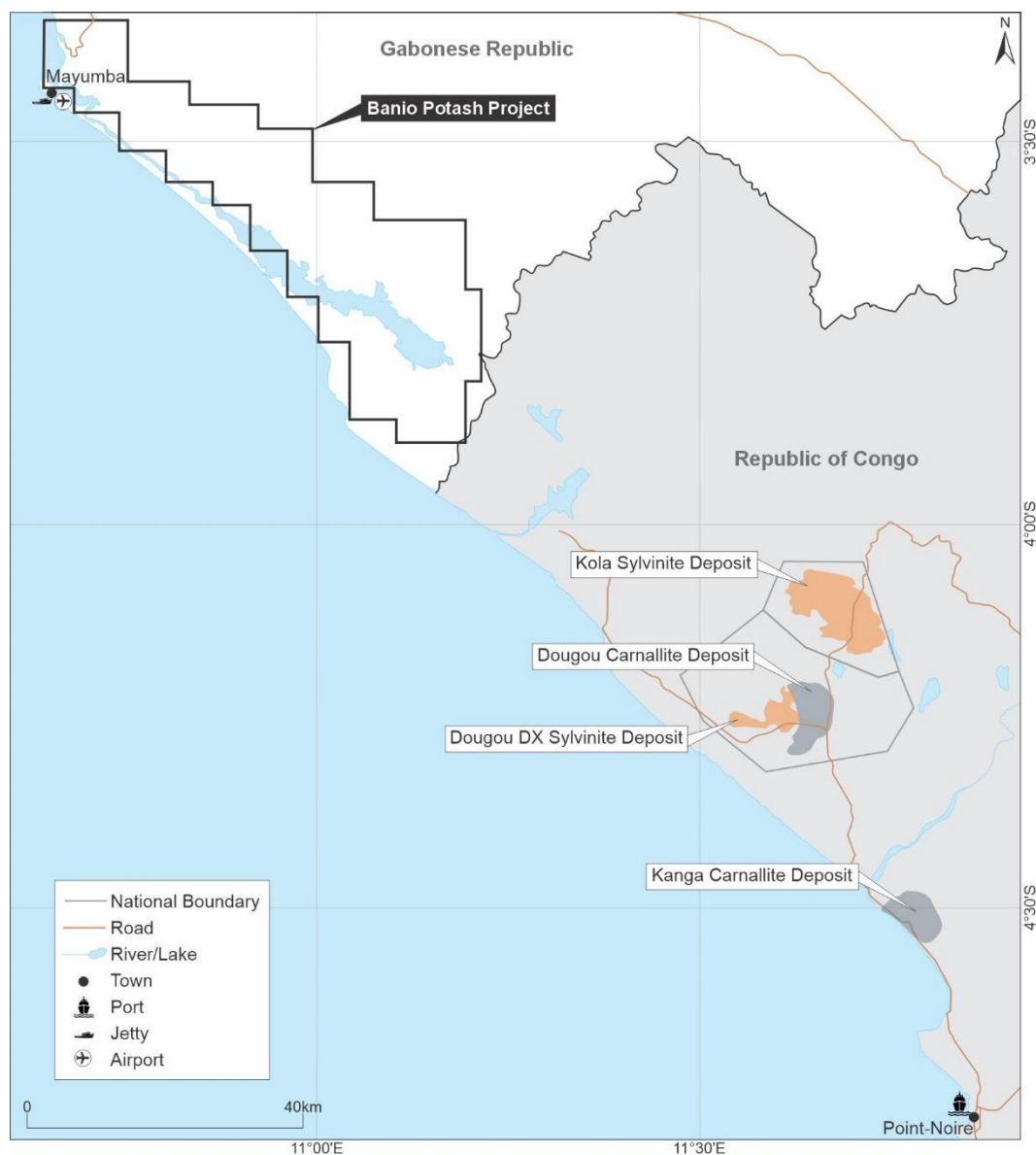
Negotiations with the Gabonese Government still require defining the production royalty, and the typical 2-year start-up import tax "holiday" used to encourage companies to prepare and have a full stock of spare parts at the warehouse.

Other unknowns which require more negotiation and development include off-shore gas production and infrastructure and reticulation to shore and the Mayumba Port location, size and availability to reserve storage loading infrastructure.

23.0 ADJACENT PROPERTIES

There are no direct adjacent potash properties to the Banio Project. Properties with similar mineralisation relevant to Banio are located <150 km to the southeast in the Republic of Congo. Three properties, namely the Kola Project, the Dougou Carnallite Project, and the Dougou Extension (DX) Project are located 60 km from Banio in the Sintoukola Potash District and Kanga Potash is located approximately 120 km in the Kouilou Province (Figure 23.1).

Figure 23.1: Location of Adjacent Potash Properties to the Banio Project



Source: Micon, 2024

23.1 KORE POTASH PROJECTS

The Kola Project, the Dougou Carnallite Project, and the Dougou Extension are 97% owned by Kore Potash Plc (formerly known as Elemental Minerals Ltd) and consist of two mining licences and an exploration licence for three different projects. All three Kore deposits are characterised by high-grade, shallow mineralisation and are situated near the coast with access to infrastructure. The information cited in this statement has been obtained from reports on the Kore website and the ERCOSPLAN NI 43-101 Technical Report on the Banio Potash Project (2023).

23.1.1 Kola Project

The Kola Project is a sylvinitic and carnallite deposit, it was awarded a mining licence in 2013, and in 2017 a mining convention with the Republic of Congo was ratified. A PFS was completed in 2012 by SRK et al., a FS in 2018, and a DFS in Q1 of 2019.

In 2019, Kore declared that the project had sylvinitic Measured and Indicated Mineral Resources of 508 Mt with a grade of 35.4% KCl, and carnallite Measured and Indicated Mineral Resources of 1,068 Mt with a grade of 20.6% KCl. The Proved and Probable Ore Reserves were declared by Kore at 152.4 Mt with a grade of 32.5% KCl. The Mineral Resources and Ore Reserves were estimated in accordance with the guidelines of the JORC Code (2012) by Met-Chem, a division of DRA Americas Inc., a subsidiary of the DRA Group.

The recommended mining method for the deposit involves conventional underground mining using a continuous miner and conveyor belt system. The ore will be processed to produce MOP at a surface-based processing plant.

23.1.2 Dougou Carnallite Project

The Dougou Project is 15 km southwest of the Kola Project consisting of a large, thick carnallite deposit and has had a mining licence since 2017. A Scoping Study completed by ERCOSPLAN in February 2015 declared Measured and Indicated Mineral Resources of 1,068 Mt grading at 20.6% KCl.

The project is intended to be mined by solution mining methods.

23.1.3 Dougou Extension (DX) Project

The Dougou Extension (DX) Project is a sylvinitic deposit occupying an area of approximately 10 km by 15 km immediately west of the Dougou Deposit. It is covered by a new Sintoukola exploration licence, and is currently still in the exploration stage.

In 2019, Innovare Technologies Ltd completed a Scoping Study on the deposit, which was followed by a PFS in 2020. As per the results, the sylvinitic Indicated Mineral Resources were 79 Mt with a grade of 39.1% KCl, and Inferred Mineral Resources were 66 Mt with a grade of 40.4% KCl. Additionally, sylvinitic Probable Ore Reserves were declared at 17.7 Mt with a grade of 41.7% KCl. Agapito Associates Inc estimated the Mineral Resources and Ore Reserves in 2020 according to the guidelines of the JORC Code (2012).

This project is intended to be mined by solution mining methods like the Dougou Carnallite Project.

23.2 KANGA POTASH

The Kanga Potash project is being developed by Sarmin Mining Inc (23.88%), a subsidiary of Sarmin Mining Group, African Mineral Exploration and Development (AMED) (68.57%), a Luxembourg-based private equity group, and Baker Steel Resources Trust (7.55%), an LSE-listed investment company.

An NI 43-101 compliant DFS was completed on the Kanga Potash project in August 2020 for an initial 600 kt/a production rate. The MOP product is intended to be produced via solution mining of carnallite seams with a mining thickness of >210 m with an average grade of 17.5% KCl. The 11,890 Mt Mineral Resource was estimated by ERCOSPLAN and is based on assays from three exploration drill holes. The Kanga Potash project is anticipated to provide at least 20 years of mining. Reliable consultants contributed to the DFS including K-UTEC for geochemical analysis, Novopro for dissolution testwork and IFG for rock mechanics. Results of the economic evaluation produced an NPV of US\$604 million with a CAPEX of US\$457 million and an IRR of 23.1%.

24.0 OTHER RELEVANT DATA AND INFORMATION

All relevant data and information regarding the Banio Project have been included in other sections of this Technical Report.

Micon and the QPs are not aware of any other data that would make a material difference to the quality of this Technical Report or make it more understandable, or without which the Report would be incomplete or misleading.

25.0 INTERPRETATION AND CONCLUSIONS

The Banio Project is a greenfields potash exploration project located in the Congo Potash Basin, in the Gabonese Republic. Millennial entered into an option agreement with Equatorial Potash to acquire up to a 100% interest in the company and since then have commenced an exploration diamond drilling programme to confirm historical resource estimates and report new Mineral Resources in accordance with NI 43-101.

Ten potash cycles have been identified on the property based on seismic interpretations and evaluation of drill hole results from three potash exploration drill holes and six historical hydrocarbon exploration drill holes.

In August 2023 Millennial commenced drilling with an extension of historical drill hole Ba-002. The extension resulted in identification of seven potentially economic cycles, dominated by carnallite mineralisation. Drilling work commenced on Ba-001, but this has not yet been completed due to drill rig breakdowns.

A Mineral Resource Estimate (MRE) was prepared by ERCOSPLAN using information from the 2017 potash drill holes and the extension of hole Ba-002, which was completed by Millennial in 2023. The Mineral Resources have been classified as Indicated and Inferred made up of a combination of sylvinite and carnallite mineralogy. The MRE was filed on 20th February 2024 totalling 656.65 Mt of Indicated Resources grading of 15.9% KCl and an Inferred Resource of 1,159.14 Mt grading of 16.0% KCl. The Banio Project Mineral Resources are summarised in Table 25.1 and have an effective date of 7th November 2023.

Table 25.1: Summary Mineral Resources for the Banio Project

Mineralogy	Category	Tonnage (Mt)	KCl Grade (%)	Tonnage (Mt KCl)
Sylvinite	Inferred	43.79	21.2	9.28
	Indicated	20.12	21.6	4.34
Total Sylvinite		63.91	21.3	13.62
Carnallite	Inferred	1,115.35	15.8	176.04
	Indicated	636.53	15.8	100.23
Total Carnallite		1,751.88	15.8	276.27

The large Mineral Resource situated in the north of the prospective Banio licence area is sufficient to support a long mine life and is closer to the infrastructure in Mayumba. In the southernmost part of the licence area, there are significant resources that have been identified in historical hydrocarbon drill holes. Millennial intends to explore this potential in the future, although the current wellfield design already has substantial resource potential. Therefore, it is not an immediate focus.

Millennial plan to extract the potash using solution mining methods, with a process plant located approximately 60 km away in Mayumba. Non-selective solution mining has been chosen for the Banio Project utilising one well per cavern, drilled to a vertical depth of approximately 530 m to 550 m. The design for the single-well caverns is based on a radius of 50 m.

Ambient-temperature water, drawn from the Banio Lagoon, and partially saturated brine will be recovered through the production tubing. Assuming a production rate of 400 kt/a of MOP the LoM is expected to be 112 years. For 600 kt/a of MOP production the LoM will be 79 years and for 800 kt/a of MOP production the LoM will be 56 years.

The proposed solution mining aerial extraction ratio is estimated to be 21%. To minimise ground disturbance and slow surface subsidence, solution brine will be left in the caverns after mining is complete. Therefore, subsidence at the Project site is expected to be gradual and non-disruptive. A surface subsidence analysis was completed based on the cavern layout design. The maximum predicted ultimate subsidence for the preliminary mine plan is approximately 6.7 m.

The processing flowsheet recommended in this PEA is designed to produce MOP with a guaranteed purity of 95% KCl (K60) with a maximum of 5% impurities, most of which is NaCl. The intended products from the process plant are saleable grade K60 MOP in both standard and granular form together with a saleable grade industrial vacuum salt containing a minimum of 99% NaCl which is suitable for a variety of chemical applications such as the chlor-alkali process.

The base case for this PEA has assumed a production rate of 400 kt/a of MOP, which will be exported to the Brazil market as granular MOP making use of the Mayumba Deep-Water Port. The most crucial element of the Banio Project is currently the required infrastructure, especially the ability to export the MOP product. The Gabonese Government plans to build a Deep-Water Port and securing allocation at the port will be integral to the Project success. Alternative port options are also available, and Millennial could also investigate building a long jetty into the ocean from which MOP product could be loaded onto ships for export. These export options require further investigation as part of the next phase of the Project.

Two alternative scenarios were considered, including a production rate of 600 kt/a of MOP and 800 kt/a of MOP.

A discounted cash flow model has been built for the Banio Project to consider the 400 kt/a base case and the two alternative scenarios. CAPEX and OPEX cost inputs are $\pm 30\%$ accuracy. The results of the DCF are summarised in Table 25.2.

Table 25.2: DCF Analysis Conclusions

Line item	Unit	Option 1 (400 kt/a)	Option 2 (600 kt/a)	Option 3 (800 kt/a)
Total Initial CAPEX	US\$ million	320	402	480
Total OPEX LoM	US\$/t	83	68	61
Post-Tax NPV ₁₀	US\$ million	440	769	1,071
Post-Tax IRR	%	26.2%	30.2%	32.6%
Payback Period	Years	1.9	1.5	1.4

The results of the economic analysis indicate that Option 3, with a production rate of 800 kt/a is the most appealing scenario for the Project at present with an NPV of over double that of the initial CAPEX and the option with the shortest payback. This option requires US\$480 million in initial CAPEX, but also has the best post-tax IRR at 32.6%.

Selecting the best option becomes a strategic decision and trade-off between the Company's risk appetite and ability to raise capital whilst improving economic statistics such as NPV, IRR and payback period. Within the industry, other commodities such as lithium, are finding it difficult to raise funds for large initial CAPEX near and above the US\$ billion marker. The 800 kt/a option has a CAPEX of <US\$500 million, which is likely to be more appealing to the current market appetite, and also places Millennial in an advantageous position with options to reduce production to 600 kt/a and still maintain strong positive project economics, or alternatively investigate larger production rates to further increase NPV.

An additional option is to phase the ramp-up and commissioning processes from, for example, Phase 1, 600 kt/a up to Phase 2, 800 kt/a. This will enable a lower initial CAPEX and will de-risk the project by commissioning and starting to produce revenue before expanding and transitioning into phase two to increase throughput and improve economies of scale.

26.0 RECOMMENDATIONS

The next stage of the Project is to move from a PEA to a Feasibility Study (FS), where CAPEX and OPEX numbers are required to carry a confidence of 15% to 20%. The following is a list of recommendations to create further understanding and confidence in both the inputs and outputs of the technical approach and financial model:

Exploration and Mining

- Continue exploration drilling, firstly completing Ba-001 and then moving on to a new hole, Ba-004, located about 4 km east of Ba-001, to test the potential of potash mineralisation in that region of the basin. Compile updated Mineral Resources based on the results of new drill holes;
- Large diameter geotechnical drilling should also be carried out during the next drilling phase so that creep testwork can be performed for cavern design;
- Further detailed numerical modelling of single-well cavern deformations and surface subsidence can be conducted in the next phase of the study using information from the additional drill holes; and
- Complete a trade-off study looking at the cost-benefit of using hot (pre-heated) water for solution mining as opposed to using ambient-temperature water for solution mining. Quantify the impact that hot leach mining, and a higher potassium content in the mining brine has on the gas consumption at the process facility and the power requirements at the mine site.

Processing and Metallurgy

- Dissolution testwork is needed to understand the dissolution rate within the cavern and the steady-state brine composition that will be reached, including the waste composition. This can be carried out using new drill cores from Ba-001 and Ba-004; and,
- Testwork to determine if there is a requirement to provide a decomposition evaporator and hot leach tank to accommodate the high-levels of MgCl within the carnallitic leach brine which would negatively impact the solubility of Na and K salts.

Environmental

- Commence with baseline studies and assessments required for the EISA. Develop preliminary environmental management plans and increase regular communication with local communities; and,
- Commence with baseline social studies, understand the Project's sphere of influence, identify local stakeholders and start to build a community presence with open communication with local stakeholders.

Marketing

- Complete an in-depth market study of NaCl 99% salt to understand possible markets to sell the salt, focus on the African market to analyse the demand and the possibility for geographically closer purchasing clients in order to minimise freight cost and maximise profit. This will eventually lead to a better understanding of the sale price of the salt product as an input to the financial model; and,

- An in-depth MOP market study is also required to improve the understanding of the Brazilian potash market and the local African potash market for granular and standard SOP. During operations it is very likely that a small proportion of granules or pellets are crushed or damaged and not all products can be sold as granular MOP. It is probable that only 95% of the annual MOP production will be granular (gMOP) and the remaining MOP will be classified as standard (sMOP). The amount of sMOP that is likely available for sale from the Project varies between 20 kt/a for the 400 kt/a Option and 40 kt/a for the 800 kt/a Option. Commonly sMOP is purchased for use in fertilizer blending plants and it is possible the local West African market could absorb the quantities available for sale.

Transport and Logistics

- The Gabonese Government is still finalising the location and conceptual design of the Deep-Water Port at Mayumba. There are a number of potential large mining clients in the region which would need a port to load their final product and send it to market. This final port design and layout will allow for more detailed costing of size and CAPEX for storage of products, transport options, relative distances between the mining area, processing plant and location of port for both CAPEX and OPEX reasons etc.;
- An infrastructure and logistics study is required to determine the optimal methods of moving the potash brine from the wellfield to the plant and from the plant to the port and must include a survey of the proposed pipeline, road and electricity routes;
- A separate transport and logistics study is required to review the different port options and the infrastructure required to export potash as bulk, containers, 25 kg, 50 kg and 1 t bags. The study must also investigate the different port options including loading bay logistics and vessel handling capabilities; and,
- Bench scale testwork of brine composition using core chemistry analytical results to synthesise a brine and determination of what the waste product will be.

Finance

- Some of the OPEX costs such as labour and sustaining CAPEX have been simplified in the financial model as fixed costs. In the next pass of the model, with more detailed information these costs can be modelled as fixed and variable which will bring more accuracy to comparison between cases and the effect of economies of scale;
- The effect of stockpiling the final product as a strategy or as a consequence of delayed or offset sales has been ignored and simplified. In the next version, an effect of lagging sales or seasonal sales can be modelled;
- Taxation, Royalties and tax holidays are subject to negotiation with the Gabonese Government and are conducted when the exploration licence is converted to a mining licence. For this study Micon selected the midway point of possible tax ranges, and no tax holiday was applied. These should be investigated during the Feasibility Study; and,
- Test the appetite of the market for raising US\$402 vs US\$480 million CAPEX, which are the current modelled requirements for the 600 kt/a and 800 kt/a options. This could explore an option to fund and construct the mine in phases; Phase 1 at 600 kt/a with a low initial CAPEX and lower throughput, ramping up to commissioning production then expansion into Phase 2.

27.0 DATE AND SIGNATURE PAGE

Signed on behalf of Micon International Co Limited:



Liz de Klerk, M.Sc., Pr.Sci.Nat., FIMMM, (QP)
Managing Director
Effective Date: 7th November 2023
Signed Date: 4th June 2024

Signed on behalf of Micon International Co Limited:

Dr. Chris Gilchrist, Ph.D. (Eng.), CEng, FIMMM (QP)
Micon Associate Mineral Processing Specialist
Effective Date: 7th November 2023
Signed Date: 4th June 2024

Signed on behalf of Agapito Associates, Inc.,:

Dr. Biao Qiu, B.Sc., M.Sc., Ph.D., P.E., P.Eng. (QP)
Vice President of Agapito Associates, Inc.,
Effective Date: 7th November 2023
Signed Date: 4th June 2024

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29.0 CERTIFICATES

CERTIFICATE OF QUALIFIED PERSON LIZ DE KLERK

As the co-author and Qualified Person of this Report entitled “NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic” with effective date 7th November 2023, I, Liz de Klerk, do hereby certify that:

1. I am employed as a Senior Geologist by, and carried out this assignment for, Micon International Co Limited, Suite 10, Keswick Hall, Norwich, United Kingdom. tel. 0044(1603) 501 501, e-mail ldeklerk@micon-international.co.uk.
2. I hold the following academic qualifications:
B.Sc. Geology University of Leicester, United Kingdom, 2000;
M.Sc. Exploration Geology University of Rhodes, Grahamstown, South Africa, 2002;
3. I am a Fellow of the Institute of Materials Minerals and Mining (FIMMM) (No. 682617) and a Fellow of the Geological Society of Africa and a registered Professional Natural Scientist (Pr.Sci.Nat. 400090/08)
4. I have worked as a geologist in the minerals industry for over 18 years in the mining industry in Africa, Europe, Russia and the United Kingdom.
5. I do, by reason of education, experience and professional registration, fulfil the requirements of a Qualified Person as defined by NI 43-101 and CIM Standards;
6. I visited the property that is the subject of this Technical Report from 21st and 22nd November 2023;
7. I have reviewed the geology, mineral resources, mineral reserves and site operations. I am responsible for the preparation or supervision of preparation of all sections of this Technical Report;
8. I am independent of the Millennial Potash Corporation, their directors, senior management, and other advisers, and I have had no previous involvement with the property.
9. I confirm that I have read all the relevant sections of the Canadian National Instrument 43-101 and the Technical Report and confirm that this Report has been prepared in compliance with the instrument; and,
10. As of the date of this certificate, to the best of my knowledge, information, and belief, the “NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic” with effective date 7th November 2023 contains all scientific and technical information that is required to be disclosed in order to make the Technical Report not misleading.



Liz de Klerk, M.Sc., Pr.Sci.Nat. FIMMM (682617)
Managing Director,
Micon International Co Limited
Effective Date: 7th November 2023
Signed Date: 4th June 2024

CERTIFICATE OF SENIOR RESOURCE GEOLOGIST RYAN LANGDON

As the co-author of this Report entitled “NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic” with effective date 7th November 2023, I, Ryan Langdon, do hereby certify that:

1. I am employed as a Senior Resource Geologist by, and carried out this assignment for, Micon International Co Limited, Suite 10, Keswick Hall, Norwich, United Kingdom. tel. 0044(1603) 501 501, e-mail rlangdon@micon-international.co.uk.
2. I hold the following academic qualifications:
MEarthSci: Earth Sciences University of Oxford, United Kingdom, 2010;
PhD Geology, Camborne School of Mines, University of Exeter, 2015;
Applied Geostatistics Citation University of Alberta, 2023;
3. I am a Fellow of The Geological Society of London and a registered Chartered Geologist (No. 1022491);
4. I have worked as a geologist in the minerals industry for over 11 years in the mining industry in Africa, Asia, Europe, and the United Kingdom;
5. I do, by reason of education, experience and professional registration, fulfil the requirements of a Senior Resource Geologist;
6. I have reviewed the geology and the mineral resources;
7. I am responsible for the preparation of Section 7.0 and 8.0 of this Technical Report;
8. I am independent of the Millennial Potash Corporation, their directors, senior management, and other advisers, and I have had no previous involvement with the property;
9. I confirm that I have read all the relevant sections of the Canadian National Instrument 43-101 and the Technical Report and confirm that this Report has been prepared in compliance with the instrument; and,
10. As of the date of this certificate, to the best of my knowledge, information, and belief, the “NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic” with effective date 7th November 2023 contains all scientific and technical information that is required to be disclosed in order to make the Technical Report not misleading.

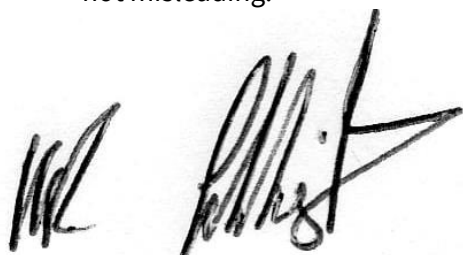


Ryan Langdon, Ph.D., MCSM, MEarthSci, CGeol, FGS
Senior Resource Geologist,
Micon International Co Limited
Effective Date: 7th November 2023
Signed Date: 4th June 2024

CERTIFICATE OF QUALIFIED PERSON CHRIS GILCHRIST

As the co-author and Qualified Person of this Report entitled “NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic” with effective date 7th November 2023, I, Chris Gilchrist, do hereby certify that:

1. I am employed as an Associate Mineral Processing Specialist by, and carried out this assignment for, Micon International Co Limited, Suite 10, Keswick Hall, Norwich, United Kingdom. tel. 0044(1603) 501 501, e-mail chris@gilchristmining.com.
2. I hold the following academic qualifications:
B.Sc. Hons. Eng. University of Birmingham, United Kingdom, 1981;
Ph.D, Eng. University of Witwatersrand, Johannesburg, South Africa, 1994;
3. I am a Fellow of the Institute of Materials Minerals and Mining (FIMMM) (No. 454529) and a registered Chartered Engineer (No. 454529);
4. I have worked as a processing specialist in the minerals industry for over 40 years in the mining industry in Africa, Europe, Russia and the United Kingdom.
5. I do, by reason of education, experience and professional registration, fulfil the requirements of a Qualified Person as defined by NI 43-101 and CIM Standards;
6. I visited the property that is the subject of this Technical Report from 21st and 22nd November 2023;
7. I have reviewed the metallurgy and processing;
8. I am responsible for the preparation of Sections 13.0 and 17.0 of this Technical Report;
9. I am independent of the Millennial Potash Corporation, their directors, senior management, and other advisers, and I have had no previous involvement with the property.
10. I confirm that I have read all the relevant sections of the Canadian National Instrument 43-101 and the Technical Report and confirm that this Report has been prepared in compliance with the instrument; and,
11. As of the date of this certificate, to the best of my knowledge, information, and belief, the “NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic” with effective date 7th November 2023 contains all scientific and technical information that is required to be disclosed in order to make the Technical Report not misleading.



Chris Gilchrist, Ph.D. (Eng.), CEng, FIMMM
Associate Mineral Processing Specialist,
Director Gilchrist Mining Ltd.
Effective Date: 7th November 2023
Signed Date: 4th June 2024

CERTIFICATE OF QUALIFIED PERSON BIAO QIU

As the co-author of this Report entitled “NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic” with effective date 7th November 2023, I, Biao Qiu, do hereby certify that:

1. I am employed as a Principal by Agapito Associates, Inc., 715 Horizon Dr. Suite 340, Grand Junction, CO, USA 81506, and carried out this assignment for, Micon International Co Limited, Suite 10, Keswick Hall, Norwich, United Kingdom. tel. 0044(1603) 501 501, e-mail bqiu@agapito.com.
2. I hold the following academic qualifications:

B.Sc. Engineering	Xi'an University of Science and Technology, China, 2006;
M.Sc. Mining Engineering	Xi'an University of Science and Technology, China, 2009;
Ph.D. Mining Engineering	West Virginia University, USA, 2013;
3. I have been registered as a Professional Engineer in Colorado (No. 50658) since December 2015. I am a Professional Member of the Association of Professional Engineers and Geoscientists of Saskatchewan. I have been registered as a Professional Engineer in Saskatchewan (No. 35995) since July 2021, and as a Professional Licensee in Alberta (No. 291909) since March 2022;
4. I have practiced my profession as a mining engineer since 2013 and have over 11 years' experience. I have provided services to solution mining projects in industrial minerals such as salt (halite), potash, trona, borate, and nahcolite;
5. I do, by reason of education, experience and professional registration, fulfil the requirements of a Qualified Person as defined by NI 43-101 and CIM Standards;
6. I have reviewed the mining methods;
7. I am responsible for the preparation of Section 16.0 and partially responsible for the preparation of Section 21.0 of this Technical Report;
8. I am independent of the Millennial Potash Corporation, their directors, senior management, and other advisers, and I have had no previous involvement with the property;
9. I confirm that I have read all the relevant sections of the Canadian National Instrument 43-101 and the Technical Report and confirm that this Report has been prepared in compliance with the instrument; and,
10. As of the date of this certificate, to the best of my knowledge, information, and belief, the “NI 43-101 Preliminary Economic Assessment Technical Report on the Banio Potash Project, Gabonese Republic” with effective date 7th November 2023 contains all scientific and technical information that is required to be disclosed in order to make the Technical Report not misleading.



Biao Qiu, Ph.D., P.E., P.Eng.
Principal,

Agapito Associates, Inc.

Effective Date: 7th November 2023

Signed Date: 4th June 2024

30.0 GLOSSARY AND ABBREVIATIONS

30.1 MINERAL RESOURCES AND MINERAL RESERVES DEFINITIONS

Mineral resource and mineral reserve definitions, according to the “CIM Standards on Mineral Resources and Reserves – Definitions and Guidelines”, are given as follows.

30.1.1 Mineral Resource

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 and quantity 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.

Modifying Factors are considerations used to convert Mineral Resources to Mineral Reserves. These include, but are not restricted to, mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social and governmental factors.

30.1.2 Mineral Reserve

A 'Mineral Reserve' is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level as appropriate that include application of Modifying Factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified.

The reference point at which Mineral Reserves are defined, usually the point where the ore is delivered to the processing plant, must be stated. It is important that, in all situations where the reference point is different, such as for a saleable product, a clarifying statement is included to ensure that the reader is fully informed as to what is being reported.

The public disclosure of a Mineral Reserve must be demonstrated by a Pre-Feasibility Study or Feasibility Study.

A 'Probable Mineral Reserve' is the economically mineable part of an Indicated, and in some circumstances, a Measured Mineral Resource. The confidence in the Modifying Factors applying to a Probable Mineral Reserve is lower than that applying to a Proven Mineral Reserve.

A 'Proven Mineral Reserve' is the economically mineable part of a Measured Mineral Resource. A Proven Mineral Reserve implies a high degree of confidence in the Modifying Factors.

30.2 GLOSSARY

Anhydrite (CaSO_4): Anhydrous calcium sulphate, common mineral in sedimentary rocks. This mineral is especially important in evaporate deposits, often found with gypsum - hydrated calcium sulphate.

Aphthalite also known as Glaserite ($\text{K}_3\text{Na}(\text{SO}_4)_2$): Potassium sodium sulphate uncommon evaporite mineral, however it is an important potash source.

Argillaceous rocks: Group of detrital sedimentary rocks, commonly clays, shales, mudstones, siltstones and marls.

Basalt: A finely crystalline igneous rock with a basic composition.

Bischofite $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$: Hydrated magnesium chloride mineral.

Brecciated (breccia): Fragmented rock consisting of angular particles that have not been worn by water (unlike conglomerates).

Calcite (CaCO_3): Calcium carbonate.

Carbonate rock: Rock primarily composed of carbonate minerals: calcite, aragonite, dolomite, magnesite, siderite etc. The majority of carbonate rock is formed by sedimentation in sea and lake basins.

Carboniferous Period (359 Ma to 299 Ma): The Carboniferous Period is the fifth of the six periods of the Palaeozoic Era. It is preceded by the Devonian Period and succeeded by the Permian Period. Especially known for its large coal deposits.

Carnallite ($\text{KMgCl}_3 \cdot 6(\text{H}_2\text{O})$): Hydrated potassium magnesium chloride, common marine evaporite deposit mineral and an economically important potash source.

Carnallite: Potassium rich evaporite rock consisting mainly of carnallite, halite, kieserite and anhydrite.

Centrate: Water leaving a centrifuge after the majority of the solids have been removed.

Clay: Finely grained sedimentary rock composed of clay minerals.

Cretaceous Period (359 Ma to 299 Ma): The Cretaceous Period is the third of the three periods of the Mesozoic Era. It is preceded by the Jurassic Period and succeeded by the Palaeogene Period.

Cut-Off: An assay cut-off is the break-even economic value of the ore; the block cut-off is the economic value that optimises the net present value of the operating assets.

Demurrage: A charge payable to the owner of a chartered ship on failure to load or discharge the ship within the time agreed.

Depocentre: An area or site of maximum deposition, or the geographic location of the thickest part of any specific geographic unit in a depositional basin.

Dolomite ($\text{CaMg}(\text{CO}_3)_2$): Calcium magnesium carbonate rock.

Evaporite Deposit: A sedimentary rock deposited from aqueous solution (e.g. seawater) as a result of evaporation.

Footwall: The rock on the underside of a vein or ore structure.

Glaserite also known as Aphthitalite ($\text{K}_3\text{Na}(\text{SO}_4)_2$): Potassium sodium sulphate uncommon evaporite mineral, however it is an important potash source.

Goethite ($\alpha\text{FeO} \cdot \text{OH}$): Hydrated iron oxide, rust like in appearance.

Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$): Calcium sulphate, common mineral in sedimentary rocks. This mineral is especially important in evaporite deposits.

Haematite (Fe_2O_3): Iron oxide common in igneous, metamorphic and sedimentary rocks.

Halite (NaCl): Sodium chloride, very common evaporite deposit mineral.

Holocene Epoch (0.1 Ma to present day): This is the current period of geological time which began 12,000 to 11,500 years ago at the close of the Palaeolithic Ice Age and continues to the present day.

Igneous rock: A rock formed by the solidification of magma.

Intrusion: A body of igneous rock that invades older rock. The invading rock may be a plastic solid or magma that pushes its way into the older rock.

Jurassic Period (201 Ma to 145 Ma): This is the middle period of the Mesozoic Era, it is preceded by the Triassic Period and followed by of the Cretaceous Period.

Kainite ($\text{KMg}(\text{SO}_4)\text{Cl} \cdot 3\text{H}_2\text{O}$): Hydrated potassium magnesium sulphate. A secondary mineral in marine potash deposits formed due to metamorphism or resolution by ground waters.

Kainitite: Potassium rich evaporite rock consisting mainly of kainite and halite.

Kieserite ($\text{MgSO}_4 \cdot \text{H}_2\text{O}$): Hydrated magnesium sulphate monohydrate, commonly occurring mineral in marine evaporites.

Lacustrine: Relating to or associated with lakes.

Langbeinite ($\text{K}_2\text{Mg}_2(\text{SO}_4)_3$): Potassium magnesium sulphate uncommon marine evaporite mineral, however it is an important potash source.

LayCan: This is an abbreviation for the “Laydays and Cancelling” clause in a charter-party contract in the shipping industry. It is particularly used in voyage chartering and it refers to the time frame within which a vessel is expected to arrive at the loading port.

Limestone: A common sedimentary rock composed mainly of calcium carbonate.

Magmatic: Consisting of, relating to or of magma origin.

Metamorphic rock: A rock that has, in a solid state, undergone changes in mineralogy, texture, or chemical composition as a result of heat or pressure.

Mine: An excavation from which valuable materials are recovered.

Mineral deposit: A body of mineralisation that represents a concentration of valuable metals. The limits can be defined by geological contacts or assay cut-off grade criteria.

Open pit: A mine that is entirely on surface; also referred to as open-cut or open-cast mine.

Operational reserves: Balance mineral reserves that have been adjusted for dilution and losses, and have been incorporated into a mine production schedule.

Palaeozoic Era (541 Ma to 252 Ma): One of the eras of geologic time occurring between the Late Precambrian and Mesozoic eras, comprises the Cambrian, Ordovician, Silurian, Devonian Carboniferous, Permian periods.

Permian Period (299 Ma to 252 Ma): This is the last period of the Palaeozoic Era, it is followed by the Triassic Period of the Mesozoic Era.

Polyhalite ($K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$): Hydrated potassium calcium magnesium sulphate. Common marine evaporite deposit mineral and an economically important potash source.

Precambrian (4,560 Ma to 541 Ma): Precambrian is an informal name used for the long interval of geological time preceding the Cambrian Period.

Pyrite (FeS_2): Iron sulphide.

Run of Mine (RoM): A term used loosely to describe ore of average grade as produced from the mine.

Sedimentary rock: Rock formed by sedimentation of substances in water, less often from air and due to glacial actions on the land surface and within sea and ocean basins. Sedimentation can be mechanical (under the influence of gravity or environment dynamics changes), chemical (from water solutions upon their reaching saturation concentrations and as a result of exchange reactions), or biogenic (under the influence of biological activity).

Sylvinite: Evaporite rock comprising sylvite and halite.

Sylvite (KCl): Potassium chloride, common evaporite deposit mineral and an economically important potash source.

Syngenite ($K_2Ca(SO_4)_2 \cdot H_2O$): Potassium calcium sulphate mineral.

Suite: An aggregate of conformable rock beds with similar general properties that differentiate them from overlying or underlying rocks.

Tachyhydrite ($CaMg_2Cl_6 \cdot 12H_2O$): Calcium magnesium hydrated chloride mineral. Unstable salt constituent within marine salt evaporite deposits.

Triassic Period (252 Ma to 201 Ma): The Triassic Period is the first of the three periods of the Mesozoic Era. It is preceded by the Permian Period (Palaeozoic Era) and succeeded by the Jurassic Period.

Trona ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$): A non-marine evaporite mineral which occurs in salt deposits and consists of hydrated sodium carbonate and sodium bicarbonate.

30.3 ABBREVIATIONS

%	Percent
°	degree (angle)
°C	degree Centigrade
AACE	Advancement of Cost Engineering
ADB	African Development Bank Group
Agapito	Agapito Associates, Incorporated
AISC	all-in sustaining costs
ALMA	African Leaders Malaria Alliance
AMED	African Mineral Exploration and Development
AOI	Area of Influence
API	American Petroleum Institute

B.I.C.E	Bureau d'Ingénierie, de Conseil et d'Expertise
Black Mountain	Black Mountain Gold USA Corp.
BOP	blow-out prevention
Ca	Calcium
CAPEX	Capital Expenditure
CaSO ₄	Calcium sulphate
CBL	cement bond log
CCL	casing collar locator
CFR	Cost and Freight
CHP	combined head and power plant
CIM	Canadian Institute of Mining, Metallurgy and Petroleum
CoV	coefficient of variation
CPC	Syndicat de Recherches de Potasse au Congo
CRM	certified reference material
CSA	Canadian Securities Administrators
CSA Global	CSA Global Pty Ltd
Cu	Copper
DEUSA	DEUSA International GmbH
DFS	Definitive Feasibility Study
DGEPN	Direction Generale de l'Environnement et de la Protection de la Nature
EAD	Environmental Affairs Department
EBITA	earnings before interest, taxes, and amortization
EFG	European Federation of Geologists
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement, and Construction
ERCOSPLAN	ERCOSPLAN Ingenieurgesellschaft Geotechnik und Bergbau mbH
Equatorial Potash	Equatorial Potash Pty Limited
ERHSC	Expendable Retrivable Hollow Steel Carrier
ESG	Environmental, social, and governance
ESIA	Environment and Social Impact Assessment
ESMS	Environmental and Social Management System
ESP	Electrical submersible pump
FEED	Front-End Engineering Design
FEL	front-end loaders
FIFO	Fly-In, Fly-Out
FOB	Free on Board
G&A	general and administration
GMT	Greenwich Mean Time
GRI	Global Reporting Initiative
µg/m ³	micrograms per cubic metre
g	Gram(s)
g/L	Gram(s) per litre
g/t	gramme/tonne
gMOP	granular MOP
h	Hour(s)
h/d	Hour(s) per day
ha	Hectare
h/a	Hours per annum

HSEC	Health, Safety, Environment and Communities
HSECMS	Health, Safety, Environment and Communities Management System
ICP-OES	inductively coupled plasma-optical emission spectrometry
ID ²	inverse distance weighting to the power of two
ID ³	inverse distance weighting to the power of three
Infinity	Infinity Lithium Corporation
Insols	Acid insoluble material
IRR	internal rate of return
IUCN	International Union for Conservation of Nature
K	Potassium
K ₂ O	Potassium oxide
KCl	Potassium chloride
kg	kilogramme
km	kilometre
km ²	square kilometre
k m ³	thousand cubic metres
Kore	Kore Potash Limited
kt	thousand tonnes
kt/a	thousand tonnes per annum
kV	kilovolt
kW	Kilowatt(s)
kWh	Kilowatt hour(s)
kWh/t	Kilowatt hours per tonne
L	Litre(s)
LoM	life-of-mine
LOTO	Lockout/Tagout
LRMC	long-run marginal cost
µm	micron
mm	millimetre
m	metre
m ²	square metre
m ³	cubic metre
m ³ /h	cubic metres per hour
M m ³	million cubic metres
M m ³ /a	million cubic metres per annum
msec	milliseconds
m/s	metres per second
Ma	Millions of years ago
masl	metres above sea level
Mayumba Potasse	Mayumba Potasse SARL
Millennial	Millennial Potash Corp.
MDPA	Mines de Potasse d'Alsace
Mg	Magnesium
MgCl ₂	Magnesium chloride
MgSO ₄	Magnesium sulphate
Micon	Micon International Co Limited
MOP	Muriate of Potash
MOU	memorandum of understanding
MRE	Mineral Resource Estimate

Mt	million tonnes
Mt/a	million tonnes per annum
MW	megawatt
N	Nitrogen
Na	Sodium
NaCl	Sodium chloride
N/A	Not applicable
NGO	Non-Governmental Organisation
Nm ³	normal cubic metre
NN	nearest neighbour
NPV	net present value
NSR	Net Smelter Return
OEM	original equipment manufacturers
OPEX	operating costs
oz	ounce
P	Potassium
Perenco	Perenco Oil & Gas Gabon
Plymouth	Plymouth Minerals Limited
PNN	Pulsed Neutron-Neutron
PTSM	Pre-Stack Time Migrated
QA/QC	Quality assurance/quality control
QP	Qualified Person
Report	technical report
ROI	Radius of Influence
RoM	Run of Mine
s	Second
SDPS	Surface Deformation Prediction Software
SMCD	solution-mining-design program
sMOP	standard MOP
SOP	Sulphate of Potash
SOPM	sulphate of potassium magnesia
SPAFE	Société Pétrolière de l'Afrique Française Equatoriale
SW Geophysics	SW Geophysics Limited
TDS	total dissolved solids
t	tonne
t/a	tonnes/year
t/d	tonnes/day
t/h	tonnes/hour
TD	total depth
ToR	Terms of Reference
TVD	True Vertical Depth
TWTT	two-way travel time
US\$	United States dollar
V	Volt(s)
VAT	Value Added Tax
WEF	World Economic Forum
Wt%	Weight percent
y	Year(s)